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Theoretical requirements and practical realisation for wing players in modern male handball based on the 2014 men's European Championship in Denmark

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Summary

In this thesis I want to show which requirements exist for wing players in modern men´s handball and how they solve these challenges in the game.

Keywords
Wing, fast break, backcourt, player, pivot

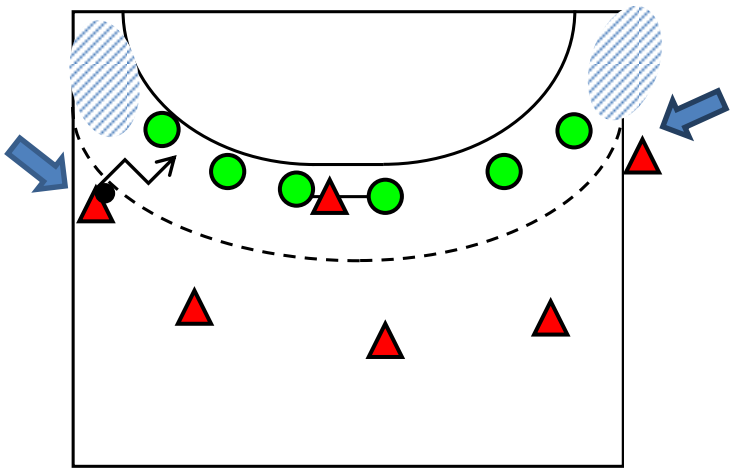
Introduction
The wing play in modern men´s handball has changed in the last 10 to 15 years a lot. In the 80s and 90s and even in the early 00s there have been wing players like Mile Isaković, Stefan Kretschmar or Mirza Dzomba for example, who could help their back players a lot with their individual class and very often they could even win a game nearly alone by themselves. In the present time wing players mostly have to play a passive role at the starting of an attack. In the past there have been a lot of tactical turns, which were especially created for the wing players, but now their main task is to start a triggering action. An active playing with the back players or beside them is very rare in the present. In the first quarter of the century players like Stefan Kretschmar or Florian Kerman shot a lot of goals by using feints 1 against 1, but nowadays wing players have to wait in a very passive way in the corners. But if you compare them with the "*old school*" wing players, they have much more shooting variations. And they are able to use them in the most effective way. But this is very important for them because goalkeepers nowadays are excellent and because of that it´s very hard to score from the wing position against them. In the 80s and 90s the wings had only a small selection of very good shots and that was enough.
A typical attribute in modern wing playing is that both wings in numerical minority often turn over to two pivots to irritate the defence and help the back court players to create a solution for shooting a goal or even passing to them.
Also in defence the tasks for wing players have changed a lot. In the past they only had to play against the wing player of the other team. But as in the present the offensive wing players are standing in the corner of the court, so the defender would have to run too long lanes. In modern handball the defending player on the wing position has to try to prevent passes from the back court player to the wing.
A second task is to support the player beside to defend the back court player, because nowadays back court players are physically very strong and it is not very easy to defend them 1 against 1.
Another task is to disturb the back court player before he gets the ball to prevent that he can make a good decision or shoot a goal. With this action the defence keeps the back court player away from a good position.
For all these defence tasks it is necessary that a wing players has special qualities. He has to be very quick with his legs, he should have a strong physics and he should have a very good anticipation.
A big advantage of this kind of defence is, that the defending wing is 2 or 3 meters in front of the wing player of the offensive team and in case of a fast break he can easily run to the other goal without being disturbed by an opposite player. This fact has been practiced by some teams at the Euro.
In some teams at the European Championship 2014 one wing player had to run across the court to the other side in team fast break. The motivation was that the wing player could

pass with his better hand very easily to the players on the other side and that there was a man advantage because of his running across the court. That tactical move also worked when they used it at fast throw off.

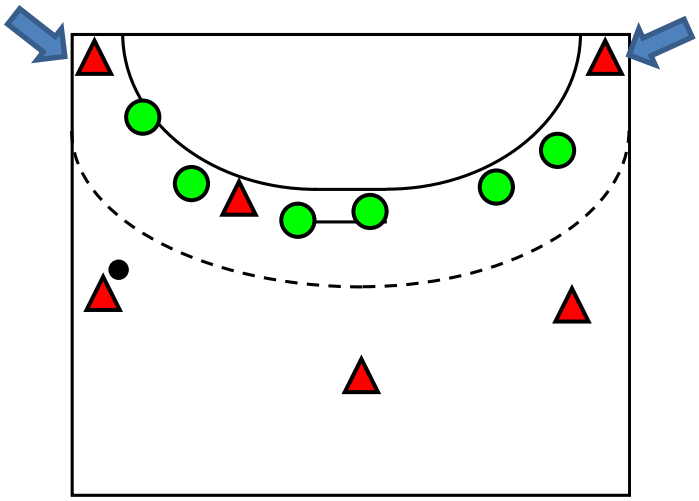
1. Tasks of Wing Players in Modern Men´s Handball in Detail

- **Wings have to play a passive role at the starting of an attack, only staying at the corner of the court**

  This is the most distinctive attribute in modern handball. In the past both wing players were standing outside the 9-meters and also were allowed to take part at the starting of an attack. The space near the corners has not been used. Only when a wing was expecting a pass to shot after a tactical move he went to the corner.



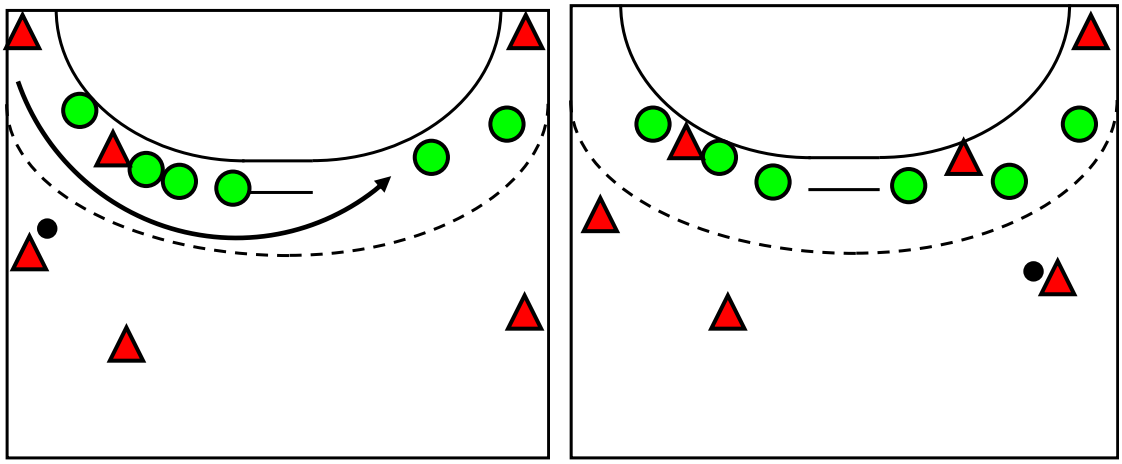
In the present both wings are positioned at the corner of the court and don´t take part at the starting of an attack.
Because of this decision backcourt players have more space and the defence has to defend the whole space from one corner to the other. The main task for wing players is to shoot from a free position after a good pass. To do this very efficient, the best wing players can handle a lot of shooting variations very well to make it very hard even for the nowadays excellent goalkeepers to save the ball.



A big handicap for the wings is that they are about 2 or 3 meters behind their opposite player in case of a turn over and that it is not very easy for them to prevent a fast break goal. A lot of the best wings can only handle this handicap by having a very distinctive anticipation and a very high level of handball IQ.

- **Starting a triggering action is the only input of the wing players for a tactical move**

  The only task for the wing players at the stage of beginning an attack is to start a trigger action. For example to run inside the defence as a second pivot to irritate the defence players; to help the other players of their team to create a solution for scoring or passing the ball to them. To solve this task as well as possible, a wing player has to be physically very strong to fight against the very tall and strong defence players in the middle.



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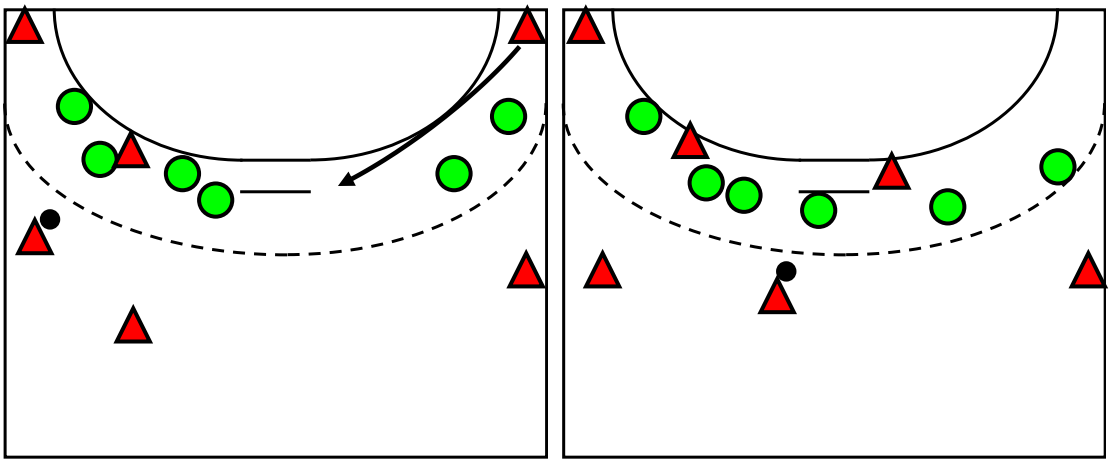
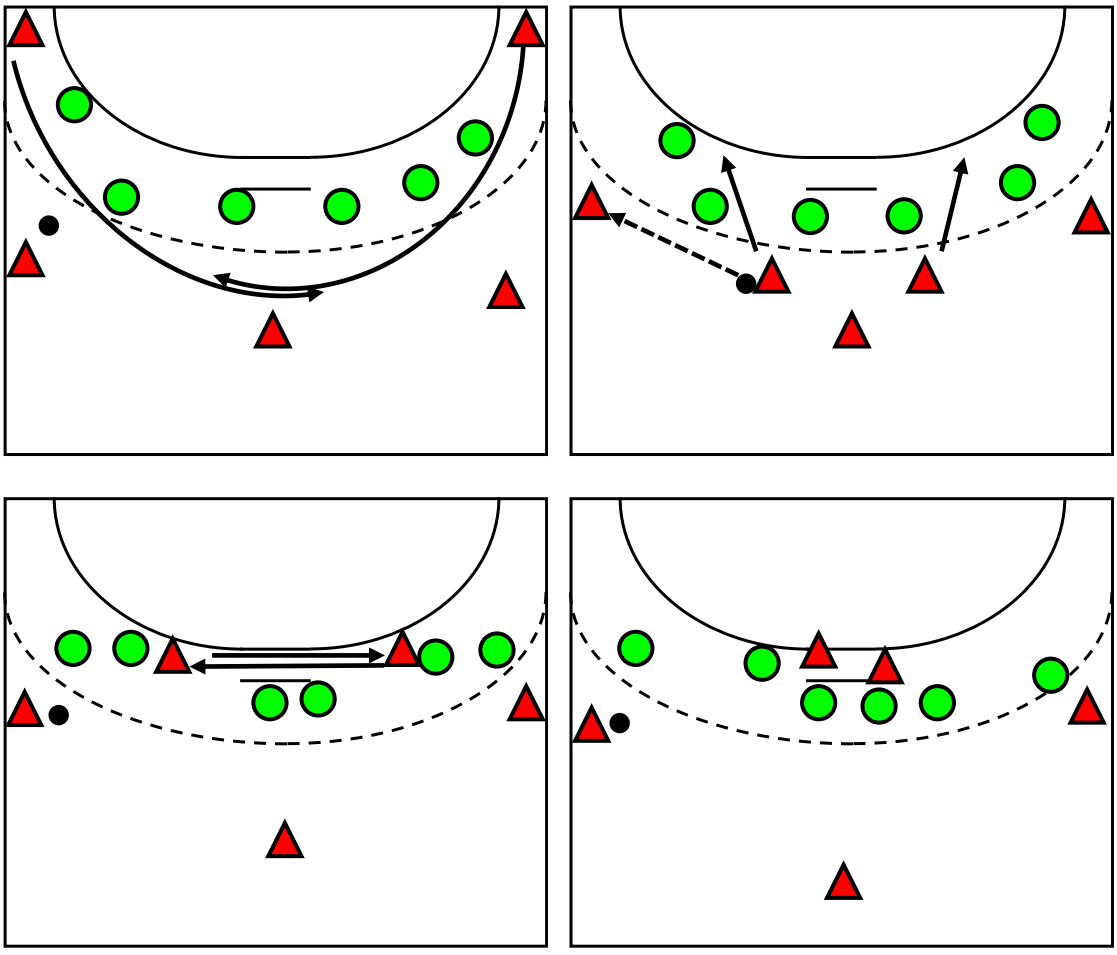


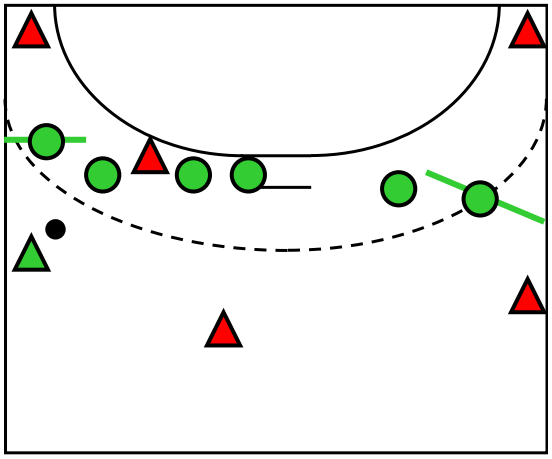
- **Starting a triggering action in numerical minority**

  In the last years teams developed a new solution for numerical minority. Both wing players start a trigger action by running along the 9-meter line until they cross their ways and then they go to the pivot, each on one side. Then they cross on the 6-meter line again and stop between defence player 1 and 2. With this action and synchronized attacking of the backcourt players the defence very often gets irritated by these movements and makes mistakes. And this helps the back court players to create a solution for shooting or passing to one of the pivots.

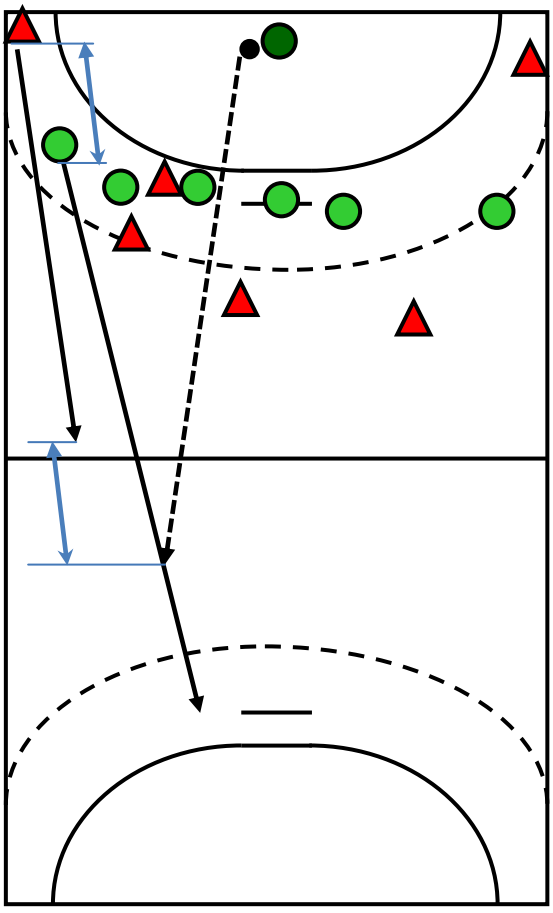


- **Defence: prevent passes from the back court player to the wing instead of defending 1 against 1**

  In the past the wing defender had the main task to prevent the goal shooting of the offensive wing. Nowadays tasks have changed. As on the one side the offensive wing players have their position at the corners of the court, and on the other side back court players nowadays are very strong and tall, the wing defender has to assist the player beside him and has to look for the offensive wing player. The only way to handle this situation is to prevent the pass from the back court to the wing. To solve these tasks as good as possible, a wing defender needs some very important attributes. He has to be very quick with his legs, he should have a strong physics and he should even have a very good anticipation.

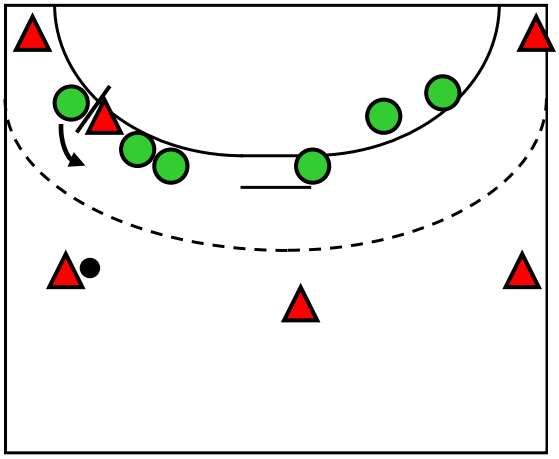


A big advantage of this kind of defence is, that the defending wing is 2 or 3 meters in front of the attacking wing player and in case of a turnover he can easily run for a direct fast break without being disturbed by an opposite player. This fact is often practiced by some teams.



- **Defending against a pivot player which is standing between 1st and 2nd defender trying to block the wing defender**

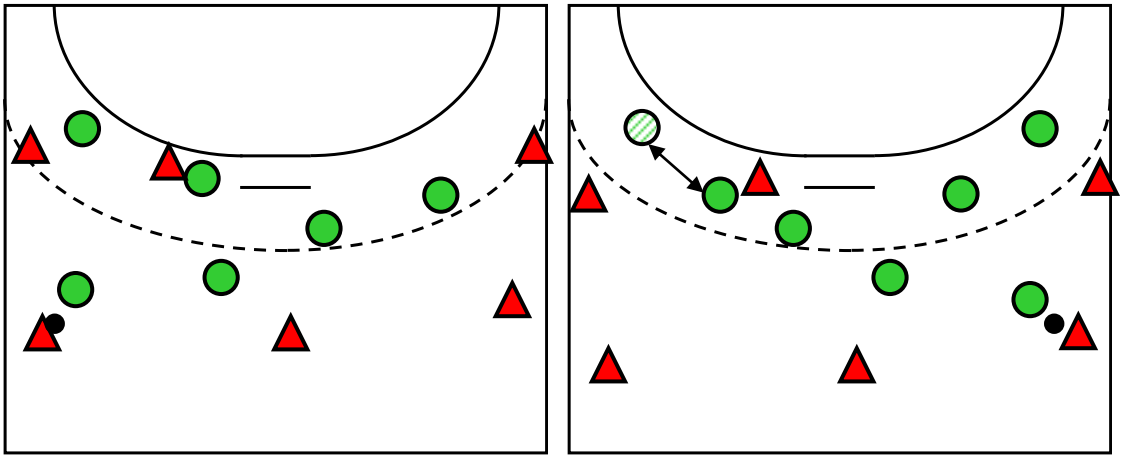
  Since the last years a lot of teams are using a tactical solution in which the pivot player is standing between 1st and 2nd defender. So the smaller wing defender hast to fight hard against the block of the pivot player, because normally pivot players are much bigger and stronger than wing defenders. The only chance is that the wing defender tries to run in front of the pivot player to prevent the pass from the back cord player to the pivot. But as in this situation the wing defender has to play against two players (the wing player and the pivot), he has to have a very good anticipation to recognize where the back cord player passes the ball and fast legs to solve this problem. And a strong physique could help a lot in this situation.



- **Long ways to go for a wing defender in a 3-2-1 defence in modern handball**

  As in modern handball wing players a standing in the corners of the cord, the wing defenders have to run long ways to make a good job. Beside the main task to prevent shots from the wing player he has to help to defend the pivot player and also has to try to prevent long passes to the back cord player on his side and if possible to steel this pass to go for a fast break.

  in the past:



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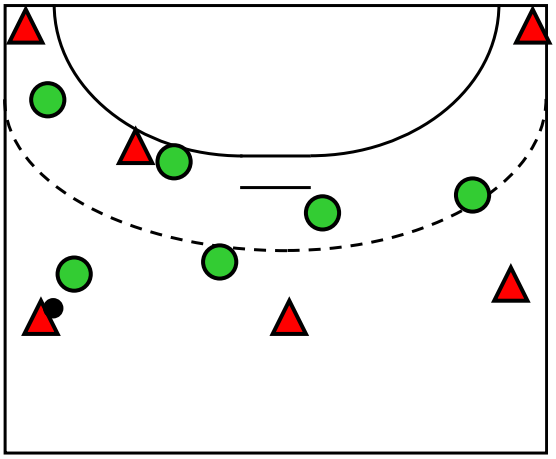
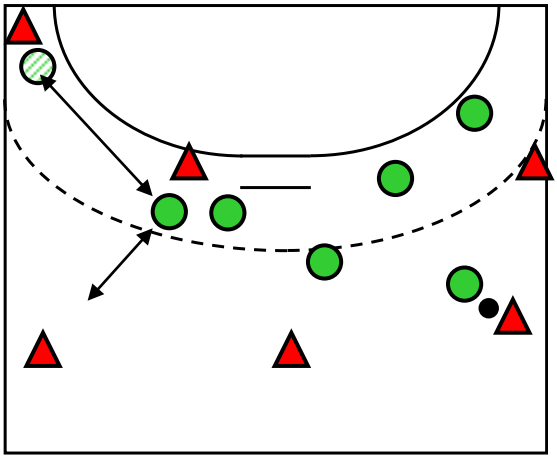


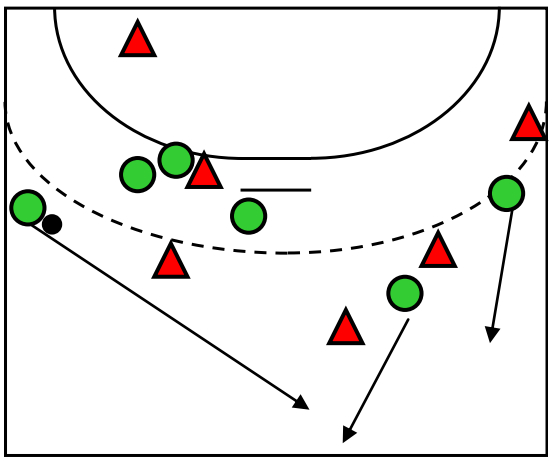


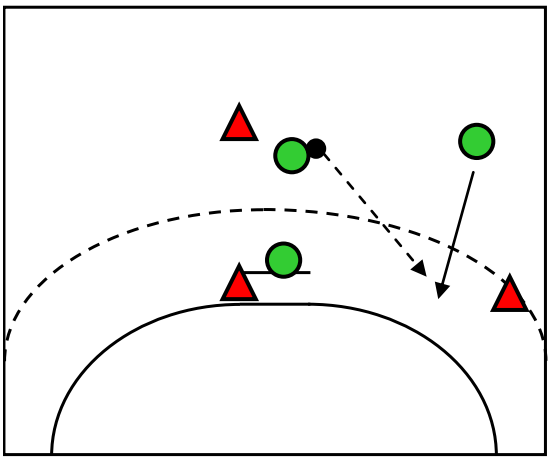
- **In 5-1 defence wing players often are the offensive defender**

  In the past in a 5-1 defence the offensive defender often was a back cord player because wing players were not strong enough to fight against the much bigger and stronger back cord players. As in the present wing players are physically much stronger and back cord players are not playing so statically as in the past and are very quick on their legs, a lot of teams use one of their fast wing players for this defence job.

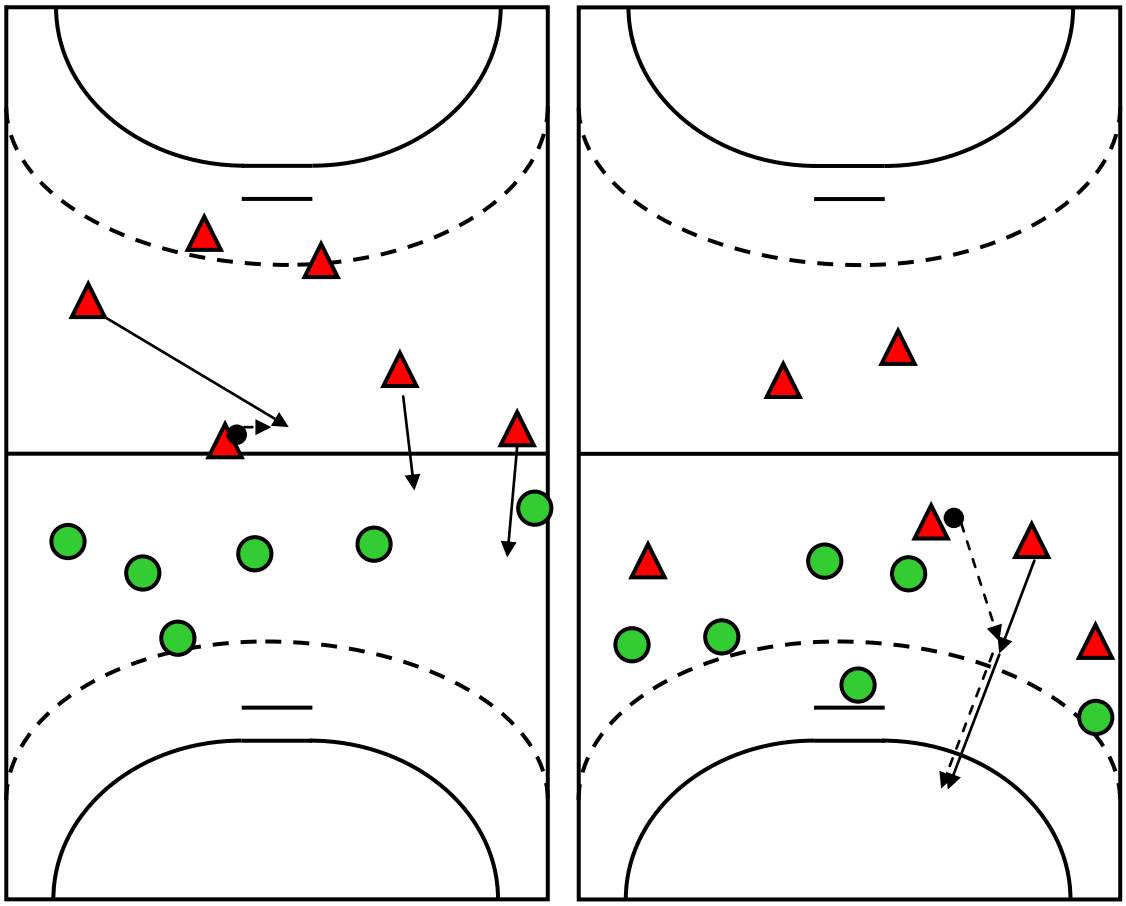
- **Crossing of a wing player in the team fast break**

  At the Euro 2014 some teams often played a special solution for the team fast break: one wing started a triggering action running across the court with the ball instead only running forward. As his opposite player was 2 or 3 meters behind him his team get a man advantage on the other side and as his better hand was situated on the right side he was able to make a very good and quick pass to the next player and they could make use of this advantage very easily.





Some teams created a similar solution at the fast throw off. In this case the wing came running in full speed to for the throw off and they played the same tactical move as descripted above.



Statistics of Wing Shots and Individual Fast Breaks of the best 4 Teams (8 Games) and last 4 Teams (3 Games) oft the Years 2002, 2006, 2010 and 2014

EHF Championships 2002

Wing Goals

Rank		Goals / Shots	average	%	Shot % from all
1.	SWE	44 /79	5,5	56	19
2.	GER	37 / 79	4,6	47	18
3.	DEN	52 / 75	6,5	69	25
4.	ISL	21 / 39	2,6	54	10
Total		**154 / 272**	**4,8**	**57**	**17**

Rank		Goals / Shots	average	%	Shot % from all
9	POL	15 / 26	5	42	22
10	ISR	4 / 17	1,3	36	6
11	SUI	4 / 13	1,3	58	5
12	CRO	8 / 18	2,7	50	11
Total		**31 / 74**	**2,6**	**42**	**11**

This statistic shows that wing players were very important for success. The average of scored goals of wing players of the best 4 teams was 4,8 goals, of the last 4 teams only 2,6 goals per game. The wing players of the first 4 teams had a success percentage of 57%, wing players of the last 4 teams only 42%

Ind. Fast Break

Rank		Goals / Shots	average	%	Shot % from all
1.	SWE	28 /50	3,5	56	12
2.	GER	22 / 39	2,8	56	11
3.	DEN	27 / 42	3,4	64	13
4.	ISL	34 / 60	4,3	57	15
Total		**111 / 191**	**3,5**	**57**	**13**

Rank		Goals / Shots	average	%	Shot % from all
9	POL	5 / 10	5	50	7,5
10	ISR	3 / 7	1,3	43	4,5
11	SUI	2 / 6	1,3	33	2,6
12	CRO	10 / 24	2,7	42	14
Total		**20 / 47**	**2,6**	**43**	**7**

Wing players of the best 4 teams scored on an average of 3,5 fast break goals per match, wing players of the last 4 teams only scored 2,6 goals per game by fast break situations. Similar to wing goals the percentage of fast break goals was over 50% (57%) for the best 4 teams and under 50% (43%) for the last 4 teams.

EHF Championships 2006

Wing Goals

Rank		Goals / Shots	average	%	Shot % from all
1.	FRA	26 /44	3,3	59	11
2.	ESP	37 / 54	4,6	69	15
3.	DEN	36 / 64	4,5	52	14
4.	CRO	33 / 54	4,1	61	14
Total		**132 / 216**	**4,1**	**61**	**13**

Rank		Goals / Shots	average	%	Shot % from all
13-16	SUI	11 / 26	3,7	42	13
13-16	SVK	8 / 22	2,6	36	11
13-16	HUN	21 / 36	7	58	25
13-16	POR	14 / 28	4,7	50	18
Total		**54 / 112**	**4,5**	**48**	**17**

Similar to the European Championships 2002 wing player of the best 4 teams scored more than 4 goals per match. Interestingly wing players of the last 4 teams in average scored more goals (4,5), but the success percentage is still under 50%.

Ind. Fast Break

Rank		Goals / Shots	average	%	Shot % from all
1.	FRA	17 /24	2,1	71	7
2.	ESP	20 / 23	2,5	87	8
3.	DEN	11 / 13	1,4	85	4
4.	CRO	9 / 11	1,1	82	4
Total		**57 / 71**	**4,1**	**80**	**6**

Rank		Goals / Shots	average	%	Shot % from all
13-16	SUI	1 / 1	0,3	100	1
13-16	SVK	5 / 10	1,7	50	7
13-16	HUN	9 / 10	3	90	11
13-16	POR	3 / 6	1	50	4
Total		**18 / 27**	**1,5**	**67**	**6**

In this statistic shows that wing players had a high quality in fast break shots. 80% for the best 4 teams is very excellent, and also the value for the last 4 teams is over 50%

EHF Championships 2010

Wing Goals

Rank		Goals / Shots	average	%	Shot % from all
1.	FRA	31 /54	3,9	57	14
2.	CRO	29 / 54	3,6	54	14
3.	ISL	23 / 45	2,9	51	9
4.	POL	36 / 55	4,5	65	16
Total		**119 / 208**	**3,7**	**57**	**13**

Rank		Goals / Shots	average	%	Shot % from all
13-16	UKR	6 / 11	2	55	7
13-16	SRB	8 / 18	2,7	44	10
13-16	SWE	12 / 27	4	44	15
13-16	HUN	16 / 25	5,3	64	20
Total		**42 / 81**	**3,5**	**52**	**13**

In 2010 the success percentage was over 50% for all teams. Also the scored wing goals per game were nearly the same. In this case you can see that the individual class of a wing player is not so important than the quality of the whole team.

Ind. Fast Break

Rank		Goals / Shots	average	%	Shot % from all
1.	FRA	9 /9	1,1	100	4
2.	CRO	4 / 4	0,5	100	2
3.	ISL	12 / 13	1,5	92	5
4.	POL	9 / 10	1,1	90	4
Total		**34 / 36**	**1,1**	**94**	**4**

Rank		Goals / Shots	average	%	Shot % from all
13-16	UKR	0 / 2	0	0	0
13-16	SRB	1 / 1	0,3	100	1
13-16	SWE	1 / 2	0,5	50	1
13-16	HUN	2 / 3	0,7	67	5
Total		**4 / 6**	**0,3**	**67**	**1**

This statistic shows that not only the tactical discipline in the offence but also in the reversing play was very high. So it was not so easy for wing players to shot goals in the fast break.

EHF Championships 2014

Wing Goals

Rank		Goals / Shots	average	%	Shot % from all
1.	FRA	25 /45	3,1	56	10
2.	DEN	40 / 56	5	71	16
3.	CRO	37 / 63	4,6	59	16
4.	ESP	39 / 72	4,9	54	16
Total		**141 / 236**	**4,4**	**60**	**14**

Rank		Goals / Shots	average	%	Shot % from all
13-16	CZE	4 /7	1,3	57	5
13-16	NOR	13/ 26	4,3	50	17
13-16	SRB	14 / 24	4,7	58	8
13-16	MNE	12 / 17	4	54	18
Total		**43 / 74**	**3,6**	**58**	**11**

As in 2010 the average of scored wing goals was at about 4 goals. And also success percentage of the wing players of all teams was higher than 50%. But 141 scored wing goals of the best 4 teams is an excellent value that shows the high quality of the wing players.

Ind. Fast Break

Rank		Goals / Shots	average	%	Shot % from all
1.	FRA	8 /8	1	100	3
2.	DEN	1 / 2	0,1	50	0
3.	CRO	7 / 7	0,9	100	3
4.	ESP	6 / 7	0,8	86	3
Total		**22 / 24**	**0,6**	**92**	**2**

Rank		Goals / Shots	average	%	Shot % from all
13-16	CZE	3 /3	1	100	4
13-16	NOR	1/ 1	0,3	100	1
13-16	SRB	2/ 2	0,7	100	3
13-16	MNE	4 / 6	1,3	67	6
Total		**10 / 12**	**0,8**	**83**	**3**

Similar to the Euro 2010 the statistic shows that scoring goals by fast break is not so easy for wings like in the past. The main reason is that a lot of teams use the tactical solution of team fast break and don't take the risk of a fast break of their wing players.

Conclusion of Statistic

Based on these statistics you can see that the percentage of wing goals has been equal at the last 4 EHF Championships, between 11 and 17 percent without finding out a tendency in one direction. After a first look you could say that the quality of wing players was the same through these years. But you will have to consider that the conditions for wing players in the offensive are much tougher nowadays than in the past because of the much higher quality of defences. In the present it's much harder for wing players to score because they are depending on good passes from their backcourt players. And these players have to find solutions against very tall and strong defensive players. And creating chances for shooting by using feints 1 against 1 is not so easy because wings have their position at the corners of the cord and from there it's very hard to win 1 against 1. From this point of view this statistics show that the quality of wing players has increased in the last years.
The percentage of individual fast break goals, which is normally a main task of wing players, has surprisingly decreased although wing defenders have a very good starting position for the fast break compared with the offensive wing players. I think that a very high level of discipline of all teams in case of a turn over and running back to defence is one reason for this. And the other reason is that teams more often use team fast breaks to score than take the risk of a turn over by making a long pass to the fast wing player.

Conclusion

In principle the importance of wing players has not changed. A good wing player can make the difference between winning and losing a game. In a lot of the best teams in the world the wings are the guaranty for easy goals. On one side by scoring with efficient wing shots, fast break goals or pushing the team fast break. But also in defence they can make the difference. Not only by preventing goals from his opposite player but also by helping to defend against backcourt players and stealing the ball from offence and shooting fast break goals.
Only the main tasks have changed. A wing player has to master much more shooting variations. For this he needs an excellent springiness, his body condition has to be on a top level, he has to be very strong for defence tasks against backcourt players and pivot players. And he has to have very quick legs for preventing passes, making steals and running fast breaks.

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Qualitative Analysis

“The Pivot Player against open and closed defense system”

Mag. Simona Spiridon

Austrian Handball Federation

1. SUMMARY

In the first part of my study I characterize the main role and characteristics of the pivot player in a handball game. As well, the aim was to show the main tasks and skills of the pivot in attack. The profile of the pivot player falls on the same coordinates of the modern approach of content in the handball game.
In the second part of this study I show the evolution of the pivot players that played in the Final 4 of the Women´s EHF Champions League in 2013/14 season and the importance of this position in modern handball.

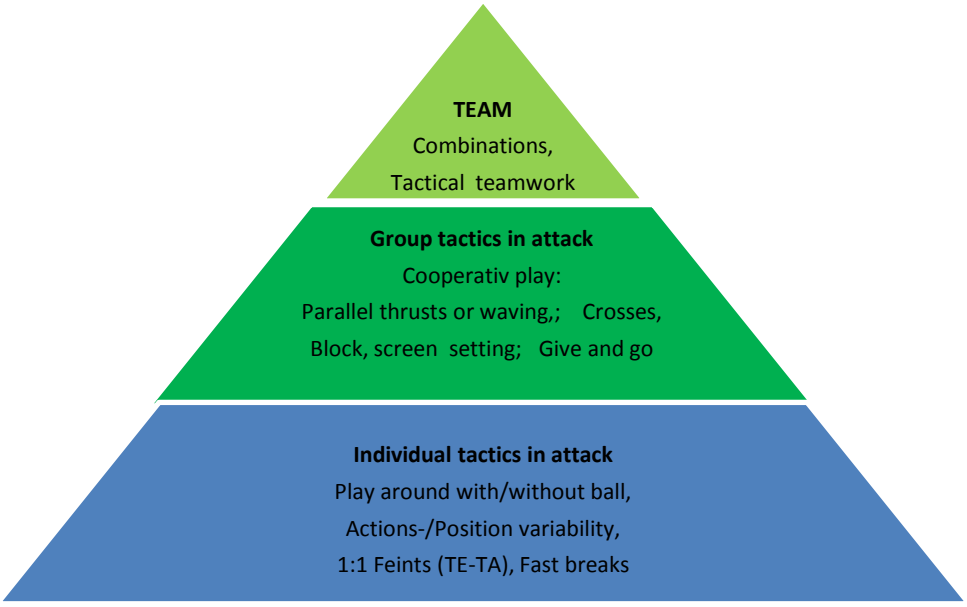
Key words: handball, pivot, line player, playing system, patterns

2. INTRODUCTION

Handball is a sport game characterized by a clearly defined goal: scoring many goals and conceding as few as possible. The achievement of this aim is determined by technical and tactical knowledge. Technique and tactics of handball are regarded together on purpose. Usually handball tactics are divided into tactics of play in attack and tactics of play in defense. Therefore, the results in a handball game are determined by numerous factors, where the performance efficiency of tactical actions assumes an important role. It can be said that attack is a period in a game in which the basic tactical aim is to score.

2.1 Attacking in handball

Attacking in handball consists of three hierarchical levels build on each other:



The fundament of the pyramid system is formed of **individual qualities/tactics of the players**. That means that the players have to:

- Ball reception, catching and passing the ball
- Shooting,, throwing a goal
- Dribbling, advancing the ball by dribbling
- Running-inside (to the 6 m line) and opening (freeing oneself, breaking away)
- Feints (faked technical elements)
- Fast-breaks..

"Individual strength is not everything - but without individual strength eveything is nothing."

The better the skills and the skills of each player are formed and the more variable they can bring their individual quality at different levels for successful use , the more efficiently operates the attack.
Klaus Feldmann (2014)

The second part are the group tactics which become most obvious through the following planned actions:

- Thrusts (run-ups, running starts) or waving
- Give and go
- Crosses
- Lead away (move away, clearance)
- Block , screen setting
- Group counter-attack
- Various combinations

If we are dealing with cooperation among 2-5 players, then we are talking about group tactics. Principles of teaching and mastering this segment of play say we must start with simple forms of cooperation between two players , first with those playing nearby positions (LB-LW, CB- P, RB- RW, LB- P, RB- P, LW- P, RW- P…), and last we should gradually expand education and tactical solution in attack with more players.
Research studies have shown the following occurrence rate of cooperation between certain groups of players in attack during a match:

- „Most frequent is the cooperation between 2 and 3 backs (about 50%),
- Cooperation between backs and wings follows (about 27%),
- **Cooperation between backs and pivots (about 20%**),
- Least frequent, as expected, is tactical **cooperation between wings and pivots (2%)."**

Zdravko Malic & Boric Dvorsek (2012)

The last part is the team tactics also known as **collective tactics** where all field players are analysed through:

- Group and/or collective counter-attack
- Offense set play with one pivot
- Offense set play with two pivots
- Offense set play with one pivot and one post
- Offense set play in attack in numerical superiority and inferiority
- Offense set play with seven attackers

The collective tactics assumes optimal use of the specific qualities of every individual player by assigning tasks compitable with theri abilities and in appropriate time and space terms depending on the confronting activities of players of the opposing team. On the basis of these knowledge I want to analyse the technical and tactical play of a pivot player against open and closed defense system.

2.2 Pivot / Line player skills

Pivot players or Line players – should be strong and robust players by their body constitution like Dragana Cvijc. In some teams they are the tallest players like Thorsgaard from Midtjylland because they must endure constant physical contact with 1-2 opposing players.

The most common **play tasks** of a pivot are:

- The typical basic psycho-motor abilities for a pivot should be: strength, power, coordination, agility, and speed.
- The following TE-TA qualities specially characterize these players: excellent pivot technique to both sides, extremely good ball reception technique with one and two hands, ability to perform feints, a rich repertoire of shots (jump shots, dive shots and set shots) and double pass (return pass) play.
- They should also practice playing on the positions of backs and wings in order to be able to realize scoring chances from these positions.
- They belong to the first wave group in the counter-attack – meaning they perform similar tasks as wing attackers.
- They have to play most of the game for their teammates (back players) to facilitate their scoring chances; that means the pivot players need good mental qualities.
- The pivot player is the only player who usually stands with his/her back to goal in the attack position.
- Another important factor is the individual choice of the position on the field according to the team tactic, the choice of position play, the choice of time and the constant willingness to turn back as fast as possible to the defense.

Zdravko Malic & Boric Dvorsek (2012)

In addition to the play tasks the line players need high **technical demands** to:

- Jump with the left or right leg
- Jump with both legs
- The timing of blocking: pivot players use their bodies to block free movements of defenders, thus providing free space for their teammates to breakthrough or to take an open shot. They can also break by stepping aside, thus providing themselves with a free passing lane for open ball reception and scoring opportunity.
- catch hard and hard to reach balls
- fight for and enforce rebounds
- receiving the ball under pressure
- receiving the ball in motion
- solve throws from rotation out of the opponent
- jump, fall-jump throws from the 6 m line
- receiving the ball even with one hand in various heights and obstruction with ball security
- frontal, side and back blocking on circle (6 m)
- continue playing the ball even under heavy oppression
- variable feints with change of direction

In handball practice we can find the active and passive blocks of a line player:

In **passive** blocks the pivot uses her body to block, prevent defenders from acting against another attacker while she taking a shot.

In **active** blocks, the pivot tries to open free he has delayed the defensive action of the blocked defender. The pivot steps aside or in depth to break away, thus clearing for the ball reception and shooting. In handball theory and practice the following blocks are most frequent:

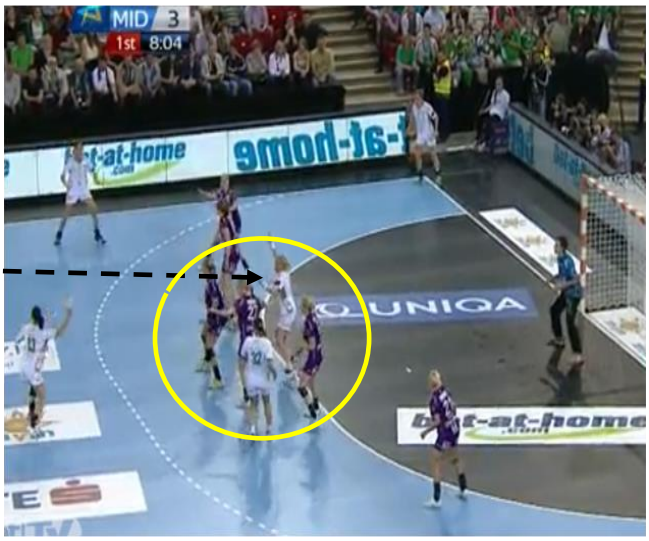
- a block on the half, either vertical or diagonal,
- a block on the front defender,
- a block on a defender,
- a block on the back-center,
- a screen set for the 9m throw performance.

Any block can be executed with and without the ball. By the criterion of the blocker positioning, blocks can be classified as the front blocks (face to face with the defending counterpart being blocked), back blocks (with the back to the defender), and the most frequent diagonal, side, lateral blocks, which are most suitable for the entry and subsequent exit out of the block setting.

This part of the group tactics is frequently used in breaking one of the open, agressive, to-player-and-ball-oriented defences, against combined defences and against „man-to-man" play.Although, one must admit that the so called closed, fixed, shallow defence formation, like 6:0, have become ever more aggressive in modern elite handball.

a block on the back-center

Block for MB player



No look pass to pivot

Block on the half defender

A screen set for the 9m shot performance

3. DEVELOPMENT

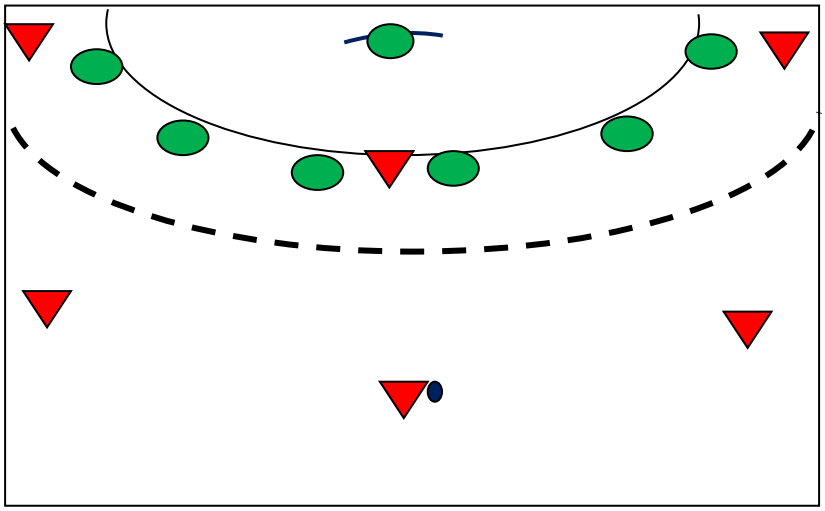
3.1. Attack vs. 6:0 (close defense)

What we have to do against 6:0 defense in line? Klaus Feldmann says: **"**Open spaces - take advantage of gaps" ("Räume offnen – Lücken nutzen")

Characteristics of defensive defense :

- The defense players are very close
- The corridors between defenders are very narrow
- Playing with the pivot is limited

First of all: "The Wall Must Fall!"



1. In the first step the attack has to try to open rooms in the width so that the gap cannot get even smaller.

2. LW / RW should act in the corner or line outside. LB / RB should also take a wide position on the sidelines.

3. The second task is that the ball has to go faster than the defense can move

4. The third task is so called "lateral movement" of attacker, in contrast to the classical shock movements (front and back on the position).

5. In the last step is asked the cooperation with the pivot players , pivot which should block the side moves of the defender

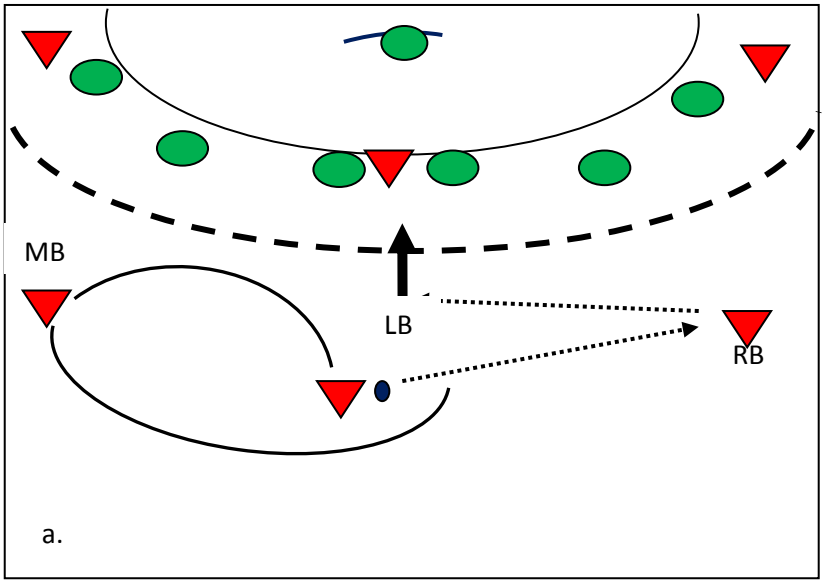
6. The pivot must not act just between the central defenders but also between half and outside defender.

The most frequently relationships play against defense 6: 0 to 1 Pivot

A. Changing positions among back court players (Leeres Kreuz) with multiple possibilities to complete

a) Pivot position between IL and IR defender. MB attacker passes the ball to RB and change position without ball with LB who runs into the center position. RB passes the ball to the LB which chooses to throw because defender players IL and IR play defensively against the Pivot.

When the defender choose to remain at the 6 m line, first option for LB is to throw over the screening of the Pivot. This is the main task for the Pivot.



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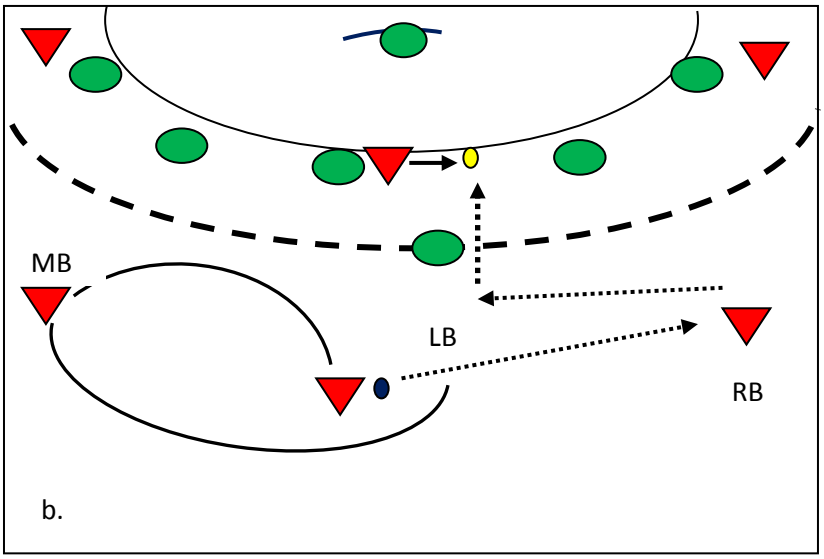
b) Pivot Position between IL and IR defender. MB attacker passes the ball to RB and change position with LB who runs into the center position.RB passes the ball to the LB and she (new MB) tries to provoke the IL defender to make a step forward – thus eliberate a space for the P. In the very moment when IL falls out to the LB, LB plays the ball to the Pivot which moves laterally into the free space behind the IL . P catches and throws the ball.

When IL defender chooses to fall out to tackle the CB (LB initial), first option for LB is to pass to the pivot. This is the second main task for the Pivot



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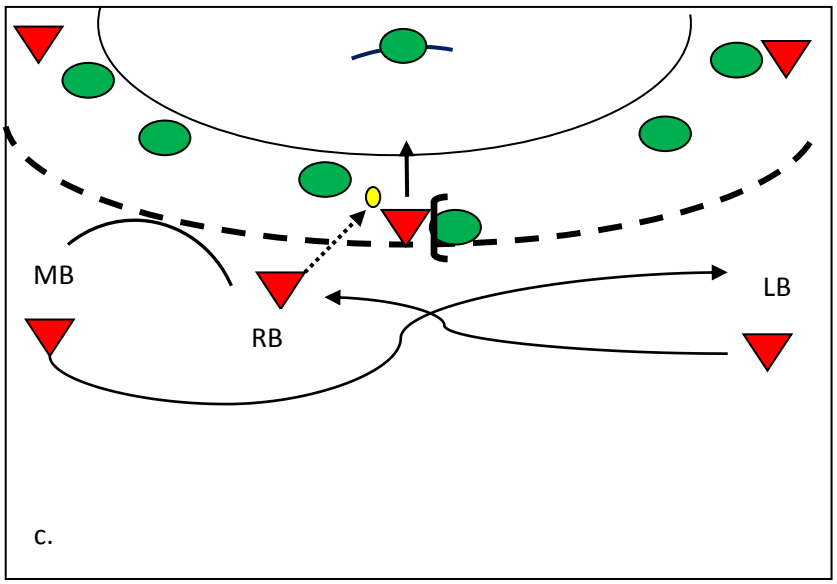
c) The same situation like b), Pivot position between IL and IR defender. MB attacker passes the ball to RB and changes position with LB who runs into the center position.RB passes the ball to the LB and she (new MB) tries to provoke the IL defender to make a step forward –thus eliberates a space for the Pivot. In this moment when IL falls out to the MB (LB), the Pivot changes the position from the IR to the IL and picks the block to her. MB tries to execute crossing with the RB, wich plays pick and roll with the P.

Changing positions without the ball LB with MB; then MB crosses with RB who plays pick and roll on the IL with the P. P throws after pick and roll.



When IL defender choose to fall out to tackle the RB after the crossing MB (initial LB) with RB, the Pivot will play pick and roll with RB and the Pivot will throw. This is the third main task for the Pivot: pick and roll

Marko Sibila Attack (2012)

B. Intercrossing of the MB with the LP followed by the entry of the LP on the line and the MB going on to the RB or LB position. This is followed by a 1:1 game and creating surpluses or intercrossing the guards

MB crosses with Pivot
MB goes to the RB position.
P takes the position between 3-3

After Intercrossing of MB with P, the RB goes to MB position and plays 2:2 with the Pivot

C. **LW Transition to second pivot: the main idea of the offense when playing against a 6:0 defence with 2 pivots is to split the defence into two parts, left one and right one. This is easy to see because one pivot man finds himself between defence players 2 and 3, and the other one between players 4 and 5. At that moment the compactness of defence 6:0 disappears, the attack has the possibility of playing 2:2 (cooperation between a back and a pivot man) on both sides; left and right.**

3.2. Attack vs. Open defense (5:1; 4:2; 3:2:1)

The most important detail of an open defense is the aggressiveness of the front (first) line. This aggressiveness means “speed” against “power”.
Pokrajac (2014)

Characteristics of the open defense :

- The Front defender has to interrupt the ball transition between the backcourt players
- The Front defender has a task to push away the middle back as far as possible, in order to hinder the intersection of backs.
- The Back center half has to be a good coordinator, an excellent blocker and good in guarding wing players sweeping inside.

Problems of such defence appear when the attack switches to two pivots and in this situation the open defence very often adapts itself, that is, transforms into another formation. One could use many ways of transformation which depends, first of all, on the profile of the defence players.

The open defense offers a good opportunity to play

A.**Transition from the Wings positions in a system of play with two pivots**

Against 5:1 Defense: Transition RW to 2 pivots, breakthrough of P

B. Transition from Back players into a system with two pivots

The LB passes to the MB and rushes into the defense as a second pivot player.She intends to go out to the RB position. The MB takes by the transition the place of the LB and the RB takes the place of the MB.

Against open defense: Transition from LB to two Pivots and then moves out to RB

Excursus: „The main role of pivot is to perform a well- timed break away into a gap behind the back of the defender who has fallen out to the attacker to prevent a shot, and to „cut down, split the zone", i.e.break the defence on the position either the 3rd or 2nd defender with the aim to prevent deep side movement of the defenders, thus creating breakthrough opportunities to his/her teammate. He/ she crosses with one of the back in a way to represent a direct scoring danger, usually from 7-8m, or to set a block for the open shot performance of the backcourt player."

Zdravko Malic & Boric Dvorsek (2012)

4. METHODS

I was collecting data of the women Final 4 CL matches from the website of the European Handball Federation. Observations made by studying the video recordings of pivot play in the Final 4 matches.

Statistical calculation of the collected data was necessary to analyze the individual pivot performance using the following techniques:

- Percentage of the shots on goal, which indicated efficiency, as the ratio between the number of goals and the total number of throws.
- Playing time
- Pivot placement
- Tactical variations (block e.g.)
- Cooperation with group / team tactic

5. STATISTICS

Analysis of the 5 pivot players of the women champions league final 4 teams in Budapest Mai 2014.

The five pivot players are:

1. Heidi Löke/AUDI ETO Györ
2. Cvijic/Buducnost
3. Dokic/Vardar Skopje
4. Begona Fernandez
5. Thorsgaard/ Midtylland

1) LÖKE HEIDI
Season 2013/14 scored 52 Goals in CL
Pivot Player
Born 12 December 1982
High 173 cm, ± 73kg

Heidi Löke has about 173 cm with a density and an interesting explosion. Her positioning is always back to goal or facing the ball. She is often between the position 2 and 3 on the left side. Her playing is almost exclusively close to 6 meters. She rarely uses play towards releasing its partners (delivery block, postman, etc.). She offers rapid succession: reception/without firing pulse with one arm.

Table 1:

Name of Pivot	Match	Goal	Shots	6mC	%	7mP	Team Scored	% of Team
LÖKE Heidi	GYÖ- MID	3	7	3/7	43%	0	29	10%
	GYÖ- BUD	4	8	4/8	50%	1	27	15%
	Total Final4	7	15	7/15	46%	1	56	13%

Table 2: Heidi Löke placement in PIVOT at the beginnig of the set play system in attack

LÖKE HEIDI	Defense System	**1-2 Position**	**2-3 Position**	**3-4 Position**	**4-5 Position**	**5-6 Position**	**Post player Position**
GYÖR-MIDT	**6:0 Defence**	7	11	18	4	4	9
	5:1 Defence	2	15	9	3	3	6
GYÖR- BUD	**6:0 Defence**	4	33	22	9	2	5
	TOTAL	**13**	**59**	**49**	**16**	**9**	**20**

2) CVIJIC DRAGANA
Season 2013/14 scored 47 Goals in CL
Pivot Player
Born 15 March 1990
High 185 cm, ± 95kg

For me she is the perfect player on the pivot position. She is absolutely complete because she is strong and robust, very good in attack, very good in defense, she is a FIGHTER!
She will catch the ball from everywhere and make blocks/screens for the backcourt players.

Table 3:

Name of Pivot	Match	Goal	Shots	6mC	%	7mP	Team Scored	% of Team
CVIJIC Dragana	BUD- VAR	5	5	5/5	100%	2	22	22%
	BUD-GYÖ	4	4	4/4	100%	2	21	19%
	Total	9	9	9/9	100%	4	43	20%

Table 4: Dragana Cvijic placement in PIVOT at the beginnig of the set play system in attack

CVIJIC Draga	Defense System	**1-2 Position**	**2-3 Position**	**3-4 Position**	**4-5 Position**	**5-6 Position**	**Post player Position**
BUD-VAR	**6:0 Defence**	2	9	12	3	0	0
	5:1 Defence	0	25	4	3	3	0
BUD-GYÖR	**6:0 Defence**	2	15	35	3	0	0
	TOTAL	**4**	**49**	**51**	**9**	**3**	**0**

3) DOKIC ANA

Season 2013/14 scored 52 Goals in CL
Pivot Player
Born 9 February 1979
High 165 cm, ± 60kg

One of the smallest pivot players but she has a great fighting spirit. She is very "sly", strong and has a good coordination, agility, speed and also anticipated well the game of pivot. In defence you will not score easily against her.

Table 5:

Name of Pivot	Match	Goal	Shots	6mC	%	7mP	Team Scored	% of Team
DOKIC Ana	VAR-BUD	2	4	2/4	50%	2	20	10%
	VAR- MID	2	3	2/3	67%	3	34	5%
	Total	4	7	4/7	57%	5	54	7%

Table 6: DOKIC placement in PIVOT at the beginnig of the set play system in attack

DOKIC ANA	Defence System	**1-2 Position**	**2-3 Position**	**3-4 Position**	**4-5 Position**	**5-6 Position**	**Post player Position**
BUD-VAR	**6:0 Defence**	14	23	24	18	2	6
VAR- MIDT	**6:0 Defence**	0	1	4	2	0	1
	5:1 Defence	3	10	7	6	2	4
	TOTAL	**17**	**34**	**35**	**26**	**4**	**11**

4) FERNANDEZ BEGONA

Season 2013/14 scored 11 Goals in CL
Pivot Player
Born 22 March 1980
High 180 cm, ± 71kg

She had played more in defense then in offense during this season in the EHF Champions League. Not strong but also not weak. Has a good mobility and speed.

Table 7:

Name of Pivot	Match	Goal	Shots	6mC	%	7mP	Team Scored	% of Team
FERNANDEZ Begonia	VAR-BUD	0	0	0	0%	0	20	0%
	VAR-MID	2	2	2/2	100%	0	34	5%
	Total	2	2	2/2		0	54	3%

Table 8: Fernandez placement in PIVOT at the beginnig of of the set play system in attack

FERNANDEZ Begona	Defence System	**1-2 Position**	**2-3 Position**	**3-4 Position**	**4-5 Position**	**5-6 Position**	**Post player Position**
BUD-VAR	**6:0 Defence**	0	1	0	0	0	1
VAR- MIDT	**6:0 Defence**	5	4	10	7	2	3
	5:1 Defence	0	0	0	0	0	0
	TOTAL	**5**	**5**	**10**	**7**	**2**	**4**

5) THORSGAARD SUSAN

Season 2013/14 scored 33 Goals in CL
Pivot Player
Born 13 October 1988
High 190 cm, ± 80kg

Susann Thorsgaard is just playing in offense.

She is a typical Scandinavian pivot player. She catches the balls from everywhere, doesn´t play a vertical block but everything around 6m belongs to her. The highest pivot player in Women´s EHF Champions League; stands at 190 cm, strong and clever, with much knowledge about the pivot game. I don´t understand why she plays in attack only because she is a very good defense player too.
To remove her from the game, opposing teams have accomplished defenders almost a mark near "man to man".

Table 9:

Name of Pivot	Match	Goal	Shots	6mC	%	7mP	Team Scored	% of Team
THORSGAARD Susan	MID-GYÖ	1	2	1/2	50%	3	26	4%
	MID- VAR	4	5	4/5	80%	3	31	16%
	Total	5	7	5/7	71%	6	57	8%

Table 10: Thorsgaard placement in PIVOT to the beginnig of playing system in attack

THORSGAARD Susan	Defence System	**1-2 Position**	**2-3 Position**	**3-4 Position**	**4-5 Position**	**5-6 Position**	**Post player Position**
GYÖR- MIDT	**6:0 Defence**	10	8	20	10	3	0
VAR- MIDT	**6:0Defence**	1	4	17	8	1	0
	5:1 Defence	5	18	5	2	0	0
	TOTAL	**16**	**30**	**42**	**20**	**4**	**0**

6. DISCUSSION

All 4 teams in the Final 4 matches played a 6:0 defense set. Moreover the handball of our days is faster and more physical. Just Midtjylland sometimes changed their defense into 5:1 or 5:0+1.

In the first table of each player we can see the effectiveness of the pivot player in her team in two different matches. Heidi Löke had an average of total goals in her team of about 13%, Dragana Cvijic had 20%, Ana Dokic had 7%, Begona Fernandez 3% and Susan Thorsgaard had 8%.

In the chart with the “Placement of PIVOT at the beginnig of the set play system in attack” I’ve analysed that:

- Löke´s game takes place in the center between 2-3 and 3-4 defender player most of the time.
- Cvijic´s game takes place also in the center between 2-3 and 3-4 defender player most of the time. 95% of the passes to the pivot she gets from the left back (Neagu). She is addicted of the performance of left back.

- Dokic´s game takes place on all positions from outside right to Left Half excepting the 5-6 space between left half and left outside defender.
- Fernandez´s game takes place more in the middle of the defense between 3-4 Inside defenders.
- Thorsgaard´s game takes place from the outside right position to left half position.

The teams from Györ, Buducnost and Vardar played more than half time of both games in a system with 2 pivot players with tranisition from wings about 80% (84 times) and about 20 % of backcourt transitions (22 times). Midtjyllands team didn't play in a system with 2 pivots in attack.

In all „Man Down" situations Buducnost, Vardar and Midtjylland played a transition from wings position to the pivot and they played in a „System with one pivot". Györ played direct with 1 Pivot from the beginnig.

The most played combination in this tournament were following :
- Wings Transition
- Intercrossing from MB with Pivot
- „Empty crossing" (change places without ball of MB and one Back player)
- Veszprem (one back player passes the ball to the wing and changes places without ball with Middle back)

Midtjylland played a typical Scandinavian handball that means they played not a lot of combinations they concentrated their game in attack with crossings and direct 1-1 on the goal. Their game is more based on group tactics game and not on collective game.

7. CONCLUSION

In modern top-level handball very few teams use an open set defense system as their basic solution. But many of them try to perform this kind of defense as a surprise during the matches.

Goal Distribution % Season 2013/14 of all 5 Pivots Player in WOMEN`S EHF CHAMPIONS LEAGUE
Table 11:

Teams in CL Season 2013/2014	Pivot -Club	Teams No. of goals in CL	Pivot No. of goals in CL	Efficiency of Pivot %
Györi ETO	Löke	371	52	14%
Buducnost	Cvijic	349	47	14%
Vardar Skopje	Dokic/Fernandez	461	32/11	6% / 2%
Midtjylland	Thorsgaard	374	33	9%

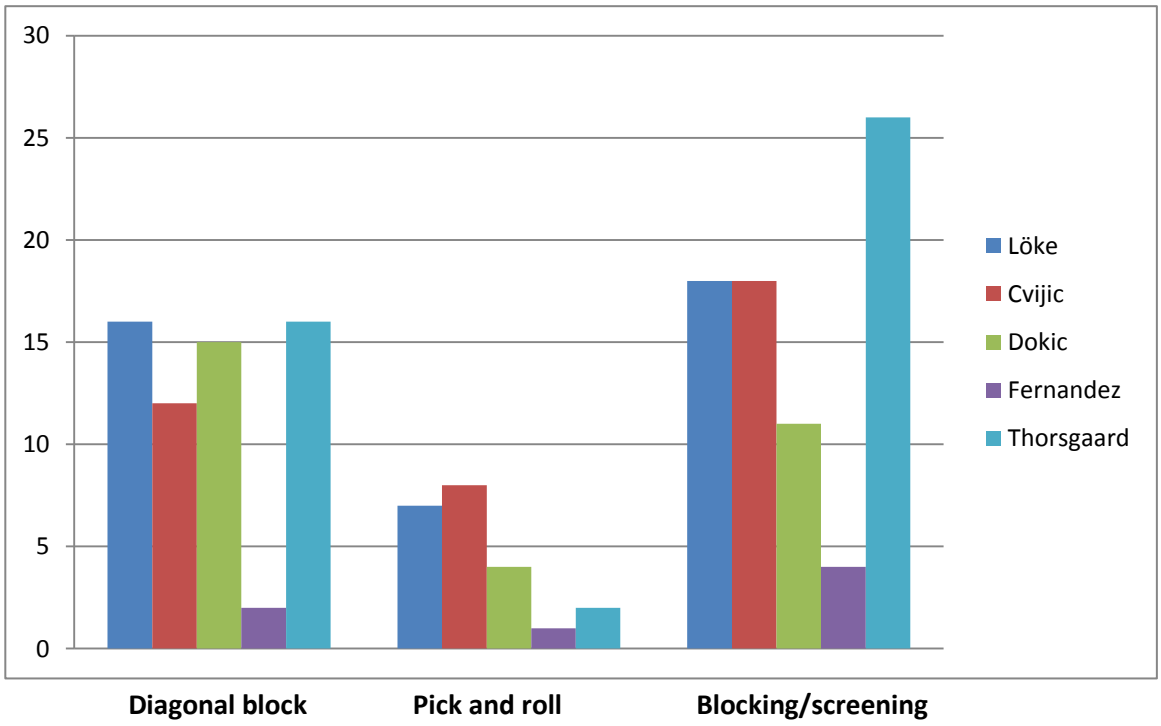
As we can see in the table above Heidi Löke and Dragana Cvijic took a really important role in their teams. Both had a 14% percentage of the goals of their teams in the EHF Champions League Season. Even if those 2 players don´t have the ball they accomplish important tasks in every situation of their respective team in attack. They have a key role in their teams.

As you can see in the lower chart Löke likes to play more with blocking and pick and roll. Löke is playing more self-orientated and not as much for the team.

Cvijic picks more screening for her backcourt players. Her scoring percentage is the best of all players.

Thorsgaard is playing more for their teammates. She sets the screen for the 9 m players more than all other pivots. Also she prefers more a block set close to the 6m line.

Table 12:



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Marko Sibila Attack vs. 6:0 zone defence (close defence)”

Pokrajac Branislav „Open defense system 3:2:1; 3-3; 4:2” Denmark 12-18 January 2014)

Zdravko Malic & Boric Dvoršek “Handball- The Bench Perspective “

Matches Analysis: http://www.laola1.tv/de-at/ehftv/266.html

Video Internet: www.ehftv.com

FURTHER READING:

Francisco M. Ávila Moreno – „Set-Offence design”

Master Coaches Theses – Part 1
Master Coaches Theses – Part 2

Mag. Roman Filz „The qualitative analysis of the EHF Men’s 20 European Championship “

The relative importance of the speed of players in different positions in modern handball.

Marko Koks

Estonian Handball Federation, Estonia

01.09 2014

In this study I examine the role of the increase of speed and the specifics of the activities of the different positions of modern handball compared with the past.
Modern handball, which is faster and more dynamic than ever (Sevim, 2008), in general has become one of the fastest racing games in the world, and both individual as well as team activities in attack and defense in the game have become increasingly faster and more powerful. Depending on this according to the game players in different positions need to be as fast as possible, out of them the fastest players are wingers, which role performs the author by himself.

Due to this, there came up a corresponding interest in the study, as the author himself engaged in handball on the professional level scientific explanation, appropriate tests and trials to be very helpful for future in his sports career.

There is a lack of studies on what are the activities of the players of the various positions and how big is the intensity of speed and movement activity in an attack. Based on this work we establish our goals:
1.To examine the movement activities of players on different positions.
2.To provide the motor abilities of players in different positions..
3 To bring out the intensities in speed of players in different positions.

General characteristcs of modern handball

Handball is a team game where two teams act alternately in attack and in defense, depending on who owns the ball, and who trys to get it.The main aim of attacking team is to carry the ball through or past from the opposite team's defense and to score a goal.The aim of the defending team is to prevent the opponents to score and stir attacking players as much as possible and to win possession of the ball as quickly as possible.
Victory in handball, like in other ball games, is when team is able to throw more goals than the opposite team (Šibila et al, 2004)

- Handball is a dynamic, popular and exciting sport that requires an athletic person, strength, endurance, coordination, and in particular the excellent team work.
- Handball is the fastest sport after the ice hockey.
- Handball is one of the most popular sports in the world.
- Handball helps to preserve and maintain health and good physical condition.
- Handball is a very fast, dynamic and exciting game, which uses many movements from other fields of sport, and vice versa movements which are used in handball are used in many other sports.
- Handball is treated as a primary or underlying sport, in which there are characteristic activities inherent in human - running, walking, jumping, throwing.
- Handball is a simple game that can play any child or adult who has a desire to have fun and spend time emotionally

- Handball is the most popular sports in Europe aftert football, and one of the fastest-growing sport games in Asia and Africa.

- Handball is characterized by frequent physical contacts; unlimited number of exchanges; goal shots which speed often exceeds the 100km / h, this all keeps the high emotional tension in the game.
- There is a distinction made between so-called Olympic handball (handball hall 7: 7), beach handball and outdoor playgrounds played handball known as a great handball (11:11).

The structure of the game

Parameters of the game

Handball has changed very fast over the last 10-15 years. More pronounced practical changes in the game are:

- There are no long, slow attacks, with many interruption by protecting players; the time of the attacks are very short – lasting just a few seconds.
- Due to the rapid pace of the game there are lot of turnovers.
- A large number of attacks (almost all) are fast attacks.
- After the goal achieved by players from on team the other players try, in every possible case, to begin the attack as quick as possible.
- During the game significantly more goals are scored in average.

These changes in a game are caused by:

- improved protection in a game - it is very difficult to achieve goals against an organized defense. Protective game has become aggressive and often uses defense systems, in which protecting players operate far outside, this complicates the whole team ’s combination in the game;
- players better physical, technical and tactical preparation;
- changes in the rules of the game;
- spectators demand, ie. game as a show.

The impact of regulations to the game

Over the past decade, the handball regulations have been changed and these developmental changes have positively affected the pace of the game. Through greater dynamism the game has become much more attractive for spectators. Changed rules of the game have accelerated and extended the playing time. A game has become faster, more dynamic and demanding for energy supply (Urban jt., 2010; Tàborsky, 2011).

Becoming faster very significantly influenced modern handball by just a few changes and updates to the rules. Those favor faster playing off the ball and does not allow to slow down the game, so-called long keeping the ball in the vast time.

Changes are been made in the handball regulation in the recent years:

- quick throw off;
- after attacking team's goal the throw off team does not have to wait until the opposite team players return to their half of the playground (IHF, 2001);
- entering to the attacking team's goal area line, the ball is not thrown off from the goal area line but the throws off takes place from anywhere in the goalkeeper's playing area. (IHF; 2005);
- passive game - when the attacking team is attacking for a longer period of time and has not completed any throws on goal or do not show up willingness to attack the goal, and in clear way try to stretch the time, the referee raises his hand as a sign of calling passive play (IHF, 2001).

For example, thanks to the rule "quick throw off" during the period 1995-2005 the number of goal considerably increased from 46.3 to 58.3 in one game (Späte, 2005).

In modern handball there are added some structural (interpretation of the rules of the game - for example, a passive game), and intellectual elements, which have changed concepts of defense (Visnapuu, 2008).

The speed as physical ability - special forms of speed and nature of these

Various authors have examined the ability of different speed as a physical aspect. Each ball game area has a certain speed requirements and parameters, which outcome is possibility to demonstrate good results.
Linear speed is a very important factor in athletic performance. Faster athletes usually win races, are able to jump further, to throw further, reach to the ball earlier, are ahead of the defending players, etc. (Cissik, 2004).

Speed is a physical ability, which is a presumtion for successful execution of movements with high intensity and short-term. Capability of speed means complex of the functional properties of athletes', which ensures a minimum time of movement execution activities (Urban jt., 2011).

Speed is a movement in maximum speed from one point to another or execution of the request of the athlete as quickly as possible (Sevim, 2008)

If in sprint the high maximum running speed is foundation for sport performance, then good speed abilities are needed for many other track-and-field and other fields of sports, both as acyclic (emissions-jumping, racing games, two fighting areas, etc.), as cyclical areas (running, swimming, skiing, bicycling, etc.). Speed capabilities constitute physical, cognitive,

coordinative ability, which depends on the genetic assumptions, gene abilities, stage of development, the level of cognitive, physical fitness, and energy to support and locomotive. For good development it is necessary for the optimal development for all factors (Matsin, 2008).

Types of Speed

Basic shapes of various of speed (see Figure 1); (Weineck ja Jalak, 2008)

- speed of reaction;
- the speed of individual movements;
- speed of locomotor, fast coordination
- speed endurance
- start-up acceleration
- velocity, the basic rate of speed
- professional speed, operating speed

Speed

Reaction time	speed of movements	speed endurance
Muscle response	the maximum cycle rate	cyclical movements
Selective reaction	the maximum speed of acyclic	acyclical movements

Figure 1. Subclasses of speed (Weineck and Jalakas, 2008)

Speed is a various physical ability and practising different fileds of sport there there is possibility to talk about:

- quick decision-making and action;
- perception and cognitive behavior (according to the opponent's behavior);
- ability to act as quickly and efficiently as possible, based on complex sensorial, and tactical abilities.

Basic forms of speed are relatively independent, their transport options are limited. Good reaction does not ensure a good rate of movements or great velocity (Espe, 2008).

The reaction speed

The reaction rate shows an ability to respond quickly on a signal. Trained human's reaction time is 0.1 to 0.2 sec, untrained 0.2 - 0.3 sec: The response becomes increasing by age, as

well as the various optical, acoustic, tactile stimuli. The reaction is slower to the optical (light) signal than to the sound (acoustic) signal stimulation. In turn we can distinguished a straight-, complex- and choice reaction. Simple reaction is a relatively small movement, one signal elicits a quick response. Complex reaction, however, is related to the entire body. When the muscle reaction has often inherent assumptions, then the choice of response has possibilities to work it out and it is particularly important, for example, in sportgames. Choice reaction speed is more difficult to develope than simple reaction speed. Choice reaction speed needs special practise. Development of the choice reaction of an athlete who does not know what will happen ahead. Among many of the signals an athlete must respond certainly to the one of the signals and in correct form (wrestling, sports games, etc.). For beginner athletes the response time is always longer than for elite athletes, since the acquisition of new movements takes time - skills are less and developing cognitive skills takes time. (Weineck and Jalak, 2008).

The speed of movements

The speed of movements particularly depends on:

- muscle contraction speed, intercourse from fast and slow muscle fibers;
- lability of central nervous system;
- from the strength and elasticity of muscles;
- from flexibility and relaxation of muscles.

The ability of muscle contraction is significantly related to the proportion of the fast contractions of muscle fibers. If an athlete has fast contracted muscle fibers over 50% of all, then he has a great potential to achieve a high level of every speed species. But for the great talent in sprint the corresponding figure has reached up to 90%. From children there have been found a large percentage of the so-called intermediate fibers – from boys 13%, from girls a little less 8%, from adults only 2-3%. When children are actively engaged in various exercises of speed, it is possible that the intermediate filaments partially transferred to the rapid fibers. From here comes a practical advice - games in early childhood, quick movements, all these are good preconditions for the future to achieve a higher level of speed and the speed of the force. Powerful high-speed movements are possible due to the quick rotation of rapid excitation and braking in the body, and good function of the apparatus of muscles. There should act a good coordination in movements. In training exercises should be used so-called frequency movements (hand job, running against a stand, running against the stand with one-leg, etc.), which goal is to particularly develop coordination and to feel muscle tonicity (Weineck and Jalak, 2008).

In sports games, and naturally particularly in handball, should be developed the speed of the acyclic movements and then the speed of the cyclical movements. Use different weights of training tools, exercise in mitigating and aggravating circumstances. In good start-up acceleration, in swift start-up gesture has great importance to the forcing speed, its

required level. In sports games there are important just short restarts, movements which correspond to specific of a game. The speed of movements are the main feature of the central nervous system, which is reflected in reaction time and movements when there is a muscular movement under load. It is genetically determined, and its development is limited. (Loko, 2004)

The importance of speed in handball

In handball there are important: stamina of velocity, speed stamina, maximal aerobic power and the explosion force, the reaction speed (Suvi, 2010). Young et al (2001) define a speed of game as an ability to change direction, possibility quickly take off and slow down. Young et al. (2001), carried out a research by increasing the normal abilities of speed through sprinters practise, but it still has a limited effect on overall capability of speed of the athlete according to the specific field of sport Handball as a sport game develops direction of speed and power, which is due to the increase in players' physical abilities and technical-tactical skills in successful implementation of a high speed (throw the ball and capture in high-speed, field vision, and quick response to situations arising in a game) (Costantini, 2000; Feldmann, 2001).In handball as an acyclic field of sport the movements speed will affect technique and coordination of movements, initial velocity abilities and anthropometric parameters. Handball technique is most affected by high speed, the explosive force, stamina of force and maximal aerobic power (Verhoshanski, 1996; Kovacs, 2001).

To get an advantage against opponents in the game a lot fast ball passing is used. Also is used a single-handed catch, because by this you can throw the ball forward faster and perform flips. There is an increase in the proportion of fast attacks, face-to-face actions with the ball and without it (Johannson, Späte, 2004; Klein, 1998).

The efficacy of the attack in the game depends on the ability to use feints at high speed. In preventing strong contacts is important the movement at high speed with changes of direction, which help to create a predominance in the moments (Zvonarek, 2003).

The reaction speed:

- Vision 0,15 sec.
- Listening 0,12 – 0,27 sec
- Sense 0,09 – 0,27 sec

Sprint speed:

- General
- Specific to handball

Stamina of rapidity:

- General

- Specific to handball

Rapidity technique

The decision-making speed

The share speed of the different positions of the players in handball.

Over the past ten years the speed of solving situations in a game has greatly increased. The number of attacks has increased, and their duration is shorter than before. The transition from defense to attack is intensified and more and more teams are starting to use the faster execution of attacks from the home side's goalie's throw. The explosive techniques for executing the game (speed and strength without losing technical accuracy) is the basic factor in all game situations (mostly 1-1 situations). I assume that an adequate structure of the body: a strong skeleton and well-developed musculature; low body fat percentage; a sufficient ratio of body weight and lenght is useful to maintain a high level performance in modern handball. All this, however, is common,because, in many ways the activities of players on different positions in a game is different , one important difference is the intensity of the movement within the game (Urban et al, 2011).

The action of movement of top handball players' is investigated by Rogulj (2004) and has submitted the following structural parameters of movements for one game:

- Moving submaximal and maximal speeds (fast attack, a semi-quick attack, quick attack obstruction): 51x25 m (total 1275 m)
- Moving at moderate speed (movement from attack to defense and positional attack):20x25 m (total 510 m)
- Movement at low speed: 28x25 m (total 700 m)
- Moving maximal and submaximal speeds and during defense and positional attack: 160x3-4 m (total 560 m)
- Moving slowly in defense and during the position attack: 92x3-4 m (total 322 m)

In a game there are also performed other movements of varying intensity, which are more or less specific to the different players who all have different intensity according to their position on offense and defense (Kotzamanidis et al, 1999):

- Changes in the direction of submaximal and maximal speeds 211x (in a game)
- Changes in the direction of moderate and slow speeds 140x (in a game)
- Short starts 2-10 m (total 1500 – 2450 m)
- Jumps in a game 50x

Moving during the entire game is very intensive. There are many different ways of movement, and all are alternately repeated and frequent in use. Most of the time there occurs walking during the game, which is due to calmer situations in both, defense and

attack, the initial stages of the attack and of course during the defense, when the most of movement happening in walking. Most of the game occurs during walking, which is due to both defense and attack calmer situations, the initial stages of the attack and the defense, of course, with mostly walking step movement happening. All in all this rapid movement (starts, sprint), forming a very large-scale of movements of one player during one game (see table 6). It shows how fast has handball become, due to the changes of development (Urban et al., 2011)

Table 6 The structure of movement in a game based on the Danish elite league.

	Play time for one game (s)	Teamwork % for one game	The distance moved by (m)	% of working distance
Standstill	1190 - 277	36.8	0	0
Walking	1281 – 233	39,6	1423.6 – 265.3	39.2
Jogging	279 – 70	8.6	617.6 – 155.1	17.0
Running	141 – 34	4.4	510.1 – 120.7	14.1
Sprint	44 – 18	1.4	207.1 – 91.3	5.7
Starts	12 – 11	0.4	78.3 – 91.4	2.2
Lateral movement	240 – 87	7.4	666.3 – 242.4	18.4
Running backwards	44 – 27	1.4	124.0 – 76.3	3.4
Total	3231 – 352	100	3627.0 – 568.4	100

The intensity of speed for players in different position during the attack

In handball there is at each position a different player. Differences are diverse, starting with physical and ending with mental abilities. There is also some differences in the positions of players movements, aerobic fitness, abilities of speed, explosive force etc. The speed-based game has become a more attractive and high-scoring game. Speed is succinctly important

for player of each position, but the usability is different in terms of volume, which players of different positions use differently. Players of different positions are forced to use specific forms of speed which is needed in different game situations. For the run from defense to attack, or vice versa, it is necessary to use a respond to any situation there must be well-developed response to speed, a quick throw and deceptions and other movements will depend on the maximum of movement speed (Rogulj, 2004) The same leap that handball players use very often in a variety of situations, depends on the explosive force, which is depending on the speed. Be sure to have the speed endurance, from which depends end components on the games, as well as the body gets tired but throws and other movements requires maximum strength.

Speed is distributed very differently in the sense of positions, for example, a player on the wing must according to their scheme intend to solve a lot of fast attack situations that simply depend on maximum speed and totally they gather the biggest number of starts during the game. The part of the play of back players in the game is definitely a versatile speed but, for example, the line players will make much fewer sprints. Compared to the previous two position for players in the line, especially during the attack, the main feature of the deal is to cope with the opponent defenders and so they move less. In the team goalies use fewest sprint and fast run; their main properties are rather more advanced reaction of movements and speed, just fending off these properties as needed (Michalsik, 2011).

<u>Goalie's personal speed properties can be considered:</u>
Agility, which is reflected in the speed of movement, this is one of the most important characteristics of the motor feature, which must any goalkeeper have. Even more, the goalkeeper must have a balance of diligent and extremely precise movements with or without the ball, and speed to orient in space and time (Oxyzoglou et al., 2008).

There is estimated that the team wingers run the most and the high-speed intensity is one of the most essential parts of their play style.
Players of this position shall take care crossing the 46% of commited half -speed and high-speed attacks from the entire team basis, if 65% of these attacks are highly effective.
Most of the time their greatest result efforts come from the sudden and unexpected attacks (high-speed attack), so in their properties the power level shall be well developed.
Regarding agility the results show that the main difference during greatest changes occur when the player runs the distance 5x3 m, which includes a variety of movements in all sorts of directions, and the results are in the range of 10.91 - 03.03 seconds at different positions.
Many of the players, but especially the wingers, who attack from the side and protect his own position in edge protection, move constantly running backwards and sidewards sections
5-6 m long. Throughout the game the winger passes through with top speed 1,000 m sprint (Oxyzoglou et al, 2008).

Back players often perform in a team a key role in attack and defense, and their movement and speed will vary to a great deal.
In handball the playful agility or speed of motor ability has a very important role, especially for the players who play both in attack and in defense. Their movement takes place in different parts of the field, and "cover " vacated holes in sections of 3-4 m (Bayios, 1999). More often back players pass back towards movements 5-6 m during the attack, and they also cover within a game of a total of about 1,000 m (Oxyzoglou et al, 2008).

Line players are a great force during attacks in the game, and thanks to their quick movements and sufficient velocity properties the other attackers also used different situations through them.
Speed as a physical ability is required for the line position player, mainly because of his role in the attack action, as players frequently move to exchange right place and move 3-4 m sections a lot (Bayios, 1999). Even more, the line players are playing between defensive players and during attack they are covered by protectors, who are characterized by a very high average power and the force of the explosion. The same ability of power and force is needed from line players. Thus, the ability of speed becomes even more necessary.

Results of the analyzes show that: the goalkeepers have the lowest speed, but at the same time, the best level of flexibility, primarily in the pelvic region, in comparison with other positions of the players. Wings have developed the level of power in the speed part in comparison to other positions. Back players are due to their large size and big workload the less flexible players. Motor abilities of line players is lower compared to other players in the field, their part of game does not depend so much on the speed of running longer distances (Oxyzoglou et al, 2008).

Movements in the game are divided into different forms, ranging from about standing up to sprinting, into various classes. Šibila (2004) in their study comprised four different speed classes, by which they can compare the positions of the movement in some speed capacity of the game.

The increase of speed in the attack game

In handball attacking players try to shoot on goal, from a position where the defensive player is not able to attack physically or obstacle the throw in any way. This can be achieved by using the right tactical components, weather in the form of dense assists, or by using a variety of throwing techniques. In games, players commit around 73 - 75% of their throws from jumping, followed by throws with momentum on support position(14-18%), then followed by a 7-meter penalty throws (6-9%), throws from a breakthrough (2-4%) and the

free throws which make up 0-1% of the total number of throws in the game (Wagner et al, 2008).

The results have shown that the average game in the European tournament has gone faster. There are carried out more attacks - with the exception of the European Championships in 2010. Therefore now more goals are scored. The preparation time of an attack is shortened, and the game has become more personalized, with lesser amounts of assists in the attack. This is interesting, because the number of goals shot from the fast break has not risen. Despite the fast pace of the game, more goal shots of the attacks and more goals scored, it seems that teams prepare more the structure-controlled attacks against zone defence and combined defense. Such attacks have very short preparation time and players decide quickly to shoot at the goal (Sibila et al, 2011) (see table.....)

SUMMARY

In this topic of study the author has chosen the speed specifics actions in handball of players in different positions. Choosing the theme was based on the fact that he is engaged in Estonia fulfilling his responsibilities in the position of a high-level winger. Therefore it is interesting to know the different characteristics of the different positions in handball. In the game there are used a lot of different activities and according to them the author sets the aim to examine speed features for different positions and overall actions in game and in

attacks (throws, jumps, etc.). Also, the author has examined the characteristics of the specific players in general, mainly on the basis of the movement – how much different forms of exercise speed is used during the game by the players.

This thesis showed that handball has developed very rapidly in the last ten years. Handball has become more dynamic and more attractive, and thus gained a great interest among spectators. A sport in which where is a need to develop high level all physical abilities in order to achieve maximum success.

The game has become much faster due to developing of number of different playful parameters. The attacks last for a shorter time, and this is made even more pointers during the game, which in turn is achieved more goals. Due to the rapid game, it is possible to perform more fast attacks which characterize modern handball perfectly. Definitely has increased the pace of the game due to some changes of the rules of the game, which has been established in recent years. New regulations basically encourage playing off the ball quicker in different situations, and it creates no "free" style of in handball game. Analysis of the results of top teams showed that fast and versatile performance in the game of different positions players is a profitable success factor. Estonian handball strives every day to a higher level, but it has to work for both physical and tactical sense.

Speed has a wide range of different types and due to its diversity of several species has a direct impact on handball. Generally, in the main species sports games, so of course, handball, priority should be to acquire the execution speed of acyclic movements and then the cyclical movements in the rate of the speed: reaction time, speed of movement and the speed of the durability. In sports games, also in handball, priority should be developed to the execution speed of acyclic movements and then the cyclical movements in the rate.

The studies revealed that in sports activities there are two main speed abilities to get the most basis of: coordination and motor abilities.

In handball there are the most important classes in speed: speed-force stamina, speed endurance, maximum aerobic power, explosive power and reaction speed. In handball speed is of utmost importance, and at each position individually very often there is needed specific forms of the speed. Wingers have their smallest body size in the team, and the analysis showed that due to these characteristics they are able to move at higher speed and use most spurts or use their maximum speed. Due to the large size of body of back players there is also big volume of their movement because there must be done a lot of intensive work in both attacks as well as middle position defense. Speed of movements of line players depend on, according to the study, how fast and how numerous quick cuts and turns can they

perform between defenders. Explosive properties are characteristic of goalkeepers on which they perform fast and flexible movements to repel throws towards the goal.
Based on the literature review and made analysis, the author came to the following conclusions:

1. The results showed that, in the team on average wingers move the most in the game. Their speed abilities are at a high level and due to it they perform a lot of quick attacks, which make up a large part of their total distance during the game.
2. By motor abilities the most powerful players in a team are back-players. Players who are usually tall, but according to the required action in the game must be mobile, strong and accurate in the throw from a distance. They must gain a certain strength level for the defense based on the game.
3. For wingers there are the greatest importance of "speed class" in the game, and in the other situations of the game the high-speed intensity is one of the most essential parts of their play style
4. Line players are a huge power and thanks to their quick movements and sufficient speed properties they are used by other attackers throughout different situations in the game.
5. Analyses have shown that the goalkeepers are in motor abilities slightly weaker compared to other positions of the players.

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2014 EHF "RINCK" CONVENTION OPEN MASTER COACH
AND LICENSING COURSE (2ND MODULE)

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THE RELEVANCE OF FAST BREAK IN HANDBALL TEAM OF PÕLVA SERVITI FROM ESTONIA

Thesies

Estonia 2014

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THE RELEVANCE OF FAST BREAK IN HANDBALL TEAM OF PÕLVA SERVITI FROM ESTONIA

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Summary: The aim of the present study was (1) To assess the use of fast-break and their effectiveness on the basis of Serviti handball team`s official competition games. (2) To assess the use of fast-break and their effectiveness from their opposite teams` point of view. (3) To compare the importance and effectiveness of fast-break between Serviti handball team and the opposing teams analized in the study , also in comparison with national teams starting in the final round of the European Championship 2014. Subjects and methods: Analysed were 13 games of handball team of Põlva Serviti from Estonia (7 of them win); 13 games of Põlva Serviti opposite teams; 13 win games and 13 lost games in European Championship, 2014. Conclusion: According to the study: (1) Handball team of Põlva Serviti from Estonia performed significantly more total attacks in game than other studied groups of games but effectiveness of them was lowest. (2) National teams in win games on European Championship, 2014 throw significantly more goals, and with significantly higher % than other studied groups of games. (3) There were not significant differences in fast-break efficiency between studied games. (4) Handball team of Põlva Serviti (Estonia) play with highest % of fast-breaks from total attacks and realize highest % of goals with fast- break.

Key words: handball, fast break, European Championship, Põlva Serviti (Estonia)

1. INTRODUCTION

Modern handball is characterised (Sevim et al, 1997; Klein, 1998; Taborsky, 1998) by:

- the increasing number of attacks
- extraordinary high load
- the whole team fast breaks all over the area
- short-time positional attacks based on 2-3 players` cooperation
- intensive without-ball activities in offence
- aggressive and agile zone set defence (protection)
- high-level goalkeepers` action
- fast alteration of game-situations and increased number of fast breaks
- decreased number of failed attacks thanks to the players` higher individual mastership and skills

A high-grade top handballer is characterised by great physical abilities without which it is difficult to succeed in today`s physically demanding game. According to the players` functions in the game there are four basic models of players: back court players, wingers, pivot and goal-keepers. It enables to make use of each player`s individual physical peculiarities, skills and abilities to solve specific tasks in the game (Sibila, 1997).
According to different researches (Czerwinski, 1991; Kotzamanudis et al., 1999; Rogulj et al. 2004) the distance covered in the game depends on the players` mastership, each player`s role in the game, the importance of the game (Visnapuu, 2002).

Depending on the specific position in the court, the players on different positions perform different number of movements. Rogulj et al. (2004) analysed the players` locomotive

activities on the basis of Slovenian Championship games and found it out that in the games researched the players` activity was the following:

- top handballers covered 51 x 25 metres at maximal or submaximal intensity
- 20 x 25 metres at moderate intensity
- 28 x 25 metres from defence to attack were covered at low intensity
- in all 160 x 3-4 metres on attacks and defence were covered at maximal and submaximal intensity
- 92 x 3-4 metres on defence and attacks were covered at slow tempo

Any handball game requires good aerobic and anaerobic work fitness from all team members. The players in this game have to perform both technical and tactical methods throughout the whole game. This is why they must have good aerobic capability as the achievement ability must be high even at the end of the game, in fatigue and exhaustion. In case of fast breaks where ball is transferred intensively from defence to the offense, anaerobic energy production is dominating (Czerwinski, 1991). Rannou et al. (2001) has compared the handballers` maximal oxygen consumption ability with that of the endurance-event athletes that shows that the handballers` corresponding data is only 10% lower. So, handball game presumes good aerobic and unaerobic work fitness from all team members. A number of researches (Kotzamanidis jt. 1999; Rannou jt. 2001) show the essential importance of anaerobic metabolic processes in the game, referring to direct connection between blood lactic and game activities. In games with equal opponent the average frequency of heart beat varies between 170-200 beats a minute (Kotzamanidis et al. 1999).

The movement activities in handball game has got intermittent character and intensity: running, spurts, throws and jumps, also the activity that demands physical contact (Rogulj et al. 2004). The basis of the game is tempo (speed and pressure) that has to be optimum, so that in addition to speed also good technique is retained. Tactically the teams should develop fast pass game to keep the opponent` defence under pressure. All movements have to be performed at high speed to create some free room for finding the attacking possibility. (Mocsai, 2002).

2. REVIEW OF THE LITERATURE

2.1. Speed in court sports

Running is common to many recreational and organized sport activities and requires moving the body mass (Mastrangelo et al. 2004). Malina et al. (2005) confirm that body mass and maturity accounted for 50% of the variance in running speed. So the relative mean power, which is highly determined by body mass, could be the most important factor in running (Mastrangelo et al. 2004).

Sprints for short distances (20 – 30 m) are fundamental in team handball – during a fast break or while returning to defence after a ball loss (Lidor et al. 2005). Earlier studies (Cronin & Hansen 2005) emphasized that first step quickness and acceleration are important to many sports. According to Armstrong et al. (2001) the performance in cycling sprint tests depends on muscle power whish results from optimal combination between force and velocity.

In handball there are many essential factors: the quickness of reaction, speed endurance, endurance of explosive power, maximum anaerobic power and explosive power (Mansson, 2000). Handball is an a-cyclic sport where speed is influenced by the technique of perforformance and coordination of movements, initial speed abilities and antropometrical

parameters. Technical-tactical speed in handball is mostly influenced by explosive power, toughness and anaerobic capability (Kovacs, 2001).

Speed in handball is expressed in fast breaks, one-on-one situations and steals (Wallace & Cardinale, 1997). It is also expressed by defence activities, transmission from defence to offense, passing the ball, goal shots. The faster and exacter the team actions, the better is the score (Klein et al.1998; Späte, 2003). Young et al. (2001) defines the playing speed as change of direction speed, to start and to stop quickly. The reactive strength of leg extension muscles (leg muscle power) has some importance in direction-switch performance (Young et al. 2002). According to Young (2001 et al.) the straight sprint and agility tests assess specific qualities which do not transfer one to the other. The straight sprint training has still a limited effect on change of direction speed.
Dierk`s and Lühnenhschlos (2001) confirm that the speeding activities in sportgames are determined by:

- motor abilities – the speed of moving, maximum speed, velocity power and speed endurance
- coordination abilities – the speed of reaction, action, movements and single movements

Handball belongs to the group of court spors that demands the varied speed capabilities in changing situations. In game situations the changes of direction are used to dodge the rivals or to react to the moving ball (Young et.al, 2001). Young (2001 et al.) confirm the necessity for having special training in order to develop specific speed for sports needed change of direction speed often.
Handball is developing towards speed and power that is resulting from improving the players` physical abilities and more successful use of technical-tactical skills at high speed (passing–catching at high speed, seeing the playground and instant reaction to changing game situations) (Costantini, 2000; Skarbalius, 2001; Feldman, 2001).

2.2. The characteristics and tactics of fast break

The essence of any counter-attack lies in speed (Späte, 1995). A fast-break can be defined as the attack against unorganized defence. With fast transfer of the ball from your defence area to your opponent`s area one attempts to make use of the rival`s opponent`s mistakes and create scoring possibilities. It is important for each player to participate in the fast-break (Visnapuu, 2002). A fast-break starts the attack immediately after:

- save by the goalkeeper
- losing the ball of the attacking team

According to Späte and Suter (1995) the fast- break consists of several components:

1. Gaining the ball into your possession. The opponent`s loss of the ball, intercepted pass, rival`s breaking the rules, gaining the rebounding ball from the goal-post or goalkeeper, also the goalkeeper`s fast control over the ball after a opponent`s missed shot or successful defence – these are the factors that help you to gain the ball. After that the first-wave players start their counter-attack.
2. Opening the attack. A long pass from the goalkeeper or your team-mate to the first wave player. The other possibility - a short pass to the second wave player and players` individual actions.
3. Transferring the ball to the attack area, either as a result of a singular player`s action or in cooperation with other first-wave players. Also, transferring the ball into the attack area by the second-wave players or using cooperation between the first and second-wave players.

4. Finishing the attack. A player`s individual break-through, playing with prelavence in number or as the result of the whole team`s collective action

Disrupting the fast-break and returning to position attack. The aim of the fast-break is to exceed the defence-players of the opponent team in speed when returning to their positions and to start a new attacking action as soon as possible.
The necessary pre-conditions for performing a fast-break are:

- gaining the ball into your possession
- instant moving towards the opponent´s goal
- faster organized action compared to the team moving to defence (Constantini, 2002).

The fast-break is first of all based on good defence that causes a bad shot. Its success also depends on the goalkeeper`s ability in putting the ball back in the game as fast as possible (Grynge, 1998). Fast –break enables the team to score easily. Some players should start the fast-break before the team masters the ball, when there is a slightest advantage to transfer the ball to your team, at a goal shot, in the fight for a free ball, a possible call on breaking the rules from the rival`s side ( Constantini, 2002 ). Most of the teams consider fast-break very important in their tactical arsenal and pay a lot of attention to it in their training process. Even more, a number of teams have got their own strategy of using the fast-break. The players` tactical and technical maturity has to be on high level in order to evaluate the situation. They have to be able to see when it is expedient to start the attack and when the team should slow down their tempo and start building a new attack. (Grynge, 1998).
Fast-break strategies (Späte, 1994):

- to anticipate the attack-defence change
- to attack the unorganized defence
- to affect the tempo of the game
- to exert physical and psychlogical pressure on the rival-team players
- to affect the opponent`s offense tactics (to evoke the rivals` uncertainty)
- to raise the attractiveness of the game.

In handball we can speak about each member`s tasks in successful realisation of the strategy and tactics of the whole team. Also, in effective use of fast-breaks we can speak about definite tasks given to the players. In this game the players are forced to act at different periods of time in different game situations where they have to make decisions and find the ways out from the new situations at the given moment in spite of the player`s specific character (Costantini, 2000; Cuesta, 2001; Feldman, 2001). When performing fast-breaks the players are given their tasks as clearly, simply and unambigous as possible. In such complicated situations the players should be able to act at maximum speed, effectively and successfully (Visnapuu, 2008). They have to play a well-organized but not too overstrained game. Success in fast-break is usually achieved through the players` creative activities. So, they ought to be given certain freedom in their choice of action. In this way they make it harder for the rivals to guess their next move. Of course, they have to act in the frames of general rules, but be flexible and not too transparent. General concept of fast-break must be adjustable to the opponent` conduct in every game situation (Späte, 1995).

2.3. Possibilities for starting the fast-break

2.3.1. Starting the fast-break after the goalkeeper`s defensive actions

Analyzing goalkeepers` combating actions, on both 2006 Juniors`and 2004 Men`s European Championships, we can see that the goalkeepers`successful defensive actions create excellent preconditions for a fast game. In today`s handball the goalkeepers are trying harder and harder to put the ball into the game as fast as possible, except the situations that

proceed from tactical considerations. They are trying to make use of unorganized defence and achieve better attacking results. (Späte, 2004; Pollany, 2006).

A goalkeeper can be the starter on all three attacking phases, but their pass to the first wave players is the only one that brings success. If this possibility lacks, they try to get the ball out from the goal area using a short pass to the player on the mostfavourable position or to the certain field-player. This way they create good conditions for performing the second and third waves of fast-break (Pollany et al, 2003).
Next to combating fast-breaks and short shots, the goalkeeper`s combating activity is based on his personal mastership and cooperation with defence players. As handball has become faster and faster, more and more situations where the goalkeeper has to show his mastery are evoked. These are the situations where the shot on the goal is performed on a break-through, from the wing or one-on-one situation while combating a fast-break.
Goalkeepers` and defence-players`organized and meaningful collaboration create excellent possibilities for successful counterattacks (Pollany, 2006). The former Swedish goalkeeper Mr. Olsson also confirms the importance of defence players`positions and combating with helping the goalkeeper and creating good possibilities for a fast-break (Olsson, 2004).

The team that prevails in number has also got good possibilities for performing fast-breaks. It also concerns the situations where the referee has given the opposing team the respective signal about a passive game (Costantini, 2002). In case of the warning signal the offensive team has very little time for performing a proper attack and they do their shot on goal hastily or from a very inconvenient position. It gives the goalkeeper of the defence team a good chance to save the shot and start a new fast-break. In the situation where the referee has given a warning about passive game, the defensive team has to do everything possible to hinder the shot on the goal. They have to position themselves so that it makes the pass directions for the offence players difficult and complicated, almost impossible. At the same time it is necessary to maintain colaboration in the defence formation to avoid the possibilities for the offensive team to take profit from the situation (Costantini, 2002).

2.3.2. Starting the fast-break from the opponent`s mistake

A fast-break starts the attack after the teams have swapped their parts. One of these possibilities where one can use the opposers` unorganized situation when returning back to defence, is to start the fast-break just after the attackers have lost the ball. Already from the beginning of 7:7 handball the teams have paid attention to starting the fast-break from the distinct players who are still on defence just before the attacking side has performed a goal-shot. Whenever the thrower makes a mistake or his throw is blocked, or the goalkeeper gets control over the ball, arises the advantage for starting the fast-break over the team that is beginning to organize its defence activities (Costantini, 2002). It means that in order to perform a fast-break, the defence has to be able to turn into attack much faster than the attaking team turns into defence (Costantini, 2002). This kind of tactical solution embodies certain dangers for the team starting the fast-break. Just for a second before the goal-shot, the team starting off leaves its goal not defended and the danger occurs that from blocking or goalkeeper`s rebound the ball still remains in the area. To minimize this kind of possibility the teams use definite tactics where the zone that was left is covered by some other team-mate. Unfortunately, using this kind of tactics, can also be dangerous from time to time. When a winger has performed a goal-shot, we can see the situation in nowaday`s handball that the fast-break is started by the third defence-player from the position where the shot was made. The reason for this kind of situation is not far to look for – the winger who

performed the shot may have difficulties in switching over to defence activity (Costantini, 2002).

2.3.3. A fast throw-off

Fast throw-off was taken into use to make the handball game more dynamic and avoid possible standstills in the game (IHF, 2001). This change in rules gives the ball to the team that has conceded a goal to start their contra-attack immediately from the middle line. The only condition is that all the team members must be on their side of the field. After a fast throw-off the attacking team makes use of the defencive team`s weak readiness and rush forward to perform a shot on the goal without being well prepared for it. The fast throw-off creates good possibilities for scoring as after the opponent`s goal they have difficulties in drawing back to defence. Most often it is true for the player who just scored. Practically we can talk about playing in the situation where one team prevales the other in number and uses it in his favour (Späte, 2005). Next to instant surprise moment the fast throw-off has also a tactical aim. It is to hinder the opposing team to bring specialized defence players to the play field (Späte, 2005). According to the analysis (Pollany, 2006) carried out on the basis of the year 2006 European Masterships in Switzerland, most teams nowadays are trying to take up fast-breaks just after they have got the ball in their possession. It doesn`t always bring direct risk to the goal when the players are trying to transfer the ball as fast as possible. When performing fast throw-offs, the teams have their targets for doing so (Pollany, 2006).

Späte (1995) presents the following fast-break phases and strategies:

First phase is "renegading" the opponent using correct timing for a start.

First line fast break – 2-3 players (usually wingers) leave the defence area pretty early as soon as the opponent`s throw is absolutely certain to be performed , just to "renegade" the players returning to their defence area. A long pass from the goalkeeper or one of the in the home front defenders to a player of the first wave – is a typical completion of the first wave fast-attack (Visnapuu, 2008).The performers of the first wave fast-break are most often the wingers who are really fast players with excellent speed abilities (Wallace and Cardinale, 1997; Klein, 1998) and possess great reaction and starting speed (Czerwinski, 1991; Sibila & Bravnicar, 1997). Gaining the ball into your possession is a decisive factor in fast-break, especially in the first wave fast-break. As a rule there are usually two players who start in the first wave fast-break so that both wings would be covered.

The second phase of fast-break – making use of prevailing in number due to more players in the game. When it is not possible to pass the ball directly into the first wave, the second wave players advance with quick short passes to locally outnumber the retreating defenders and use this situation to enable scoring (Späte, 1995; Pollany, 2006).The second wave player with the next pass into the centre of the field is allowed to complete the fast-break when the following principles are kept in mind :

- when any second wave player is possessing the ball, he must pass it over to the first wave player being sure that the latter is ready to receive it. Keep the eye-contact!
- back centre (generally the second wave player in central position) is the last man (a helping valve) in the fast-break and should position himself so that every player from any position could give him a pass. He must lag a bit behind the other second wave players.
- when the fast-break is started with a long pass to the first wave player, the second wave players (even if they don`t have the ball) immediately move towards the wing. In case the first wave player cannot complete the fast-break, they can pass the ball

back to the second wave player so that the fast-break could be continued following a new scheme (Späte, 1995; Pollany, 2006).

The third phase of fast-break – continuing at high tempo the attack, defence is formed but not regulated or organized

When the opposing team members succeed in running back to defence and avoid a shot on the gate through the first and second waves, the defenders in this situation tend to be somewhat passive. Not every player is back in his defence position yet and exact action in accordance with the defence rules does not work. The aim of the third wave is to make use of this temporary passiveness and weak readiness. As soon as the second wave players bring the ball forward, the game is continued at very high speed with purpuseful tactical attacking elements to achieve a good throwing position, where the players are back but still passive (that means that the attack is continued without any pause in between) (Späte, 1995; Pollany, 2006). The key of a successful fast-break lies in crossing the middle line of the field as quickly as the attacking team is able. Very often this kind of activity reveals the opponents` weak places (Späte, 2005).

2.3.4. Advantages of using the fast-break

- possibility to gain an easy goal
- avoiding physical contacts
- attractiveness
- limited possibilities against aggressive defence in set play attacks

The use of fast-break in handball gives the teams a chance to gain an easy goal when making use of the opposing team`s uncertainty in organizing their defence activities. The players with good aerobic and anaerobic capabilities enable their team to use constant high tempo and thus keep the opposing team under a big pressure. It means that finally they can succeed even at the end of the game. Another possibility to be successful is to use constant fast throw-offs. These influence not only the opposing team`s physical durability but also their psychological readiness (Moscai, 2002). The use of fast-break by teams gives the offensive team possibilities to score even against the opposing team in full body without a well-organized defence (Späte, 2005).

2.4. Rapid game and importance of fast-break in it

Analyzing the title matches statistical data that show the number of performed attacks and the average time spent on them, one can notice the tendency of constantly growing tempo in handball games (Späte & Taborsky, 2006).

Handball game has essentially become faster and more attractive in connection with the changes that are being made in the competition rules. The most important of them are the ones that effect the tempo of the game:

- a fast throw-off (IHF, 2001)
- defenders do not have to stay in their part of the field after scoring (IHF, 2001)
- in case of breaking the line-rule in the goal area, the ball is put into the game by the goalkeeper (IHF, 2005)
- passive play (IHF, 2001; IHF, 2005)

The speed factor is becoming a more and more characteristic indicator of achievement and effectiveness (Klein, 1998). In today`s handball where the average duration of an attack is within the limits of 30 seconds , there is no need to imply any time-limiting rules for attacking. On the contrary, this kind of rules most likely lower the tempo (Späte, 2004). In the course of recent years the average number of scores has risen. In the finals of 2003

World Championships in Portugal the German national team performed 61 attacks that set up a new record in the finals and Croatia performed 60 attacks. When comparing the realization of the attacks the, Germans` indicator was 50, 8% (61/31) and that of Croatia 56,7% (60/34). The attack lasted less than 30 seconds (Späte, 2003). 60 goals in a game shows the 26 % increase of effectiveness since the 1995 World Championships.

The use of the first wave fast-break has become dominating in every fast game. It often becomes possible when the wingers of the first wave start early just a bit before the opposing team`s shot on the goal (Späte, 2005). In 2005 World Championships the teams performed 120,2 attacks in average. The average length of each attack was 29,9 seconds (Späte, 2005).

Table 1. The analysis of a fast game on basis of title matches (Späte, 2005).

Competition	**Total number of games**	**Average number of attacks per game**	**Average duration of attacks /s**
WCh 2005 Women	84	129,8	27,7
OG 2004 Men	33	124,5	28,9
WCh 2005 Men	86	120,2	29,9

Based on statistical Data of the World Championships the number of goals in a game has risen from 46,3 to 58,3 within the years 1995 –2005 (Späte, 2005).

Table 2. Statistics of eight more successful teams results and its changes on the basis of European Championships (Mocsai, 2002; Taborsky, 2004).

Competition	**Total number of games**	**Average results of games**	**Average number of goals per game**	**Difference between winner- loser**
ECh 1994	18	25, 8 : 21, 7	47, 5	4, 1
ECh 1996	18	25, 3 : 21, 9	47, 2	3, 4
ECh 1998	18	26, 9 : 22, 1	49, 0	4, 8
ECh 2000	18	26, 0 : 22, 9	48, 9	3, 1
ECh 2002	18	27, 6 : 23, 6	51, 2	4, 0
ECh 2004	18	28, 7 : 25, 5	54, 2	3, 2

The rise in the tempo of the game is also confirmed by the comparison between apt throws and final result in the game on different title matches. In the year 1958 in the World Championship there were 32, 9 apt throws on the goal in average and the final score of the game was 19, 9 : 13, 0. The respective indices had risen to 54,2 and 28,7 : 25,5 in the 2004 competitions (Taborsky, 2004; Sevim & Taborsky, 2004).
There are more possibilities for fast.break because the offense players perform more risky and surprise- founded throws on the goal. Very often passes to the line-player are used . The line-players are given passes which can easily be intercepted by defence that can instantly start a counterattack. Also, after a failed fast-break, there is a possibility to start a fast counterattack. (Späte, 2005). In 2004 Athens Olympic Games the fast-breaks made up 18, 5% of all the attacks. Scoring is very high. In 2004 Athens Olympic Games it was 76, 5% (Späte, 2004). The average length of the attack was 30 seconds (Sevim & Taborsky, 2004).

Handball teams today use fast-break throughout the whole game, ie. 60 minutes. The further trend is based on continuous speedy game. Already in 2005 World Championships more than 70 attacks were performed in 10% of games. The final game between Spain and Croatia was very fast with 65 attacks per team. (Späte, 2005).

Table 3. The procentage % of fast-breaks out of the total number of attacks on different title matches (Seco, 1999; Pollany et al, 2003; Späte, 2005).

OG 1972	WCh 1974	WCh 1978	OG 1980	OG 1984	OG 1988	WCh 1990	OG 1992	WCh 1993	WCh 1995	OG 1996	WCh 1997	WCh 1999	ECh 2002	WCh 2005
8, 6	10, 7	12, 1	12, 7	13, 4	13, 7	17, 8	18, 9	22, 3	18, 1	18, 1	24, 4	20, 9	16, 3	17, 4

Table 4. The analysis of fast-break on basis of title matches (Czerwinski, 1998; Mocsai, 2002; Späte, 2004; Späte, 2005).

	ECh 2002	OG 2004	ECh 2006
Average number of attacks in a game	97, 8	115, 7	117, 1
Effectiveness of attacks %	53, 0	53, 4	51, 0
The % of fast-breaks from the total number of attacks	10, 4	12, 5	14, 6
The effectiveness of the three best teams in using fast-break - %	78, 0	82, 1	74, 6

In the year 2006 European Masterships all teams tried to use the first wave of fast-break with one or two players doing it very fast and decisively. The second wave of fast-break followed at once with all six field players participating in it (Pollany, 2006).

3. THE AIM OF THE STUDY

The aim of the present study was to investigate the importance of the fast breaks carried out to the final result of the game therefore the following tasks were set up:

1. To assess the use of fast-break and their effectiveness on the basis of Serviti handball team`s official competition games
2. To assess the use of fast-break and their effectiveness from their opposite teams` point of view.
3. To compare the importance and effectiveness of fast-break between Serviti handball team and the opposing teams analized in the study , also in comparison with national teams started in final round of European Championship, 2014.

4. MATERIAL AND METHODS

4.1. Characteristics of subjects

The research observed the Põlva Serviti handball team`s and their opponent`s games in 2013, and 2014 Estonian Championships, Baltic League games in 2013 and 2014, EHF Cup games in 2013 and the European Championships games in 2014. Altogether 2 EHF Cup games, 6 Estonian Championships games, 7 Baltic League games and 13 European

Championships games were observed. The opposing teams to Põlva Serviti were HC Kehra, Riihimäki Cocks (Finland), SKA Minsk (Byelorussia), Fyllingen Bergen (Nor), Klaipeda Dragunas (LTU),
HC Meschkov Brest (Byelorussia).
The following playing characteristics were analysed:

- the total number of shots done
- the total number of goals
- the effectiveness % of total attacs
- total number of fast-breaks
- number of goals from fast-breaks
- the effectiveness % of fast-breaks
- percentage (%) of fast-breaks from total attacs
- percentage (%) of goals from fast-breaks from all goals
- the result of the game, win/ loss

4.2. Statistical analyses

The analysis was conducted using the SPSS version 10.0 statistical software program (SPSS Inc., Chicago, IL). Standard statistical methods were used to calculate mean ($\overline{X}$) and standard deviation (± SD). The effectiveness % was calculated. A Fisher`s least significant differences test was used to determine the differences between groups of studied games. The α level of 0.05 was used for all statistical tests.

5. RESULTS AND DISCUSSION

5.1. General characteristics of the study

In total 52 games were taken to study. The analysed were 13 games of handball team of Põlva Serviti from Estonia (7 of them win); 13 games of Põlva Serviti opposite teams; 13 win games and 13 lost games in European Championship, 2014.
The survey has been conducted on 13 matches of Põlva Serviti (Estonia) men´s handball team, as the author of the study is the head coach of the team, also former Estonian Men´s national handball team head coach, who is primarily interested in development of Estonian handball. The offensive tactics of Põlva Serviti handball team are focused on gaining success via fast breaks and from this originates the interest towards the research subject. The target of the survey is to bring out the importance of fast breaks of Põlva Serviti team on season 2013/14 in most important matches. Additionally it was targeted to compare the usage and effectiveness of fast breaks of Põlva Serviti team and opponent teams on these mentioned matches. The last aim was to compare the usage of fast breaks of Põlva Serviti team with the usage of fast breaks on selected matches (13) in 2014 European Championships. The European Championship matches were separated according to the result – victory or loss.
The European Championship matches which were taken into consideration were the following: 5 matches of team France (all victories), 3 matches of team Denmark (all victories), 3 matches of team Iceland (1 victory, 1 draw, 1 loss), 2 matches of team Hungary (1 victory, 1 loss), 2 matches of team Spain (1 victory, 1 loss), 2 matches of team Croatia (2 losses) and 1 match of team Sweden (victory). From teams from Norway, Russia, Austria, Poland, Belarus, Serbia, Czech Republic and Macedonia were selected one match which resulted with loss.

The time-table of studied games are presented in tables 5 and 6.

Table 5
The time-table of studied Põlva Serviti and its opposite teams games

	Game	Score	Playing time	Competition
1.	Põlva Serviti (EST) – Fyllingen Bergen (NOR)	**27** **30**	07.09.2013	EHF CUP
2.	Fyllingen Bergen (NOR) – Põlva Serviti (EST)	**32** **22**	15.09.2013	EHF CUP
3.	Põlva Serviti (EST) – HC Kehra (EST)	**26** **24**	21.09.2013	Baltic Handball League
4.	Põlva Serviti (EST) – Riihimäki Cocks (FIN)	**33** **32**	22.09.2013	Baltic Handball League
5.	Põlva Serviti (EST) – Klaipeda Dragunas (LTU)	**23** **21**	05.10.2013	Baltic Handball League
6.	SKA Minsk (BLR) – Põlva Serviti (EST)	**34** **29**	09.11.2013	Baltic Handball League
7.	HC Meschkov Brest (BLR) – Põlva Serviti (EST)	**32** **36**	10.11.2013	Baltic Handball League
8.	Põlva Serviti (EST) – HC Kehra (EST)	**29** **24**	14.11.2013	Estonian Championship
9.	HC Kehra (EST) – Põlva Serviti (EST)	**24** **24**	05.02.2014	Estonian Championship
10.	Põlva Serviti (Est) – HC Kehra (EST)	**28** **21**	27.03.2014	Estonian Championship
11.	Riihimäki Cocks (FIN) – Põlva Serviti (Est)	**29** **25**	30.03.2014	Baltic Handball League
12.	Põlva Serviti (Est) – SKA Minsk (BLR)	**26** **31**	13.04.2014	Baltic Handball League
13.	Põlva Serviti (Est) – HC Kehra (EST)	**26** **25**	08.05.2014	Estonian Championship

Table 6
The time-table of studied win and lost games of European Championship 2014

	Game	Score	Playing time	Competition
1.	ICELAND – NORWAY	**31** **26**	12.01.2014	European Championship, 2014
2.	FRANCE – RUSSSIA	**35** **28**	13.01.2014	European Championship, 2014
3.	HUNGARY – ICELAND	**27** **27**	14.01.2014	European Championship, 2014
4.	AUSTRIA – DENMARK	**29** **33**	14.01.2014	European Championship, 2014
5.	POLAND – FRANCE	**27** **28**	15.01.2014	European Championship, 2014
6.	BELORUSSIA – SWEDEN	**22** **30**	15.01.2014	European Championship, 2014
7.	ESPANIA – ICELAND	**33** **28**	16.01.2014	European Championship, 2014

8.	DENMARK – CZECH REPUBLIC	**33** **29**	16.01.2014	European Championship, 2014
9.	SERBIA – FRANCE	**28** **31**	17.01.2014	European Championship, 2014
10	MACEDONIA – HUNGARY	**25** **31**	18.01.2014	European Championship, 2014
11.	FRANCE – CROATIA	**27** **25**	19.01.2014	European Championship, 2014
12.	FRANCE – SPAIN	**30** **27**	24.01.2014	European Championship, 2014
13.	DENMARK – CROATIA	**29** **27**	24.01.2014	European Championship, 2014

5.2. Analyzed playing characteristics

Mean analyzed playing characteristics are presented in table 7.

From submitted data it showed that the total amount of attacks per match is highest in team Põlva Serviti (58.9±5.9) and the lowest in European Championships matches with resulted with victory or loss (53.1 ± 2.9 and 53.0 ± 2.9)**.** At the same, team Põlva Serviti and its opponent teams, show the highest difference in minimum and maximum total attacks quantity (19 and 17 attacks accordingly). In 2014 European Championship victory and loss matches the same figure was almost 2 times lower (10 attacks) compared to Põlva Serviti result. The second important figure is the realization of attacks. In here the situation is reversed – the highest result was shown in European Championship victory matches (57.8 ± 5.0) and lowest in Põlva Serviti matches (46.6 ± 7.1). Also the minimum and maximum realization percentage shows the same tendency, where Põlva Serviti result was 26% and in European Championship victory games 17% (table 7). These figures refer to instability in matches and shortages in defensive game of team Põlva Serviti. Such differences can be explained with the highest performance level of national team players and this result with more stability in the game and defensive work. This is based on good cooperation of team players and excellent physical condition.

The same tendency appears also in the total usage of fast breaks and its usage effectiveness as with total attacks result. Põlva Serviti team uses the most fast breaks in matches – average 7.1 ± 2.8 fast breaks per match, however the realization of fast breaks (81.6 ± 13.9%) is lower than opponent teams´ realization (82.6 ± 17.2%) and also lower than the realization that was demonstrated in victory matches in 2014 European Championship (84.8 ± 14.6%). The usage of fast breaks in matches is related with hazards, as it causes higher amount of turnovers (Späte, 2005). Probably from here originates the lower realization percentages of team Põlva Serviti.

In the present study it was taken into examination the fast breaks usage percentage quantity from total attack amount and fast breaks percentage quantity from effective attack total amount. From here the positive side can be brought out from Põlva Serviti fast breaks usage. Serviti uses the most attacks via fast breaks (12.2 ± 5.1%) and accomplishes the most goals via fast breaks (21.7 ± 9.4) compared to all other team matches under investigation. In European Championship matches the corresponding figures are lower in games that resulted with victory or loss (accordingly 11.3 ± 4.0% and 16.0 ± 4.9% in victory matches and 8.8 ± 3.2% and 12.7 ± 4.2% in loss matches).

Table 7
Mean playing characteristics (*X* ±SD with minimum and maximum).

	All games n = 52 (*X* ±SD)	SERVITI n = 13 (*X* ±SD)	opponents of Serviti n = 13 (*X* ±SD)	ECH2014 win games n = 13 (*X* ±SD)	ECH2014 lost games n = 13 (*X* ±SD)
Shots total Min - Max:	55.8 ± 5.2 46.0 – 69.0	**58.9 ± 5.9** 50.0 – 69.0	58.1 ± 5.8 51.0 – 68.0	53.1 ± 2.9 46.0 – 56 0	**53.0 ± 2.9** 46.0 – 56.0
Goals total Min - Max;	28.1 ± 3.6 21.0 – 36.0	27.2 ± 3.9 22.0 – 36.0	27.6 ± 4.6 21.0 – 34.0	**30.6 ± 2.5** 27.0 – 37.0	**26.8 ± 1.9** 22.0 – 29.0
Effect % Min - Max;	50.6 ± 7.4 36.0 – 67.0	**46.6 ± 7.1** 36.0 – 62.0	47.8 ± 7.6 38.0 – 59.0	**57.8 ± 5.0** 50.0 – 67.0	50.3 ± 4.2 45.0 – 61.0
FB total Min - Max;	5.9 ± 2.5 2.0 – 14.0	**7.1 ± 2.8** 3.0 – 12.0	5.9 ± 2.8 4.0 – 14.0	6.1 ± 2.3 2.0 – 10.0	**4.7 ± 1.8** 2.0 – 8.0
FB goals Min - Max;	4.8 ± 2.2 1.0 – 11.0	**5.9 ± 2.8** 2.0 – 11.0	4.8 ± 2.3 2.0 – 11.0	4.9 ± 1.5 2.0 – 7.0	**3.4 ± 1.1** 1.0 – 5.0
FB effect % Min - Max;	80.8 ± 16.6 50.0 – 100.0	81.6 ± 13.9 50.0 – 100.0	82.6 ± 17.2 50.0 – 100.0	**84.8 ± 14.6** 60.0 – 100.0	**74.6 ± 20.1** 50.0 – 100.0
% FB shots from all shots Min - Max;	10.6 ± 4.5 3.7 – 25.0	**12.2 ± 5.1** 5.2 – 20.7	10.2 ± 4.9 6.6 – 25.0	11.3 ± 4.0 3.9 – 18.5	**8.8 ± 3.2** 3.7 – 14.8
% FB goals from all goals Min - Max;	17.0 ± 7.3 3.9 – 37.9	**21.7 ± 9.4** 6.1 – 37.9	17.5 ± 7.2 9.4 – 34.4	16.0 ± 4.9 7.4 – 23.3	**12.7 ± 4.2** 3.8 – 20.0

5.3. Comparison the playing characteristics of Põlva Serviti handball team with its opposite teams and analyzed national teams of European Championship 2014.

Differences between analyzed playing characteristics of Põlva Serviti with its opponent teams and analyzed national teams of European Championship are presented in table 8.

From submitted data analysis it appeared that Põlva Serviti and its opponent team attack total quantity is statistically significantly higher than in 2014 European Championship matches. Goals thrown in one match and attacks realization percentage is however statistically significantly higher in European Championship victory matches (accordingly 30.6 ± 2.5 goals and 57.8 ± 5.0%) than in all other observed groups (table 8). Põlva Serviti uses the most fast breaks in matches, but not statistically importantly. However, the goals achieved via fast breaks are statistically relevantly higher in Põlva Serviti and European Championship victory matches than in loss matches. The resent study did not show statistically significant differences in fast breaks realization among all investigated groups. The lowest was the realization in European Championship loss matches (74.6 ± 20.1%) and the highest in victory matches (84.8 ± 14.6%). The present study showed that Põlva Serviti team scores statistically relevantly more goals via fast breaks (21.7 ± 9.4%) than in observed matches in European Championship (accordingly 16.0 ± 4.9% and 12.7 ± 4.2%). Therefore the present study showed that Põlva Serviti active usage of fast breaks in matches and training process

respective structure is justified. It is aimed to achieve more stability in game via training process and therefore higher realization level.

Table 8
Differences between analyzed playing characteristics of all teams (*X* ±SD)

	SERVITI n = 13 (*X* ±SD)	Opponents of Serviti n=13 (*X* ±SD)	ECH 2014 win games n=13 (*X* ±SD)	ECH 2014 lost games n=13 (*X* ±SD)
Shots total	**58.9 ± 5.9 &,€**	58.1 ± 5.8 **Ω, £**	53.1 ± 2.9	**53.0 ± 2.9**
Goals total	27.2 ± 3.9 **&**	27.6 ± 4.6 **Ω**	**30.6 ± 2.5 & Ω #**	**26.8 ± 1.9**
Effect %	**46.6 ± 7.1 &**	47.8 ± 7.6 **Ω**	**57.8 ± 5.0 & Ω #**	50.3 ± 4.2
FB total	**7.1 ± 2.8 €**	5.9 ± 2.8	6.1 ± 2.3	**4.7 ± 1.8**
FB goals	**5.9 ± 2.8 €**	4.8 ± 2.3	4.9 ± 1.5 **#**	**3.4 ± 1.1**
FB effect %	81.6 ± 13.9	82.6 ± 17.2	**84.8 ± 14.6**	**74.6 ± 20.1**
% FB attacks from all attacks	**12.2 ± 5.1 €**	10.2 ± 4.9	11.3 ± 4.0	**8.8 ± 3.2**
% FB goals from all goals	**21.7 ± 9.4 &, €**	17.5 ± 7.2	16.0 ± 4.9	**12.7 ± 4.2**

p < 0.05

¤ - significant differences between playing characteristics of Serviti and its opposite teams
& - significant differences between playing characteristics of Serviti and analysed win games of European Championship, 2014
€ - significant differences between playing characteristics of Serviti and analysed lost games of European Championship, 2014
Ω - significant differences between playing characteristics of Servitis´ opposite teams and analysed win games of European Championship, 2014
£ - significant differences between playing characteristics of Servitis´ opposite teams and analysed lost games of European Championship, 2014
 # - significant differences between playing characteristics of analysed win games and lost games of European Championship, 2014

6. CONCLUSION

According to the study we resume:

1. Handball team of Põlva Serviti from Estonia performed significantly more total attacks in game than other studied groups of games but the effectiveness of them was lowest.
2. National teams in win games on European Championship, 2014 throw significantly more goals, and with significantly higher % than other studied groups of games.
3. There were not significant differences in fast-break efficiency between studied games.
4. Handball team of Põlva Serviti (Estonia) play with highest % of fast-breaks from total attacks and achieved highest % of goals with fast- break.

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EYEHAND REACTION AND COORDONATION

CONSTANTIN IOLIA

ENGLAND HANDBALL ASSOCIATION
ENGLAND

INDEX

EYE-HAND REACTION AND COORDONATION

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Improving eye-hand reaction and coordination

Summary

The aim of this paper is to investigate how to improve eye-hand reaction and coordination with specific exercise, to allow players to see the ball leaving the hand of a team mate or an opponent earlier, to be able to see the ball trajectory sooner to react accordingly in the shortest time possible. Usually players, and in particular, a goalkeeper do not have sufficient time to decide the best point in time of the ball trajectory, to start moving and reach a position that allows a successful action.
The result shows an incremental improvement in performance, which can be used in order to gain a successful outcome and optimal performance.
In addition, the paper aims to contribute better understanding and to investigate the link between the visual neurological stimulus and motor action.

Keywords

Handball, eye-hand reaction and coordination.

Introduction

We see so many times not only in the beginners' game, but also with more experienced players, that the players with the ball without any pressure simply pass the ball to the adversary. Is this because the visual stimulus is slow in sending the information, or do the muscles in the hand react too late?
Eye-hand coordination and reaction is a subject not readily available in sports conditioning journals and books and is not dealt with in great detail by sports scientist experts.
In order to obtain information on the subject, I have researched medical journals and I applied the relevant information.

Handball is the fastest game second only to ice hockey, and incorporate power, speed, foot and hand coordination. These qualities allow a controlled reaction to ball movement, whilst at the same time ensuring the team mate makes an effort to be in a free zone concurrently being aware of a defending player's action. The speed, power, and the ability to prepare for the next step, pass the ball or shoot is affected by visual perception and a faster decision making process.
Quote "These ability's to respond in a controlled manner and the velocity in a pre-planned movement is better described as a response reaction to a stimulus such as a light.''
Young & Farrow(2006) Review of Agility. Journal of Sport &Conditioning vol.28 pg 24-29

Handball coaches want players to respond more quickly, have good coordination, and have more agility. Reaction and coordination drills must be included in every training phase, even

in the pre-season preparation work. Coordination and reaction is needed throughout the competitional season.
It is important to remember that speed is dependent on recognition, reaction and anticipation. The reaction, recognition and anticipation are fundamental elements for all body movements as well as individual body part movements.
Recognition refers to the sensory motor system's ability to receive information and process it. In handball it is good to be able to read a team mate's movements in order to decide where the pass of the ball is going.
Reaction is the neuromuscular ability to process and command a movement or make a response-reaction to an action, activity or observation. An example in handball could be the goalkeeper ability to react by blocking an attacker throw from 6m.
Quote "Anticipation Benjamin Tibet suggested that a state of consciousness takes about half a second to form because that is how long it takes the brain to complete all the processing.
So how does a player's reflex, reaction, to a bouncing ball stand up to scrutiny? Anticipation is the answer and anticipation is critical to the understanding of consciousness itself. Anticipation is a quality that combines experience and recognition and is best illustrated using the example of an experienced player who can ''read'' where the ball will be passed next in the game.
While lesser players in a team grind out play after play in a game with patient decision making efforts eliminating risks and playing the percentage, the truly gifted players seem to perform tricks with time. They bring an unkurried genius to their game that allows them to play shots or make tackle which sometimes surprise even themselves for sheer audacity
Such activities can be brought to the playing field by a combination of recognition, reaction, and anticipation.''
SAQ International; Mod3, wk2, L4, pg 27-29

Methods

I started working with Brunel University male students to prepare them for the Qualifications phase of the English Handball University's Cup. The programme was over 8 weeks with students' ages between 20-24 years old with just 1 year experience in handball.
The training programme consisted of elements of speed training (agility, quickness, reaction, quick change of direction) followed by technical, tactical and individual skills exercise specific for handball.
The aim of the programme was to increase the speed, strength, endurance and special eye-hand reaction and coordination (to be able to handle the ball without mistakes). "Conditioning can be defined as the process of changing the physical, physiological and psychological behaviour of the individual or team" as stated by Hennesy 2002 Resistance & Weight Training –Lecture and Workshop Notes SeTANTA College as in SAQ International Module 4 Resistance Training for Court Team Sports.

The initial evaluation focused on:
- the kind of training they did at present, other sports they played or other teams they played with
- the functional movement assessment , overhead squat test
- the L test, 7 metres test (for players but especially for goalkeepers), 60 seconds passes at 5m distance pair of 2, player perception test POMS

- their shooting power
- how quick they were
-their ball handling, eye-hand coordination
-recording the work

To achieve the improvement of eye-hand reaction coordination we focused on:
-basic skill, speed, agility, coordination,
-jumping, horizontal, vertical, eccentric jumps
- circuit training foundation, body strength, rubber band, kettle bell
- power and plyometrics
- mobility

This is conforming to Tudor O Bompa in *Periodizing Training for Peak Performance* (p271). Quote- ''The preparatory phase is divided into two sub phases: general and specific preparation. The general preparatory sub phase should develop a high level of physical conditioning that will facilitate future training and performance. The specific preparatory represent a transition phase towards the competitive season where toward the end of this sub phase, the volume tends to drop progressively, allowing an increase in the intensity or quality of training''

Handball sport conditioning training would consist of 2 sessions per week. The first session would be in the gym, where we would do 1 hour and 10 min resistance training with 10min warm up and cool down at the end.
The second training session is a total of two hours, consisting of 20min warm up and dynamic stretches, then speed workout followed by 1 hour handball skills and tactical exercises, and lastly cool down.
For the preparatory phase, i.e. weeks 1 to 3 we had circuit training to strengthen all of the major muscles, the ligaments and tendons. This allowed the players to become familiarised with the exercise and gives the players good overall strength, balanced development, muscular endurance and cardio vascular fitness.
Some of the largest errors many coaches make are to ignore training the team on their physical strength. In handball, strength work is still seen as interference to the "real" work of endless repetitive drills and the long hours on tactical and technical skills during the competition phase. Strength training follow by plyometrics is crucial. It's the basis for speed, power, power-endurance, agility, and of course the capacity to generate force. You need it whether you are goalkeeper, centre back, line, or playing only defence or just attacking phase. If you want your muscles to fire with power right WHEN you need it most, you have to train those muscles to react. If you want to avoid fatigue, which affects your decision and technical skill, then strength training is crucial. Strength is also an important factor in injury prevention.

Strength training does not necessarily mean you have to do intense heavy lifting. Instead, you can use dynamically challenging exercises that require hand-eye and body-limb coordination. Even if you're an experienced handball player with many years of training in different forms of exercise, it's still worthwhile doing strength work in the off-season, to keep you fresh and work on the areas where during the season that small muscles are not trained so much, as an example is the rotator cuff muscle.

Functional Competence Testing:
The team started training for 8 weeks and were subject to 5 tests: L test; Overhead Squats; Hamstring Test; 60' Pressup; 60' Ball passing. Please refer to Appendix A, table 1: 1, which shows the results from the first until the last week of training.
- Functional Movement Screen I chose the Overhead Squat Test for Stability and Mobility, (Gray Cook, Sport Fitness Testing pg -29)
- For Flexibility the Straight Leg Hamstring Test
- For Power Endurance I chose 60 seconds press-up.
- For Speed-quickness the ''L'' test.
- 60seconds passing the ball test at 5m between players and we recorded the amount of passes between players. Two lines were drawn on the floor with a 5 metres distance between them and 2 groups of 2 players, one on each line. The first group passed the ball to each other within the group. The players were allowed to step on the line but not to cross the line. The second group counted the passes between players in the first group. The 60 seconds passing ball start and stop were given by a whistle signal by the coach.
- Especially for goalkeeper, eight metres throw trough a laser beam after the warm up, this would normally involve a physical demonstration and the expectation from players and in other hand from goalkeepers.
- 15 penalty shoots from 7m (recognition reaction) in the end of the training session.
On the Functional Movement Screen, the overhead squats generally showed that all but two players had poor mobility and stability with tight calf and thigh muscles. We also worked on identifying and improving the players' weaknesses. In the first session on the 60 seconds passing the ball test I could see all players had at least one technical fault, miss the pass or didn't catch the ball properly.

Development

Quote "The key role of visual focus while sprinting has important implications when executing agility drills. In general, the athletes head should be in a neutral position and his or her eyes should be focused directly ahead regardless of whether moving forward, backward or laterally. Exceptions to this guideline can be made when the athlete is required to focus on a team mate, opponent, ball or other visual target. Furthermore, directional changes (cutting left or right) and transitions (turn and run from a backpedal into a format sprint in the same direction should be initiated by getting the head around and finding a new point of focus. Examples of coaching points that reinforce visual focus are to "open up from the top down'' and "let the hips and shoulder follow the eyes''. Errors may occur when athletes initiate such ward, resulting in rounding off a turn or weaving outside of a desired movement path with a subsequent loss of time or efficiency.''
Brown/Ferrignos/Santana ; Human Kinetics -2000

One question we asked. What role do the arms play during agility movements?
Quote "***Dribbling feint focus - sudden change of direction of movement with ball"***
It means if a player suddenly changes direction during a dribble it's also one kind of feint – its ***dribbling feint***: something new in handball what we, still, don't use enough (while in basketball it's one of the basic elements).

For dribbling feint player can use both arms (right and left), for last step forward can be also use left and right leg. It means that we have 4 different solutions, what means more problems for defence player.''
Pokrajac Branislav EHF Master Coach 1st module in Denmark (http://activities.eurohandball.com/ehfcan/16505 .)
As Pokrajac lines up around 8 kind of feints, all this can be added to our recognition and reaction exercises to respond to a visual stimulus, where the defence attack to obtain the ball and the attacker responds almost simultaneously to a mirror neuron response to avoid the attacker's reaction, as W. Pollany stated in theory and practice on EHF Open Master Coach 2nd module in Hungary, http://activities.eurohandball.com/ehfcan/17502

In handball this means that someone who is experienced does not need to focus on basic skills such as dribbling but his focus on attention is in attacking, watching defence, watching offense, but a novice finds that he has to concentrate on basic skills, dribbling a ball, and has less time to focus on watching defence, offence or attacking as in Appendix A, Table 1:3.

The information impulse travels in different compartments as follows:
Quote "Attention Process > Information Process > Memory System > Measuring Information > Selective Attention > Information Processing Capacity > Attentional Narrowing > Being in Zone > Measuring Attentional Focus > Information Process Model

The storage system is capable of holding a large amount of sensory information for up to one-half second before it is either lost or transferred to a more permanent storage system. Events often occur so rapidly in a game that it is hard for the player to make an immediate decision; if it's not immediate the player will discover that the image (opportunity to engage a team mate) is no longer available. That portion of the information that we can effectively attend to is passed on to a short term memory system for further processing.
Information comes into STM (short time memory) for rehearsal from both sensory store and permanent memory. Information that comes from sensory store is often new or original information.
Selective attention. Wrisberg and Shea(1978) demonstrated through the use of the reaction time probe that the attentional demand of a motor act decrease as learning increase. Each athlete's information processing capacity, or space, is limited. Processing space is not the same as intelligence.''
Dribbling, planning, watching defence, watching offense: See Appendix A - Table 1:3
Richard H. Cox; Sport Psychology, 2002, Mc GrawHill

After stimulating the CNS for a long accumulative training period would take longer to recover and to reach a peak performance. The tapering zone phase after training the CNS in parallel with strength training and speed can reach between 3 to 6 weeks according to the level of players' experience.
Training the perception-action cycle should be repeated all the competitional year as the visual perception would be lost after few months.

To develop eye-hand reaction and coordination you mimic the movements made during game play and by repeating them in specific drills. Each drill mirrors a movement similar to

those on court and is performed over short period of time focussing on the development with the relative positions of the body in each plane and axis.

Practical training for faster reaction time and coordination

1. Focus reaction time

To exercise your focus and attentions skill, bounce two balls at the same time, with hands forward, hands on the side, walking forward, backward, sideways with sumo squats, sideways, walking lunges forward and backward.
Alternate ball bouncing.

2. Batak light board reaction

Quote "Most sports need fast reactions. It might be a sprinter going on the "b" of the "bang", or an F1 driver seeing a gap and steering into it. So what affects your reaction to speed, and can you improve it? Scientific research[1] suggests that many things affect response time, including:
Age and gender
Fitness level
Body temperature
Length of neural pathways
Alertness
Personality
Experience
Anticipation
Stimulus strength
Psychological state
Number of possible response

If you have to do a sum as well as hit a light, it slows you down a lot. This mental processing is what improves with practice, fitness and alertness. Repeating the same task over and over again re-wires the nerve connections in your brain, making you faster at that particular task. Eventually you really can do it without consciously thinking. That's the science of how "practice makes perfect."."
*www.scientistsinsport.com/resources/analysing.../**reaction-test**.aspx*

Also we can see in the youtube link bellow how this highlights the points raised above on the eye-hand coordination and reaction. In handball we have specific roles such as goalkeeper player, line player, and centre back player, what would have a huge benefit from this kind of training. Faster reaction times mind the better sensor- motor performance and better processing ability of the central nervous system.
www.youtube.com/watch?v=cyy4lqRERJM

3.Rebounder reaction

This is for a rapid functional eccentric exercise to improve eye-hand reaction, coordination, absorption of the force generated by the return of the ball to the player, position in space, body awareness and to produce more force externally when passing the ball.

We have a bouncing platform incline at 45 degrees and medicinal balls vary from 1kg to 10kg.

I. Both hands passing the medicinal ball from the chest level towards the rebounder, while the ball returns from the rebounder the player makes a side step to the left and back in the centre to catch the ball and to repeat in the right side. Each side six times. Progression, have two steps sideways.
II. Hold the medicinal ball over the head with both hands stretched at maximum, jump and throw the ball in rebounder, a quick land and jump catch the ball over your head stretching as much as you can and pass from overhead again towards the rebounder, when you are in the air. Repeat 6 times. Progression for this would be a fake pass on the right or left when the player is in the air before throwing the ball towards the rebouncer.
III. Your right arm is extended over the head with the medicinal ball in hand jump, pass the ball towards the rebouncer, land and make a step to the right, jump on the left, catch the ball with the left hand and pass towards the rebouncer. Repeat right and left six times . Progression, when you are in the air change the ball from one hand to other before you pass it towards the bouncer again.
IV. Wood chops bouncing, side bouncing and other variations.

4. Strength training as in Appendix A - Table 1:4

In handball we need power and power endurance.

Quote ''At 15 repetitions we are in the high end to develop power (5-15 rep max) and power endurance (10-25 rep max), short term anaerobic endurance, strengths and speed of contraction, ATP and PCr connective tissue and glycolysis'' as per B.J. Sharkey – Steven E. Gaskill in SPORT PHYSIOLOGY FOR COACHES pg.53.

5.Ladder workout: Quick Feet; Bunny Jumps; Hop Scotch Drill; Skiers with Reaction – total body reaction time to visual; Hop- Scotch with reaction; Icky shuffle with reaction; In and Out shuffle; Chubby Checkers with reaction. After the first 4 weeks the order of the exercises is changed to circuits, 2 circuits over the 7min.

6. Partner mirror running

Result

As can be seen from the table 1:1 in Appendix A, there was an improvement in ability and quickness, ball handling and eye-hand coordination. The 60 seconds passing the ball test at 5m improved the team passes by 348 passes and per player by 25 passes. In addition, for the L Test over an 8 week period all players improve by 2.23 seconds and overall the team improved with 33 seconds.

The second Goalkeeper prepared with the laser beam (See Appendix A - table 1:2) just after the warm up when he was more fresh (adapted for handball from SAQ International idea).

At the beginning we started with 15 players throwing the ball towards the goalkeeper from 8m distance. We tested when the goalkeeper could see the laser beam on the ball. We took into consideration only when he could see the laser beam on a minimum of 6 balls. When we started he could see the laser beam on the shooting ball at 3 m from the goal. We advanced by 10- 20 centimetres each time when he could see the light on at least 6 of the balls. In the first three weeks there was no significant improvement, the recognition time remained the same as found in the General Adaptation Syndrome. We were in the alarm stage where shock and stress interfere and performance decreases for a short period of time. But in the 4th week we could see an improvement of 50centimetres, and after 8 weeks training he could see the laser beam on the balls at 4.5 m. The improvement was in seeing the ball 1.5m sooner over an 8 week period. This is the body compensation response and adaptations; the body goes through a process of recovery from shock and then ensures that it is capable of meeting this shock if confronted again. What this means that he can see the ball one or two milliseconds earlier and have more time to react as documented in Simple eye-hand reaction time study in 2011 as below.

Also the penalties shoot was held in the end of the training sessions as a cool down phase. The goalkeeper penalties saves in training sessions after 8 weeks were improved from 1 in 15 to 15 saves in 15 penalty shoot i.e. 100% improvement in week 7. Table 1:2.

Discussion

An important factor in eye-hand coordination and reaction is muscle balance. Muscle balance means handball players should have equal strength, power and power endurance in primary and secondary muscle movement as well as in the antagonist, stabilization muscles together with left and right side of the body. The antagonist muscles at the front and back of the body, which cause the opposite movement, should be in the correct balance. Similarly the left and right side of the body need to be equally balanced. In handball we use just one hand for throwing, therefore care must be taken to evaluate bilaterally this unilateral use of muscle to ensure bilateral muscle balance.
This is important because muscle balance can help athletes avoid chronic muscle injury such as shoulder injuries as an example. The rotator cuff muscles have a large role in stability of the shoulder joint, for that reason we have to develop strength in this muscle group.
Brian J./ Sharkey/Steven/Gaskill; Sport Physiology for Coaches; Human Kinetics - 2006

As we can see from the many studies, we could improve performance by new and different method of training, and improve our personal achievements.
Quote “One critical aspects of sports vision is eye-hand reaction, especially for visual stimuli in the retinal periphery. A key question is: Can eye-hand reaction time be reduced with training? Evidence from a series of recent experiments suggest that it can:

1. Eye-hand reaction time can be reduced by training a small extent (-10-20 msec) involving central visual processing changes.
2. The training effect transfers to other retinal loci.

3. The improvement is retained following the cessation of training. These results suggest that training of eye-hand reaction time in the retinal periphery should be considered in athletes to potentially improve their on-field sports performance.

From vision to decision: the role of visual attention in elite sports performance. A skilful player essentially relies on a complex set of brain functions engaged once visual signals are relayed from the eye. We overview a series of these neural mechanisms-focusing specifically on the critical role of attention in sculpting the visual processing that takes place leading up to a decision. These brain functions are introduced within the theoretical concept of the 'Perception-Action Cycle.' Vision does not stop at the eye but requires a coordinated set of brain mechanisms called on to convert visual input into rapid decisions about action."
Lippineot Williams & Wikiny; Jan 2011, 145-146; Simple eye-hand reaction time. Ciuffredo, Journal of the contact lens.
We can describe it easily as:
Stimuli => Mental Operations => Response
Reticular sensorimotor > cerebral cortex > hypothalamus > CNS
Cox, Sport Psychology, 2002, , Mc GrawHill

Conclusion

In the last 6 years, I used Batak reaction for many tennis players, football and handball goalkeepers with fantastic results for upper limb reaction.
Batak light reaction for hand exercise can be for 30 and 60 seconds. This exercise is relevant for all handball players in particular for centre back, line and goalkeeper.
One other important aspect to notice on the reaction time and muscle power is that the left handed have a small advantage over the right handed as suggested bellow.
Quote "Performance in team sports athletes further suggest that the ability to use manoeuvres successfully in the actual game will depend on other factors such as visual processing, timing reaction time, perception and anticipation.
Handball games are associated with eye-hand visual reaction time and visuospatial intelligence.
In humans the right cerebral hemisphere is dominant in visuospatial and nonverbal functions such as art, architecture, geometry and maths, whereas the left cerebral hemispheres' is dominant in verbal functions such as rhetoric, literature and poetry
(Gesmind & Behan 1982, Springer & Dentch 1998, Gar 1999).
It can be stated that exercise may increase both muscle power and information processing speed of brain. But exercise's positive effect is especially associated with the right brain or left hand.''
Taylor & Francis, International journal of neuroscience vol.118 no.3 2008 pg 349-354

We should not forget a very important aspect for the eye-hand reaction and coordination as a gender difference and the dominant eye-hand controlling the movement.
In the Journal of Neuroscience written by Dane & Erzurumluoglu they demonstrate that in the case of handball players there are several eye-hand differences between male and female players and left or right hand players.
Right handed players had visual reaction times longer for women than for men, but there was no visual reaction time difference in left handed players. In the left eye and the left hand visual reaction times, the left-handed players had an advantage over the right

handers. “The results suggest that left-handed players have probably an intrinsic neurological advantage.’’
Dane & Erzurumluoglu Journal of neuroscience, 113: 923-929, 2003
“Gender and handedness differences in eye-hand visual reaction times in handball players”

The new trends in handball games, Olympics, World Cup, European Cup and the national competitions, are moving towards developing a faster game, to score more goals, and to develop individual players with a rich set of skills. To promote this new trend, eye hand reaction and coordination have a significant role by influencing the pace of the game. In the last decade or so the players have become more powerful, agile and quick. If we are to add and develop the eye-hand reaction with the visual stimulus, it will be more beneficial for the player, the team and the game.

Appendix A

TABLE 1:1 - TEST RESULTS after specific training for reaction and coordination:

Players	L Test Second ’s		Overhead Squats		Hamstring Test cm’		60’Press-Up		60’Ball Pass	
	START	END	START	END	START	END	START	END	START	END
G1	10.1	8.3	1	3	1	7.5	21	34	-	-
G2	10.4	7.7	2	3	2	9	20	40	36	60
LW	9.6	7.9	2	3	3.5	6	24	37	45	67
RW	8.7	6.8	3	3	5.5	10	33	53	65	87
LB	9.0	7.2	3	0	7.5	14	37	58	65	87
RB	11.3	8.7	2	3	-3.5	0	27	38	45	67
CB	10.7	7.8	2	3	2	8.5	19	32	43	68
L	11.0	8.8	1	1	0	3	29	41	43	68
9	11.1	9.3	2	2	1	6	19	34	39	65
10	10.5	9.0	1	3	1.5	7.5	17	29	39	65
11	10.7	8.1	1	2	-3	2	30	39	35	62
12	11.5	9.5	1	2	0	2	27	41	35	62
13	11.3	9.1	0	2	-10	0	28	37	36	64
14	12.1	9.0	0	3	-3	9	23	35	36	64
15	11.5	8.9	2	3	-8.5	0	27	38	36	60
Total	159.45	126	23	36	-4	84.5	381	586	598	946
Team		**-33.45**	**1.53**	**2.4**		**80.5**		**+205**		**+348**
Player		**-2.23**		**0.87**		**5.63**		**+13.66**		**+24.85**

TABLE 1: 2 –EYE-HAND REACTION AND 7 M TESTS:

	W1	W2	W3	W4	W5	W6	W7	W8
7M saves	0 0%	1 7%	4 17%	6 27%	7 47%	10 67%	15 100%	11 74%
LASER BEAM (metres)	3	3	3.2	3.7	4.0	4.2	4.3	4.5

Table 1:3 changes of focus and attention in beginners and professionals

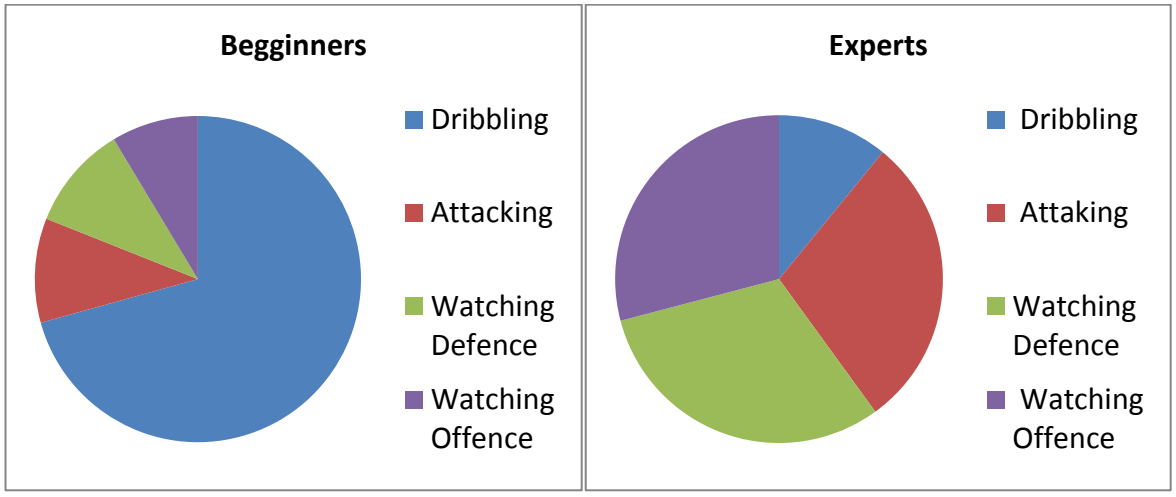

Table 1:4 Strength Training over the 8 weeks

	W1	W2	W3	W4	W5	W6	W7	W8
Cirquit	2	3	3	-	-	-	-	-
SETS	-	-	-	4	4	5	3	2
REPS	15	12	12	8	5	3	8 -10	10
%	45 - 65	45 - 65	65	70 -85	80 -90	90 -100	65 -75	65 -75
Plyometrics	-	-	-	-	-	-	v	v
Kettlebells	-	-	-	-	-	-	v	v
Rest between sets	-	-	30 sec	30 - 60sec	30 - 60sec	60 - 90sec	50sec	60sec
Rest between exercises	1-2min	1-2min	1 – 2min	2min	2min	3min	2-3min	3min

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European Handball Federation

2014 EHF "Rinck" Convention Open Master Coach and Licensing Course

Module 3-Thesis

How can new technologies help Handball Coaches?

Table of contents

1) Summary

Handball coaches have to accomplish a large number of tasks. As new technologies play a growing role in our daily life, some applications, devices and equipment can potentially support the coaches to reach their goals.

In the meantime, though the large portfolio of technical solutions on the market, there are still several areas of a coach's job with very little devices or solutions on offer.

As entertainment and performance will continue to play a key role in professional sports, handball regulations change will open new markets to new technologies.

2) Keywords

Application, device, coach,

3) Introduction

The purpose of this thesis is to show some of the technologies available in 2014 that can support handball coaches in the completion of their tasks and the achievement of their goals.

Complex or expensive technical solutions mostly used for research purposes are not covered here. This thesis focuses on cheap or easy to handle devices and software that can potentially support handball coaches on a daily basis.

The large majority of the applications named in this thesis can be used on smartphones/iPhones, tablets/iPads and/or laptops.

4) Method

Most of the inputs of this thesis come from Internet researches, applications tests, and an interview.

5) The role of a coach

A handball coach has a vast list of tasks to carry and his role may not be the same in each of his assignments, depending on the situation, the environment, and the priorities set by the management.

In this thesis, we will focus on the following aspects (Ref. MACKENZIE, B. (2005) Coaching Roles and Skills [WWW] Available from: http://www.brianmac.co.uk/coachsr.htm):

5.1) Coaching Roles

Some of the roles and that an individual will find undertake as a coach are listed below. But this list is not a comprehensive list:

Advisor
Advising athletes on the training to be conducted and suitable kit and equipment.

Assessor
Assessing athletes performance in training and in competition

Counsellor
Resolving emotional problems on the basis that sharing anxieties can be both relieving and reassuring.

Demonstrator
Demonstrate to the athletes the skill you require them to perform.

Friend
Over the years of working with an athlete a personal relationship is built up where as well as providing coaching advice you also become someone, a friend, who they can discuss their problems or share their success with. It is important to keep personal information confidential because if you do not then all respect the athlete had for you as a friend and coach will be lost.

Fact finder
Gathering data of national and international results and to keep abreast of current training techniques.

Instructor
Instructing athletes in the skills of their sport.

Mentor

When athletes attend training sessions you are responsible, to their parents and family, for ensuring that they are safe and secure. You have to monitor their health and safety whilst training and support them should they have any problems or sustain any injuries.

Organiser and planner
Preparation of training plans for each athlete and organise attendance at meetings and coaching clinics.

The roles of the coach and athlete in determining training requirements will change over the time an athlete is with a coach.

When an athlete first starts in a sport/event (cognitive stage) the coach's role is to direct the athlete in all aspects of training (telling or showing coaching style).
As the athlete develops and demonstrates a sound technical understanding (associative stage) of the sport/event then gradually the coach's role changes to one where the coach and athlete discuss and agree appropriate training requirements (involving coaching style).

As the athlete matures and demonstrates a sound understanding of training principals (autonomous stage) then the athlete will determine the training requirements. The coach's role becomes one of a mentor providing advice and support as and when required.

5.2) Coaching skills

As a coach you will initially need to develop several skills at the same time: organising, building rapport, providing instruction and explanation, demonstrating, observing, analysing, questioning and providing feedback.

Organising
In organising the training session you need to plan in advance how you will manage the athletes, equipment and area - group athletes accordingly to numbers, ability and the activity - continually check the plan is safe during the session.

Building Rapport
In building rapport with the athletes learn and use their names, smile and make eye contact, coach the athlete rather than the sport, show interest in and respect for the athletes.

Instruction and explanation
In providing instruction and explanation you should think about and plan what you are going to say, gain the athlete's attention, ensure they can all hear you, keep it simple and to the point and check they understand by asking open questions.

Demonstration
In providing demonstration make sure you are in a position where the athletes can clearly see and hear you, identify 1 or 2 key points for the athletes to focus on, repeat the demonstration in silence 2 or 3 times (side, back and front view), ask if they have any

questions and check they understand by asking open questions. There are times when it might be more appropriate to use someone else to provide the demonstration.

Observation and Analysis
In observing and analysing break the action down into phases, focus on one phase at a time, observe the action several times from various angles & distances, compare the action with your technical model and if appropriate determine what corrective action is required. Remember your ears can also be used to observe - e.g. listen to the rhythm of the feet of the hurdler.

Feedback
In providing feedback encourage the athlete to self analyse by asking appropriate open questions, provide specific and simple advice, limit the advice to 1 or 2 points, check they understand what they will do next and make the whole process a positive experience for the athlete.

Ref. MACKENZIE, B. (2005) Coaching Roles and Skills [WWW] Available from: http://www.brianmac.co.uk/coachsr.htm

6) Tasks and tools

The purpose of this area is to suggest devices and solutions that can potentially support handball coaches to do some of their tasks and achieve their goals.

6.1) Athletics Fitness

The athletic fitness of the player is one of the main areas a handball coach will focus on. Obviously, a coach will be interested in setting actions and plans to improve the athletics fitness of the participants. But, before that, the first steps are to assess the initial athletics condition of the individual and make sure this aspect is under control.
In other words, the devices and software described below

Most of the software mentioned here are simple apps that can be easily downloaded for free or for a cheap price and that can be used from a common device: tablet, laptop, etc.

Many of these applications are specific to the measurement of a specific athletic skill.

Beep Test

Beep Test App

Team Beep Test (from Bitworks) will enable the coach to conduct a Beep Test for the whole team and then be able to compare the performance of each player versus the others.

Cardio-Vascular

Heart Rate Measurement

This application enables Heart rate measurement, beeps with your pulse. It also provides Real-time chart that will show your every heart beat, your Real-time PPG (EKG-like graph). All these data can be shared to Twitter, Facebook and other social networks.

Step Test

The step test is an easy to administer sub-maximal test of cardiovascular endurance. This step test app is based on the 3-minute Queens College Step Test procedure. This app is ideal for testing your own fitness. The app does all the work for you so you can concentrate on the test. The app has an internal metronome to help you keep pace for the three minutes (different rate for males and females), then you are guided through the counting of the heart rate for 15 seconds. The heart rate measurement is used to determine your level of aerobic fitness and predicted V02max.

There is also a growing number of devices that enable to monitor the Heart Rate, the BPM (Beat Per Minute) but also enable Cardio data sharing. Main companies with a presence on this market are Garmin Forerunner, Soleus, Suunto, Polar.

Most of the devices and software enable to assess athletes in a training environment. However, in the last ten years there is a growing attempt in the assessment of players' cardio-vascular behaviour in a game situation.
The last device of this category is the new wireless health technology from Nuubo. This wireless platform for remote cardiac ECG enables the monitoring of individuals or large groups in an easy, cost-effective and flexible way. Further tests have been conducted with the EHF during the Men's 18 EHF Euro.

Speed:

Photo Finish Timer App

SprintTimer, a unique timer and photo finish app that uses the same techniques as the professional equipment used in Track and Field, though it can be used for other sports too, such as horse racing, greyhound racing, cycling, speed skating, car racing, rowing, plus much more.

Start the timer and point the camera towards the finish line. Then sprintTimer will build an image of narrow slices of the finish line, each representing 0.03 s in time. You can then scroll along the photo to get the time at which each competitor crosses the finish line with a 0.01 s resolution.

12 minute Run

The 12 Minute Run (Cooper Test) is the commonly used test of aerobic fitness, in which you run as far as you can in 12 minutes. The test is usually conducted around a measured track so that the distance is easily calculated. Using the features of the phone, these apps remove the need for such a track, as the app can use GPS technology to track the runner and calculate distance covered. Therefore you can run wherever you like and the total distance will still be calculated. Using the values of age and sex your results will be calculated giving you a your rating and predicted VO2 Max score.

Speed/Radar

The SpeedClock video radar iPhone App is an unique app to easily measure the speed of most moving objects, such as runners, cars, boats, skaters, skiers, cyclists, animals, footballs, tennis serves etc. There are lots of great applications for this App in the field of sports testing. The App uses motion detection, so you only have to hold up the iPhone and point the camera towards the moving object for it to work. SpeedClock also includes two distance estimation tools and an additional high speed tool.

Vertical Jump

VERT

Vertical jump measurement. small and discreet, can be worn for testing, training and during competition measures every jump, with results shown in real time. Athletes can challenge, compete, compare and share their performance. Spectators can follow an athlete's performance as it happens on their smart device. Coaches can monitor their athlete's performance using the Coach app

Global Athletics Fitness Monitoring:

FitnessMeter
With little additional settings efforts, this application enables the monitoring of the speed and the vertical jump. With additional settings of the environment, an individual beep test can also be conducted.

Fitness bands:

Jawbone Up, Fitbit Flex, and Nike Fuelband enable the tracking of the entire activity of the individual (Sleep, Activity, Food, Weight, Heart, Glucose, BP). Data can be extracted and shared with the coach.

These software and devices described above would help a handball coach in many ways as they cover many of the athletic fitness aspects required to play handball. They show a growing trend for easy assessment and self-monitoring. They also show the growing acceptance of the individuals to wear a tracker.

However, it remains the entire responsibility of the coach to set a training plan and actions to enable the athlete to perform better.

6.2) Nutrition

Anyone who has been deceived by a punchbowl at a party, or a diet-busting cake, will recognize the value of knowing exactly what you are eating. A new pocket scanner promises to deliver that power by giving the user an instant breakdown of alcohol, sugar, or calorie content before they consume.

The USB-shaped 'SCiO' device is a product of Israeli start-up Consumer Physics, it uses spectrometry to read the "molecular fingerprint" of an object, shining near Infra-Red light on it which stimulates the molecules and then records their reactions.

An accompanying app then displays the nutrient values on a smart phone, measuring fat, protein and carbohydrate levels to the milligram, as well as overall quality. `

Ref : http://edition.cnn.com/2014/05/02/tech/innovation/molecular-sensor-fits-in-your-hand/

The technology is based on the use of a sensor that individuals wear. This sensor will capture intimate data and these data will be shared. Here again, this trend shows the growing openness of individuals to be tracked and that their private date are shared.

6.3) Technical excellence

Technical excellence is one of the areas where a handball coach can bring added value inputs to the participants when athletics performance and nutrition improvement can be conducted by Athletics coaches and nutritionists.

Technical excellence can be assessed in two different ways. On the one hand, technical excellence can suggest the ability to do the right move properly. On the other hand, technical excellence can be considered as technical efficiency. For example, a coach working with beginners will assess how the participants reproduce the moves he has shown them when a coach leading professional players will rather assess their performance according performance ratios, for example, the percentage of goals scored in a game versus the number of throws.

If we first focus on the ability of the participants to do the right move properly, the main key elements here will be to use visual elements. Record their initial move, show them their move, show them the correct move, lead them to reproduce the correct move.
The main components to proceed would be a camera, a software, a device on which the video can be played.
As a camera, a simple ipad or tablet can be used. Several applications are on the market (Coaches Eye, Ubersense, Coach My video, ICoach View, Dartfish Express, etc.) where Coaches Eye and Ubersense seem to be the most popular ones.
These software enable to help the athlete improve his moves through a simple process: Record the video, review the video with the athlete and provide feedback, share the video if feedbacks from additional experts are needed.

To improve the quality of the recording you can additional tools or accessories such as:

- The moviemount accessories,

- The GoPro cameras: These cameras can be attached on the player and enable to record what the player sees when he is performing a drill or in a game situation

The add-ons can be used for all technical purposes: Ball handling, player's balance, coordination, steps, throwing Accuracy, throwing speed

Obviously, more complex technical solutions can be set up for research purposes and enable deeper analysis, like analysing the throwing technique per player's type (back court, wings, line, etc.), as in the article"Performance and Kinematics of Various Throwing Techniques in Team-Handball" where 8 camera Vicon MX13 motion capture system have been involved.

For advanced groups, when the technical excellence is also linked with the efficiency, additional software like five strike (http://www.fivestrikes.de/), in German, or HB-All Handball statistics (http://hb-all.appspot.com/), in English, can be used to enable a statistics approach. For example, these apps would enable to assess from which position on the court a player is the most successful.

Though the large amount of applications on the market, for the time being, no software or device could be found to specifically measure the wrist flexibility and wrist movement width and the wrist movement width when this was assessed as part of the study "Profile of Elite Handball Athletes by playing position".

The number of devices and applications available on the market at an affordable price (+/- 250 Euros for the full moviemount accessories pack) enables handball coaches to run a video analysis to a decent cost and in a short period of time.
This way to work will be an increasing part of the coach tasks in an environment where screens are part of our daily life and their tutorial role increases in today's learnings' methods.

6.4) Equipment

As equipment, here, we consider athletes' equipment used in handball or that could rapidly be adapted for a handball purpose.

The development of sportswear techniques and materials has been driven for the last decades by athletics, swimming and extreme sports with high financial revenue like Formula 1 car racing.
In this industry, firms invest massively in R&D to create their own micro-fibres.
Football and rugby are now taking advantage of these technologies. Handball could potentially take even more benefits of these sportswear high-tech materials than it already does.

The company X-Bionic has been taken here as a business case to show the kind of sportswear developed for other sports and what is their aims:

- Reduce the loss of energy:
X-bionic developed race shirts that supports the cooling system and reduce the loss of energy, so that the athlete can push his limits longer (3D Bionic Sphere System).

- A kit a maximum of elasticity :
Only knitwear can provide a 6-Dimensional Elasticity. High-tech yarns, knitted structures and highly elastic flat seams are featured in X-BIONIC® sports wear in order to ensure extreme elasticity and to guarantee a perfect fit.

- Prevent sweat :

As soon as our muscles begin to warm up, sweat production kicks in. Traditional garments are not able to effectively draw away the moisture. To prevent excessive sweat dripping even at the beginning, X-BIONIC® built in the SweatTraps® where sweat is collected. The Evaporation Surface Expander™ in this area helps process sweat from the SweatTraps® away from the skin.

X-Bionic creates its own micro-fibres: Mythlan, Windskin, Bionic Aramid, Sobranevapore, Macrotermes, Nanocore, Xitan, etc. where each new material becomes a trademark.

Shoes:

Due to the particularity of athletes' moves and contact with the ground, shoes have been part of the development of this sport for a long time.
Companies use high-tech materials and technologies to develop new handball shoes or create their own technology. The increasing use of marketing and technical wording may be a bit confusing for consumers, above all, for amateurs.

As an example we take two main brands acting on the handball shoes market. One is Adidas, a multi-sports, international company. The second one is Kempa, a company initially coming from the handball market. Both models below address both handball players' concerns in terms of chock protection, balance at landing and stability. However, the names and technical description are clearly different.

Adidas Adizero Counterblast 7 ;
Material: Air-Mesh, Synthetic
Sole: Ruber Spitzengrip
Technologies: SPRINTWEB, ADIPRENE+, TORSION SYSTEM, ADITUFF

Kempa Cyclone ;
Material: Synthetic, Mesh
Sole: Ruber
Technologies: KageTech Schaft, TPU fixing elements, Kbox, Heels buckles

If handball shoes makers develop shoes with specific features for handball, they do not always integrate technologies used by shoemakers of other sports.

The growing trend in the sport shoes industry is to couple shoes with a sensor and a device that monitors the activity of the athlete.

For example, the Adidas Speed Cell is combination of Bluetooth technology, Speed Cell Software, and a Device. As results, you can:

- See your speed profiled for the whole game

- Know how much ground you covered and at what speed
- Your max. speed is shown from every game.
- With the miCoach Mobile app the SPEED_CELL enables you to track your stride rate.

Your stride rate is the number of steps you take per minute. Stride rate could also be called your running cadence or turnover. Calculating your stride rate is easy, simply count how many times your right foot hits the ground while running, and then multiply by two. This number is your stride rate.

6.5) Team assessment

In §3.2 we have already seen what the devices (for example, cameras) and software (for example: Coaches Eye) can provide an individual assessment. However, other applications enable the assessment of several players or the whole team in a game situation.

The first stage is a statistics approach where the performance of the team in game situation will be saved and analysed. For instance, names and number of scorers, 2 minutes given, etc. The Handball statistics (http://www.youtube.com/watch?v=zxnqdOd46eo) application shows most of the relevant fixtures. Five strikes potentially offers even more statistics but could only be found in a German version.

The next stage would be the match analysis with the help of the video, where the video itself can be made easily with an appropriate software, like SVAT of Sportimization or the Gamebreaker of Sportstec that enables record, play, edit and analyse any video (http://sportstec.com/gamebreaker/gamebreaker-overview.php). Other applications enable the analysis and the creation of statistics related to a specific game, like Dartfish (http://www.dartfish.com/en/coaching_software/team-sports.htm).
Some software editor also created specific applications for real time video analysis purposes like Sportscode (http://sportstec.com/products/sportscode-10-whats-new)

But 3D software is taking over on this particular market segment. Now Sport TV consultant use 3D Analysis and it is already used by coaches in several professional sports (for ex.: American football, football).
As an example, Viz Libero made by Vizrt (http://www.vizrt.com/products/viz_libero/)
Viz Libero is the global leader for 3D virtual sports enhancements. Based on existing TV images only, Viz Libero generates the perfect perspective for analysing interesting or controversial scenes. The idea is to provide unlimited insights into sport games, where the most relevant key features for the coaches would be the Realistic 3D replays, the In-Game 3D replays, and the Interactive touchscreen.

6.6) Teaching

Today, screens are part of everyone's life. Computers, laptop and tablets play a growing role in the educational system, even for the youngest kids (http://www.microsoft.com/education/ww/leadership/Pages/SchoolLeaders.aspx). So that,

the next generations of handball players will learn easier if knowledge and skills are taught through a screen.

As a matter of fact, in addition to the video analysis features that have been shown above, tutorials will play an increasing role in the sport education of a player. Young player will probably retain more through what they see than through what they listen to.
This will have a major impact on how handball coaches are sharing their knowledge and analysis. In a way, the best coaches in the near future will have to be able to use appropriate tutorials as part of their training programmes and video analysis, real-time video analysis and other visual tools as part of their coaching.

Coaches will need to be able to use a new range of products that are not part of their initial training to become a coach:
Video editor Software like Wondershare for Mac and they will need to be able to use visual effects software like After Effects to create their own videos and tutorials.

In addition, coaches will need to be able to handle even more visual tools like (Handball Coaches Clipboard) to display their tactical schemes.

Obviously, handball coaches of the professional handball world may be able to get the support of a specialist of these areas as part of their budget. But all the other coaches, coaches of clubs with lower budgets, amateurs, and beginners will need to learn how to handle those tools.

6.7) Communication

Now that we have an overview on the inputs that a handball coach can bring to the players with the means mentioned above, the next topic is to review what solutions can be used to share these.

Most of the applications above can be shared on smartphones, laptop or tablets as this feature is part of the application.
Social Medias like facebook also enable to share contents and target the appropriate groups through the groups settings. And Video plateforms like youtube enable public video sharing easily.
In addition to this, the audience analysis of some of these social medias (for ex. Facebook) enables the page administrator to have deeper insights about who is viewing the page content.

Voice over IP applications are the probably the most suitable tools to run a distance one-to-one meeting or a conference or webinar. These solutions enable the coach to share his expertise even if he is not at the same location as the participants. But they also give the coach the opportunity to invite another expert to bring his own analysis.
Skype is one of the most popular tool of the free application's family. It enables the creation of a conference with a low number of participants. But the sharing of content is very limited.
Webex is one of the most low cost solution used in small and medium size organisations to run virtual meetings, conferences or webinars. This solution enables a screen sharing, so

that participants can see what the speaker displays on his screen. A whole presentation can be run this way without investing in a video-conference system.

Kadrige iSharing would probably be the most advanced solution as it based on a co-browsing technology. In other words, the speaker invites the participants to access an interactive content (i.e: videos, questionnaires, etc.) located on a different server. The main benefits of this solution are:
- Content security: Only the content saved on this particular server can be shown to the participants
- A large number of participants can join the session (> 100)
- The content can be interactive
- The data of the interactions during the presentation can be saved and be displayed in charts and graphs.

Due to the increase of the video contents in the coaching material, the efficiency of the new teaching methods will not only be linked with the content but will also depend on the tools used to share this content.

6.8) Planning & Organisation tools

Planning and organising are two additional coach tasks as he must overlook the team activities and keep the flow under control.

There is a number of applications on smartphones or tablets with little difference between each of them.
Team Stuff aims at keeping all members of team connected to each other and keep each player connected to the team's calendar.
Mitoo contains many social features, and also offers a module to reach more fans. Teamplan Buch is potentially the best application in terms of event planning but is only in the German language.

Finally, Myteamcaptain.com contains two interesting modules : the upload of video analysis, and the setting of an online shop.

Depedending on the aim and size of his club, the coach may be interested in an application focusing on rather planning activities with players than in an application linking with externals users (fans, kit buyers) or vice versa.

6.9) Sport Predictions

Sport predictions are a new area where software editors begin to investigate. The main idea of these modelling software is to create a projection of what the team could look like under a specific aspect according to the history and events that come up.

As an example, hereafter are the results of Neural Network when used to predict Sports injuries (NeuroSolutions Infinity) with the following aims:
- Ability to predict soft tissue injuries and player performance during the early in-season games, based on pre-season training programs.
- Ability to predict soft tissue injuries and player performance on a week-by-week basis during the in-season.
- Provide the medical and conditioning staff with a tool to search for optimal activity levels to achieve specified outcomes in player performance and injury risk. –
- Assess new player, draft candidates and recommend selections based on required player or team composition.

Results :
One of the major sporting clubs recently reported that since the implementation of the neural network model there has been a 57% reduction in player injuries! In one of the most recent seasons the club was also rated #1 in the AFL for the most players to have played every game, least games missed through injury, most players to play 20+ games and least missed games by top 11 players in each team.
(See more at): http://www.nd.com/apps/content/predicting-sport-injuries-and-player-performance-using-neural-networks#sthash.pajxGLQ4.dpuf

7) Conclusion

While a number of ad-hoc complicated high solutions and systems are being used for Research purposes (EHF Scientific Conference report, 2013), new technologies products launched on the Consumer Market are conceived with the idea of being easy and ready to use.
These trend shows that there is a growing Market for performance measurement, as individuals, living in a society where performance is king, are now used to self-assessment and are also used to be assessed by others.

Nowadays sports people, whatever their level, invest in devices that enable real-time assessment. Doing so, users accept a new type of privacy and freedom as they wear a monitoring device constantly accepting that data concerning their way of life are being stored.

This change will probably impact the relationship between the coach and the athletes, as the coach will access even more intimate data and will have a wider and deeper view in the lifestyle of the athletes he is coaching.

In addition to this, the increase of monitoring devices in real game situations is opening new doors to coaches, as they will be able to assess the performance of their athletes in a way they never could do it before.

There is also a growing trend of self-monitoring that implicitly or not makes consumer believe that they can spare the presence and monitoring of a coach through the acquisition of a device and save the coaching costs. Some solutions even pretend to design appropriate training programme for the individual (example: Nike shoes+ Ipod + Sports Sensor, http://www.gizmodo.com.au/2012/02/new-nike-sensor-brings-the-power-of-nikes-research-lab-to-your-shoes/)

However it may be that in a near future, the mass consumer market requires less and less analysis from the coach but requires even more his ability to set ad hoc performance programmes.

Handball, as a team sport, will potentially be less affected by this trend as other individual sports due to the teams aspects that cannot be self-monitored with current technologies. But Handball coaches have now the opportunity to give more responsibility to their players as they can assess by themselves a part of their athletic fitness.

Though the rapid increase of technical solutions shown in this thesis, there is a clear unbalance in terms of offer from a sport area to another. For instance, if the portfolio of applications in the areas of athletics fitness, team video analysis, and team planning and organisation are growing, other areas are still suffering a lack of technical solutions. As an example, I could not find any applications, devices or tools to improve the steps technique,

which is really particular to handball. I could not either find on the market tools to work on the physical contacts of one-one situation in defensive phases. Other collision sports like rugby have developed particular tools to improve these key aspects of the game (example: Rhino collision equipment)

The performance in terms of psychological mindset is probably the area where there are the less applications, devices and tools on offer.
From my interview with Dr. Michael Bruce on September 4th, 2014 (Dr. Michael Bruce, Speed & Fitness Centre, Lee Valley Athletics, London. Dr. Michael Bruce has been helping players of Arsenal, Chelsea, Tottenham FC and West Ham for years to better perform), I understand that the work on the psychological mindset of an athlete is the key to bring a high level athlete to the stage of a champion. As Dr. Bruce says, "The body cannot go where the mind has never been". Dr. Bruce initial methodology stage in this matter focuses on the assessment of the following aspects of the athlete: Motivation, Know-how, Exploration, Rigorousness, Educational profile, Positive self-belief and Social consideration, where the Educational profile is a key point in the ability of an athlete to improve his psychological mindset as it shows is ability to reproduce what he has been taught.
The lack of technical solutions on the market to improve the athletes' psychological mindset is probably due to the specificity of the psychological material.
However, as some methodologies have enough history, it should be feasible to develop applications to help assess some of the aspects of psychological mindset assessment.
Obviously, with the introduction of new technologies in the coaching process, this particular aspect will be even more a key point, as not only the coach, but also the athlete will be expected to have knowledge of the devices and applications used in the learning process.

Finally, as sports regulations change to provide a better entertainment, it may be that handball regulations change as well in future and open new markets to new technologies.
For example, why not accept that coaches use microphones and headphones during games?
Or, as another example, maybe the development of the Geckskin gloves will enable an improvement in terms of adherence, so that every player, whatever his hands size, will have the same grip ability?

8) References

Litterature
(Ref. MACKENZIE, B. (2005) Coaching Roles and Skills [WWW]

Interview
Interview with Dr. Michael Bruce
Dr. Michael Bruce, Speed & Fitness Centre, Lee Valley Athletics, London

Internet
Beep Test App
Heart Rate Measurement
Step Test
3-minute Queens College Step Test
Garmin Forerunner, Soleus, Suunto, Polar
remote cardiac ECG
Photo Finish Timer App
12 minute Run
Speed/Radar
VERT
Jawbone Up
Fitbit Flex,
Nike Fuelband
USB-shaped 'SCiO' device
http://edition.cnn.com/2014/05/02/tech/innovation/molecular-sensor-fits-in-your-hand/
Coaches Eye
Ubersense
"Performance and Kinematics of Various Throwing Techniques in Team-Handball"
http://www.fivestrikes.de/
http://hb-all.appspot.com/
"Profile of Elite Handball Athletes by playing position"
3D Bionic Sphere System
SweatTraps®
Adidas Adizero Counterblast 7 ;
stride rate
http://www.youtube.com/watch?v=zxnqdOd46eo
lSVAT of Sportimization
Gamebreaker of Sportstec
http://sportstec.com/gamebreaker/gamebreaker-overview.php
Dartfish
Sportscode
http://www.vizrt.com/products/viz_libero/
Viz Libero
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Wondershare

After Effects
Handball Coaches Clipboard)
Skype
Webex
Kadrige iSharing
Team Stuff
Mitoo
Teamplan Buch
Myteamcaptain.com
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http://www.nd.com/apps/content/predicting-sport-injuries-and-player-performance-using-neural-networks#sthash.pajxGLQ4.dpuf
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Rhino collision equipment
Geckskin gloves

HANDBALL SPECIFIC PERFORMANCE DIAGNOSTICS - RELIABILITY AND VALIDITY OF HANDBALL-SPECIFIC-COMPLEX-TEST (HBKT)

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1 Introduction

Team Handball is a fast paced match of defensive and offensive action that includes specific movements of jumping, passing, throwing, checking and screening (Wagner et al. 2014). The level of performance in modern Team Handball is determined by the players` technical, tactical, psychological/social and physical characteristics. All these elements are of high importance in Team Handball and also closely interlinked making Team Handball a particularly complex type of sport (Michalsik et al. 2013). However, it`s unclear which part of variance is explained by those factors regarding match performance (validity). Despite the knowledge of these factors, only conditional tests (e.g., 30m-sprint test, countermovement jump, squat jump test, vertical-jump test, abdominal strength, Yo-Yo Intermittent Endurance Test; repeated sprint ability) are part of the performance diagnostic (Krüger et al. 2014, Massuca et al. 2013, Moncef et al. 2012). Moreover, there are a lot of studies concerning training in handball (Carvalo et al. 2014, Cherif et al. 2012, Ignatovic et al. 2012, Hermassi et al. 2010) and contributions of conditional and anthropometric characteristics of professional handball (Chelly et al. 2011, Granados et al. 2013, Krüger et al. 2014, Massuca et al. 2013, Matthys et al. 2013, Michalsik et al., 2013, 2014, Póvoas et al. 2012, Vieira et al. 2013).
On the other hand, handball specific skills (e.g., dribbling, throws, passing, catching the ball, feints) are not taken into account within a complex test design. Moreover, the different demands of the playing positions (wings, pivots, backs, goalkeepers) are also unconsidered in these tests.
Therefore, the scientific and practical situation concerning handball specific performance diagnostic is poor and unsatisfactory. There is a great contradiction between the often described complex requirement profil of Team Handball and the non-specific and non-complex performance diagnostic on the other hand. There are few publications within the last 16 years regarding validity or reliability of tests used in team handball (Chelly et al. 2010, Debanne et al. 2011, Krüger et al. 2014, Krustrup et al. 2003, Lidor et al. 1998, 2005, Massuca et al. 2013, Matthys et al. 2013, Schwesig et al. 2013, Hermassi et al. 2010, Sporis et al. 2011, Viera et al. 2013, Visnapuu et al. 2009, Wagner et al. 2014). Merely Massuca et al. (2013) and Wagner et al. (2014) validated handball specific tests.

2 Requirement profile in handball

The basic feature of team sports (handball, football, basketball, hockey, etc.) are the complex attributes (strength, endurance, speed, agility, coordination skills, motor skills, tactical-cognitive skills, mental skills, etc.), which are attached to the player. The characteristic 'complexity' can be seen as a common feature in various team sports. Nevertheless, the various team sports differ greatly from each other. This is due to the different rules (court dimensions, playing time, number of players, substitutions, body contact, etc) of the sport, and thus results in a significantly divergent stress and strain profile. Therefore the complexity of team sports, as described above, requires a thorough and detailed analysis of the attributes of the respective sport. Without this dedicated knowledge it is difficult to obtain sufficient performance diagnostic assessments for each particular sport. In the following chapters the components of the game and handball specific performance under the primacy of condition and technique will be explained.

Handball is particularly characterized by the acyclic exchange of high-intensity phases and periods of low intensity. On one side there are quick vigorous actions in form of dynamic accelerations, short maximal sprints, direction change, explosive jumps, powerful throws, and the physical confrontation of 1:1- attack vs. defense situation with the opponent. On the other hand there is controlled bridging of the playing field by careful and calm playmaking within the offensive and defensive phases of the game.
Intense shock and recoil movements, dynamic cross movements, powerful blocks, transitions in sprint, aggressive and highly intensive cooperation between the defender, alternate with game interruptions (time-out, injury, etc). Overall the game of handball has a high occurrence of intermittent load or stress and these loads will take place at different levels of the human organism.

Table 1. *Kinds of stress in handball (Brack, 2002, p. 151).*

	Energetic stress	Informational stress
External load	Scope, intensity, density of runs, jumps and throws	Quantity and quality of technical-tactical actions
Internal load	Active and passive musculoskeletal system, cardiovascular and metabolism	Information, acquisition and processing (perception, anticipation and decision-making processes), psychological distress

Load profile

Absolute and effective playing time

Michalsik et al. (2013) monitored in their study 26 players (9 wingplayers, 7 backplayers, 7 lineplayers, and 3 goalkeepers) over a total of 62 matches in the Danish league during a period of six years and the following data was obtained: The total time was 78:54 minutes. Here, the first half amounted to an average of 38:12 minutes and the second half at 40:42 minutes. The effective playing time was just under 54 minutes. Povoas et al. (2012) examined 10 matches of the men's first league Portugal and determined an average duration of the games of 73 minutes. Manchado et al. (2007) came to an average total playing time of 72 minutes, and an effective playing time of about 43 minutes from the analysis of the Women European Championship. Investigations of nine games of the effective playing time for the men's world championship in Germany 2007 showed that the wingplayers (37.4 min) and goalkeepers (37.1 min) are on the field considerably longer than backcourt players (29.2 min) and lineplayers (29.4 min) (Luig 2008).

Distances

Luig (2008) determined that the players - regardless of their playing position - run an average distance of 2936 m. However, to be considered in this context is that the variability of the total distance was very large, and ranged from 237 m to 6443 m. It was also determined, that the distance travelled when comparing the 1st and 2nd half of the game was not significantly different. A position-specific breakdown of the travel distances of the players showed that the wingplayers (3711 m) run a significantly greater distance than backplayers (2840m), and lineplayers (2787 m). Goalkeepers reached a total average distance of 2058 m (Luig, 2008).

Players in the Danish first division ran an average of 3627 ± 568 m with an average speed of 6.4 ± 1.01 km / h (Michalsik et al., 2013). The players run 1846 ± 346 m in offensive situations and covered 1781 ± 337 m in defensive situations. The players ran 1789 ± 232 m during the first half and 1838 ± 235 m in the second half. Povoas et al. (2012) determined on the basis of 10 official games and a total of 30 players in the first division in Portugal, a total distance of 4370 m.

Handball specific elements of the game

Recent studies (Povoas et al., 2012), which were carried out on 30 male field players during 10 official matches in the Portuguese league, showed that players jumped an average of 14 times, threw 7 times and conducted a total of 31 stop movements. This number was derived from the sum of the number of stop movements in attack (13) and defense (18). 31 times they changed the whole direction during the game, which was due on 13 change of direction in attack and 18 changes of direction in defense. The statistical survey of the 1:1 situation showed a total value of 20 1:1 situations of which resulted in 12 tackles in defense. 825 activity changes in 6 seconds intervals were recorded by means of a time-motion analysis.

Brack (2002) determined that the players conducted an average of 28 jumps per game and threw 8 to 11 times on the opponents goal (Brack, 2002). The number of sprints (70 sprints, 6-8 m, Brack, 2002) over a short running distance is consistent with studies by Manchado et al. (2007) who identified an average of 76 high-intensity phases within womens matches.

Speed of Movement

In the studies of Michalsik et al. (2013) the speed of movement of distance running was analyzed by a division in to eight criteria. The speed of movement was divided into slow motion activity ("Standing": 0 km / h; "Go": 4 km / h), moderate exercise activity ("jogging": 8 km / h "lateral movement": 10 km / h "reverse run ": 10 km / h," race ": 13 km / h) and high motion activity (" fast race ": 17 km / h and" sprinting "24 km / h). Overall, the players spent on average 39 ± 9% dedicated to slow motion activity, 53 ± 10% to moderate exercise activity and 8 ± 5% to high motion activity. 1482 ± 313 speed of movement changes were observed within a game. It was also noted that the average speed, and the amount of high movement activity decreased in the second half. Attention must be given in this context to the fact that the only games that were integrated into the analysis, were the ones in which the observed players acted on the field in 70% of the playing time (42 minutes or more) and at least 60% of the playing time in the first half (18 minutes or more) (Michalsik et al., 2013).

Povoas et al. (2012) studied the movement speed of the covered distances in an identical manner. The players stand for 43% of the playing time, and for 35% of the playing time, the players walked. For 9% the players jogged, for 2.2% they ran quickly, and only 0.4% of the distances covered in a handball game were managed by sprinting. Lateral movements exist at 5.2% with a moderate intensity, and at 1.1% with high intensity.

Luig (2008) determined on the basis of his investigations of the running speed, which were divided into the different categories of speed "Walk", "Run Slow", "Fast Run" and "Sprint", the following values were obtained: The total distance of the players were - independent from the position - walking (39%) , slow running (43%), fast running (16%) and sprint (3%).

Comparing the studies of Michalsik et al. (2013), Povoas et al. (2012) and Luig (2008), there are similar abnormalities. The majority of the movement speed was clearly in the slow, and moderate range (39% low-intensity activities, 53% moderate-intensity activities (Michalsik et al., 2013), 43% standing, 35% walking, 8.8% Running (Povoas al, 2012) and 34% walking, 45% slow running (Luig, 2008)). Only small percentages existed in the investigated games with

respect to the fastest running speed (3% sprinting, 18% fast running (Luig, 2008), 2.2%, fast running, 0.4% sprinting, 1.1% sideways high-intensity movement (Povoas et al. 2012) and 8% high-intensity running (Michalsik et al., 2012)).
Manchado et al. (2007) analyzed - as already mentioned above - 7 matches of the German women's national team at the European Championships in 2004, and found that 76.0 ± 10.2% were intensive attack phases. This attack phases had a mean duration of 5.7 ± 0.4 seconds. In this case, these periods of high intensity were observed by two experienced handballcoaches.
Expressed in this context Boraczynski et al. (2008) reported a total of about 50 attack and defensive phases. In this case, the average duration was from 31 to 35 seconds for 60% of the time, for 22% over 35 seconds, and 17% for a period of less than 20 seconds (Boraczynski et al. 2008). The situation is similar to Schwesig et al. (2012). They observed 4 matches of the third league of men from the season 2011/2012. They determined an average of 99 activity phases ("time interval between two interruptions of the game, that substitutions allowed" (Schwesig et al., 2012, p 155)) with a duration of an average of 31 seconds. The shortest activity phases were presented at 3 seconds and the longest activity phases at 120 seconds. The effective playing time was an average of 48:02 min.

Stress profile

Heart rate

Krüger et al. (2014) determined in their study within the period of preparation for a handball-bundesliga team, the average heart rates of four different playing positions during two games. They analysed significant differences of the strain of the heart. Wingplayer had the highest average heart rate (165 ± 5 bpm), followed by the backcourt players (162 ± 7 bpm) and the lineplayers (155 ± 4 bpm). The goalkeeper achieved an average heart rate of 139 ± 3 beats per minute. Based on the maximum heart rate the backplayers reached the highest cardiac stress. After that, the back player stood at 86%, the wingplayers at 85%, the lineplayers at 83%, and the goalkeepers at 75% (Krüger et al., 2013).
Further differentiations of the heart rate of 30 field players of the first Portuguese league was taken from Povoas et al. (2012). They divided the heart rate into the categories of total playing time and effective playing time, in which the player acted on the field. The players then reached an average heart rate based on the total playing time of 139 ± 32 beats per minute which corresponds to 72 ± 17% of maximum heart rate. The maximum heart rate was diagnosed by the "Yo-Yo intermittent endurance test level 2". There are no detailed values for the proportion of total and effective playing time. 73 minutes have been the average duration of the observed games. Based on the effective playing time, the average heart rate was 157 ± 18 beats per minute, respectively, at 82 ± 9% of the maximum heart rate. The highest heart rates during the studied games were at 185 ± 10 beats per minute. Another striking feature are two other findings: first, the players acted in more than half (53%) of the effective playing time over 80% of their maximum heart rate, had only 7% of the effective playing time under 60% of their maximum heart rate. Consequently, 40% of the effective playing time between 60% and 80% of their maximum heart rate. On the other hand, the duration decreased from effective phases of the game in the second half, in which the players were above 80% of maximum heart rate, which was to be demonstrated by the observation of lower intensities within the playing phases of the second half, although no significant changes within the lowest heart rate were perceived (Povoas et al., 2012). In a study of the stress profile in women's handball (Manchado et al., 2007), the average heart rate based on the effective playing time (players acted on the field and the ball was in play)

was at 161 ± 3 beats per minute, and thus at 87 ± 6 % of maximum heart rate. Comparing the results of the three studies similar heart rate values for the effective running time of men and women can be presented.
In a study of the heart rate behavior of 18 young handball players (about 15 years of age) in six handball matches Chelly et al. (2011) determined an average of 172 ± 2 bpm. This higher average heart rate compared to the studies mentioned above is due to the younger age of the players. Reer et al. (1998) pointed out to differences between adult and youth groups in the triathlon, which are related "by the more emphasized frequency response of the youthful heart at loads and low anaerobic capacity of young people" (Reer et al, 1998, p 151). At 72% of the total game time the young handball player exceeded heart rates of 170 beats per minute. In line with the study of Povoas et al. (2012) it is to notice, that the average heart rate in the second half was significantly lower than in the first half (83 vs. 87% Heart rate max).

Lactic load
Due to the acyclic motion and intermittent play structure in team sports (handball, football, basketball, ice hockey, ...), the analysis of energy supply is far trickier than in sports with cyclical movements. This fact is possibly due to scientific data that has at most rudimentary features. Delamarche et al. (1987) study of seven players during a handball game on a lactic load in the range of 4-9 mmol/l in blood. Brack (2002) mentioned in his remarks, regarding the laktaziden load of players during a handball game, concentration values from 3-8 mmol/l. The middle section was 4-5 mmol/l. More recent studies of young handball players (Chelly et al, 2011;. Souhail et al, 2010) showed lactate concentrations of 9.7 ± 1.1 mmol/l at the end of the first half, 8.3 ± 0.9 mmol/l at the end the second half, and 9.22 ± 2.3 mmol/l three minutes after the end of the game.
Overall it can be stated that the serum lactic load which the player reaches during the game is in the range between 3-9 mmol/l , with peak values exceeding 10 mmol/l. However, it should be noted that in most phases of the game, the energy is provided mainly from the extraction of aerobic units. In high intensity phases of the game, the energy is provided by the use of energy storage of Adenosine-triphosphate (ATP), and Kreatine-phosphate (KP).
In the breaks or phases with low intensity, the ATP stores are filled oxidatively (without lactic acid formation) again. The anaerobic degradation of carbohydrates and an associated increased lactic acid formation occurs only in rare, prolonged intensive uses (e.g. in three counter-attacks straight). “This lactate is already dismantled under emergency recovery in low-intensive phases of the game "(Brack 1993, p 65).
This finding is two decades old; nevertheless it seems not to have lost its timeliness and accuracy. Overall, it can be stated that the requirements for indoor handball besides technical and tactical skills have "required a high degree of conditional requirements." (Mellwig et al. 2009, p 6).

3 With regard to validity and reliability tested handball specific tests

After analyzing the current scientific situation in terms of handball specific performance diagnostics it was not possible to find handballspecific tests, that were reviewed with respect to the main quality criteria of validity and reliability.
A study of Hermassi et al. (2010) will be presented here and discussed. This involves the direct validity of the Yo-Yo Intermittend Recovery Test (Yo-Yo IR1) with youthful male handball players. 18 players were filmed in six handballgames (2 x 25 minutes per game with 10 minutes break). Their running performance was analyzed by a computer programm. During the analyzed games, players were not allowed to be substituted, to avoid differences in the playing time. In addition, the heart rate was measured in 5-seconds intervals during the games and the Yo-Yo IR 1. The concentration of lactate in blood of the players was taken immediately after the two halftimes and three minutes after Yo-Yo IR1. They found out, that the Yo-Yo IR 1 has high reliability (ICC=0,96, CV=3,8%). Using correlation analysis Hermassi et al. (2010) determined, that the distance of the Yo-Yo IR1 with the running performance of the players during the games significantly correlated (r = 0.88). The research group also found out, that no significant differences in heart rate and lactate concentration at the Yo-Yo IR1 and handball games existed. They concluded, that the Yo-Yo IR1 can be considered as a relevant test to assess the "Intermittend high-intensity" for youthful male handballplayers.
However, it is unclear to which individual handball specific game performance is related to the absolute distance covered running track and needs to be further investigated. The absolute running performance in the game is similar to an endurance performance test (Yo-Yo IR1) by only one conditional parameter and it is quite explainable and understandable that both parameters (endurance) are correlated. What is necessary is the integration of specific handball factors (goals, assists, technical errors, blocks...) to estimate the individual game performance (= gold standard), and to devise valid tests of specific handball performance.

4 Research design

Study Sample
The HBKT investigation was performed twice within 48 hours, and took two handball teams (n=30) of the third league(Team 1; n=13; Team 2; n=17). The players of both teams completed about 8 to 10 exercises in the preparation period and about 5-7 training sessions during the competition period per week. The position-specific division of players was made by the respective coaches of the two teams. Based on this assessment, four goalkeepers, seven wingplayers, six lineplayers, and thirteen backcourt players were part of the investigation (Tab. 2). 13% (n=4) of the tested players were left-handed.

Table 2. *Position-specific classification and anthropometric characteristics of players (mean ± SD).*

	age [years]	height [m]	weight [kg]	BMI [kg/m²]
goalkeeper (n=4)	29,3 ± 2,94	1,88 ± 0,03	93,0 ± 15,3	16,4 ± 3,72
lineplayer (n=6)	24,0 ± 2,15	1,88 ± 0,08	94,7 ± 10,5	26,8 ± 1,31
wingplayer (n=7)	25,8 ± 3,89	1,84 ± 0,09	89,1 ± 15,9	26,2 ± 2,40
backplayer (n=13)	25,3 ± 4,26	1,90 ± 0,05	99,7 ± 31,8	27,7 ± 8,67
total	*25,7 ± 3,85*	*1,88 ± 0,07*	*92 ± 11,4*	*26,1 ± 2,2*

The study was conducted at the beginning of the preparation for the season 2013/2014. The investigation of the teams from the third league East and West took place in July and August 2013. Here the HBKT was carried out under the supervision of a staff of six people. The principal investigator and two employees were responsible for the measurement of time and the listing of errors during the HBKT. Another three people were responsible for measuring and recording the stress parameters heart rate and lactate. Before carrying out the HBKT players were shown a demonstration video of the HBKT and just before the warming up of the teams started, the individual action sequences were again demonstrated by an employee.
In detail, the examination proceeded on the test day as follows:
1. Presentation of the study design and the study objectives,
2. Test presentation (oral, video) and test demonstration
3. 10-minutes rest period in a sitting position,
4. Resting heart rate and resting lactate measurement,
5. 15 minutes warm up of the entire team,
6. Individual test execution (time per athlete: 5-7 min) and simultaneous warm up of the following individual athletes,
7. 14 minutes follow-up period.
Thus, the duration of investigation per athlete was approximately 50 min.

Methods of investigation
Handball specific complex test (HBKT)
Test setup
The HBKT (Schwesig et al., 2010, 2012) consists of four activity series (AS): agility course, defensive action, sprint (10 m, 20 m), throw on goal course (Figure 1). The 4 AS are to be completed twice and contain five active pauses (three times for 30 s, 35 s twice), which reflects the intermittent load character during the match.
The test assembly is standardized in relation to the size of a regular handballfield of 40 m in length and 20 m in width. While time is measured in the activity series sprint (10m, 20m) by light barriers, the activity series agility course, defensive action and throw on goal course are detected by manual timing. The active break I and II is controlled by the test administrator as well as the length of the break of 30 seconds after the first round.
The intermittent structure of handballgames is figured out by the four activity series and the two active breaks. According to the conditional-coordination, cognitive and technical requirements that are placed on a handball player in the game, the HBKT was designed of various action sequences with the objective to orient the HBKT as close as possible to the load structure in high-intensity phases of handball. In addition, pressure conditions were implemented within the sequences of actions in terms of time and accuracy, to put pressure on the players in order to make detailed and sophisticated statements on different performance levels of the players. The need for the players is clear that - based upon this objective - the players have to perform all acticity series, with exception of the two active periods, with maximum speed and precision.

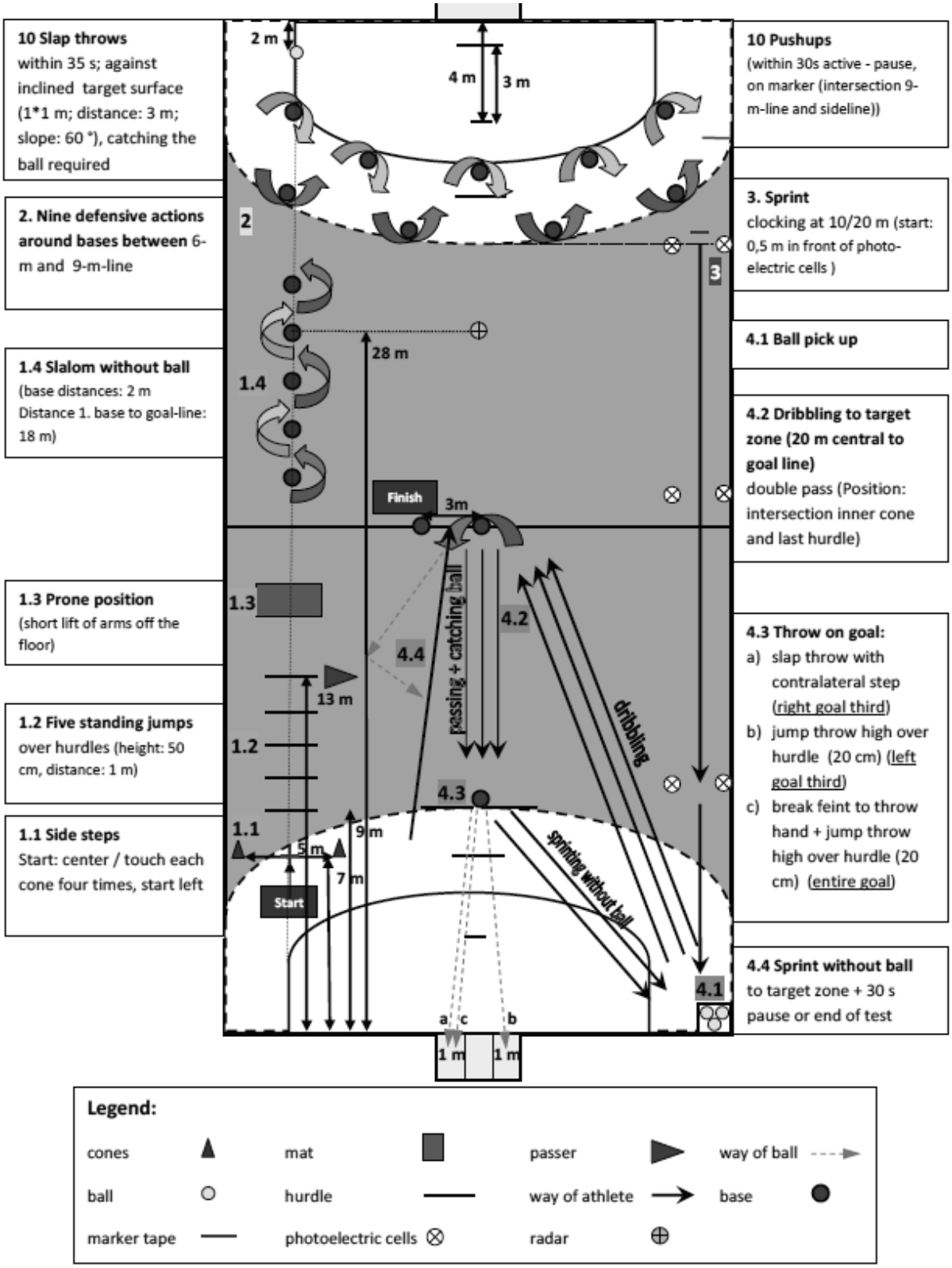

Fig. 1. HBKT - test design (schematic) and short description of the activity series

Test parameters

The aim of the HBKT is the mapping of the major handball specific performance requirements in a standardized form as much as possible. These include the speed with and without the ball, the speed endurance with and without the ball (round 1 vs. round 2), the ball velocity, the handball specific anaerobic capacity as well as the ability for handball

specific recovery. In addition, it is possible to evaluate handball specific skills like shots, variations of shots, dribblings, defensive actions and technique of passes under pressure and precision. This review is carried out qualitatively (failure) as well as quantitative (time). Through the various loads during different action sequences of HBKT individual stress on the player should be diagnosed on the basis of heart rate and lactate measurement. For this reason, in the present study, the heart rate was evaluated at rest, after round 1, before round 2, after Round 2 and in the follow-up period (E2, E6, E10, E14). The lactate levels were determined at rest and in the follow-up period (E2; E6, E10, E14).

Table 3. *Summary of all measured parameters and dimensions of the HBKT.**

Measured parameters	
Number of technical errors	**Time**
• Throw on goal, pass, ball control, dribbling, defensive action, push-ups, slalom sprint • 1 s-penalty per technical error or missed throw	• 10 m-Sprint, 20 m-Sprint, agility parcours, defensive action, throw on goal
Velocity	
• Throw on goal, • 10 gruond shots on target (first active pause)	
Lactate	**Heart rate**
• At rest, RM2, RM6, RM10, RM14	• At rest, end of R1, before R2, RM0, RM2, RM6, RM10, RM14
Dimensions	
Speed with and without ball	**Speed endurance with and without ball**
Anaerobic capacity (handball-specific)	**Recuperativeness (handball-specific)**
Handball-specific skills under pressure of time or accuracy: • Throw accuracy (throw alternatives) • Dribbling (linear, with shifts in direction) • Defensive action • Pass/ball control (pass accuracy)	

* RM=recovery minute, R=round

Data aquisition was performed by means of following assessments

Time: Time was recorded using photoelectric cells (AF Sport, Wesel, Germany), paced at the start (0 m) and at 10 and 20 m from the start. The activity series 1, 2, 4 and the active breaks were measured maually with a stopwatch by two trained raters.
Throwing velocity: The maximum throwing velocity was determined by a Speed Check Radar (Stalker Solo 2; Stalker, Plano, TX, USA). The reliability of the radar system was checked by measuring rolling balls by the radar and checking them over a given distance using photoelectric cells. Intraclass correlation coefficient and CV for the test were 0.92 and 3%, respectively (Gonzales-Rave et al. 2014).
Heart rate: Heart rate was measured using a real time monitoring system (RS 400; Polar Electro GmbH, Büttelborn, Germany).
Lactate: Lactate measurements were performed using a lactate analyzer (Super GL easy; Dr. Müller Gerätebau GmbH, Freital, Germany).
Number of technical errors: manually (three trained raters, majority decision)

Analysis of the competitive performance
The individual game's performance of the players, which were involved in the investigation, was collected through video recordings of the 30 season games of the season 2013/2014. To evaluate the observable motor actions of the handball player systematic game observation was used as a descriptive and analytical method (Böttcher 1998). The high complexity of handball requires accurately defined monitoring criteria for beeing clear, "what events are to be observed" (Friedrichs 1973, p 275). It is necessary and important to have a basic understanding of typical movement patterns in handball (Böttcher 1998).

Parametrization of the match performance

Calculation of a match performance score for field players and goalkeepers following:
Match performance = addition of positive actions (for example goals, assists, steals) + subtraction of negative actions (for example technical errors, missed throws)
The calculation for goalkeepers was different (percentage catched throws based on the total number of throws.

Statistical Analyses
All statistical analyses were performed using SPSS version 22.0 for Windows (SPSS Inc., Chicago, IL, USA).
Descriptive statistics (mean, SD, 95% CI) were ascertained for the HBKT parameters. Mean differences (session one vs. session two) of HBKT parameters were tested using a general linear model. Differences between means were considered statistically significant if p-values were less than 0.05 and partial eta-squared ($\eta 2$) values were greater than 0.10. Because of the small number of cases (e.g., position specific analysis, Table 1), decisions of significance were made primarily based on $\eta 2$-values.
The statistical power was calculated using the GPOWER software (Erdfelder et al. 1996). The statistical power for all the statistical tests was 0.95 (α error) and 0.80 (β error). The effect size for the correlation coefficient was large (0.65). Therefore, thirty subjects were necessary for a sufficient reliability analysis. The sample size (n=30) is large compared to the number of subjects (range: 20-27) in other reliability studies (Beekhuizen et al. 2009, Haj-Sassi et al. 2011, Mirkov et al. 2008, Munro et al. 2011).
Relative (Intra-Class Correlation; ICC) and absolute (Coefficient of Variation; CV) reliability were calculated and interpreted based on Shrout & Fleiss (1979) and Hopkins (2000) and Buchheit et al. (2010), respectively. The ICC indicated: excellent reliability if the value was

above .75; fair-to-good reliability between .40-.75; and poor reliability when less than .40 (Shrout & Fleiss 1979). The typical or random error of measurement (within-subject variation for two session) was expressed as a coefficient of variation (CV, %) and derived from log-transformed data (Hopker et al. 2010, Hopkins 2000).
Absolute reliability is the degree to which repeated measurements vary for individuals (Atkinson et al. 1998). Numerous earlier studies have reported biomechanical variables with CVs below 5% as reliable (Cormack et al. 2008, Haj-Sassi et al. 2011, Impellizeri et al. 2008, Spencer et al. 2006, Wragg et al. 2000). As a result, a CV <5% was set as the criterion to declare a variable as reliable.
The 95% confidence intervals were calculated for each CV and ICC.
In accordance with Schwesig et al. (2014a, b) the parameters were also presented graphically (scatter-plot technique) in Bland-Altman plots (Bland and Altman 1986). Furthermore, calculated differences for each parameter were plotted against their average value for all subjects. The level of agreement was tested by limits of agreement defined as the mean ± two standard deviations (mean ± 2SD) of the measured differences.
The validation was performed using linear regression analysis (model: inclusion). The test parameters were used as independent variable, the match performance score was the dependent variable.

5 Results

Reliability of the Handball-specific complex tests (HBKT)

From exam 1 to exam 2 improvements in almost all parameters were observed (Table 4).This does not include three parameters in round 1 (agility, defensive action, overall throwing time).
24% of the parameters (8/33) showed significant differences ($p<0.05$ and $\eta 2>0.10$) comparing the two sessions. The marked difference between round 1 (5/10) and round 2 (9/10) is remarkable.

Table 4. *Descriptive statistics (mean ± SD) calculated for each stress and load parameter.*

Parameter	exam 1		exam 2	
	Mean	**SD**	**Mean**	**SD**
stress parameters				
Resting heart rate (b*min^{-1})	73	12	63	9
Heart rate after round 1 (b*min^{-1})	189	8	185	7
Heart rate before round 2 (b*min^{-1})	184	8	177	9
Heart rate after round 2 (b*min^{-1})	189	7	188	8
Heart rate recovery minute 2 (b*min^{-1})	140	14	131	10

Heart rate recovery minute 6 (b*min^{-1})	120	10	111	9
Heart rate recovery minute 10 (b*min^{-1})	117	10	107	9
Heart rate recovery minute 14 (b*min^{-1})	116	10	105	9
Resting lactate (mmol/l)	0.88	0.23	0.87	0.29
Lactate recovery minute 2 (mmol*l^{-1})	15.7	3.25	13.3	1.99
Lactate recovery minute 6 (mmol*l^{-1})	15.9	3.36	13.8	2.85
Lactate recovery minute 10 (mmol*l^{-1})	15.1	2.90	12.7	3.05
Lactate recovery minute 14 (mmol*l^{-1})	13.9	3.28	11.3	2.72
Load parameters – round 1				
agility (s)	24.3	1.41	24.3	1.70
defensive action (s)	16.8	1.22	17.1	1.40
Sprint-10 m (s)	1.90	0.14	1.88	0.11
Sprint-20 m (s)	3.32	0.25	3.30	0.22
Overall throwing time (s)	42.6	2.97	42.9	3.35
Throwing velocity first throw (km*h^{-1})	88.9	8.11	94.9	8.46
Throwing velocity second throw (km*h^{-1})	78.6	7.28	86.6	6.44
Throwing velocity third throw (km*h^{-1})	79.7	8.46	84.3	7.64
Missed throws	0.79	0.77	0.45	0.51
Technical errors	1.00	1.08	0.73	0.74
Load parameters – round 2				
agility (s)	27.7	2.26	26.3	1.85
defensive action (s)	18.4	1.73	17.5	1.21
Sprint-10 m (s)	2.08	0.24	1.95	0.14
Sprint-20 m (s)	3.64	0.37	3.47	0.26
Overall throwing time (s)	45.0	3.37	43.0	3.14
Throwing velocity first throw (km*h^{-1})	84.3	9.33	93.4	7.64
Throwing velocity second throw (km*h^{-1})	76.0	8.42	83.6	7.46
Throwing velocity third throw (km*h^{-1})	75.3	10.5	83.4	9.50
Missed throws	0.41	0.57	0.31	0.54

Technical errors	1.63	1.99	0.90	1.03

SD=standard deviation
b=beats

Table 4 contains the results of the reliability analysis. On the basis of the cutpoints for the relative (ICC>0.75) and absolute (CV≤5%) reliability it is noted that the absolute reliability (52% (17/33) reliable parameter) was greater than the relative reliability (42% (14/33) reliable parameter). 23% (3/13) of the stress parameters and 45% (9/20) of the load parameters showed a high relative and absolute IR (ICC>0.75 and CV≤5%) (Table 5).

Table 5. *Relative (ICC) and absolute (CV) Intraobserver reliability of stress parameters (heart rate, lactate) and load parameters within the HBKT (n=30). ICC interpretation: >0.75=high reliability; 0.40-0.75=sufficient reliability; <0.40 low reliability (29). CV interpretation: ≤5.0%=high reliability (5).**

Parameter	**Relative reliability**			**Absolute reliability**		
	ICC	**95% CI**		**CV**	**95% CI (%)**	
		LL	**UL**	**(%)**	**LL**	**UL**
stress parameter – heart rate						
Resting heart rate (b*min^{-1})	0.61	-0.18	0.86	8.9	7.4	12.7
Heart rate after round 1 (b*min^{-1})	0.84	0.23	0.95	1.6	1.3	2.2
Heart rate before round 2 (b*min^{-1})	0.76	-0.09	0.92	2.2	1.8	3.0
Heart rate after round 2 (b*min^{-1})	0.93	0.86	0.97	1.3	1.1	1.8
Heart rate recovery minute 2 (b*min^{-1})	0.57	0.05	0.81	6.2	5.1	8.8
Heart rate recovery minute 6 (b*min^{-1})	0.70	-0.21	0.91	3.9	3.2	5.4
Heart rate recovery minute 10 (b*min^{-1})	0.66	-0.19	0.88	4.8	3.9	6.6
Heart rate recovery minute 14 (b*min^{-1})	0.57	-0.24	0.85	4.9	4.0	6.8
mean	*0.71*			*4.23*		
stress parameter - lactate						
Resting lactate (mmol/l)	0.42	-0.25	0.73	28.7	25.7	47.1
Lactate recovery minute 2 (mmol*l^{-1})	0.56	-0.08	0.81	12.7	10.6	18.6
Lactate recovery minute 6 (mmol*l^{-1})	0.78	0.13	0.92	10.7	8.90	15.4
Lactate recovery minute 10 (mmol*l^{-1})	0.77	-0.16	0.93	10.2	8.50	14.8
Lactate recovery minute 14 (mmol*l^{-1})	0.71	-0.16	0.90	13.0	10.9	19.1
mean	*0.65*			*15.1*		
Load parameters – round 1						

agility (s)	0.92	0.83	0.96	2.5	2.0	3.4
defensive action (s)	0.72	0.26	0.88	3.2	2.6	4.3
Sprint-10 m (s)	0.87	0.73	0.94	3.1	2.5	4.3
Sprint-20 m (s)	0.95	0.89	0.97	2.3	1.8	3.1
Overall throwing time (s)	0.89	0.77	0.95	3.4	2.7	4.6
Throwing velocity first throw (km*h^{-1})	0.74	0.04	0.91	5.0	4.0	7.1
Throwing velocity second throw (km*h^{-1})	0.48	-0.22	0.79	6.2	5.0	8.7
Throwing velocity third throw (km*h^{-1})	0.86	0.12	0.96	3.6	2.8	5.0
Missed throws	0.23	-0.49	0.62	30.0	21.9	84.0
Technical errors	0.48	-0.07	0.75	62.6	56.6	181
mean	*0.71*			*12.2*		
Load parameters – round 2						
agility (s)	0.78	0.04	0.92	3.5	2.8	4.8
defensive action (s)	0.90	0.77	0.95	4.8	3.9	6.7
Sprint-10 m (s)	0.66	0.17	0.85	5.6	4.6	7.8
Sprint-20 m (s)	0.75	0.35	0.89	4.7	3.8	6.6
Overall throwing time (s)	0.80	0.26	0.92	3.5	2.8	4.8
Throwing velocity first throw (km*h^{-1})	0.51	-0.19	0.80	7.2	5.8	10.3
Throwing velocity second throw (km*h^{-1})	0.55	-0.13	0.81	7.3	6.0	10.5
Throwing velocity third throw (km*h^{-1})	0.72	-0.08	0.90	6.9	5.6	9.8
Missed throws	-0.19	-1.60	0.45	30.8	20.3	142.2
Technical errors	0.51	0.02	0.76	68.4	65.7	188.1
mean	*0.60*			*14.3*		

* ICC=Intraclasskorrelationskoeffizient, CV=Coefficient of Variation, CI=confidence interval, LL=Lower Limit, UL=Upper Limit.

Based on the confidence intervals (LL ICC>0.75 and UL CV≤5%) this proportion decreased from 36% (12/33) to 12% (4/33). For the following four parameters a high reliability could be shown:

- heart rate after round 2,
- agility round 1,

- sprint 20 m round 1,
- overal throwing time round 1.

The heart rate showed to be more reliable than lactate in direct comparison (∅ICC=0.71 & ∅CV=4.2 vs. ∅ICC=0.65 & ∅CV=15.1%). The average IR of the load parameters in round 1 was 0.71 (ICC) and 12.2% (CV) (round 2: ∅ICC=0.60 & ∅CV=14.3%).
A low IR (ICC<0.40 and CV>5%) was seen in the following parameters:

- missed shots in round 1,
- missed shots in round 2.

When the parameters missed throws round 1 and 2 were excluded, the IR further increased (∅ICC=0.67 vs. 0.71 and ∅CV=11.3 vs. 10.1%).
Overall the HBKT demonstrates sufficient absolute (ØCV=11.3%) and relative (ØICC=0.67) IR. Without the two above mentioned parameters the IR increases significantly (∅ICC=0.71 & ∅CV=10.1%).
The test-retest analysis based on the Bland-Altman plots (Table 5, Figure 2a-b) showed for the heart rate parameters the largest mean differences and standard deviations (mean=7.7, SD=14.0).

Table 6. *Limits of agreement (mean ± 2SD) of the Bland-Altman plots depending on HBKT parameter (n=30).*

Parameter	**Difference**			
	Mean	**2SD**	**Limits of agreement**	
			Upper limit	**Lower limit**
			Mean+2SD	**Mean–2SD**
stress parameter – heart rate				
Resting heart rate (b*min^{-1})	10.3	17.5	27.8	-7.20
Heart rate after round 1 (b*min^{-1})	4.37	8.70	13.1	-4.33
Heart rate before round 2 (b*min^{-1})	6.63	11.0	17.6	-4.37
Heart rate after round 2 (b*min^{-1})	1.27	7.14	8.41	-5.87
Heart rate recovery minute 2 (b*min^{-1})	8.87	24.7	33.6	-15.8
Heart rate recovery minute 6 (b*min^{-1})	9.27	12.6	21.9	-3.33
Heart rate recovery minute 10 (b*min^{-1})	9.30	14.8	24.1	-5.50
Heart rate recovery minute 14 (b*min^{-1})	11.5	15.2	26.7	-3.70
mean	*7.69*	*14.0*	*21.7*	*-6.26*
stress parameter – lactate				
Resting lactate (mmol/l)	0.01	0.64	0.65	-0.63

Lactate recovery minute 2 (mmol*l^{-1})	2.40	5.20	7.60	-2.80
Lactate recovery minute 6 (mmol*l^{-1})	2.04	4.26	6.30	-2.22
Lactate recovery minute 10 (mmol*l^{-1})	2.42	3.50	5.92	-1.08
Lactate recovery minute 14 (mmol*l^{-1})	11.2	14.6	25.8	-3.44
mean	*3.61*	*5.64*	*9.25*	*-2.03*
Load parameters – round 1				
agility (s)	-0.04	1.76	1.72	-1.80
defensive action (s)	-0.31	1.52	1.21	-1.83
Sprint-10 m (s)	0.02	1.80	1.82	-1.78
Sprint-20 m (s)	0.01	0.22	0.23	-0.21
Overall throwing time (s)	-0.25	4.02	3.77	-4.27
Throwing velocity first throw (km*h^{-1})	-5.96	12.1	6.14	-18.1
Throwing velocity second throw (km*h^{-1})	-7.96	13.9	5.94	-21.9
Throwing velocity third throw (km*h^{-1})	-4.59	7.92	3.33	-12.5
Missed throws	0.34	1.72	2.06	-1.38
Technical errors	0.27	2.16	2.43	-1.89
mean	*-1.85*	*4.71*	*2.87*	*-6.57*
Load parameters – round 2				
agility (s)	1.43	2.72	4.15	-1.29
defensive action (s)	0.89	2.48	3.37	-1.59
Sprint-10 m (s)	0.13	0.36	0.49	-0.23
Sprint-20 m (s)	0.17	0.52	0.69	-0.35
Overall throwing time (s)	1.92	4.42	6.34	-2.50
Throwing velocity first throw (km*h^{-1})	-9.11	16.4	7.29	-25.5
Throwing velocity second throw (km*h^{-1})	-7.57	15.2	7.63	-22.8
Throwing velocity third throw (km*h^{-1})	-8.07	14.6	6.53	-22.7
Missed throws	0.10	1.64	1.74	-1.54
Technical errors	0.73	3.56	4.29	-2.83
mean	*-1.94*	*6.19*	*4.25*	*-8.13*

The smallest differences between the two sessions were found for the load parameters in round 1 (mean=-1.85, SD=4.71).

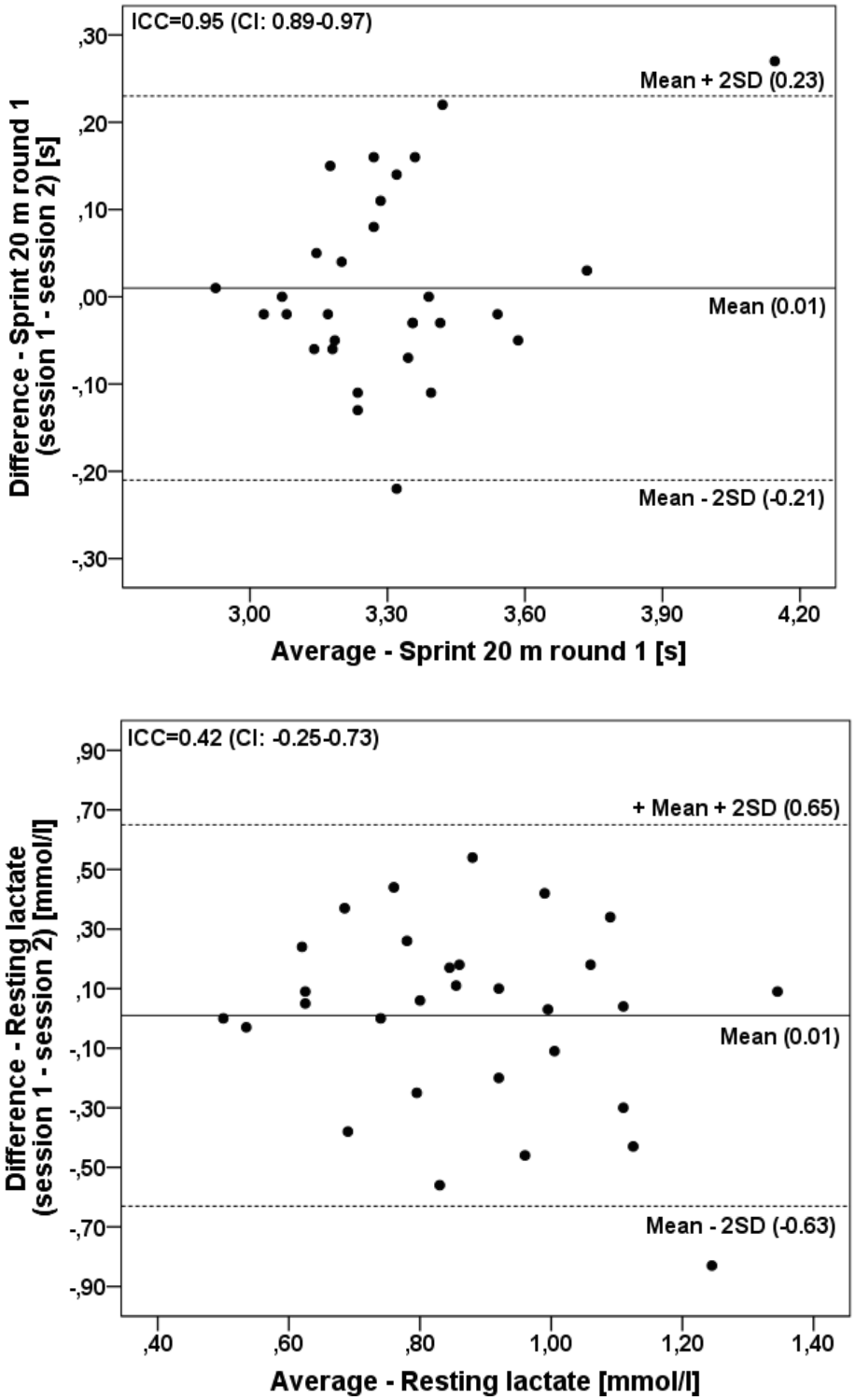

Fig.2 Bland-Altmann Plots with the lowest and highest reliability (ICC & CV, Table 5)

The limits of agreement differed very significantly (Table 6). They changed on average between 9.44 (load parameters round 1) and 28.0 (heart rate) and corresponded with the ICC and CV analysis (Table 5) where the parameters had the greatest reliability at round 1.

After all 7 parameters (70%) in round 1 had a mean of the difference which amount was smaller than 1.

Validity

The validity of overall 33 parameters was assessed via linear regression analysis (Table 7).

Table 7. Validation of the test performance by means of the gold standard match performance (30 matches of the season 2013/2014) using linear regression analysis (model: inclusion). CI=confidence interval. Highlighted in bold are only variables with a R^2>0.10

Parameter	functional equation	CI for m	R^2
HBKT – stress parameters (n=27)			
Resting heart rate (b*min^{-1})	y=0.04*x + 45.9	-1.44 – 1.51	-0.04
Heart rate after round 1 (b*min^{-1})	y=-1.46*x + 324	-3.45 – 0.53	0.05
Heart rate before round 2 (b*min^{-1})	y=-2.07*x + 427	-3.95 – -0.19	**0.14**
Heart rate after round 2 (b*min^{-1})	y=-1.87*x + 402	-4.14 – 0.40	0.07
Heart rate recovery minute 2 (b*min^{-1})	y=0.14*x + 29.6	-1.01 – 1.29	-0.04
Heart rate recovery minute 6 (b*min^{-1})	y=0.14*x + 32.5	-1.59 – 1.86	-0.04
Heart rate recovery minute 10 (b*min^{-1})	y=0.49*x - 7.98	-1.14 – 2.11	-0.02
Heart rate recovery minute 14 (b*min^{-1})	y=0.18*x + 28.1	-1.41 – 1.77	-0.04
Resting lactate (mmol/l)	y=-48.1*x + 90.4	-119 – 22.5	0.04
Lactate recovery minute 2 (mmol*l^{-1})	y=-0.47*x + 56.0	-5.59 – 4.65	-0.04
Lactate recovery minute 6 (mmol*l^{-1})	y=1.17*x + 30.0	-3.82 – 6.16	-0.03
Lactate recovery minute 10 (mmol*l^{-1})	y=4.21*x -15.0	-1.35 – 9.77	0.05
Lactate recovery minute 14 (mmol*l^{-1})	y=2.92*x + 8.02	-2.13 – 7.96	0.02
Recovery heart rate (relative); end round 1-start round 2	y=20.3*x - 11.6	7.19 – 33.4	**0.26**
Recovery heart rate (relative); recovery minute 2 to recovery minute 14	y=-1.67*x + 113	-4.98 – 1.66	0.01
Recovery lactate (relative); recovery minute 2 to recovery minute 14	y=-0.77*x + 61.6	-2.34 – 0.80	0.01
Lactate degradation rate per minute; recovery minute 2 to recovery minute 14	y=19.4*x + 42.2	-86.6 – 126	-0.03
HBKT – loading parameters round 1 (n=27)			
agility (s)	y=2.17*x – 4.16	-9.49 – 13.8	-0.03

defensive action (s)	y=-1.65*x + 76.3	-15.6 – 12.3	-0.04
Sprint-10 m (s)	y=36.7*x – 21.3	-75.7 – 149	-0.02
Sprint-20 m (s)	y=4.30*x + 34.3	-60.7 – 69.3	-0.04
Overall throwing time (s)	y=-0.73*x + 79.4	-6.45 – 5.00	-0.04
Throwing velocity first throw (km*h^{-1})	y=1.28*x - 66.4	-0.86 – 3.42	0.02
Throwing velocity second throw (km*h^{-1})	y=1.49*x - 97.9	-0.28 – 3.97	0.09
Throwing velocity third throw (km*h^{-1})	y=0.30*x + 24.8	-1.75 – 2.35	-0.04
HBKT – loading parameters round 2 (n=27)			
agility (s)	y=-1.49*x + 90.0	-9.05 – 6.08	-0.03
defensive action (s)	y=0.59*x + 37.9	-9.27 – 10.5	-0.04
Sprint-10 m (s)	y=8.99*x + 30.2	-63.8 – 81.8	-0.04
Sprint-20 m (s)	y=-3.38*x + 60.9	-47.9 – 41.2	-0.04
Overall throwing time (s)	y=-2.38*x + 155	-6.93 – 2.16	0.01
Throwing velocity first throw (km*h^{-1})	y=0.53*x + 3.68	-1.28 – 2.34	-0.03
Throwing velocity second throw (km*h^{-1})	y=1.12*x – 37.4	-0.87 – 3.11	0.02
Throwing velocity third throw (km*h^{-1})	y=0.24*x + 30.4	-1.43 – 1.91	-0.04

For the following two parameters an explained variance higher than 10% could be calculated:

- Recovery heart rate (relative); end round 1-start round 2: R2=0.26
- Heart rate before round 2: R2=0.14.

7 Discussion, practical applications and conclusions

Overall, the IR of the HBKT must be regarded as sufficient and the validity as insufficient. Four highly reliable parameters (heart rate after round 2, agility round 1, 20 m sprint round 1, overall throwing time round 1) stand against two parameters with a low reliability (missed throws round 1 and 2). Only in two parameters of the HBKT the correlation of variation (Recovery heart rate (relative); end round 1-start round 2; Heart rate before round 2) was higher than 10%.

A discussion of the external examination results is very difficult so far, because only one comparable test is described in the scientific literature (Wagner et al. 2014). Wagner et al. (2014) developed a match based performance test for team handball. Regarding test-retest reliability (interval: seven days; n=17) they found an ICC>.70 for the peak blood lactate concentration, heart rate and ball velocity. In order to assess validity Wagner et al. (2014) disposed percentaged running speed over the match as dependent variable (gold standard). A high correlation with the percentaged running speed in the game based performance test is shown. Remarkably critical is the fact, that the complexity of the match performance is limited to the conditional parameter running speed. Hermassi et al. (2010) investigated the direct validity of the Yo-Yo Intermittent Recovery Test (Level 1) in 18 adolescent handball players (14.3±0.5 years) on the basis of match performance. As Wagner et al. (2014) they also reduced the match performance to just one conditional parameter (total game distance). Yo-Yo IR performance (1,831 ± 373 m) was significantly related ($r=0.88$, $p<0.01$) to total game distance (1,921 ± 325). In contrast to Wagner et al. (2014) which at least were able to specify the independent variable (game based performance test) the specificity is missing for both of the variables (total test and total game distance) in the test design of Hermassi et al. (2010). These two examples are representative for a fundamental and wide spread problem: Despite the unanimous scientific references, that handball is characterized as a very complex sport (e.g. jogging, sprinting, backwards movement, sideways movement, jumps, throws, steals blocks, changes of direction, one-on-one-situations, feints), the match performance is literally reduced to conditional parameters (total game distance or relative running speed). It is not surprising, that two conditional parameters highly correlate with each other. Thus, this is not a proof of validity, because neither Yo-Yo IR1 nor the parameterization of match performance (distance, speed) meet the requirements of the sport handball. Buchheit et al. (2010) investigated the reliability of a repeated shuttle-sprint and jump ability (RSSJA) test developed by Spencer et al. (2006). Semiprofessional handball players (n=14) acted as sample group. The time interval between two tests was seven days. The CV's ranged from 1.0% (sprint) and 2.9% (jump) and thus were often lower than in the HBKT (range: 1.3% -68.4%). The indices based on the mean and best values, however, showed significantly higher CV`s (21.2 to 34.8%). In regards to the prior described research Buchheit et al. (2010) discuss their findings exclusively sport unspecific. They point to similar evidence for repeated isolated sprint tests from other team sports. Sheppard et al. (2007) found in male elite volleyball players a CV of 2.4% for the repetitive sprint ability. Spencer et al. (2006) observed a CV of 0.7% for field hockey players (n=10) and Impellizzeri et al. (2008) found a CV of 0.8% for professional football players (n=22). Sattler et al. (2012) addressed

volleyball-specific jumping procedures and tests. They found the highest reliability for specific jumping tests (ICC range: 0.93-0.97, CV range: 2.1-2.8%).
Mirkov et al. (2008) evaluated the reliability of soccer-specific field tests. Most often the tests revealed high intraclass correlation coefficients (i.e.,>0.80) and small inter-individual variations (CV<4%). Regarding the throwing - in and standing - kick tests, which showed a markedly lower reliability, direct measurement of the ball velocity (e.g., with standard radar gun in the HBKT) is recommended (Mirkov et al. 2008).
In accordance with Buchheit et al. (2010) Spencer et al. (2006) recommend as a result of their investigation not to use indexes as these go hand in hand with a reduction of reliability (CV: 14.9%, CI: 10.8 to 31.3%). Instead, the total sprint time (total of 6 runs) should be used. The lower reliability of HBKT compared to RSSJA is probably explained by its higher complexity. A higher test complexity implies more grades of freedom in the performance of the test.
Krüger et al. (2014) showed - based upon the parameter shot rate - that the position-specific differences increase with the complexity of the test task. The mean throw velocity was between 72.7 and 90.7 km*h-1, depending on type of throw and position of the player, and was comparable to this study (range: 75.3 to 94.9 km*h-1).
In accordance with this study Impellizzeri et al. (2008) defined also a minimum interval between the two test days of 48 h. Numerous authors (Beekhuizen et al. 2009, Haj-Sassi et al. 2011, Munro et al. 2011) examined the test-retest reliability of different agility tests (hexagon test, repeated modified agility test, agility T-test). They also used a time interval of two days (Beekhuizen et al. 2009, Haj-Sassi et al. 2011) or one week (Munro et al. 2011) and reported excellent reliability for the agility tests (ICC>0.82).
From a test-methodological perspective it can be noted that there is currently no uniform standard with respect to the time interval used in reliability studies (Schwesig et al. 2014a,b; Wilhelmsen et al. 2008). A small time window between test and retest promotes learning effects and thus implies a low reliability, whereas too large time windows contain development processes due to exercise, illness and injury. This also would result in a lower reliability. In this respect, the comparability of the test results is affected not only by the lack of substantive agreement (handball specific, complex), but also by different time intervals (2-7 days).

Limitations

The validation of a test is the first step in the process of evaluation. In this regard the measure of the match performance (dependent variable) is the challenge to take at present. The match performance can be described as multifactorial and is roughly subdivided in offensive and defensive actions. Here, the problem is to measure the individual performance (offensive action: goals, assists, one-on-one balance; defensive actions: steals, blocks, one-on-one balance, penalties) and to put them in a sensible overall score. This purpose is hindered by the dependency of every single action in terms of position and game system. However, the test validity is highly dependent on the quality of the parameterization of the match performance.
Key factors (e.g., influence of opponents, psychological distress during competition, match ability) are also disregarded in the HBKT, as they elude standardization (control). However, the HBKT lies regarding its motion-structural and temporal intensity profile significantly closer to the requirements of the sport as previously used established conditional tests (e.g., sprint tests, jump force tests, treadmill test levels, and shuttle run tests). Like any skill test,

the HBKT also contains learning and adaptation effects, as evidenced by the performance improvements from exam 1 to exam 2.
The observational equivalence regarding the pre-start condition could not be fully ensured because the athletes were tested in succession and the warm-up period was individually performed and planned. An individual, standardized warm-up (Lidor et al. 2005) is generally recommended but usually not feasible in handball due to spatial limitations.
Knowing the maximum test requirements, the retest showed a more efficient division of power on the part of the athletes. Indications are the reduced metabolic stress (parameter: lactate) in the post load period as well as the small deteriorations in round 1 in the activity series 1, 2 and 4 (agility, defensive action, throw on goal) for examination 2.
The activity series 1, 2 and 4 were manually measured with a stopwatch by two trained investigators. Vicente-Rodriguez et al. (2011) demonstrated that manual measurements by a trained investigator using a stopwatch are a valid method to assess assurance speed and agility fitness testing in adolescents. They pointed out that researchers must be trained to minimize measurement error.

Practical Applications
At present there is no reliable and valid handball specific test that should be realized in practice. Also the HBKT turned out to be inefficient, especially in terms of validity. It seems as if there is no scientific legitimation for specific performance diagnostics in handball. Test procedures are reduced to conditional parameters that are easy to assess but highly unspecific. So far, it was not possible to make the complexity of the sport (match performance) measurable and reflect it by a sensible score. To resolve this problem the following procedure might be necessary:

1. Parameterization of the match performance: Development of a score that reflects the match performance metrically and acts as the dependent variable (gold standard) in the process of validation.
2. Handball specific complex test: Subsequently there is to develop a highly complex and handball specific test that is based on the evidence of the profile handball.
3. Validation: Validation of the test parameters (point 2) based on match performance (point 1). The match performance should be measured prospectively for at least half of the season.
4. Iterative loops: An adjustment of the test procedure as well as a re-validation might be necessary.
5. Proof of reliability
6. Reference data collection (position dependent and league dependent).
7. Design of handball specific training routines.

Ultimately, there is the possibility that as a result of these studies there will be no efficient and handball specific test. As an alternative it should be considered to qualify the match observation to integrate the performance diagnostics into the match. An advantage would be the perfect identity of test and match performance as well as the measure of all parameters that cannot be explained by conventional test procedures (influence of opponents, decision-making ability, speed of action). The disadvantages are the low standardization and consequently the limited comparability. Definitely, the outlined problem can only be tackled together (trainer, scientists).

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Table of Contents

SCORING EFFICIENCY DEVELOPMENT OF TWO JAPANESE U21 NATIONAL PLAYERS, REGARDING 1:1 WITH THE GOALKEEPER

Roland Nemes

Japanese Handball Association and Hungarian Handball Federation

Summary

The purpose of this study was to start an investigation on a very complex performance indicator. All shootings from situations where the shooter is in one on one with the goalkeepers, so there is no defender between them and the shooter can execute the attempt. These situations include all shots from fast break, break through, 6m line and wing position. Development in efficiency of two Japanese junior national players was investigated from their age of 12 to 20. All together sixty-two domestic and seven international games of the 2013 Youth World Championship were analyzed.
Results showed cohesion between domestic and international performance. Both players indicators on one on one shooting situations with the goalkeeper were high domestically and internationally as well. However they showed a poorer performance internationally in those elements which they lacked the domestic experience, or morphologically did not suit them well (field shot).
Despite the fact that this study was not designed to give a full understanding about these indicators, it could give a useful idea for future work

Keywords: handball, shooting efficiency, Japanese, youth, player

1. Introduction

Handball, among other invasion games has undergone several changes in the last decades. South-Korean national teams successfully implemented a new style of play in the second half of the eighties. They have started to dominate Asia, and regarding the South-Korean female team, the world's handball as well. The South-Korean style is well known for its quick movements, rapid ball circulating. This style has been a model for the Japanese handball since it had lost Asian dominance at the 1988 Olympic Games. Furthermore, European teams had to start taking seriously the Korean style of handball. Thus handball has stepped on a path, which led to nowadays quick and attractive game. Previous studies presented that success and performance in contact team sports depends on various factors and that situation efficacy models differ for every team and almost every match (Gruich, 2006). The average number of goals had been increasing since European Championship (ECh) 1994. The average was 47.5 goals in 1994, and it had reached to 60.5 goals at the ECh 2006 (Sibila, 2011).
Various studies (has confirmed that handball game has became speedier, and by that, fast breaks, line shots, penalties gained more importance than ever before. The effectiveness in these factors is decisive between winner and loser teams, especially in

regard with line and penalty shots (Alexandru et, 2009). This fact is even more important for Japanese teams due to their low efficiency in field shots (Wada, 2012). This study was focusing on particular performance indicators that are close range 1:1 shooting situations with the goalkeeper. As I could not find a proper term, which would stand for all these type of shots, I will call it clean shots.

According to my coaching experience with different age and gender group of Japanese national teams, they often had problem in the close range, clean 1:1 shooting situations with the goalkeeper (fast break, line shot or 6m shot, 7m shot,
wing shot). Due to the limited time during a preparation period, emphasized training on these situations is not possible in case of a national team. The selected players shall be prepared before they join the national team. Shooting among other technical skills shall be practiced continuously and frequently in training and game situations as well. However, I have not found any research, which would address this issue. Can one significantly develop in clean shooting efficiency after a certain age?

Shall one practice everyday clean shooting situations? Finding answers for such questions would certainly give an enormous help for coaches around the globe.

My intention with this was to start focusing and to find some basis for further researches. Nevertheless it would also influence my daily coaching work.

The sport system is strongly attached to the school education in Japan. There are no professional clubs, hardly any local territorial clubs, where the children could practice handball from various schools. Most practices are organized in the schools, available only for those who are enrolled in that particular school. There is no existing coach education, which could be compared to Europe. Thus, teachers are in charge for the trainings, mostly with none, or little knowledge about the world's handball. Japanese Handball Association has been doing enormous effort to create a nation wide handball education system.

I chose two players and gathered their available games for research. Both players had started handball before the age of twelve. They joined the schools handball clubs at the age of twelve and started to practice on daily basis. In accordance with the Japanese education system, students change school at the age of twelve, fifteen and eighteen in case of university studies. Since there are no clubs for junior players, most players have to go to university to continue playing handball. University is the last grade for handball education. Only a handful of them can continue in some companies amateur club after graduating the university. The frequent change of schools and teachers (coaches) make it an even more difficult task to build any long-term sport education system.

Japanese school system

- 6-12 Elementary school
- 12-15 Junior High School
- 15-18 Senior High School

National competitions are organized only for one category in every school stage, not in age groups like in many European countries.

2. Methods

2.1 Subjects of the study

Two U21 national team players were chosen.
Kei Tanaka: born in 1994; height 173 cm; weight 71 kg; center backcourt player, right handed. Ranked 9th on the 2013 Youth World Championship top scorer list.
Shinnosuke Tokuda: born in 1995; height 178 cm; weight 77kg; right backcourt player, left handed. Ranked 4th on the 2013 Youth World Championship top scorer list, MVP of the 14th Asian Qualification for Men's Junior World Championship, Brazil 2015.

2.2 Study samples

Videos and official data of various tournaments and age categories were gathered and analyzed statistically and mathematically. The iPad application, CoachBook Pro® was utilized for video analysis. Official statistics were used in regard with the IHF Men's Youth World Championship in Hungary 2013 (YWCH).

Kei Tanaka:
Domestic competitions
- JHS: 2008 three games, 2009 two games, 2010 six games
- SHS: 2011 two games, 2012 two games
- University: 2013 twenty-one games, 2014 nine games

International competition
- 2013 YWCH seven games

Shinnosuke Tokuda:
Domestic competitions
- JHS: 2010 four games
- SHS: 2012 four games
- University: 2014 nine games

International competition
- 2013 YWCH seven games

Performance indicators:
1. Long Distance Shot (Long Dist. Shot) – from the outer 9m zone
2. Middle Distance Shot (Middle Dist. Shot) – from the area between 9m and 6m
3. Fast Break – from counter attack
4. Break Through – from breaking through the defense line
5. Line Shot – from pivot positions around the 6m line
6. Wing shot – from the wing positions
7. 7m Throw – direct shot from penalty

Performance indicators were chosen in line with the IHF statistics, except for Long Dist. Shot and Middle Dist. Shot. These indicators appear as Field Shots (FS) on IHF statistics,

therefore the figures of these two indicators had been added to summed on the charts for easier comparison.

3. Results and discussion

3.1 Tanaka's overall shooting performance

Table one presents Tanaka's overall performance in shooting from various zones and situations on domestic and international tournaments between 2008 and 2014.

Table 1.Tanaka's overall shooting performance 2008-2014

Age Group/Torunament	Long Dist. Shot			Middle Dist. Shot			Fast Break			Break Through			Line Shot			Wing Shot			7m Throw			Total		
	G	S	%	G	S	%	G	S	%	G	S	%	G	S	%	G	S	%	G	S	%	G	S	%
JHS Individual	0	1	0%	10	21	48%	8	11	73%	8	12	67%	1	1	100%	0	1	0%	1	1	100%	28	48	58%
SHS Individual	0	1	0%	10	17	59%	12	17	71%	12	22	55%	1	1	100%	0	1	0%	3	3	100%	38	62	61%
2013 Spring Univ. Ind.	0	0	0%	1	1	100%	3	4	75%	1	1	100%	0	0	0%	2	3	67%	0	0	0%	7	9	78%
2013 Autumn Univ. Ind.	0	0	0%	7	13	54%	15	26	58%	14	16	88%	0	0	0%	0	0	0%	3	4	75%	39	59	66%
2014 Spring Univ. Ind.	1	2	50%	9	13	69%	14	17	82%	5	7	71%	1	1	100%	0	0	0%	2	2	100%	32	42	76%
2013 Youth WCH Ind.	0	0	0%	8	24	33%	5	6	83%	12	12	100%	10	15	67%	3	3	100%	14	17	82%	52	77	68%
Totals	1	4	25%	45	89	51%	57	81	70%	52	70	74%	13	18	72%	5	8	63%	23	27	85%	196	297	66%

G goal; **S** shot

The indicators show very little number of shots from the outer 9m zones, wing position and from the 6m line. Shooting efficiency has been improving on the domestic tournaments, except for the 2014 autumn season. However, field shot efficiency is much lower on international level. Much more attempts and goals have been carried out from line and wing shot. Tanaka has been showing a constant improvement in total and in the clean shooting efficiency.

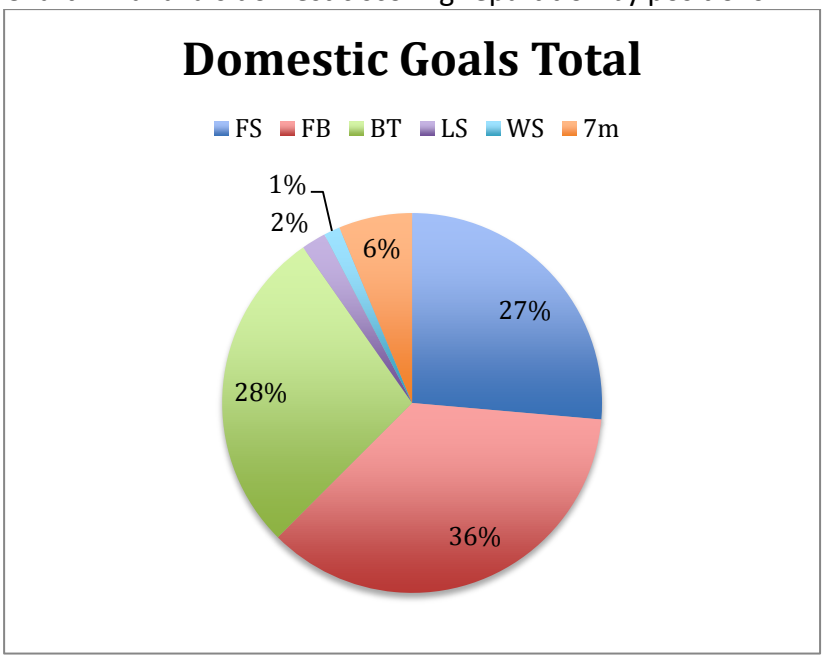
Table 2. Tanaka's shooting performance in clean shot situations

Age Group/Torunament	Clean shots		
	G	S	%
JHS Individual	18	26	69%
SHS Individual	28	44	64%
2013 Spring Univ. Ind.	6	8	75%
2013 Autumn Univ. Ind.	32	46	70%
2014 Spring Univ. Ind.	22	27	81%
2013 Youth WCH Ind.	44	53	83%
Totals	150	204	74%

G goal; **S** shot

Regarding clean shot situations, Tanaka shows an improving performance domestically and internationally as well.

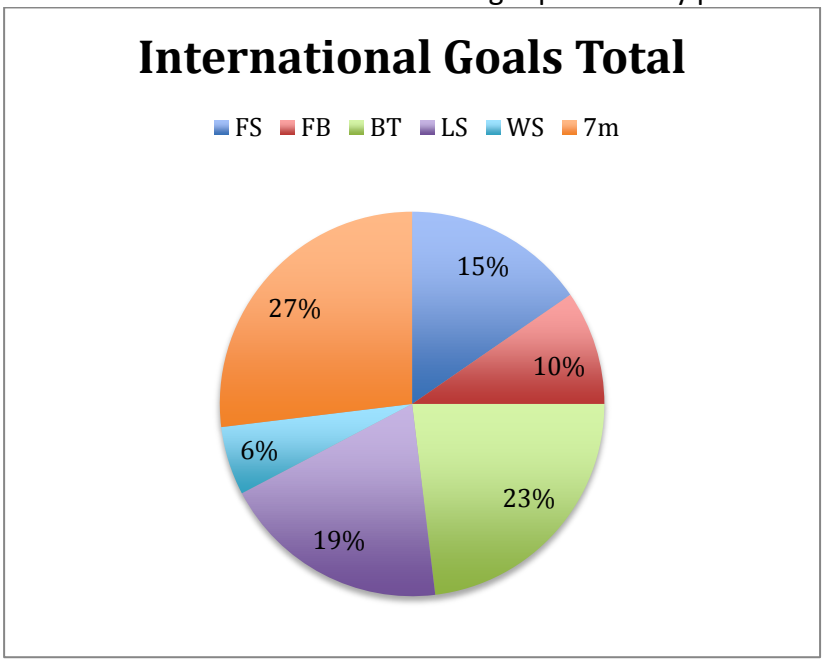
Chart 1. Tanaka's domestic scoring repartition by positions



FS Field Shot; **FB** Fast Break; **BT** Break Trough; **LS** Line Shot;
WS Wing Shot; **7m** Penalty

Tanaka scored more than half (64%) of his goals from fast break and break through situations.

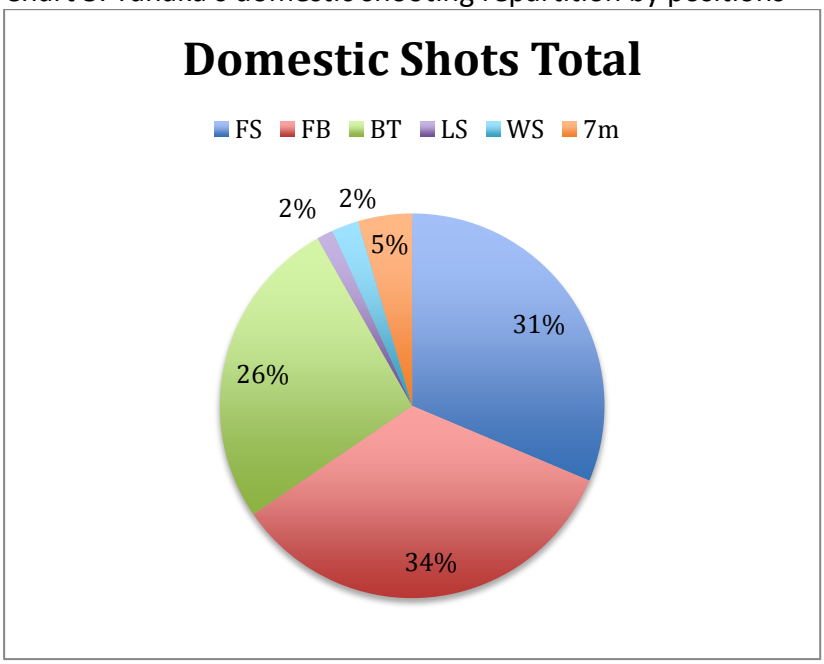
Chart 2. Tanaka's international scoring repartition by positions



FS Field Shot; **FB** Fast Break; **BT** Break Trough; **LS** Line Shot;
WS Wing Shot; **7m** Penalty

The international level required a wider variety of performance from him. Interestingly, the excellent execution of penalties was the main factor on international level. Goals from penalty and break through add up to 50% of the total scores.

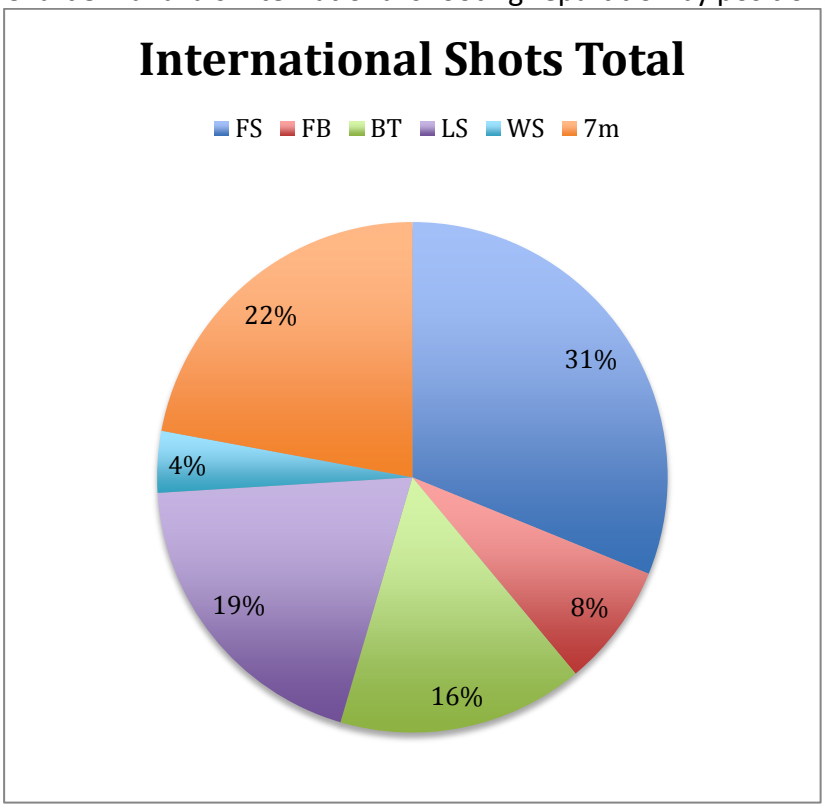
Chart 3. Tanaka's domestic shooting repartition by positions



FS Field Shot; **FB** Fast Break; **BT** Break Trough; **LS** Line Shot;
WS Wing Shot; **7m** Penalty

Numbers of shooting attempts were coherent with the scoring repartition.

Chart 3. Tanaka's international shooting repartition by positions



FS Field Shot; **FB** Fast Break; **BT** Break Trough; **LS** Line Shot;
WS Wing Shot; **7m** Penalty

Scoring attempts show that the most tries came from field zones.

3.2 Tokuda's overall shooting performance

Table 4 Tokuda's

Age Group/Torunament	Long Dist. Shot			Middle Dist. Shot			Fast Break			Break Through			Line Shot			Wing Shot			7m Throw			Total		
	G	S	%	G	S	%	G	S	%	G	S	%	G	S	%	G	S	%	G	S	%	G	S	%
JHS Individual	2	3	67%	8	16	50%	5	6	83%	12	16	75%	1	1	100%	2	2	100%	7	7	100%	37	51	73%
SHS Individual	3	9	33%	18	43	42%	6	6	100%	18	21	86%	2	2	100%	1	1	100%	4	5	80%	52	87	60%
2014 Spring Univ. Ind.	4	10	40%	15	28	54%	13	20	65%	19	30	63%	2	2	100%	1	1	100%	1	1	100%	55	92	60%
2013 Youth WCH Ind.	12			27		44%	19	23	83%	7	8	88%	9	16	56%	2	5	40%	9	11	82%	58	90	64%
Totals	9	22	41%	41	87	47%	43	55	78%	56	75	75%	14	21	67%	6	9	67%	21	24	88%	202	320	63%

G goal; **S** shot

Tokuda's performance indicators had not any significant improvement on the domestic tournaments. Indicators of the international tournament showed a similar performance to the domestic tournaments. Tokuda's efficiency in fast break, break through and penalty shooting was very high on international and domestic tournaments as well.

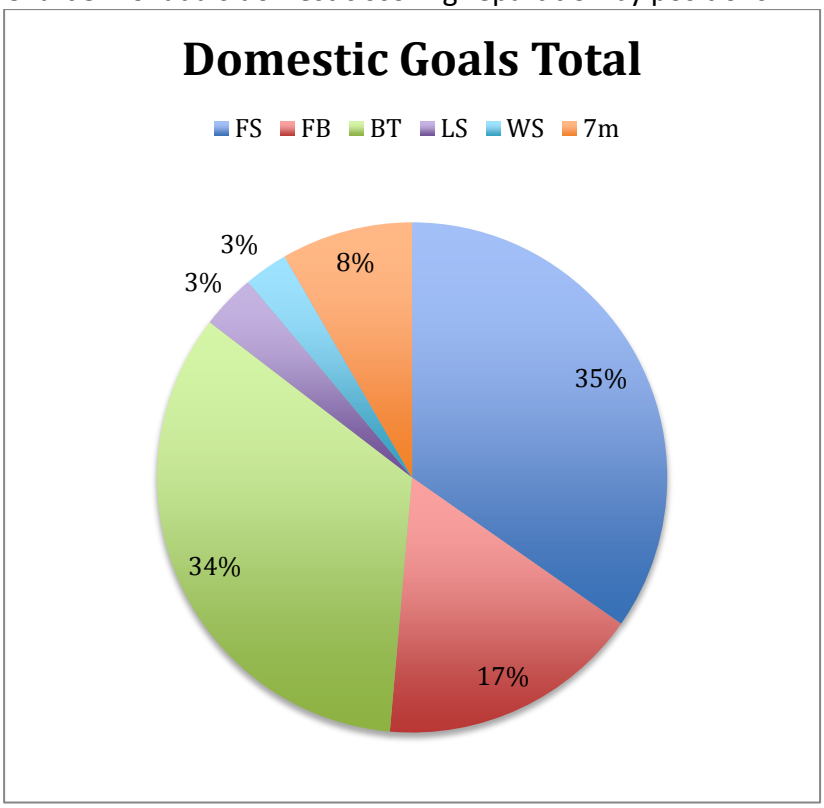
Table 5 Tokuda's

Age Group/Torunament	Clean Shots		
	G	S	%
JHS Individual	27	32	84%
SHS Individual	31	35	89%
2014 Spring Univ. Ind.	36	54	67%
2013 Youth WCH Ind.	46	59	78%
Totals	140	180	78%

G goal; **S** shot

Performance in clean shot situations has decreased domestic wise and went below his average. However there could not be seen a significant difference between domestic and international performance.

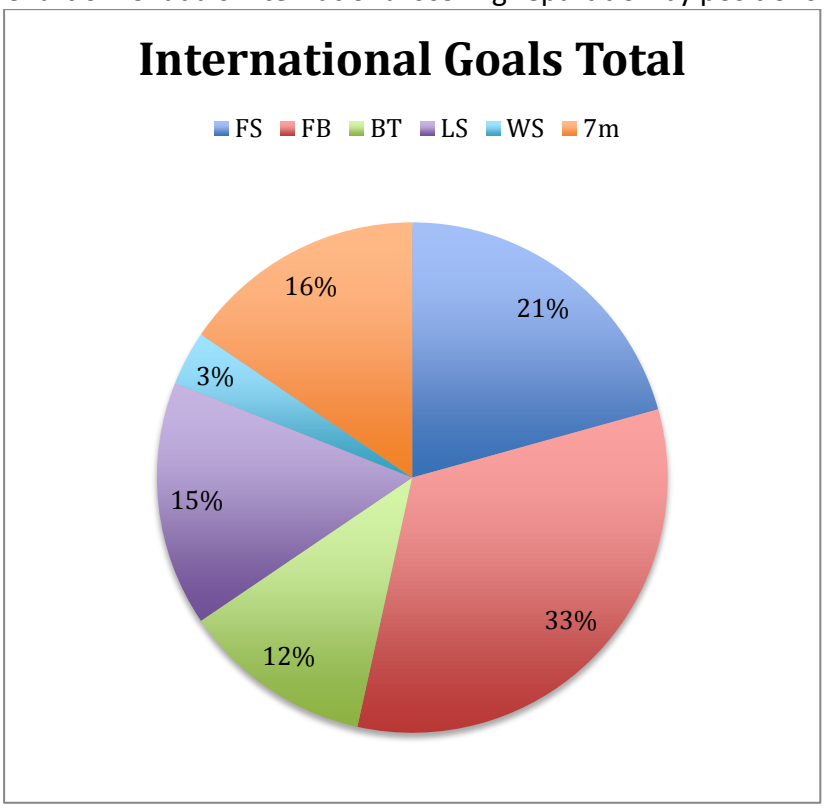
Chart 5. Tokuda's domestic scoring repartition by positions



FS Field Shot; **FB** Fast Break; **BT** Break Trough; **LS** Line Shot;
WS Wing Shot; **7m** Penalty

Tokuda has scored 69% of his goals from field shot and break through.

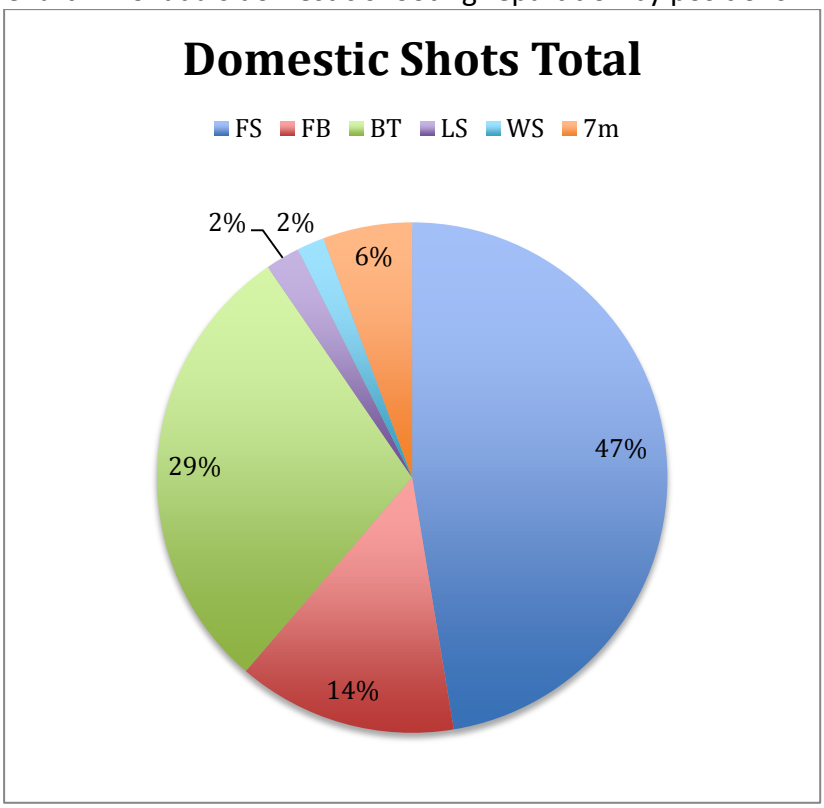
Chart 6. Tokuda's international scoring repartition by positions



FS Field Shot; **FB** Fast Break; **BT** Break Trough; **LS** Line Shot;
WS Wing Shot; **7m** Penalty

Most goals were achieved from fast breaks, significantly more than from any other situation.

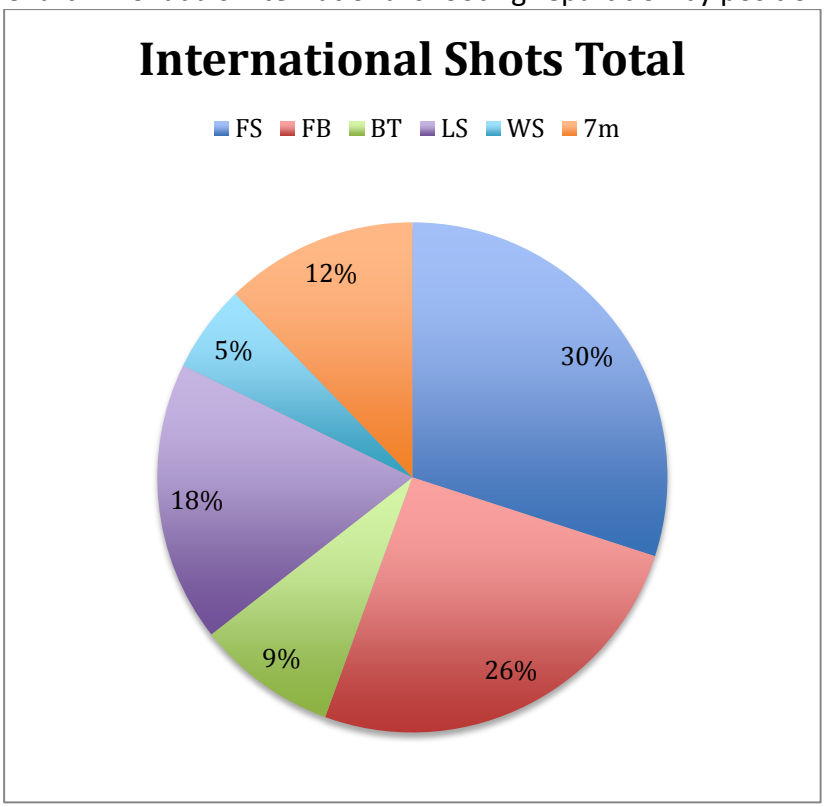
Chart 4. Tokuda's domestic shooting repartition by positions



FS Field Shot; **FB** Fast Break; **BT** Break Trough; **LS** Line Shot;
WS Wing Shot; **7m** Penalty

Almost 50% percent of the attempts were carried out from shooting from the backcourt positions. If we added the break through attempts to it, it would result 76% of all attempts.

Chart 4. Tokuda's international shooting repartition by positions



FS Field Shot; **FB** Fast Break; **BT** Break Trough; **LS** Line Shot;
WS Wing Shot; **7m** Penalty

Shooting from the backcourt positions also dominated his play. However we could find significantly large number of attempts from fast break situations too.

4. Conclusion and discussion

4.1 General conclusions

The data showed a very strong performance in both backcourt player cases. Finding showed, that efficient clean shooting domestic performance resulted high efficiency on international matches as well in youth category.

Furthermore, repartition showed a need to be prepared from more zones of the court on international tournament, than on domestic ones. Both players had significantly more attempts from line and wing positions, as well as from penalty shots.

Break through play appeared to be a very important element in both players performance. Also, both players have been carrying out penalty shots with high accuracy.

4.2 Kei Tanaka

- As a relatively light and short backcourt player, he was not efficient enough from field shooting on international matches. His attempts were only half as efficient as on domestic tournaments.
- We can suspect that Tanaka's international experience on the 2013 Youth WCH had a positive effect on his domestic performance. His performance in the 2013

spring championship is not significant, due to the little playing time he has received as a rookie.

- Although Tanaka is not a wing player he could score with 100% accuracy from that position on international matches, and had shown improvement on domestic games as well
- Indicators showed an outstanding gradual improvement in almost every shooting situations, except field shots
- Efficient from anywhere on the court domestic wise, but lacks in field shot accuracy when it comes to international match

Future areas for progression

- Needs to work on his field shooting ability on international level
- Keep other elements on similar level on junior and adult competitions

4.3 Shinnosuke Tokuda

- His performance in field shot had fallen on international games, but not significantly
- Significant decrease was found in line and wing shot efficiency on international competition
- Significant drop was found in efficiency of fast break and break through shooting on domestic matches
- His performance in outer 9m long distance field shooting has also majorly fall since the age of 15
- Executed field, fast break, break through and penalty shots more effectively than the average on the 2013 Men's World Championship (annex, table 8)

Future areas for progression

- Line and field shots shall be practiced in order to be more successful on international level
- Improving in shooting accuracy in fast break and break through situations against domestic goalkeepers
- Wing shot performance need to be also improved for international level

The data that has been analyzed was maybe not enough to draw conclusions, but it showed some valuable information. Both players had to play differently on domestic and on international matches. Due to the changes, they were required to shoot from unfamiliar positions. Their indicators showed similar results to those that were found in Wada's work, regarding the Japanese Men's National Team's efficiency. Main factors in play are break troughs, fast breaks and penalties. All fall under the clean shot category, which proves my hypothesis about the importance of these indicators, especially important for Japanese handball teams, because of the problems with the field shot accuracy (Yamada, 2013).

The data showed relevance with changing the environment in both players' cases. Changing to university from high school caused some incline in their indicators and efficiency. Due to the Japanese competition system, the first year students can only compete in one team with the fourth year students, because national competition for lower age groups does not exist. That means, a rookie 18 years old youth player has to

compete with the 22 years old one. Nevertheless, domestic games were good indicators for international performance in both players' case.
Although Tanaka performed well, they lack the experience in wing and line shot. Tokuda is a left-handed player; therefore there is a real possibility he has to move to the wing position too. Tanaka has to work on his field shot abilities to become an internationally successful player and together with Tokuda lead the Japanese national teams in the future. Higher efficiency in line shots also an issue for both players, which suggest some focus on young player's education in Japan. Low efficiency from the backcourt positions is caused by several reasons, but undeniably one is the morphological difference in height compared with European teams. Japanese and Korean teams depend very much on the player's quickness and mobility in attack. This kind of playing style can result high number of penalties in favor of the smaller and quicker Asian players. Thus, the successful execution of these shots is a keen aspect in order to win. Both of our research subjects showed an outstanding performance in this indicator.
As a matter fact, both players successful rate at the 2013 Youth WCh was above the average of the 2013 Men's WCh in most indicators. It will be interesting to follow their performance in the upcoming years on men's tournaments.
You cannot easily find players higher than 190cm, not to mention 2m high specialists. These morphological characters also suggest the importance of multiply educated players and proper tactical preparation is important for Japanese handball.
Many aspects have not been analyzed. The analysis did not take into account any circumstances, such as situation before and during the attempt (unless the referee indicated fault), or techniques used during the attempts.
There is a wide range of possibilities for future researches.
Suggestions for future research

- A follow up on these players on adult level
- Biomechanical comparison on technique and situation
- Same type of research on players from various positions

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Change of defense and offense strategy - the way to success on the example of the match Veszprem - Kiel in April 2013.

Contents

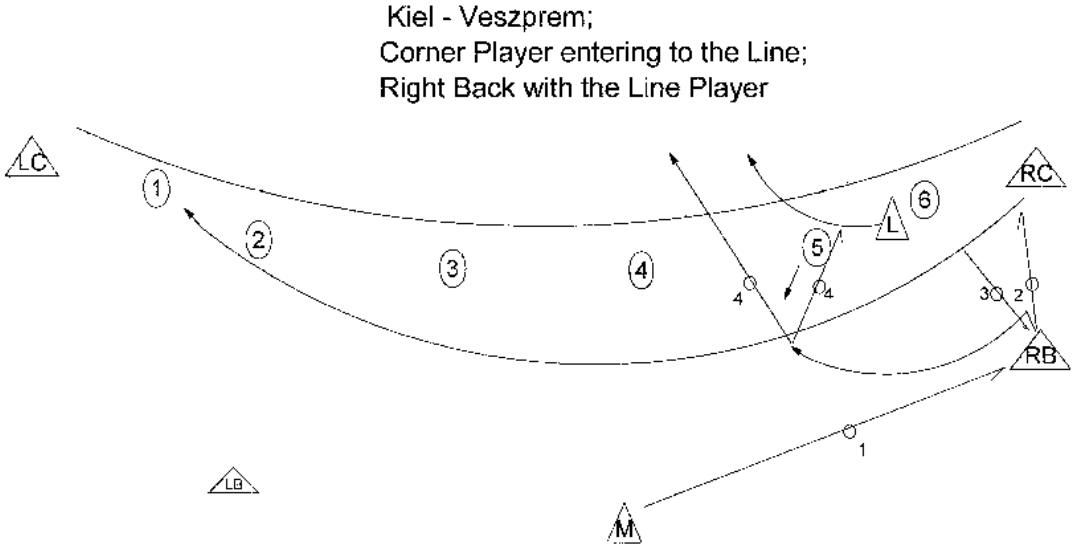
1 The first game in Kiel. Kiel - Veszprem in April 2013.

THW Kiel and MKB Veszprem got drawn together as opponents in the quarter-finals of the Champions League in the season 2012-2013.

These teams had met several times over the season before, so both teams knew the opponent very well. In the first game in Kiel, Veszprem clearly had a better start for the reasons following;

Attack Veszprem;

Kiel was operating in a 6-0 defense and had big problems getting Nagy under control.
With a tactic, where the right wing player was entering to the line, Kiel had big problems because it left players 5 and 6 in the defense with big space against Nagy and Sulic with the following problem; if 5 falls out to the tackle Nagy, then the defender 6 is left alone with a very physical Sulic who has a clear advantage.
If the defender 5, on the other hand, does not tackle Nagy he is a player that is almost impossible to block, because of his size and class.

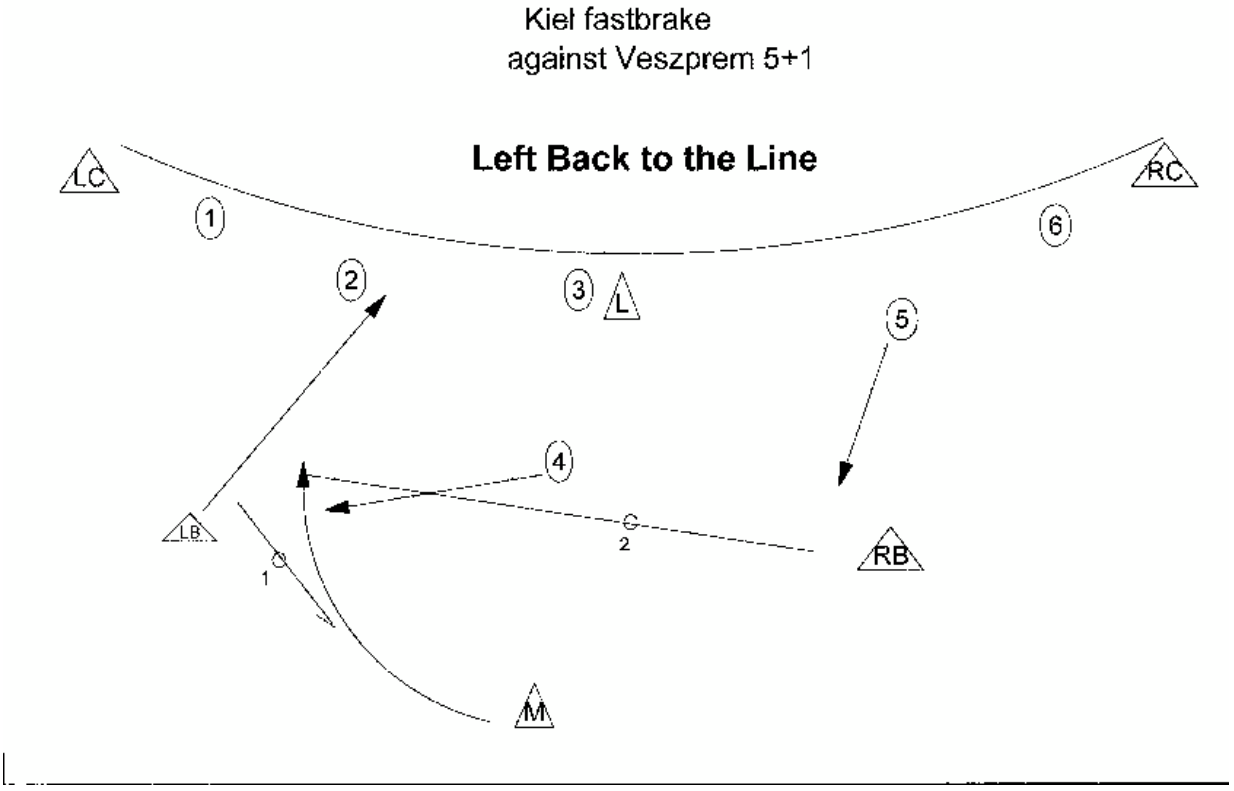


Continuing this tactic also gave Jamali on the left side good options allowing him to score also. In fact Kiel got no real solution against this in their 6-0 defense. Most of the other tactics of Veszprem were regular, also giving goals sometimes, but of no great danger.

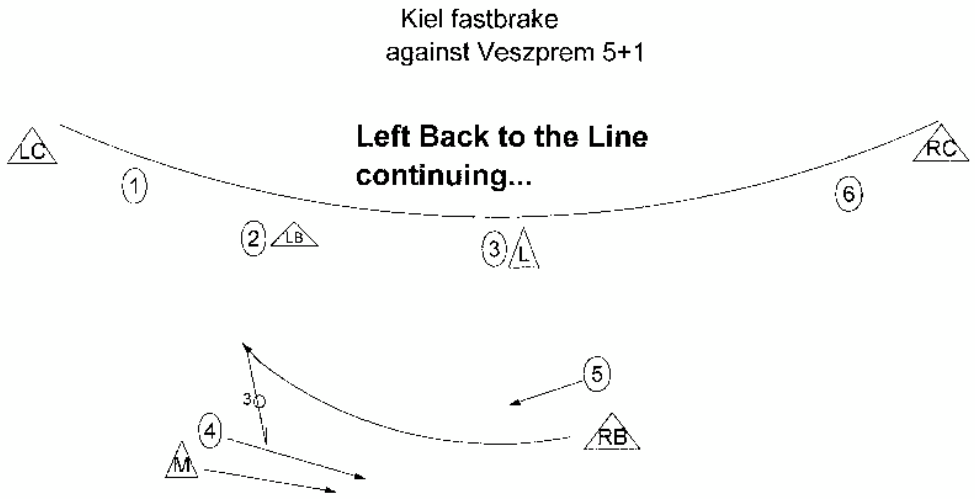
Fast breaks Veszprem;

During the first half especially, Kiel was giving Veszprem unusually many goal on fast breaks because of very good 5 + 1 defense against the Kiel own extended fast breaks. Most of the fast break-goals of Vesprem were of that kind, or after technical errors in the attack of Kiel. We will come to that later.

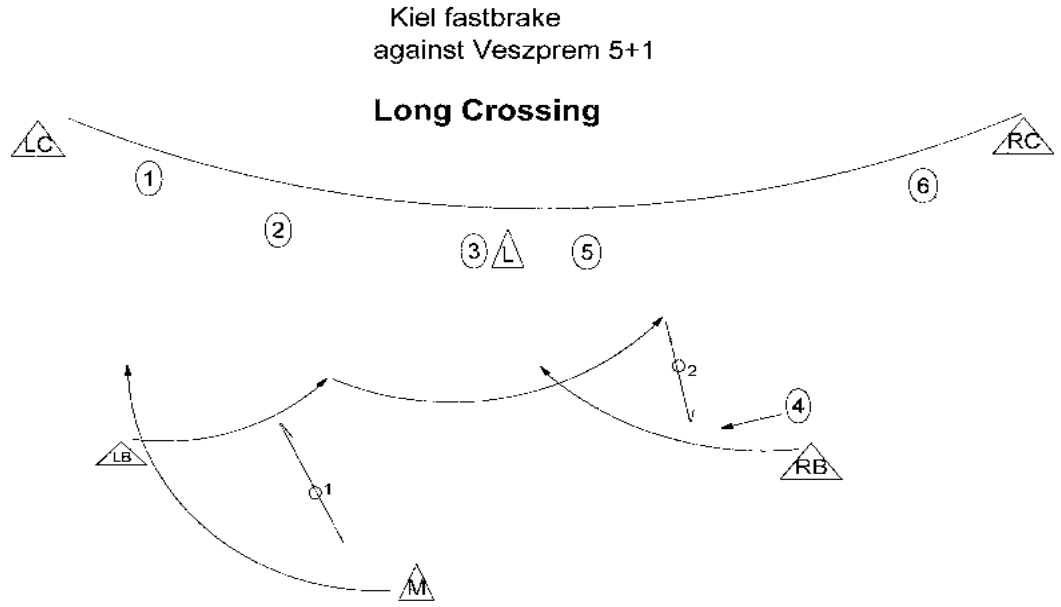
Kiel was running the following extended fast-break strategy;



Here the Left-back is going to the line as a second line-player. In this moment Ugalde, operating as an up-court defender made a great job in taking out the middle back of Kiel and so the Kiel right-back player, running with the ball, is several times left without a passing option in the last moment;

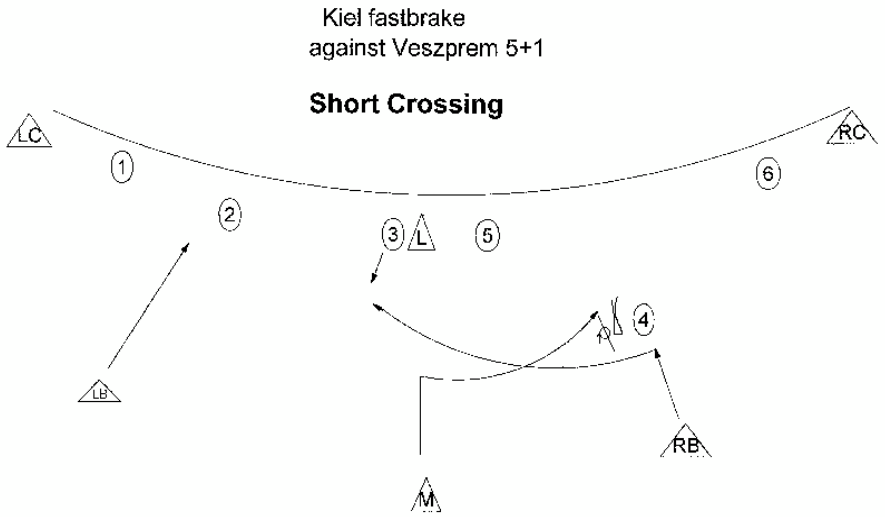


resulting in a loss of the ball and an easy counter-attack goal of Veszprem. After a while Kiel got this problem under better control and Veszprem responded after a while by having Ugalde press Kiel´s right-back. This led to a change of Kiel´s tactic, moving to a long-cross,of the left-back with the right-back..



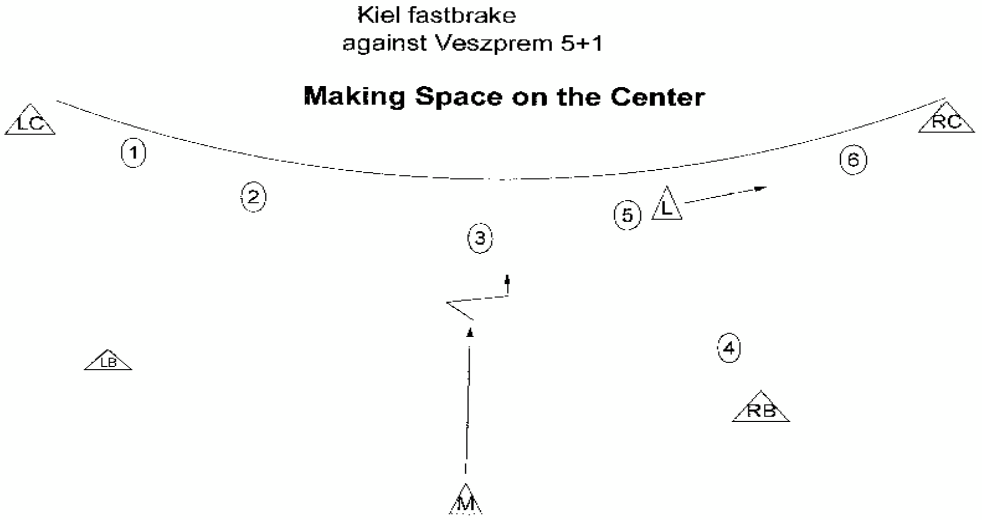
This still was dangerous, because Ugalde still could steal the pass between the backs, but it left a bigger space, especially for the line man and got more movement into Kiel fast breaks.

In the second half of the game Kiel was operating on more simple fast break tactics like the following;



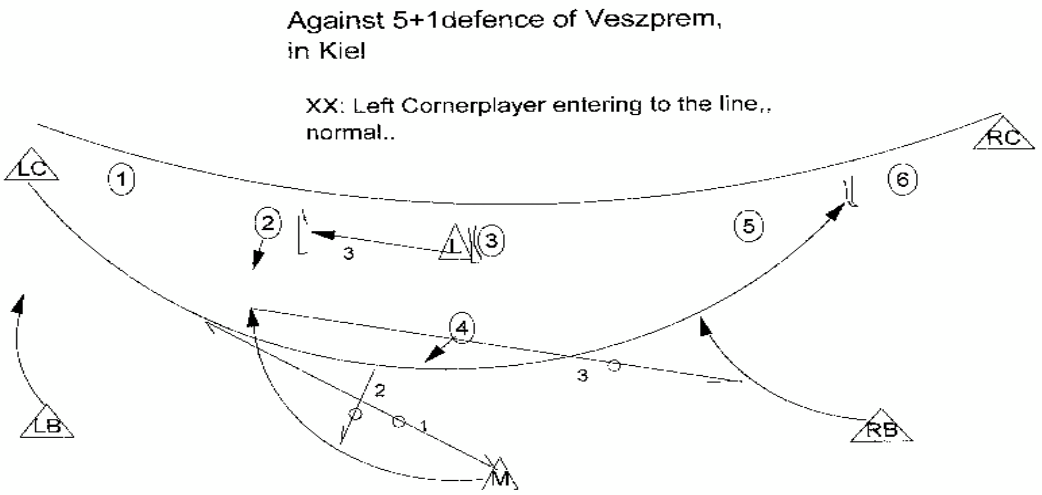
with the left-back running broad, and the middle-player attacking the space between 4 and 5 sometimes resulting in Veszprem defense giving the attackers of Kiel too big a space.

Also Kiel was trying to give players like Narcisse, who is an excellent "one against one" player room by letting the line player run into the gap behind the up court-player.

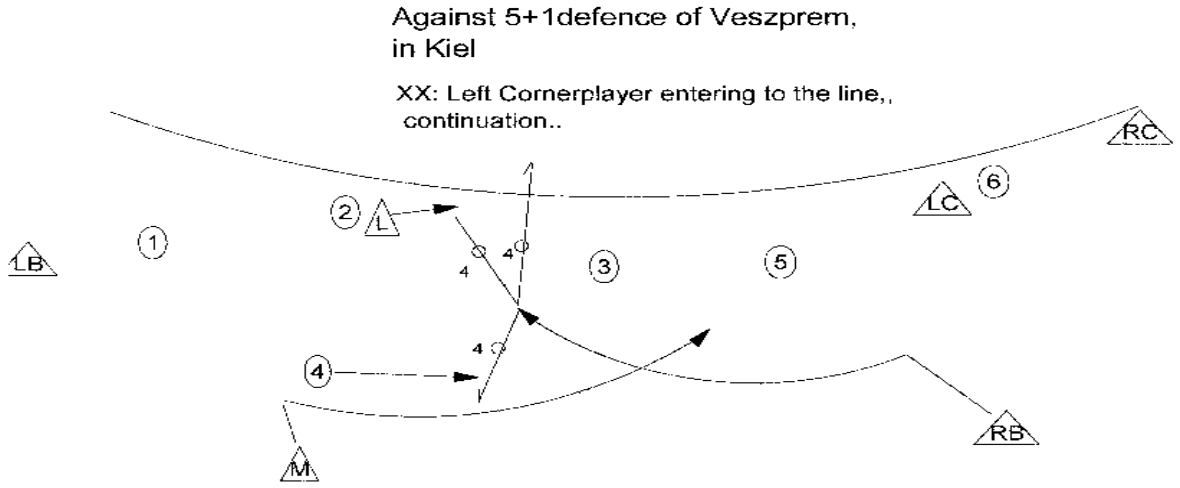


Attack of Kiel against Veszprem 5+1.

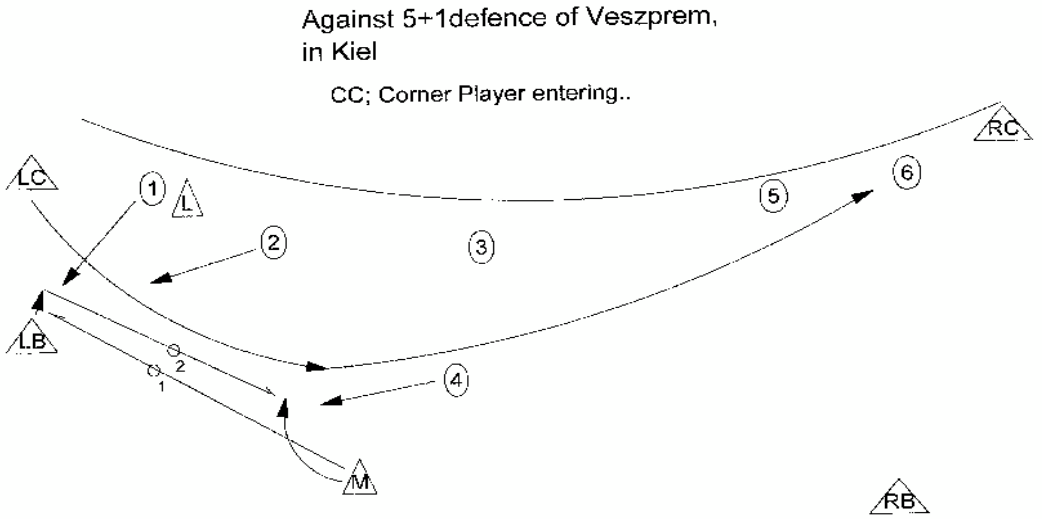
Veszprem was operating with a "Spanish 5+1" defense with Ugalde up court, making very much pressure on the middle back and also doing an excellent job in cutting the pass routes, making the attacking game of Kiel, at least in the beginning very hesitant.



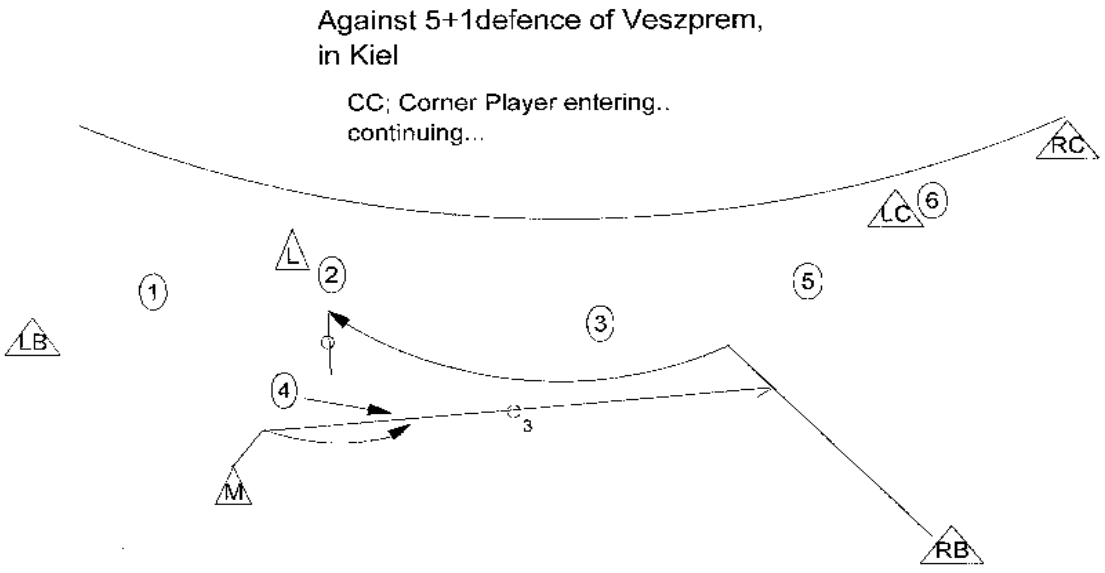
Kiel started playing tactic "XX" where the left wing comes running up court, gets the ball from the middle-back, and then, depending on the reaction of the Veszprem up court-player, a) crosses with the right-back if the defender moves to the middle-player, or b) passes the ball back to the middle back, if the defender follows the move of the left wing.



In most of the cases (not always, in second half), the up court-defender did move to the middle back player. This led to the situation that when the right-back came with the ball to the center, having as a "last-option" the crossing with the middle back, he found himself in the air, having the very tall defense of Veszprem in front and the up court-player making a great job in stealing the ball intended for the middle back. This led to easy goals for the Veszprem team and having Kiel trailing by 3 to 4 goals most of the first half.

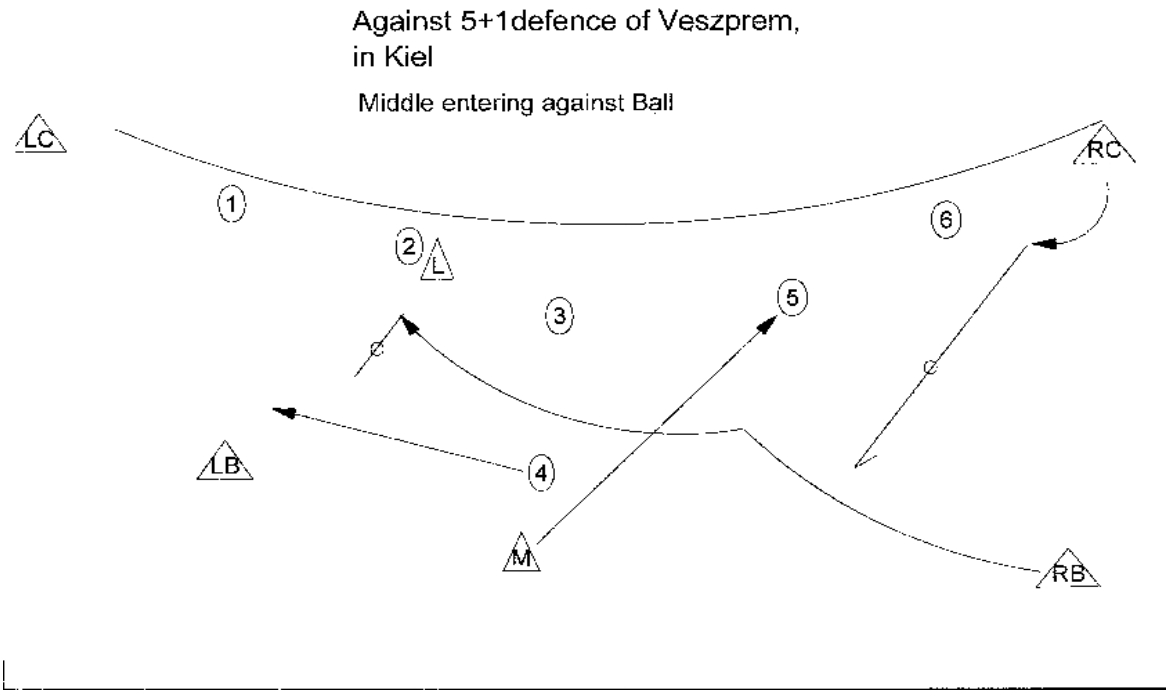


Other Kiel tactics like "CC" where the wing player enters without the ball and the left-back and the line player are playing "two against two" were not leading to goals and continuing..



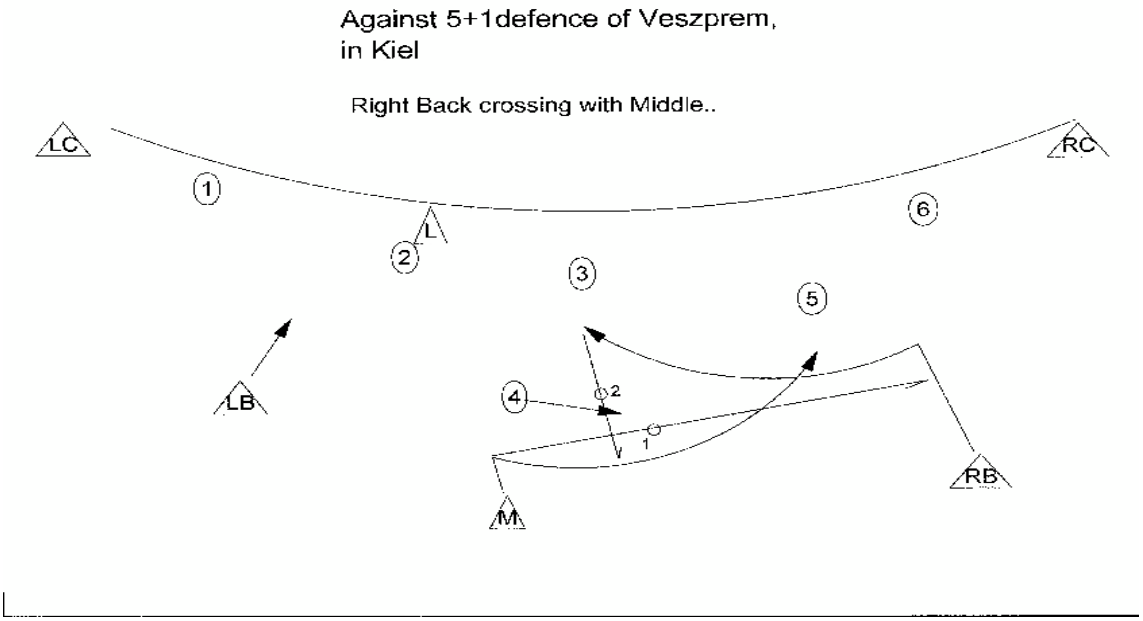
in a similar way had similar results, bringing to many errors.

The same did a tactic, where the middle back was entering to the line, in the moment when the right wing started attacking.

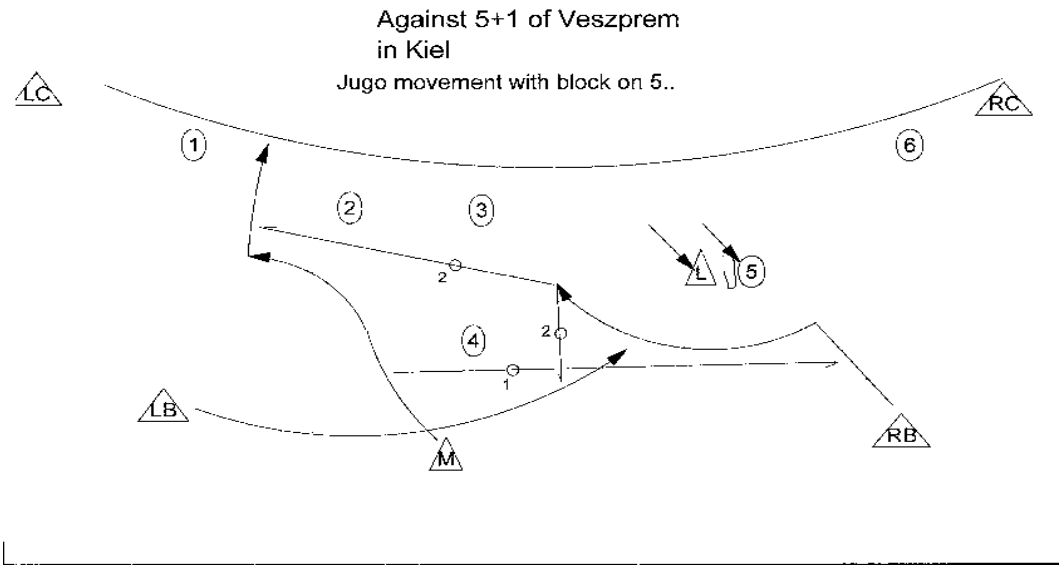


In this case, the up court-player went to the Kiel left-back, again leaving the right-back of Kiel with limited passing option, forcing him to shoot against a massive defensive block.

The game improved with tactics like; right-back crossing with the middle back, with the lineman on the inside of 2, Kiel was having better success. Here the right-back can shoot, pass to the line if number 3 in defense commits an error, pass to the left-back who is to attack between 1 and 2 (or alternatively attack the block by the line player on 2). The right-back also has quite a secure pass to the middle back, which will cross behind him.



Also with the Jugo-movement, with the line player on 5, when the right-back attacks to the centre, getting a screen by the line player. There the right back has an option to go against the movement, between 5 and 6 (this actually happened a few times), to shoot, to let the ball for the left-back who is coming the long way around or to pass over to the middle back that was on the other side then.

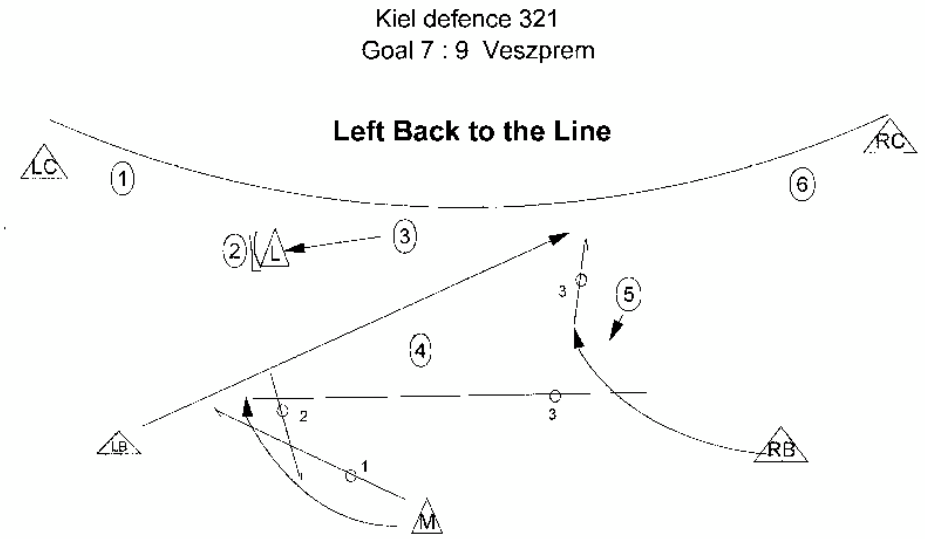


After the first quarter of the game in Kiel, the attack of Kiel was getting more fluid losing fewer balls. Doing more harm to the Veszprem defense, so that in the minute 24 they changed to a 6-0 set-up.

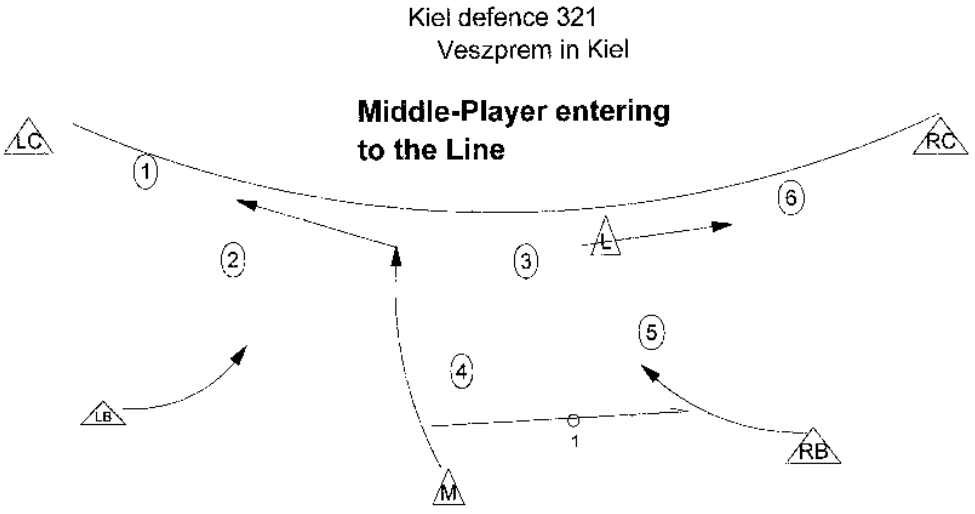
In second half Veszprem returned to a 5+1 set-up and then in the 50th minute back again to a 6-0 zone.

Attack of Veszprem against the 3-2-1 defense of Kiel.

After having serious problems in the 6-0 defense in the first half, Kiel changed to 3-2-1 defense after not only Nagy making problem, but also the young Jamali.
Veszprem responded in sending Jamali to the line. Kiel made an error and Jamali was alone behind 5 which resulted in a goal. Kiel went back to 6-0.



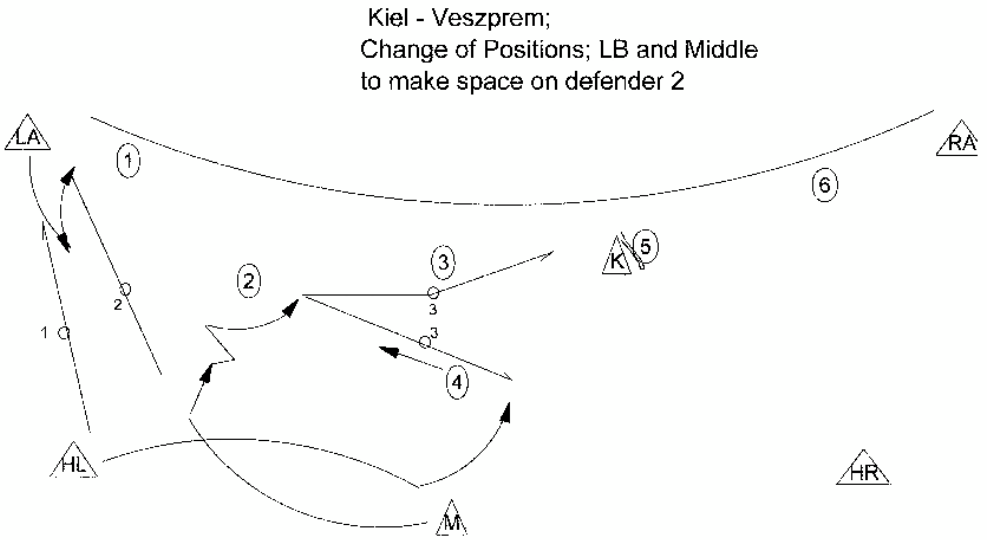
Continuing having problems in 6-0, Kiel again went to 3-2-1. This time Veszprem played a very common tactic where the middle back enters to the line after having passed the ball to the right-back.



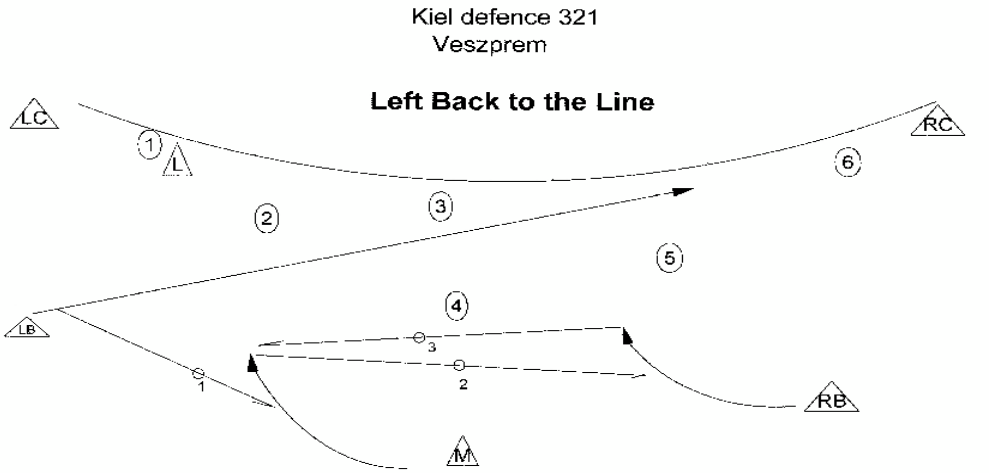
This tactic did no harm because this time the defense managed to close the passing lanes.

Kiel started the second half in 6-0, having similar problems again with the shooting power of Nagy and the speed of players like Chema Rodrigues. Five minutes into the second half the Kiel-coach changed again to 3-2-1.

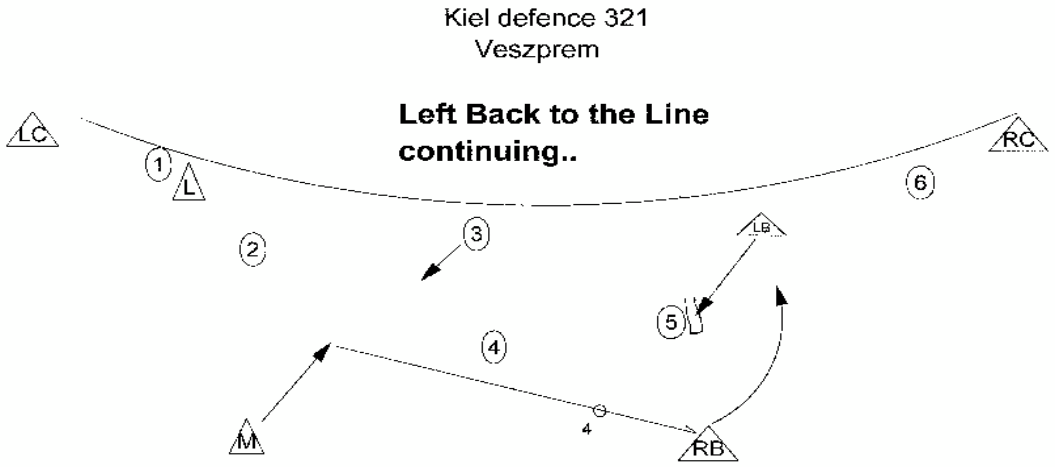
This time, having his right-back Vujin to defend, because the Kiel-bench now was on the left (far) side, Veszprem, as expected started to test his defensive abilities with tactics like...



The purpose of course was sending the best "one on one" player against Vujin, with big space to defend. As Vujin did an unusually good job defending this, Veszprem put Kiel in big trouble with the following tactical move:

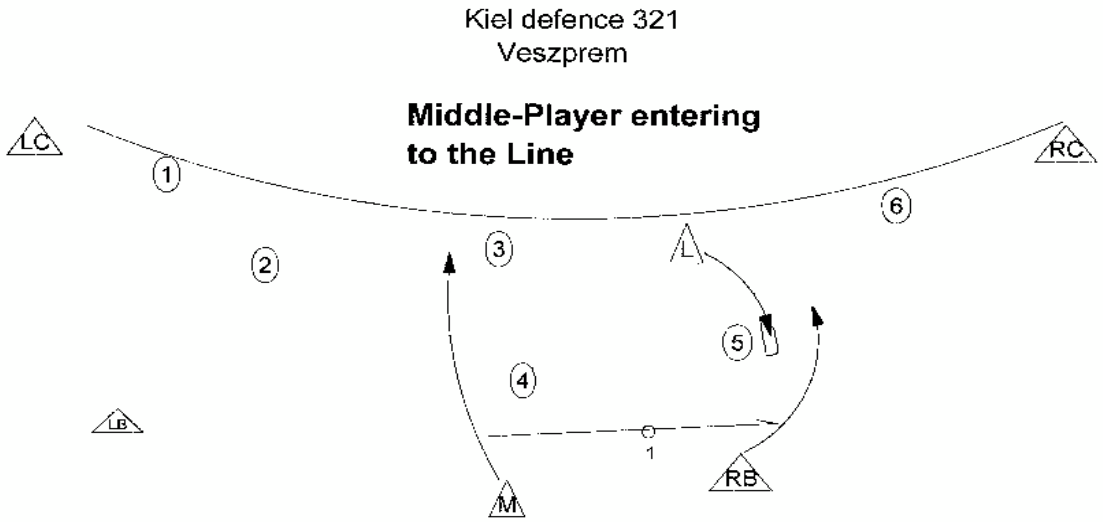


Left-back entering to the line up to defender 6, line-player also staying wide with defender 1, middle back threatening to attack between 2 and 4 then passing to the right-back, who immediately passes back. In this moment the left-back puts a block on 5, in the moment the middle back passes back to the right-back again. This caused several goals by the right back and good chances for the wing player.



By this time Veszprem was leading 21 - 27. The attack of Kiel was improving but the defense still was a huge problem.

Next tactic that was similar in the execution was the following;

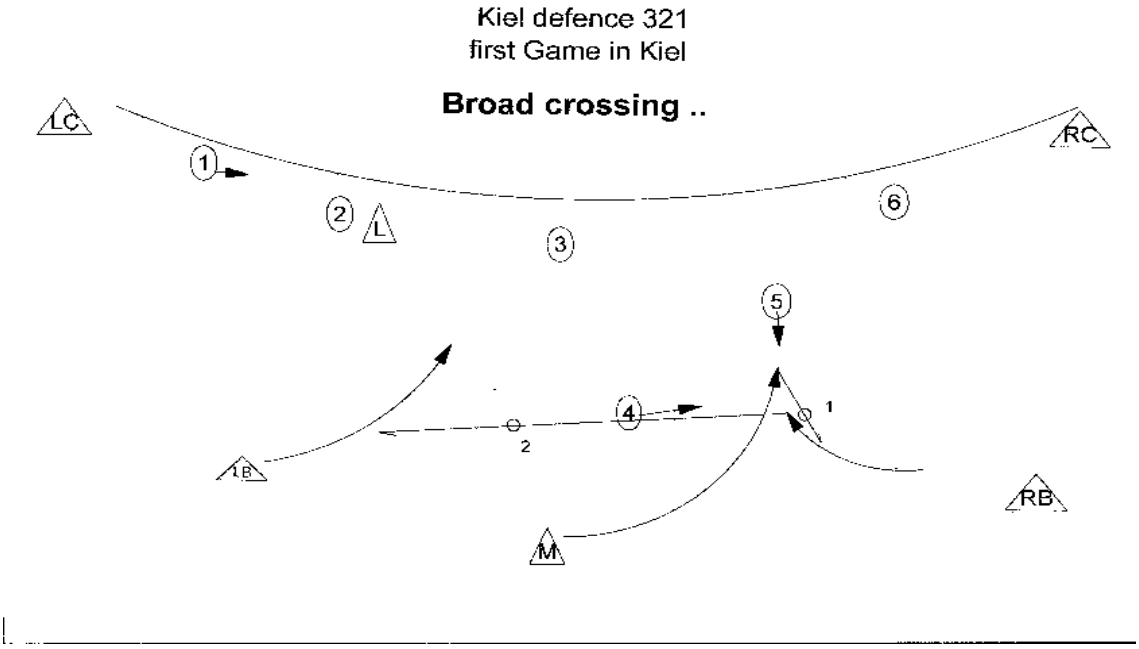


Here the middle player passed to the right-back, who immediately put an outside block on a

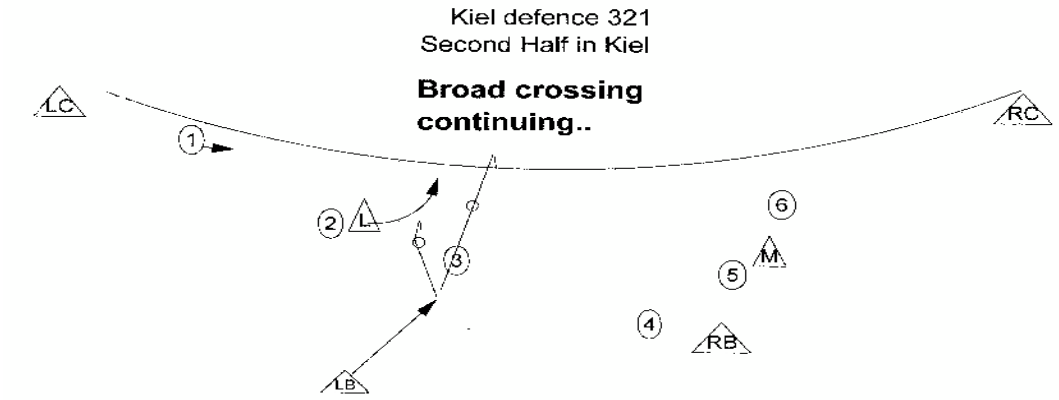
sleeping defender 5.

After changing to 6-0 for a while, Kiel was back in 3-2-1 for the last 5 minutes, still 3 goals down. Now Veszprem players started to make individual errors, not keeping to tactics and losing their discipline.

In the last minutes Veszprem played following tactic;



... which Kiel had been expecting. Continuation was like this:



Both technical errors in both cases because of the good job of the defenders 4 and 5, allowing Kiel to score on fast breaks and having Kiel to win the game by 1 goal pretty luckily.times this situation came up with defender 2 making a mistake, but Veszprem attackers made

Aftermath of the first game Kiel - Veszprem

After the first game in Kiel it was very clear that Kiel had a lot to improve in attack, but especially in defense. Very obvious problems were uncovered in both defense-variations in the first game. The 6-0 did not get under control the fire power of Veszprem´s backcourt and when trying to be more aggressive, the line players and the one-against-one quality of people like Chema were too much on that night.

The 3-2-1 defense of Kiel was often outplayed and not aggressive enough, but also simply to slow mentally to meet up with the tactics of Veszprem. Maybe it was still in the minds of the Kiel Players that the last game of these teams ended with an 11 goals victory of Kiel. The Veszprem players surely hadn´t forgotten that and played a very aggressive, very hard defense, Sulic being very lucky not to get a red card in the dying minutes due to a brutal foul on Sprenger.

2 Second game Veszprem - Kiel

So it now was a very demanding task to go to Veszprem, one of the most difficult away-arenas in the Handball world, with an advantage of one goal only.

First of all there were a few tasks Kiel had to do better in the second game;

1. Play a lot better 6-0 in the first half of the game in Veszprem. The plan was to go to 3-2-1 only in the second half.

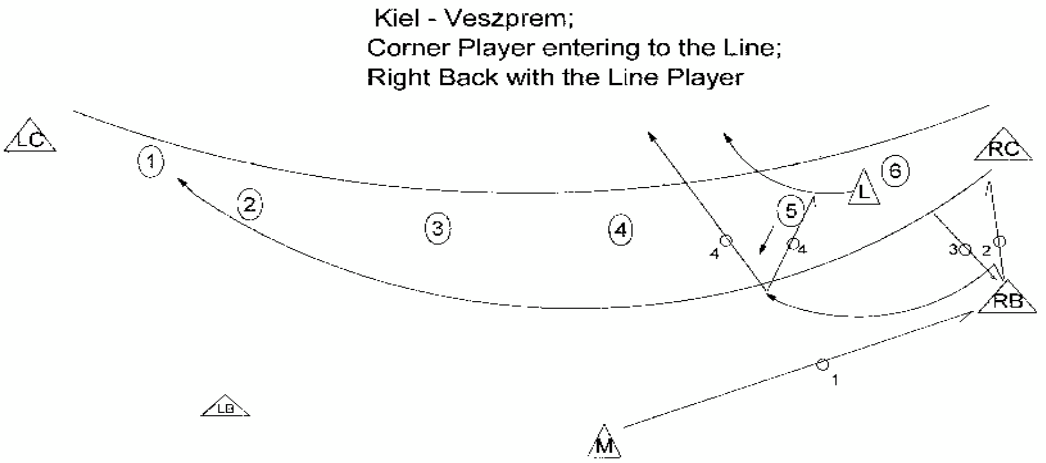
2. Changing a few offensive tactics to surprise the 5+1 set defense, this had forced way too many turnovers in the first game. Allowing Veszprem to make a lot of easy goals and making the flow of the Kiel- attack to slow down and be insecure.

3. Changing the way of how the 3-2-1 of Kiel-defense would react against the offensive-tactics of Veszprem. BUT only in the second half, after the half-time-brake, hoping that Veszprem would not realize this change in time and not react accordingly.

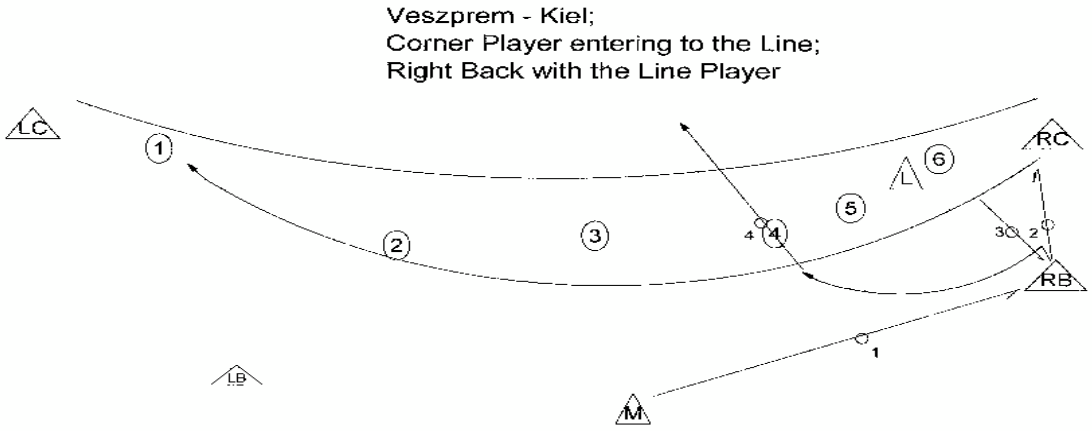
First Half of the second game Veszprem - Kiel.

Both teams started defending in 6-0. Veszprem started their defense extremely aggressively, almost brutally. They tried very much to double up from the sides, also working extremely hard against the line player and the backcourt players of Kiel. In the beginning this was tolerated by the referees, allowing Veszprem to get to a 5 : 1 lead.

Kiel at this moment was slowly getting under control the tactics that had caused so much damage in the first game like;



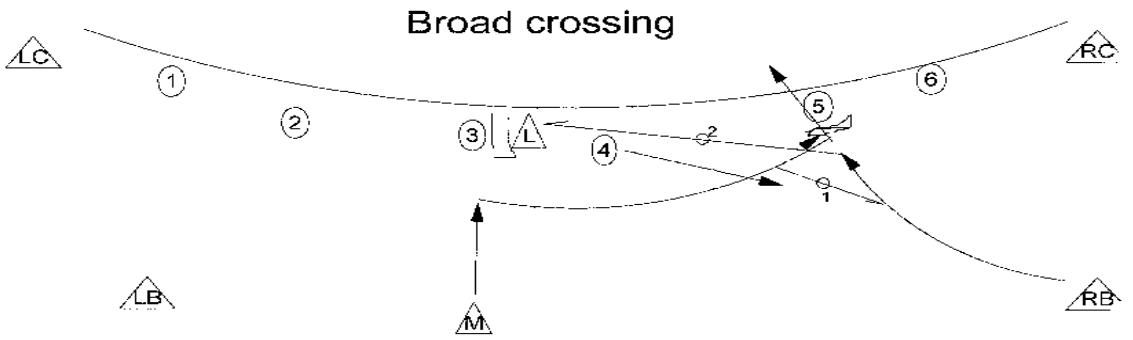
in the following way;



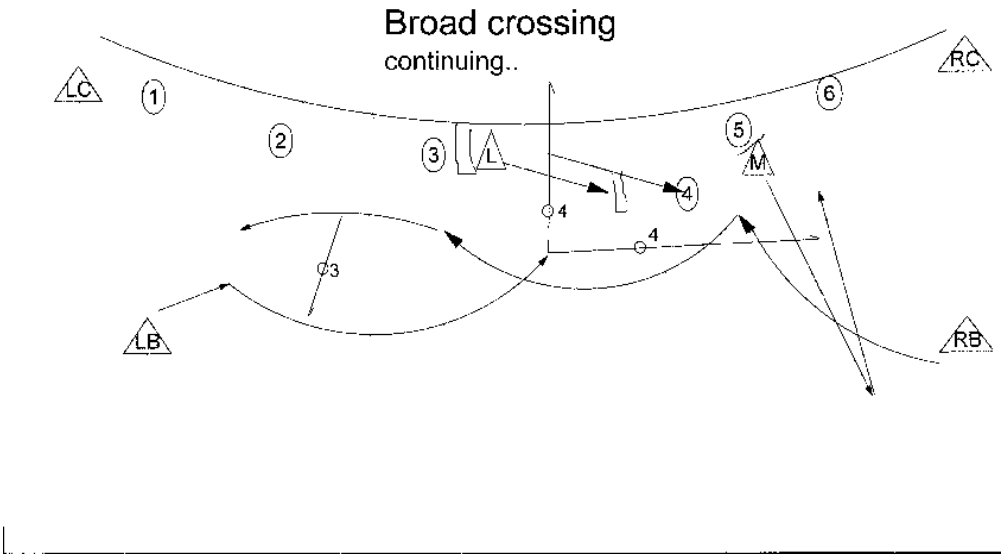
The change was to double up on Nagy; left outside stuck with the line-player, 5 did not go on Nagy´s shooting-arm but was responsible for Nagy not being able to pass to the line. Defender 4 went for Nagy´s shooting-arm and the rest had to move a little over, leaving more space on the other side.

This did not work in the first attack, Nagy still scoring from 10 meters, but after that, only Chema Rodriguez could make advantage of this change, causing a penalty once. The same way of dealing took place with the tactic from the left side. Many times Veszprem tried this again in the first half without success.

Veszprem then responded with trying to get more cross movements into their attack, like the following tactic; wide crossing / double-crossing;



and then continuing like this;



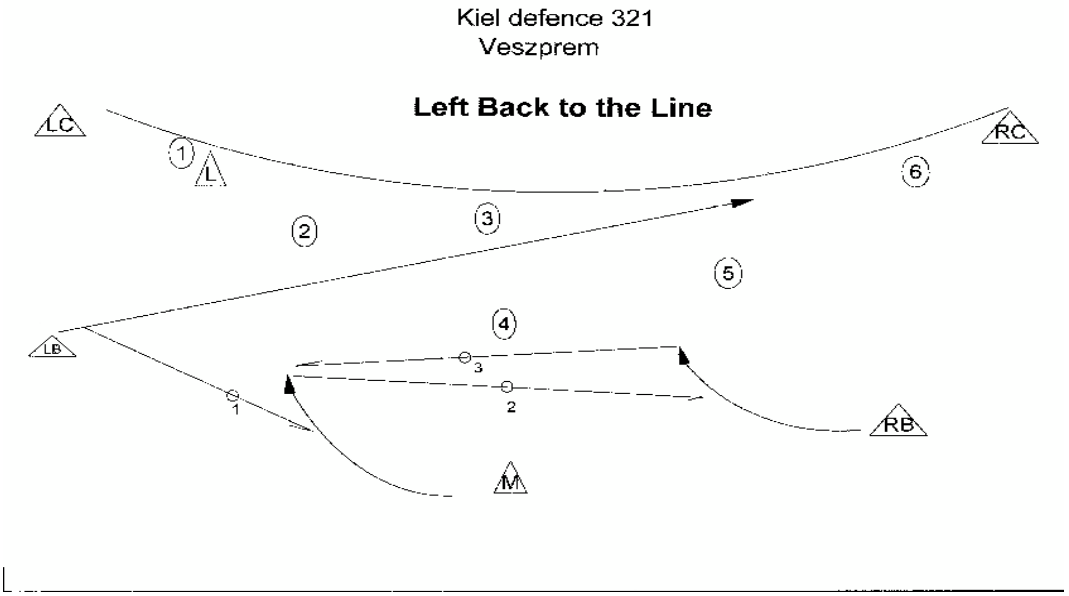
These tactics gave Veszprem goals and 2 Minutes sanctions to Kiel, who in the 24 minute responded with "man press" defense on Nagy, with no success, because Chema Rodrigues now had too much space. Then Kiel was forced to go into their 3-2-1 "old-style" bringing the same problems like in the first game but luckily getting a couple of offensive fouls against Veszprem because of wrong blocking. The last minutes of the first-half Veszprem was showing a little lack of discipline, with Jamali taking a silly shot and in the last seconds the referees gave Sulic 2 minutes for a foul on Pálmarsson that was a very clear red card.

With this Veszprem only went with a 14-12 lead into the second-half and a 5 against 6 situation.

Second Half of the second game Veszprem - Kiel. Defense Kiel

Starting the second-half, Kiel had the ball and 6 against 5 and immediately put the score to 14-13. Now the 3-2-1 defense had to show a different face than in the first game. This did not happen in the first defense action, since Veszprem scored 5-6.

Again in 6 against 6, Veszprem started playing the tactics that gave such a good results in the first game;



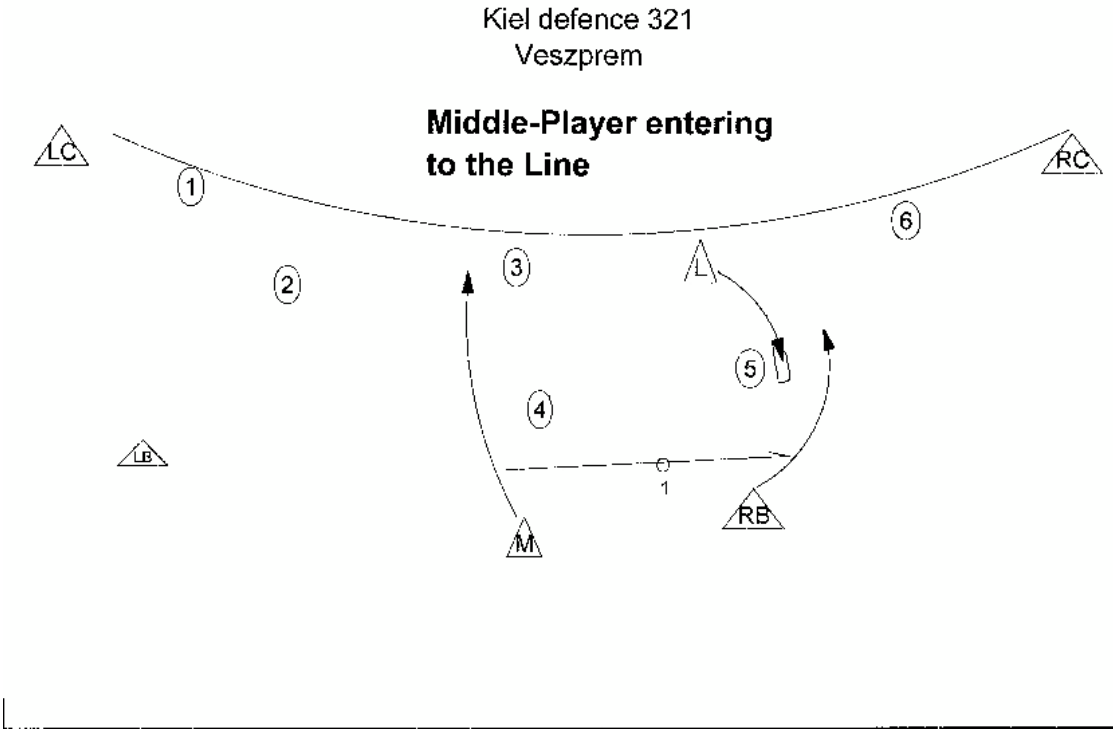
This time the change was that the Kiel defenders were to double up on Nagy immediately.

* Defender 5 should approach to him, but by no means allow him to pass over him to the Left-back, now attacked by the left outside defender (who should concentrate on this, leaving his right wing alone).

* Defender 4 was to attack Nagy on his throwing arm-side, not giving him any time to get a good view on the situation.

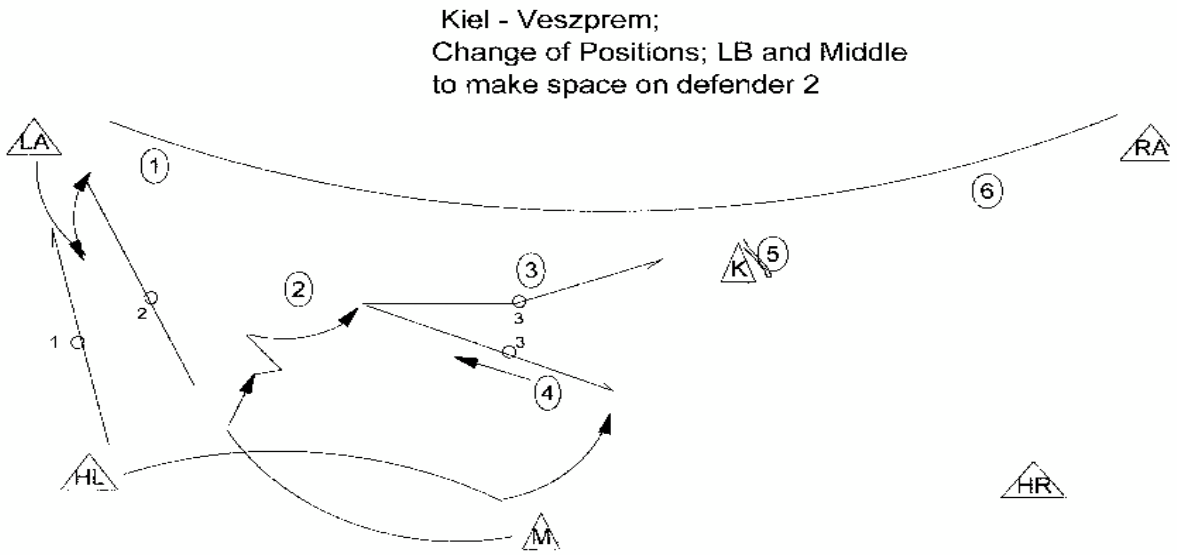
* Meanwhile, defender 3 should stay on his post, expecting either the line-player or the left-back to move again into the center of the line.

* Defender 2 should move up to the middle back, in the moment he had made the pass to Nagy in the first place.
This way Veszprem seemed very surprised, all the time getting the flow of their attack stopped and always starting again with free-throws. This tactic now only produced technical errors and easy goals for Kiel. Now Veszprem tried the following tactic that had succeeded in Kiel;



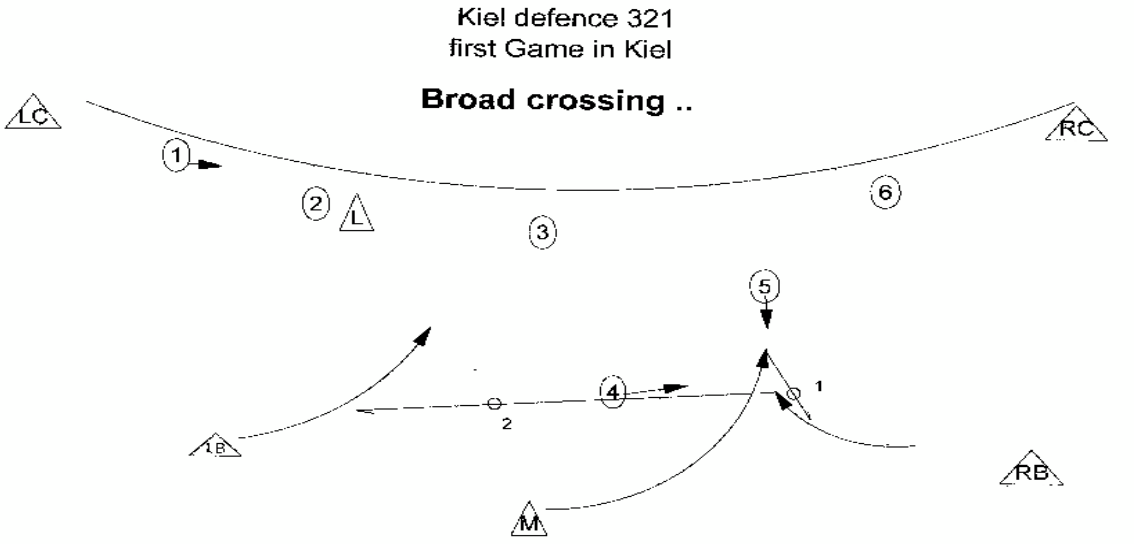
This time defenders 4 and 5 managed to avoid the outside-block, with defender 2 moving out up-court on the left-back and the middle-back being in the pass-shadow of defender 3.

Veszprem now changed to the following tactic that had caused problems in the first game:

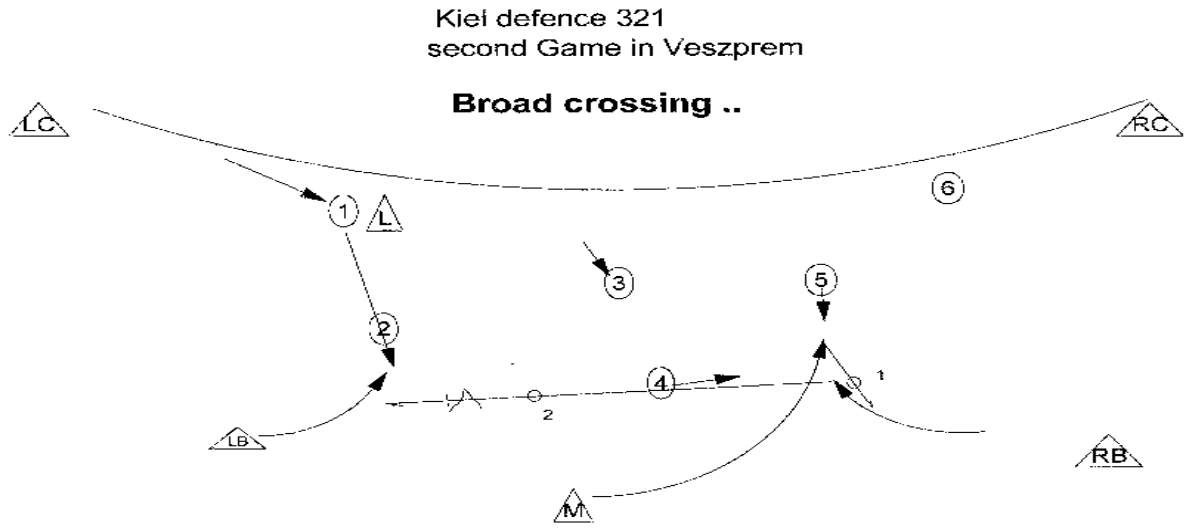


The situation now was different. This time the right side of Kiel was the bench-side, so that the best "one against-one" player of Veszprem got no significant result, only wearing himself down against better defenders on this position than in the first game.

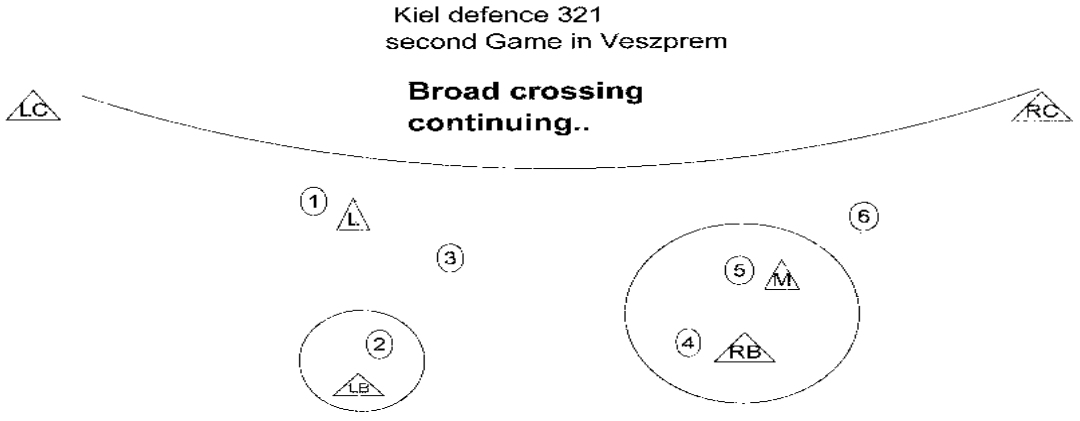
Next Veszprem tried a tactic, that in Kiel should have been a success but wasn´t, because of their own errors and therefore did not result in Veszprem goals in the first game.



This time there was another (better) defender on 2.



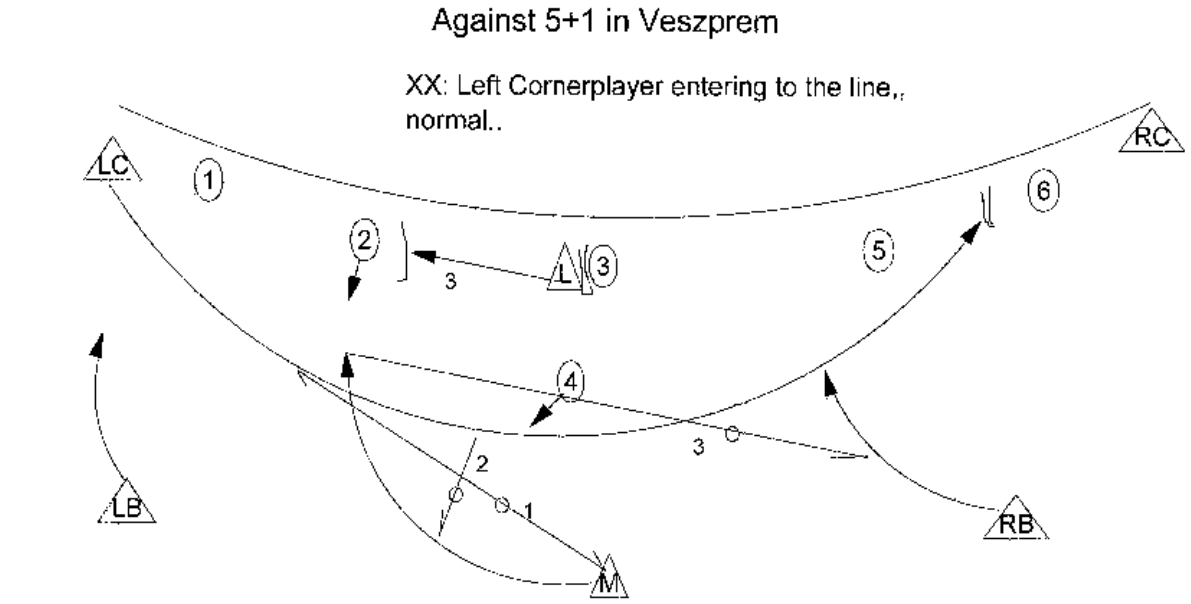
When this "wide-crossing" was coming up, defender 2 immediately was to run up and take out the left-back, so that he would not get the pass from the right-back. During this crossing, defender 4 and 5 should together stop the middle-back and the right-back, and not let them closer than the 9 meter line.
Defender 3 was to be in the passing line of the right-back to the line player. The right-outside defender (1) was to move to the lineman as far as his nearer goal-post and risk leaving the left-wing-player alone. This would leave Veszprem in the following situation; high-risk-pass or just getting a free throw to start things over.



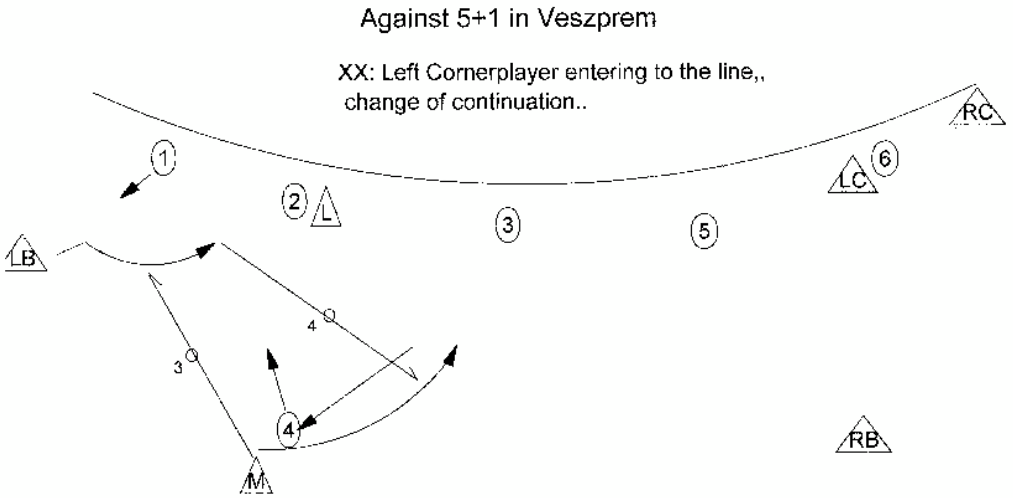
Veszprem tried several times to play these tactics in the second half with very little result, probably only much later realizing the changes that had been made.

Second Half of the second game Veszprem - Kiel. Attack Kiel.

The second half in Veszprem was curious because there was often a situation where the one team or the other had numerical superiority. Kiel clearly made a better job of being in the minority than Veszprem did in theirs. Veszprem had played the entire first half in 6-0 defense and first going to 5+1 after around 40 minutes had been played. In this case Kiel played a tactic that had no success in the first game;

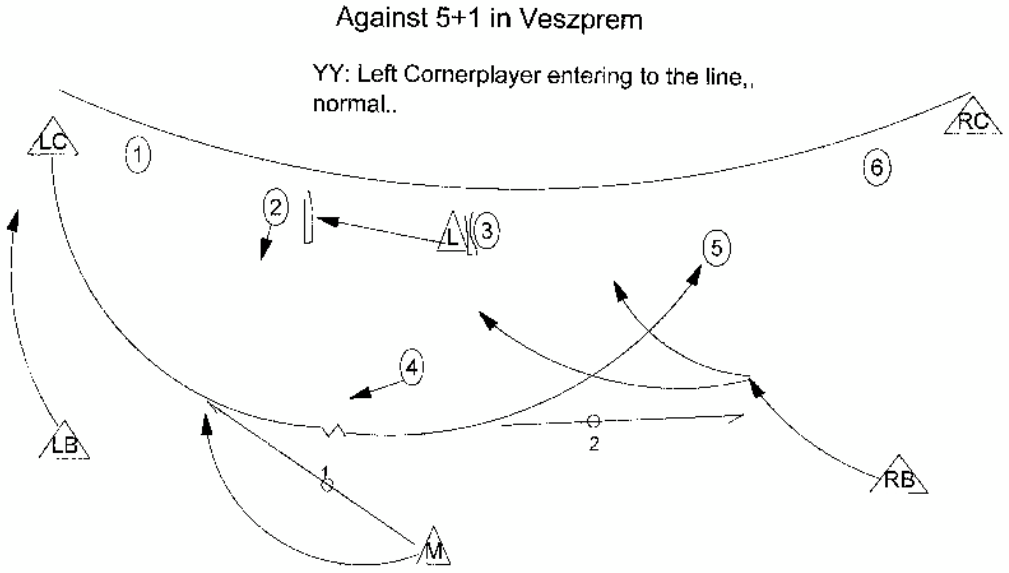


This time Kiel played it with one extra pass, letting Narcisse attack between 1 and 2;

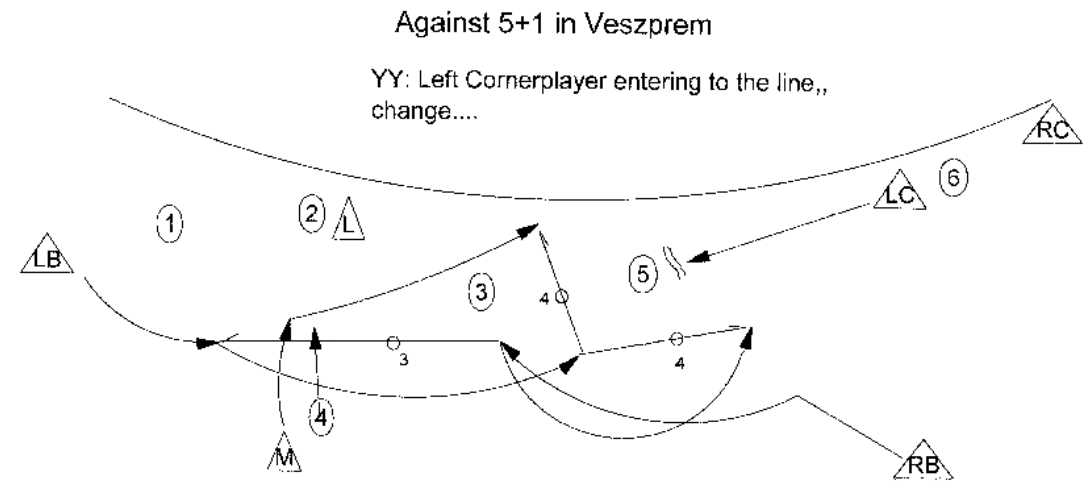


In doing this, the up-court-player made a step in his direction, allowing the middle-back, Pálmarsson a freeway to the goal.

In the last six minutes of the game Kiel played a tactic that had not given any good results in the first game;

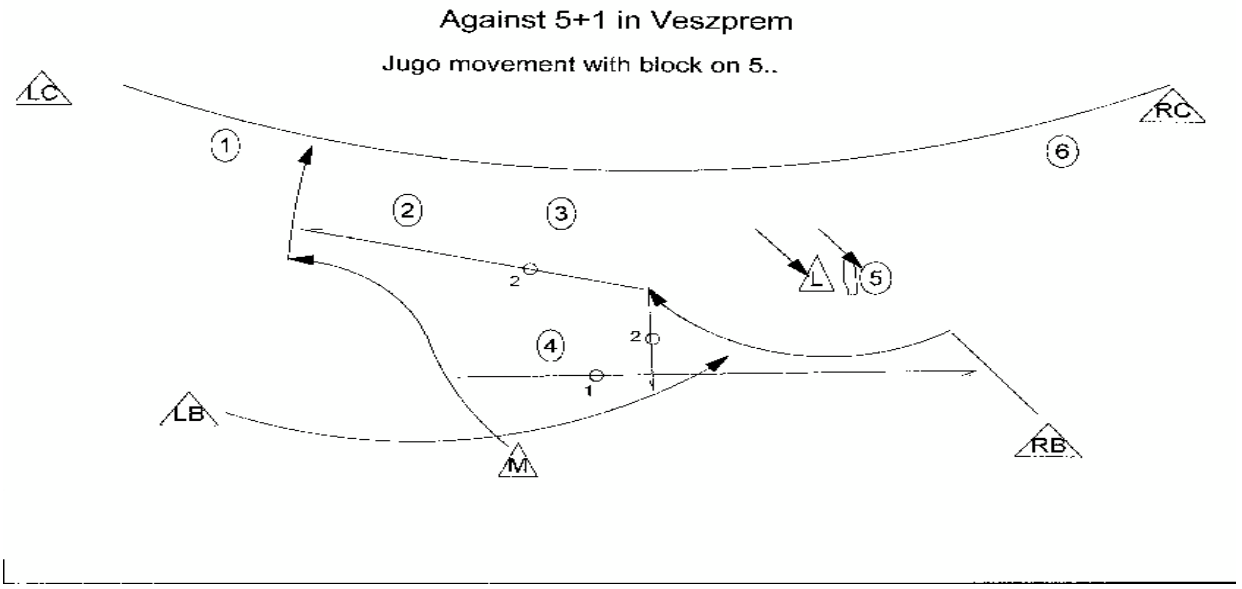


But this time with a change that aimed to get the up court-defender out of the way;



The left wing starts running up-court, gets the ball from the middle-back, and crosses for the right-back. Now the problem in the first game had been that the up court-defender was cutting the middle back out in the same time as the right outside defender was cutting the left-back out; leaving the right-back of Kiel without passing options and resulting in technical errors, meaning Vesprem´s- easy-goals.
This time the middle-back was to run towards the line pretending to get a tip-pass behind the up
court-defender. The aim was maybe a free middle-back OR the left-back freeing himself from the corner and having a free space towards the center. This went almost as hoped for, in any way resulting in an extremely important goal to the score 24 - 27.

In the decisive attack, some 4 minutes before the end of the game, Kiel played - for the first time in this game - a tactic that had given the best results in the first game:



3 Conclusion: Champions-League-Quarter-Final games Kiel against Veszprem in April 2013.

These games, between two very good and very experienced teams in April 2013, were overall very equal games. In the first game in Kiel, from the beginning Veszprem was the leading team having advantage of, maybe, being the team better prepared in this game, having learned from the games the teams had played against each other the season before.

In April 2014 Veszprem played a really good game in Kiel. When they operated with a 6-0 set defense, it was very aggressive, sometimes having luck, like when Sulic-red-card-foul on Sprenger was ignored, but played, in general a better 6-0 defense than that 6-0 of THW Kiel.

When Veszprem played their 5+1, in the first 20 minutes of the game, Kiel had big problems bringing their tactics to function. This again was the case for a period in the second half. This "Spanish-style- defense", with Ugalde going long ways, pressing the back-court of Kiel a lot, cutting passes and gave the Kiel-players a lot to think about. Behind Ugalde, Veszprem´s middle-block had several excellent, very tall defenders. Sometimes being rather passive, blocking the ball very well. They were working very well with the goalkeeper, sometimes changing and forming a defense that operated in 4-2 set formation. Anyway, in the beginning Kiel had almost lost the game because it took them way too long to find answers to this kind of defense.

In the first game it was obvious that neither the 6-0 defense, nor the 3-2-1 defense of Kiel got control over an excellent Veszprem attack. After being 6 goals down after some 40 minutes, it was rather increasing errors of Veszprem, than great performance of Kiel that allowed Kiel to win the game. Perhaps this was the result of the fact that at the end of the game Veszprem had to give their star- players some rest and the back-up players, did not have the overview or experience to play against the 3-2-1 defense and therefore gave Kiel several ball-possessions in the end of the game. Perhaps it was also the fact that Kiel, in the Bundesliga, is used to tight matches in the end of the games, where Veszprem seldom has to fight longer than 20 minutes for their victories in the Hungarian league.
Who knows…

It was very clear to Kiel that the team had to improve in every aspect of their play in the second game in Veszprem.

What changes were made?

Significant changes in the 6-0 defense.

The changes made in Kiel 6-0 defense, against major Veszprem 6-0-tactics, surely gave the team enough air in the first half to be in winning distance when starting the second half.

Small changes in attack against the 6-0.

Honestly Kiel expected Veszprem to start with their 5+1 defense, given the problems Kiel had with this defense in the first game. Surprisingly, Veszprem played extremely aggressive 6-0 defense. An improved attack, against this rough 6-0 defense, kept Kiel in the game in the first half. Veszprem defenders 2 and 5 were doubling up a lot when the attackers were in the movement from the other side.

In the same time players 3 and 4 worked very aggressively on Kiel´s line-player, never allowing him to set blocks for the backcourt. Kiel responded in sometimes placing the line player between defender 1 and 2 or 5 and 6, thus making the working-space for defenders 3 and 4 a lot bigger with one of these players being Veszprem's most important player, Nagy. It was probable that at times this Veszprem defense was over-pacing and again was lucky that in the last minute of that first half, Sulic only got some 2 minutes suspension only, when he committed a very clear red-card-foul on Pálmarsson.

Changing of some of the offence-tactics against 5+1.

The changes that Kiel made by few tactics against the 5+1 defense of Veszprem did not result in many goals because Veszprem only played their offensive defense for some 10 minutes of the game. These 10 minutes were, on the other hand, at the end of the game and these changes had an immense effect. Every changed tactic brought a goal this time, instead of the technical errors in the first game.

Changes of how the 3-2-1- of Kiel responded to Veszprem-tactics.

A changed 3-2-1 was planned to surprise the Veszprem team. It was very important doing this only for the second-half, so that there would not be much time to make changes in attack. The changes made, without doubt brought Kiel the victory and made it possible to go to the final weekend in Cologne.

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Predicting Team Rankings in Team Handball: The Questionable Use of On-Court Performance Statistics

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EHF Master Coach Thesis

2014

Predicting Team Rankings in Team Handball: The Questionable Use of On-Court Performance Statistics

Abstract

Statistics on on-court performances (e.g. number of shots from distance of 6 m , 7 m and 9 m, wings shots, turnover, steals, blocks, goalkeepers efficiency etc.) of handball players during actual games are typically used by handball coaches and sport journalists not only to assess the game performance of individual players and the entire team, but also to predict future success (i.e. the final rankings of the team in big events of handball like is Wch and Ech).

This study presents 1. The descriptive statistics of each on- court performance variable in each of the championship games, 2. The correlation analyses between each of the on- court performance variable and the final ranking of the teams in each championship, and 3. The profiles of the on- court performance variables of the best four teams and the worst four teams in each championship. Based on the data obtained in this study is elaborate upon the contribution of on- court performance variables to predicting the final ranking national handball team.

The purpose of this correlational study was to examine the relationships between 14 handball on-court performance variables and the final rankings of handball national teams during big events, using information gathered from seven different events from 2007 to2013, including 3 Ech (2008,2010,2012) and 4 Wch (2007,2009,2011,2013) controlling for multicollinearity. Data analyses revealed that (a) some on-court performance statistics can predict national team rankings on big events of handball; (b) Different between best ranked and lowest ranked teams in Ech is much smaller than different between best ranked and lowest ranked teams in Wch.

It is recommended that handball coaches will use the individuals on- court statistics for predicting the final rankings of their teams and their success. Also it is recommend to use all data from on-court statistic for the practice process and to create successful team by this information.

Keywords: National team, European championship, World championship, predicting ranking, on- court performance.

1. Introduction

The use of statistical reports to measure on-court performances of team handball players (e.g., number of shots from distances of 6m, 7m, and 9m, turnovers, steals etc.) has become a common practice in professional and amateur competitions and leagues. These statistical reports are used by coaches and players to assess defensive and offensive performances demonstrated by the individual player and the entire team during a single game, the all competition like European or World championships, or a number of competitions collected from few years. Statistical information on team handball's on-court performances is also used by coaches when preparing the player/team for the upcoming game/s. Quite often, these statistics are used by those professionals who work with the team handball team (e.g., coaches, assistant coaches, and scouts), as well as by journalists representing the written and electronic media, to predict future success and final rankings of the national handball teams.
Unfortunately, few studies have examined the relationships between on-court game statistics and predicting final success in handball team. . Brčić, Viskić- Štalec, & Jaklinović-Fressl (1997) search The predictive value of variables for the evaluation of technical-tactical elements in handball, . Gruić, Vuleta, Milanović, & Ohnjec (2005) search the influence of performance parameters of backcourt attackers on final outcomes of matches of the 2003 World Handball Championships for Women in Croatia and Vuleta, Milanović, Gruić& Ohnjec (2005) search Influence of the goals scored on final outcomes of matches of the 2003 World Handball Championships for Men in Portugal. Therefore it is not yet understood whether on-court game statistics can predict a win/loss ratio or the team rankings at the end of a season or a tournament. The purpose of this correlational study was to examine the relationships between a series of team handball on-court performance variables and the final rankings of team handball teams that participated in three European Championships and four World Championships. We used the information gathered from these championships while controlling for multicollinearity.
The handball game is defined by a very simple goal- one team strives to score more goals and to receive fewer goals than its opponent (Rogulj,2003). Individual matches within the official competitions are the situations in which this ultimate, so simply defined , aim is realized. A handball match is a contest of two opponents, that is, two handball teams of variable handball proficiency, meaning their player's skills, motor abilities, physical fitness level and technical-tactical. Preparedness and knowledge are rarely even.
The aspiration of both teams is the same: to beat the opponent or to achieve as favorable result as possible by applying all the by-the-rules-of-the-game allowed means, that is, by the application of handball technical tactical elements being at the disposal of the players on the court. Insight into the repertoire of the technical-tactical elements applied in each match by both teams can be acquired by means of either the output of the game statistics software, which collects data *in situ*, during the very match, or afterwards, by viewing a video footage of the match(Vuleta, Gruić, & Ohnjec, 2005). Such data, registered for each team separately (meaning there are always two sets of data for each match, pertaining to the two teams engaged in the match), represent the frequencies of the technical-tactical elements applied in the match observed. Analysis of the data, that follows their acquisition, allows a coach or any other handball expert to determine the game efficiency (performance) of the observed teams.

Or, in other words, it is possible to determine the factors influencing the accomplished result and their contribution to it (Hughes & Bartlett, 2002).The hierarchical structure of performance in sporting team games consists of 4 groups of interrelated factors (according to Milanović, 1997). The first factor group embraces the basic anthropological features. The second factor level describes performance by means of the specific handball features of the players, related to the specific physical fitness features and to the level of technical-tactical proficiency. Contemporary handball is characterized by very intensive play activities which demand from players, female and male alike, the well-developed basic and sport-specific physical fitness, adjusted to the specific structures and demands of the game of handball. At the third level of the performance hierarchical model is the situation-related efficacy (performance realized by the application of technical-tactical elements) that determines directly the final outcome of a match.

Performance parameters are, as a rule, collected at major competitions by means of either the existing methods of registration during a match and/or a competition (the International Handball Federation, IHF, or the European Handball Federation, EHF, prescribed parameters, that is, the outcomes of play actions), or in any time after the match or competition by reviewing video recordings .Variable events or game situations, or the flow of the game in each match is a result of unique, specific interactions and a manifestation of synergies of a large number of interwoven abilities and attributes, and it is also the result of interactions of the coaches and the entire logistic team, as well as of the substitutes on the bench, of the referees and their decisions, even of the spectators. Therefore, each match of two opponents produces only similar, never identical match courses or a result progress (Rogulj, 2003).

2. Method

2.1. On court performance data from big events (Ech 2008,2010,2012 and Wch 2007,2009,2011,2013) of the EHF (European handball federation) and IHF (International handball federation) were collected from two sources: the official EHF website and the IHF official website.
All 3 Ech 2008,2010,2012 played with 16 national teams which qualified to the championship. All 4 Wch2007, 2009,2011,2013 played with 24 national teams which qualified to the championship.
Every national team can play with 16 players on the official match report. All players have to be with passport of the country that they present. During the EHF and IHF final tournament all statistic information collected and published by the EHF and IHF on official website.
Data on 14 on court performance variables were collected separately for each game and were also combined into one database of all the competitions. The variables were as follow: team shots from 6 m (shots per game, goals per game, shots from 6 m from all shots), team shots from 9m (shots per game, goals per game, shots from 9 m from all shots), team shots from 7m –penalty (shots per game, goals per game, shots from 7 m from all shots), team shots from wings (shots per game, goals per game, shots from wings from all shots), team shots from fast break (shots per game, goals per game, shots from fast break from all shots), team shots from breakthrough (shots per game, goals per game, shots from breakthrough from all shots), total number of shots per game, total number of goals per game, turn over per game, steals per game, assists per game, yellow card per game, 2min. suspension per game, goal keeper saves per game (and efficiency of goalkeeper from all shots). All statistics describing the actions carried out by the players and handball teams marked out on official, according to official measurements handball constitution.

2.2. Data analysis.
Data were analyzed separately for each competition (Ech/Wch). Inside every competition data were analyzed separately by every event (Ech 2008,2010,2012) (Wch 2007,2009,2011,2013) and in total (summary of all Ech and all Wch).
2 nd part of analysis was focused on teams ranked 1-4 (highest ranked teams) and 13-16 (lowest ranked teams) in Ech and on teams ranked 1-4 (highest ranked teams) and 21-24 (lowest ranked teams) in Wch. From this data we create the total number (summary) for the best ranked teams on Ech and Wch and lowest ranked teams. A step-wise multiple regression analysis was performed to assess which independent variables predicted team rankings at the end of each competition and for all competitions combined. The P values to enter the model were less than.05, and values to be deleted from the model were greater than .10. Multicollinearity was assessed, and a tolerance level of .5 or less was considered an indication for multicollinearity. While low tolerance values (e.g. .2 or less) indicate multicollinearity, it has been suggested that values of .5 or less (that are related to R values of .7 or higher) are of concern (Peat and Barton, 2005). This procedure was followed by a factor analysis on the 14 variables. Absolute values of all variables were converted into Z-scores in order to allow condensing a number of variables into one. Following the factor analysis, a multiple regression analysis was repeated with the new condensed variables. Internal reliability of the new variables

that emerged from the factor analysis was measured using Cronbach's alpha. Descriptive statistics are presented as means ± SD, and alpha level was set at .05.

3. Results:

In the following tables the results of the descriptive statistical analysis are shown.

Table 1. Descriptive statistic of the performance parameters of the teams playing at the 2008, 2010, 2012 European championships and 2007, 2009, 2011.2013 World championships

		Europe 12 groups 48 games				World				Total			
	VAR	Mean	sd	Min	Max	Mean	sd	Min	Max	Mean	sd	Min	Max
	TeamMP	5.88 ±	1.85	3.00	8.00	8.00 ±	1.45	6.00	10.00	7.29 ±	1.88	3.00	10.00
6m	shots_6m_tot_PER_GAME	6.33 ±	1.79	2.00	10.33	7.63 ±	2.07	4.20	13.22	7.20 ±	2.07	2.00	13.22
	shots_6m_GOALS_PER_GAME	4.55 ±	1.21	1.67	7.33	5.17 ±	1.44	2.00	8.78	4.96 ±	1.40	1.67	8.78
	shots_6m_per	72.9% ±	8.8%	50.0%	93.3%	68.0% ±	8.0%	39.4%	91.4%	69.6% ±	8.6%	39.4%	93.3%
	per_6m_tot	12.9% ±	4.0%	4.0%	24.0%	15.3% ±	4.1%	8.4%	25.7%	14.5% ±	4.2%	4.0%	25.7%
	per_6m_GOALS	16.5% ±	4.7%	6.7%	31.4%	18.9% ±	5.0%	8.1%	31.2%	18.1% ±	5.0%	6.7%	31.4%
wing	shots_Wing_tot_PER_GAME	7.56 ±	1.93	3.67	12.67	6.58 ±	1.56	3.00	11.22	6.91 ±	1.75	3.00	12.67
	shots_Wing_GOALS_PER_GAME	4.35 ±	1.50	1.00	7.83	3.58 ±	1.12	1.29	6.70	3.83 ±	1.30	1.00	7.83
	shots_Wing_per	56.6% ±	9.7%	27.3%	79.3%	54.0% ±	9.1%	31.3%	72.2%	54.9% ±	9.3%	27.3%	79.3%
	per_Wing_tot	15.4% ±	4.3%	6.6%	27.3%	13.2% ±	3.0%	5.8%	20.9%	13.9% ±	3.6%	5.8%	27.3%
	per_Wing_GOALS	15.7% ±	5.3%	3.8%	26.8%	12.9% ±	3.4%	4.8%	21.4%	13.9% ±	4.3%	3.8%	26.8%
9m	shots_9m_tot_PER_GAME	22.23 ±	4.74	10.00	34.00	21.37 ±	3.52	13.78	33.00	21.65 ±	3.97	10.00	34.00
	shots_9m_GOALS_PER_GAME	8.85 ±	2.20	3.86	13.67	8.36 ±	1.80	4.78	13.78	8.53 ±	1.95	3.86	13.78
	shots_9m_per	39.7% ±	4.7%	27.4%	52.6%	39.3% ±	6.5%	20.5%	54.7%	39.5% ±	6.0%	20.5%	54.7%
	per_9m_tot	44.7% ±	8.0%	22.4%	61.4%	42.9% ±	6.0%	28.8%	58.6%	43.5% ±	6.8%	22.4%	61.4%
	per_9m_GOALS	31.9% ±	7.5%	13.0%	47.1%	30.5% ±	5.5%	19.8%	44.3%	31.0% ±	6.2%	13.0%	47.1%
7m	shots_7m_tot_PER_GAME	4.15 ±	1.30	1.33	7.33	3.65 ±	0.86	2.00	6.57	3.82 ±	1.05	1.33	7.33
	shots_7m_GOALS_PER_GAME	3.01 ±	1.00	1.33	5.33	2.64 ±	0.71	1.14	5.29	2.76 ±	0.84	1.14	5.33
	shots_7m_per	73.0% ±	10.6%	50.0%	100.0%	72.2% ±	9.7%	46.4%	96.8%	72.5% ±	10.0%	46.4%	100.0%
	per_7m_tot	8.4% ±	2.6%	2.9%	14.7%	7.3% ±	1.7%	4.3%	14.0%	7.7% ±	2.1%	2.9%	14.7%
	per_7m_GOALS	10.9% ±	3.5%	4.9%	21.6%	9.6% ±	2.5%	4.5%	17.9%	10.0% ±	2.9%	4.5%	21.6%
FastBreaks	shots_FastBreaks_tot_PER_GAME	5.60 ±	1.83	2.63	10.50	6.59 ±	1.74	2.57	10.50	6.26 ±	1.83	2.57	10.50
	shots_FastBreaks_GOALS_PER_GAME	4.17 ±	1.30	1.67	8.00	4.91 ±	1.44	1.67	7.89	4.66 ±	1.43	1.67	8.00
	shots_FastBreaks_per	75.4% ±	9.4%	55.6%	100.0%	73.9% ±	7.4%	52.0%	89.2%	74.4% ±	8.1%	52.0%	100.0%
	per_FastBreaks_tot	11.3% ±	3.5%	5.6%	21.4%	13.2% ±	3.1%	5.6%	20.4%	12.5% ±	3.4%	5.6%	21.4%
	per_FastBreaks_GOALS	15.0% ±	4.3%	7.1%	27.7%	17.6% ±	4.1%	7.9%	26.9%	16.7% ±	4.3%	7.1%	27.7%
Breakthroughs	Breakthroughs_tot_PER_GAME	3.55 ±	1.62	0.33	9.67	4.01 ±	1.91	0.78	9.33	3.86 ±	1.82	0.33	9.67
	Breakthroughs_GOALS_PER_GAME	2.74 ±	1.20	0.33	6.71	2.88 ±	1.31	0.67	6.78	2.83 ±	1.27	0.33	6.78
	Breakthroughs_per	79.1% ±	11.9%	51.7%	100.0%	73.3% ±	10.1%	45.5%	100.0%	75.2% ±	11.1%	45.5%	100.0%
	per_Breakthroughs_tot	7.3% ±	3.4%	0.6%	19.3%	8.1% ±	3.9%	1.6%	19.3%	7.8% ±	3.8%	0.6%	19.3%
	per_Breakthroughs_GOALS	10.0% ±	4.4%	1.1%	22.7%	10.5% ±	4.7%	3.0%	22.5%	10.3% ±	4.6%	1.1%	22.7%
tot_shots	tot_shots_PER_GAME	49.41 ±	2.99	43.00	55.33	49.83 ±	3.49	40.14	60.67	49.69 ±	3.33	40.14	60.67
	tot_shots_GOALS_PER_GAME	27.67 ±	1.98	22.00	31.13	27.53 ±	3.52	14.71	34.22	27.58 ±	3.09	14.71	34.22
	tot_shots_per	0.56 ±	0.03	0.49	0.66	0.55 ±	0.06	0.36	0.67	0.56 ±	0.05	0.36	0.67
	AS_GAME	12.28 ±	3.27	5.00	19.86	11.22 ±	2.93	4.00	19.40	11.57 ±	3.08	4.00	19.86
	@TO_GAME	12.00 ±	1.98	8.63	16.67	13.67 ±	3.35	9.33	27.29	13.11 ±	3.06	8.63	27.29
	ST_GAME	3.28 ±	1.21	0.33	7.00	5.59 ±	3.36	1.67	20.78	4.82 ±	3.03	0.33	20.78
	BS_GAME	3.02 ±	1.46	0.33	7.67	2.96 ±	1.33	0.29	5.83	2.98 ±	1.37	0.29	7.67
	YC_GAME	3.04 ±	0.25	2.67	3.67	2.97 ±	0.27	2.33	3.83	3.00 ±	0.26	2.33	3.83
	@2Min_GAME	4.38 ±	1.28	2.00	9.33	0.15 ±	0.14	0.00	0.71	1.56 ±	2.13	0.00	9.33
	goalkeeper_stop_PER_GAME	13.18 ±	1.79	9.33	16.71	13.64 ±	1.87	9.00	18.14	13.49 ±	1.85	9.00	18.14
	goalkeeper_per	0.32 ±	0.04	0.23	0.39	0.33 ±	0.04	0.21	0.42	0.33 ±	0.04	0.21	0.42

MEAN arithmetic mean; **SD** standard deviation; **SUM** sum; **MIN** minimum amount in average per game; **MAX** maximum amount in average per game;**VAR** variable; **Europe** data from Ech; **World** data from Wch; **Total** summary Ech and Wch; **SHOTS_6 M_TOT_PER_GAME** total shots taken from 6 m line in average per game; **SHOTS_6M_GOALS_PER_GAME** goal area line shots scored (in average per game);**SHOTS_6M_PER** efficiency of area line shots in average per game ;**PER_6M_TOT** area line shots from all shots (% in average per game);**PER_6M_GOALS** area line goals from all goals scored (in average per game); **SHOTS_9 M_TOT_PER_GAME** total shots taken from 9 m, backcourt positions, in average per game; **SHOTS_9M_GOALS_PER_GAME** 9 m shots scored (in average per game);**SHOTS_9M_PER** efficiency of backcourt positions shots in average per game ;**PER_9M_TOT** backcourt positions shots from all shots (% in average per game);**PER_9M_GOALS** backcourt positions goals from all goals scored (in average per game) **SHOTS_WING_TOT_PER_GAME** total shots taken from

wings positions in average per game; **SHOTS_WING_GOALS_PER_GAME** wings positions shots scored (in average per game);**SHOTS_WING_PER** efficiency wings positions shots in average per game ;**PER_WING_TOT** wings positions shots from all shots (% in average per game);**PER_WING_GOALS** wings positions goals from all goals scored (in average per game); **SHOTS_7 M_TOT_PER_GAME** total shots taken from 7 m penalty throws in average per game; **SHOTS_7M_GOALS_PER_GAME** goals 7 m penalty throws scored (in average per game);**SHOTS_7M_PER** efficiency of 7 m penalty throws in average per game ;**PER_7M_TOT** 7 m penalty throws from all shots (% in average per game);**PER_7M_GOALS** 7 m penalty throws goals from all goals scored (in average per game); **SHOTS_FASTBREAKS_TOT_PER_GAME** total shots taken from fast breaks in average per game; **SHOTS_FASTBREAKS_GOALS_PER_GAME** goals fast break shots scored (in average per game);**SHOTS_FASTBREAKS_PER** efficiency of fast breaks shots in average per game ;**PER_FASTBREAKS_TOT** fast breaks shots from all shots (% in average per game);**PER_FASTBREAKS_GOALS** fast break goals from all goals scored (in average per game); ; **BREAKTHROUGHS_TOT_PER_GAME** total shots taken from breakthroughs in average per game; **BREAKTHROUTH_GOALS_PER_GAME** goals from breakthroughs scored (in average per game);**BREAKTHROUGHS_PER** efficiency of breakthroughs shots in average per game ;**TOT_SHOTS_PER_GAME** amount of all shots taken from all positions in average per game; **tot_shots_GOALS_PER_GAME** amount of goals scored from all positions in average per game; **tot_shots_per** efficiency of all shots from all positions in average per game; **AS_GAME** assists per game in average; **@TO_GAME** turn over per game in average; **ST_GAME** stills per game in average; **BS_GAME** blocks per game in average; **YC_GAME** yellow cards per game; **@2 Min_GAME** 2 min. suspensions per game.

Data (means and sd all vars) by competition is summary of all events. For Europe is summary of 2008,2010 and 2012 Ech and for World is summary of 2007,2009,2011 and 2013 Wch.

The total average number of shots and throws taken in total (European championships and World championships) is 49.61, with a shot efficiency of 56% and 27.58 goals per game. Regarding the playing positions the largest number of shots was taken from the backcourt positions, 21.65 on average, with a shot efficiency of 39.5 and 8.53 goals per game, followed by the shots taken from the 6m line positions (7.20 on average , with an efficiency of 69.6% and 4.96 goals per game. Shots taken from wings are 6.91 in average with 54.9% efficiency and 3.83 goals. There was an average of 6.26 shots taken from fast breaks out of which 74.4% were successful and gave 4.66 goals per game. Break through shots are 3.86 in average per game with efficiency of 75.2% and 2.83 goals.

The teams won on average 3.82 penalties (7m) throw and score 72.5% which is 2.76 goals per game.

The average of assist passes and technical fouls were 11.57 and 13.11, respectively.

Breakthroughs shots were 3.86 in average per game with 75.2% and 2.83 goals.

All team made 2.98 blocks in defense, received 3 yellow cards and spend 1.56 times 2 min. suspensions (in average per game)

Table 2. Descriptive statistic of the performance parameters of the highest ranked teams (1-4) and lowest ranked teams (13-16) playing at the 2008, 2010, 2012 European championships and highest ranked teams (1-4) and lowest ranked teams (21-24) playing at the 2007,2009,2011, 2013 World championships.

		Europe				World			
		TOP		BOTTOM		TOP		BOTTOM	
	Variable	Mean	SD	Mean	SD	Mean	SD	Mean	SD
	TeamMP	7.33	1.50	3.50	1.17	9.50	1.03	7.75	1.34
6m	Shots / game	6.36	1.73	5.65	2.15	7.02	1.82	7.83	2.25
	Goals / game	4.33	0.98	4.42	1.46	4.98	1.29	4.88	1.55
	Shots(% success)	69.0%	8.5%	79.5%	7.7%	71.1%	4.7%	62.5%	8.4%
	(Shots / total)%	13.2%	3.8%	11.4%	5.0%	14.1%	3.5%	16.2%	4.6%
	(Goals /total) %	16.0%	4.2%	16.6%	6.2%	16.4%	4.0%	20.8%	5.7%
wing	Shots / game	7.96	1.39	7.40	2.73	7.30	1.43	6.33	1.58
	Goals / game	4.76	0.84	4.18	2.14	4.49	1.15	3.00	0.98
	Shots(% success)	60.0%	4.4%	54.3%	14.0%	61.1%	6.4%	47.3%	8.9%
	(Shots / total)%	16.5%	2.9%	15.0%	6.2%	14.7%	3.0%	13.1%	3.0%
	(Goals /total) %	17.5%	2.9%	15.6%	7.8%	14.8%	3.6%	12.8%	3.7%
9m	Shots / game	20.62	3.79	24.99	5.78	19.65	2.79	22.14	3.44
	Goals / game	7.91	1.60	9.35	2.70	8.72	1.63	7.59	2.35
	Shots(% success)	38.5%	4.4%	37.1%	4.2%	44.3%	4.5%	34.1%	7.7%
	(Shots / total)%	42.5%	6.4%	49.4%	8.8%	39.3%	4.4%	45.8%	6.0%
	(Goals /total) %	28.9%	5.0%	34.7%	8.9%	28.7%	4.7%	31.9%	5.6%
7m	Shots / game	4.32	1.31	3.88	1.67	3.70	0.97	3.17	0.63
	Goals / game	3.21	0.98	2.82	1.18	2.89	0.79	2.19	0.51
	Shots(% success)	75.1%	10.4%	74.5%	13.3%	78.5%	8.6%	68.8%	7.9%
	(Shots / total)%	9.0%	2.8%	7.7%	3.2%	7.4%	2.0%	6.6%	1.2%
	(Goals /total) %	11.7%	3.2%	10.5%	4.5%	9.6%	2.7%	9.5%	2.5%
Fast-Breaks	Shots / game	5.15	1.84	5.19	1.44	7.71	1.42	4.96	1.49
	Goals / game	3.93	1.26	3.83	1.34	5.89	1.01	3.41	1.22
	Shots(% success)	77.7%	7.6%	72.8%	11.0%	76.7%	5.1%	68.1%	9.1%
	(Shots / total)%	10.6%	3.7%	10.4%	3.0%	15.4%	2.5%	10.1%	2.6%
	(Goals /total) %	14.3%	4.2%	14.3%	4.8%	19.4%	3.1%	14.1%	3.5%
Penetration	Shots / game	3.91	1.09	2.99	2.36	4.53	1.81	3.94	2.15

	Goals / game	3.16	0.91	2.18	1.22	3.36	1.32	2.59	1.41
	Shots(% success)	81.1%	8.2%	82.6%	18.1%	76.0%	9.6%	67.4%	11.7%
	(Shots / total)%	8.2%	2.6%	6.0%	4.7%	9.2%	3.9%	8.2%	4.4%
	(Goals /total) %	11.6%	3.5%	8.3%	4.9%	11.2%	4.5%	10.9%	5.4%
Shots(total)	tot_shots / game	48.31	2.92	50.10	3.65	49.90	2.48	48.37	4.71
	tot GOALS / game	27.30	2.10	26.78	1.89	30.33	1.65	23.66	4.79
	percent goals	0.57	0.03	0.54	0.03	0.61	0.03	0.49	0.07
	Asists / game	13.03	2.36	11.71	4.35	13.01	2.12	8.97	3.17
	turn overs / game	11.23	1.83	12.26	2.21	11.52	1.35	17.04	5.12
	Stills / game	3.10	0.96	3.11	1.46	6.60	4.75	5.24	3.19
	BS / game	3.37	0.98	2.76	1.80	3.87	0.93	2.17	1.30
	Yellow cards / game	3.00	0.28	2.97	0.30	2.99	0.29	2.87	0.22
	2 Min / game	3.78	1.12	5.18	1.54	3.48	0.78	3.94	0.54
Goalkeeper	stops / game	12.46	1.40	12.89	2.03	13.75	1.65	12.91	1.84
	Stops (% scuccess)	0.32	0.04	0.30	0.04	0.35	0.04	0.31	0.06

Mean-arithmetic mean; **SD**- standard deviation; **Europe-**Ech; **World-**Wch; **TOP-**best ranked national team (places 1-4) in each competition; **BOTTOM-** lowest ranked national teams (Ech 13-16, Wch 21-24).

This table compare all variables between best ranked teams (1-4) and lowest ranked teams (13-16) in European championships 2008,2010 and 2012 and all variables Between best ranked teams (1-4) and lowest ranked teams (21-24) in World championships 2007,2009,2011 and 2013.

Results for Ech:

The total average number of shots and throws taken in European championships is 48.31 for best ranked teams with 57% efficiency and 27.3 goals per game, while lowest ranked teams shot 50.1 with 54% efficiency and 26.78 goals per game.
Best ranked teams shot 7.96 times in average from the wings positions with 60% and 4.76 goals per game, while lowest ranked teams shot 7.40 with 54.3% efficiency and 4.18 goals per game. Next variable by number of shots is the 6 m shots, 6.36 shots in average for best ranked teams with 69% efficiency and 4.33 goals per game comparing to 5.65 shots for lowest ranked teams with 79.5% and 4.42 goals per game.

Fast breaks shots are 5.15 with 77.7% and 3.93 goals per game for 1-4 ranked teams and 5.19 with efficiency of 72.8% and 3.83 goals per game for 13-16 ranked teams.

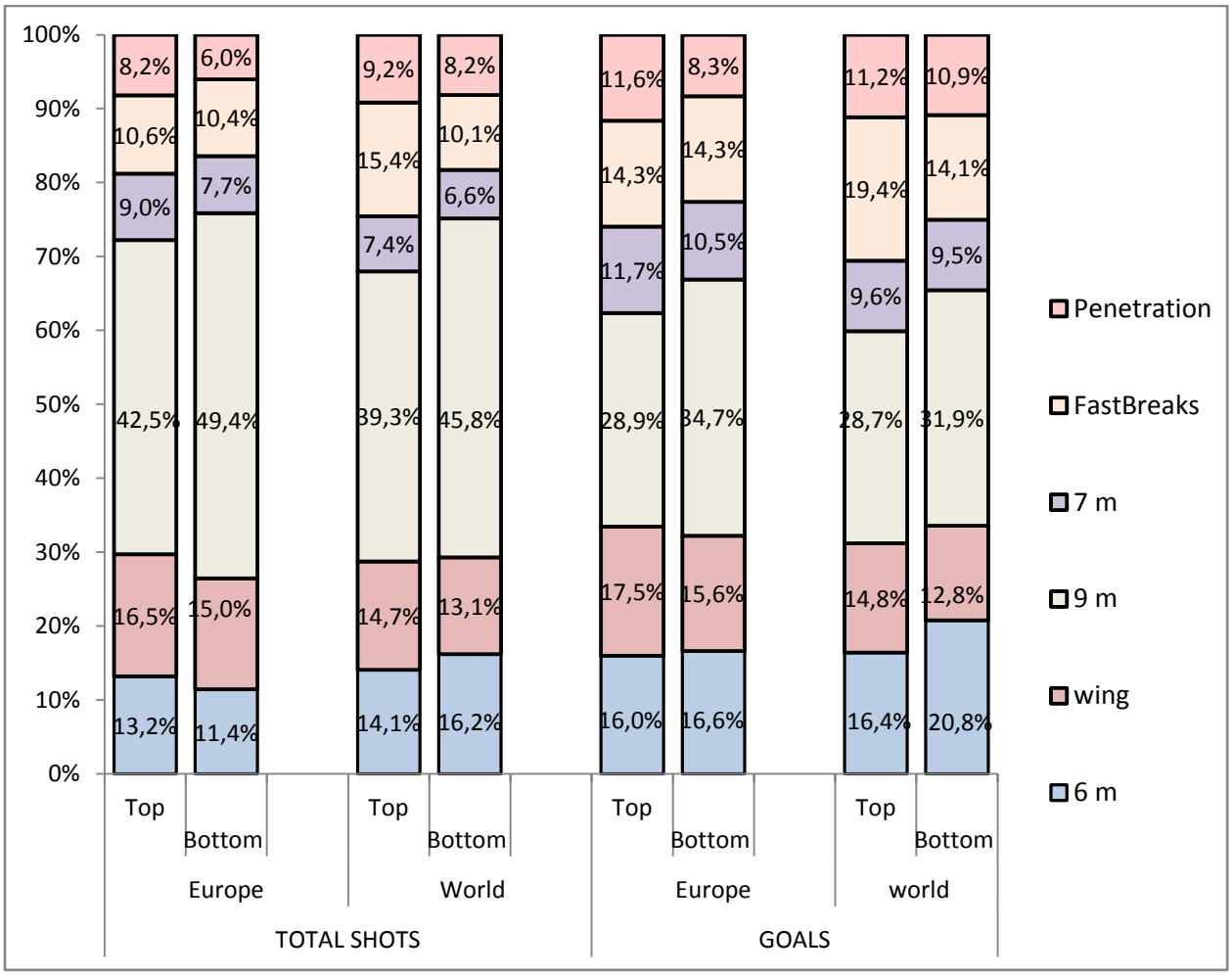
From the 7 m (penalty shots) best ranked teams shot 4.32 times with 75.1% and 3.21 goal per game, while lowest ranked teams shot 3.88 times with 74.5% and 2.82 goals per game in average.
Shots from breakthroughs were 3.91 shots per game for best ranked teams with 81.1% and

3.16 goals in average and lowest ranked teams shot 2.99 times with 82.6% efficiency and 2.18 goals per game.
On "other variables" best ranked teams pass 13.03 assists per game in average and lowest teams pass 11.71, turn over balls variable is 11.23 for best teams and 12.26 for the lowest teams. Stills are almost the same numbers for best and lowest ranked teams with 3.10 for best ranked and 3.11 for lowest ranked teams, best ranked team made 3.37 blocks in defense, while lowest ranked teams made 2.76. Best ranked teams received 3.00 yellow cards per game in average and lowest ranked received 2.97. 3.78times 2 min suspensions for best teams and 5.18 times for lowest ranked teams in average per game. Goal keepers save 12.46 times per game for best teams and 12.89 times for lowest ranked teams.

Results for Wch:
The total average number of shots and throws taken in World championships is 49.9 for best ranked teams with 61% efficiency and 30.33 goals per game, while lowest ranked teams shot 48.37 with 49% efficiency and 23.66 goals per game.
Best ranked teams shot 7.30 times in average from the wings positions with 61.1% and 4.49 goals per game, while lowest ranked teams shot 6.33 with 47.3% efficiency and 3 goals per game.
Next variable by number of shots is the 6 m shots, 7.02 shots in average for best ranked teams with 71.1% efficiency and 4.98 goals per game comparing to 7.83 shots for lowest ranked teams with 62.5% and 4.88 goals per game.
Fast breaks shots are 7.71 with 76.7% and 5.89 goals per game for 1-4 ranked teams and 4.96 with efficiency of 68.1% and 3.41 goals per game for 21-24 ranked teams.

From the 7 m (penalty shots) best ranked teams shot 3.70 times with 78.5% and 2.89 goals per game, while lowest ranked teams shot 3.17 times with 68.8% and 2.19 goals per game in average.
Shots from breakthroughs were 4.53 shots per game for best ranked teams with 76.0% and 3.36 goals in average and lowest ranked teams shot 3.94 times with 67.4% efficiency and 2.59 goals per game.
On "other variables" best teams pass 13.01 assists per game in average and lowest teams pass only 8.97, turn over balls is 11.52 for best teams and 17.04 for the lowest teams. Best teams still the ball 6.60 times and lowest teams 5.24. Every game in average 1-4 ranked teams block 3.87 shots and 21-24 ranked teams only 2.17. Best ranked teams receive 2.99 yellow cards per game in average and lowest ranked teams receive 2.87. 3.48 times 2 min suspensions for best teams and 3.94 times for lowest ranked teams in average per game. Goal keepers save 13.75 times per game for best teams and 12.91 times for lowest ranked teams.

Table 3. Goals by positions (% from all shots) by competition (ECH/WCH) AND FINAL RANKING (top 4 vs. bottom 4)

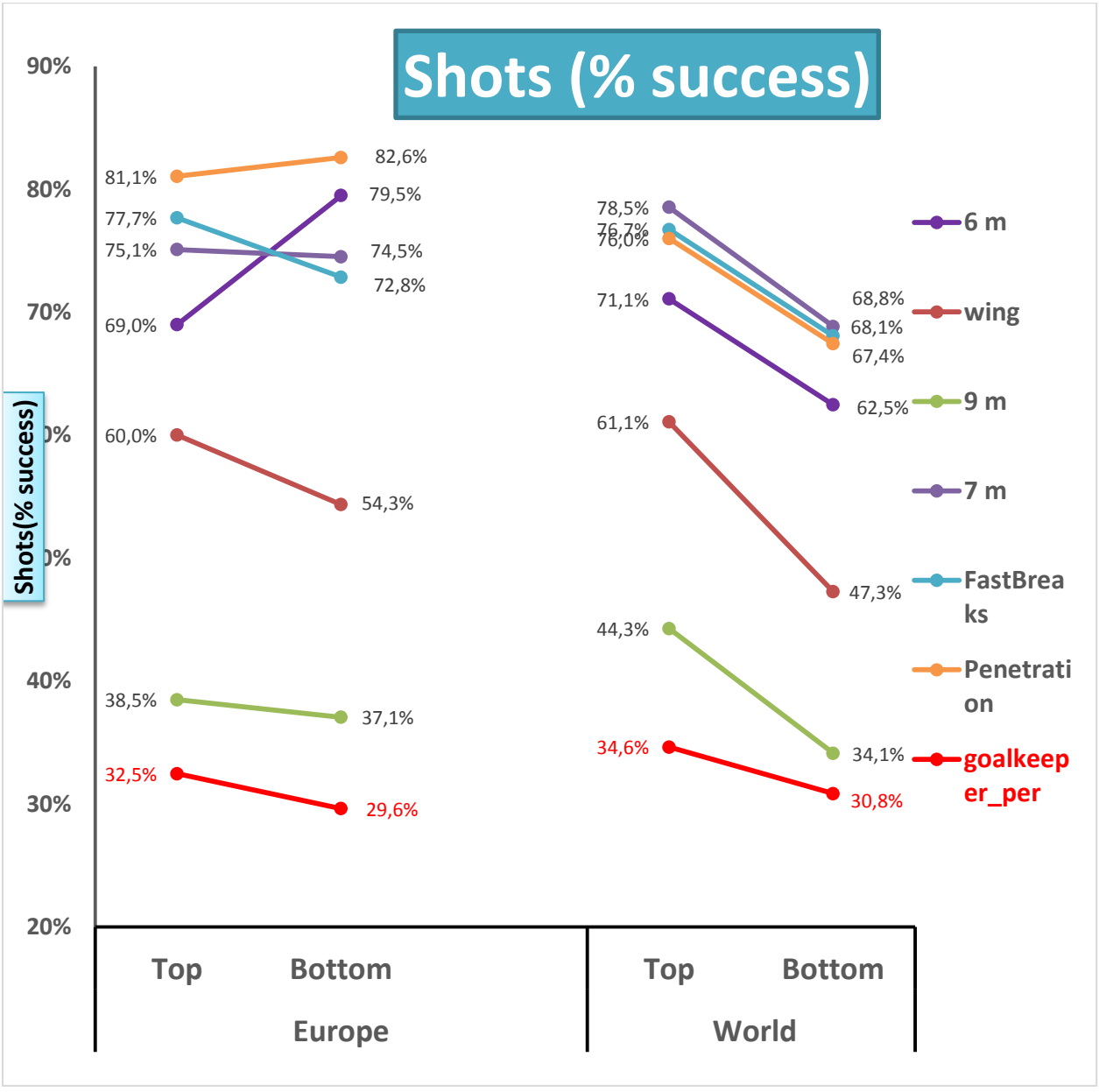


6m-shots from 6 m line; **Wing-** shots from the wing position; **9m-**shots from the 9 m, back court players; **7m-** 7 m throw ;**Fast breaks-** shots from the fast breaks position; **Penetration-** shots from penetration position; **Goal keepers_per-** efficiency of goal keepers; **Europe-**Ech; **World-**Wch; **TOP-**best ranked national team (places 1-4) in each competition; **BOTTOM-** lowest ranked national teams (Ech 13-16, Wch 21-24).

Table 3. Shows the ratio between all kind of shots (in average per game) and all kind of goals positions of shots. There is data for best 4 ranked team and lowest 4 ranked team in European championships and best 4 ranked teams and 4 lowest ranked teams in World championships.

It is very clear that most of the shots and goals are from long distance (9 m shots). Best ranked teams shot less than lowest ranked teams in Ech and Wch from 9 m.

Graph 1: Shots by position (% success):

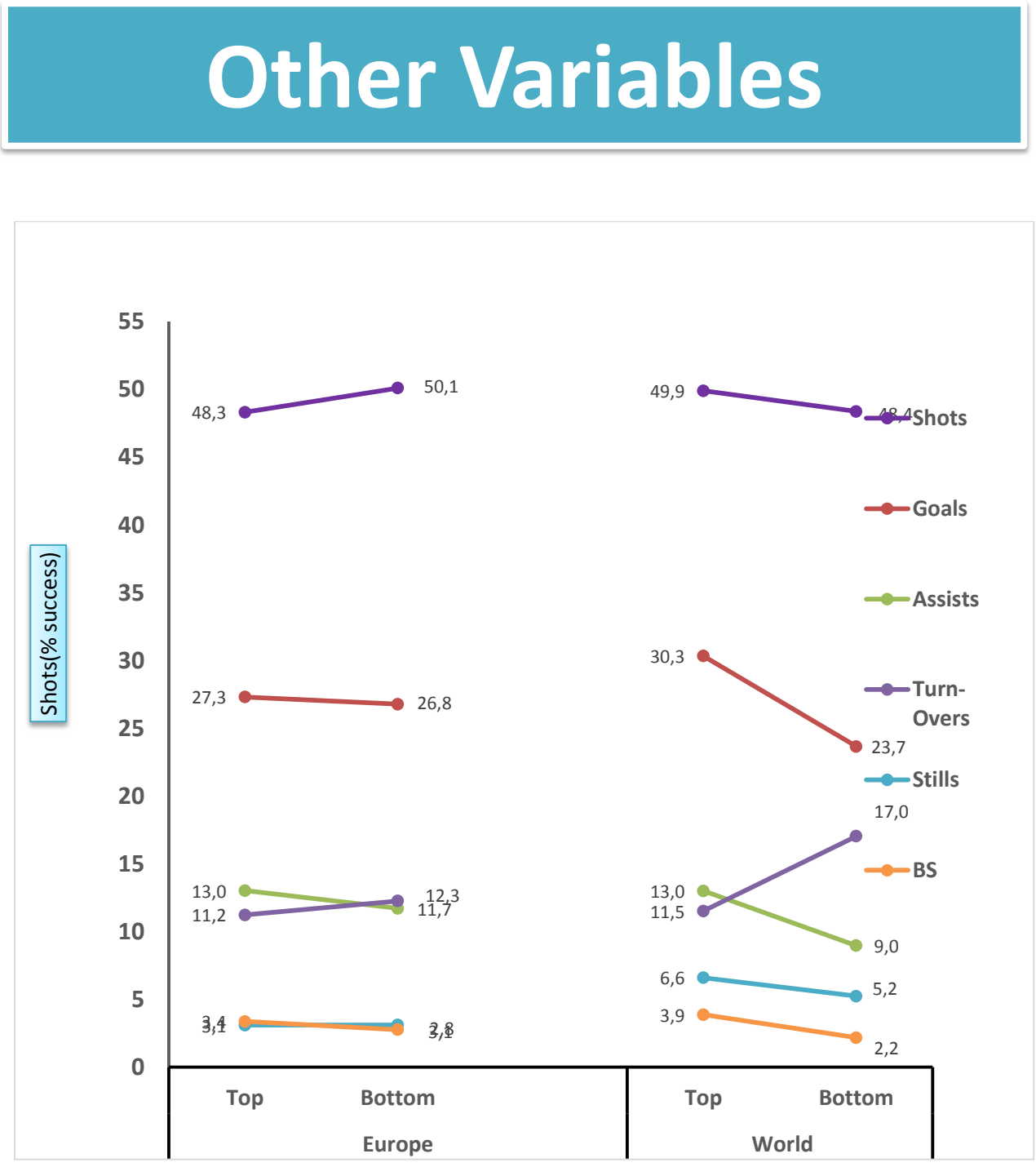


Shots (%success)- efficiency of shots; **6m-**shots from 6 m line; **Wing-** shots from the wing position; **9m-**shots from the 9 m, back court players; **7m-** 7 m throw ;**Fast breaks-** shots from the fast breaks position; **Penetration-** shots from penetration position; **Goal keepers_per-** efficiency of goal keepers; **Europe-**Ech; **World-**Wch; **TOP-**best ranked national team (places 1-4) in each competition; **BOTTOM-** lowest ranked national teams (Ech 13-16, Wch 21-24).

This graph shows the efficiency of shots (goals per shots) by positions, compare the highest and lowes4 ranked team in European and World championships.

There is only one var. with better efficiency from 4 lowest teams. Just in 7 m shots we can find 79.5% success from 4 lowest ranked team and 69% from highest ranked teams (during European championships). All others var. are more successful and with better efficiency in best 4 ranked teams.

Graph 2. Compare other variables between best and worse four ranked teams:



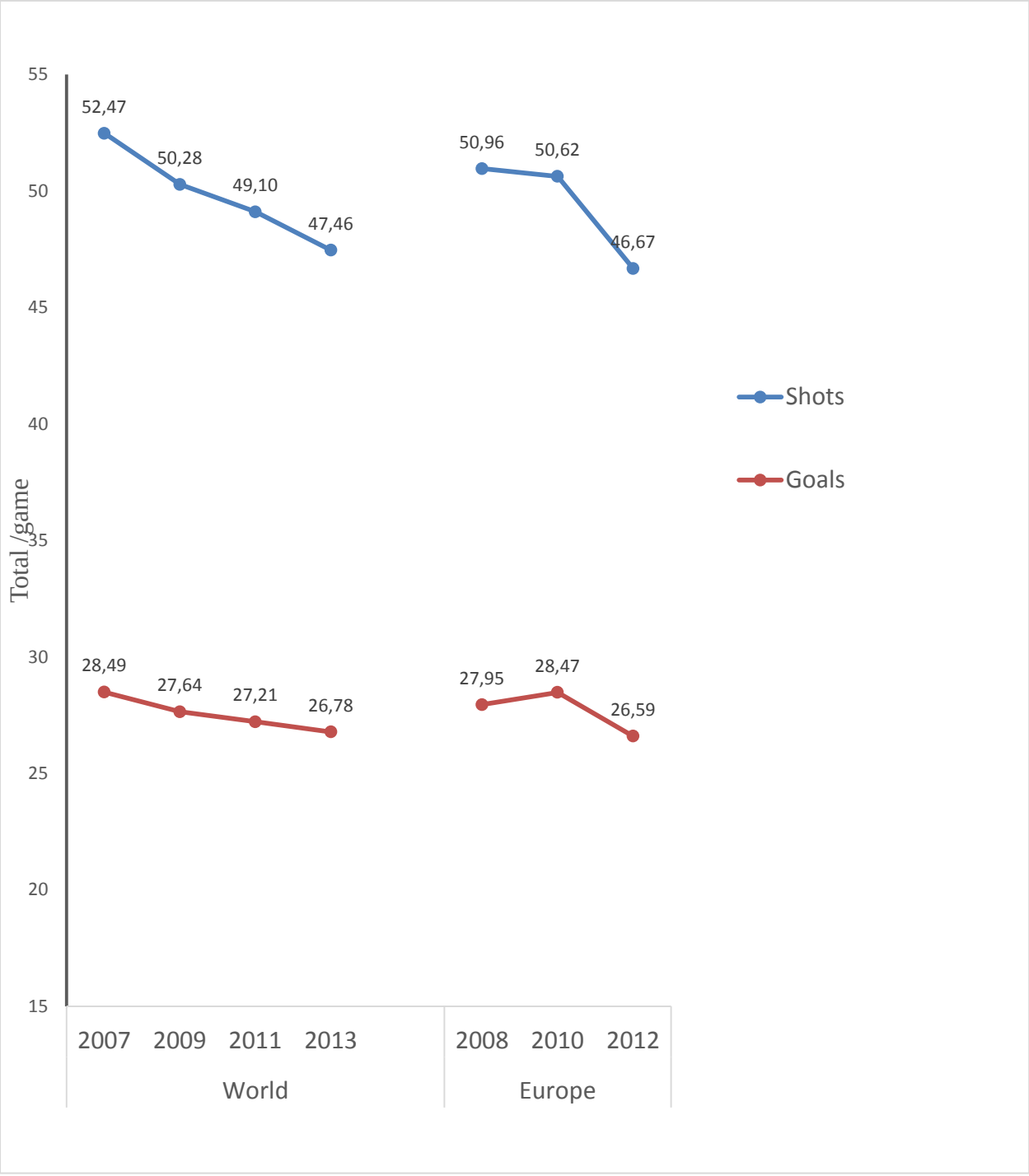
Shots- total number of shots; **Goals-** total number of goals; **Assists-** assists per game; **Turn** over- Turn over per game;**Stills-** stills per game; **Blocks-**blocks per game; Europe-Ech; **World-**Wch; **TOP-**best ranked national team (places 1-4) in each competition; **BOTTOM-** lowest ranked national teams (Ech 13-16, Wch 21-24).

Graph 2 describe "other variables" like total shots, total goals, assists, turn over, stills and blocks, comparing between best ranked teams and lowest ranked team during Ech and Wch. As it looks from the graph that all positive variables (total shots, total goals, assist, stills and blocks) are on higher numbers in average per game. There is only one "positive" variable that is lower in the best 4 teams (48.3 in average per game) than in the 4 worth teams (50.1 in average per game) and it is total number of shots during Ech.

"Negative" variable like is turnover is higher in 4 worth teams during Ech and Wch as well.

It is very clear that different in all variables between 4 best ranked teams and 4 lowest ranked teams during Ech is much smaller than in Wch.

Graph 3. Trends over competition by years:



World Wch; **Europe** Ech; **Total/game** total shots or goals per game in average; **Shots** shots taken per game in average; **Goals** goals scored per game in average.

Graph 3. Describe trends that has been found from the original data from Ech and Wch . This graph compares total number of shots and goals in average per game. As we can see, the trend is that number of shots is going down from competition to competition and during the years. About goals, we can see just one competition that number of goals rose on the graph from 27.95 in 2008 to 28.47 in 2010 (goals in average per game).

Table 4. Spearman's Rho with final ranking:

		Europe				World		
Variable		**2008**	**2010**	**2012**	**2007**	**2009**	**2011**	**2013**
Wings	**Shots (% success)**				**-0.674**	**-0.693**	**-0.492**	**-0.667**
9 m	**Shots (% success)**				**-0.667**	**-0.694**	**-0.619**	**-0.513**
Shots (total)	**% goals**	**-0.624**	**-0.536**		**-0.734**	**-0.740**	**-0.717**	**-0.817**
Goalkeepers	**Saves (%success)**	**-0.624**		**-0.529**	**-0.650**	**-0.728**	**0.598**	**-0.758**

Wings shots (%success) efficiency of shots from wings positions; **9m shots (%success)** efficiency of shots from 9 m, backcourt players; **Shots (total) %goals** score efficiency of total shots ; **Goalkeepers Saves (%success)** efficiency of goalkeepers; **Europe** Ech; **World** Wch

Table 4. describe the correlations between teams descriptive statistics and final ranking. There are only few variables with correlation to final ranking. For the 2008 Euro the efficiency of total shots and the goalkeeper's efficiency were the strongest variables for the final ranking (-0.624). For the 2010 Euro it was only efficiency of total shots (-0.536) and for 2012 Euro it was efficiency of goalkeepers (-0.529). For the world championships final ranking we can see strong correlation between 4 different variables and final ranking: efficiency of shots from the wings (-0.693), efficiency of shots from 9 m (-0.694), efficiency of shots in total (-0.740) and goalkeepers efficiency (-0.728) in average per game.

4. Discussion and conclusions:

Two main findings emerged from the current study: (a) some on-court performance statistics can predict national team rankings on big events of handball (b) Different between best ranked and lowest ranked teams in Ech is much smaller than different between best ranked and lowest ranked teams in Wch**.**

Analyzing all data and statistics details collected from Ech and Wch show us very strong correlation between final ranking (best ranked team and lowest ranked teams) and few variables (from all 14 variables checked). All information and prove for the good correlation shown in table 4. "Spearman's Rho with final ranking".

Strongest correlations with final ranking:

Wch 2007,2009,2011,2013:

1. Wing shots (%success)- efficiency of shooting from the wings positions. Over all World championships analysis in this research there is strong correlation to final ranking. On 2007 (spearman's Rho is -0.674), 2009 (-0.693), 2011 (-0.492) and 2013 (-0.667).

Efficiency in average per game during all 4 Wch is 61.1% for the best 4 ranked teams and 47.3% for the lowest 4 ranked teams. For these results can be two reasons: first, is the quality of the wings players in the best teams comparing to lowest teams. Best teams have wings players with better tactic-technic skills than lowest team's wings players. Second is the reason that best team play collective game in attack, and usually they shot less shots from 9 m and more shots from 6 m line and wings. We can see that correlation between number of shoots from the wings and final ranking is not so strong (7.3 shots per game for best teams and 6.33 shots per game for lowest teams), but situation for the shots from the wings position is much better in best teams. The best teams wings shot with good angle and movement and not like "last solution" for positional attack. When we speak about 61.1% from the wings it is clear that strategy of the team is collective game in attack and using the high level skills of the wings players.

2. 9 m shots (% success)- efficiency of shooting from the back players 9 m positions. Over all World championships analysis in this research there is strong correlation to final ranking. On 2007 (spearman's Rho is -0.674), 2009 (-0.667), 2011 (-0.734) and 2013 (-0.650).

Ohnjec, Vuleta, Milanovic and Gruic found on 2003 research: PERFORMANCE INDICATORS OF TEAMS AT THE 2003 WORLD HANDBALL CHAMPIONSHIP FOR WOMEN IN CROATIA: It can be concluded from the statistical significance that the limitation, that is, the reduction of the unsuccessful shots attempted from the backcourt play positions defined the result achievements in the competition. Namely, unsuccessful attack conclusions from the backcourt positions are usually a consequence of poorly set and realized attack actions.

There is very strong correlation between efficiency of shots from 9 m and final ranking. High efficiency will lead to better ranking. High efficiency of shots from 9 m means that these shots were well prepared and the players choose these shots like good option with good chances to score. We can use more data from this research like is number of shots from 9 m and we will find that best ranked teams shot only 19.65 times per game in average when lowest ranked teams shot 22.14. Selection of shots in best ranked teams is better. We can analyze one more important number and it is the shots from 9 m position from all shots during the game and we will find that best ranked teams shot 39.3% from all shots from 9 m, when lowest ranked teams shot 45.8% from 9 m. Sometimes shooting from 9 m in lowest ranked teams is just because they don't have better solution for attack. Of course different of efficiency for 9 m shot is because best ranked team have better back players with very good tactic and technic skills.

3. Total shots (% success)- efficiency of total shots per game. Over all World championships analysis in this research there is strong correlation between efficiency of all shots (all positions) and final ranking. On 2007 (spearman's Rho is -0.734), 2009 (-0.740), 2011 (-0.717) and 2013 (-0.817).

Efficiency of total shots (all shots from all positions) is 61% for best ranked teams and 49% for lowest ranked teams. Even difference in number of total shots is not so big (49.9 shots per game for best ranked and 48.37 shots for lowest ranked teams) , there is dramatic difference in goals, 30.33 goals per game for best ranked teams and only 23.66 goals per game for lowest ranked teams. This result shows us how best ranked teams use their shots. We can see that best ranked teams shot more from wings, 6 m, 7m, breakthrough and fast breaks comparing to lowest ranked teams. All these shots have better efficiency than 9 m shots and it shows strategy and philosophy of the teams in attack- more collective and better selection of the shots. Only one variable of shooting is higher in lowest ranked teams and it is shooting from 9 m , what can prove that these teams try to shot without idea how to use other positions for shooting with better efficiency.

In this case we can add one more important variable and it is the number of assists per game. Best ranked teams pass 13.01 assists per game, while lowest ranked teams pass only 8.97 assists per game. Usually every assist ends with a shot from good position to score, something that support collective activities in attack.

4. Goalkeepers (%saves)- efficiency of goalkeepers per game. Over all World championships analysis in this research there is strong correlation between efficiency of goalkeepers and final ranking. On 2007 (spearman's Rho is -0.650), 2009 (-0.728), 2011 (-0.598) and 2013 (-0.758).

It is more than clear that goalkeeper's efficiency and goalkeeper's performance will lead to better ranking during each game and competition. Goalkeeper position become very important is handball game. The reason connected to the style of the game. During the last years, since the rules changed (fast restart and advantage for attackers) we find more shots to the goal. Best defense offer the shot from the hardest position for attacker and there is the place where goalkeeper is very important. We can see that best ranked teams goalkeepers save 13.75 times

per game, while lowest ranked teams goalkeepers save 12.91. Efficiency for the best teams goalkeepers is 35% and for the lowest teams goalkeepers is 31%.

Ech 2008,2010, 2012

For the European championships there is only strong correlation to better ranking with two variables:

1. Total shots (% success)- efficiency of total shots per game. On 2008 (spearman's Rho is -0.624), and 2010 (0.536). We can see that correlation between efficiency of total shots (from all positions) and final ranking found just on 2008 and 2010 Euros. There is no strong correlation for this variable on 2012.

2. Goalkeepers (%saves)- efficiency of goalkeepers per game. On 2008 (spearman's Rho is -0.624) and 2012 (-0.529). We can see that correlation between efficiency of goalkeepers and final ranking found just on 2008 and 2012 Euros. There is no strong correlation for this variable on 2010.

5. Conclusions:

Analyzing all data of on- court performance and statistics tests lead us to important conclusions, which support the predicting of team ranking in team handball. For these conclusions I used table 5. (appendix 1). This table shows the summary of all variables from Ech and Wch together.

1. All the best ranked national teams on Ech and Wch from 2007 until 2013 score more goals from the fast break position (6.61 for best ranked teams with 77.1% and 5.06 for lowest ranked teams with 70.1%) and wing position (7.59 for best ranked teams with 60.6% and 6.79 for lowest ranked teams with 3.51%) than bottom national teams. Fast break is connected to defense and goalkeepers abilities and structure (idea and philosophy) of the fast game of the team. Shooting from the wings position is coming from collective game in attack. As much as the team play collective we will find more assists passes per game, more shots from the wings and less shots from 9m positions. With high efficiency of shots from the wing position (one of the strong correlation to best ranking on Wch) we can predict that team which will shot more shots with good efficiency from the wings will be better ranked.

2. Data from "other variables" show us that ratio between assist and turnover is very important for final ranking. As much as this ratio is higher for assist and lower for turnover the final ranking will be better. Of course these two "other variables" are very connected. Last pass can be assist or turnover. It means that the team which take better decisions during the game and open more opportunities for passing (by movement without the ball, special passes like "kempa" pass, better organize defense etc.) will be better ranked.

3. As we can see, there are just two variables on Euro with strong correlation to final ranking. One of them is the efficiency of all shots (just on 2008 and 2010) and second is goalkeepers efficiency (just on 2008 and 2012). For the World championships there are 4 different variables with strong correlation to final ranking (for 4 competition chacked).

It means that different between national team on Euro is much smaller than in World. It is well known that handball is very popular sport in euro and quality of the European teams is better. In all World championships checked on this research all best 4 ranked team came from Europe. In addition, quality of the players and the games are higher in ECH than in WCH and first 10-12 ranked NT's on the world ranking by IHF are European.

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9. European Handball Federation, official website: www.eurohandball.com

10. International Handball Federation, official website: www.ihf.info

Appendix

Appendix 1:

All variables compared between High (best 4 ranked teams) and Low (lowest ranked teams) during all Wch and Ech (7 competitions).

		High		LOW	
		Mean	sd	Mean	sd
	TeamMP	8.57	1.64	5.93	2.48
6m	shots_6m_tot_PER_GAME	6.74	1.78	6.90	2.43
	shots_6m_GOALS_PER_GAME	4.70	1.19	4.68	1.50
	shots_6m_per	70.2%	6.5%	69.8%	11.7%
	per_6m_tot	13.7%	3.6%	14.2%	5.3%
	per_6m_GOALS	16.2%	4.0%	19.0%	6.2%
wing	shots_Wing_tot_PER_GAME	7.59	1.43	6.79	2.17
	shots_Wing_GOALS_PER_GAME	4.61	1.02	3.51	1.66
	shots_Wing_per	60.6%	5.5%	50.3%	11.7%
	per_Wing_tot	15.5%	3.0%	13.9%	4.6%
	per_Wing_GOALS	16.0%	3.5%	14.0%	5.9%
9m	shots_9m_tot_PER_GAME	20.06	3.23	23.36	4.72
	shots_9m_GOALS_PER_GAME	8.37	1.64	8.35	2.61
	shots_9m_per	41.8%	5.3%	35.4%	6.5%
	per_9m_tot	40.7%	5.5%	47.4%	7.4%
	per_9m_GOALS	28.8%	4.7%	33.1%	7.2%
7m	shots_7m_tot_PER_GAME	3.96	1.15	3.47	1.22
	shots_7m_GOALS_PER_GAME	3.03	0.87	2.46	0.90
	shots_7m_per	77.1%	9.4%	71.3%	10.7%
	per_7m_tot	8.1%	2.4%	7.0%	2.3%
	per_7m_GOALS	10.5%	3.0%	10.0%	3.5%
FastBreaks	shots_FastBreaks_tot_PER_GAME	6.61	2.04	5.06	1.45
	shots_FastBreaks_GOALS_PER_GAME	5.05	1.48	3.59	1.26
	shots_FastBreaks_per	77.1%	6.2%	70.1%	10.1%

	per_FastBreaks_tot	13.4%	3.9%	10.3%	2.8%
	per_FastBreaks_GOALS	17.2%	4.4%	14.2%	4.0%
Breakthroughs	Breakthroughs_tot_PER_GAME	4.26	1.55	3.53	2.25
	Breakthroughs_GOALS_PER_GAME	3.27	1.15	2.42	1.33
	Breakthroughs_per	78.2%	9.2%	73.9%	16.4%
	per_Breakthroughs_tot	8.7%	3.4%	7.3%	4.6%
	per_Breakthroughs_GOALS	11.4%	4.1%	9.8%	5.3%
tot_shots	tot_shots_PER_GAME	49.22	2.75	49.11	4.30
	tot_shots_GOALS_PER_GAME	29.03	2.38	25.00	4.08
	tot_shots_per	0.59	0.04	0.51	0.06
other	AS_GAME	13.01	2.18	10.14	3.90
	@TO_GAME	11.39	1.55	14.99	4.72
	ST_GAME	5.10	4.01	4.33	2.77
	BS_GAME	3.65	0.97	2.43	1.53
	YC_GAME	3.00	0.28	2.91	0.26
	@2Min_GAME	3.61	0.93	4.47	1.23
goalkeeper	goalkeeper_stop_PER_GAME	13.19	1.65	12.90	1.89
	goalkeeper_per	0.34	0.04	0.30	0.05

MEAN arithmetic mean; **SD** standard deviation; **SUM** sum; **MIN** minimum amount in average per game; **MAX** maximum amount in average per game;**VAR** variable; **Europe** data from Ech; **World** data from Wch; **Total** summary Ech and Wch; **SHOTS_6 M_TOT_PER_GAME** total shots taken from 6 m line in average per game; **SHOTS_6M_GOALS_PER_GAME** goal area line shots scored (in average per game);**SHOTS_6M_PER** efficiency of area line shots in average per game ;**PER_6M_TOT** area line shots from all shots (% in average per game);**PER_6M_GOALS** area line goals from all goals scored (in average per game); **SHOTS_9 M_TOT_PER_GAME** total shots taken from 9 m, backcourt positions, in average per game; **SHOTS_9M_GOALS_PER_GAME** 9 m shots scored (in average per game);**SHOTS_9M_PER** efficiency of backcourt positions shots in average per game ;**PER_9M_TOT** backcourt positions shots from all shots (% in average per game);**PER_9M_GOALS** backcourt positions goals from all goals scored (in average per game) **SHOTS_WING_TOT_PER_GAME** total shots taken from wings positions in average per game; **SHOTS_WING_GOALS_PER_GAME** wings positions shots scored (in average per game);**SHOTS_WING_PER** efficiency wings positions shots in average per game ;**PER_WING_TOT** wings positions shots from all shots (% in average per game);**PER_WING_GOALS** wings positions goals from all goals scored (in average per game); **SHOTS_7 M_TOT_PER_GAME** total shots taken from 7 m penalty throws in average per game; **SHOTS_7M_GOALS_PER_GAME** goals 7 m penalty throws scored (in average per game);**SHOTS_7M_PER** efficiency of 7 m penalty throws in average per game ;**PER_7M_TOT** 7 m penalty throws from all shots (% in average per game);**PER_7M_GOALS** 7 m penalty throws goals from all goals scored (in average per game); **SHOTS_FASTBREAKS_TOT_PER_GAME** total shots taken from fast breaks in average per game; **SHOTS_FASTBREAKS_GOALS_PER_GAME** goals fast break shots scored (in average per game);**SHOTS_FASTBREAKS_PER** efficiency of fast breaks shots in average per game ;**PER_FASTBREAKS_TOT** fast breaks shots from all shots (% in average per game);**PER_FASTBREAKS_GOALS** fast break goals from all goals scored (in average per game); ; **BREAKTHROUGHS_TOT_PER_GAME** total shots taken from breakthroughs in average per game; **BREAKTHROUTH_GOALS_PER_GAME** goals from breakthroughs scored (in average per game);**BREAKTHROUGHS_PER** efficiency of breakthroughs shots in average per game ;**TOT_SHOTS_PER_GAME** amount of all shots taken from all positions in average per game;

tot_shots_GOALS_PER_GAME amount of goals scored from all positions in average per game; **tot_shots_per** efficiency of all shots from all positions in average per game; **AS_GAME** assists per game in average; **@TO_GAME** turn over per game in average; **ST_GAME** stills per game in average; **BS_GAME** blocks per game in average; **YC_GAME** yellow cards per game; **@2 Min_GAME** 2 min. suspensions per game; **High-** best ranked national teams; **Low-** lowest ranked national teams.

The analysis of the goalkeeper performance in the EHF CL final game

Michael Niederwieser

FIGH – Italian Handball Federation

EUROPEAN HANDBALL FEDERATION

15.09.2014

EHF Master Coach and Licensing Course

Summary

This thesis presents the analysis of the goalkeeper performance in the EHF CL final game 2013/2014 between THW Kiel and Flensburg Handewitt.

In the introduction I am showing the elements about the importance of the handball goalkeeper in the past, the present and in the future. In the second part I analyze and discuss every goal shoot and the movement of the goalkeeper. In the third part I present the result of the analysis by graphic table. In the fourth part I make the conclusion and influence of this performance for the result in the game.

1. Introduction

A lot of Handball experts have the opinion that the goalkeeper performance is more than 50 % of the performance of the whole team. Reasons for this opinion are manifold. A defense with a good goalkeeper has more self confidence because a mistake can be corrected by the goalkeeper and the attackers of the other teams have more respect. The goalkeeper is not only the last defender in a team but also the first attacker. During the time the handball game has become much faster and therefore goalkeepers must handle very well the beginning of the first or second wave and the fast middle.

The handball player and trainer Ante Kostelic asked one time the former player and trainer Zdravko Zovko how many times he trains the defense and how many times he trains the goalkeepers. Kostelic answered that it will be better to train more often the goalkeepers than the defense and to train more the attack with the team because almost all shoots are arriving to the goal.[1] On one hand he is right but on the other hand and in my opinion the defense must be adapted on the quality of the goalkeepers. If you have for instance a goalkeeper with excellence performance on shots from nine meters, you have to play 6:0. If you have a goalkeeper with excellence performance from six meters you can play with a more open defense systems like 5:1 or 3:2:1 and so one. You can also let shoot the wings in such case. You see that the collaboration between goalkeeper and defense must be very good and for that reason you have to train it very often.

This collaboration between the defense and the goalkeeper is very important. If for instance a shot has a speed of 75 km/h it has a speed of 20.83 m/sec and therefore the goalkeeper has only 0.25 seconds reaction time for a shot from five meters distance and 0.5 seconds reaction time for shots from ten meters. The consequence of this abstract physical calculation is that it is impossible for the goalkeeper to save these balls only by reaction. The goalkeeper has to anticipate the ball and for these reason he needs help from the defense, which usually covers one part of the goal and the goalkeeper covers the other part. Normally the goalkeeper covers the short part of the goal. In this way he can wait and have not to move before the shot. But you can also change this behavior and the goalkeeper covers the long part of the goal. This will be usefully if a player is shooting more to the long part of the goal than to the short part. The collaboration between defense and goalkeeper should be very clear and everyone knows what he has to do. If offenders are shooting from the six meters area the defense players have to disturb in that way, that the attackers have only a short time to think about the way of shooting. In this way the goalkeeper has more probability to save the ball.

In the last decades the shots from the six meter area increased from 20 % to 40 %. For this reason it will be more and more important that you have a goalkeeper with a successful behavior in one-to-one situations with the offender.

A lot of experts say that the goalkeeper is only as good as the defense. I think that this belief is partly true. If you have for example a goalkeeper who is saving in a game five penalties from seven meters or five shots from six meters he will make the difference and can decide the game alone. You will see that Kiel could have win the game, but the goalkeeper from Flensburg, Mattias Andersson, had made the difference with more saving actions in comparison to the goalkeeper from Kiel.

But what are the characteristics of a good goalkeeper? In the book from Andreas Thiel and Stefan Hecker "*Halten wie wir*" is written that a good goalkeeper must be: athletic, in a good condition, having a quick reaction, springiness, courage, fighting spirit, self confident and to emanate advantage.[2] The body size is not deciding but in my opinion a goalkeeper has to be minimal 180 cm tall. If you are tall you occupy more space of the goal. In the last years not only the handball players became faster but also the goalkeepers and especially the agility of the goalkeepers became faster. There exist goalkeepers with different forms of technique. For me the most important technique schools are the Scandinavian school with Roland Matson, Mats Olson, Tomas Svensson and the former Yugoslavian school with Abas Arslanagic, Zlatan Arnautovic, Mirco Basic and Arpad Sterbic. In my opinion the best goalkeeper at the moment is Niklas Landin who has an excellent agility despite of his size. I think that a goalkeeper must have a basic technique and he has to adapt this technique to his capacities.

It is not important how the goalkeeper saves the ball. Saving the ball is the most important target.

2. Analysis

Page 1

First picture: 1:0 Kiel
Right half back (left handed player) goes to the left side of the field and throws the ball diagonal from the eight meters distance high on the left side of the goalkeeper Andersson, who goes down on the right side.
My opinion: in similar situations a lot of left hand player are shooting diagonal.

Second picture: 2:0 Kiel
Fast break: Kiel's right hand attacker jumps from the six meters line in the middle of the field and shoots diagonal down on the right side of Andersson, who moves the left leg.
My opinion: holding this shot is very difficult for the goalkeeper.

Page 2

First picture: save from Andersson and goal Flensburg: 2:1
Fast break for Kiel and save from Andersson (you cannot see it in the picture): Kiel's right hand attacker jumps from the six meters line in the middle of the area and shoots diagonal high on the right side of Andersson, who holds the ball.
My opinion: Good save from the goalkeeper.

Goal Flensburg: During the third wave the right wing player jumps and shoots with the lower arm between the legs of the Kiel's goalkeeper.
My opinion: the goalkeeper could have read this shoot. It was not necessary to open the legs: he could have gone down with the arms and let the legs closed.

Second picture: 3:1 Kiel
Right half back (left handed player) shoots in elevation from the nine meters of the right side of the field and shoots down on the long right side of Andersson.
My opinion: holding this shot is very difficult for the goalkeeper.

Page 3

Not to analyze, because the player shoots out.

Page 4

First picture: 4:1 Kiel
Central player shoots from the middle of the field high on the right short side of Andersson.
My opinion: the goalkeeper must hold this ball, because it is on the right short side.

Second picture: save from Sjöstrand
Right wing (left handed player) jumps and shoots with the arm low at half height on the long side of the goalkeeper.
My opinion: Good save from the goalkeeper.

Page 5

First picture:
Not to analyze.

Second picture: 4:2 Flensburg
Middle player bursts into the defense and shoots down from the right side of the field from the six meters line.
My opinion: holding this shot is very difficult for the goalkeeper.

Page 6

First picture: goal Kiel 5:2
Left wing shoots. Impossible to analyze on the cut.

Second Picture: 6:2 Kiel and 6:3 Flensburg
First wave: left wing shoots diagonal on the right side of the goalkeeper from the middle of the six meters area.
My opinion: holding this shot is very difficult for the goalkeeper.

Fast middle for Flensburg and right back (left handed player) shoots from six meters on the left short side of the goalkeeper.
My opinion: very difficult to hold for the goalkeeper. Sjöstrand moves the right foot before the shoot and the defender covers the long side, so it is not necessary to move before on the long side.

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First picture: 7:3 Kiel
The middle player shoots jumping the high corner on the left side of the goalkeeper from the middle of the field.
My opinion: holding this shot is very difficult for the goalkeeper.

Second picture:
Not to analyze.

Page 8

First picture: 8:3 Kiel
Fast break: the left wing shoots from the right wing position between the legs of the goalkeeper.
My opinion: not impossible to hold the ball. The attacker is falling down and in this case it is very difficult to shoot high.

Second picture:
Not to analyze.

Page 9

First picture: save from Andersson
Right back (left handed player) goes to the middle of the field and shoots in elevation, down on the left side of the goalkeeper.
My opinion: good save from the goalkeeper.

Second picture: Save from Andersson and goal Flensburg 8:4
Save from Andersson: right back (left handed player) shoots between the feet of the goalkeeper from the right side of the six meters area.
My opinion: in this situation it is very easy for the goalkeeper, because the attacker is under foul and he has not the possibility to make a good shoot.

Goal in the second wave for Flensburg: the right wing shots from his position with the arm completely opened on the long corner on the middle high of the goalkeeper.
My opinion: The goalkeeper from Kiel makes a wrong movement: he moves to the short corner without reading the movement of the attacker's arm. The attacker can only shoot on the long corner.

Page 10

First picture: First wave shot from Andersson and goal Flensburg 8:5
Good shot from Andersson and goal from the right wing from the six meters area to the right corner between the feet of the goalkeeper from Kiel.
My opinion: saving this shot is very difficult for the goalkeeper, but in the last moment the attacker's arm opens and the attacker can shoot only in that corner. The goalkeeper could have read this movement.

Second picture: 9:5 Kiel
Right back (left handed player) shoots in elevation from his position down in the middle of the goal.
My opinion: the goalkeeper should have saved this ball but he moves before the shot.

Page 11

First Picture: save from Sjöstrand
Shot from the right side of the six meters area, diagonal middle-high to the right side of the goal.
My opinion: it is a good save from the goalkeeper, but he is lucky because he saves this ball with his head.

Second picture: save Sjostrand and goal Kiel 10:5
Left handed player shoots from the six meters area with the arm high and he shoots high to the first corner.
My opinion: good save from the goalkeeper.

Second wave: Kiel's left wing shoots from his position low to the first corner.
My opinion: The attacker's arm goes down and the goalkeeper could have saved the ball. Andersson had not to jump.

Page 12

First picture: save from Sjöstrand and goal Kiel 11:5
The middle player shoots from his position down on the right side of the goalkeeper.
My opinion: Good save from the goalkeeper.

Goal in second wave: the left wing shoots from his position from the six meters area down on the long side of the goalkeeper.
My opinion: holding this shot is very difficult for the goalkeeper.

Second picture: 11:6 Flensburg
Right half back (left handed player)shoots from the six meters area from his position high to the long corner.
My opinion: the attacker has a defender in front of him. The attacker has the arm high and so he can shoot only high. Sjöstrand has his arms down and so he cannot save this ball. I think that the goalkeeper should have saved this ball.

Page 13

First Picture: Save from Sjöstrand
The right back shoots from the middle of the field down on the right side of the goalkeeper.
My opinion: Good save from the goalkeeper.

Second Picture: Kiel 12:6 and save from Sjöstrand
Right wing jumps from the six meters line and throws with the hand completely opened in the long corner.
My opinion: the goalkeeper must hold this ball, because the wing can only shoot in that corner.

The right wing jumps from the six meters line and shoots middle high in the first corner of the goalkeeper.
My opinion: good save from the goalkeeper.

Page 14

First picture: Save from Andersson
Right back (left handed player) shoots in elevation from his position in the first corner. The goalkeeper saves the ball with his hands.
My opinion: Good defense and the goalkeeper must save this ball.

Second Picture: goal Flensburg 12:7
Penalty from seven meters line: Flensburg left wing makes a feint and shoots with the arm up and open high on the left side of the goalkeeper.
My opinion: the goalkeeper falls down, but looking at the attacker's arm the goalkeeper can understand that the shot will probably be high and not down.

Page 15

First Picture: Save from Andersson and rebound

Middle player shoots from the eight meters line from the middle of the field down on the left side of the goalkeeper and the rebound goes to a Kiel's player on the six meters line but the goal is not accepted.

My opinion: good save from Andersson.

Second picture:

Reply of the first picture.

Page 16

First picture: 12:8 Flensburg

The attacker shoots from the right side of the six meter area with the arm in a high position. He shoots diagonal high.

My opinion: holding this shot is difficult for the goalkeeper, but the goalkeeper can understand that the shot will be probably high because of the position of the arm.

Second picture: Save from Andersson

Right wing shoots from his position but with lots of space. Andersson saves the ball in the long corner.

My opinion: good save from Andersson, because he looks to the arm position.

Page 17

First Picture: 12:9 Flensburg

Right wing shoots from his position with the arm opened and high to the long corner.

My opinion: the goalkeeper follows the arm movement but he moves a little bit too late.

Second picture: 13:9 Kiel

The left wing shoots hindered by the defender and he shoots down to the long corner.

My opinion: the goalkeeper must save this ball. Because of the movement and the jump, the goalkeeper can understand that the shot will be down.

Goal Flensburg 13:10

You cannot see it on the video.

Page 18

First picture: save Andersson
Right half back shoots from his position down to the short corner of the goalkeeper.
My opinion: good save from the goalkeeper.

Second Picture: save from Sjöstrand and goal Kiel 14:10 and goal Flensburg 14:11
Right half back shoots from his position down to the short corner of the goalkeeper.
My opinion: good save from the goalkeeper.

Right half back shoots from the eight meters line from his position down to the short corner.
My opinion: the goalkeeper should have saved this ball.

Right half back go one-to-one and shoots from the six meters line hindered by the defender down to the long corner.
My opinion: the attacker is falling down and his arm is open, so he can shoot only in that corner, but the goalkeeper moves to late.

Side 19

First Picture: fast break shot from Andersson and goal Flensburg 14:12
Shot from Andersson to the left wing, who shoots from the six meters line to the long corner.
My opinion: good shot from the goalkeeper. Sjöstrand can only pay attention to the attacker's movements to understand that the shot would be high.

Second picture: 15:12 Kiel
From the six meters line of the left side of the field falling down shot goes diagonal high on the right side of the goalkeeper.
My opinion: good shot impossible to save.

Page 20

First Picture: 16:12 Kiel
Fast break: left handed player shoots from the six meters line of the right side of the field diagonal down to the long corner.
My opinion: Following the arm movement the goalkeeper can understand that the attacker can shoot only to the long corner, but Andersson moves the other leg.

Second Picture: Goal Flensburg 16:13
Left handed player shoots from the middle of the field over the block but the ball arrives distractedly in the goal.
My opinion: difficult to save. The goalkeeper falls down.

Page 21

First picture: save from Andersson, save from Sjoestrand, save from Andersson
The attacker shoots down from the middle of the field on the left side of the goalkeeper Andersson.
My opinion: good save.

The attacker (left handed player) shoots from the seven meters line of the middle of the field middle high on the right side of the goalkeeper.
My opinion: good save from Sjoestrand and he follows the arm movement of the attacker.

Fast break: the attacker shoots in elevation from the eight meters line of the right side of the field, diagonal down on the right side of the goalkeeper.
My opinion: Good save from Andersson.

Second picture: fast break shot from Andersson and goal Flensburg 16:14

Good shot from goalkeeper Andersson to the right wing and shot from the middle of the field from the six meters line down on the left side of the goalkeeper.
My opinion: saving this shot is difficult for the goalkeeper.

Page 22

First picture:
not to analyze.

Second picture: 16:15 Flensburg
Right half back (left handed player) shoots from the six meters line diagonal high on the right side of the goalkeeper.
My opinion: the attacker has his arm high and the goalkeeper goes down.

Page 23

First picture: 17:15 Kiel
Right half back (left handed player) shoots from the seven meters line with a defender in front of him without jumping diagonal on the left side of the goalkeeper.
My opinion: Andersson starts to fast to the long corner.

Second picture: save from Sjoestrand and rebound goal Flensburg 17:16
Left wing player shoots from his position to the long corner down and the goalkeeper from Kiel saves the ball. The rebound is taken by Flensburg's wing, who shoots into the goal from the six meters line down to the left side of the goalkeeper.
My opinion: Good save from Sjoestrand but the goal is not regular, because the left wing is inside the six meters area and he goes out to take the rebound covering the others players. This shoot is difficult to save but studying the movement of the arm it is possible to. The goalkeeper moves the wrong foot.

Page24

First Picture: 18:16 Kiel and save from Sjoestrand and rebound goal Flensburg 18:17
Middle player right handed player shoots from the nine meters line from his position. He shoots down to the first corner.
My opinion: Andersson should have held this ball.

Right half back (left handed player) shoots from the six meters line disturbed by a defender. He shoots down in the middle of the goal. The goalkeeper saves the ball but the rebound goes to the attacker who shoots from the six meters line.
My opinion: first good save from Sjoestrand. It is impossible for him to hold the other shoot.

Second picture: 19:17 Kiel
Kiel's central player jumps from the middle of the field and shoots to the first corner.
My opinion: Andersson does not consider the movement of the body, of the arm and the block of the defender. The goalkeeper moves before the shoot.

Page 25

First picture: Save from Andersson
The right wing shoots from his position from six meters line with his arm high. He shoots high.
My opinion: good save from Andersson.

Second picture: goal Flensburg 19:18 and save from Andersson

Right half back (left handed player) shoots from the nine meters line from his position up to the long corner.
My opinion: the goalkeeper does not consider the defender's block and he moves before the shoot.

Right half back (left handed player) from Kiel shoots from nine meters line from his position down to the first corner.
My opinion: good save from Andersson.

Page 26

First picture: 19:19 Flensburg
Left half back shoots from six meters line down diagonal on the left side of the goalkeeper to the long corner.
My opinion: it is a good shot, it is difficult to save this shot but considering the movement of the arm the attacker can shoot only in this corner.

Second picture: Save from Andersson
Right half back shoots from seven meters distance from the left side of the field with a defender in front of him. He shoots down in the middle of the goal.
My opinion: it is easy to save this ball for the goalkeeper.

Page 27

First Picture: 19:20 Flensburg
Right wing jumps from his position and passes the ball to the left wing in the air.
My opinion: spectacular goal. It is impossible to hold this ball.

Second picture: save from Andersson
The pivot shoots from six meters area with the hand open downstairs on the short side of the goalkeeper.
My opinion: Good saving action from Andersson because he considered the movement of the body and the arm of the attacker

Page 28

First picture: goal Flensburg 19:21 and save from Andersson

The right half back (left handed player) jumps from ten meters distance from his position and shoots to the long corner diagonal.
My opinion: the goalkeeper stays too much on the first corner.

Middle player of Kiel shoots from the nine meters line from his position. He shoots diagonal high.
My opinion: good save from Andersson because he considers the defenses' block and the movement of the arm.

Second picture:
Not to analyze.

Page 29

First picture: **save from Andersson**
Right wing jumps from his position with a lot of space and shoots middle-high diagonal to the long corner.
My opinion: good save from the goalkeeper, because he considers the movement of the arm.

Second picture: 20:21 Kiel
Central player shoots from his position in the short corner high on the left side of the goalkeeper.
My opinion: Andersson does not consider the arm and the defense's block and in addition he moves before the shoot.

Page 30

First picture: 20:22 Flensburg
Right half back (left handed player) shoots from the middle of the field. He shoots diagonal down in the first corner.
My opinion: it is very difficult to save the ball.

Second picture: save from Andersson
Central player shoots from the middle of the field in the center of the goal.
My opinion: it is easy to save this ball.

Page 31

First picture:20:23 Flensburg
Right wing jumps from his position with a lot of space and shoots down in the first corner.
My opinion: It is difficult to save this ball but usually when wing players have lot of space they prefer to shoot in the first corner. Also the movement of the arm can help the goalkeeper to understand the direction of the ball.

Second picture:
Not to analyze.

Page 32

First picture: 21:23 Kiel
Central player shoots from his position from seven meters distance. He shoots high diagonal on the right side of the goalkeeper.
My opinion: it is very difficult to hold this ball, because the defender is making a block and the attacker comes very fast until seven meters line.

Second picture: 21:24 Flensburg
Rebounded ball from right wing who shoots diagonal down in the long corner of the goalkeeper.
My opinion: the goalkeeper should have saved this ball just following the movement of the body and of the arm. In this case the shoot can go only in that direction.

Page 33

First picture: 21:25 Flensburg
Fast break and goal from the six meters line of the middle of the field. A right handed player shoots diagonal on the right side of the goalkeeper.
My opinion: it is difficult to hold this ball but the goalkeeper should have considered the movement of the body.

Second picture: Save from Andersson and save from Palicka
Fast break action: shot from six meters line high on the right side of the goalkeeper.
My opinion: excellent save from Andersson.

Pivot shoots from the six meters line from the right side. He shoots down diagonal on the right side of the goalkeeper.
My opinion: good save from the goalkeeper.

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First picture: 22:25 Kiel
Shoot from six meters line from pivot position high on the left side of the goalkeeper.
My opinion: it is very difficult to save this ball but the attacker has the hand high.

Second picture: 22:26 Flensburg
The left wing jumps with the hand completely down and he shoots down in the first corner.
My opinion: the goalkeeper does not consider the movement of the arm and Palicka opens the first corner before the shoot.

Page 35

First picture: 23:26 Kiel
The central player shoots from his position from nine meters distance high on the left side of the goalkeeper.
My opinion: the goalkeeper moves before the shot to the right corner. The attacker can shoot the ball only in this way and so the goalkeeper must leave his hands up.

Second Picture: save from Palicka and save from Andersson
Rebound on the left wing jumping from his position with hand open in high position and shooting high on the long corner of the goalkeeper.
My opinion: Good saving action of Kiels goalkeeper.

In the fast break second wave shoot from the right half back from nine meters from the middle of the field with two defenders before him downstairs in the middle of the goal.
My opinion: good defense work and goalkeeper have to hold this ball.

Page 36

First picture: 24:26 Kiel
Left half back shoots from his position high in the first corner of the goalkeeper.
My opinion: the goalkeeper should have saved this ball because the first corner belongs to him.

Second picture: 25:26 Kiel
Right half back is shooting in the second wave downstairs on the long corner of the goal.

My opinion: Andersson is not considering the block and is moving before the shoot on the wrong corner.

Page 37

First picture: 25:27 Flensburg
Left wing in second wave shoots from six meters line and there is a defender disturbing him. He shoots in the first corner down.
My opinion: the goalkeeper does not consider the defender position and the attacker's body and hand.

Second picture: save from Andersson
Right back (left handed player) shoots from the nine meters line of his position. The shot is in the middle of the goal and the rebound goes on the crossbeam.
My opinion: the goalkeeper should have saved the ball.

Page 38

First picture:
Reply.

Second picture: 25:28 Flensburg
Shot from six meters line.
My opinion: it is not good to analyze.

Page 39

First picture: 26:28 Kiel
Right wing jumps from his position and shoots with the hand open in the long corner.
My opinion: Good shoot but the goalkeeper is to slow to close the long corner and he moves the wrong leg.

Second picture:
Replay.

Page 40

First picture: 26:29 Flensburg
Left handed player shoots from pivot position falling down and having the hand completely open. He shoots down on the right side of the goalkeeper.
My opinion: the goalkeeper does not consider the movement of the body and of the attacker's hand.

Second picture: 27:29 Kiel
Central player shoots from the six meters line (pivot position) on the left side of the field down to the short corner.
My opinion: It is very difficult to save this ball but the probability that the player shoots to the short corner is high.

Page 41

First picture:
Not to analyze.

Second picture: 28:29 Kiel
Right half back (left handed player) shoots from the seven meters line to the long corner.
My opinion: Andersson goes to the wrong corner without considering the block on this corner.

Page 42

First picture:
Reply.

Second picture: 28:30 Flensburg
Right half back from pivot position (six meters line) shoots falling down and having the hand down. He shoots down.
My opinion: the goalkeeper has to consider the movement of the body and the attacker's hand. He should have gone down.

Page 43

First Picture: double save from Andersson
Left half back goes to the right side of the field and shoots diagonal on the right side of the goalkeeper.

My opinion: Good save from Andersson, because in similar situation 90% of shots from right handed player are thrown on the right side of the goalkeeper.

Middle player shoots from his position on the left side of the goalkeeper.
My opinion: Good save action, because the middle player shoots very often in this corner during this game.

Second picture:
Not to analyze.

Page 44

First picture: save from Andersson
Right half back shoots against the block.
My opinion: for Andersson it is very easy to hold this last ball.

3. Results

	6m save	7 to 11 m save	fast break	goal	%
Flensburg	8	14	3	28	44
Kiel	6	5	0	30	27

4. Conclusion

Mattia Andersson, Flensburg's goalkeeper, made the difference for the result of this game.
He saved eight balls from the six meters distance and fourteen balls from seven to eleven meters distance. In total he saved twenty-two shots in final.
The two goalkeepers of Kiel saved six shots from the six meters distance and five balls from seven to eleven meters. Totally they saved only eleven shots.
As a result the goalkeeper Andersson saved eleven shots more than the goalkeepers of Kiel Johan Sjöstrand and Mattias Palicka.
In addition Andersson started three fast break actions with successful goal actions. Sjoestrand and Palicka started no fast break actions.
Considering the final result (30:28), it is clear that the goalkeeper made the difference.
Probably with a better goalkeepers' performance, Kiel could have win the final.

5. Bibliography

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OFFENCE SYSTEMS AGAINST 5:1 DEFENSE

MACEDONIA HANDBALL FEDERATION

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Title: OFFENCE SYSTEMS AGAINST 5:1 DEFENSE

Abstract

This paper covers the offensive systems attack on 5:1 zone defense, i.e. theory and methods of attack on 5:1 zone defense in handball.

The first part presents a short analysis of the 5:1 defense. 5:1 zone defense in handball is frequently used when it comes to professional handball and to lower rank teams and youth teams as well. In the case of 5:1 zone defense there are five defending players on the six-meter line. In the middle of the handball court, aka zone, there is one player deep in the playing field (the basic position would be approximately 9 meters from the goal). When the offensive players change into an attacking formation with two lineplayers, this zone quickly transforms into combined defense 5+1, 4+2 or zone defense 6:0. The attack on zone defense requires different specific skills of the players that will enable proper tactical play for them. In the second part of this paper, the strategic principles or the offensive directions for attacking a 5:1 zone defense, as well as several tactical combinations are explained, i.e. plans of attacks, which are used by teams and which are intended for attacking this specific zone formation. It covers collective combinations in order to use all players, in which particular case the weaknesses of this defense are either attacked or exploited. The third part presents the methodological actions which are mainly used for learning and training of the presented offensive combinations. A graphic presentation of the described matter is given using figures from the program Easy Sports – Graphics Handball 2.0. This paper shall be easily used as a handbook for handball coaches when working with their teams.

Key words: handball, attack on 5:1 zone defense, learning and training methodology of the attack on 5:1 zone defense.

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1.Introduction

Sport is a crucial element in human life. The same applies to sports games as one of the most popular types of sports. The core of sports games is the successful joint cooperation accompanied by individual human ideas. Handball, the most popular and most dynamic sports game worldwide, is one of these games. Handball is the number one sport in Macedonia and its popularity and ratings increase day in day out.

The form of motor structures that are part of the game classify handball in the group of half-structural complex sports. The game consists of a large number of motor structural units that the players perform with or without a ball. Complexity is yet another crucial characteristic of handball. The individual activities as part of the game have cyclic and acyclic movements. All motor structures are implemented in the game under certain conditions in the presence of an opponent and taking into account the rules of the game. Hence, the selection and implementation largely depend on the situation in the given game. Then, the individual, i.e. player must choose the activities or movements which would contribute to successfully carrying out the desired action plan. The efficiency of these activities would depend on the structure and level of handball development to an important dimension of psychosomatic status (internal performance factors), training conditions and objective factors (external performance factors). As I already mentioned we can easily place handball in the polystructrural complex sport category. This implies that handball consists of or is structured out of a number of individual elements (structural elements, technical – tactical elements or elements of basic or specific handball motorics) which are performed by the players during the game in a complicated manner and in cooperation with their teammates or during a duel with their opponents. In the course of the cooperation or inability to cooperate due to the opponents, different structural situations (actions) occur that may be typical (they occur rarely in the course of the play or as a novelty in a rather unexpected way and the players in such a form are not identified).

Handball is divided into phases or parts. The basic division is in two main phases:

- defense phase
- attack phase

The defense phase is divided into two sub-phases:

- sub-phase return to defense
- sub-phase defense with zone or combined defense

The attack phase is also divided into two sub-phases:

- sub-phase of counterattack (individual and collective)
- sub-phase of attack on zone or combined defense (Sibila, Bon, Peri, 2006).

In addition to this, there are other very significant criteria that we have to take into consideration when it comes to resolving problems in modern handball games. Namely,

- In all phases of the game there are precisely defined roles which are determined in terms of space, time and situation.
- Universality of players (to be able to solve problems in different phases of the handball game in different structured situations)
- Transfer of the focus of the game in offense through different forms of counter-attack
- More and more activities and movements without a ball when in offence.
- Transfer of the focus of the game in defense by way of effective turnover play and playing in a deep zone formation which would disable shooting and passing the ball from long and medium distances. The manner of developing the game in zone formation is: atypical non-European, defense with exclusively offensive deep formations: (1:5, 3:2:1), and European defense, where shallow defense formations are formed (6:0, 5:1), (Sibila, 2004).

Big development steps were taken in the past few years in handball. They can be seen from the following:

- The players run more and faster
- There are more technical and tactical elements
- The average number of attacks has increased, leading to an increased number of goals as well
- More action in the game

This is the result of:

- Change of rules of the game
- Large number of professional clubs and leagues
- Introduction of new scientific studies in theory and practice in handball

The trends necessary to be followed for the development of handball when it comes to offense, and defense as well, are the following:

1. Trends for defense development:

- The most popular defense systems are: 6:0, 5:1, 3:2:1
- Defense systems are getting more and more flexible and adjustable to the opponent
- Variable defense systems are set by the teams, based on the individual abilities of the defending players.

- Passing the ball to the pivot is significantly hindered.
- The defending players are strong in feet movement and hand coordination, which improves the orientation in the defense area.
- Fast return in defense in order to hinder the opponents counterattack.
- Fast turnover play with a given target.
- Improved tactic to hinder counterattack.
- Improved skill of the defending player that enables flexibility in the game and tactical strategies.
- Placement of two shot blocking specialists.

2. Trends for counterattack development

- A turnover is reflected with a fast counterattack.
- Set tasks for the players in counterattack.
- Counterattack with a single pass.
- First wave with one or two players.
- Second wave that follows after the first.
- The first pass in opening the counterattack by the defending player which is being developed in the middle of the court.
- Limited success of the counterattack in matches for the highest honors.

3. Trends for game development in offense on established zone, or combined defense.

- The use of bounce passes to the pivot, even in impossible situations.
- The use of different fast passes (volleyball pass and alley-oop).
- Decreased number of bad passes increases the chance to create a situation for scoring a goal.
- Improved technical performance of the player (better technical trainings, catching the ball with one hand).
- Large number of players that play 1:1 and create an empty player, i.e. an extra.
- Increased percentage of accurate passes performed under pressure by the defending players.
- Increased number of team attacks.
- Shorter offense time.
- The number of passes, while preparing for the attack, is 4 or 5.
- 1:1 game in aggressive defense.
- Game strategy in offense is generally based on 1:1 and 2:2.
- Despite the fact that good defense hinders counterattack, the teams try to score a goal from counterattacks or an extended fast break.
- The short exchange of passes between the backcourts and wingmen are important.
- Fast game with appointed tasks.
- 3:3 and 4:2 formation offence, (Percic, 2009)

2.Methods

While writing this paper I used diverse literature from the area of handball. The different articles in the periodical literature (mostly the magazine “Trener vo rakomet” (Handball Coach)) and books in Macedonian or foreign languages, were of big help to me when writing this paper. The literature (English) that I found on the web page of EHF also helped me greatly.

Some of the literature I got was from authors who dealt with this topic as their undergraduate thesis, and also from my extensive handball experience while working with top handball coaches. I showed the different situations in the 5:1 defending formation, as well as attacking the 5:1 defending formation in the program Easy Sports-Graphics Handball 2.0.

The program Easy Sports-Graphics Handball 2.0 is a program for analyzing matches, a program for outlined presentation of the planned actions, program for planning training sessions etc. A program that is very simple and easy to work with. Using the program the court, the ball and the players are drawn on different positions.

3.Development

In everyday practice we come across with two expressions that have multiple uses for the same thing – tactics and strategy in the game.

In order to create an organized tactic or attack strategy on the zone formation 5:1, it is necessary to know the basic principles of this 5:1 zone formation. The basic placement of the players in the 5:1 zone formation is shown in Fig.1. In the basic placement five players are on the line of the goalkeeper's space, and one is in the middle of the court a little bit more forward in the playing field, near to the 9 m line.

The defending players have special names. We name the players as first and second on the left or right side, back center and front center. This zone system enables deep defense, hinders the fast movement of the ball, and enables uninterrupted execution of actions, as well as fast development of counterattacks when the ball is intercepted

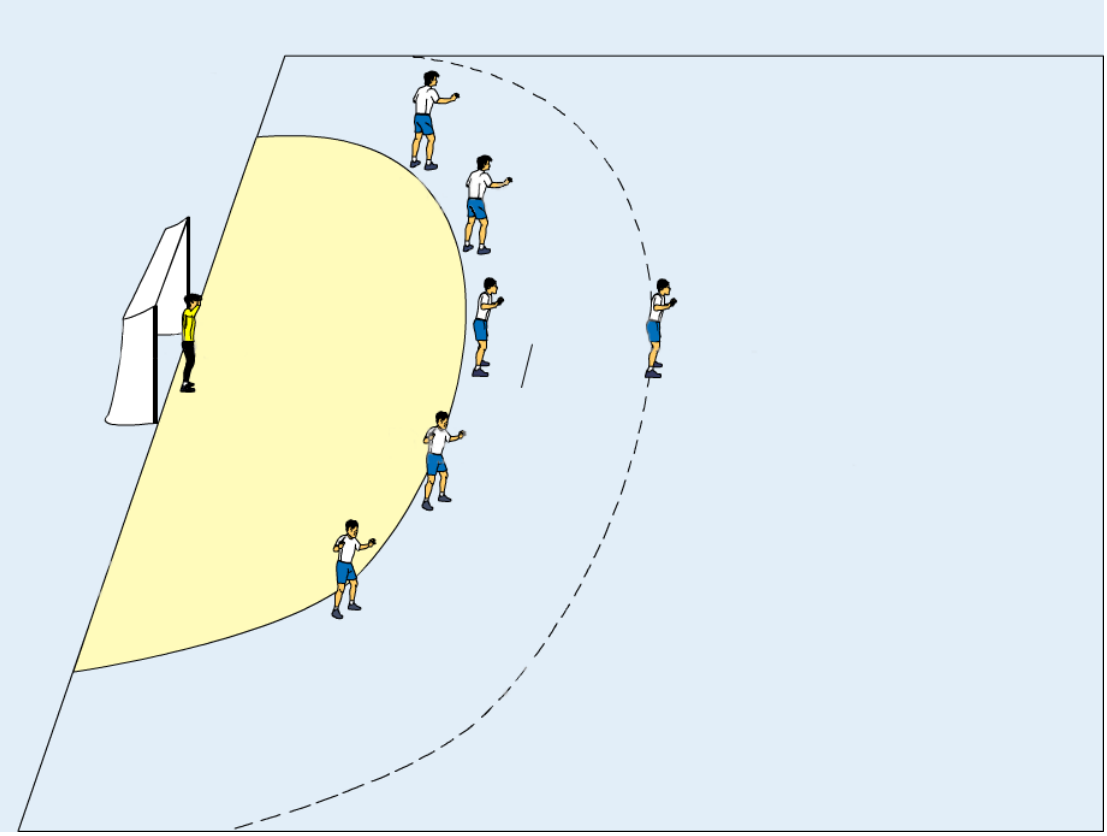

Figure 1. Basic placement of the players in 5:1 zone (Sibila, 2004)

The movement of the defending players in accordance to the location of the ball will be also shown.

3.1.Way of defense of the first defending player or the half right and half left players

The primary task of the outside left and outside right player is to decrease the space for attack by fast side movement, i.e. the width of the defense, and to intercept passes to the wingman, which, in terms will hinder the sprint of the backcourt player in offence, as well as to quickly return to help in cooperation against the pivot (Fig.2.).

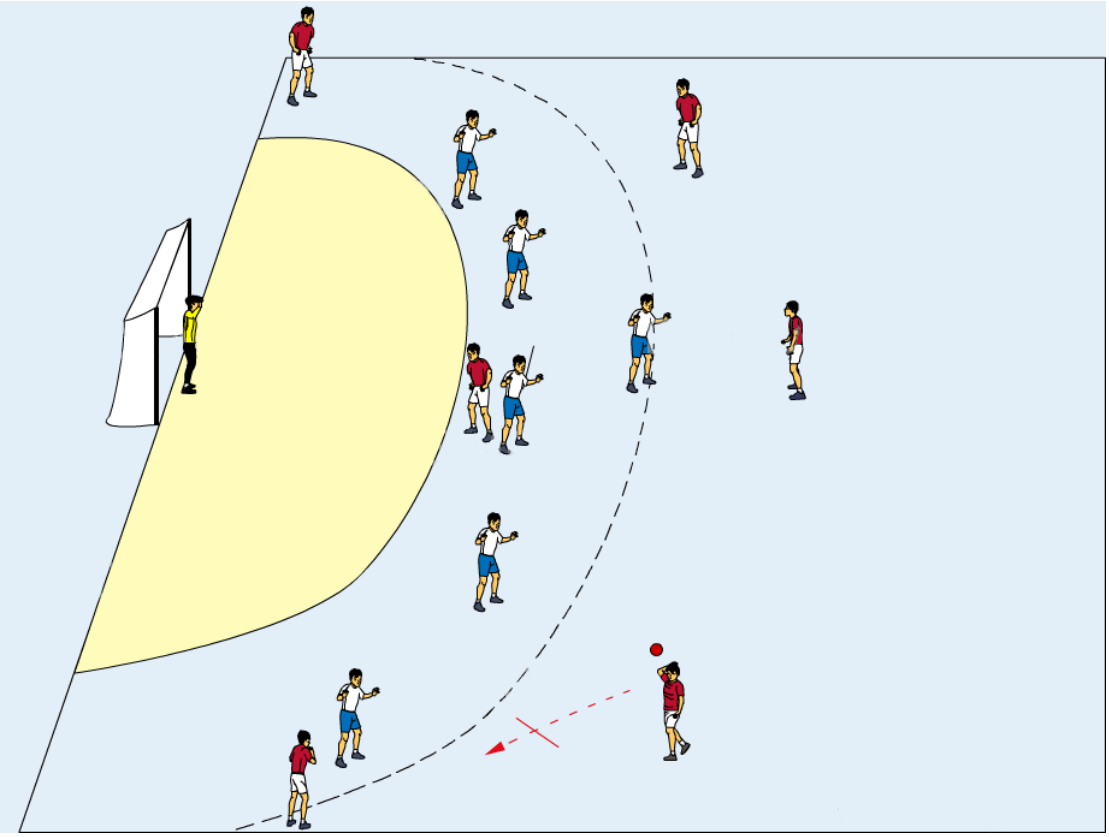

Figure 2 The position of the primary defending player, "intercepting the wingman" right when the outside offensive player prepares to pass the ball. (Sibila, Bon, Pori, 2006)

3.2.Way of defense of the second defending player (half) from left and right, as well as of the back center.

The main task of these defending players is to hinder the shot of the two back centers, and to hamper the penetration in the shot area, i.e. the goalkeeper's space. With their movement they need to create bigger density with which they will render it difficult the pass to the pivot. The game of these players greatly depends on the position of the pivot. The basic movement of the center half is to cover the pivot. They are the conductors of the defense and they should never leave the goal area line, except in rare occasions when the front center is blocked.

3.3.Way of defense of the front center.

The front center is appointed to cover the middle player or any player that will attack their space. They help the two second players in hindering the left and right backcourt player.

To successfully play the 5:1 formation, the following rule is to be followed:

- The second defending players help the first players when the wingmen dribble towards the middle.
- The second players help the front center when the centre back player penetrates between them and the front center.
- The front center helps the second defending players (halves) when the backcourt players try to pierce the middle.
- The first and the back centre players help the halves when they help in the center. (Ceranic, 2006).

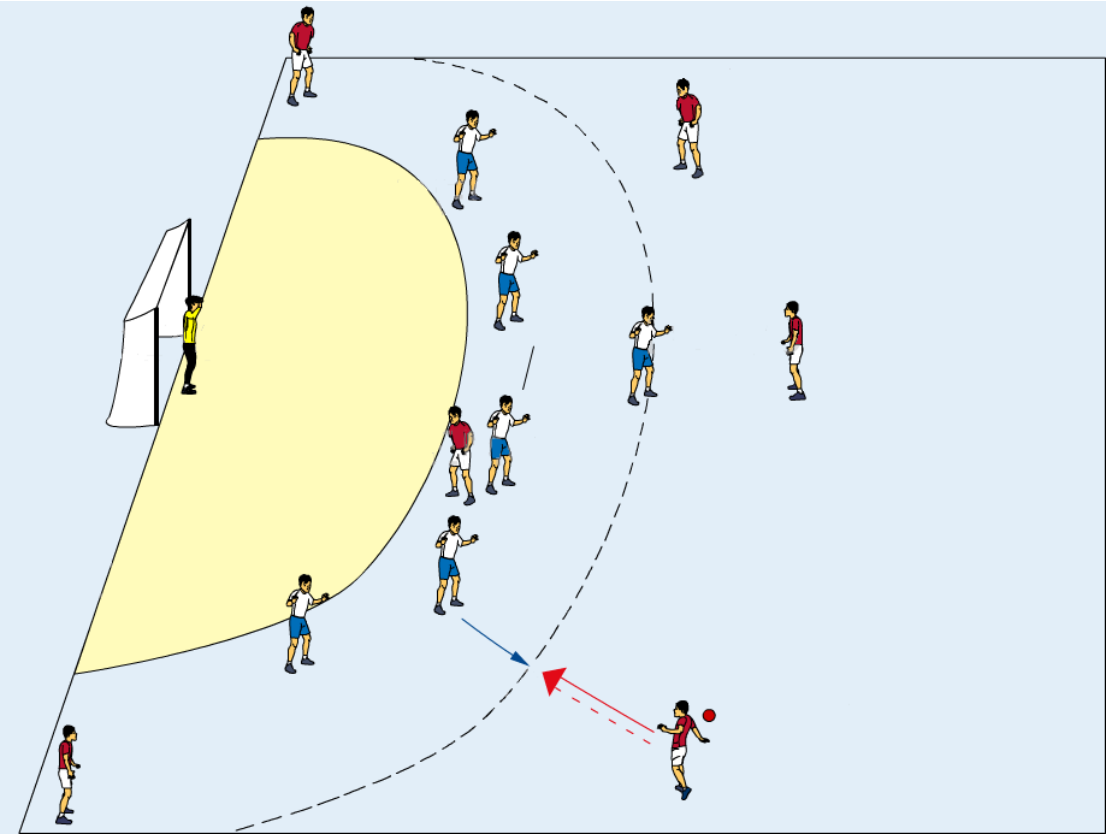

Figure 3 Position of the defending player in 5:1 zone defense when the pivot is between the second and the third defending player, the backcourt player widens the attack

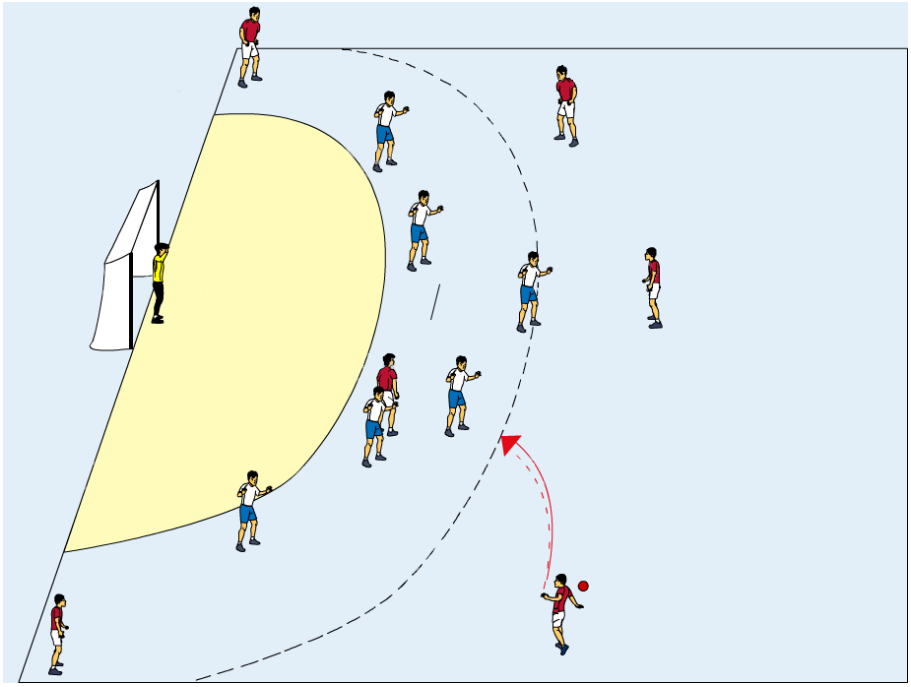

Figure 4 The defending player's position, whilst the pivot is in between the second and third players, the backcourt player attacks towards the middle. (Sibila, Pori, Bon, 2006)

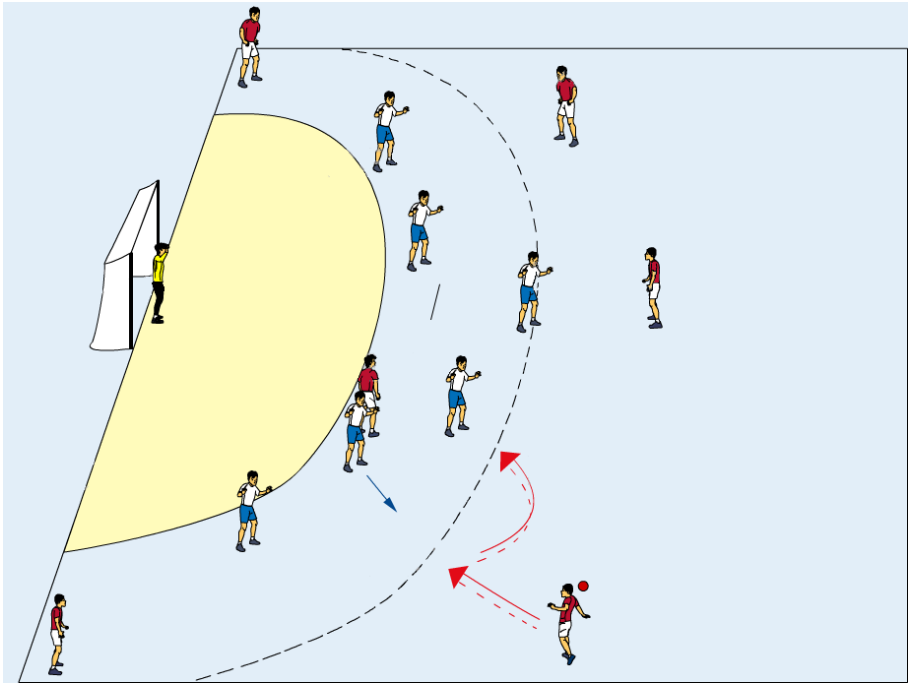

Figure 5 The position and reaction of the defending player when the left backcourt player has a straightforward momentum and moves towards the middle. (Sibila, Bon, Pori)

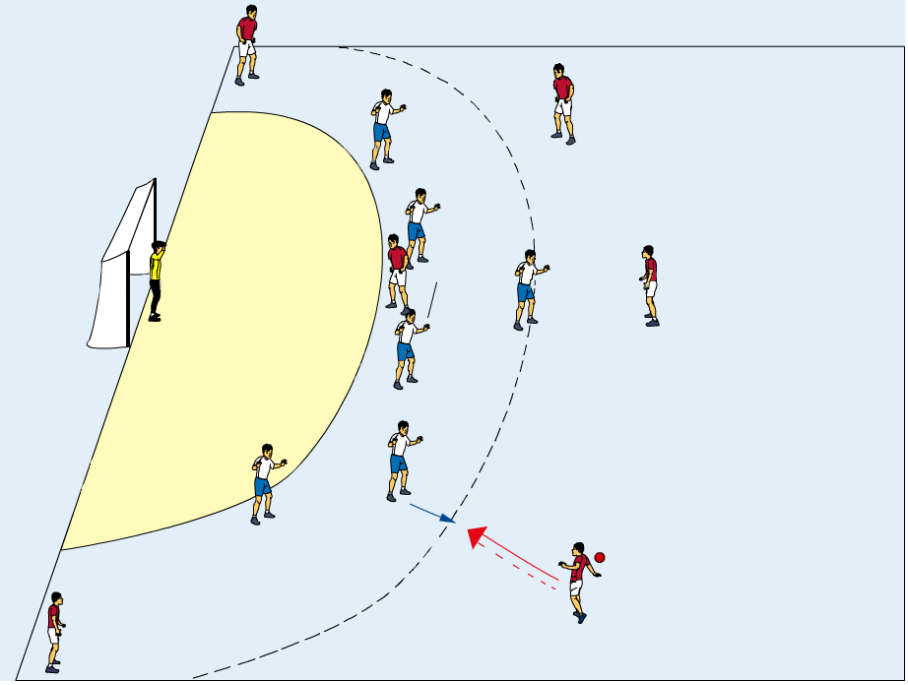

Figure 6 Positioning of the players in a 5:1 zone defense when the ball is in the left backcourt's hands, whilst the pivot is on the opposite side of the ball (Sibila, Bon, Pori, 2006)

For this type of defense, it is highly significant and considerations should be given when the defense transforms into (6:0, 5+1, 4+2) from a typical 5:1; this is the case when a second pivot enters the game. In the following slides and illustrations, initial defending when the zone defense transforms into (6:0, 5+1, 4+2) will be shown. In order to retaliate to this transformation, especially to the 5+1 and 4+2 formations, cunning and agile players are needed, players which are not the tallest, nor the heaviest in morphological features. These players need to be able to accurately predict the situation, to be able to intercept the ball (the planned attack), and transfer it into counterattack, i.e. into individual offense, thus it is deemed necessary for them to have a good overview of the whole court. (Pokrajac, 2010)

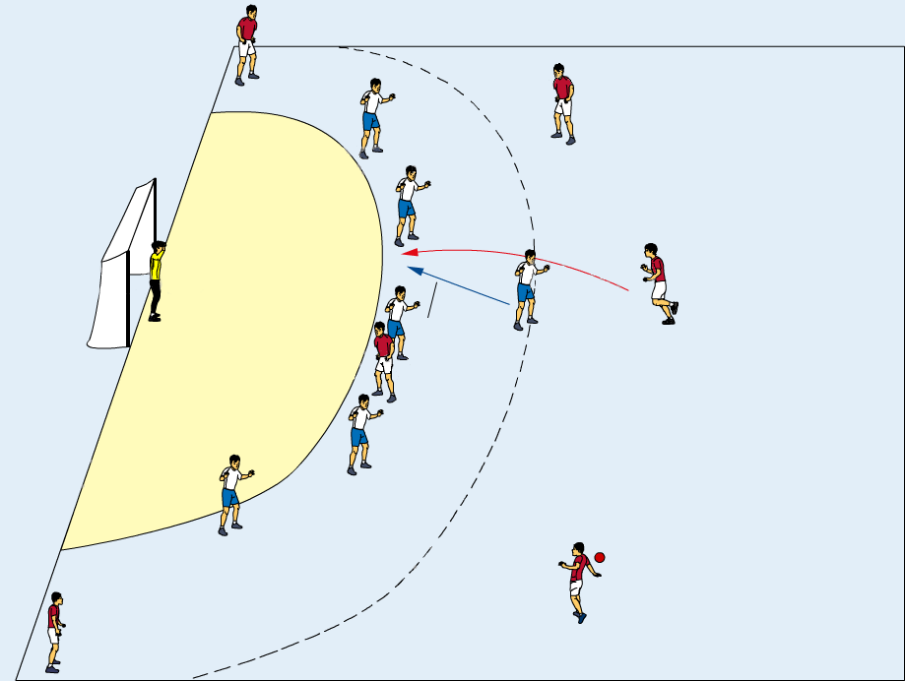

Figure 7 Transformation of a 5:1 into a 6:0 formation. Middle backcourt entry into a double pivot (Pokrajac, 2010)

An example when the frontal centre is in a position to play the third position in a 6:0 situation.

On the following illustration, a situation is shown where the front player will not take the third position in a 6:0

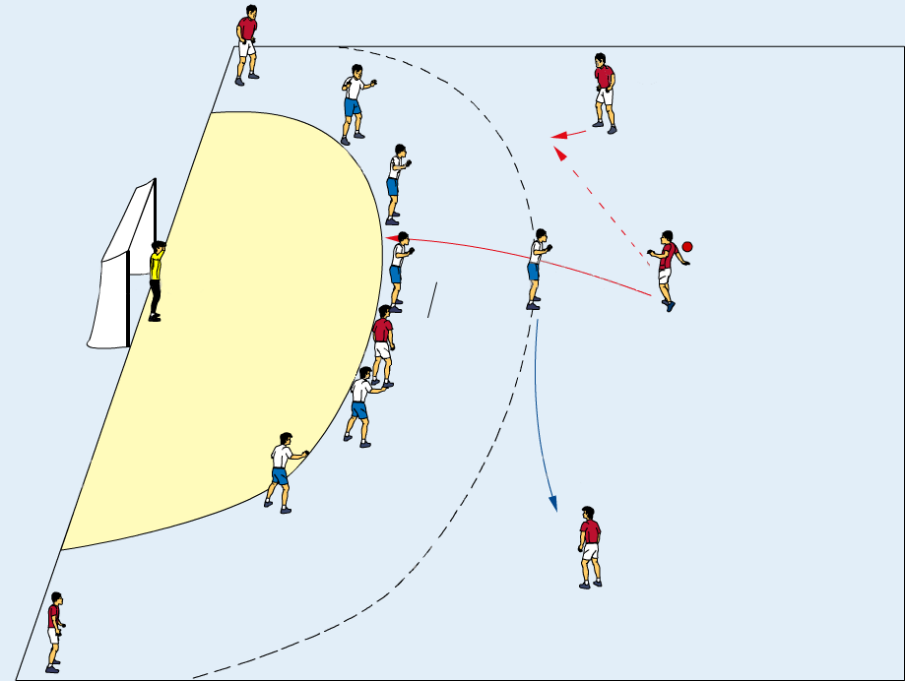

Figure 8 Entry of a middle backcourt player onto the second pivot, the front center guards the player without the ball

The same applies when a right or left backcourt player enters to the second pivot.

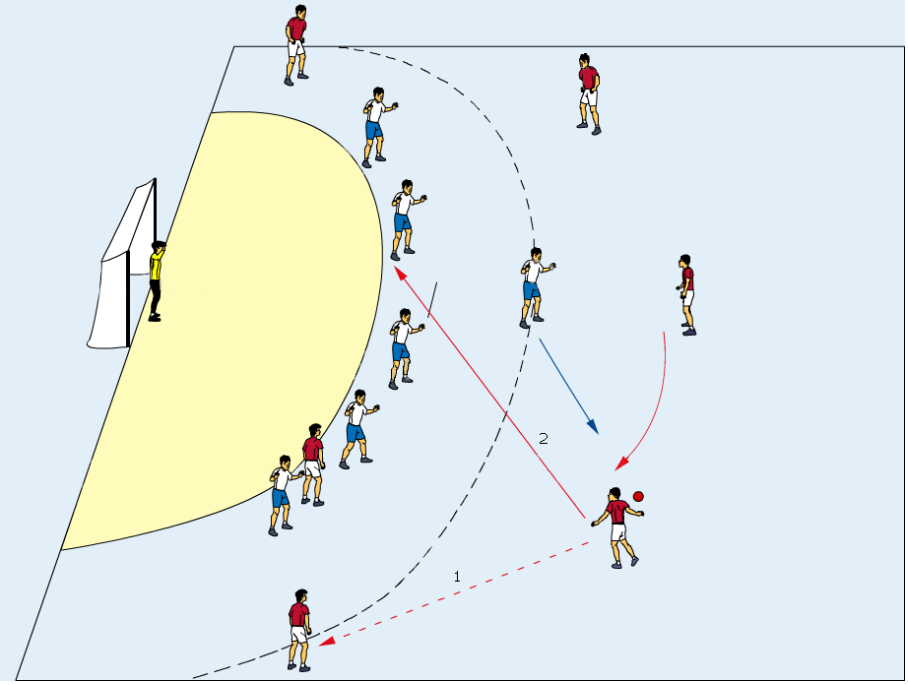

Figure 9 Entry of a left backcourt to a second pivot, the front center guards the free offensive player, in this case the middle backcourt player (Pokrajac, 2010)

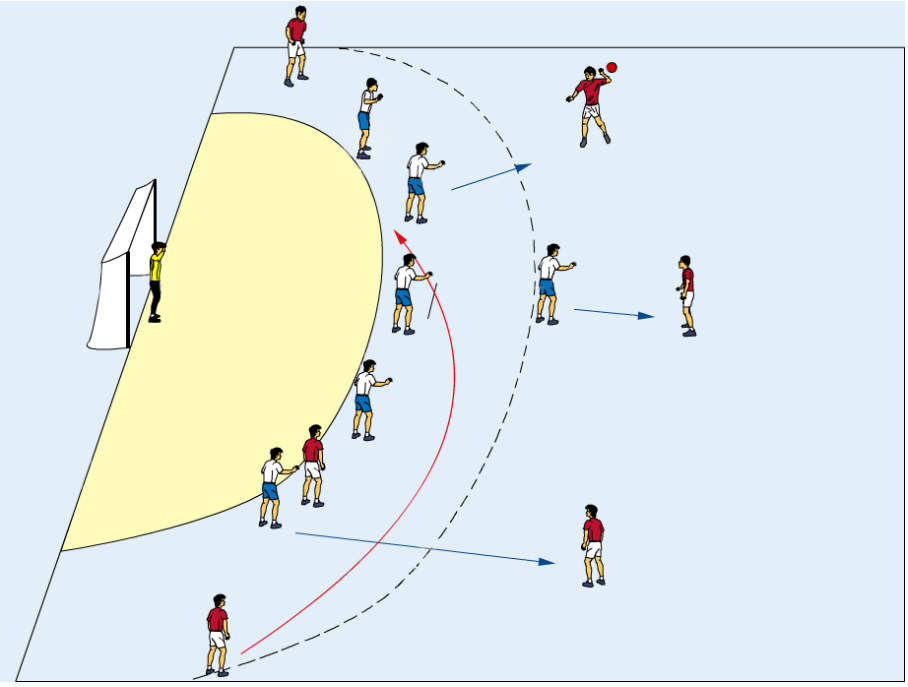

Figure 10 Entry of a wingman to the second pivot, the defense transforms from a 5:1 to a 4+2 (Pokrajac, 2010)

Following these initial defensive positioning schemes 5:1, with all their transformations, the collective offenses in this zone should be observed as well. It should be noted that the structure of the handball offensive tactics could be divided into: individual, group and collective tactics.

Individual tactics

- Avoid violation
- Player elasticity
- Target
- Dribbling

Group tactics

- Opening
- Entry
- Pick and roll
- Give and go

Collective tactics

*Counterattacks

*Extended counterattacks

*Attacks on an established zone or combined defense

- with one pivot

- with two pivots passing through

- special situations

- extra player (players)

*with a pivot

*without a pivot

*nine meter line (Sibila, 2004)

On the next illustration, an initial positioning of the offensive players onto a 5:1 is shown (Sibila, Bon Pori, 2006)

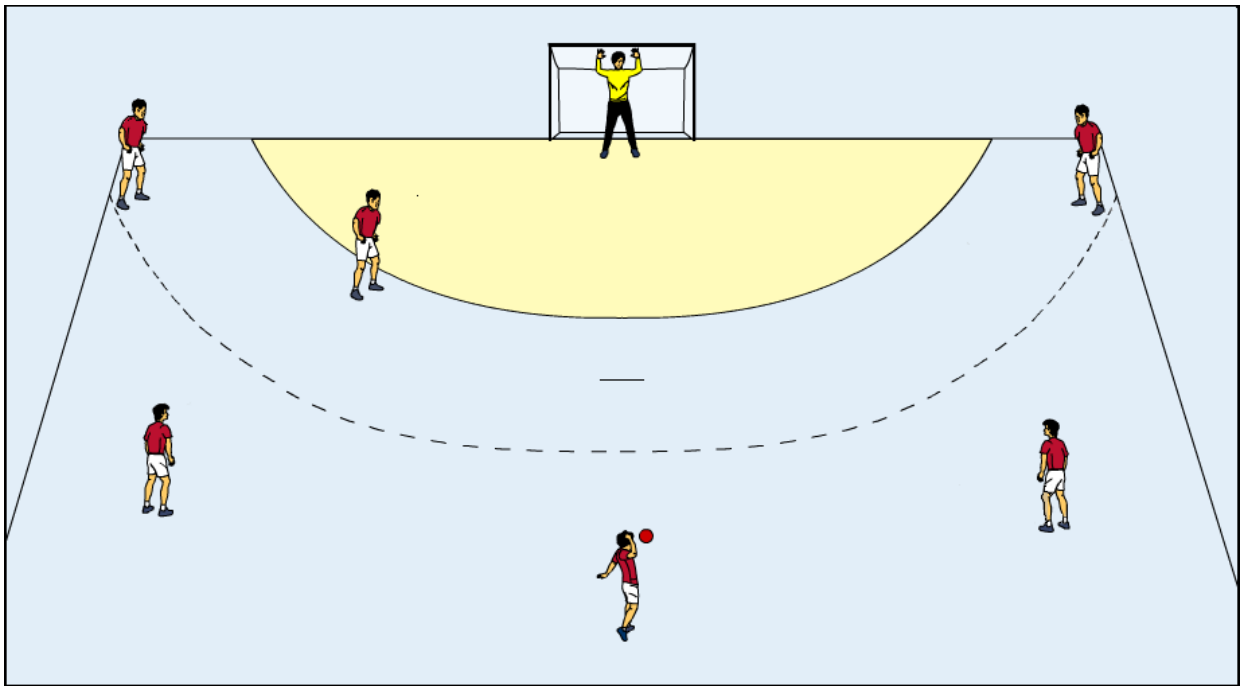

Figure 11 The basic positioning of the players for attack in 5:1. (Sibila, Bon, Pori, 2006)

In order to perform a good collective attack on a 5:1 zone defense, it is necessary for the players to follow the following principles:

- The wideness of the attack needs to be constantly maintained by playing with the wingmen as much as possible
- Playing with pivot
- In terms of individual tactics it is necessary to pull away the front defending player from the initial position to one side of the court.
- In terms of group tactics, to create an opportunity for some maneuvering room with three players.
- In terms of collective tactics, above all, the space that will be created by leaving out the defending players should be used.

The goal of every offensive player is the score a goal from a position of the 6 meter line, with the highest odds for that. An attack with two pivots renders the job of the front defending player more difficult, who is one of the most important in this defense. The offense players must prepare actions in the space between the front defending and the secondary player on the right and left, so that they would have a 2 to 1 situation, and make the front player leave their space (Gucek, 2002).

In the following illustrations I will show you my visions or the starting collective variations for attack in this zone formation.

3.4.COMBINATION NUMBER 1

Sweep of the wingman into the second pivot by crossing over with the backcourt player. The pivot is positioned between the primary and secondary players on the side of the wingman who is entering. The wingman in this situation is on the left after the crossing over with the left backcourt player, and enters the line between the center half and the secondary player on the opposite side.

Variations

1-1 play of the wingman, pass to the middle backcourt player, long ball to the right backcourt; pass to the middle backcourt that passes to the left backcourt (is played very often). (Sibila, Bon, Pori, 2006).

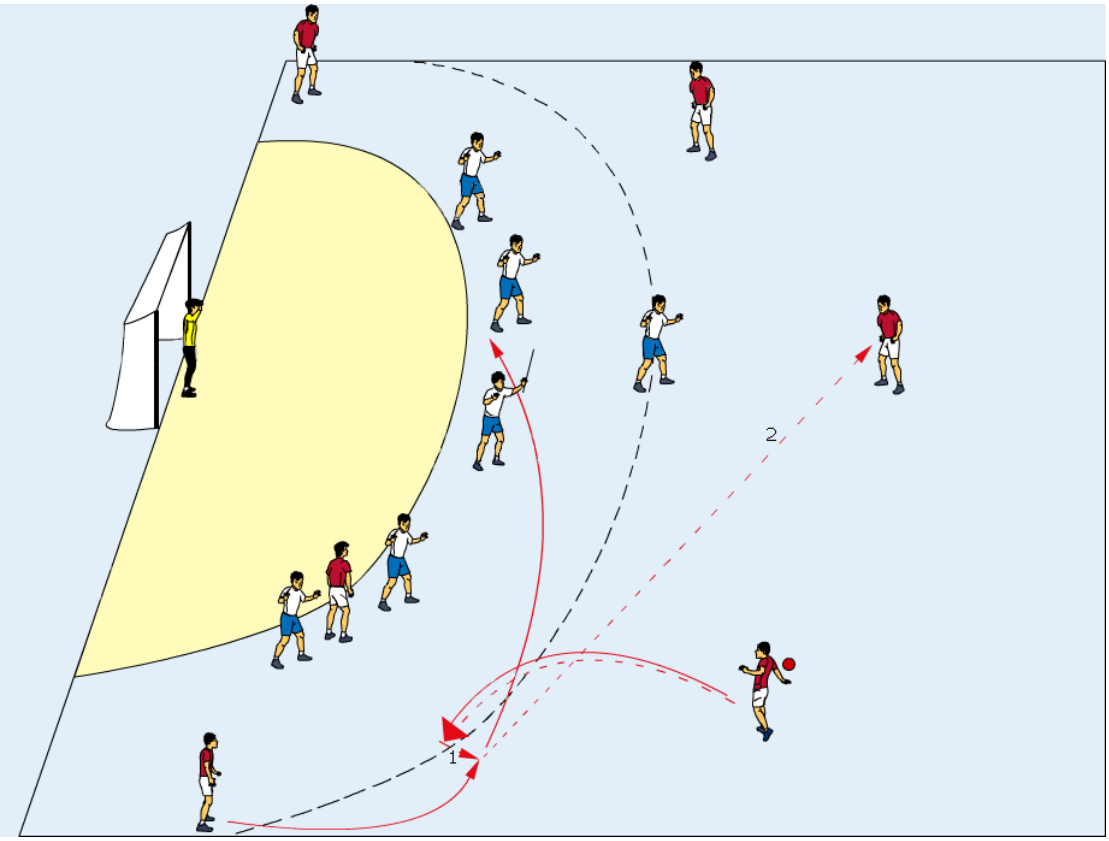

Figure 12 Entry of the left wingman into the double pivot after the crossover with the left backcourt

3.5.COMBINATION NUMBER 2

Move of the middle backcourt player to the second pivot after the pass to the pivot. The middle backcourt player passes the ball to the pivot and opens up on a place on the post in the depth (somewhere around 9 or 10 meters). The pivot in the basic form of the action passes the ball to the left backcourt in full momentum, assists the middle backcourt from the 6 meter line. After

the pass to the left backcourt, the pivot continues close to the outside defending player or to the center between the second defender and the back center.

Variations

The shot of the left backcourt player, a long ball to the right one, assist to the middle that opens to the pivot, pass to the pivot, or pass to the wingman (Sibila, Bon, Pori, 2006).

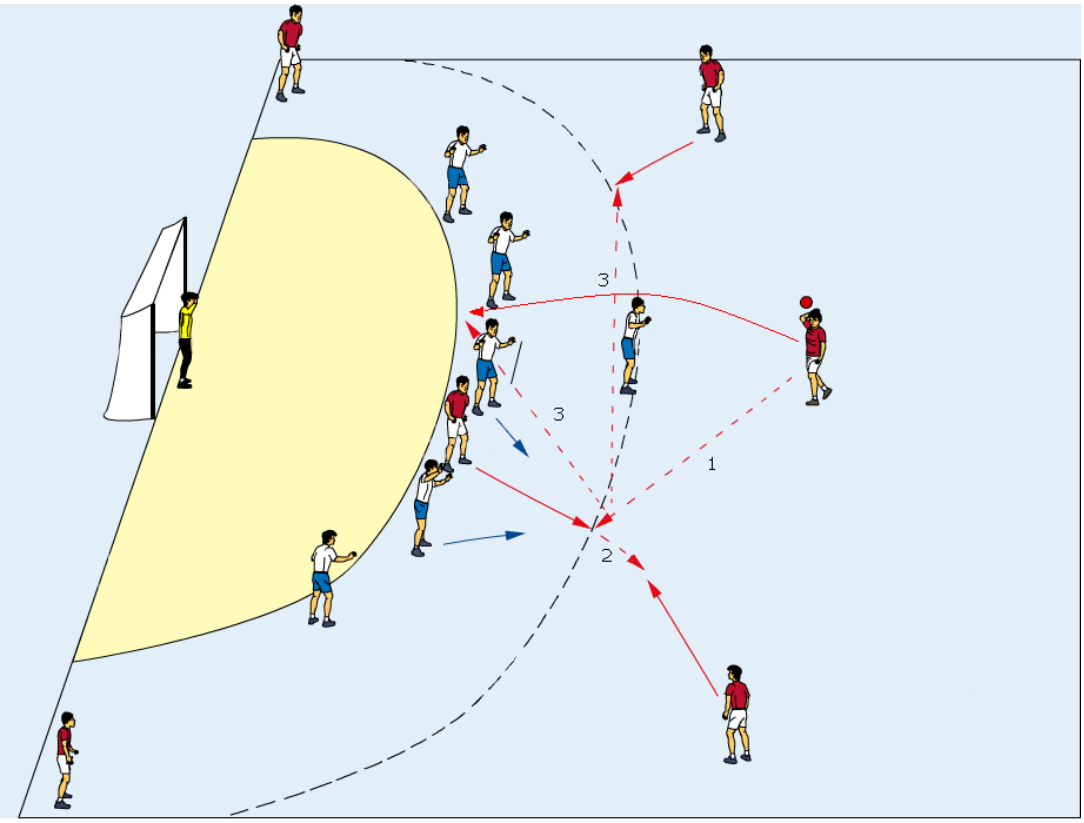

Figure 13 Crossover of the middle backcourt to the second pivot after a pass with the pivot (Sibila, Bon, Pori, 2006)

3.6.COMBINATION NUMBER 3

Move of the middle backcourt to the second pivot after a return pass to the left backcourt. The pivot is positioned between the second and the third defending player on the opposite side from where the middle backcourt runs in and thus where the left backcourt comes to shoot. In the basic form of this action the left backcourt passes the ball to the middle backcourt player who creates space for a return ball to the left backcourt and creates a good chance to score. Afterwards, the left backcourt player chooses different ways for the continuation of the action. After the return pass, the middle backcourt player runs in to the 6 meter line.

Variations

Altering the movement of the left backcourt on the side of the backcourt player and an alley-hoop, the left backcourt shoots, pass to the pivot, pass to the middle backcourt, who opens to the second pivot, long ball to the right backcourt player, pass to the wingman.

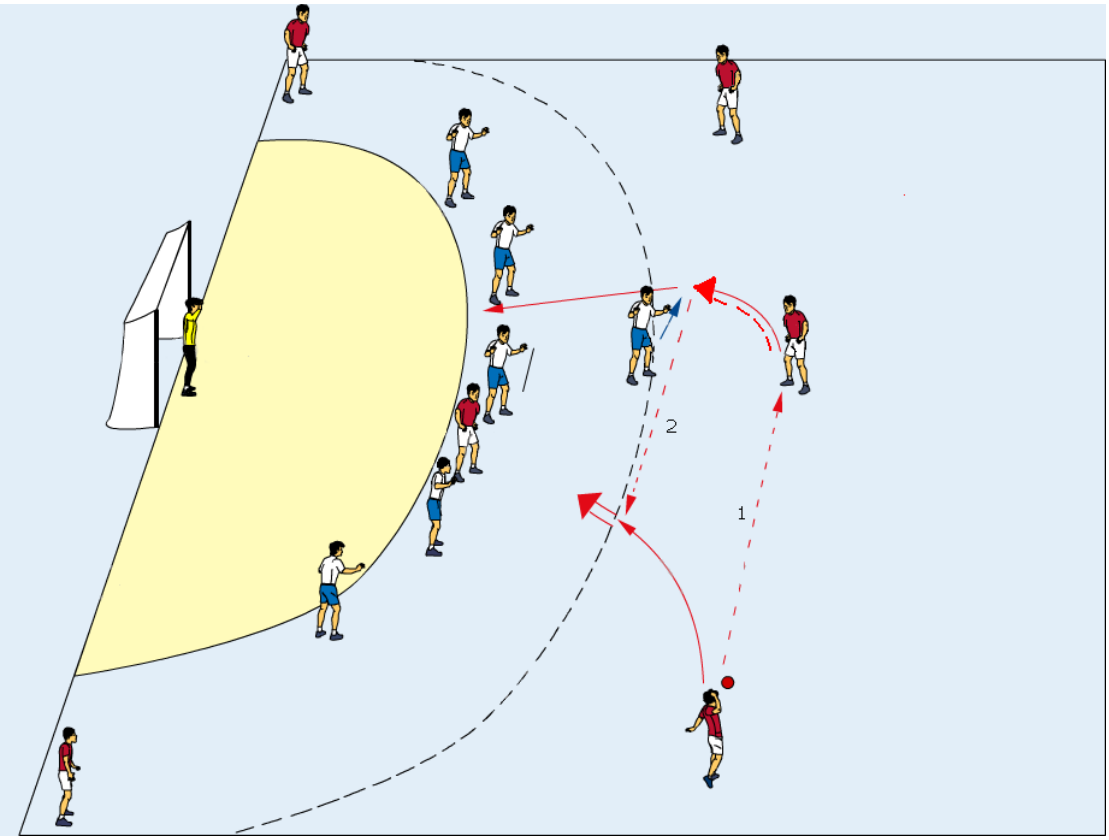

Figure 14 Move of the middle backcourt to the second pivot by return pass to the left backcourt player

3.7.COMBINATION NUMBER 4

Move of the left backcourt into the second pivot after passing to the left wingman. The left backcourt, in the basic form, passes to the left wingman and after that enters diagonally into the second pivot. The positioning of the left backcourt on the secondary pivot is wide on the second left defending player. After receiving the ball, the left wingman passes it to the middle backcourt player, who opens to the side where the left backcourt player is basically positioned. The middle backcourt player, afterwards, chooses how they should continue the action.

Variations

The middle backcourt shoots, the middle backcourt plays with the pivot, the middle backcourt passes a long ball to the right backcourt player, pass to the wingman.

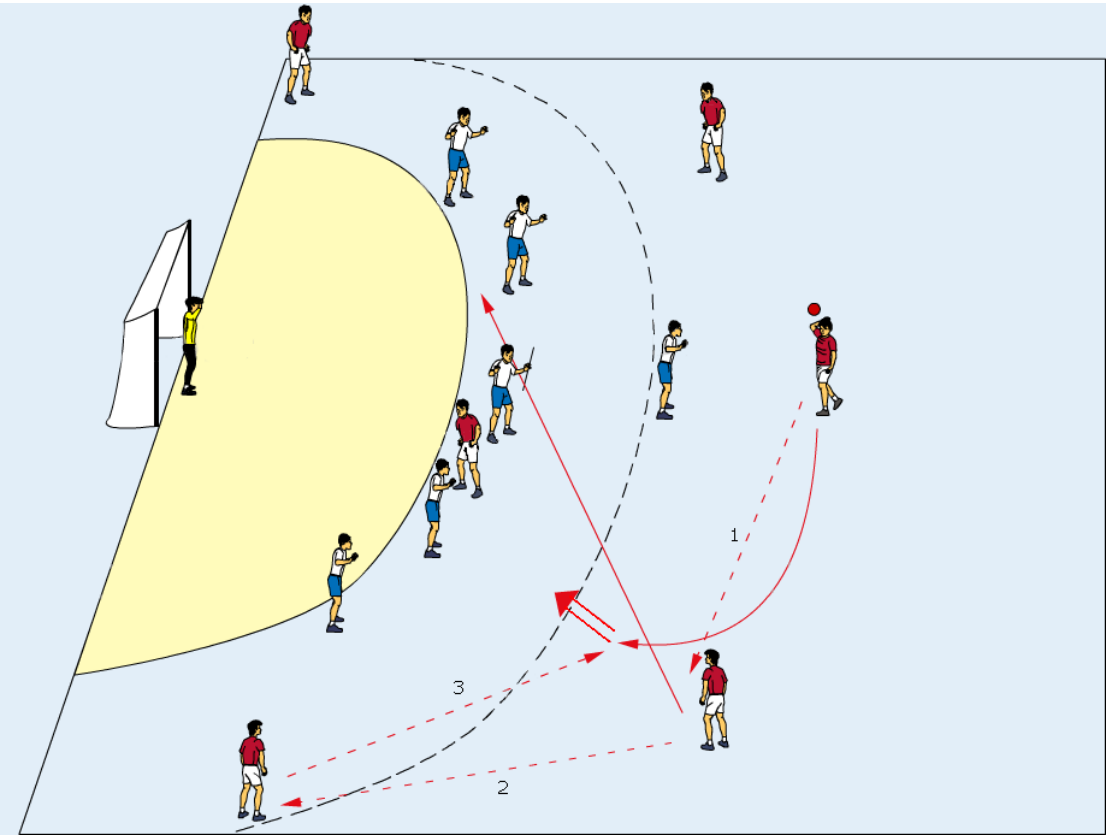

Figure 15 Move by the left backcourt to the pivot after passing to the left wingman

3.8.COMBINATION NUMBER 5

The left backcourt passes the ball to the middle backcourt. The middle backcourt makes cross over with the right backcourt and enters diagonally to the line. The pivot is positioned between the second and the back center players. The positioning of the middle backcourt player, who runs in, is with the second right defending player behind his back. The right backcourt passes a long ball to the left backcourt player, who has different solutions for the ending of the action. This combination is especially efficient when the second defending player plays high in the field.

Variations

The left backcourt shoots, pass to the middle backcourt that ran into the second pivot, pass to the left wingman, diagonal pass to the pivot.

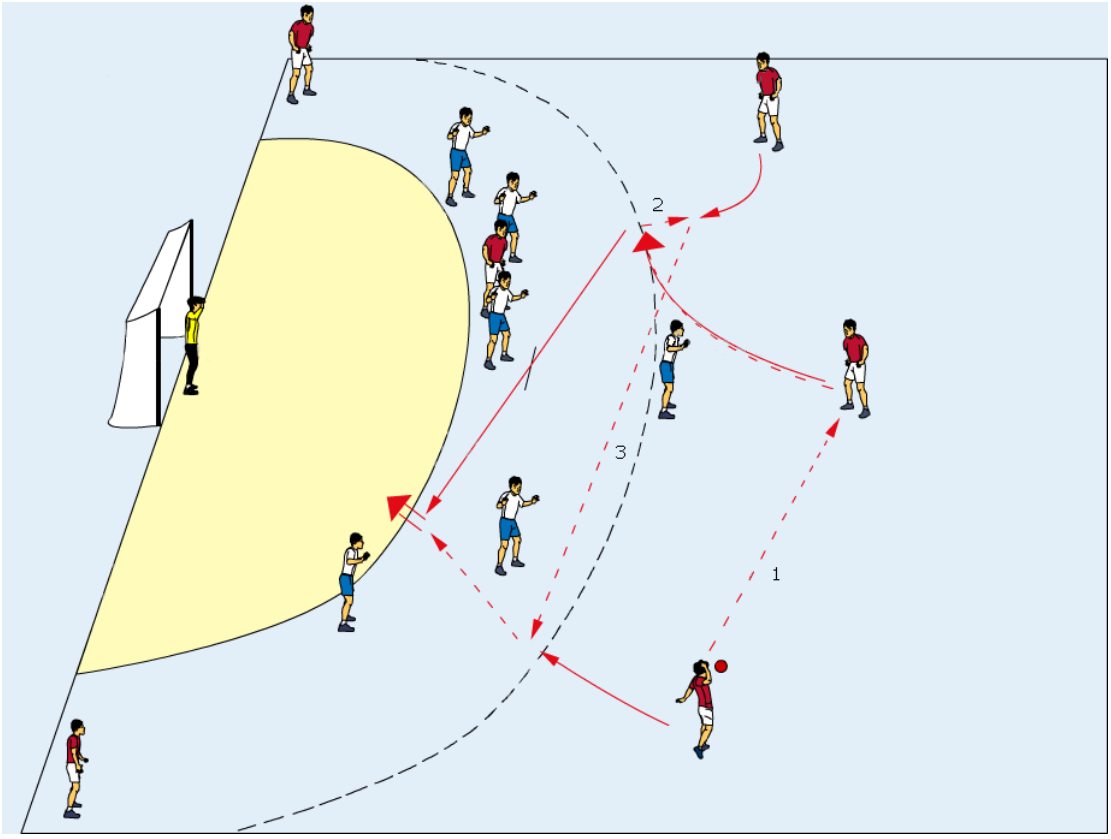

Figure 16 Move of the middle backcourt to the second pivot after a crossover with one of the backcourt players

3.9.COMBINATION NUMBER 6

The middle backcourt player passes to the pivot which opens to the right; then the middle backcourt changes the place with the left backcourt player, who on the other hand, takes his place – emptying and filling in the space with the pivot.

Variations

The left backcourt shoots, pass to the pivot followed by a pick and roll, pass to the right backcourt, pass to the middle backcourt, pass to the right wingman.

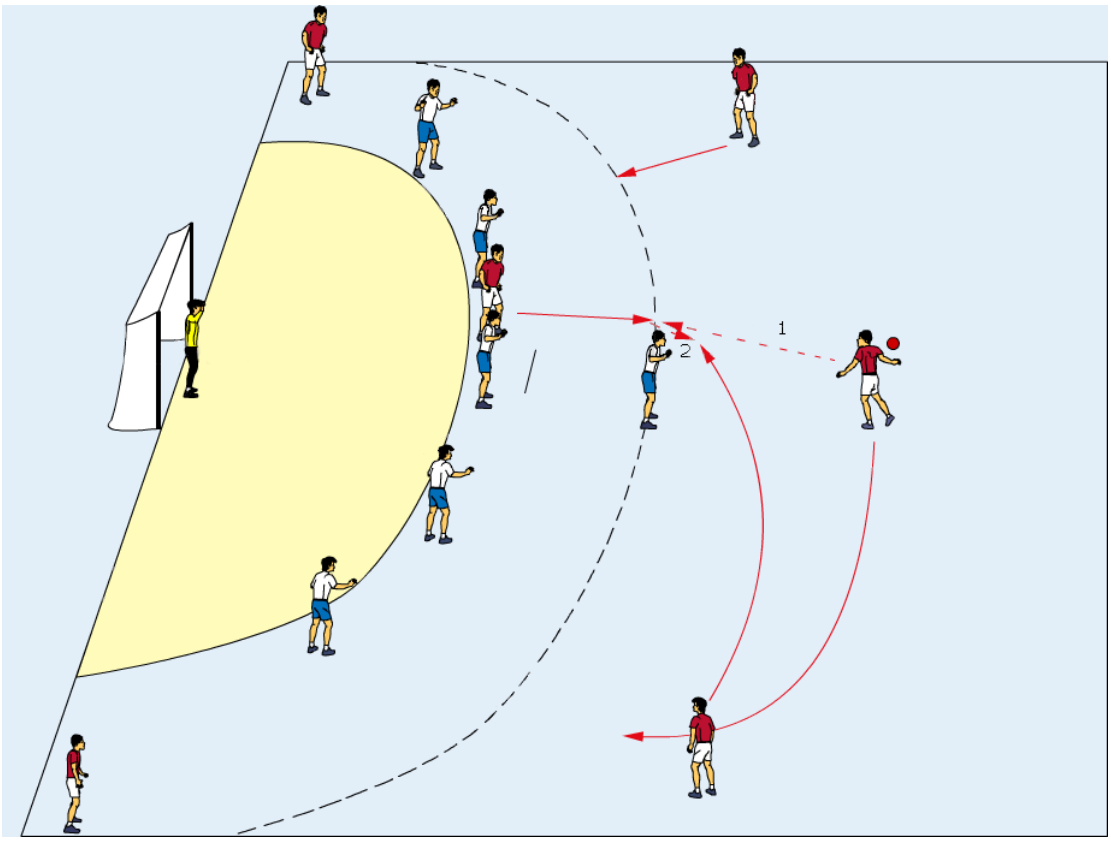

Figure 17 Emptying and filling in the space between the middle backcourt and the left backcourt player by passing to the pivot who gets the ball from the middle backcourt player

The coaches during the training process, as well as during the match, often are dissatisfied by the performance i.e. the efficiency of the agreed collective actions or combinations. That is owing to the fact that the game is played too much by the pattern, therefore it is predictable to the opponent. In order to improve the efficiency and the results of the performance in offence, it is needed to approach the strategy during the training with a certain methodology. This means that certain combination needs to be taken apart into logical pieces by which a steady learning of the tactical skills, needed for that combination, will be enabled. The exercises need to be modeled in a way that the performance will be identical to a situation during a match, which will allow a creative selection of the player with different technical and tactical solutions in the given situation. (Passing to the most uncovered offense player, adapting to the opponent's reaction, etc.)(Pori, 2006).

The initiation of the players into the ways of playing the offence combinations must be gradual and thought through. The selection of exercises for the played combinations must be correct, and be adequate (and not over-complicated) for the age category, and offer drills which will give different solutions for the given offence situation of the game.

Further on in this paper, the methodological procedure for training of the first offence combination, i.e. combination number 1, will be given.

3.1.1.THE METHODOLOGICAL PROCEDURE FOR LEARNING THE OFFENCE COMBINATION NUMBER 1 DURING TRAINING SESSIONS

1. The players are allocated to the positions of left wingman, right wingman, left backcourt and right backcourt players in the offence formation. On each position at least two players are needed. The left backcourt crossovers with the left wingman, who performs a long pass to the opposite backcourt, the right backcourt player. The right backcourt player after receiving the ball makes a crossover with the right wingman, who also makes a long pass to the opposite, left backcourt, player. The players are constantly changing their positions while passing the ball.

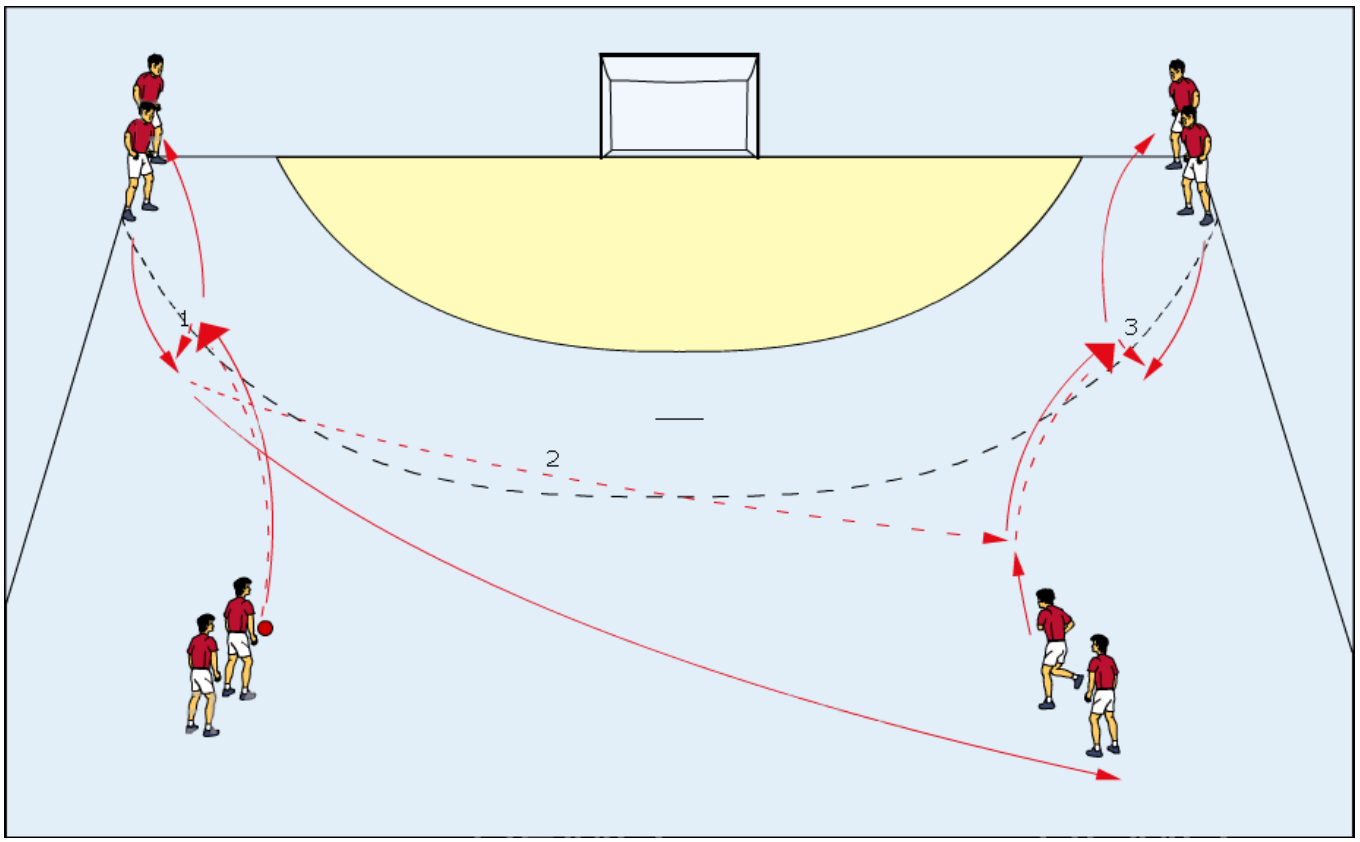

Figure 18 The first step in the methodological procedure for learning the combination number 1 during training session

2. The players are allocated to the playing positions the same as in the previous situation; with the difference that now we pass to the middle backcourt player too. After passing by the middle backcourt, the left backcourt crossovers with the left wingman, who shoots to score. The exercises should be performed alternating from left and right.

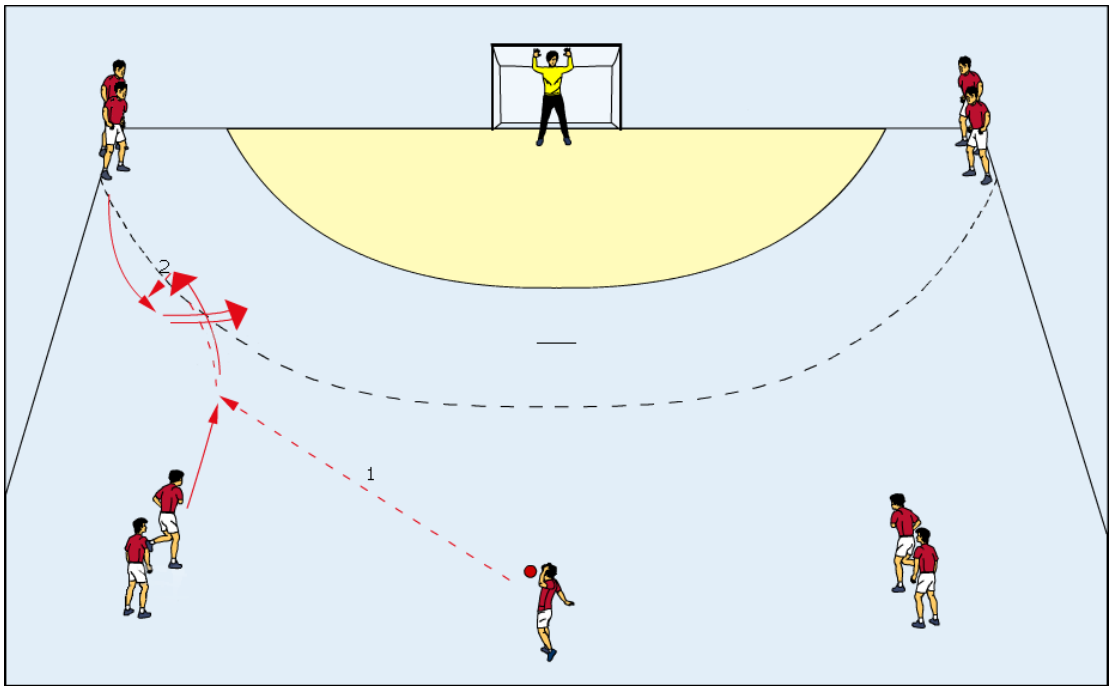

Figure 19 The second step in the methodological procedure for learning the combination number 1 during training session

3. The positioning of the players is identical to the previous exercise. After crossing over of the backcourt with the wingman, a long pass t to the right backcourt on the opposite side follows. The backcourt players shoots from the ground or by jumping, and the exercise is performed intermittently both to the left and to the right.

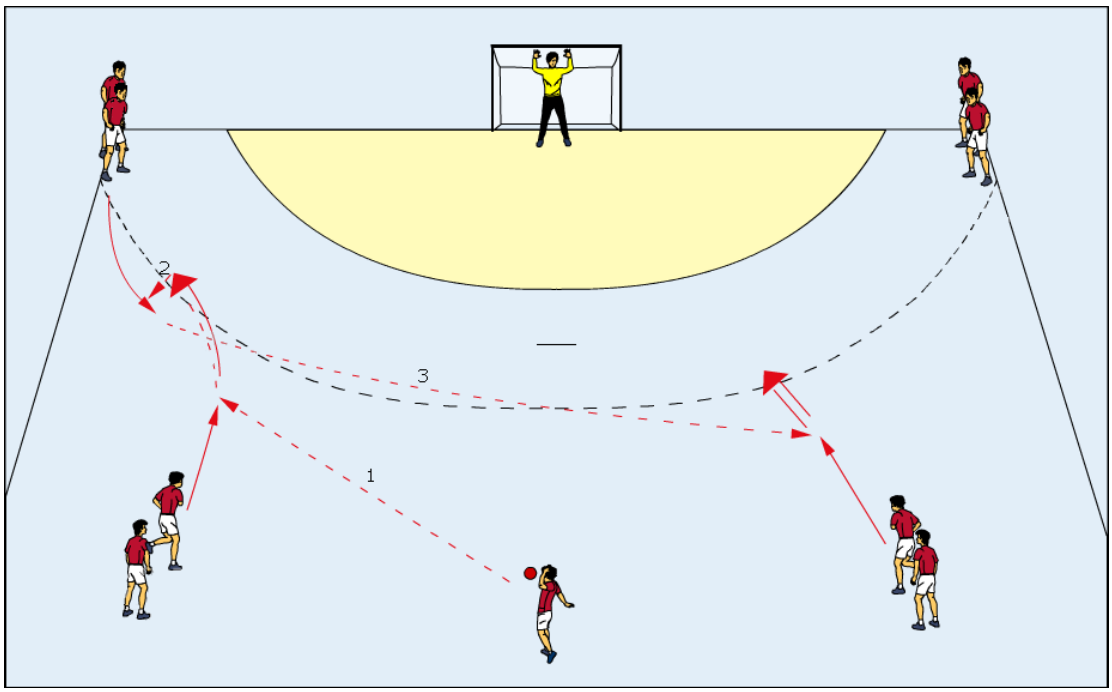

Figure 20 Step three

4. The positioning of the players is identical to the previous exercise. Here, in this exercise one of the backcourt players starts to cross over with the wingman, followed by a long pass to the opposite backcourt player. After the pass, the wingman runs into the second pivot, and then the backcourt passes the ball to the wingman in the right pivot position. After the pass, the left wingman shoots to score. The exercise is done intermittently on both sides.

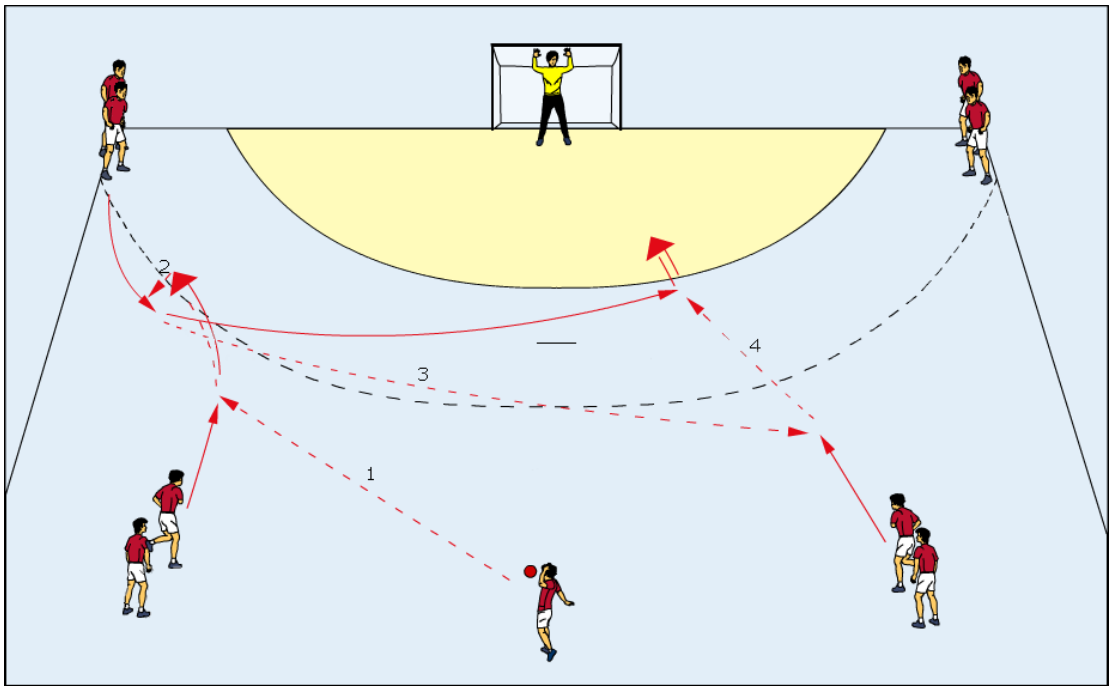

Figure 21 Step four

5. During this exercise the players are positioned identically as in the previous one, with the difference that a defending player to the position 2 left is added. The initial part of this exercise is the same, except now the entry of the wingman is done to have a situation of right backcourt and left wingman (on the place of the pivot) playing 2-1 on the defender and a possibility to end the attack with a shot. The possibilities that are offered to the right backcourt are: shot, penetration, return pass with the pivot, fake pass to the pivot – penetration. The exercise is carried out on both sides with one defense player or we add one more player to the 2 right position.

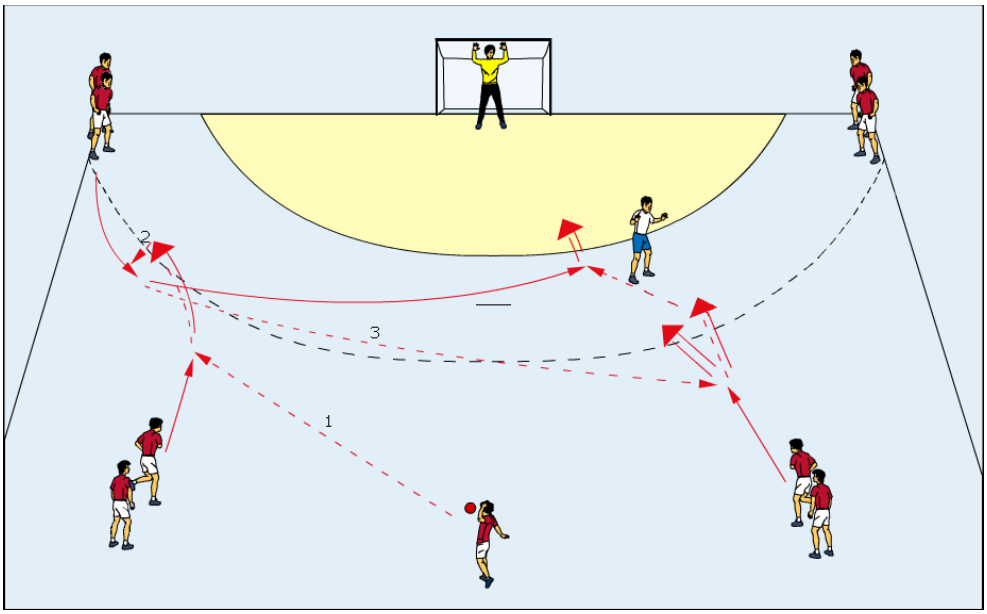

Figure 22 Step five

6. The positioning of the players is completely the same as in the previous exercise. The difference here is that one more defending player on the position of back center is added. Now, after the initial part, the right backcourt and the left wingman (instead of the pivot) are in a game 2-2 that is practiced with two defending players. The exercise is performed intermittently, on the left and on the right.

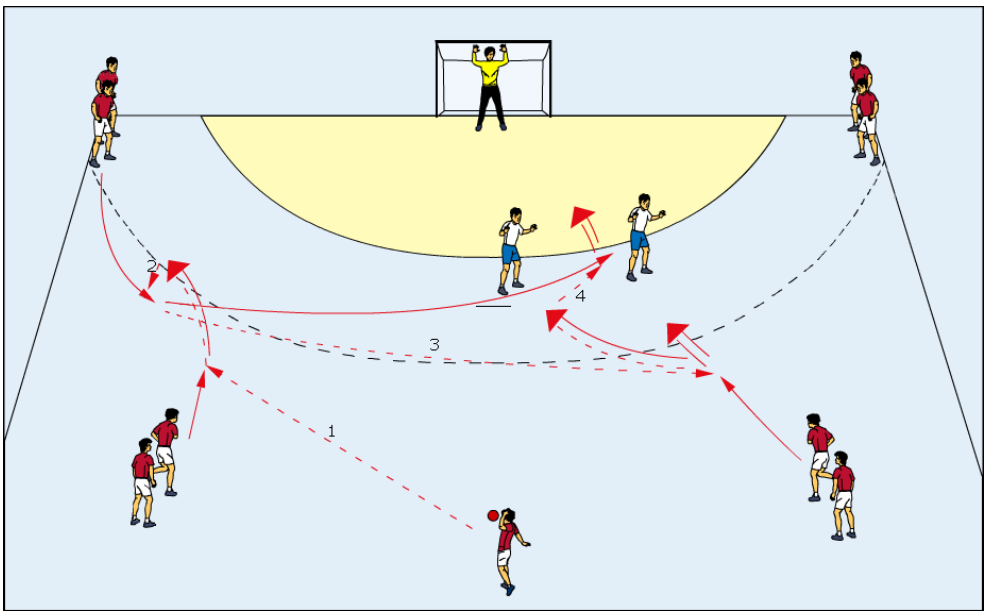

Figure 23 Step six

7. The game 6-6 on one goal – the defending players are positioned on their places characteristically for the zone formation 5-1. The middle backcourt player (organizer of the game) clearly tells the players from which side the game combination will be played, and properly positions the pivot. The defending players with several small intensive movements facilitate the performance of the game.

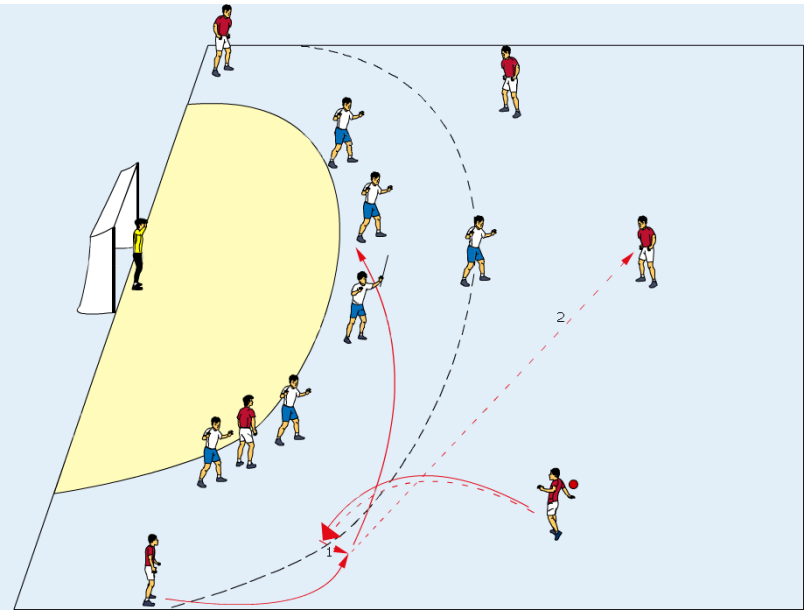

Figure 24 Step seven

8. Game 6-6 on one goal. The engagement of the defending players is far bigger, and they try to hinder the action. The middle backcourt player (the organizer of the game) gives the instructions from which side to carry out the action, positions the pivot, while each player in the action (the offence players) must fulfill the tactical tasks, to be always ready to score a point or to assist a teammate. The best way to perform this exercise is by setting a competition between the players of the offense and the defense.

9. Game 6:6 on two goals. In a game 6-6 the practiced combination is repeated in a competing situation, a situation closest to the one in a real match. Every goal scored making use of the offense combination number 1 is counted as 2.

4.RESULTS AND DISCUSSIONS

Trying to give the best answer to the given problem, I tried to collect and present information for the tactics in attack on zone defense and combined defense, in handball. In addition, I tried to focus on the rules of positioning and moving of the players in different positions, mostly in attack on 5-1 zone defense. Thereby, I showed:

1. Some typical team combinations, adjusted for attack on 5-1 zone defense.
2. The methodology in teaching, i.e. learning the team combination number 1 in attack on 5-1 zone defense.

5.CONCLUSION

Handball is a game that develops very fast. The players are faster, stronger, and have improved technical and tactical skills. Thus, the game evolves in either direction offense as well as defense. In modern handball, where defending players are extremely mobile and fast, it is very hard to score a goal on an established zone defense. The same applies to offense, which is also exceptionally efficient. The 5-1 zone defense can be broken only by well-coordinated and set combinations, in which way, the desired results will be reached much more easily, and that is why every team has to have different well-coordinated offense combinations. Those well-coordinated offence combinations can be achieved on trainings, where the players train in different methodological procedures, which are different for each offensive combination. In my opinion, every coach needs to emphasize on that learning and coordinating the different offense plans of attacks on the set zone defense with every training session.

The pick, the selection and the presented combinations in this paper, which are adequate for a technically correct way of attack on 5-1 zone defense, are just a part of the tactical opportunities that we have at our disposal in handball. The offense combination offers many possibilities.

In practice, we have witnessed the lack of originality of the offence players time and time again, when they need to attack on different zone defenses. In order to reach high level of efficiency when attacking, a great knowledge, experience, and patience are necessary. The coaches can ask from the players only as much as they taught them. Every command needs to be completely clear to the player. Execution of the commands is not good enough; the players also need to understand it. Freedom in the game should be allowed, but not at the cost of failure of the team.

The coach must include different situations from the match, and show them during practice. They also need to be creative and never allow the trainings to be boring. Every coach knows that only by repeating the exercises many times, one can excel, but that doesn't mean that the same exercises need to be repeated. The exercises need to be upgraded and changed, considering situations played 2 against 2, 3 against 3, 3-2 etc. At least two time week should be allocated at working individually to correct the mistakes and to try to teach new skills to each of the players.

Of course, it is not that easy to play in offence as I described. All the players in the team must play according to a well created and planed process of learning during the training sessions, which is close to the ideal model of playing while in offense during matches.

Everything that is written in this paper can help coaches that will encounter the problem of an attack on a 5-1 defense zone formation. What is written may help them to get a fast insight in the theory and methodology of attacking on a 5-1 zone defense formation. Therefore, the training will be much easier and more efficient, thus, efficient during a match as well. I would also like to add that without a real attack system in modern handball, it is simply impossible to succeed. Success demands a long term plan, taking into consideration the scientific guidelines in order to be maximally efficient and successful.

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OFFENCE SYSTEMS AGAINST NUMERICAL SUPERIORITY (6-5, 6-4) AND NUMERICAL INFERIORITY (5-6)

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CONTENTS

Summary

Most team tactics in 6:6 play are similar to each other in offense as well as in defence in top level handball. The efficiencies in offense typically range from 50-60%. However, efficiencies with one man up or one man down in defence, often show significantly higher (in superiority) or significantly lower quotes (in inferiority) than the aforementioned 50-60%. The inclusion of an additional court player or the equalization of court players during a 2-min suspension can clearly increase the efficiency of attacking beyond this value.
In defence a high level of anticipation in 1:2 situations (inferiority) as well as a complete man to man marking (superiority) can clearly increase efficiency in defensive actions.

However, admittedly, all of these actions despite their extreme contributions in a potential improvement of the game´s result, can rarely be seen in top class handball nowadays. Due to the relative assimilation of team tactics in offense and defensive play, as well as the relative risk associated with these tactical decisions, in these fields a clear potential for further improvement is present.
As a consequence for the training process, a team trying to distinguish itself from the typical tactical patterns and trying to be more effective should spent high training loads for these tactical situations which might be encountered much more often as a future trend in handball.

Introduction

Handball is a sport game characterised by a clearly defined goal: scoring as many goals and conceding as few as possible. The achievement of this aim is determined by technical and tactical knowledge (Vuleta 1997; Simenc, 1998), the physical potential, morphological features and intellectual/emotional characteristics of a player, the opponent's performance and external influences of the environment. Scoring or, alternatively, preventing the opposition from scoring, depends not only on the activity and abilities of the player immediately engaged in finalisation, but is also

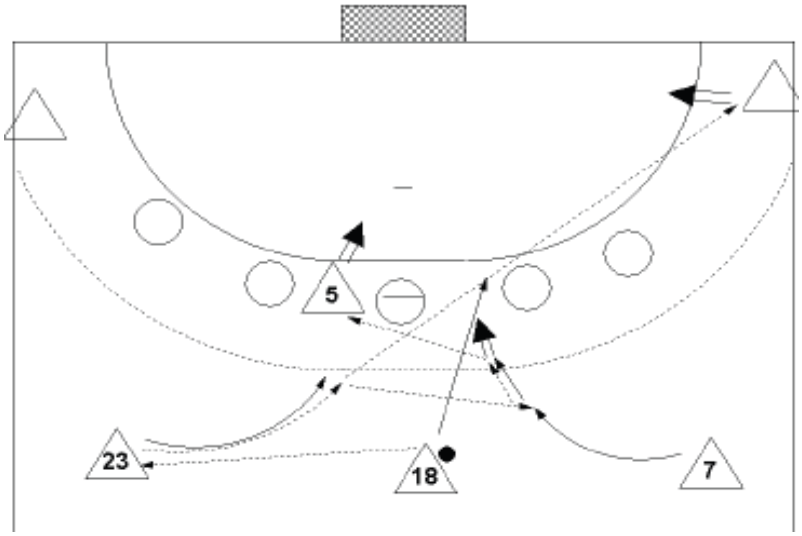
largely the result of the cumulative actions of other players and their coordinated group and collective actions. Therefore, the results in a handball game are determined by numerous factors, where the performance efficiency of tactical actions assumes an important role. Tactical activity is an essential characteristic of sport games, manifested in situation-related competitive circumstances, and it can also be defined as the planned and premeditated managing of all system dimensions to achieve the aim, i.e. to win in the framework of the current conditions and confronting opponent's activity. Tactical performance is used to purpose fully apply all of the available potential in a way least suitable for players from the opposing team in terms of time and space. This assumes the optimal use of the specific qualities of every individual by assigning tasks compatible with their abilities and in appropriate time and space terms, depending on the confronting activities of players in the opposing team. Previous researches in this area were mostly based on the basic detection of individual technical/tactical indicators, most frequently elements of the final attack, without any serious intention to try to establish their efficiency in relation to certain situation-related criteria. A certain number of previous researches were based on an analysis of the presence of technical/tactical elements in relation to players' positions (Ignjatova, 1984 p.50-52; Znoj, 1990 - diploma thesis; Šimenc et al. 1996 p.136-41; Gruić et al. 2006 p. 164-175; Ohnjec et al. 2008 p.69-79). Technical/tactical elements were equally analysed with regard to time span(Brzić, 1990 p.44-45),but also with regard to the efficiency of their implementation in competitive circumstances (Vuleta & Šimenc, 1989 p.136-141; Taborsky, 1996p p.2-11; Czerwinski, 1998 p.10-18). A few researchers analysed the differences in technical/tacti-cal elements in relation to the classification of teams in qualitative groups at competitions (Brčić et al. 1997,p.60-70 ; Rogulj, 2001 p.63-74 ; Apitzs et al. 1997 p.1395-1398; Taborsky 2008) or to the influence of technical/tactical elements on the match outcome (Czerwinski, 1995, 19-27 p.16-19; Günter, 1998 p.19-27; Srhoj et al. 2001 p.739-746, Vuleta et al. 2003 p.69-79), while far fewer researches focused on analyses of the latent structure of technical/tactical elements (Rogulj, 1990; Vuleta, 1997; Rogulj et al. 2004 p.736-746, Rogulj et al. 2009 p. 15-20).By summarising researches in the technical/tactical area, we can gain an insight into previous development of the handball game since it is evident that contemporary handball is characterised by the emphasised tactical variability and variety of game elements, abundance of technical elements, intensification and dynamicity of the game and the dominance of players' physical potential. This is directly reflected in the reduction of technical mistakes with the ball in the attack phase, an increase in the number of shots from longer distances, the more significant influence of defence elements in the structuring of the match outcome, a rise in the number of fast attacks and, generally, the performance efficiency of the attack finalisation. However, not enough researches analyse the efficiency of implementing individual and particularly group and collective tactical performances in competitive circumstances (Seco, 1998 p.36-48; Rogulj, 2003; Foretić et al. 2010 p.45-51). Starting with the importance of establishing tactical efficiency for everyday training competitive practice, the subject of this research

is an analysis of the realisation efficiency of collective tactical elements in attack, as the dominant factor of good results in handball.

Analysis of tactical objectives and practical examples (6-5, 6-4)

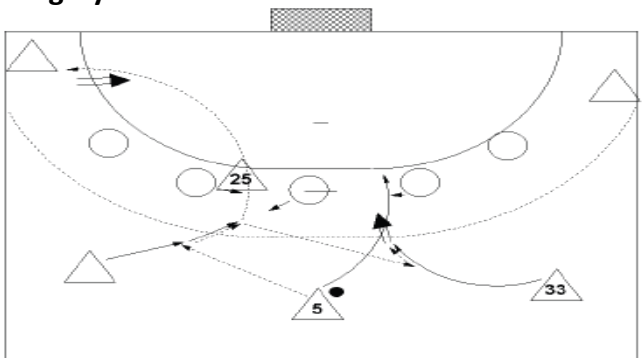
In this part, I will try to present the attack combinations 6-5 of some of the representations that are present on the big stage.

Macedonia



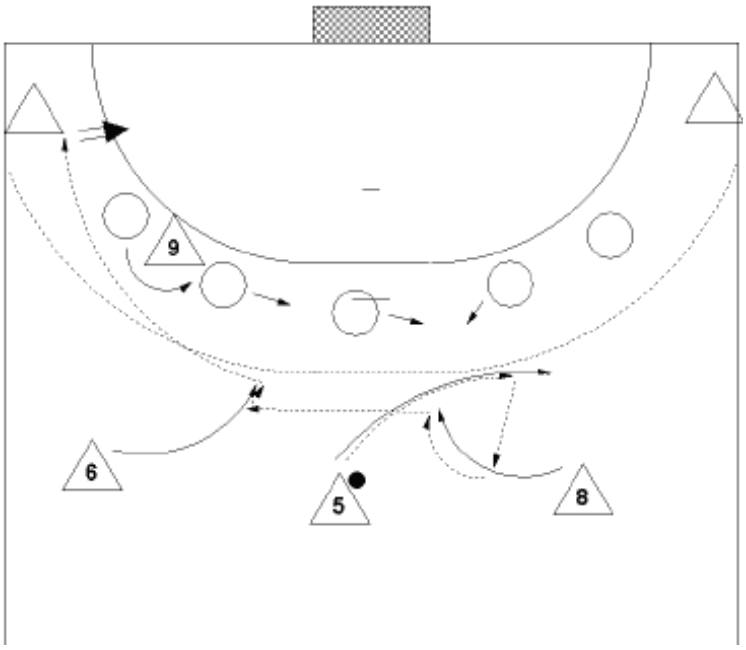
PM passes to LB and moves on to the line.
LB moves inside with the ball.
If the defence stays flat he will pass on to the RB in an inside swing for the shot or the pass to the LP.
If the defence goes deep against the RB he will launch the diagonal pass to the RW. (Pollany,2012 p. 24)

Hungary



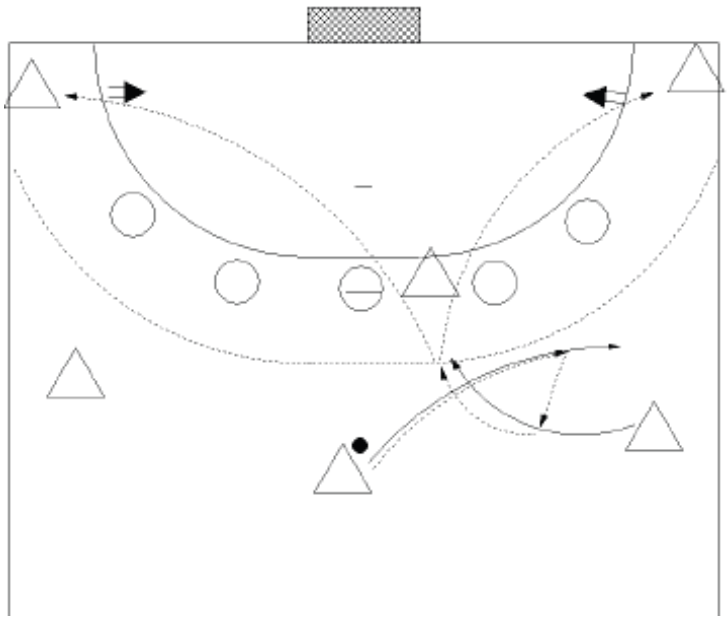
Almost identical play by the team HUN. The only difference is that in case of going deep of the defence the LB will play the pass to the LW.(Pollany, 2012 p.25)

Croatia and France



After crossing of PM and RB with the ball the RB passes the ball on to the LB on his inside move. Thus the OR is forced to screen down the LP and the LB will launch a diagonal pass to the LW in the corner. (Pollany 2012, p.23)

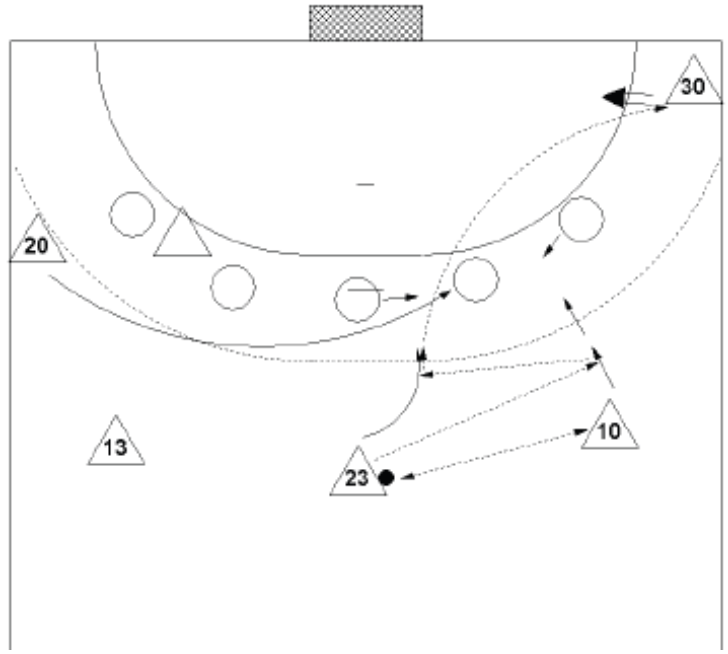
Sweden



PM goes for a crossing with the ball with RB; both wings in the corner.

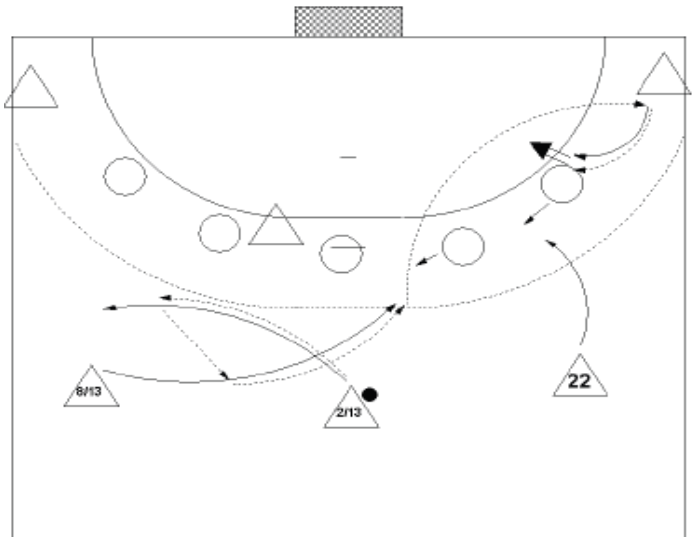
First solution – shot over the LP
Second solution – pass to RW
Third solution – pass to LW. (Pollany 2012, p.23)

Slovenia



With a pass-repass action of PM and RB the LW rushes inside.
With the LW in position at the line PM and RB start a give & go move thus forcing the OL to go for the RB. Now launches the diagonal pass to the RW in the corner. (Pollany 2012, p.24)

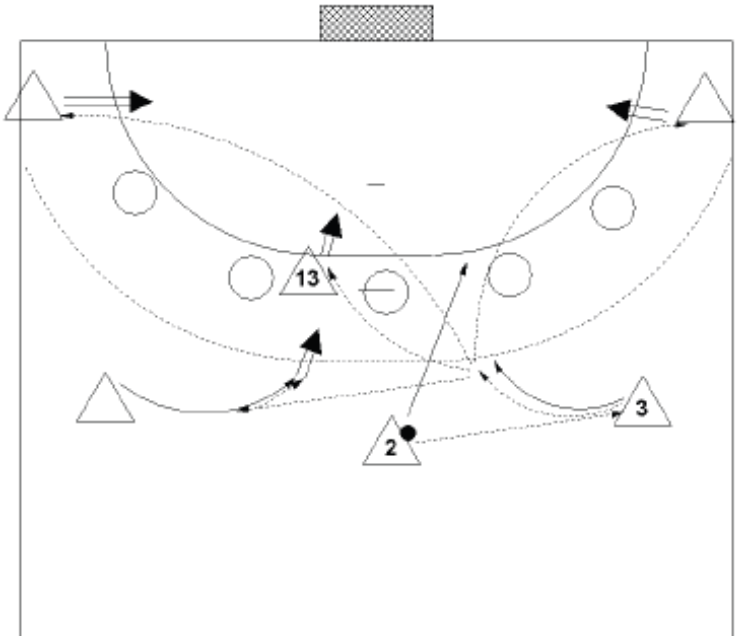
Denmark



In the version of DEN PM and LB deploy a very wide crossing with the ball.
The RB will do an outside move thus forcing the OL of the defending team to move in.

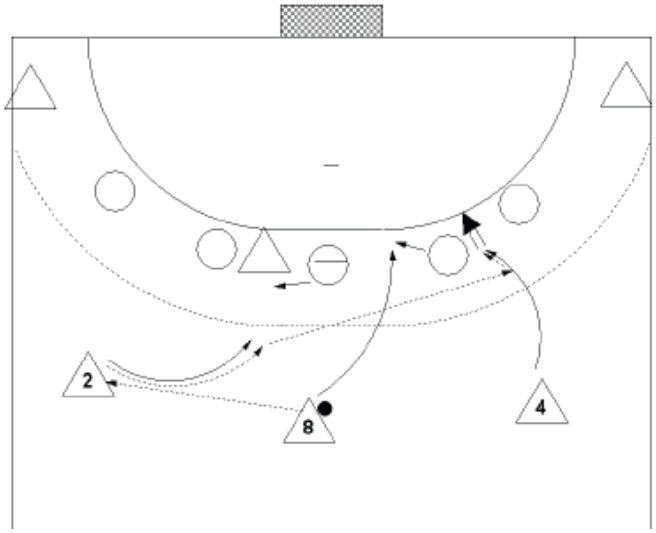
The LB will launch a diagonal pass to the RW in the corner. (Pollany 2012, p.24)

Poland



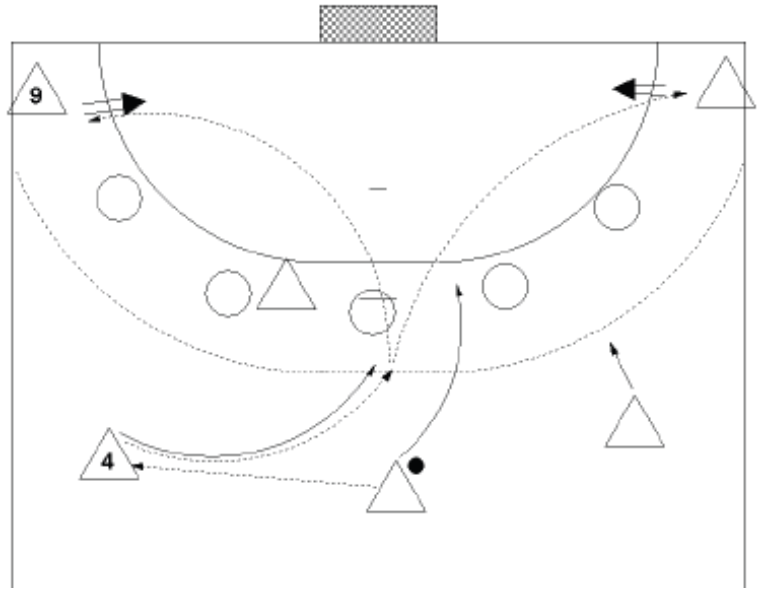
For several years now POL use to play a flip-flop version of the move.
The problem is that the RB has to decide between 4 different options very fast.
If the lefthander in this position happens to be out of shape a lot of mistakes will occur. (Pollany 2012, p.25)

France



In the version of FRA the RB will not move inside but will start an outside move.
They have played it in this way for years with a right hander in this position thus giving an excellent chance for the continuation to the RW.
And now they stay with the move even with a lefthander in the position RB. (Pollany 2012, p.25)

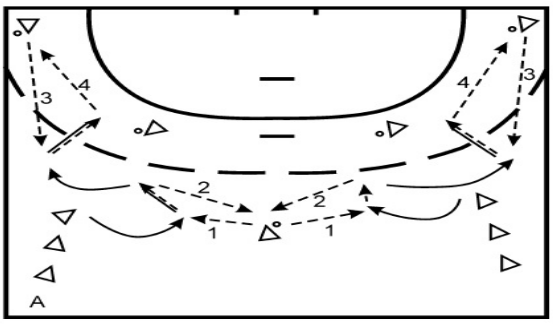
Iceland

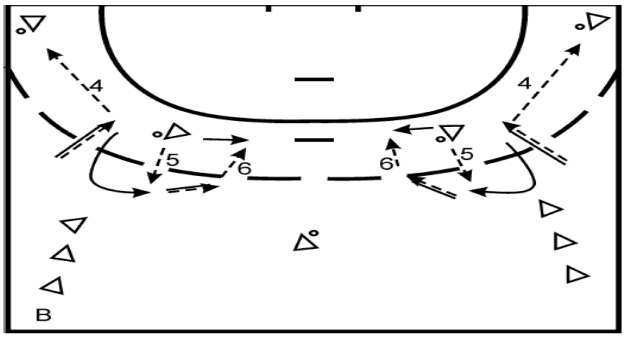


This move is the most simple and depends on no 4 and his abilities as a playmaker.
The problem of this move is that in case the two players at the line are not effective enough the defence will have a chance to create very narrow angles for the wings. (Pollany 2012, p.26)

1. Methods of coaching and training

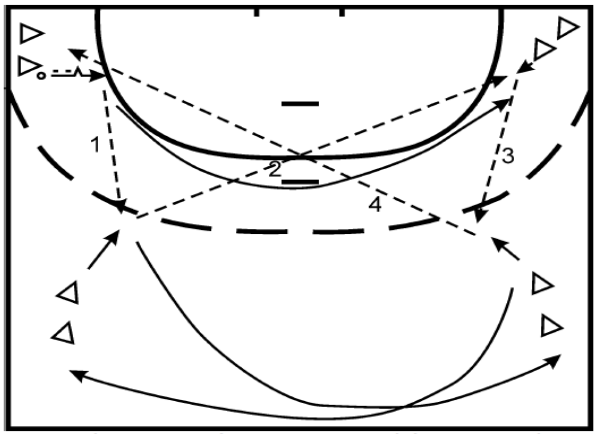
In the methodology of coaching and training more players with different types of acceleration to the goal i.e different changes of positions and rotations to the other pivot, it is important to train the players through different situation tasks. The coach must know how to prepare and organize the players during the training to repeat the moves until they manage to recognize and apply all the different solutions and place them on the field. In the methodology, it is important to apply a game with small number of players (1:0+2, 1:1+2, 2:1, 2:2+2 etc.)and after adopting it, to begin the game with equal number of players (5:5,6:6). In literature, there is a great number of training methods related to the abovementioned tactics, and I have used the systems of drills that I have partially modeled or taken over from the existing methodology. (Sibila 2005 p.84)



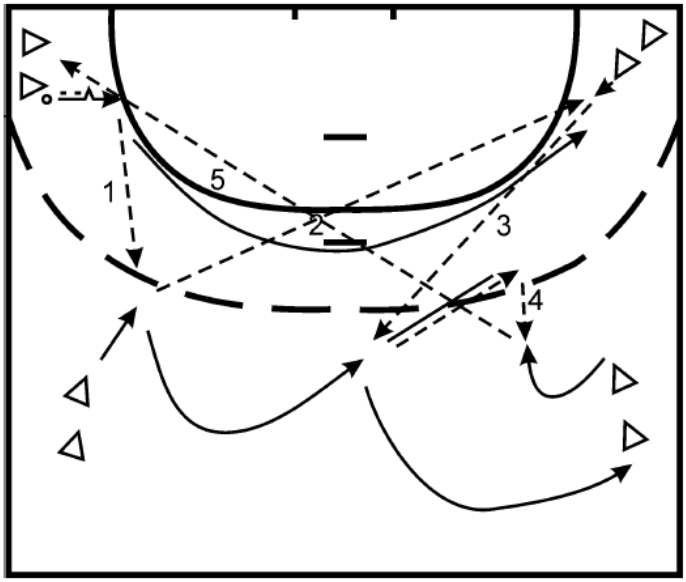


Picture A and B :

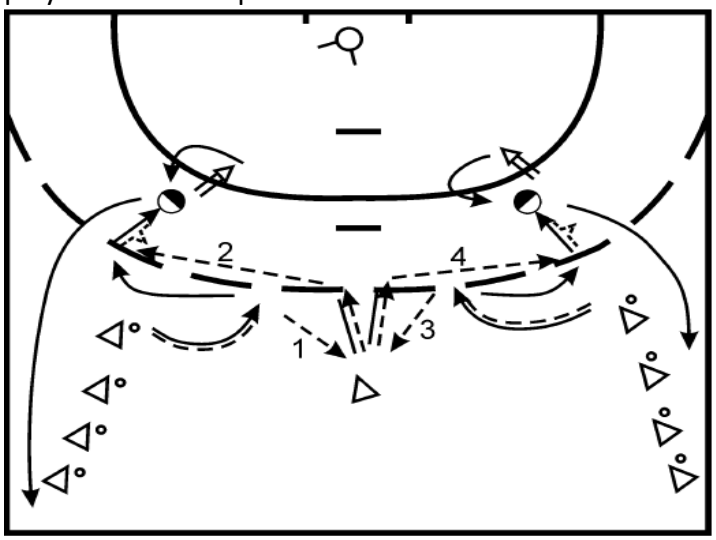
In the warming up period ,it is easy to use simple drills in which players practice different attack situations in cooperation with others co-players. These activities take place on a "ribbon without end" and should be applied as often as possible. Both pictures show drills where backcourt players are doing three different run ups, while they pass (first pass) with the centre backcourt, wing and after that, the pivot .The drill simultaneously occurs on both sides. (Sibila, 2005 p. 85)



Picture 2:
The drill in the picture is used for long passes and has good effect in improving technical knowledge. To every player's side there are two attacking players. The players pass the ball to the following schedule: LW-LB-RW RB- LW after each delivery runs to the opposite place attacking (wings to the opposite wing, outside the place of the backcourt). Players in the attack when switching places can also be semi active and defensive players, so that the attacking players can be more precise in passing.(Sibila 2005 p.86)

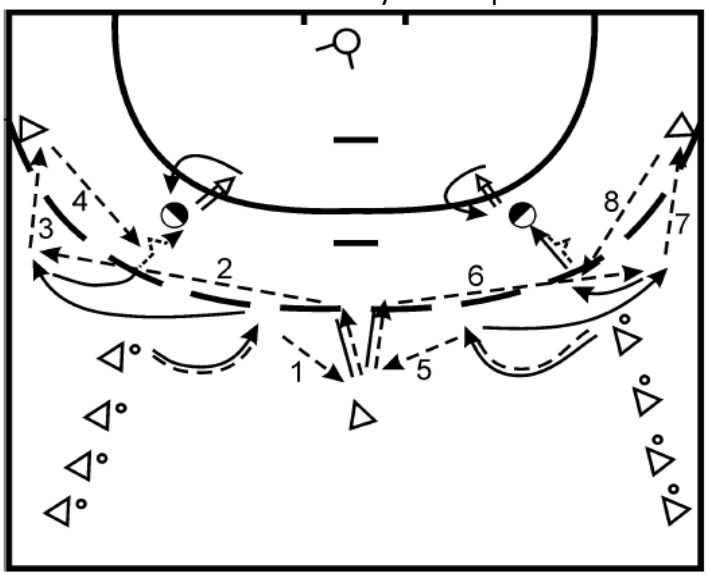


Picture 3:
A drill similar to the previous, only the purpose of the backcourts is different. After passing the ball, CB gets the ball from the wings and the circular player to the opposite external player. The ball is passed in this order: LW-LB-RW-LB+RB+LWRB+RB… (Sibila 2005, p.86)

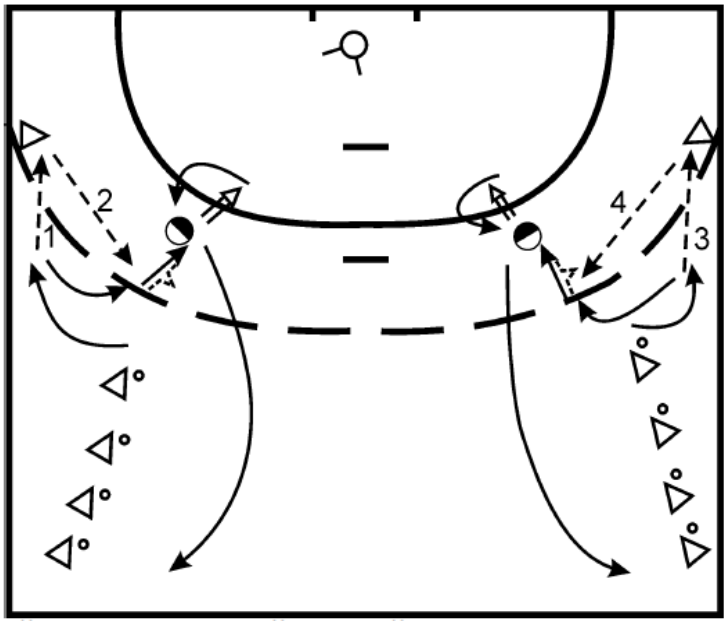


Picture 4: On the place of the left and right backcourt there are 2 lines of players, each having a ball, the attacking player is in front of them and in between are the centre backcourts that pass the ball. LB and RB in a semicircular movement pass the ball to the CB which he passes back to them after a wide movement away from the ball by LB and RB.

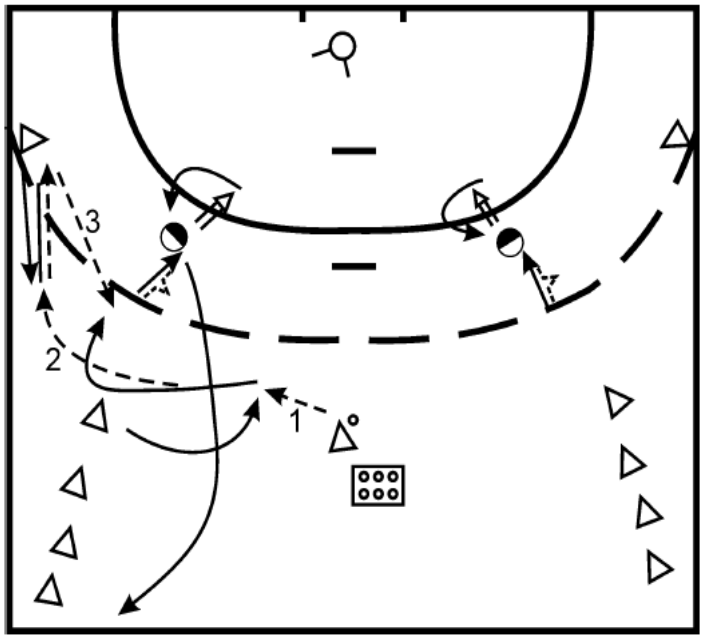
After receiving the ball, they play 1:1 with the defence players and do a shot at the door. After the shot at the door they switch places with the defence players. (Sibila 2005, p.87)



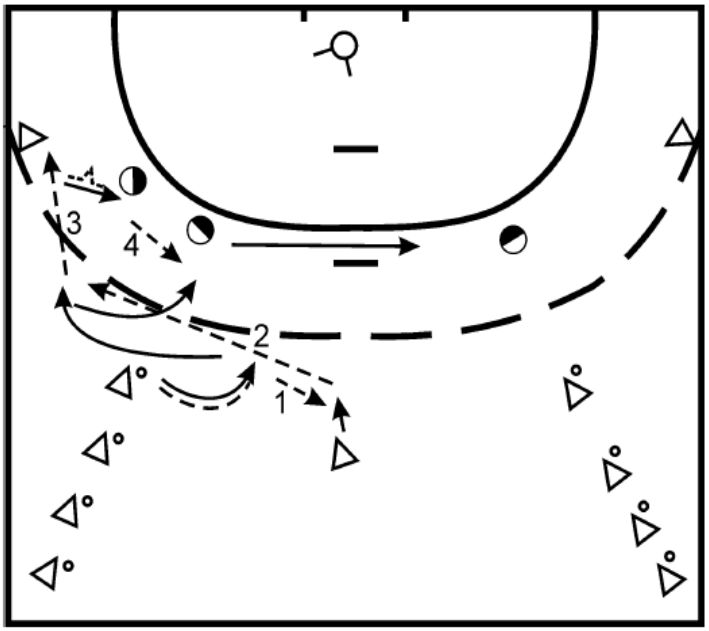
Picture 5:
The exact drill as the previous, only the LB and the RB can get the ball from the wings and continue the game 1:1 with the defence player.(Sibila 2005, p.87)



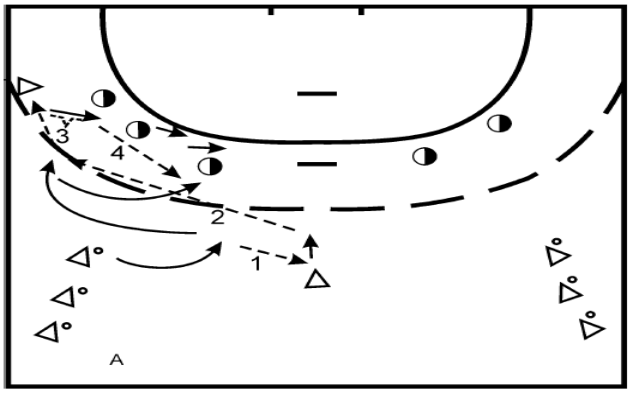
Picture 6:
In this drill the backcourt players do a wide run-up with the ball, pass to the wings that pass back the ball in the centre after which they continue to play 1:1. (Sibila 2005,p.88)

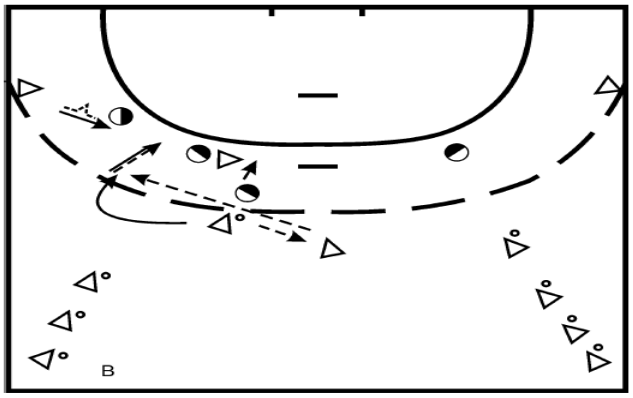


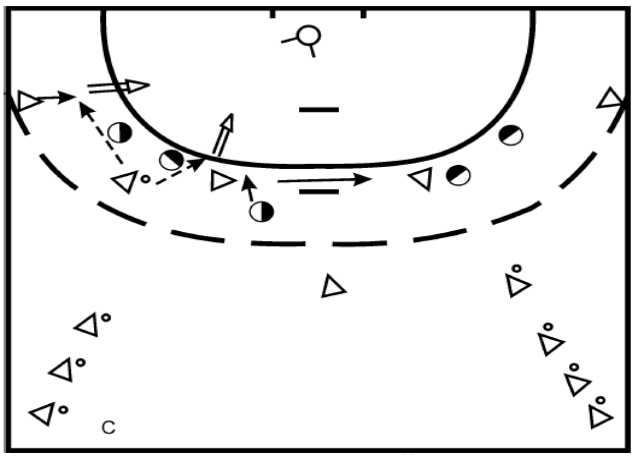
Picture 7:
The drill is similar to the previous one, only the run-up of the backcourt players during the dribbling is changed. (Sibila 2005,p.88)



Picture 8:
This drill is the continuation of the previous drills. Now, the backcourt player plays 2:2 with the wing and the defence players are in position 1 and 2 in the defence. The centre backcourt in the defence helps both backs in defence. (Sibila 2005,p.89)

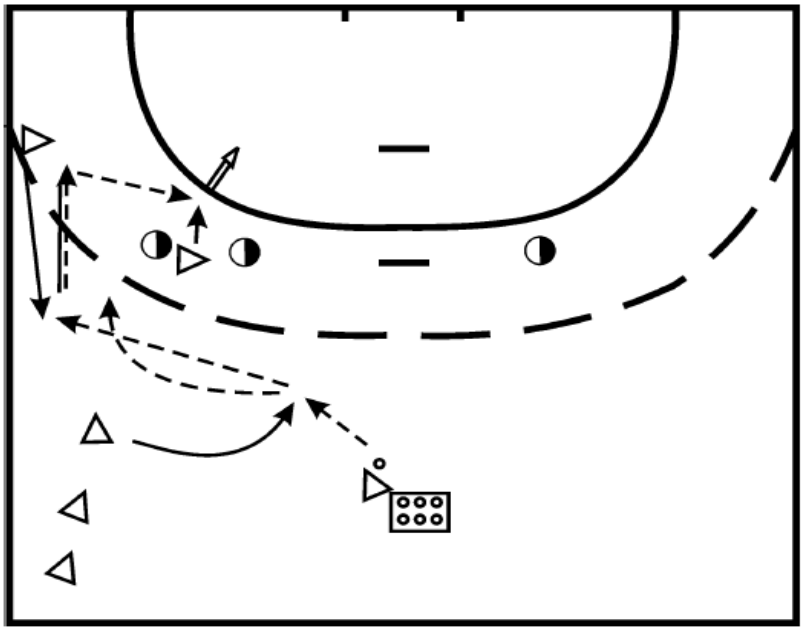






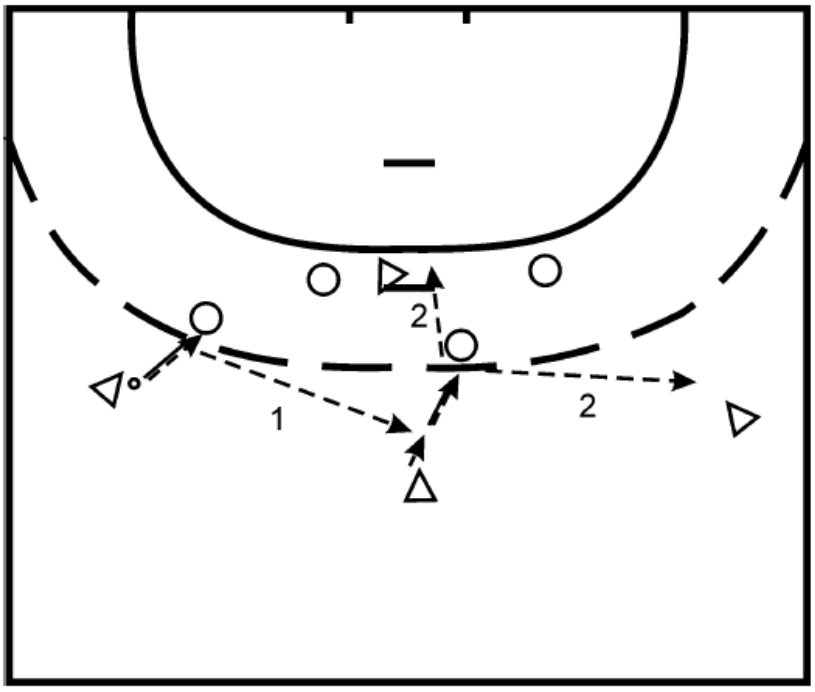
Picture 9 A, B and C:
There are 5 players in defence and the attack includes the pivot. The backcourts, wing, and the pivot play against 3 defence players and attempt to create an advantage in the marked area. The start of every action is the passing of the ball between LB and CB to the CB returning the ball to the CB who plays open game, returning the ball to the RB or LB who

pass the ball to the wings after which 1:1 game begins where with a solid run up and an aggressive game a goal can be scored. (Sibila 2005, p.89-90)

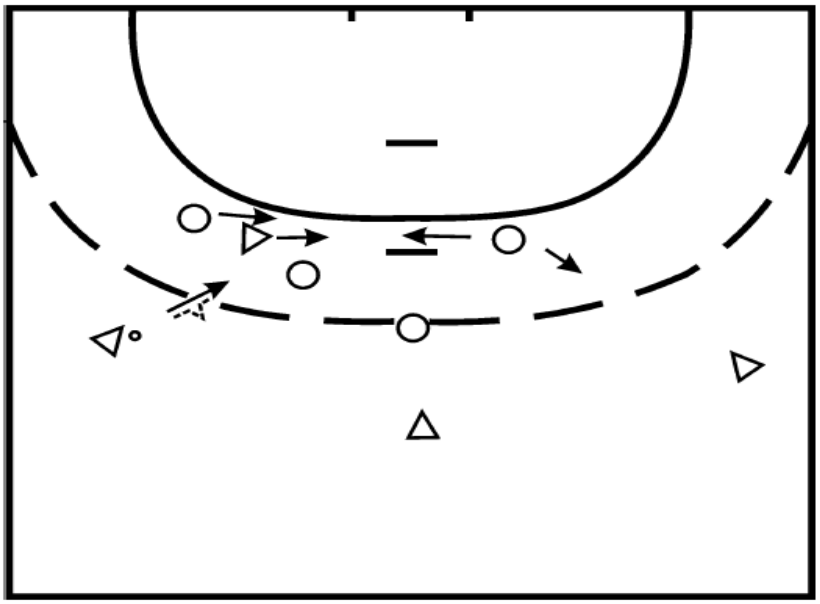


Picture 10:

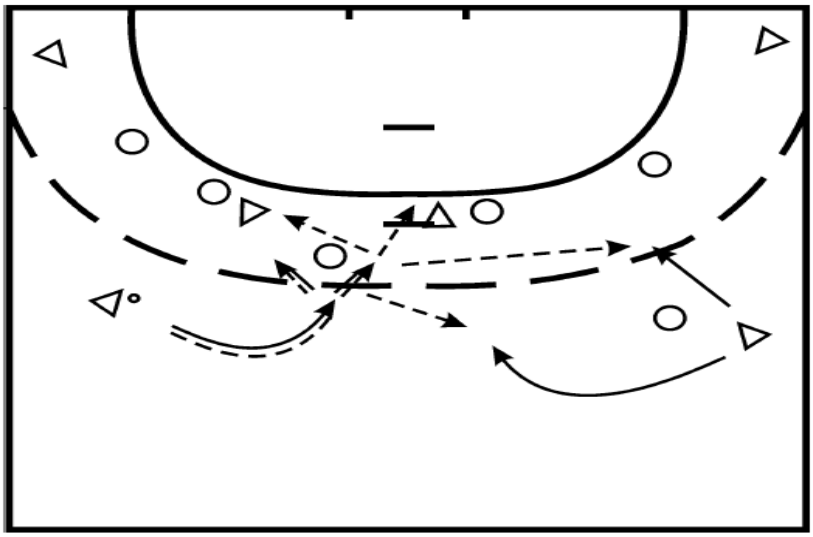
Exact drill as the previous without the first defence players. (Sibila 2005, p.90)



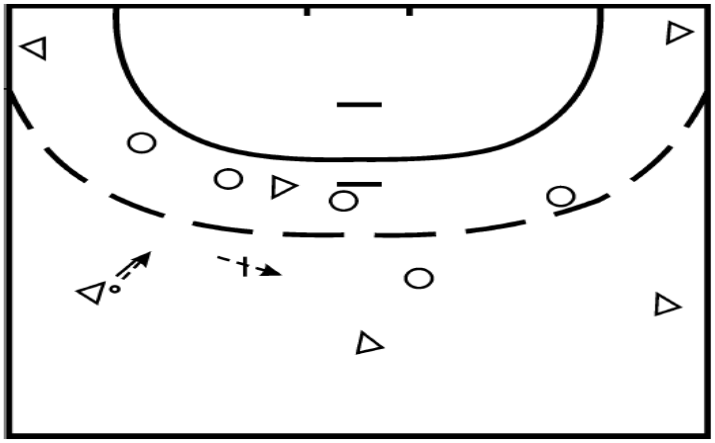
Picture 11:
A 4:4 game without backs and wings in the defence. Setting and reacting of the defence players is like in the 6:0 defence. While passing the ball the wings can be eventually included. (Sibila 2005, p. 91)



Picture 12:
4:4 game without backs and wings in the defence. The setting and reacting of the defence players is like in the 5:1 defence. The wings also can be included. (Sibila 2005,p.91)



Picture 13:
Creating a player advantage in the attack against the defence 5:1 after the run-in of the CB to the other pivot. The front part of the defence takes over the backcourt players of the side where CB runs and in this example that is the RB. Now the DV must perform a strong run-up to the centre to solve the situation that was created by the CB run-in to the other pivot. The options of cooperation between the players is demonstrated on the pictures. (Sibila 2005, p.92)



Picture 14:
The picture demonstrates a situation arising in a numerical advantage offense against an aggressive defence. This sort of situation is resolved by the centre-backcourt or the two backs switching to the pivot position and by long passing to the distant team player who must run up to score in the right moment. (Sibila 2005,p.92)

2. Development

This chapter gives a review about the game in numerical inferiority situations 5;6 which are becoming more and more decisive in modern handball.
For many years, the analysis carried out by experts on the greatest professional handball competitions and events (Olympic Games, World Championships, and European Championships) has highlighted the importance of the game in numerical inferiority situations, both offensive and defensive. Since the first stages in the history of the game some of the situations in handball that related to 2 minute suspensions have been thoroughly studied, especially those related to offensive play in superiority (6:5), and analysed scrupulously by all handball schools. Over these last years the basis for improving the defensive game in inferiority (5:6) had been deeply systemised and rigorously designed leading to noticeable results and new formulas.
No similar path has yet been pursued or studied regarding the defensive 6:5 game and the offensive 5:6 game; the first of which most possibly because of the “safety” perceived given the advantageous situation, in which any strategic design is assumed to be correct, valid and with a high success rate. Regarding the second situation, the offensive 5:6 situation (which is the purpose of this article); there is evidence of the developing of new strategic formulas that enrich the game, ensuring at the same time a better performance in such delicate situations. As explained subsequently, the development of these behaviours start from specific tactical guidelines, both demanding and mandatory for the players. The current evolution of the game clearly depends on the changes and interpretation of the rules of the game; the author has already stated in different reports the huge effect that the changes in the rules (especially those from 1997) have had in modern handball. The interpretation of progressive sanctioning in order to smooth the progress of a more “fair and favourable for

offensive play" game have improved this aspect in handball but it has also set up a situation in which the numerical inferiority situations during the match are relevant and decisive for the final result. That is the reason why "obtaining a good performance" in numerical inferiority situations is becoming mandatory in high performance handball. The game philosophy is changing and every situation becomes important and decisive for the final result; the maestros Kunst and Nedeff considered back in the 70's that in 2' superiority situations, achieving a 1-0 partial score was the ideal objective, accepting that the rival team in inferiority will "use up" the time when in possession of the ball. However, in modern handball, due to the passive game "pressure" and the fast decision making process during match situations, positioning is outdated given the increasing number of possessions in the exclusion 2' situations. From the opposite point of view, that is for the team attacking in inferiority, "using up" the time is not enough anymore and the team is now forced to assume scoring during that period as a key objective. The need for the best performance in these situations during the match is becoming more and more important and the chapter "Attacks in Inferiority" with all the necessary methodological analysis is essential to the structure within the general context of the game. This is the aspect on which this article is focused, suggesting guidelines for action and at the same time showing different examples observed at high performance level. Analysing the results of the recent European Championship in Norway 2008, the importance of an effective game and its significance regarding the final result in 5:6 situations is confirmed.

Guidelines to be considered in tactical and strategic structure of 5:6 attacks in inferiority

Tactical objectives

- Forcing of 1:1 situations on outside spaces (Wings)
- Forcing of 2:2 situations (In any space)
- "Surprising" situations
- Fly play

Collective organisation

-Attack with no pivot 3:2
-Attack with pivot and two wings 2:3
- Attack with pivot and one wing 3:2
-Choice of options against defensive variables: 6:0, 5:1, 5+1, 4+2

Recommended strategy

-Ball circulation
-"Fake" movements2.3.3. Extreme situations

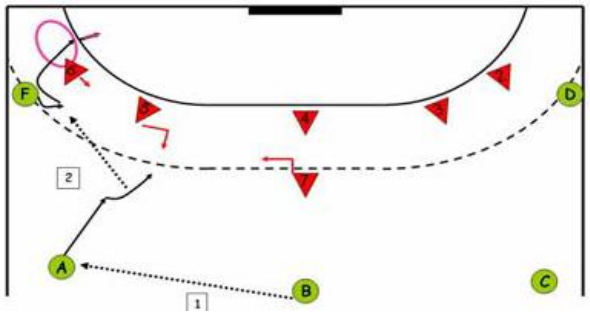
- Continuity

Analysis of tactical objectives and practical examples

Forcing of 1:1 and 2:2 situations in outside spaces (Wings)

The outside space is the most appropriate to develop a 1:1 situation and balance the numerical inferiority of the offensive team. An organised team should educate the Wings in being"sensible" in these situations in order to exploit those making individual decisions.

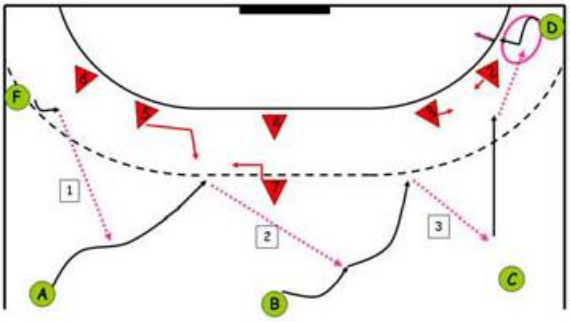
Diagram 1



(Seco,2008 p. 5)

As a follow-up to the objective described in the previous diagram, here a tactical collaboration between the Back and the Wing in a 2:2 action in order to facilitate the Wing penetration is presented. This example is just one option among the many other possible movements in order to find a shoot situation in an outside space. Other possibilities in a 2:2 situation played in the outside space include modifying the tactical option. On the left side, and at the same time that Wing F develops its action "drawing out" defender 6, Back A penetrates in the outside space and receives the ball from Playmaker B. On the other side, another option of solving the 2:2 situation is shown, thanks to the Wing initiative, a cross between Wing D and Back C takes place, and C takes advantage of the outside space

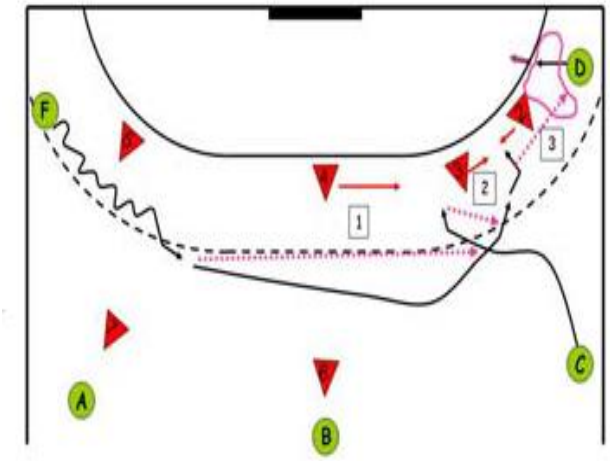
Diagram 2 and 3



(Seco 2008, p.5)

Depending on the defensive variables, the main actors change but the main idea remains unmodified: A Wing is oriented to penetrate on the outside space. In the current example against a 4+2 defence, the opposite Wing F collaborates in solving the situation by circulating and forcing a 2:2 situation where F and D face defenders 2 and 3.

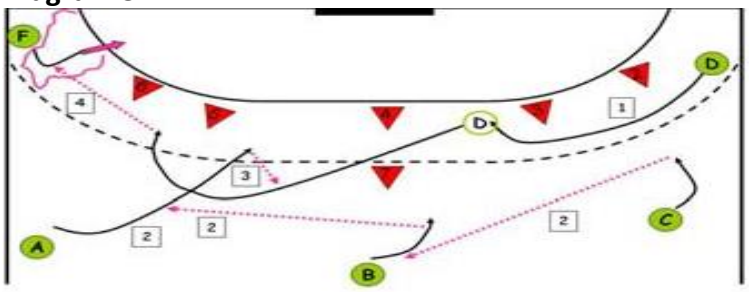
Diagram 4



(Seco 2008 p.6)

A similar approach is taken in the current example. An intermediate situation of Wing D in the pivot's space. An initial 2:2 try in which A and D face defenders 4 and 5 finally develops in a 2:2 situation where D (alter the cross with A and subsequently receiving the ball) and F face defenders 5 and 6 in order to take advantage of the outside space.

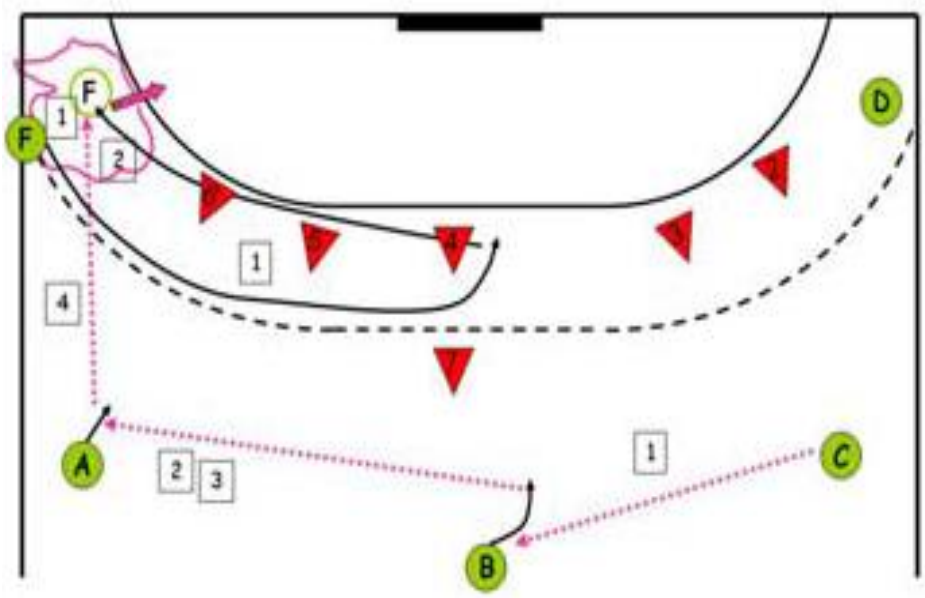
Diagram 5



(Seco 2008 p.6)

The objective here is to create a destabilised situation in the defence by using fake movements and then go back to initial positioning and exploit the possible defensive errors. This is the idea shown in the adjacent diagram where Wing F recovers its position at the same time that Back A attacks, the possible defensive error of defender 6 is exploited.

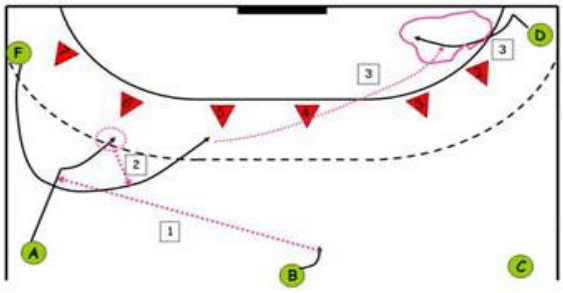
Diagram 6



(Seco 2008 p.6)

Fly play by Wing. In this case the offence is organised in a 3:2 structure (no pivot) and the defence chooses a 6:0 deploy. Left Wing F circulates coordinating its action with a fly pass to the opposite Wing D. The tactical idea remains as the outside spaces are being exploited. Many examples are currently based in this philosophy.

Diagram 7

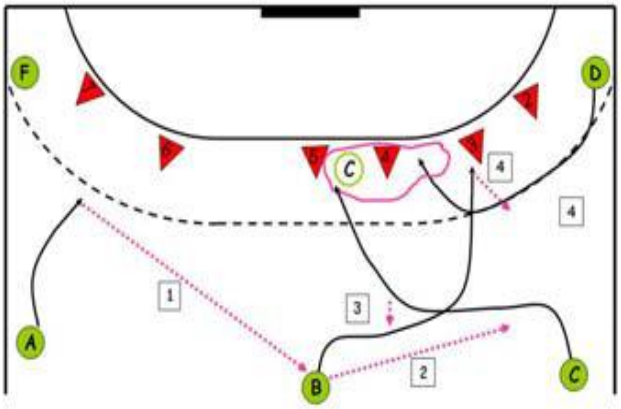


(Seco 2008, p.7)

As a practical example of a case in which the Wing does not finishes the attack in an outside space and in order to take advantage of the jump shooting capacity, a singular model is proposed, in which, exceptionally, a shot in an inside space is intended. The attack
display is a 3:2 structure (with no Pivot) and the defence is set up in a 6:0 display. A distractive movement is developed, with two crosses and with a possibility of a shot by the right Wing D.

The aim is to resolve the 2:2 situation where D and C faces 4 and 5.

Diagram 8



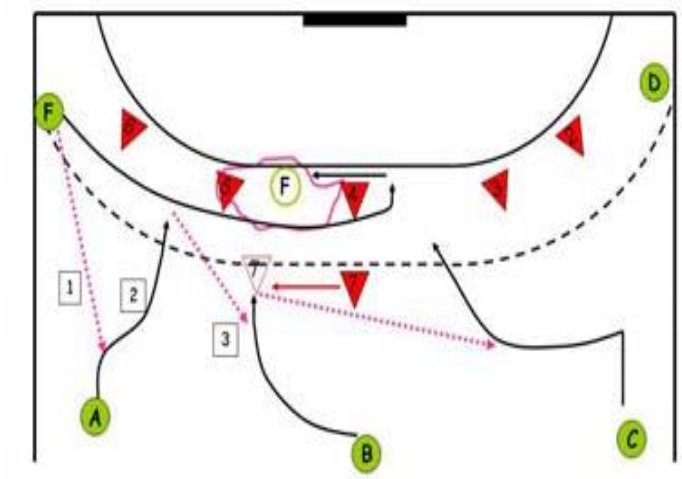
(Seco 2008,p7)

Forcing 2:2 situations in the Pivot spaces.

There are two possibilities: with a specialist playing the Pivot position in his space (3:2 with only one Wing or 2:3 with one Backline player less) and also occupying the Pivot position with a no-specialist Pivot, when a Wing or a Backline player takes that space. This last option demands an initial 3:2 offensive organisation with no Pivot.

The Wing F, from its original positioning moves to the space of the Pivot and the movements of Backcourt players A and B facilitate a 2:2 situation between Right Back C and the "Wing-Pivot" F against the defenders 3 and 4. This model represents one of many that could be coordinated with other movements from backcourt players, looking for the same tactical objective.

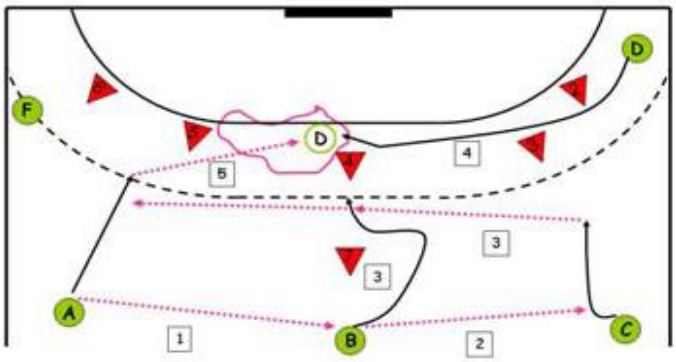
Diagram 9



(Seco 2008,p.7)

This part has stated the importance of “surprising” actions, equally valid for “Wing-Pivot” situations. In this diagram in which the movement of the Wing is done at the very last (“timing”). When facing a 5+1 deep defence structure and starting from a “pass & roll” by Playmaker B and Back C, we have a situation in the central space in which the surprising action of “Wing-Pivot” D increases the attacking options.

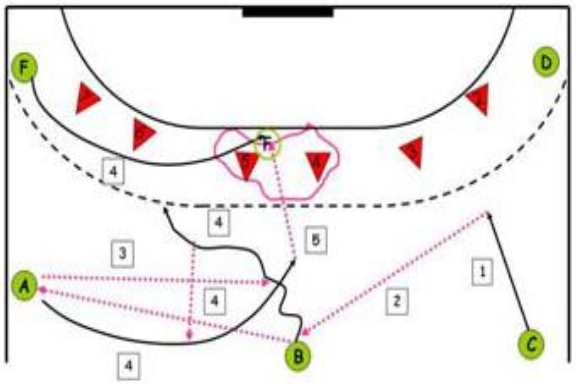
Diagram 10



(Seco 2008 p.8)

A similar example against a 6:0 defence. The objective is clear, forcing a **2:2** situation in the central zone by Left Back A and “Wing-Pivot” F with a previous tactical action (cross between B and A) in order to create confusion amongst defenders and to occupy the valid space by F in the last moment.

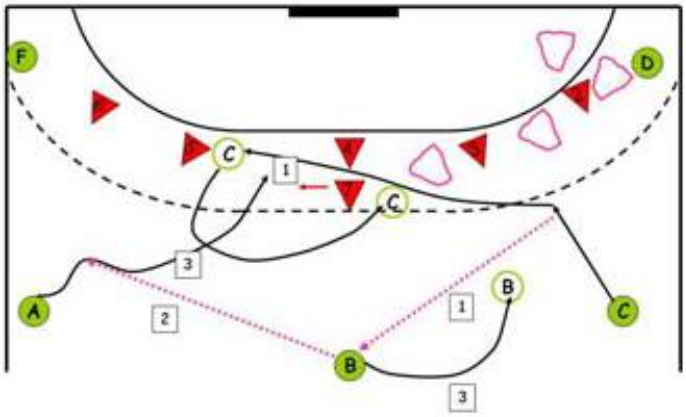
Diagram 11



(Seco 2008 p.8)

In diagram 12, the Left Back (right hand shooter) moves to occupy the Pivot position; The objective is to destabilise the advanced defender and using the cross of A with the **"Back Pivot"** C, force favourable situations for C, B and D to shoot or develop a fly shot. This example values clearly the principle of continuity.

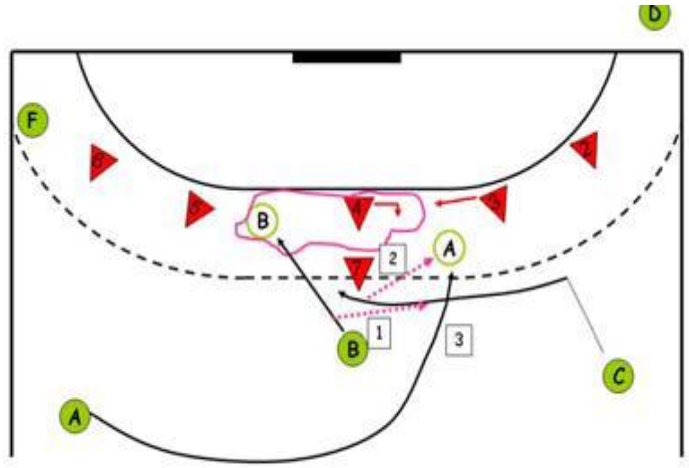
Diagram 12



(Seco 2008,p.8)

In this case, Playmaker B takes the space of the Pivot; it is now a priority to destabilise the advanced defender through a cross between C and A in order to continue the action and develop a **2:2** situation in which A and B (in their new positioning) face defenders 3 and 4.

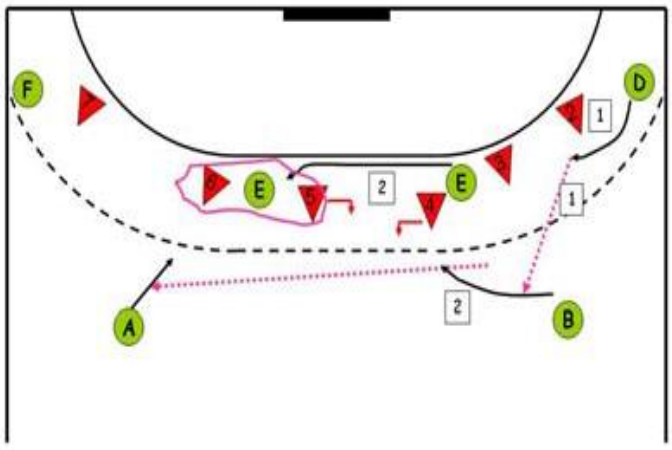
Diagram 13



(Seco 2008,p.8)

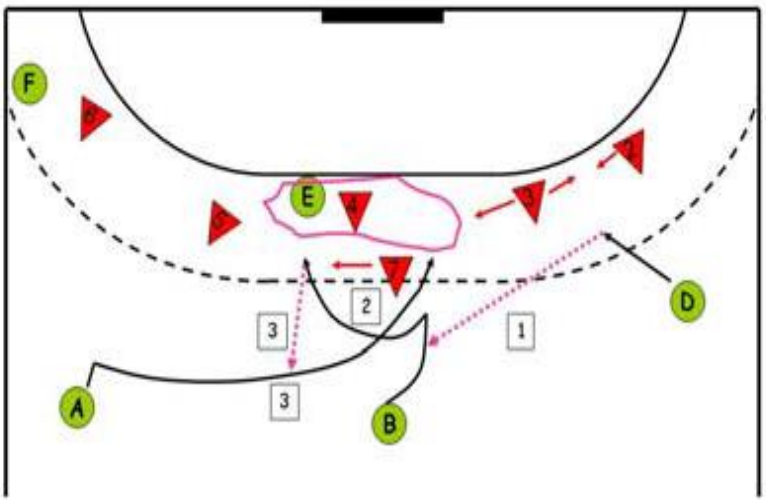
Organisation of the attack in a 2:3 set up (one Pivot and two Wings) against a 6:0 defensive system. A fast circulation of the ball and a good timing of Pivot E is needed when the ball reaches Back A from the other Back C and the option to play a **2:2** between A and E against the defenders 5 and 6.

Diagram 14



It is also used as a strategy in the 5:6 situation when leaving the outside space of a Wing unoccupied and organising the team in a **3:2 set up with a pivot**. Whichever the structure, the objectives are still aiming to obtain a 2:2 situation where the Pivot is the finisher.

Diagram 15



(Seco 2008,p.9)

These practical examples and some others that coaches would use should take into account both the individual and collective technical-tactical resources of their own team. The principle of ball circulation previous to the finalisation of the play (if the action of the defence allows it) should be observed with special attention. It is also critical to design previous fake movements, both individual and collective, that facilitate the planned objective. From individual initiative of a 1:1 situation developed in an outside space until the global collective plan of the game under the described conditions, they all should be an important part of the content of the game and of the global game systems employed by the team. To plan a collective variable in order to act in response to, at least, each basic defensive strategy will be essential in the future development of high performance handball

3. Results and Discussion

In this chapter, I would like to share the statistics from the last European championship in Denmark, January 2014, where I have was the coach of the National Team of Macedonia.

Numerical superiority was expressed with 407 goals in 47 matches: average: 8.65 – 4.3 per team. The efficiency per match was 61%.

Table 1.

Table of goals scored during man advantage

	ALL	AV	%		ALL	AV	%
ESP	45	6	64	SRB	9	3	38
FRA	41	5	67	ISL	21	3	49
POL	35	5	52	HUN	21	3,5	51
MNE	16	5	73	SWE	19	3	63
MKD	29/43	5	67				
CRO	32	4	68				

(Men's EHF European Handball Championship, Denmark 2014 Qualitative Analysis p.6 table 6)

Numerical inferiority is present with 201 goals in 47 matches. The average is 4 goals per match, meaning 2 per team. The difference between the teams was not significant. Number of offences and goals with one player more or less on the court at the European Championships from 2002 to 2010.

Table no.2

European Championship	No. of offences by the team with a player more per match	No. of goals by the team with a player more per match	No. of offences by the team with a player less per match	No. of goals by the team with a player less per match
EC 2002	7.95	4.47	6.15	2.34
EC 2004	9.43	5.54	7.35	2.60
EC 2006	8.70	5.16	6.72	2.81
EC 2008	7.74	4.71	5.85	2.32
EC 2010	7.82	4.76	5.84	2.94

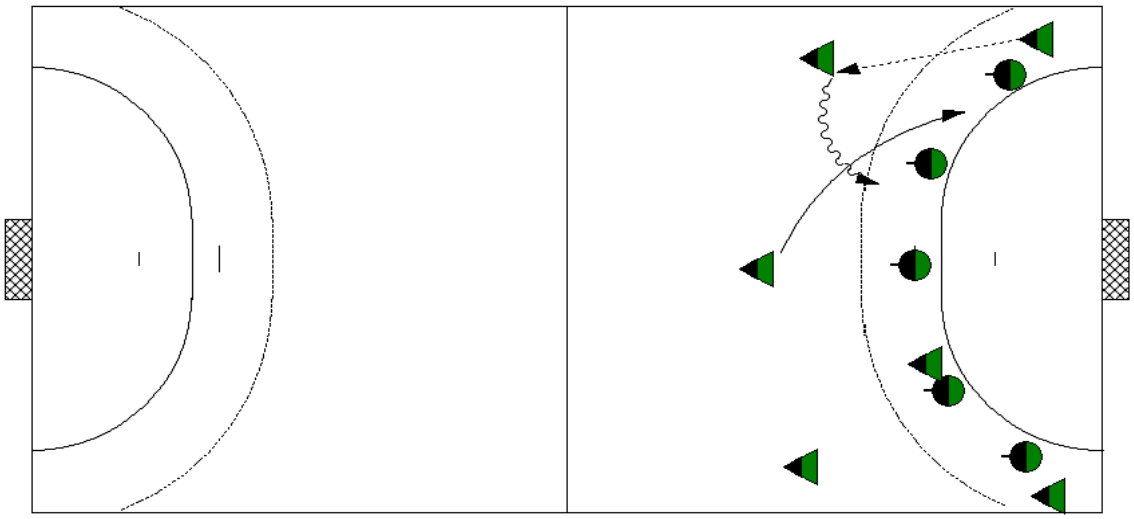
(Sibila 2012, p.1 table nr.1)

This is the review of the combinations that were mostly exploited and were the most productive for the selections of the European Championship in Denmark.

- **6 AGAINST 5**

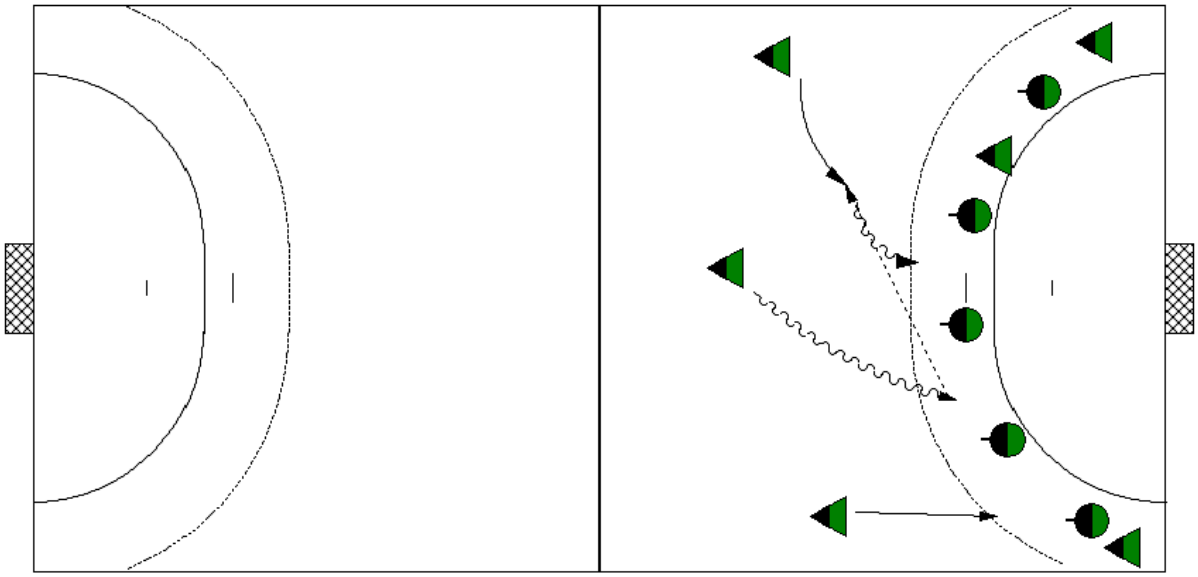
Example 1:
The pivot stands between the mid and the centre defender on the side of the ball i.e. where the offensive players start attacking the goal. In this situation, the left back and the pivot try

to cover the mid-and the centre defender. The left back then continues the game by passing the ball to the pivot, the centre back or any other free player. If the defensive players react inappropriately, the left back can also take a shot at the goal.



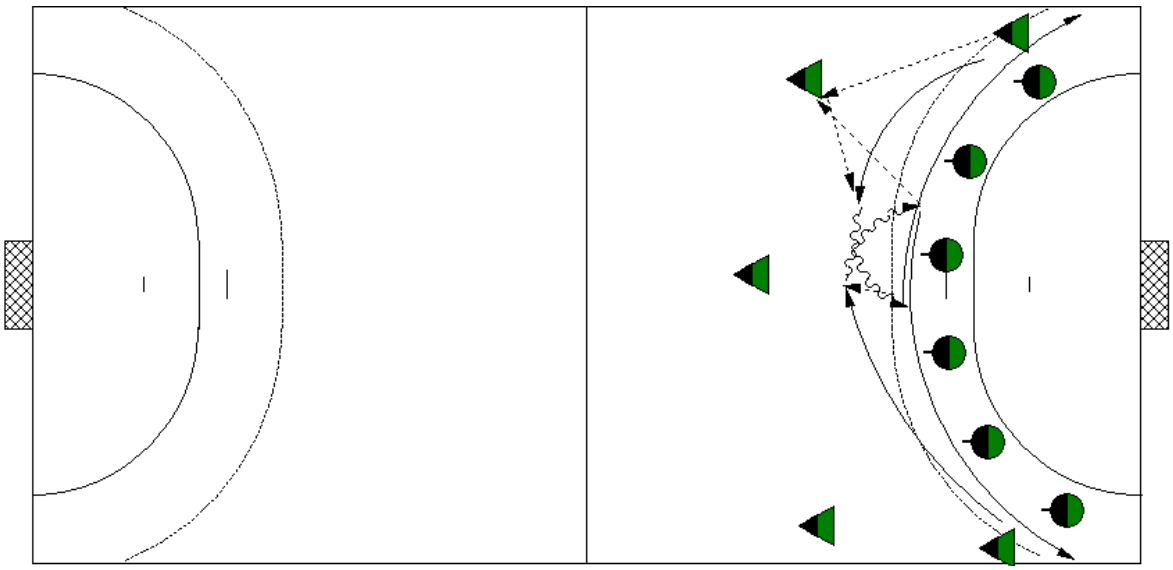
(Men's EHF European Handball Championship, Denmark 2014 Qualitative Analysis, p. 9)

Example 2:
The pivot stands between the OR and mid-defender on the side of the ball i.e. where the offensive players start attacking the goal. In this situation, the left back and the pivot try to cover the mid- and the centre defender. The left back then continues the game by passing the ball to the pivot, the centre back or any other free player. If the defensive players react inappropriately, the left back can also take a shot at the goal.



(Men's EHF European Handball Championship, Denmark 2014 Qualitative Analysis p. 10

- **5 AGAINST 6**



(Men's EHF European Handball Championship, Denmark 2014 Qualitative Analysis p. 10)

Conclusion

Most of the teams tactics in 6:6 play resemble each other in top level handball in offense as well as in defence. Efficiencies in offense typically range from 50-60%. However, efficiencies with one man up or one man down in defence often show significantly higher (in

superiority) or significantly lower quotes (in inferiority) than the aforementioned 50-60%. The inclusion of an additional court player or the equalization of court players during a 2 min suspension can clearly increase the efficiency of attacking beyond this value. In defence a high level of anticipation in 1:2 situations (inferiority) as well as a complete man to man marking (superiority) can clearly increase efficiency in defensive actions.
However, admittedly all of these actions despite their extreme contributions in a potential improvement of the game´s result can rarely be seen in top class handball nowadays. Due to the relative assimilation of team tactics in offense and defensive play as well as the relative risk associated with these tactical decisions, in these fields a clear potential for further improvement is present. As a consequence for the training process, a team trying to distinguish itself from the typical tactical patterns and trying to be more effective should spent high training loads for these tactical situations which might be encountered much more often as a future trend in handball.
The described tactical solutions must of course be adjusted to the team's structure or the quality of the players in individual playing positions. It is too often seen during matches at different levels that players cannot find an appropriate solution in the framework of well-conceived tactical combinations. One of the biggest problems is that players decide too soon to take a shot even if their position is not yet perfect. The offensive players are too impatient when preparing appropriate positions for shooting. The game is characterised by an insufficient number of adequately prepared dangerous running starts and passes without any interruptions due to breaches of the rules. The defenders can often easily anticipate the course of action from the initial position of the pivot and the initial development of the tactical situation – the offensive players' action becomes too predictable and thus facilitates the defender's response. An appropriate choice of tactical solutions enables players to learn how to dynamically and creatively solve problems encountered during the game with one player more in the offence. Most of all, a high level of dynamics must be maintained together with an adequate sequence of running starts, all of which must be in line with the depth and width of the play. The interaction with the pivot is very important as it enables the offensive team's numerical superiority to be taken advantage of. The pivots must take the opponents by surprise in their play – they must position themselves and get open in various ways. The blockades must efficiently break up a homogeneous defence and to make more difficult the anticipatory action of the defenders. A target-oriented and tactically correct offence with a player more is certainly extremely important for a successful offence. A specific tactical concept must be employed, enabling the players to be very creative and choose activities the defenders find difficult to anticipate. Thus, the offensive players exploit the advantages given by their numerical superiority or to hide the disadvantages of player less in a more controlled way. The appropriate training methods are extremely important as it gradually introduces the players to correct tactics. Work with young age categories of players is very important as it enables them to upgrade their knowledge in senior teams.
Personally, I think that when one team has an attacker plus and the way how it is performed gives the picture if that team knows the handball rules i.e. if the team is tactical, technical and mental prepared to achieve the advantage from the plus player. Many times the mental barrier contributes to the failure of the team. In this mental preparation for this kind of attack, the coaches often make mistakes when they demand from the attack a quick finalisation and have the

expectation in two minutes to make two or even three goal difference. It must consider that the defending team is prepared to perform this, so the other team should use it tactical and technical ability to the following match.
One player or two in the attack stage has a primary goal to hold the open attack and that means automatically the defence of the opponent becomes more vulnerable i.e. open. The speed of the ball in this part does not have a great importance because it was already taken the advantage of one player so it is only necessary to rule the space.

In the 5 against 6 game the primary purpose that sets the coach is the time, the holding of the ball, the ability to keep up the game. Personally I would insist on solid preparation of the action, more cross-overs, change of the places, even including the wings with run ups, cross-overs, the role of pivots or more player that can release more space for the back up line. I would not allow in the transit space passive game.

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MACEDONIAN HANDBALL FEDERATION

3:2:1 DEFENCE WITH TRANSFORMATIONS TO 6:0 AND 4:2

IVICA OBRVAN

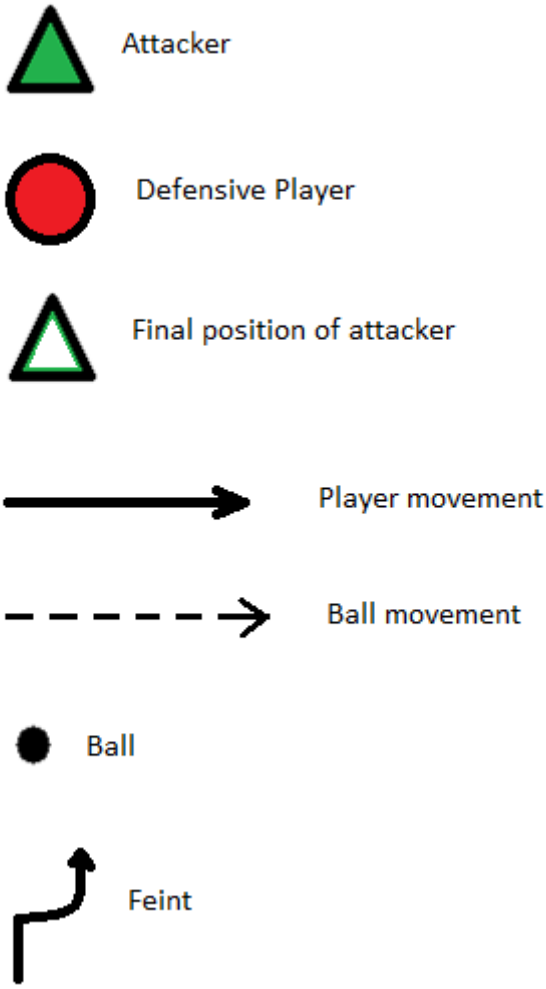
Key Words: Handball, 3:2:1 defence, transformations of 3:2:1 defence

Content:

Summary

3:2:1 defence system is one of the oldest and the most important defensive systems in handball history. It was implemented by Vlado Štencl in 1960s. Due to a lack of quality training in younger selections, high physical, tactical and fitness demands of this system, and due to a lack of time for training in modern handball, this system was abandoned. A lot of teams made small modifications, but even more teams decided to start playing other defensive systems like 6:0 and 4:2. In this paper I will write about some basic 3:2:1 methods and transformations from 3:2:1 to 6:0 and 4:2.

Key:


Attacker
Defensive Player
Final position of attacker
Player movement
Ball movement
Ball
Feint

INTRODUCTION

In this seminar paper I will mostly talk about from what I have learned troughout my professional playing and coaching career.

3:2:1 defence was introduced to handball in 1960s by Vlado Štencl with representation of Jugoslavija. The main idea of that defence is to deny the shots of the back players. This defence also has a great density in the middle, it's shape is always trying to be triangular and players are always following the ball. Three defensive players in a basic positions in 3:2:1 defence are placed on a line of six meters, two players are placed from seven to eight meters and one player is placed around nine meters from goal. This is a version that can be changed allowing the defensive players even higher positions. Triangular position of defensive players is allowing higher fall-out towards the offense players.

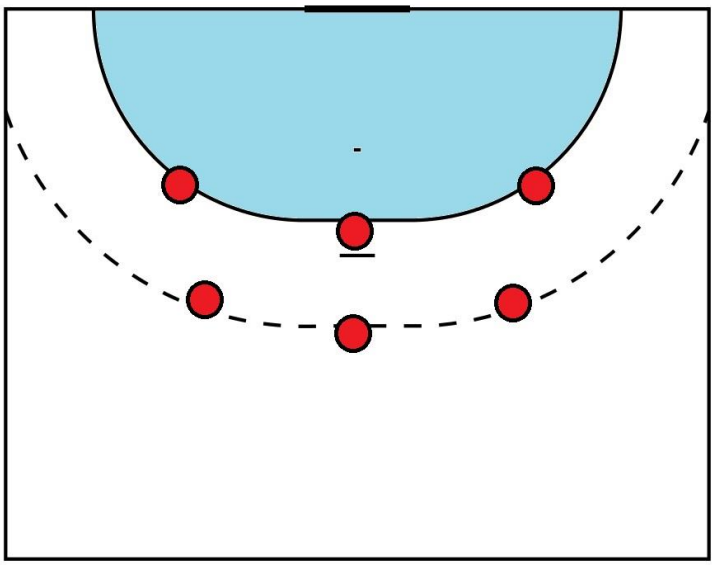
Advantages of 3:2:1 defence

- denying shots from back positions
- fast transition to counter attack
- easier transformation to other defence zones
- the tasks of defensive players are simpler then in other defensive systems
- density and depth of the defence is allowing defensive players covering and doubling offense players

Disadvantages of the 3:2:1 defence

- it requires great physical condition
- if defensive players are not on the right positions their running lanes will cross in transition to counter attack
- there is more space for wings and line players
- vulnerable to second line players and to blocks and pick & roll
- it requires constant contact play and by that defensive players are risking more exclusions

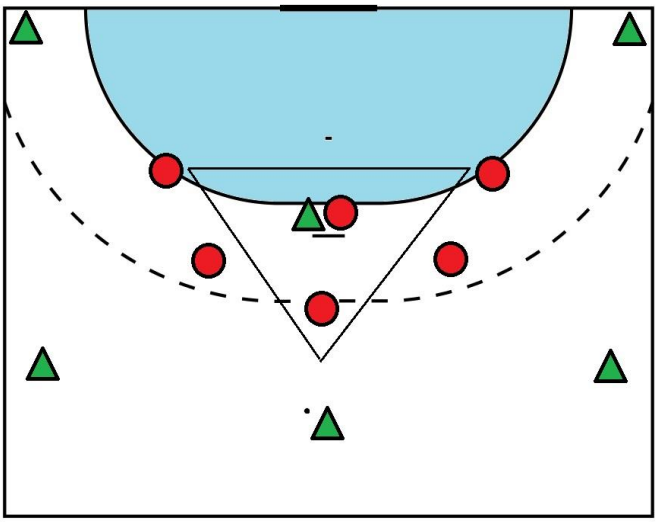
On the next picture we can see the basic model of a 3:2:1 defence

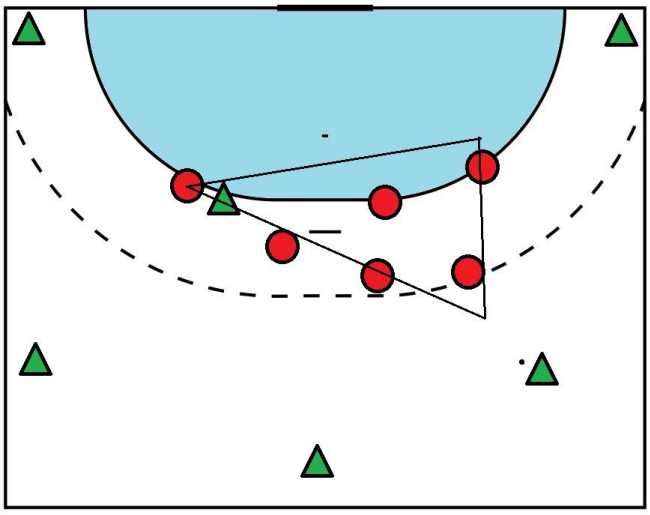


In new era of handball team which played the most sucessful 3:2:1 defence was Croatia. Croatian version of the defence had it's defenders placed shallower with a higher density in a middle and with more covering of a space. In todays handball where teams are mostly playing 6:0 defence we can find many aspects of 3:2:1 defence where defensive players are coming higher to do a foul on attacking players with higher density in the middle of the defence.

French National team was the most succesful team in the last 15 years with their specific 5:1 defence which sometimes looked like 3:2:1. The main difference in those two systems were their half backs who were mostly oriented on individual covering of the attackers where those defence didn't have specific triangular shape as 3:2:1. Center back in 3:2:1 is mostly covering the space and following ball movement, while in french system center back was always near the line player with less movement towards the ball. They were individually strong, especially in 1 on 1 play and their half backs we really succesful against the attackers. (B. Gille, G. Gille, Fernandez, Burdet, Narcisee, Karabatic, Abati).

Hereinafter I will talk about basic 3:2:1 system with transformations to 6:0 and 4:2. If 3:2:1 defence is covering the space correctly while some of the backcourt players has the ball it's shape will always be triangular.



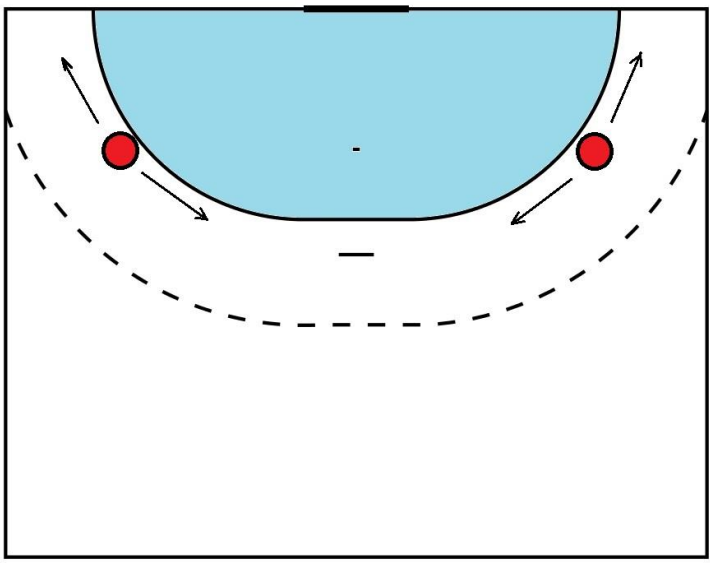


DEVELOPMENT AND OBLIGATIONS OF DEFENSIVE PLAYERS

For 3:2:1 defence to work properly every defence player has to fulfill his duties. The defensive duties of players in these systems are next:

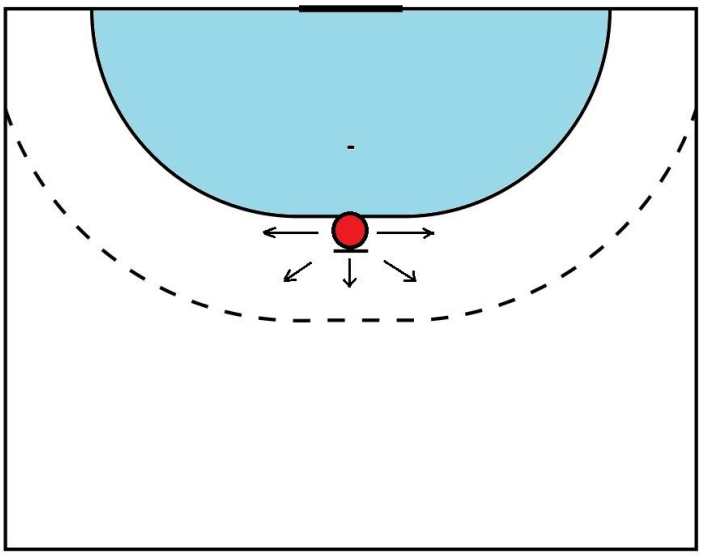
Far left and far right:

- their main duty is to cover the space of wing players in attack
- they must not allow wing players going to second line players
- they must disturb and cut long passes to line players when the ball is on the other side of the attack
- they are controlling density with their movement towards middle
- they are rarely leaving the line of six meters because of the danger of a good line player



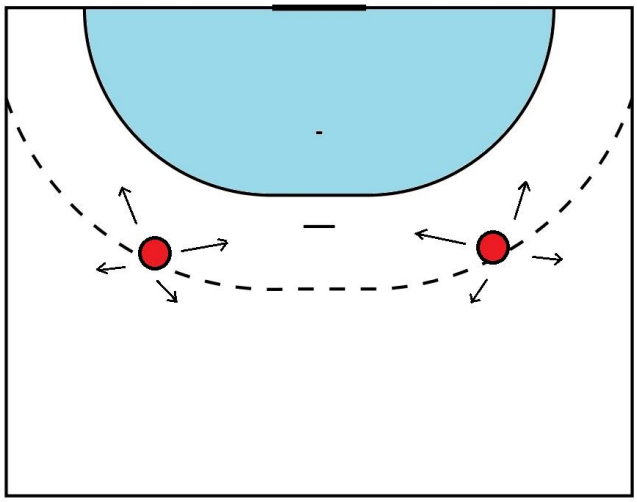
Back Center

- leader of the defence
- with his movement he is following the ball and is blocking shots and penetration from back players
- he is always positioned between his own goal and the backcourt player with the ball
- in 90% of the cases he does not leave line of six meters unless line player is playing pick & roll
- he is always the last barrier for attacking players which is requiring great physical condition, tactical knowledge and great intuitive judgement
- with chemistry and teamwork he must solve problems of pick & roll with his teammates



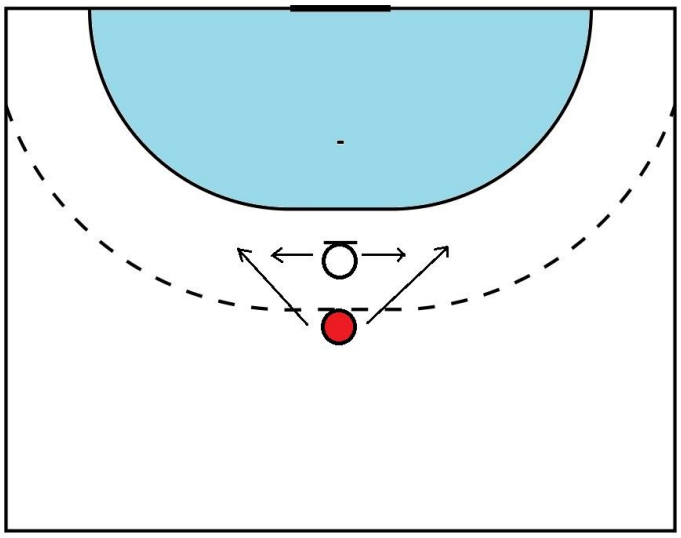
Half left and half right

- they are placed from seven to nine meters
- in their space they must stop shots or feints of right and left backcourt players
- they must stop penetration of the playmaker on the right or left of their front center
- they must help in covering the line player when the ball is on the other side of the attack
- they have to have their arms in the air all the time to stop passes to the line player
- their characteristic is triangular movement with constant obstruction of vision field of the attacking players



Front Center

- has a similar duty as a half left and half right
- his duty is to stop feint and shot of the playmaker from the centre back position
- he has to have a great judgement when to double his left and right backs
- great judgement to intercept diagonal balls to line players
- he must stand higher from nine to ten meters except when the attack has two line players, in that situation his place is around eight meters

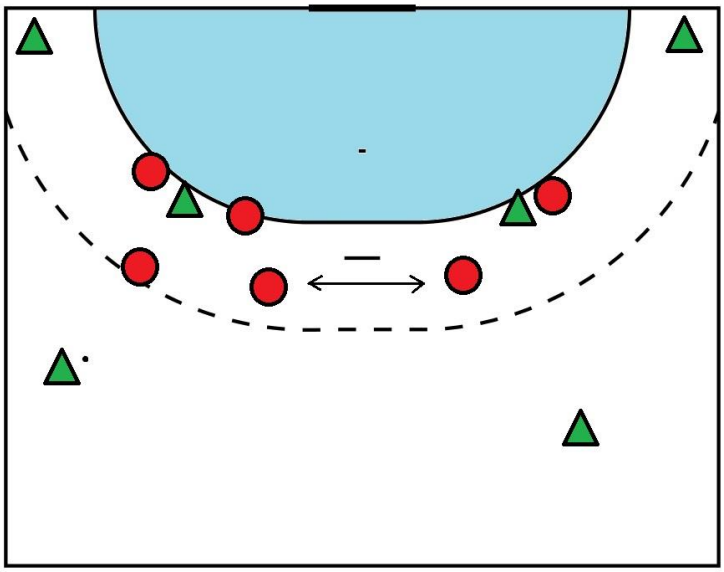


METHODS OF 3:2:1 DEFENCE

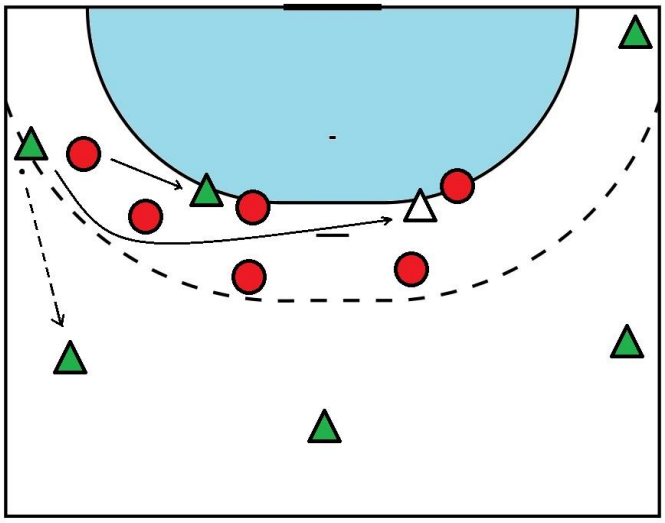
3:2:1 defence is relatively easy in theory, but the very important assumption to start learning this defence is physical fitness because this defence system is requiring a lot of movement towards the ball. This system is also requiring great individual and group tactic.

Theoretically speaking against teams which are playing 3:2:1 defence, main attacking combinations are transitions to second line players when the front center has to get back to a line of eight meters from his goal.

In that case front center has the duty to raise up his arms, he must stop diagonal ball movement to line players, he has to help his left and right back if he sees that they are losing the one on one duel and he must create a foul on attacking players with a fast reaction.

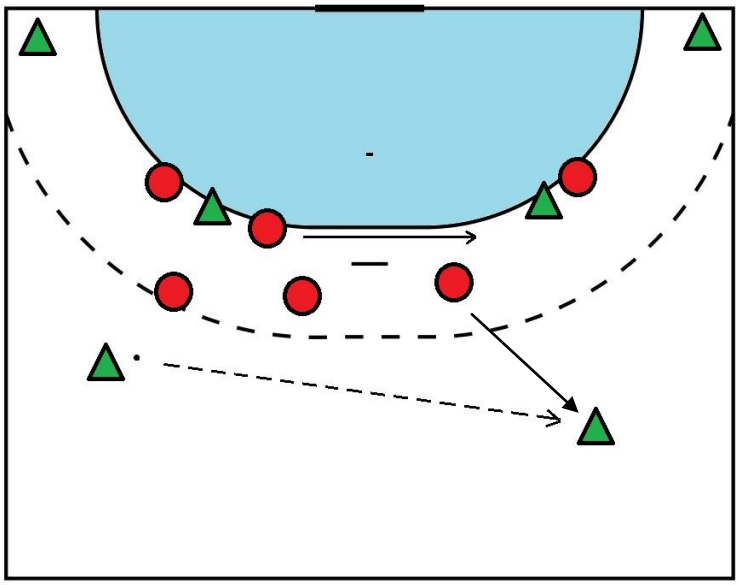


When the wing player is going to line as a second line player, the defence must keep the shape of 3:2:1 defence with an exception of far back player to create more density by moving towards the line player and he has to watch that back players do not try to penetrate the defence from wide positions (wing positions).

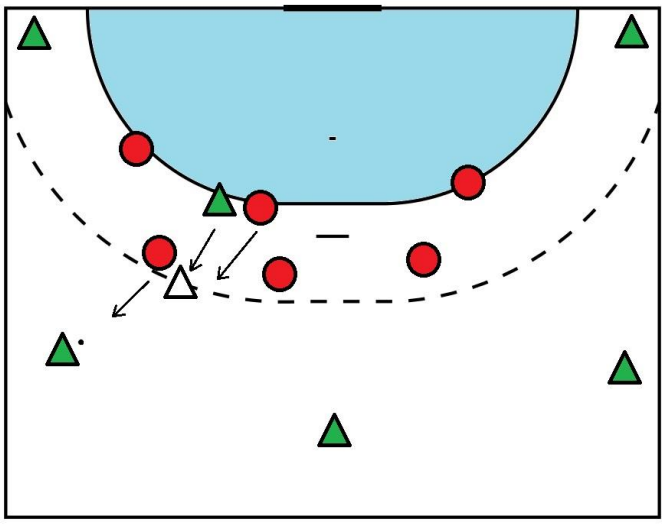


When the attack is using second line player we have one very important task of half left and right players and that is a fast foul so that back center player and the rest of the defence can get a break. Half right and left defensive players must not allow attacking players a couple of consecutive passes in a danger zone (nine meters) they must with their movement and aggressive chase those attackers further from the line of nine meters or try to make a foul.

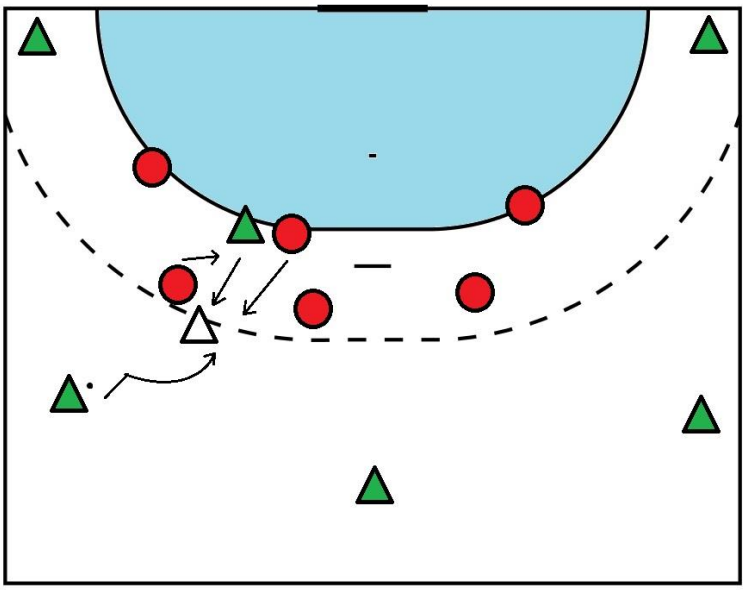
On the picture below we can see an example, far back is covering the second line player creating density, back center is following the ball while half left is going out to create a foul on the right back. Front center must screen the diagonal pass to a line player.



The main problem of a 3:2:1 defence is pick & roll. The most typical situation is when the line players is trying to create a block on a half defender. To stop the block the defensive players must communicate on time, half defence players must go out towards left or right back aggressively two or three steps with a main purpose that the block will happen 10 to 12 meters away from the goal.

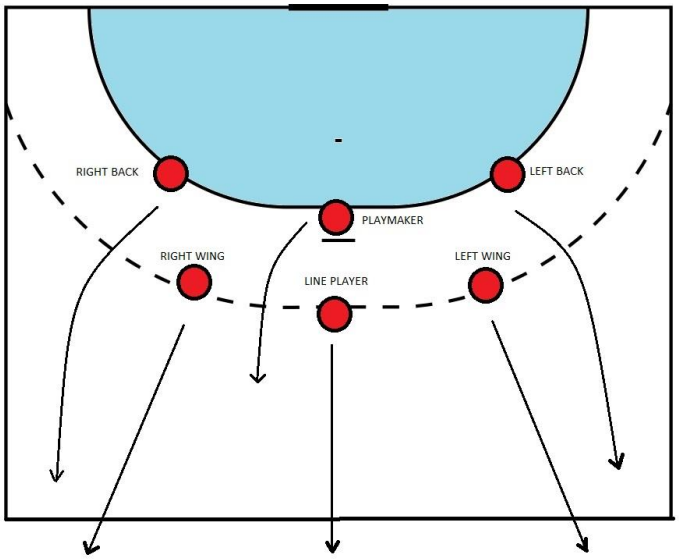


Second option to solve blocks is simultaneously covering attackers so that line player is not allowed to separate from the half player towards six meters while center back is taking over the backcourt player. That is the only situation when the center back is leaving the area of six meters.



In ideal 3:2:1 formations the ideal defensive positions of players because of the counter attacks are:

- Playmaker - Centre back
- Right and left wing - Half backs
- Right and left backs – outside defenders
- Line player - Front centre (= point)



On a front line there would be line player and wings to have shorter and faster route for a counter attack and because they are playing less demanding positions in attack they can use more energy in offense. Centre back player would be a playmaker who would develop counter attacks and the outside defenders would be left and right back.

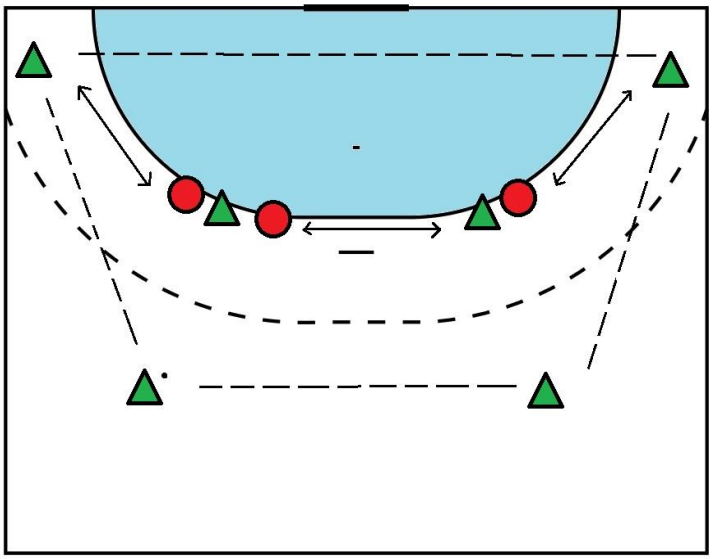
METHODS OF PRACTICING 3:2:1 DEFENCE

In this seminar paper I will present a couple of basic exercises which are good for individual and team development of defensive players. It is very important that the players start learning these things in a younger age so they can develop technical, tactical and fitness skills that 3:2:1 defence is requiring from players.

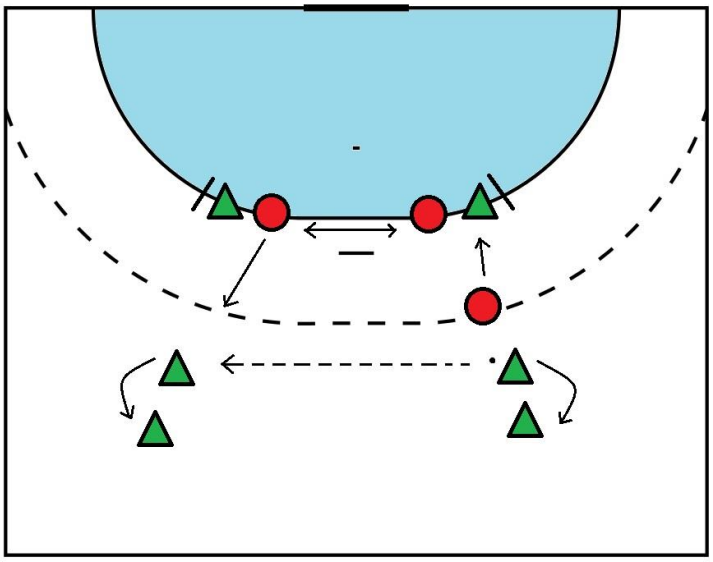
This defence is requiring a lot of one on one contact play and defensive players must practice that part of the game a lot, but in this paper I will focus on group methods of practicing the 3:2:1 defence.

Practice of a lateral movement of a far backs and centre back. Their duty is to screen passes towards the line player. Line players are static, right and left backs can pass to a line player,

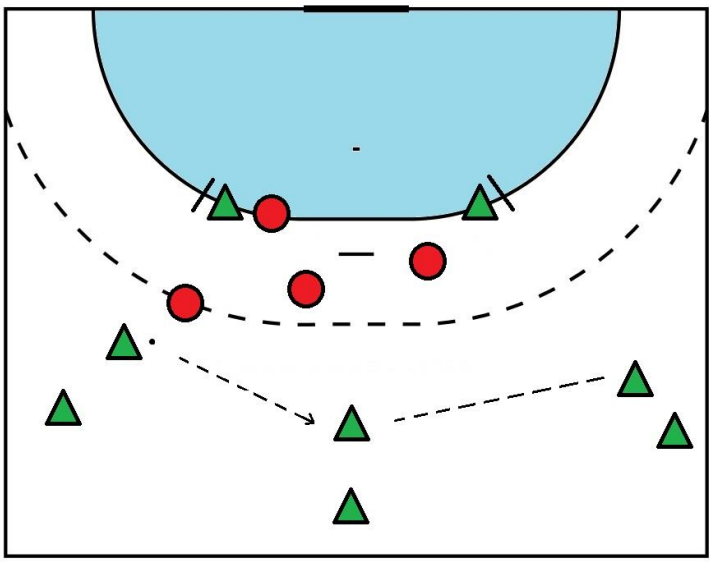
wing player and to another backcourtplayer. We have variations with and without a shot on the goal.



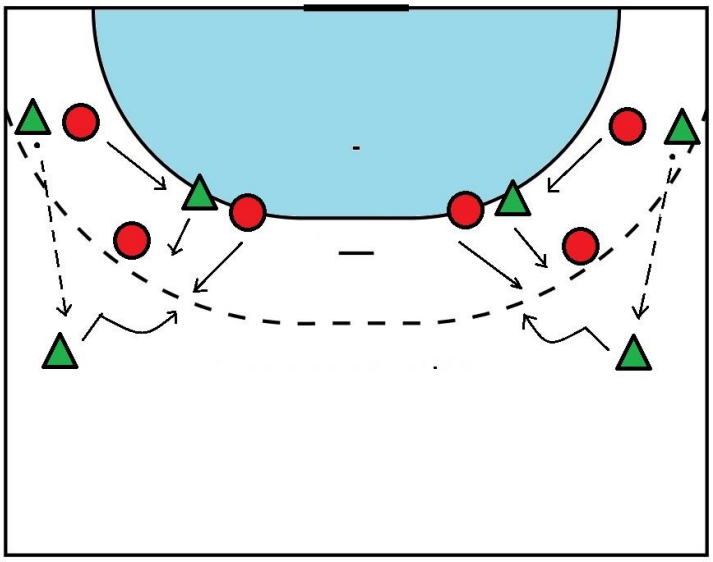
Practice for a half backs. Left and right backcourt players are constantly attacking the nine meter line. The mission of half backs is to go out towards right and left back while the center back is covering the line player behind their back. Left and right backcourt players can pass towards both line players.



This is the key practice for a center back, half backs and front center. Here they practice density, lateral movements, positioning and teamwork. Line player are static, attackers can cross ball, pass to line and shoot. Offense has one player more.



Next practice is pick & roll of a line player on the half backs. The mission of the defensive players is to solve the block by communicating and taking over right and left backs with half backs or centre back. Attackers can also shoot on goal and the main purpose of this practice is to learn how to play against pick & roll.



TRANSFORMATIONS FROM 3:2:1 TO 6:0 AND 4:2

Considering the fact that the defence 3:2:1 is often attacked with transitions to a second line player from wing or back positions, the tendency is to keep the defensive shape. In some situations when the coach assess that his team can not defend their goal anymore he has to change the tactic.

There are a couple of solutions and the most common are:

- transformation to 6:0
- transformation to 4:2
- combined transformation to 5:1

Which transformation to suggest it is up to every coach to assess the possibilities of his own team.

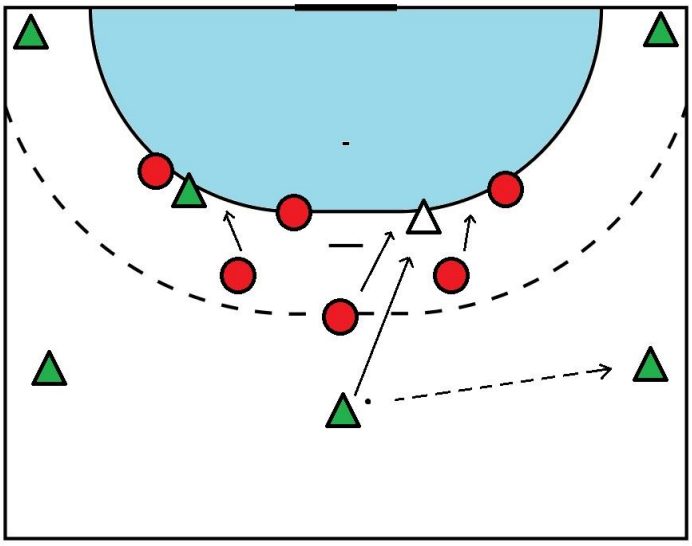
Transformations from 3:2:1 to 6:0

Why are we doing this transformation?

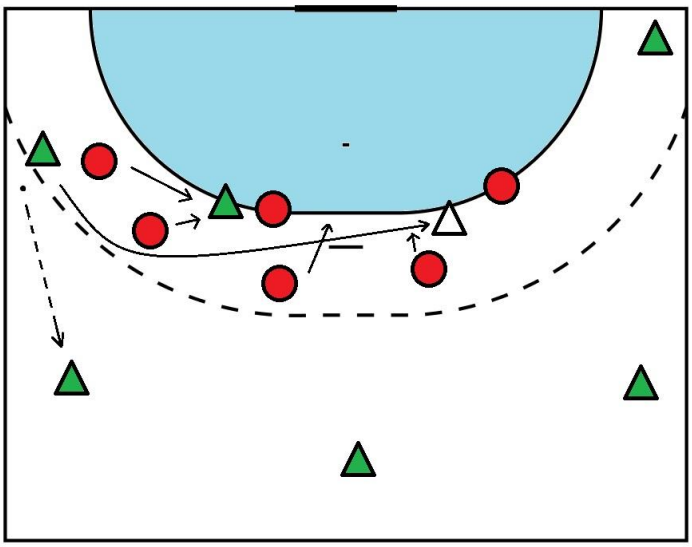
When the attack decides to make a move with a second line player, we are moving the front center back to the six meter line so that the defence can easier cover the line. It would be ideal that the front center is a tall player so that we can get density and height in the centre of the back with this transformation.

In this situation we also have to be ready stop playing by the basic principle of 3:2:1 defence and that is stopping shots from back positions. In my paper I will show some transitions to 6:0 defence when wing and back players are making transition to a second line player.

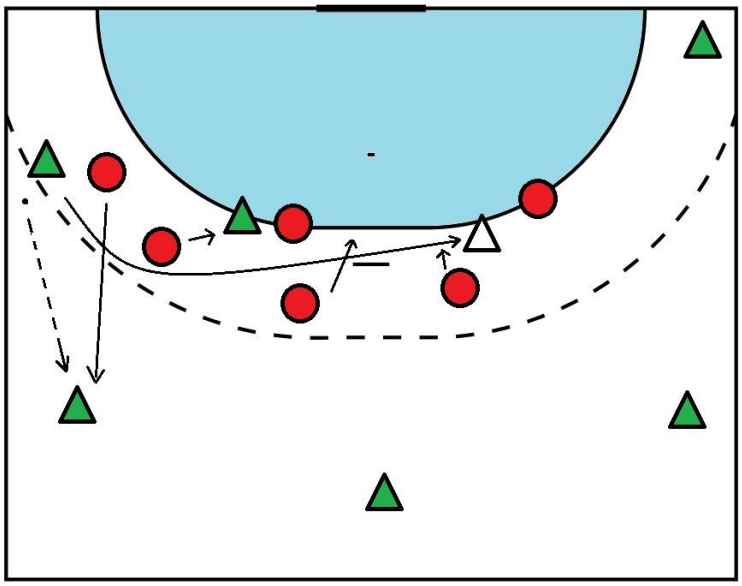
On the picture below we have a playmaker transition to second line player. Front center is withdrawing to the six meter line. Very good example of this transition is the Croatian team with Igor Vori who as a forward centre is tall and he fits ideal to a 6:0 zone.



On the second picture we can see the left wing going to second line player after passing the ball to left back. Front center withdraws to six line meter, far back which player went to line creates density by pushing first line player and taking care that the left back does not penetrate defence from wide position.



Second variation of a wing player going to line on a picture below. Far back this time is taking the left back while the half back from that side takes control of a line player. Centre back again withdraws to six line meter.



Transformations from 3:2:1 to 4:2

When do we do this transformation?

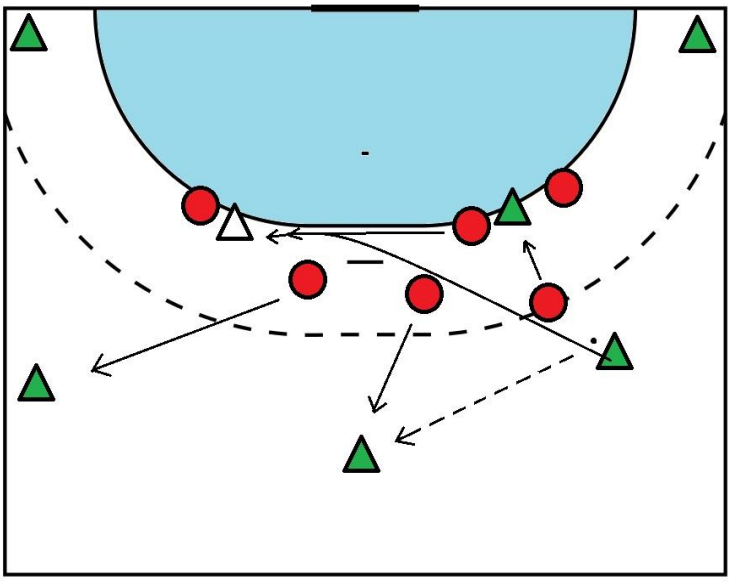
If on the positions of half backs and forward centre we have faster and shorter players and our team is not handling well second line player we have the option to make transformation to 4:2 defence.

We must always know which two players are going in front of nine meters and what are their duties. This transformation leaves a lot of space to defend, defenders have to be

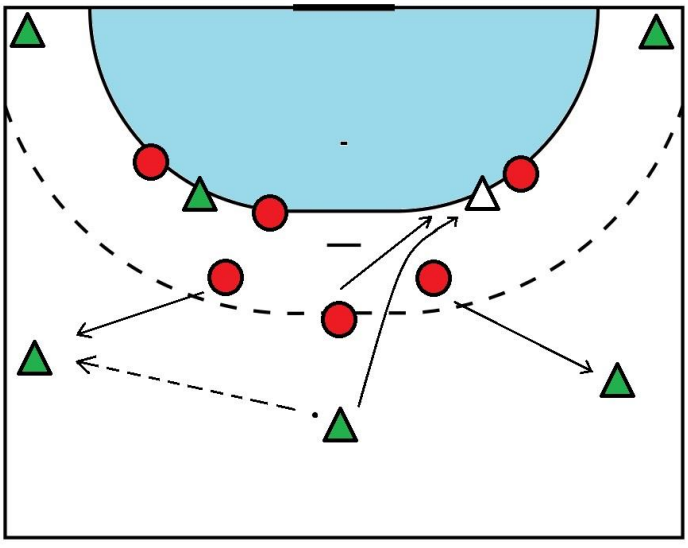
communicative and cooperative. My opinion is that neither team can play this defense for a long time since this defence works the best as an element of a surprise until our opponents adapts.

In my paper I have a couple of examples when back and wing players are making transitions to second line player.

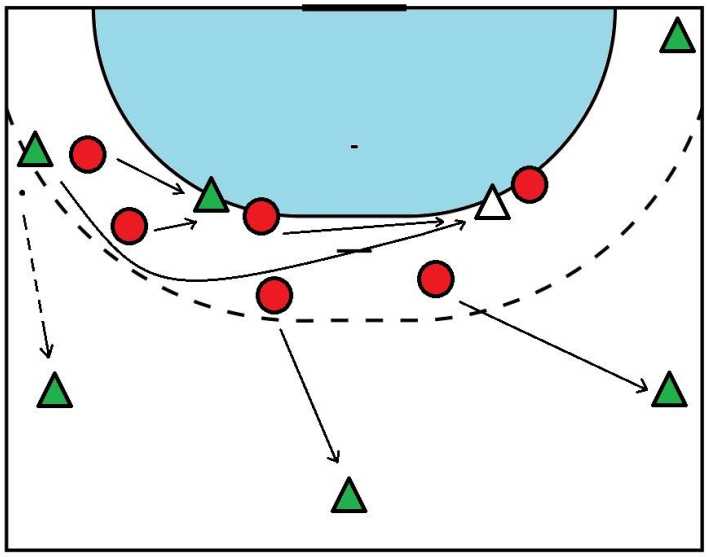
In the picture below right back goes to second line player, his half back is withdrawing to the six meter line, centre back follow right back while front center and other half back start defending playmaker and left back in front of nine meters.



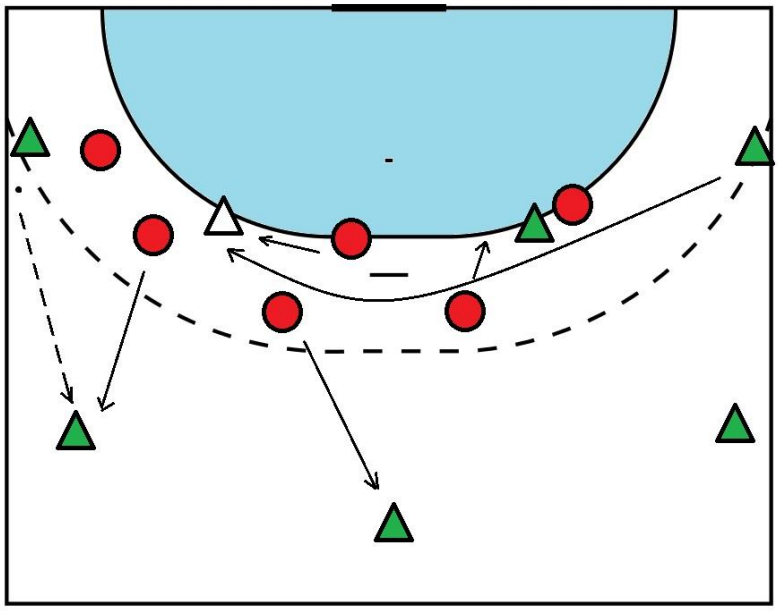
On the next picture the playmaker is going to the six meter line. Forward centre follows playmaker to the line while the two half backs start defending both backcourt players in front of the nine meter line.



On the next picture left wing is passing the ball to left back and running to six meter line. far back which wing went to six meter line is creating density by moving to first line player while front center and other half back start defending playmaker and right back.



Next example is a transition of a wing without a ball. Center back follows the wing, left half withdraws to the six meter line while front center and right half start defending playmaker and left back in front of nine meters.



CONCLUSION

The ideal formation of 3:2:1 which we have already talked about would be:

- playmaker as a centre back
- wings as a half backs
- line player as a forward centre
- right and left back as far backs

With the evolution of handball and with the tactical progress of attack on that kind of defense, a lot of teams had to abandon that defense system. The reason behind that is because there were fewer and fewer teams who were capable and able to play original 3:2:1 defence but they started playing modifications of that system.

Desirable half back were higher players who would be good in transformation to 6:0 defence where the best example we have in Petar Metlicic on right half position. Also, in the last couple of years we can see that a lot of teams have more and more defensive specialists who would and are playing only in defence. With them handball lost quality of counter attacks and there were very few teams to play 3:2:1 defence.

My playing and coaching successes are closely related to 3:2:1 defence and I am well aware how many training sessions and how much work 3:2:1 defence requires. In todays handball coaches do not have time for trainings to improve any other defence system because rhythm of the games is almost every three or four days.

My coaching experience while working with high quality players taught me that the main reason to drop 3:2:1 defence which is of extremely quality, is the lack of methodical training in younger selections.

Teams from the ex-Jugoslavia are playing more and more modifications of 3:2:1 defence or they have transitioned completely to 6:0 and 5:1. My opinion is that handball is currently handicapped for one of the top basic defence systems which had significant part in the last ten to 15 years (Croatia 1996, 2003, 2004).

While Croatia was so dominating with this defence system we have to mention that the players who were playing on the most important positions in 3:2:1 system stopped playing for their National Team and that is also one of the reasons why we are not seeing that system anymore (Metlicic, Vori, Perkovac, Kaleb, Dominikovic, Kljajic, Cavar, Jelcic).

I hope that in the near future 3:2:1 defence will become more and more playable because now a lot of teams are preferring othey defence systems. In my opinion handball would once again become tactically richer for one of the most basic defence systems and everything that comes with it.

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EUROPEAN HANDBALL FEDERATION

GOALKEEPER DRILLS FOR SAVING SHOTS IN 1:1 SITUATIONS

Nederlands Handbal Verbond

ALEXANDRU CURESCU

NEDERLANDSE HANDBAL VERBOND

NETHERLANDS

Summary:

1 Introduction :

Goalkeeper.

He is a member of the team, but the same time during the game he is separated from them by goal area line. He needs to make decisions, concern a direction of the throw and the way he wants to defend, on his own. He takes full responsibility and each action is a new experience and a new challenge. The rest of the team tries to support him by interrupting and blocking the player however he knows that the final interference in most cases is up to him.

It is said by coaches, that the most important player of the team is a goalkeeper. Unfortunately time a coach spends with goalkeepers during the trainings in not sufficient. A goalkeeper should not demand any privileges or special treatment due to his superiority in the team. Of course he plays in a different way, but he is still a member of a team.

It always happens that somebody can strike him a goal and there is always something that can be improved to make the next shot more difficult for the opponent player. Though, the best goalkeepers reach the peak of their career when they are about their thirties. That is why during the trainings he tries to be fully concentrated and work hard. It is not easy to do everything correctly at the first time that is why he has to repeat exercises on his own, whenever he has free time. His happiness is even greater when he saves one to one or penalty throw at the very end of the game especially when it brings the win to the team.

Unfortunately not each of the players that starts with handball can become a goalkeeper. This position requires essential mental abilities, like for example:

-courage

-bravery

-self-control

-concentration

-self-confidence

What is more he needs to cope with stressful situations because stress accompanies him all the time at the field.

Foto: Omeyer was outstanding in Beijing (Jonathan Nackstrand)(www.thesundaytimes.co.uk)

2. Some basics thinks

Position in the goal

Balance

Strengh

Techniques en Tactics

2.1 The position of the goalkeeper

- The arms are open

- The hands in the same line with arms (as its extension) –on the level of shoulders

- Feet not wider than hips- heels do not touch the ground, standing in parallel with each other or slightly open- evenly laden

- Legs slightly bent

- Elbows can be in front of shoulders or behind them but when the arms are banded hands have to be in the same line with forearms.

- Hands in the same line or above shoulder's level. Goalkeepers, who are on the basic level, are recommended to control his arms and hands positions. The position is correct as far as he is able to see his hands while watching the ball in front of him.

- Trunk is straight

- Head should be hold high


Omeyer - https://encrypted-tbn1.gstatic.com/images?q=tbn:ANd9GcTu7A4ADbAHw7NT8YS_PyTNGj8zfsX3-efWuIg2282dy9CXrXRlRg

2.2 Stability and balance

A goalkeeper should take the position that ensures him stability and balance all the time.

The position described above has to be kept when the ball is in the central part of the field. It

changes in the situation of possible shot or wing shot

2.3 Position in wing shots

-The goalkeeper is moving towards the goal post trying to touch it with the closer hand

- When the possibility of shot is getting bigger he moves the hand higher to the crossbar

- The position has been changed

- The foot, closer to the goal post, hip, trunk and hand above the head, should make it

impossible to score a goal.

- The second hand can be above or below shoulders, each position is allowed

Nowadays, the best goalkeepers are trying to keep both hands up all the time.


https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcTDB17kFAoENqhX_xFNrK40YIzZ_am_Opgz2quwhUjGtQACSnqQ

2.4 Saving the wing shots

One-to-one: goalkeeper and a shooter

Each throw into the goal is kind of “one-to-one” between a shooter and a goalkeeper. A goalkeeper is always trying to save a goal but the same time he cannot go back to those, he did not save. He should quickly analyze the mistakes he made, draw some conclusions and use it them in the next saving action.

How to understand a shooter?

It will be always easier for a goalkeeper to save a goal when he understands the will of the shooter. To expect the moment and the corner where the shooter throws, a goalkeeper has to:

-An attacker will be always trying to throw into the corner, which is uncovered. Wrong location is the mistake made by a goalkeeper. It allows attacker to score an easy goal.

- The analyzes said that If the position of the goalkeeper is correct, right-handed attacker throws into the right corner (right corner for a goalkeeper) and if he is left-handed it is easier for him to throw into the left corner (left from the goalkeeper’s side). That is why he has to control which is stronger and more accurate.

- If a scorer keeps the ball below shoulder’s level while he is attacking (wing shot, free

throw line shot or a shot made by a line player) it is easier for him to throw into the lower corners. It is easy to predict for a goalkeeper where the attacker is aiming at.

- If the thrower jumps up very high, is close the goal and keeps the ball high above the head, the goalkeeper can expect the throw into the high corners rather than low because it is difficult to shoot with dribble

- If a goalkeeper notices some open space between defenders he can expect straight throw into the goal in this particular area.

- When the shooter finds on his way a defender who is not moving (static defender with arms down), the goalkeeper can expect the throw into the area that should be blocked by his teammate but is not.

- If an attacker, after running with the ball jumps up(doing a curve movement in the direction of the goal) and keeping the ball. I am moving in the same direction in the goal area and in this situation he needs to expect the shot with “extension” – in the opposite direction than he has moved.

- If a goalkeeper is correctly positioned and an attacker cannot find uncovered area in the goal, the goalkeeper can follow any fakes that attacker does. The fake would make the goalkeeper move and the shooter could gain some open area to shot into the goal.

- It is important to remember that all field players are taught to throw next to the leg he is standing on. That is why if he raises one leg too quickly, then it is difficult to change it and save the goal.

2.5 Goalkeeper’s tactics

During all saving actions a goalkeeper needs to take some decision. It is called as a goalkeeper’s tactic and it is very important. Some people say that tactic is even more important than personal skills of a goalkeeper. The sooner he make the right decision (direction and the type of saving) the bigger chance to block the ball. The decision (tactic) depends on many circumstances,

- The direction from where he is coming toward the goal

- The attacker hand and trunk array

- Defenders positions:

- Blocking by defenders

- Pushing the attacker aside

- The luck of defenders

- Rules of playing in the goal

- Memories of the attacker's behaviors

Tactic is very important part of the game. If the decision made by the goalkeeper is right and he knows in which direction the ball goes, it is highly possible that he saves even if his skills are not proficient.

Wing throw

The main aim of a goalkeeper while an attacker tries to shot from the wing is to block the throw into the short corner by his appropriate position next to the goal post.

-If the angle of shot is small , the goalkeeper standing next to the goal post has to make it impossible to score a goal

- If the angle is bigger he can:

- stay next to the post trying to save the throw (usually the throw into the long corner)

- He can move ahead to mineralize the angle but the same time the player can throw the ball over him

- Moving forward always starts with the leg closer to the post. The other moves as a second.

- He also has to remember to follow the ball that is in winger's hands (he is in the jump).

CAUTION!

In the situation of small angle shots a goalkeeper has to remember to block the short corner (head supports the rest of the body in saving action) and expect a throw into the trunk. He cannot do any movements (like raising the leg or moving the hand down) , that may uncover some areas of the goal.

3. Drills

3.1 Using steps :

Steps 1x

Steps height : 20-30 cm

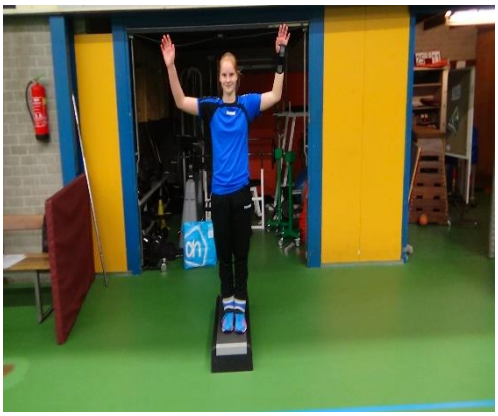
Repetition 2x 30 sec

- Move from left to right and back ; dribbling with 2 legs


- Move from left to right and back ; crossing legs


-


- Move from left to right and back ; one step down to steps up .




3.2 Using steps and hurdles :

Hurdles 2 pieces

hurdles height (30 cm)

gym mats 1x

repetition 2x 30 sec

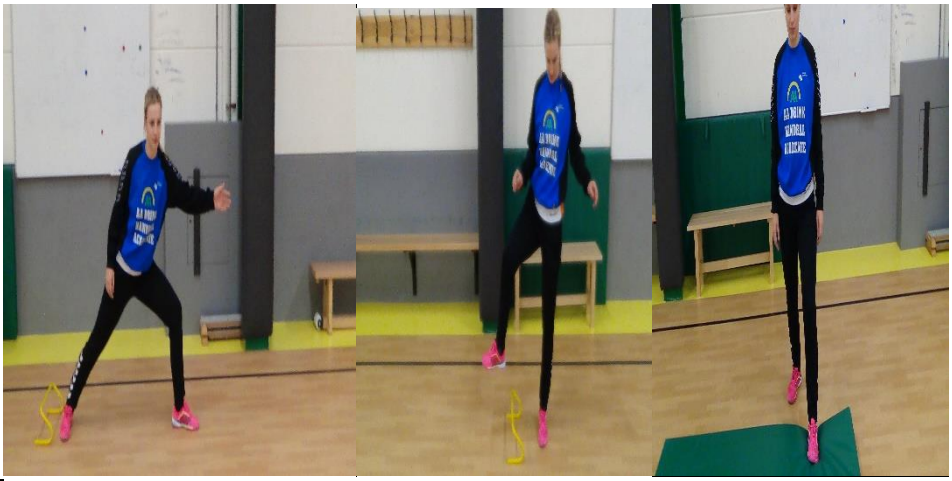
- Move from left to right and back : small jump over de hurdle – dribbling on the gym mats and jump over de last hurdle .



-

- Move from left to right and back : same as first exercise but make a stop for low balls

- Move from left to right and back : same as first exercise but make a stop for middle high balls



- Move from left to right and back : same as first exercise but make a stop for high balls

3.3 Using low bench and balloons :

Balloons 2 x

Bench 1x

Bench high 30 – 40 cm

- Move over the bench and step away to left(right) and try to keep the balloons in the air using only the arms


- Move over the bench and step away to left(right) and try to keep the balloons in the air using only the legs


- Move over the bench and step away to left (right) and try to keep the balloons in the air : one side by using only the hand and in the other side by using only with the leg

3.4 Using : shooters

Repetition 2x series from 8 x shots for each side

8x balls

Gym mats 1x

rope ball 1x (fig 1)

fig1.

- Somersaults on the gym mats and stop the rope ball with the ground tactics . after that stand up and move to the other site and stop the low balls shot by the player

-

- Somersaults on the gym mats and stop the rope ball with the ground tactics . after that stand up and move to the other site and stop the middle high balls shot by the player

- Somersaults on the gym mats and stop the rope ball with the ground tactics . after that stand up and move to the other site and stop the high balls shot by the player

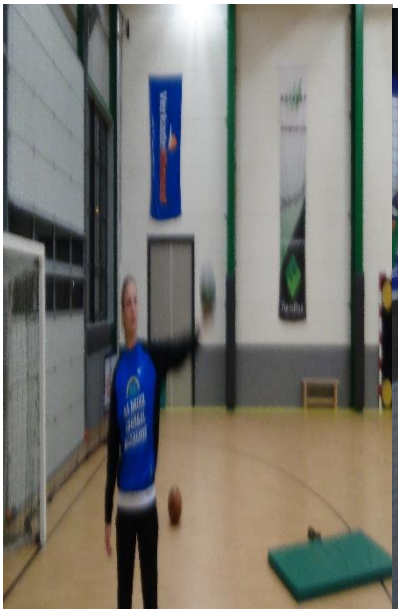
3.5 Using shooter from the wing position and balloons :

Needs balloons 1x and 8x balls

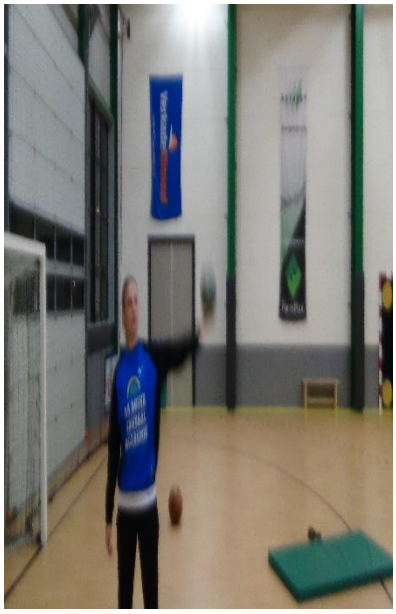
Shooting

Repetition 2x series from 8 x shots from each side (left and right wing position)

- Hit with the hand the balloon in the air, take the position for saving the balls from de wing player and stop the ball shooting by the wing player in to the lower short corner



- Hit with the hand the balloon in the air, take the position for saving the balls from de wing player and stop the ball shooting by the wing player in to the short middle high corner



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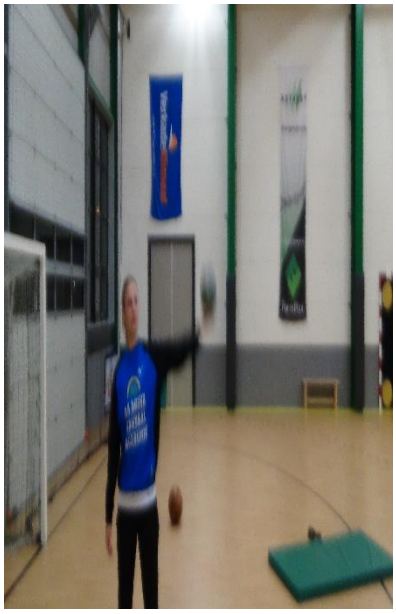
- Hit with the hand the balloon in the air, take the position for saving the balls from de wing player and stop the ball shooting by the wing player in to the short high corner



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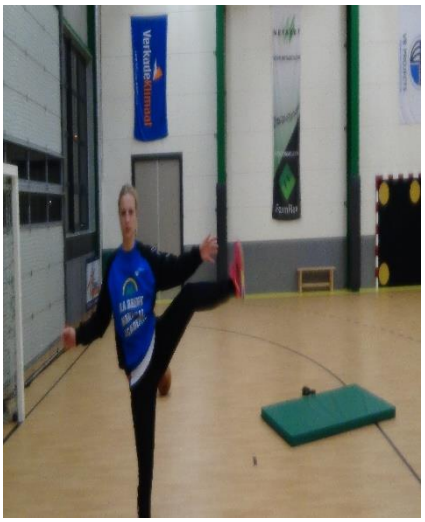
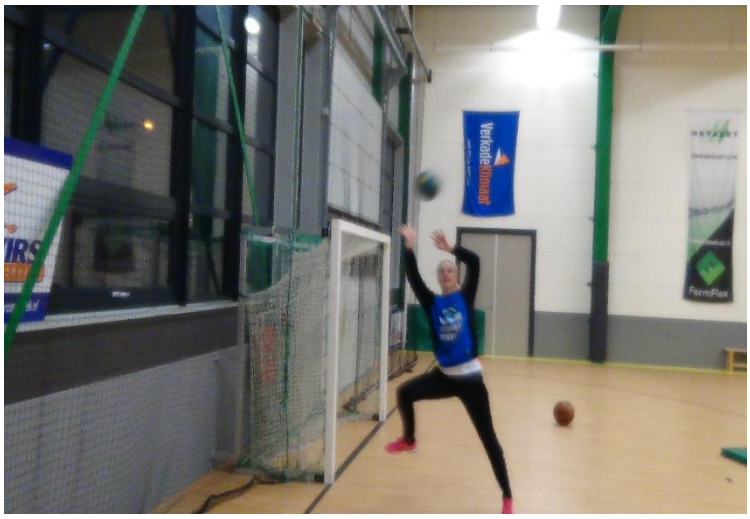
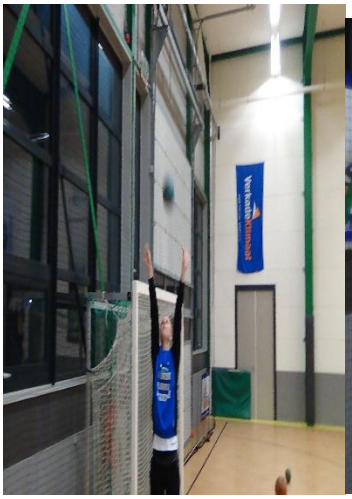
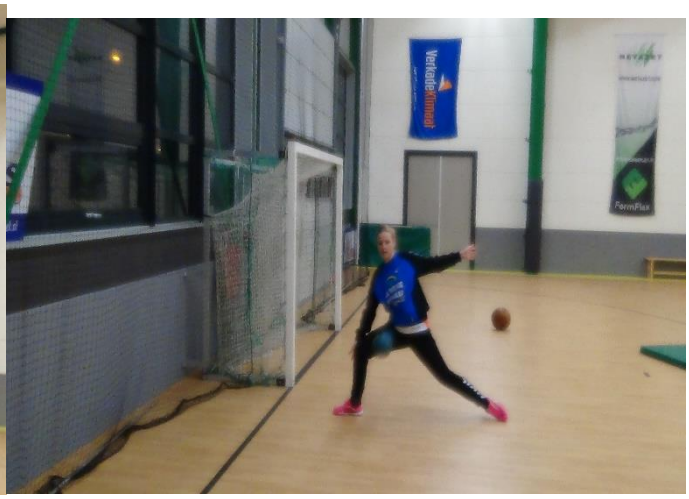
- Hit with the leg the balloon in the air, take the position for saving the balls from de wing player and stop the ball shooting by the wing player (short corner low)

- Hit with the leg the balloon in the air, take the position for saving the balls from de wing player and stop the ball shooting by the wing player (short corner middle high)

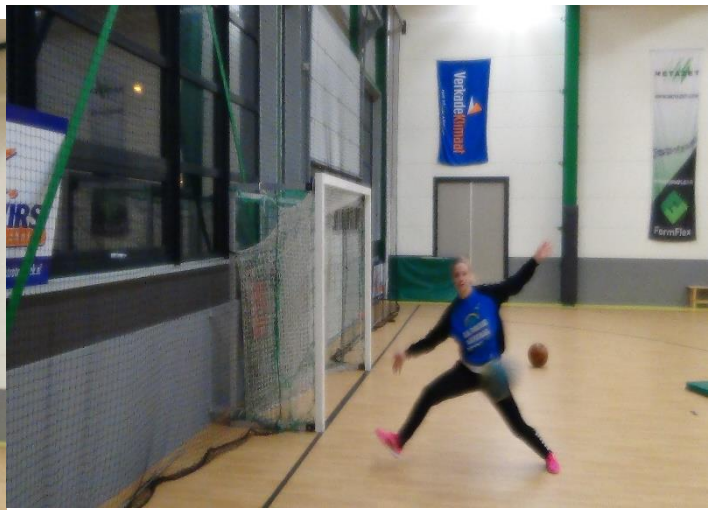
- Hit with the leg the balloon in the air, take the position for saving the balls from de wing player and stop the ball shooting by the wing player (short corner high)

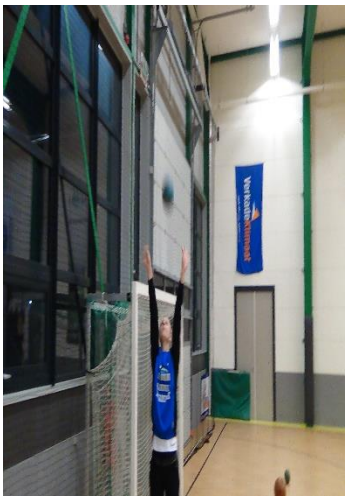
- Hit the ball with 2 hands up in the air ; step forward to take position in the goal against wing player and stop the ball shooting by the wing player (short corner ; low)

- Hit the ball with 2 hands up in the air ; step forward to take position in the goal against wing player and stop the ball shooting by the wing player (short corner ; middle high)

- Hit the ball with 2 hands up in the air ; step forward to take position in the goal against wing player and stop the ball shooting by the wing player (short corner ; high)




3.6 Using one bench and wing player with ball:
1x bench (high 30-40 cm)
8x balls
Shooting from 6m line (wing position)
Repetition 2x series from 8x balls from each side (left and right wing position)

- Bench next to the goal post ; stand next to the bench with 1 leg on the ground and 1 leg there on ; get away from the bench and stop the balls shot in the long corner (low balls)


- Bench next to the goal post ; stand next to the bench with 1 leg on the ground and 1 leg there on ; get away from the bench and stop the balls shot in the long corner (middle high balls)


- Bench next to the goal post ; stand next to the bench with 1 leg on the ground and 1 leg there on ; get away from the bench and stop the balls shot in the long corner(high balls)


- Bench at the 4m line ; stand next to the bench with 1 leg on the ground and 1leg there on ; get away from the bench and stop the balls shot in the short corner (low)

-

- Bench at the 4m line ; stand next to the bench with 1 leg on the ground and 1leg there on ; get away from the bench and stop the balls shot in the short corner (middle high)

-

- Bench at the 4m line ; stand next to the bench with 1 leg on the ground and 1leg there on ; get away from the bench and stop the balls shot in the short corner (high)

3.7 Using balls and goalkeepers :

8x balls

Shooting from 6m line

Repetition 2x series from 8 x balls on both sides (left and right)

- 2x goalkeepers with ball , outside the goalposts – they drop the ball on the ground . The goalkeeper moves from left to right and throwing the ball back . after that , the goalkeeper try to stop the low shot

- 2x goalkeepers with ball , outside the goalposts – they drop the ball on the ground . The goalkeeper moves from left to right and throwing the ball back . after that , the goalkeeper try to stop the middle high shot


- 2x goalkeepers with ball , outside the goalposts – they drop the ball on the ground . The goalkeeper moves from left to right and throwing the ball back . after that , the goalkeeper try to stop the high shot


Children, our future

Technique, Speed,
Flexibility, Creative, Attractive

A vision for youth development (5-12 years old).

Table of Contents: Pages

By:
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Relevant experiences as first coach for more than 15 years

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Chapter 1: Introduction and summary

A vision for youth development (5-12 years old).

Players have to be able to play fast, technical, attractive and creative handball in confined spaces. In this philosophy, technical fundamentals, basic movement and handball specific techniques are of the highest priority. These traits will form the basis for their development in handball.

Players should be able to apply pressure in all phases of game situations, by being pro-active.
We decide; the opponent has to follow us.
This is quite a change in player philosophy, though; defense is more important than offense.

By applying this method, we react to international trends; defenses are increasingly getting taller, faster and more powerful, making it more and more difficult for the offense to succeed. Matches with more than forty goals scored are far scarcer these days.

In this paper I emphasize on the *what*, because the *how* (content) is variable. The content varies on the prevailing views, trends, rule consensus, group composition, level of individual players and the coaches personal preference and vision.
Preparing a practice is a creative process and knows many variables.
Points of discussion will mostly be how to combine and regulate the MECOTETA principles (MECOTETA=MEntal, COnditioning, TEchnical, TActical).

Tactical elements are far less present, because of the young age of players (5-12 years old).

The *what* (technical elements) are of the utmost importance to the development of players, ages five through twelve. Goalkeeping included.
I paint a picture of possible end results in the conclusion of this paper, which shows what opportunities lay in properly following all described steps. This is also a result of practical effort.

Structure: Vision and Mission, definitions, way to play, structure of practice, methodology and Goals for several age groups.
I start with the youngest groups (E and D age) and end with the C age.
In E and D, the focus is on basic motoric skills.

Chapter 2: Terms and conditions

Definitions.
Wherever it says *handball player* or *him*; it refers to both male and female players.

Talent:
A talent is a person with a natural ability combined with tremendous persistence and passion. Only then are we able to achieve handball on the highest level.

Technique:
Technique is an element of movement for a handball player. The handball player uses handball-specific skills efficiently, in an attempt to eliminate the opponent in the situation at hand. Technique of movement determines the eventual output.
The skills of movement in handball are to be performed in an explosive manner.

Offense:
Technique, for a handball player, means: when the player gets the ball in the preferred position to create a scoring opportunity, by using the right skill of movement, power, balance, speed and timing.
Skills are, among others:
Movement, jumping, shooting, throwing, turning.

Defense:
Technique, for a handball player, means: when the player makes the opponent put the ball in a preferred position to deny him a scoring opportunity, by using the right skill of movement, power, balance, speed and timing.
Skills are, among others:
Movement, jumping, turning, sliding and blocking.

Speed:
Speed is a combination of elements of movement/skills (both physically and ball) and tactical elements.
The physical element is to be able to (either naturally or educated and refined) execute movements as fast as possible. Another way to put it, is: the ability to move the body, or parts of it, as fast as possible while in control.
The tactical element is to make the “educated” move in an efficient manner.
As far as the ball, it means that the ball is moved around with the highest amount of controlled speed and precision.

Creative:
In the context of my vision of handball, creative means an unexpected or better solution at a moment’s notice. Creativity is a combination of technique, speed and the mental component. The handball player is capable to make an original and right decision under “lots of” pressure, while applying a controlled technique and speed.

Attractive:
The game of handball is beautiful to watch. It is inspiring and enthralling.
It consists of the team play and the cohesion of technique, speed and creativity.
It's both a challenge and a norm to which the game has to conform. The audience gets what they came to see, because they appreciate what is shown.

Operational speed

Training the operational speed is an important aspect of the vision. Operational speed is a component that consists of mastering both technical and tactical skills, supported by the conditional element of power/speed and conditioning.

See figure 1.1 for an overview of basic skills in handball.

Figure. 1.1.

Basic skills		
General basic skills		**Handball specifics skills**
Skill fields	**Movement fields**	
Pass and interception	Walk and jump	Achieve a goal kick
To aim and to hit	To fall and to roll	To avoid a goal kick
Ball control	To skip/to hop/to trip	To move with and without ball
To disturb and free run	To draw and to push	Moving by change of direction
To throw and to catch		Conquering the ball
		To support teammates
		To disturb ball and passageways of opponent

Chapter 3: Concept of play

Offense	***Condition for concept of play***
Quick counterattack. Creating a supernumerary in the offensive area.	High operational speed
Taking advantage of width and depth	Man every position so that the entire field is used.
Creating maximum room to attack	Integrate quick tactical surprises (switch/cross/sper) in the offense
Put pressure on every defender (no rest for defenders). In all phases.	The offense can not be broken up by the defense. Release the ball on time. Avoiding contact with the defender.

Defense	***Condition for concept of play***
All offensive players are under pressure (no rest for the attackers). In all phases.	High operational speed and no unnecessary errors like clamping, holding or pushing. Use it functionally (=slows down the attack)
Conquer the ball in the first and second phase. After turning over the ball, regain possession.	Anticipate, react proactively
Take away width and depth. Make the field smaller.	Attackers are under pressure, especially in the corner positions. Offense in the corner.
Create a super numeral situation in the dividing area. Close in on the ball side	Defend technically correct; defend with the legs, not the arms on the ball side.
Variation in tempo and rhythm and defensive concepts	Working together to intercept the ball.

Chapter 4: Practice Structure

Practice Structure

See below for a list of practice structure elements. The reason for this list is to use these elements in separate practices.
Each practice has to consist of the ME-CO-TE-(TA) elements. Mental, Conditioning, Technical and Tactical.
The tactical element is less present when training the youngest groups.

1. Mental (ME)

- ✓ Discipline
- ✓ Team spirit
- ✓ Enjoyment of the game
- ✓ Fear of failure
- ✓ Eager to learn
- ✓ Being critical on your own performance
- ✓ Courage, concentration, self control, persistence, etc.

2. Conditioning (CO)

- ✓ Stamina
- ✓ Power/Strength
- ✓ Speed
- ✓ Mobility

Complex motoric properties:

- ✓ Dexterity (combination of speed, agility and power)
- ✓ Quickness (combination of speed and power)
- ✓ Explosiveness (combination of high velocity and power)
- ✓ Speed-endurance (combination of speed and stamina)
- ✓ Strength-endurance (combination of power and stamina)

3. Technical (TE)

- ✓ Basic skills:
  Movement, jumping, skipping, falling, rolling, spinning and turning
- ✓ Basic skill areas:
  Aiming, hitting, juggling, intercepting, passing.

The technical elements.

Offensive tactics:

- ✓ Techniques of movement: moving, turning, spinning, jumping, tempo and change of direction.
- ✓ Techniques of throwing: stretch throw, jump throw, ground pass, paralelpass, tap through.
- ✓ Techniques of catching: catching at different heights, varying catches in space and timing, rolling balls, bouncing balls, catching in special situations (like backward and sideway balls)
- ✓ Dribbling: with pace and changes of direction
- ✓ Shot attempts: stretch shot, jump shot, falling throw and their variations and combinations
- ✓ Feints without ball: singular and double, after "fake-"aspect with a part of, or the entire body
- ✓ Feints with ball: singular and double or with a longitudinal pivot, after feint with body or ball (feint move, feint pass, feint shot)
- ✓ Defensive techniques.

- ✓ techniques of movement: posture, moving with changes in speed and direction; sliding, closing out and in (merging), getting back

interfere throws: tapping the ball

- ✓ interfering catches: tapping the ball
- ✓ interfering dribbling: tapping the ball
- ✓ interfering the shot:
- ✓ tapping the ball
- ✓ block; defensive or offensive, standing or jumping
- ✓ contact defense
- ✓ defending the feint
- ✓ blocking the lanes of movement
- ✓ pressure the lane of movement: force away or outside
- ✓ fight for the loose ball

Tactical (TA):

Tactics are based on the ME-CO-TE-aspects. You clearly need the right attitude, be in a good physical shape and have a correct technique to execute tactics.
Tactics is the programmed behavior to optimally solve a game situation. The TA-aspect indicates working together in either a group- (TA-elements) or team setting (TA-concept) and the structure of this teamwork (basic principles), both on offense and defense.
These tactical elements are not much discussed in this age group.
It is of vital importance to teach this age group (5-12 yrs old) about the ME-CO-TE fundamentals; these are at the basis for the TA aspects and the further development into a high level handball player.

Chapter 5: Cohesion of practice structure in offensive and defensive concepts

Cohesion of practice structure in offensive and defensive concepts.

Acknowledging the cohesion of these components is important. These elements form the basis for our practices. All these elements have to be present in the practices. As mentioned before, operational speed is an important aspect in the vision of the game.
Operational speed consists of the conditional element and the mental element. Strength, speed, coordination and stamina are the motoric components of the conditional element. When it comes to the mental component, the cognitive element is important, such as: perception, reacting and anticipation. The structure is very close to the chosen offensive and defensive concepts.
It is important that the trainer knows what he wants to work on and determines which ME-CO-TE-TA components he would like to use in his practices. In the end, the ME-CO-TE-TA components and their structure determine the tactical concept.

Methodology:

Methodology means heading a specific direction to achieve a certain goal in practice.
All the measures used for the *how*, make the basic methodology.
That includes: considerations on teaching methods, choice of drills, the use of organizational concepts and the methods for illustration purposes.
The teaching methods are derived from:
-the practice content
-the assignments of the trainer and players
-the practice goals

Connecting with the practice organization, there are several methods applicable.
Practice goals can be achieved by:
-presentation, conversation, description, explanation or elucidation (verbal method).
-show, demonstrate, schedules, pictures and clips (illustrative method)
-try, practice, and rehearse (practical method)

In the handball course, we always say: “praatje (tell them), “plaatje” (show them), “daadje” (do it)!”

Phases of learning:

We presume learning works through three phases:

Phase 1: learning a technique (passing, catching, moving with the ball and shooting)
In connection

With relatively simple tactical components of offense and defense.

Phase 2: improving technique and tactics.

Phase 3: perfecting and automating the technique and tactics. Then, the practice schedule has to work towards the current goal, methodically.

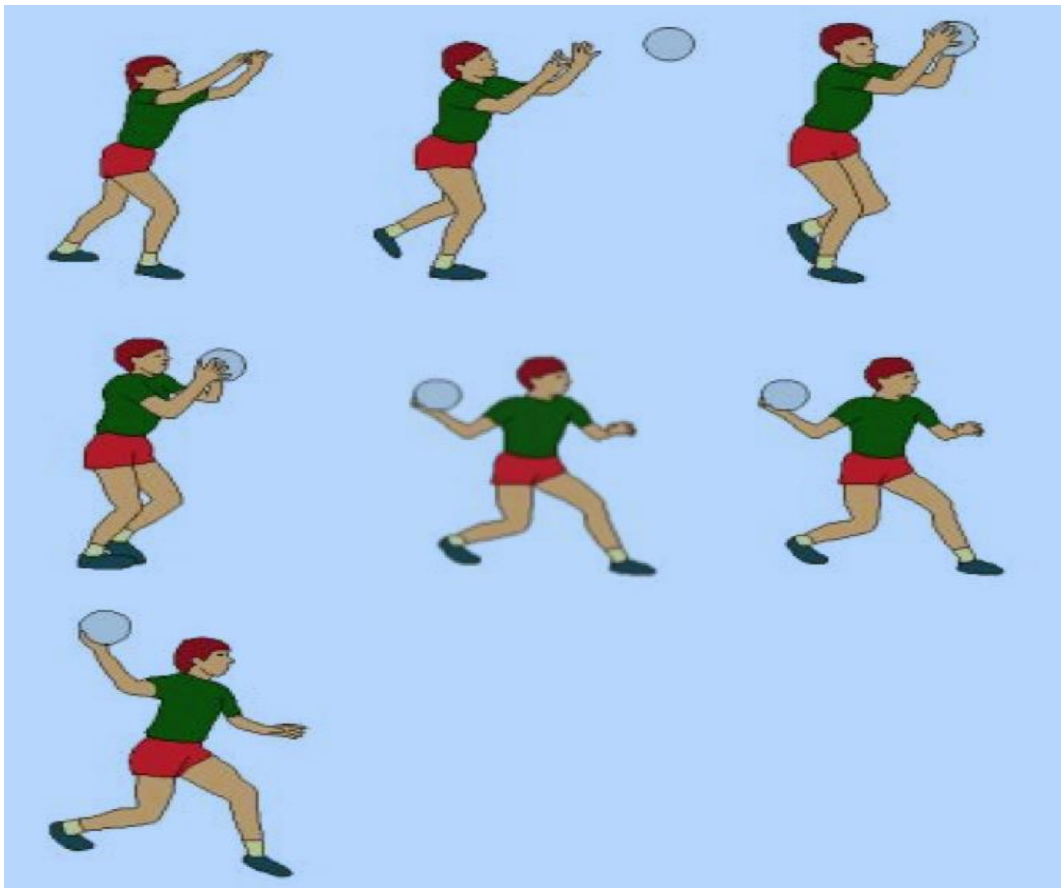
Note: following these learning phases is not age dependant, but talent dependent.
Ability and *Willingness* determine when to proceed to the next phase.
One important factor is strength-training. It has to be a conscious decision by both trainers and the talent.

Starting points

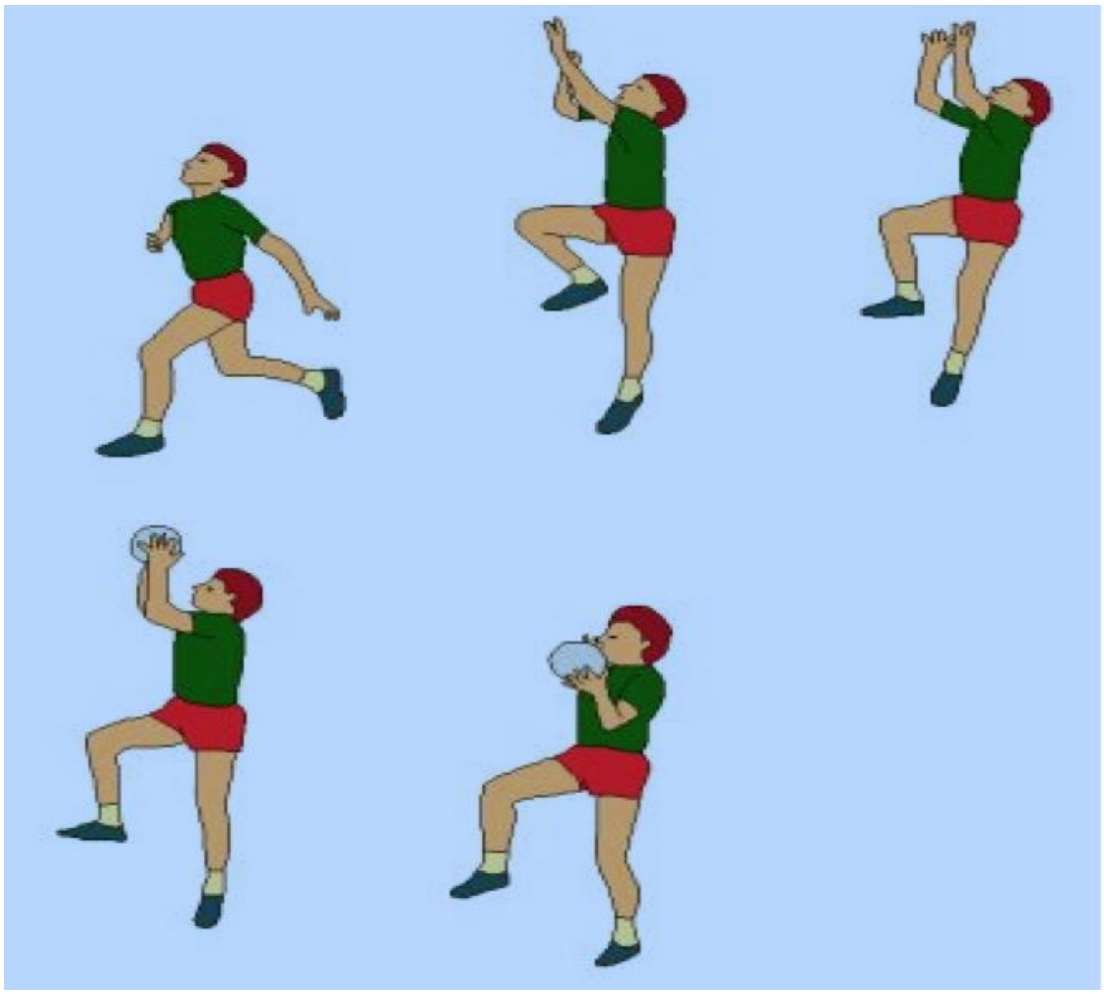
Starting point 1

In teaching the basic techniques it is important for the trainer to write down the total movement in detail.
For instance, on the subject of throwing: describe the postion of the feet, the legs, the body, the body's rotation while throwing, the throwing arm, the non-throwing arm, vision, stepping rhythm, etc.
Only then are we able to teach a movement the right way.

Example of catching the ball



Example of catching a high ball



Starting point 2
Always evolve a session of drills from closed to half open, to open.
Closed: isolated movement, where posture is key.
Half open: starting in perfect posture, start executing the (throwing) move.
Open: we make a player execute a movement with the perfect posture, start and execution with variations. One of these variations could be making the player take a small step.
Variations can also include body movement.

Starting point 3
Link an offensive move to a defensive move (we call this the horizontal link).
This makes the practice efficient, because you practice offense and defense at the same time.

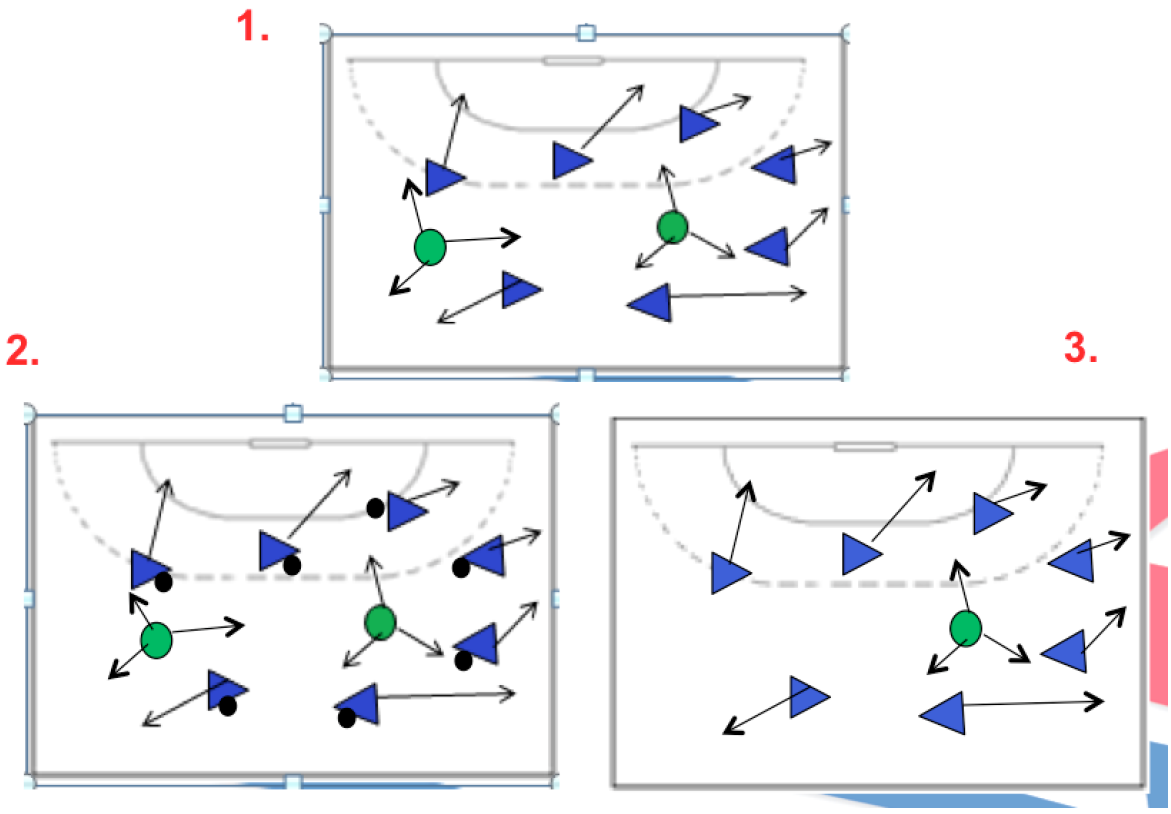
Starting point 4
Describe the basic tactics that go with the techniques. For example: a perfect defensive stance goes with a basic tactic (defending ball side). Write these tactics down when preparing for a practice.

Starting point 5
A top-level talent (i.e. a top C-youth) is able to execute the forementioned skills under great pressure and with great speed, using the right techniques and tactics.
He will need more of a challenge and could be transferred to the first year of B-youths.
In other words: keep challenging the talent.

Starting point 6
Agegroup is not determinative for proceeding to the next phase of learning. Possible proceeding is determined by talent, the cognitive and physical potential of a player.

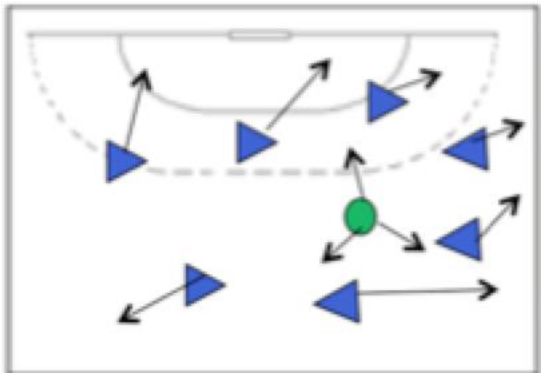
Starting point 7
We plan the program every year. The program consists of a baseline. From that baseline, we measure the practice goals and determine the practice content. The program has a minimum of three evaluations.

Example of exercise from easy to complicate

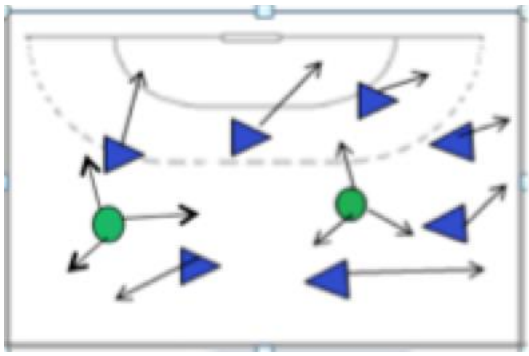


exercises from easy to complicate with explanation

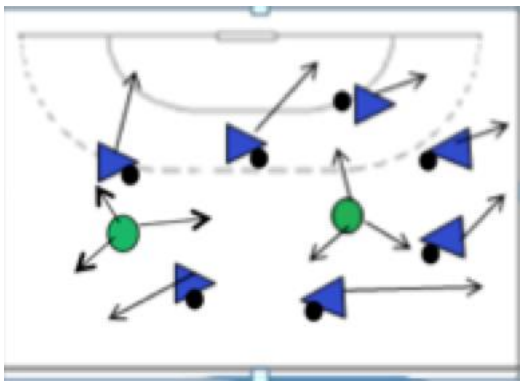
The exercise is meant to be that you will not be catched.



With one catcher on a half field the excercise starts easier



With two catchers on a half field the exercise becomes more difficult



With two catchers on a half field, all players dribbling with ball the exercise is complicated

Chapter 6: C and B Youth

C-Youth

In the youngest C-youth is the first steps in specific handball training. We start with teaching hand techniques (phase 1), which consist of:

Attack: capture, among other things, passing, shooting (this from the 2 only rhythm), feint and toes. Defense: e.g. sliders, get off, get in, ticking away of the ball and blocks. Spent in the phase also pay much attention to the general motion development. Do fun things such as track and field (walking training), swimming, judo, korfball, dancing etc. The above principles should be applied here!.

In the second phase C-youth. Trained in a dynamic environment is the learned technique. So everything from the movement to perform the techniques. So also move without ball.

An average C-player must perform the learned technique in the second year in a dynamic environment. He can fit flawlessly and capture from the 2 customize rhythm. He can shoot from the 2 pasritmen flawlessly with a stretch pitch.

In the last phase C-youth we are going to concentrate on a structured handball game (= cooperate). We use a handball concept with commands, which have to be performed. During the implementation need to be on the right move with the right tactics, timing, balance, speed and power.

I, myself, am very much in favour of a 3-2-1 coverage. The degree of control of the individual skills will be with this concept brought to judgment. Offensive can work with wing-structure combination, building-structure combination, circle-structure combination. Pin the players still not fixed on a particular position. Let them play in various positions.

The conditional element is also important. Compute in your co-ordination exercises, strength training exercises with own body weight. Put in this age phase also the basis that handball is a contact and physical sport. So defend forward instead of backward defend. We break offensive by in small spaces. We shoot in contact with a defender.

Basic skills C-Youth: the basic skills are more and more specific and more frequently trained under pressure. The basic skills in game forms can be given during the warm up or as the end game.

Technical elements:

- Passing: frontal pass, lateral pass, bounce pass, twinhanded pass,jump pass
- Catch: In the Visual field, above the head, knee height, rolling ball
- Dribbling: relays, fast-dribbel, slalom dribbles, dribble with a lot of direction change
- Shots on goal: stretch pitch, lead pitch, dive shot (no differentiation)
- Feint
- Road patting the ball
- Offering a running track, to disturb the ball land or running track
- fight for the ball, attacker with Defender
- Man marking, space coverage

Tactical elements:I
individual elements.

- Running free, offer to fellow player.
- Fast switching from attack to defense and defense to attack
- Disturb during yielding of the ball through the opponent.
- Man marking in 3-2-1 defence concept apply.

Interplay:

- Interplay between wing /circle and right/left/middle player.
- Interplay in the 3-2-1 coverage.
- trying to get the ball back after loosing it, do this on the half of the opponent
- Quick counterattack (1st phase). Together with the goalkeeper and wing players
- 2nd phase extended fast break.
- Act according to the situation, shoot at goal or play the ball to a free player

B-Youth

In this phase we differentiate and improve, refine the techniques and tactics. I.e. vary the techniques, with legs, the torso or pass.
The movements are performed at a pace variation and with great explosiveness in the final phase. This is true for both attack and defense.

Example variation of the new rhythm:
Adjust the technique from:

a. 1 of 2 steps rhythm
b. long pass ,short pass and another long pass
c. Combination of a and b

You see if you are creative and you take the time to prepare your training, you can do a lot with one technique.

In the second year B-youth. In this phase work to reducing technical/tactical errors during a game situation. The contest is a ijkmoment of the results of the training, this fixation moments can have important matches are we programming throughout the year. At these moments the handball players should be able to apply the learned techniques and can vary without too many mistakes. To do this, use a zero measurement. Start the year with an important tournament and measure the technical errors per individual. Do this again in the middle of the season and at the end of the season (starting point 6)

Also the cooperation with the mentioned in the C-Youth couples must have the appropriate cooperation and effectiveness are visible.

C-youth. Teaching Apply: Training of basic skills. Expanding to a dynamic environment	Learn all the basic techniques. Pay much attention to technique is an important pillar. Game forms use. Learn the basic tactics. Let this pass from a static situation to a moving situation.	Man marking far for purpose. Switching to 3-2-1 coverage. In about plenty to defend ball side. Defend always one to one. Legs use when defending.	3-3 position play. Position Exchange in width and depth. Quickly switch from defense to attack
E-D-youth.. Base for teaching handball game	Wide training in the motor ground properties. As little as possible tactics (handball). Free Play Animate.	Teaching 1-1 offensive. Later man marking in the 9-meter zone.	Free walk. Free play. Opponent bind than fellow player to play. in large space play.

Preferences

FIQAS Aalsmeer.(2012).*Onze toekomst, een sprong naar de top* .Aalsmeer: FIQAS Aalsmeer.

Czerwinski, J. & Taborsky, F.(1997).*Basic Handball.* Vienna

Modernization of the pre-game warm-up

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Modernization of the pre-game warm-up

Chapter 1

Introduction

Chapter 2

Old fashioned warm-up

Chapter 3

What's the purpose of the pre-game warm-up

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Chapter 6

Goalkeeper warm-up

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Conclusion

Chapter 1

Introduction

I chose the thesis “modernization of the pre-game warm-up” because the handball game has developed a lot during the last 10-15 years.

The handball game has become a lot faster and the athletic skills of the handball players have increased enormously. The perfect handball player has to be a complete athlete.

Although the handball developed ,the pre-game warm-up didn’t develop as much or at all.

When I look at a handball game and I watch the pre-game warm-up, I feel that the warm-up is not a summary of all the skills that are needed for the handball game.

It’s like hearing a baby song as warm-up before a hard rock concert.

I think that if we can create a warm-up program in which all the elements of a handball match are taken into account, we can make a big difference in the way we start to play from the first minute. A team which is really prepared to play a handball game with all of its elements will have an advantage over the team who is doing the pre-game warm-up the old fashioned way.

Following I will subscribe a complete warm-up program in which all the elements of the modern handball game are included.

Chapter 2

Old fashioned warm-up

Let’s see if we recognize the following scheme.

14 people running from the base line to the centre line.

Meanwhile they are swinging their arms and legs in all different kind of ways.

This will last for 5 minutes, afterwards everybody is lying on the ground and “stretches” the muscles.

Then all 14 people will run again, only a little faster this time.

Now 2 players take a ball and throw them to each other in different distances.

Then in one or two lines they throw the ball to the goalkeeper.

They shoot from their own playing positions and then they run to the centre line and back and try to score against the goalkeeper.

Did we all recognize what this is?

Of course we did, this is the pre-game warm-up for most of the teams.

This warm–up has a long tradition in handball.

As already mentioned, during the last 10-15 years the handball game has developed enormously, the game has become much faster and the athletic skills of the players have improved a lot.

The pre-game warm-up didn't develop at all.

Why?

I think it is kind of a tradition which is followed up during all the player generations the last years.

Nobody really questioned the way we do our warm up before a game.

Innovations were not practiced in this, important, piece of our game.

So everybody in all categories and ages were doing the same for all these years.

I also had problems in implementing a new way of doing the warm-up before a game.

When you have an older experienced player group it will be more difficult to change the pre-game warm-up because these players are doing the same warm-up for many years and don't see the urgency of a new way of doing things.

With a younger player group it will be easier to adapt this new way of doing the pre-game warm-up because the younger players can more easily adapt to new ideas and ways of doing things.

But the most important thing is for the trainer to explain why he changes the warm-up and what will be the advantages. Secondly you have to let the players cooperate in finding the best exercises for the warm-up because if they have influence in the process they are also responsible for the way they do it.

Chapter 3

What is the purpose of the pre-game warm-up?

We have to ask ourselves the question, what is the purpose of the pre-game warm-up?

During the pre-game warm-up we have to get our players,

--physically and

--mentally ready for a handball game.

For me it is important that at the moment the handball game starts, all the players should have the feeling of being in the match.

What we usually see is that during the first 10 minutes of a handball game both teams are watching and trying to find out what the opponent is doing. Both teams try to get a grip on the game. The players are trying to find their "*game mode*".

From this point of view I think that a team which does not use the first 10 minutes of a handball game as a second warm-up phase, but can fully play at a high level, has a big advantage in the game.

Chapter 4

Pre-game warm-up means more than only increasing body temperature

Increasing the body temperature is one of the things we have to do in the pre-game warm-up because increasing the body temperature gives us the possibility to move and react faster.

If we are warm and our body temperature is higher that means that our muscles can make faster contractions.

Our nerve system is working faster and gives the information faster to our muscles.

So the higher body temperature gives us the possibility to jump higher, run faster, throw harder and to react faster.

But these faster muscle contractions, which are given by the higher body temperature,

don't give us the possibility to use it at any possible time.

Therefore we have to work on increasing the intra-muscle coordination.

In our power training we train the intra-muscle coordination with heavy loads.

It is proven that we can jump the highest after we do a squat with 90 percent of our maximum power.

Can this be translated into a pre-game warm up?

Handball is different from other sports, like athletics were there are not so much unsure factors. The long jump and vertical jump for example are well structured disciplines with less unsure factors. In this kind of sports the intra-muscle coordination can be easily trained in the warm up before a jump.

Handball therefore is a specific game with lots of unsure factors, in which a lot of elements are combined,

--speed

--power

--endurance

--technique

--tactics

All these elements make the handball game so special and difficult. But this also makes it the most beautiful game.

The most important condition of playing a successful handball game is how to prepare the players **individually** and as **a team** to play at its best.

So during the warm up they have to;

--work with the ball,

--they have to duel,

--work together tactically in small groups and as a team both in defence and in offence.

As already mentioned the handball game is very complex, it depends on a lot of uncertain conditions.

All these varieties in playing conditions are not fully integrated in our pre game warm-up.

If we find a way of combining all these elements in our pre-game warm-up we will be prepared and ready for playing a handball game.

To make this easier to understand I can give the following example.

Example;

A pianist is not playing old McDonald has a farm as a warm-up before a concert in which he has to play a piece of Mozart.

So we have to think of how we can put all these elements of a handball game into a pre-game warm-up. We only have about 30 minutes time.

When I speak with other coaches about modernising the pre-game warm-up and getting the players ready for a handball match they always say that we cannot fatigue the players to much in the pre-game warm-up.

This is true but this does not mean we cannot stress the players with complex exercises during the warm up.

Only the repetitions and the duration off the pre-game warm-up shouldn't be too much and too long.

The pre-game warm-up has to be short and crunchy.

Chapter 5

3 Stage warm-up programme

5.1

What does this means in practice

The most important demand for the players during the pre-game warm-up is to be fully concentrated. They have to switch on their brain.

Every exercise they do has to be done well concentrated. Concentrated does not mean "*stressed*".

They should focus on the purpose of every exercise. What do we want to achieve with this exercise or drill.

If they have to run with maximum speed they have to work as explosive as possible.

The same counts for dribbling, passing and all other drills that are done during the warm up.

Following I will subscribe a full pre-game warm-up as an example of how it can be done.

This is not a numb guideline, it can be modified in every way a coach wants it.

It subscribes a **3 stage program** that can be followed. Every coach can modify it according his own needs and preferences.

Every coach can put his own ideas, creativity and tactical preferences in it.

Every coach has his own drills and exercises and his own sights in how certain things should be done.

I am 100% convinced that if you follow the 3 stage program your team is ready to play a game and does not need 10 minutes time to get a grip on the game.

You will have the opportunity to dictate the game and be the team that is on top of the game in the beginning.

All three stages will be described and some exercises will be exposed to give a view of what is meant.

I think that every coach will come up with some different exercises to put in his pre-game warm-up.

Goalkeepers and field players have totally different functions in the game so the pre-game warm-up of the goalkeepers is different from those of the court players.

During stage 1 and a part of stage 2 the goalkeepers are following their own program.

At the end of stage 2 and stage 3 the goalkeeper and the court players are working together.

In chapter 5 I will describe the warm up of the goalkeepers during the stages 1 and the first part of stage 2.

Really important is that you try this new way of doing the pre-game warm-up during the training sessions so that the players get familiar with it. Do not stress the players with a new kind of warm up before a match.

Ask the players for feedback and ask them if they are comfortable with the new warm-up. Maybe they come up with some adjustments you haven't thought off.

If they are comfortable with the warm-up and feel that it is theirs than you can apply it before a real match during the pre-season. When the season starts they are totally used to it and they know that it can be a big advantage. This way it gives the players also a mental advantage over the opponent.

5.2

Stage 1; Running/stretching/coordination

During stage 1 we have to increase the body temperature and work on the mobility of the body and coordination of the specific handball movements.

We have to prepare the players with all the movements they have to do during the game;

running,

sprinting,

turning,

jumping,

dribbling.

All these movements have to be done during the first stage of the warm up. They should move in all directions, not only straight forward. The have to move from the right to the left and the front to the back and sideways.

If the club has a specialist on running and coordination training a coach should make a program together with this specialist.

I let the specialist take charge in this part of the warm-up.

All movements should be done dribbling or holding the ball.

I think it is important to take the ball from the first minute we start to work.

The players should have a good ball handling, they shouldn't even notice that they are dribbling or carrying a ball.

A lot of players are a lot faster without a ball than with ball. All of the players should be trained to be as fast with ball as without a ball.

All the exercises are done between the six meter line and the centre line.

The goalkeepers are working within the 6 meter area. This is the goalkeeper area and should not be entered by the court players. During the game the players are also not allowed to step into the 6 meter area.

I always use the following order during stage 1.

- **1—running ABC, offensive movements (dribblings/fake movements)**
- **2—dynamic stretching**
- **3—coordination and speed**

- **4—defence movements (triangles, sideway movements).**

I will first give a short explanation of the 4 stages and after that I will give some examples of how this could be done.

1--In the beginning the players run from the 6m line to the centre line and do the running ABC, like skipping/tripling and so on.

After the running ABC I let the players make movements they do in offence, like dribblings and fake movements.

2--After this part they do some exercises of our dynamic stretching programme.

These drills are also done between the 6m line and the centre line.

3--Then we move forward to the coordination exercises combined with acceleration and sprints. The sprinting and acceleration drills can be done with resistance bands.

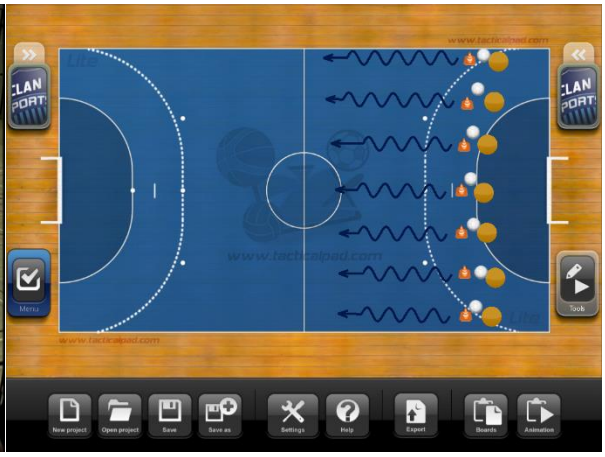
Be careful, the players should be really familiar with it if you want to do this in front of a big audience.

4--I always end with defence movements and short acceleration. Why? This should visualize the defence and starting in the changeover. For me defence is the key to win a game and play a fast game.

You can also choose to change the offence and defence movements in part 1 and 4.

This is what a trainer has to decide, which part is more important.

Ad1; running ABC/dribblings/fake movements



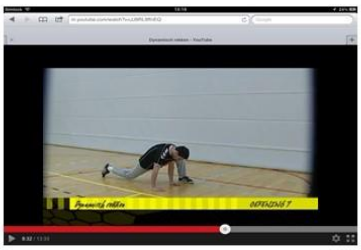
Ad 2; Dynamic stretching

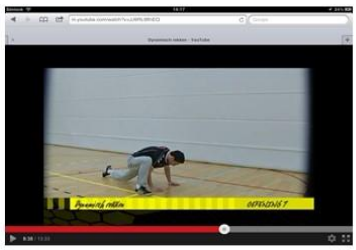
6 exercises are shown on the pictures below.

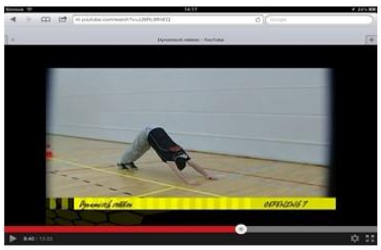
All of these exercises have to be done dynamically and three or four times in a row.

Passive stretching is not done anymore.

1







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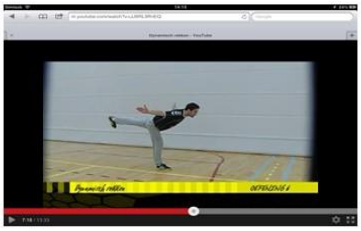

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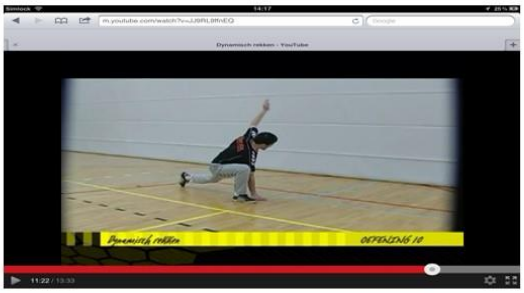

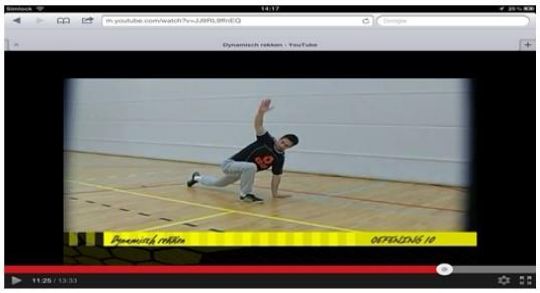

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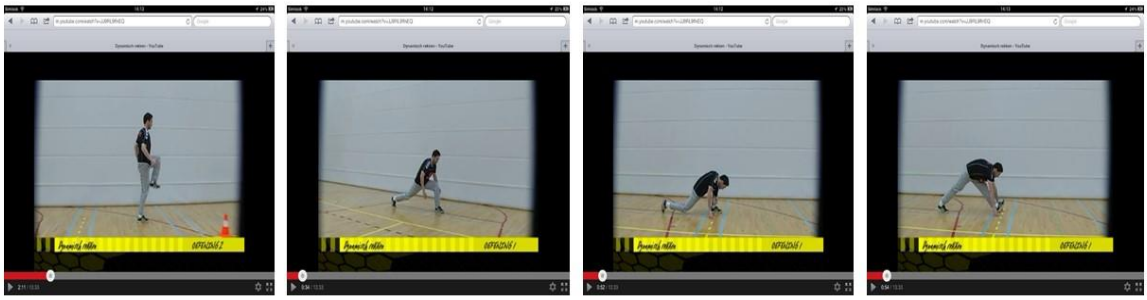

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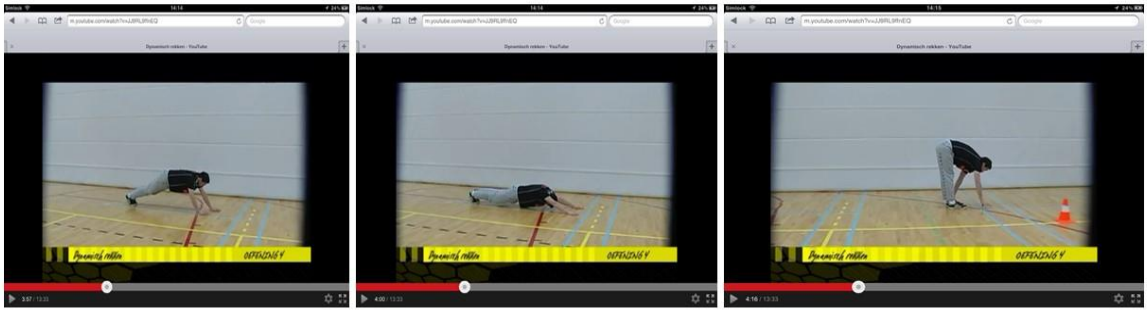


Ad 3; coordination and speed

Ad 4; defence movements, triangles/sideway movements

5.3

Stage 2; Ball routines/Goalkeeper warm up/Position shooting

In stage 2 the players will work with the ball.

It is about warming up the shoulders and shooting at the goalkeepers to get them ready for playing.

1—Ball routines.

First the players have to **warm up the shoulders** by passing the ball.

This can be done in several ways. The creativity of the trainer is leading here.

I can come up with several examples. Some of them are exposed below.

The most important is to get the players in a movement they will face during the game.

The players should receive the ball and pass it through in movement, not in a standing position.

In stage 2 the trainer can also use some tactical plays with will be important during the game.

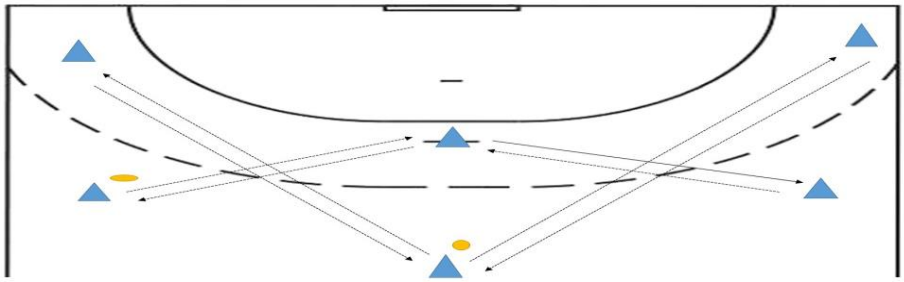
Example;

I let the players work in 2 triangles. One ball is played between the wings and the centre back.

The second ball is played between the back players and the pivot players.

All the players should receive the ball in movement and play it with pressure towards the goal to the next player.

This way the players get ready for the match in which the ball have to be played around in movement with pressure to make the defence players move sideways.



Here there are also no boundaries. The coach can create his own patterns and drills which he thinks are useful for his team.

After warming up the shoulders with the first routine I always use **passing continuing forms**, which are related to tactical plays which will be important for that game.

In a passing continuing form the ball is played during a period of a couple of minutes without a break. The ball is moving around between the players within a tactical concept. The ball has to be played with pressure and speed without making technical mistakes.

In this stage the coach can always use a different order in which the ball is played.

Important is that the ball is played with speed and pressure towards the goal during a longer period of time without making technical mistakes.

During the game it is important to minimize the technical mistakes because technical mistakes give the opponent a chance to score an easy goal in the fast break.

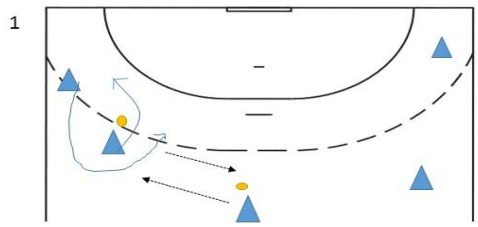
So the players have to be ready to play the ball with speed and pressure without dropping or losing the ball.

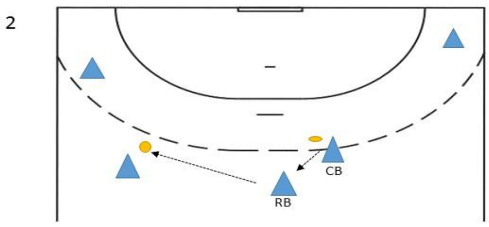
For example;

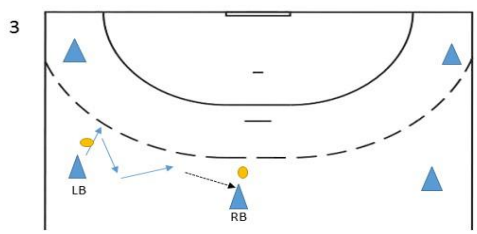
Your team will face a 6:0 defence, you can choose a passing order which is related to a tactical play against a 6:0 defence.

The next game you will face a 5:1 defence and the passing order is related to a tactical play against a 5:1 defence.

Example of passing continuing form







1--CB passes the ball to LB
LB makes a crossing with LW
LW passes the ball to CB

2--CB makes a crossing with RB
RB passes the ball to LB

3--LB makes a fake movement outside to the inside and passes the ball back to RB

Now the same passing order on the other side.
The ball has to be played with pressure towards the goal

The coach can choose to let the **pivot players** work alone during the passing continuing forms. This is not necessary; you can also integrate them into the continuing forms.

If you let them work alone they can work on making blocks and catching the ball in difficult positions.

I work with three pivot players in my team and therefore I choose to let them work specifically.

The pivot players are working in the circle at the centre line

2—goalkeeper warm up

In the old school warm up the goalkeepers were warmed up by throwing the ball at them from one or two lanes.

I prefer that you can use some movements which are related to the game.

The players should be in a movement based on a tactical play which is related to the game.

This makes it more realistic. The ball should be played by more than one person before we throw at the goalkeeper.

All the players involved should be in movement and work with different speed and acceleration.

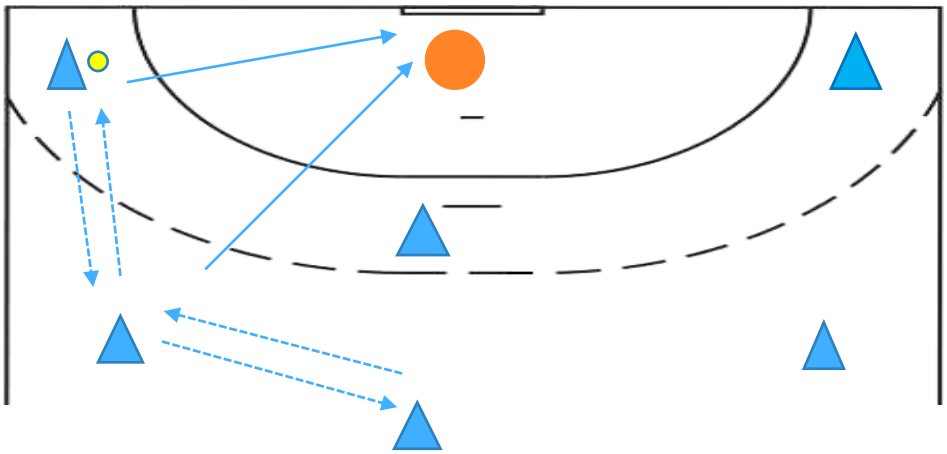
3—Throwing from playing positions

In the old school warm-up every player was standing at his position and plays the ball to his neighbour and he gets the ball back and shoots from his position.

This way of shooting has no connection with the match, it is not game related. In a real match you always get the ball in movement which follows from a tactical play or a small group play.

I think it is important to make a short game related action and from there a player shoots from his position. Two or three players should be involved in this action. Tis way the players are also preparing a goal attempt for a teammate.

Example old school;



There was totally no movement in this action, a situation that does not fit in a modern handball game.

I think it is possible to find a passing routine which is not too long but fits into a real situation that occurs in a handball match.

Two or three players should be involved in shooting from the positions. Here are also no boundaries in choosing a good drill.

Here you can also use a tactical play which will be important during the match.

If you do this you can always change this way of shooting depending on the tactical plans you have for every game.

I will explain an example which I always use during the warm-up.

I have three pivot players which I use as defence players who try to block the ball.

The passing order is always the same. LB or RB starts and passes the ball to CB, meanwhile the other Back makes a running movement and collects the ball from CB.

RB/LB shoot at the goal or pass the ball to awing player or a pivot player or to the CB who shoots at the goal.

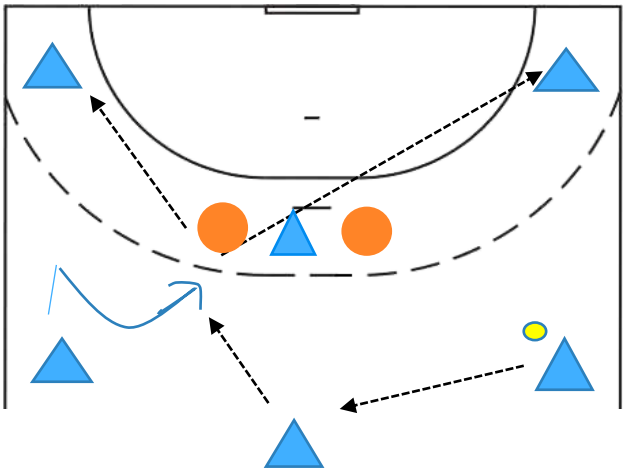
<u>Now it depends on who shoots at the goal.</u>

1--LW/RW shoots at the goal.

2--Pivot shoots at the goal.

3--LB/RB shoot at the goal.

4--CB shoots at the goal.



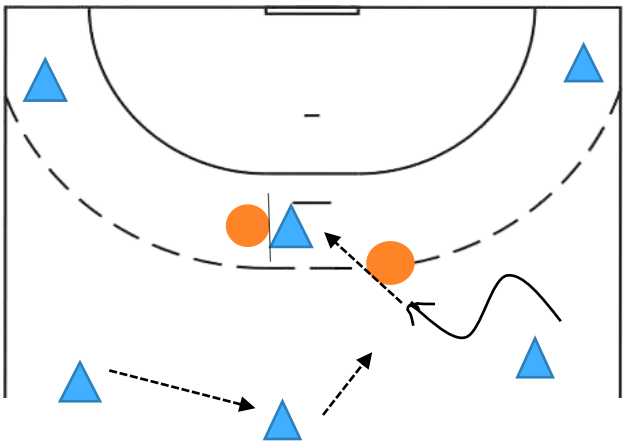
Shooting from the wing positions

RB plays the ball to CB.

Meanwhile LB makes a running movement from the outside to the inside. LB receives the ball from CB.

LB plays the ball to the RW or the LW.

RW or LW shoots at the goal



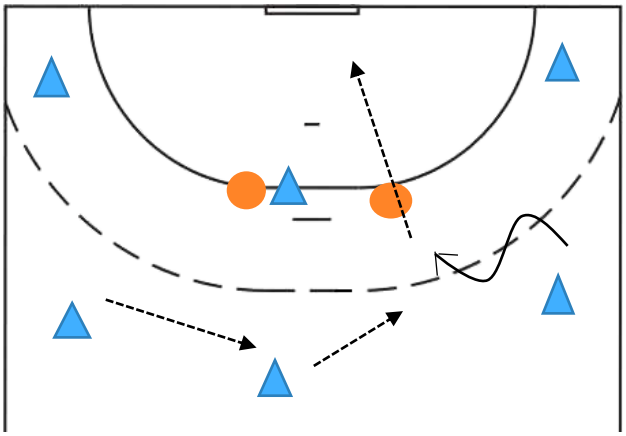
Shooting from the pivot position

LB plays the ball to CB.

Meanwhile RB makes a running movement from the outside to the inside. RB receives the ball from CB.

RB plays the ball to the pivot.

Pivot shoots at the goal



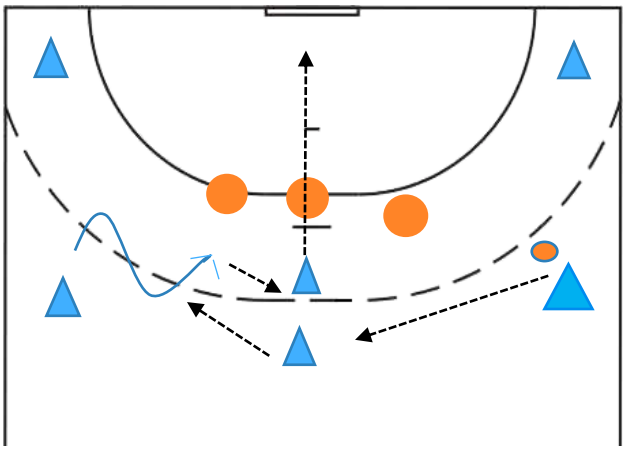
Shooting from the back position

LB plays the ball to CB.

Meanwhile RB makes a running movement from the outside to the inside. RB receives the ball from CB.

RB shoots at the goal.

Pivot tries to block the ball at 7m.



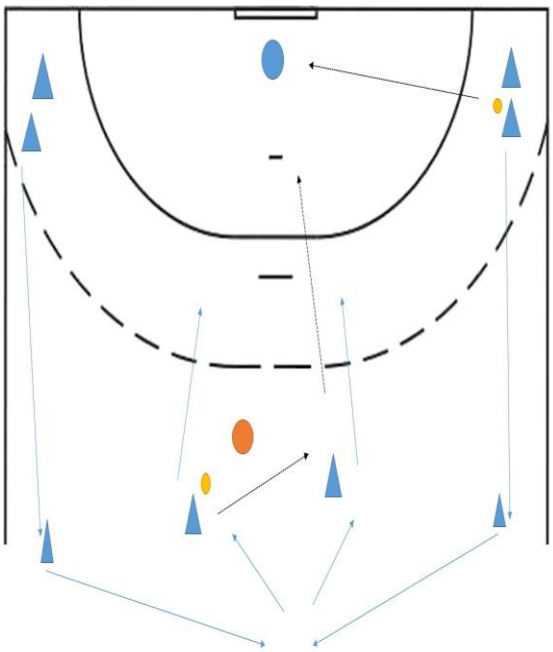
Shooting from the CB position

RB plays the ball to CB. Meanwhile LB makes a running movement from the outside to the inside. LB receives the ball from CB.

LB plays the ball back to CB.

CB shoots at the goal

Pivot tries to block the ball at 7m.



Fast break

2 players are standing in both corners. One player throws the ball to the goalkeeper, both players run to the centre line, one players receives the ball.

At the centre line they cross each other and play 2:1. One player or coach or assistant is the defence player.

You can give the players a restriction in dribbling or only one player is allowed to score.

5.4

Stage 3; Decision training in offence and defence

In this last stage before the match the players have to play in small groups and make decisions they also have to make during the match.

They have to solve match related situations in small groups or as a whole team.

They have to play these situations as if they are playing a real game.

This should also be learned and trained or else the effect we want is not as good as we want to. This is just a mind-set, but not an easy one. This is a mental preparation which is as important as or even more important than the physical warm-up.

If the team is able to create this game atmosphere during the warm-up they will have the feeling of being in the middle of the game when the real match starts.

This might give us the advantage I was talking about in the beginning. We don't have to get a game feeling anymore (hopefully), and we can play direct at a high level where the opponent is still trying to find the game mode.

No boundaries are set here again. Every coach can create his own pattern.

It depends on the impression which the coach would like to give his players with which drill you end the warm-up session. If you end the warm-up with defence impressions these impressions will be fresh when starting the game.

For example;

You can let the players play in 3 against 3 situations or 4 against 4 situations or 6 against 6 situations.

You can also do combinations, first you play 2 times 3 against 3 on both sides and the third action is 6 against 6.

No boundaries are set here again. Every coach can create his own pattern.

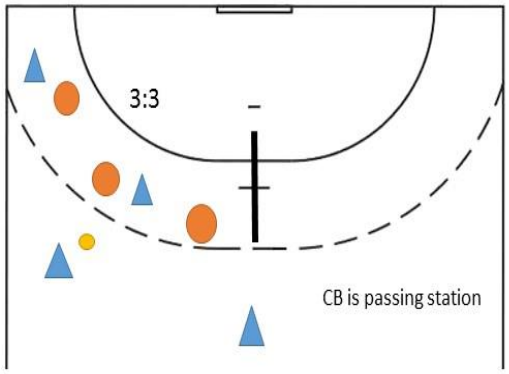
You can also choose to let the offence play with one man advantage, 6:5 or 4:3.

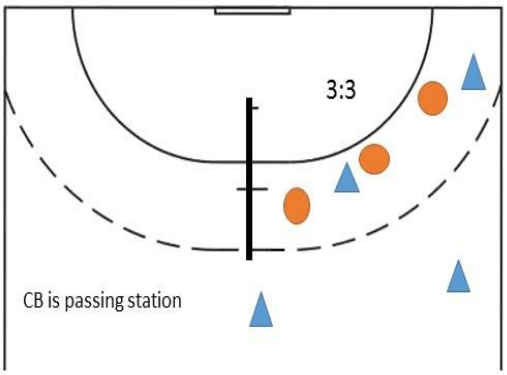
This all depends on what is important for the coach at the time.

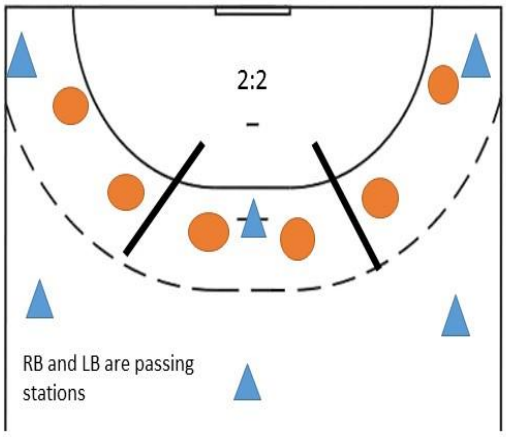
Important is that the players have to solve situations they will face during the match.

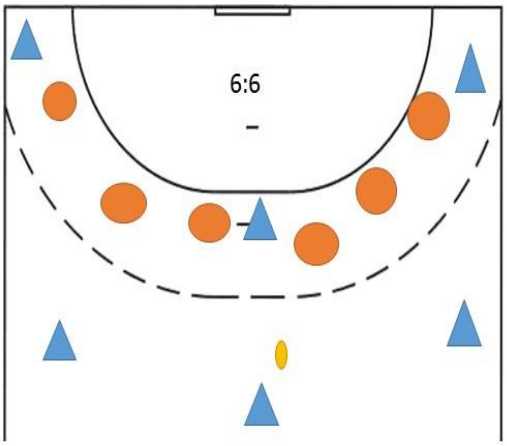
Following; 2 examples of possibilities of how you can structure this exercise.

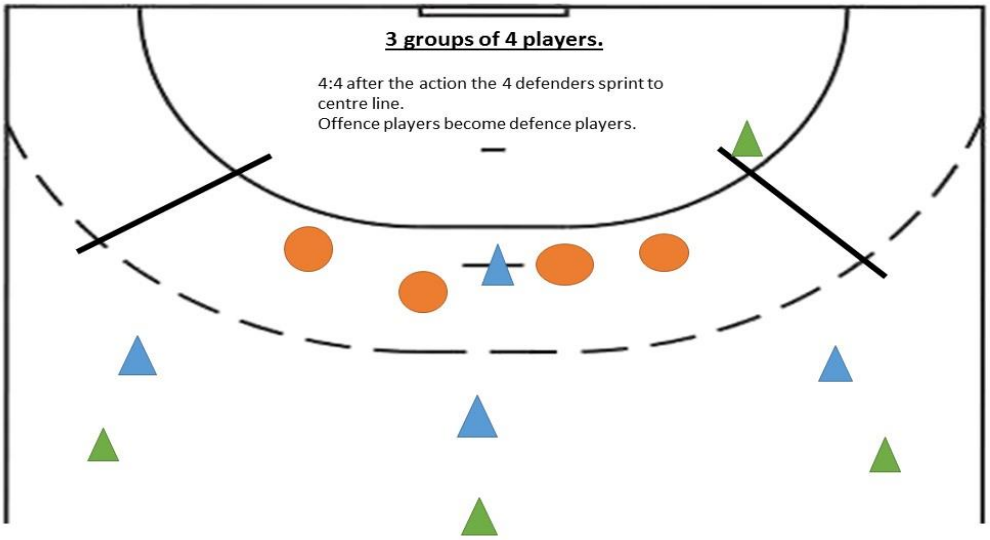
1


3:3
CB is passing station


3:3
CB is passing station


2:2
RB and LB are passing stations


6:6


3 groups of 4 players.
4:4 after the action the 4 defenders sprint to centre line.
Offence players become defence players.

Chapter 6

Goalkeeper warm-up.

As already mentioned the goalkeepers have to solve their own warm-up program in stage 1 and the first part of stage 2.

The goalkeepers are working with the rest of the team from the minute the players are shooting at the goal to warm-up the goalkeepers. This is after the ball routines of the players.

The goalkeepers are doing their warm-up program within the six meter area.

This is their area they have to defend and play in. This is their working area.

So during the warm-up they are doing all of the exercises here.

It depends on having a goal keeper coach or not how you can structure the warm-up.

If there is a goalkeeper coach he is the done doing the warm-up with the goalkeepers.

If not, the goalkeepers have to solve their program by themselves.

The goalkeepers have about 15 minutes time before they join the other players in the warm-up of the team. In these 15 minutes they have to be mentally and physically prepared to stand in the goal and stop balls.

Therefore it is important, I think, that they work from the beginning with a ball.

Getting used to the ball is really important.

The goalkeepers have to solve several exercises in the speed ladder.

Working in the speed ladder makes the footwork fast. If you add a ball (handball or tennis ball), the reflexes and the eye-hand coordination is getting warmed up.

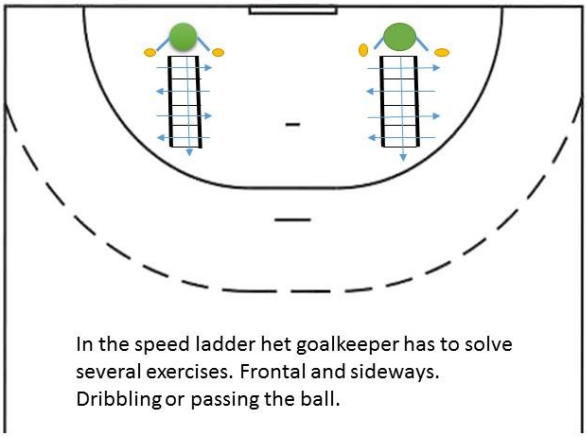
After these exercises the goalkeepers have to work with specific actions they are facing during the game.

Touching a ball before it crosses the base line.

Saving a ball which rolls towards the 6m line.

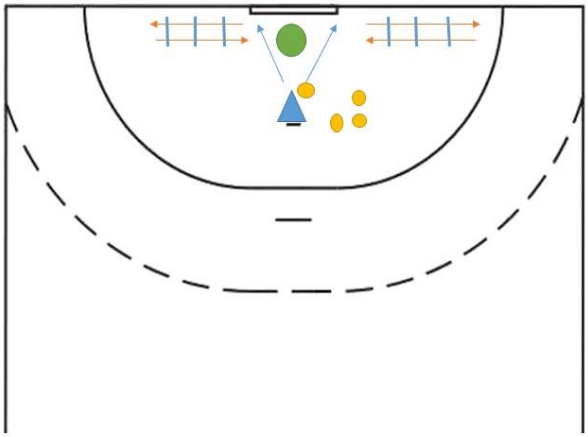
Stopping a ball and directly a long pass to the centre line (Fast break situation).

Example of exercises that can be done with the goalkeepers



In the speed ladder het goalkeeper has to solve several exercises. Frontal and sideways. Dribbling or passing the ball.

1—GK goes straight through the speed ladder. 2 contacts in each field.
2—GK goes sideways through the ladder. On both side, outside the ladder they dribble the ball one time.
3—GK's are facing eachother and go sideways through the ladder, 2 fields forward and one field back. Meanwhile they pass the ball to eachother.



1—GK moves sideways over the bars and then he has to stop a ball, high/low
2—GK moves sideways over the bars facing the wall and has to turn and stop a ball, high or low.

The same exercises can be done with 2 or 3 balls in a row.

After having done these exercises the goalkeepers have worked on;

--footwork

--reflexes

--stopping balls inside the goal, (even 2 or three balls in a row)

--controlling the 6m area

--saving balls, from the 6m area and the base line.

--throwing fast breaks

After this program the goalkeepers should be ready to join the team for the rest of the warm-up.

Chapter 7

Conclusion

The conclusion after this thesis is that the pre-game warm-up has to be done in a new fashioned way which is more related to the handball game.

The handball game has developed in each of its parts. It became faster, harder and more athletic.

All of these components have to be prepared during the pre-game warm-up.

This thesis gives us a good program to deal with this gap.

Every coach has now the possibility to make his own new pre-game warm-up program.

The thesis subscribed a 3 stage program, in which all the assets of the modern handball game are being explained. Exercises have been worked out to make it visual.

But the most important aspect is that every coach can make his own warm-up program, based on his own visions and tactics.

It is also possible to create several warm-up programs. You can create your warm-up program based on a 6:0 defence the will be faced with during the match.

Or you can create a warm-up program for those matches were you will face a 5:1 or 3:2:1 defence.

I hope that most of the coaches will see the need for a new warm-up program and I hope that I have showed a way in which this can be done.

BE INSPIRED

Defence 5:1 a new way of looking at

Rolando Freitas

Federação de Andebol de Portugal

Portugal

Summary

A reference round up through top conferences and published papers was made.
The EHF trend analyses reports from recent Men's European Championships were analysed and videos from the same competition were observed.
The aim of the thesis was understanding the traditional defence system, how it works, realize the evolution of it and its constraints and compare with how we see it actually. At the same time, an evidence of individual work required as focus is on individual capacities of players was shown.
The attention was on the historic facts of the 5:1 defence system, with a particular relevance to the French style and the evolution of it. References to the Russian system as well to the Spanish one were also pointed out.
Rules and basic guidelines from different schools or models were referred and how them work according to position of the ball and pathways from attackers.
A particular situation about modern interpretation of the 5:1 defence system was presented and discussion about it.
Finally, remarks about modern defence system were made.

Keywords

Development, Evolution, Analysis, System, Defence

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Introduction

Handball is a modern sport and is still growing. From ancient times when defence was prevalent to offense and scores weren't that too much relating to goals, moreover speed and velocity were far away from this sport to nowadays, when speed has increased a lot and players skill's is largely an influence to tactics decisions, and scores triple up the numbers from other times, defence has become better and better but somehow offense play will manage to score even so. Like once said in the press Espar (2006) "they are so good that whatever the system we are going to use, they will be able to score!".

When you look at recent European and World championships you have to notice that almost all teams are using the 6:0 defence, with different approaches.

The 5:1 defence is largely used by teams who haven't in their squads enough taller players and at the same time, for those who wants to disrupt the opposite attack and behalf on their defender players skills. This trend was not always like it is stated here. One of the first moves from the defence point of view was the change from the common used 6:0 system to different kinds of 5:1 defence systems.

Traditionally we can consider different types of 5:1 system defence, as it is said that the 3:2:1 system is an evolution of the ancient two lines defence. Clubs or national teams assumed different approaches according to particular characteristics of some individual players, but the fundamental principles were assumed.

However, actually because of the potential of attackers, who can breakthrough any defence, as they are in possession of top levels of coordination and motor skills, system 5:1 is used as a secondary/alternative option by a larger number of top teams.

But, as mentioned before, defenders have improved too. And even if we thought that speed of the game should finish with defence-offence switches, it did not; we still need specialists in defence and modern ones. Good offsets, excellent orientation, a lot of contacts, accurate sense of interception and dissuasion and outstanding collaboration between defenders and also with goalkeeper. The modern defender is active, independent from the zone or the system.

At the last Men's European Championship, as it is noticed in the qualitative analysis from it, 15 teams started with the 6:0 defence; only BLR started with the 5:1 defence as their primary system. Still, 9 teams combined their defence during the matches. Most of the times the 6:0 defence was switched with 5+1 or 5:1.

In the present the needs for flexible defensive systems adjustable to opponents, based on individual skills of defenders that should have outstanding individual abilities are a must to use flexible and adequate strategies upon on the opponent characteristics.

Methods

If we look back to watch the evolution of this 5:1 system, we have to considerer the traditional one, like it was used by the soviets and after them by their followers, the Russian team, whereas a good goalkeeper was behind three tall defenders in the centre and side back positions, and an intuitive forward centre defender. The goalkeeper, the back centre defender and the forward defender were the spinal medulla of this system. It was rigid, precise and we had to find the right players, with the right sizes to fit into this system. Then it came up the backwards from this ancient point of view. And, even if we didn't manage to have such kind of players, with some adjustments to the characteristics of our defenders it was possible to construct a 5:1 type system. It was the case of France and Jackson Richardson. In this French style system, though it seems that the anarchic movements from Richardson lead the opponent to make mistakes, the coordination with the three towers behind him, was impressively precise. We have to notice the position of the halves back defenders opposite to the ball, and how deep they were, dissuading communication with ball and pathways from attackers, leading them into the centre of the defence, where they could be easily stopped or committed errors. The big and strong guys down there allow a lot of freedom to Richardson to take advantage from his fantastic footwork as well as from his big wingspan. As we watch France become one of the big nations from world handball, we could observe the development of French system of 5:1, when they don't had anymore a guy like Richardson. Pollany, 2006, p.53, emphasized this when referring to the behaviour of the French defence “basic French style 5:1 with the well known move of the BR and BL going high on non-ball side and the point fighting every move to the centre with the ball”. However, at this point he stills remarks the evolution of the system, basically due to the different players that were involved and, at the same time, according to the enrichment of the opponents.

Image 1 – French style defence

“At most attention should be paid to France's change in the defence structure over the last years: the customary defence has been based on the 5+1 concept with dissuasion in the central area, however, in Sydney they played a traditional 5:1 system” (Roman, 2000, p.40). The author strengths the need to point out the

observed evolution from one to another system interpretation, “In the 5+1 concept with dissuasion in the central area the activity of the point defender is aimed at both marking the direct attacker and developing tasks to obstruct passages and tactical relations of other players with their direct opponents (this is described by the term dissuasion). On the contrary, the traditional 5:1 concept implies that the advanced player has to fulfil some tasks of major collaboration with the block of the five retreat players on a slightly advanced position. This novelty of the French team is possibly related to the use of Gille instead of Richardson in the advanced position.” (Roman, 2000, p.40).

Image 2 – French style defence with a front centre defender more flat

Hergeirsson, 2008, p.10 when referring to flexibility of the new French style of defence “The French team played 5:1 defence with the centre back player D. Dinart as the director. In centre front they most frequently played with B. Gille, but had flexibility and were also using other players in the same position: N. Karabatic and D. Narcisse. All the aforementioned players are very strong 1 on 1.” also states these observed changes.

Here’s an observed change example:

Image 3 – Adjustment to 1 line defence after attack goes into a fake 2:4

Image 4 – N. Karabatic transforming 5:1 in a flat defence

And another set:

Image 5 - Adjustment to 1 line defence after attack goes into a 2:4

Image 6 – French 1 line defence upon playmaker goes inside

Otherwise, historic nations took the 5:1 system as their primary one in defence, always with a particular interpretation of it. Teams like “Russia and Spain practically applied the same defence system, with slight variations, based on a defence structure of five players in the main line of defence and an advanced player with various responsibilities (5+1 with central dissuasion). The advanced specialist has to

fulfil the following tasks: Responsibility for fully marking the attacking adversary in possession of the ball; spatial advancement in order to avoid recovery of the ball by his opponent; occupation of passages to obstruct tactical relations of other attackers with the central player; definitive obstruction of the match structure in order to destroy the playing rhythm of the rival team." (Roman, 2000, p.41).

Not only defence rules were having the primary in everything that happened in front of them, but also tactics beside a 2x2 problem becomes to have more relevance according to the development of the attackers, at the same time. Traditional behaviour in a 5:1 system is not allowed anymore in account of opponents' skills. Deepness was essentially as shooters start to have success from 10-11 meters. Pollany, 2006, p.6, when analysing the 2006 Men's European Championship, "all the teams have their specific basic defence system, most of them play 5:1 or 6:0, but they all have very different interpretations", remarked this. "The 5:1 of the team CRO for instance is far away from the 5:1 of the French team." And concludes, "In general the systems have diversified, almost every top nation has a very unique realization of the schematic figures."

Image 7 – Russian style defence 5:1 with side orientation upon circulation of the wing

Image 8 – Russia defence system before crossing

Russia has also evolved his traditional 5:1 system with a new approach to a modern style of 5:1, strictly man-oriented. This kind of defence works a lot different and was very dynamic. (Pollany, 2006, p.31).

At the 2010 Men's European Championship, in Austria, "the Spanish team came up with a very new and interesting interpretation of the 5:1. The left wing plays man-to-man against the PM, but according to the situation he is free to move to either side and thus covers an enormous range of space. This sideways move will occur irregularly whenever the ball is with the wing player of the offence team. In this case one of the defence specialists will go extremely deep, if the ball is with the LW even both of them might go deep." (Pollany, 2010, p.8).

It seems sometimes interesting to see the young age categories perform in the same model as theirs National Team. We can find through a lot of countries this similarity, which was stronger and with a bigger identity when patterns across Europe could be clearly distinct. Here's an example with Spain M20 who replies their National Team at 2010 Men's European Championship.

Image 9 – Spanish style defence system with great depth of half defender

At the present we can observe different interpretations of 5:1 defence system and it seems difficult to assume a kind of similarity after the start set-up. From my point of view, it's more about how it works together rather than the initial set-up, which carries on an enormous dispersion among quite the same set-up. This can be observed in the following figures:

Image 10 - A 5:1 set play with an offensive orientation to back player in possession of ball and opposite half defender cutting spaces to centre and to direct opponent.

Image 11 – Almost the same like Image 10 with more space in between

Image 12 – Emphasized orientation on ball side

Development

Traditional characteristics of 5:1 defence system are a more aggressive defence than a traditional 6:0 system for example, protects the central area, difficult offensive game organization, but have lower amplitude in opposite to higher density in the ball region. Normally it is applied when your opponent has a good rate of movement of the ball and / or excellent organization and structuring offensive, when a player has high quality 1st line – shooting or organizing, and of course our players have the appropriate characteristics.

Facing the history that is behind this concept of defence, it matters retain something about rules, guidelines and the contiguous partnership in the system interpretations. The basic guidelines to a traditional 5:1 system can be followed down here, from a Russian/Soviet point of view (Donner, 1997):

The back central defender should be at least 195 cm high and halves defenders should be at least 192/193 cm high. The front centre defender should be a smart player and with a good footwork. The outsiders' defenders should be fast and risk players, taking most of the times the responsibility for two attackers – back and wing players, when the ball is on the other side.

In this defence system all the defenders paths have to be exclusively laterals and, at the same time, all have to play in 7 meters defence line, with their arms up in the air.

Pivot is allowed to run behind the defenders and collaboration between defenders and goalkeeper is a must. Defenders should protect the long shots and goalkeeper should take care of short shots.

Taking this in consideration, the behaviour of defence system 5:1 should carry on like this:

As we mentioned before, the front centre defender must play in 10 meters zone and all players have to play in 7 meters defence line. Pivot is allowed to run behind the defenders who must have their arms up in the air.

When the ball is in left or right back:

Front centre defender have to be in 10 meters zone - avoid passes between back players and avoid relation between back player and opposite wing player. Opposite outside defender must be in 9 meters zone; if back player assume a path away from defenders, outside defender should return to 7 meters zone.

If back player with ball attacks half defender, first defenders have to stay with arms up to protect the goal; half defender shouldn't allow the outside path to the back player; if back player goes into the middle, half defender have stay with him until the back centre defender zone and cut off all the chances to pass to the pivot.

If back player attacks between half and back centre defenders:

The front centre defender must be the first opponent and halves defenders must be responsible for the pivot. Back centre defender avoids long shots and goalkeeper short throws.

If playmaker goes inside the defence:

Halves defenders are both responsible for the pivots as front centre defender stays close to back player without ball (if playmaker goes inside the defence without ball). If playmaker goes inside with ball, front centre defender stay with him until he reaches the half defender zone and next, he stays close to back player in that side.

If a wing goes inside the defence, the outside defender has to give information and change opponent.

This kind of principles was very strictly followed and opponent teams experienced a lot of problems to beat this defence system.

We can find a lot of similarities in the next quote.

"The traditional defence 5:1 can develop, as all defensive systems, in a construction zone in which each defensive player has more individual responsibility toward the attacker in your area (shooting line) or, in addition, shared spaces with immediate colleagues and act accordingly depending on the ball (lateral movements or defensive block). In both cases the mechanical operation is similar to proceed from the point of view of the defence tactics coordination (lateral movements or defence

block); which may change from one variant to another is determined by the spaces to fill in and times of execution of tactical media. In both cases this defensive concept can also vary according to the depth of the 1st line of defence, giving them responsibilities tasks in different spaces - 7 meters, 8 meters, 9 meters or even more" (Román 2005, p. 13).

"By maintaining a course of conduct of this defence interprets here a base of operation that could be considered traditional. The position of front centre defender in 9 meters line as a starting point and in the vertical to the goal, with the ultimate goal of strengthening the central areas of defence and difficult possible distance shots from those spaces. Having an (front centre defender) 2nd line player obviously leads to a loss in the effectiveness of space near the goal area line regarding defence system 6: 0; accordingly seems easy to deduce that in such spaces the attackers have more options and therefore may be manoeuvring over the same opponent. This particularly affects the outdoor areas, these spaces considered the weakest of the defensive system that we are talking about" (Román 2005, p. 13).

However, another approach, can be observed and basic principles and rules of 5:1 defence system must be taken in consideration (Marczinka 2012, p. 12):

- Each defender should follow and control his attacker with the ball, within his area
- Always one defender falls out, while the neighbouring teammates protect the area next to or behind him
- The whole defence should shift towards the direction of the ball passed, as a whole unit
- The defenders should not change position, rather taking over and passing on within their defending zone
- The pivot should be cut off from receiving the ball from the backcourt
- Don't let be blocked by the pivot or an attacker runs into the defence wall
- Don't leave the goal-area line too far out, unless there is a danger of scoring
- The forward defender should neutralize at least one attacker, and take the impetus of the backs away
- The Centre Half defender should not fall out, unless is very necessary
- Ball should not be passed behind the Forward defender
- Defenders in different defence line should keep contact with each other
- Forward defender should move between the goalposts, unless checking

And another way of thinking the system from a traditional offensive set play is that shown below, which have basic links but also progressive variations toward to new trends of system (Rivera López, 2005, p.2):

Front Centre Defender: between 9 and 13 meters, don't allow blocks, when one to one, never consent the stronger pathway, change opponents before crossing in 1st line, lower defend pivot against external blocks to the 2nd defenders, dissuasion to playmaker, do not allow direct passes between back players, when pressing the back player to steal the ball enable passes between wing and playmaker.

Back Centre Defender: Always in the area of the ball, responsible for blocking the long angle shooting, the less he moves away from 9 meters better, in the 2x2 situation, with the halves defenders or front centre defender, have to warn and correct (Alert), it must be the main support to the halves defenders feints for the weak point and fixed front centre defender errors.

Halves Defenders: Minimum depth to the opponent with the ball is 9 meters, dissuasion to the playmaker or to the wing player, help defending the cross pivot, ry avoid blocks, 1x2 with back and pivot when the ball is on the near wing, 1x2 with playmaker and back when the front centre defender has been beaten, 1x2 with back and pivot when the ball is on the opposite side, 1x1 never consent the stronger pathway.

Outside Defenders: in 1x1 situations, the imperative depth, 1x2 with back and wing with ball on the opposite side, 1x2 when the half defender is beaten, never allow the wing to run behind him counter clockwise to the ball, dissuasion.

Analysing the 5:1 defence system, we can find situations like the one below which going more likely as the system has evolved and how it works, than either the starting basic image or the traditional working rules. “Studies can clearly show the differences among the numbers of “cases” covered by defending pairs as well as the way of co-operation of two defenders” (Nagy 2012, p.19-20).

Partnership of defenders No. 1 and 2

When “the attacking teams placed the line player between the defender pairs and built their attacking system upon it – defence actions performed by these defending pairs were more frequent. Generally speaking, the attacking teams changed to a game with running up at the wings, with two line players. Initiation of attacks started on the territory between the defenders No. 1 and 2, from the pick-and-roll game of the left/right back players and line players, the defence against it was generally achieved by switching”.

Partnership of defenders No. 2 and back centres

The “defending pairs are most charged, as the number of actions is the biggest here. These players must play with high concentration, timing and an adequate “aggression” as well, to break the attackers’ partnership and the rhythm of the attack. The most frequently used way to perform 2 against 2 playing in defence: is switching”.

Partnership of the disrupting player and the defender No. 2.

“In the basic strategy of defence, in the activity of these two defenders we can frequently see that, reacting to the cross-motions, the get to the same “altitude” and closing is performed by changing. In this partnership, the biggest challenge for the middle back is to run into the defenders’ wall, which is also frequently performed by switch”.

Partnership of the disrupting player and the back centre

"Building up the attack by closing in on the destroyer (point) will result in a 2-2 situation for the defenders, from the view of the line player. The frequently used defence tactic against this is switch. Co-operation with the point, against pick and roll, is mostly developed after escorting the cutting players, when the point steps back to the defence line. The way to perform this is generally switch".

Results and Discussion

This thesis review doesn't pretend to implement or arguing about a new concept of defence system. However, it allows itself the prerogative of finding particularities, unique, in a random variety of using the 5:1 defence system. A lot of times we are discussing about what type of defence is a team in use. And that's here that we can find the specificities a new way of looking at this defence system.

If we take the 2012 Men's 20 European Championship, in Turkey, we were able to observe several types of 5:1 defence. One of them was that used by Portuguese junior team, which becomes a consequence or evolution of the similar one that contribute a lot to become silver medal in 2010.

"Portugal, with rigid 5:1 defence, put pressure on the opponent's centre playmaker to dissolve attack sets. Depending on the opponent's passing, Portugal switched to 3:3 defences and earned a good reputation as one of the best offensive defending teams in the championship." It was remarked in the trend analysis report. This comes not after the model of France, neither from the model from Russia, but it goes more likely the Spanish team. Never less, it's a case interpretation according to mentioned principles: Portuguese and coach ideology, sports trends and capacities of players.

"Portugal's 5:1 defence set was remarkable. Centre front defence rose up to 11-12 meters while other players engaged in offensive one-on-one defending, making it hard for the opponent to play their game and increasing the possibility of turnovers. Still, this defensive set is in the proximity to some defects unless the players are used to playing with each other for a long time. Yet, if the Portuguese carry on with this defensive concept, they are very likely to make the spotlight in the years to come" it was also remarked.

Yes, collaboration between defenders as it was said before is of a significant relevance, as like time spent together, but individual abilities make any concept comes true. And this kind of philosophy seems the core of the new look at 5:1 defence system.

Being proficient before 1x1 duels is a good starting point. High intensity at defence set play, extreme good orientation facing the attackers and the area, basic simple rules in relations between nearby defenders and especially with pivot, and most of all defenders with great decision-making who can offset and adjust are stronger ideas when implementing a defence concept.

At the same time, the individual situations, closing gaps, trying to be responsible for less space, prevent or blocking the reception of the ball by the pivot,

break attack's rhythm and timings, conditioning and having factual instructions appears like general principles to perform well at defence set play.

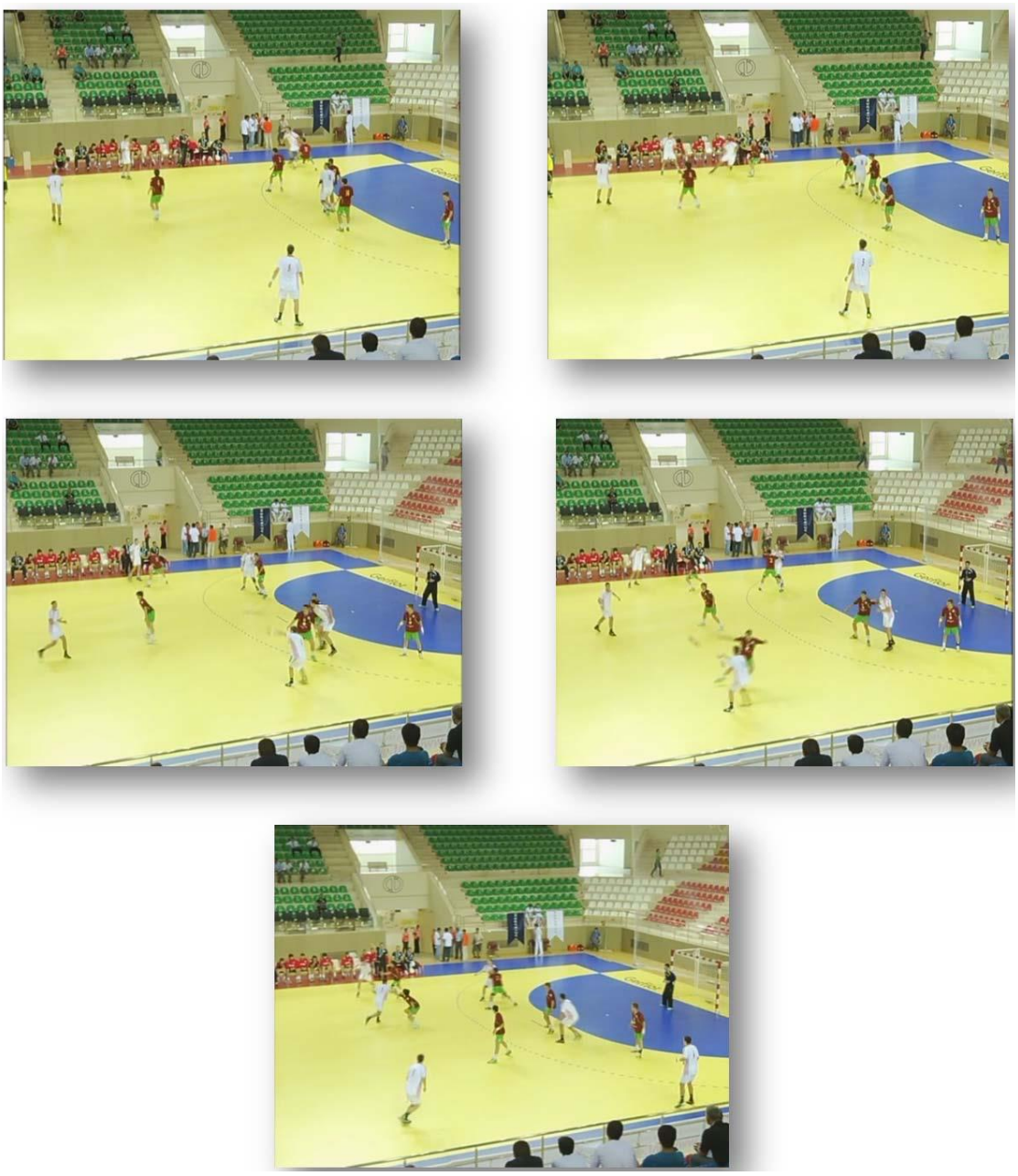

Image 13 – Sequence of images showing portuguese defence and system's depth

Conclusions

In this thesis I tried to focus on the recent history of the 5:1 defence system and how it was developed and evolved. After that I watch out what was in mind of rules and principles to use this type of defence. Looking to the present and how teams play I have to think in another factors that can contribute to how well they are organized even, like it happens with National Teams, without much time together or

with a multi national origin of players among all top teams, which emphasized the idea of outstanding individual abilities. That's why the focus should be in the individual.

We can't watch symmetric decisions in both sides of defence set in a large number of cases what goes against a traditional defence system.

Asymmetric behaviour on both sides dependent on opponent's characteristics is observed.

When offence transforms the attack from a traditional 3:3 to a 2:4 situation or a 3:3 with two pivots the routines may be different according to who is the front centre defender.

Prompt changes to the two lines defence can be implemented according to last statement or depending on opponent's characteristics.

Asymmetric behaviour on both sides is also noticed depending on strategy or individual capacities of defenders.

Evolution on defence set play is observed with less density and more dissuasion in open spaces.

Traditional systems are still in use but with major variations.

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Optimization of real-time game information to Handball coaches

2014 EHF “RINCK” Convention

Open Master Coach and Licensing Course Thesis

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Portugal

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Summary

The purpose of this report is to describe the evolution of software tools for Handball game analysis, from the traditional post-match video editor to the real-time feedback game information to support the coaches' decision making process, during match or a training session. Results from this continuous work are promising due to technology innovation, coaches' collaboration and applied sports science subjects.

Keywords: Handball, Coaches, Information, PlayfulVision, Videobserver®

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Introduction

In regard to the interaction of the technical-tactical components, the contact and invasion team sports show a complex variety of collaboration and opposition features. The multitude of possibilities to solve Handball game situations, and the need for knowledge of the interactive process, require the construction and use of tools to observe and record behaviors, that enable a more rigorous and comprehensive analysis, when possible, of what happens on the field.

The game analysis allows to describe, to understand and to estimate features and events by means of statistical procedures, only possible due to various methods of observation and technological innovation. The game analysis can be understood as the study of the game from the observation of the players and teams in different dimensions, biomechanical, physiological, psychological, technical and tactical. This has improved the knowledge of the game itself, and has helped to distinguish the importance of each element in the outcome of a competition (Garganta, 2001). The use of observational systems in game analysis aim to measure and to interpret the individual performance, the tactical situations, the interactions within and between teams, and to support the process of coach's decision making (Nevill, Atkinson & Hughes, 2008). In order to bring deeper insight into the team tactical game, it is necessary to record the substantial tactical actions in a chronological, sequential order, so the stream of tactical behavior can be recognized (Pfeiffer & Perl, 2006).

The study of the game by observing the behavior of the teams and players is not a recent phenomenon (Garganta, 2001; Hughes, 2004). Game analysis is indispensable for the design of game models and for training/coaching effectiveness. Commonly, a notational analysis (Hughes & Bartlett, 2002) is performed, where a set of categories is considered to classify the observed actions of the players during the game, being this particularly focused on the player with the ball (e.g., where he/she is in the field, to whom he/she passes the ball, where in the goal he/she shots the ball), disregarding other sources of information that may influence the course of the action, such as the position of the teammates and opponents as well the tactical context of the play. Despite of some limitations of this kind of analysis for assessing teams' and players' performance, these category systems are still used (Meletakos, Vagenas, & Bayios, 2011; Rogulj, Vuleta, Milanović, Čavala, & Foretić, 2011) and regarded as reliable indicators for Handball experts' performance analysts (e.g. EHF Periodical).

The contribution of new technologies in the Handball game analysis, relating the offensive and defensive process, is essential to the quality of: sports officials coaching, the athletes' selection, the development of more sophisticated methods and means of training and education, and for understanding the trends of the game. As a consequence, there is now a growing market to software and game information. Several software companies strive in the market with everyday technology to support teams and coaches, but most (if not all) present tools that can only aid coaches after the game. So, the rising question: Is it possible to assist coaches with real-time game information?

The purpose of this work is to show an evolution of how technological tools for Handball game analysis were developed and applied in order to give real-time game data information to support coaches' decision making process during a match or a training session.

Methods

The feasibility of game observation and analysis requires the definition of conceptual tools that limit the development and implementation of appropriate methodologies to the nature of the game (Garganta, 2001). The observational methodology has been used since it allows to observe, to register and analyze data from perceptive conducts and interaction in a natural contextualized situation. Also, it allows to build an observation instrument combining the category system accuracy and the field format flexibility (Anguera, 2003; Prudente et al., 2004). Hence, it is expected to record a variety of team and player's interactions (collaboration and opposition), which occur during a Handball game. The observational methodology can be understood as an intentional action of the scientific method to develop a series of steps, and it aims to respond to a purpose related to observable behaviors of the subjects in the natural context (Anguera, 2000).

Instruments

Observational instrument

The structure and content of the observation system were supported by a literature review of criteria and categories (indicators) validated and used in other Handball game studies and EHF quantitative and qualitative analysis. The elaboration of the observation system considered two dimensions:

1) The *contextual dimension* presents criteria which do not depend on the decision of the players, but it influence the development and quality of the game. The elements that involve this dimension try to characterize the context in which the observed actions arise taking into account: the elapsed game time, the sequence beginning and the game scoreboard;

2) The *conduct dimension* reflects the decision of the players under observation, namely their observable behaviors. In this sense, the following criteria were distinguished, as relevant to the performance analysis of the Handball game (Sousa, 2000; Sevin & Taborsky, 2004; Prudente, 2006; Gomes, 2008; Silva, 2008; Calvo & Herrero, 2001; Varejão, 2004; Freitas, 2007; Leitão 1998; Santos, 2004; Pollany, 2006; Magalhães, 1999; Antón Garcia, 2002, 2004; 2006).

Each criterion is defined by a set of categories that are represented by codes in the registry instrument. The categories are associated with indicators to carry out the observation and the registration of the observable behavior. In the registry instrument the codes are representations of the indicators and are organized in a hierarchical way. The registration units were defined as event units and the registration type was by temporal order. The categories were organized and implemented in specialized software.

Data collection instruments

Two different registry instruments were used: Videobserver® (Hernández-Mendo et al., 2014) and a testing algorithm for PlayfulVision software.

The Videobserver® is an online platform software with a set of application built originally and specifically for Handball (later versions of other sports are now being implemented), that allows users to record technical and tactical events and to view the respective data with video synchronization. This platform was used in 3 different versions: the Game Editor (post-match), the Live Observer and the Smartcoach application (beta version), and allowed to collect and record the players' actions and code them in categories. Data collection with the Game Editor uses a digital video file from the match to code the players' actions and team tactics; with the Live Observer version, data are registered *in loco* during a match and sent to the assistant coach and/or made available into a web matchcentre. With the Smartcoach application (available for portable devices such as tablets or smartphones) data is also collect *in loco*, but this time on the bench near the coach. In these last two versions data are made available to the coach at any time, as it is stored

locally and uploaded to a web server, given the possibility to consult, in real time, the statistics. In all the versions is possible to synchronize the video and to add more data and/or to make cumulative technical and tactical video playlists and share it with the coaches and players.

The PlayfulVision algorithm allows to track all the players' position using only a single video camera. In this application, the ground floor of the Handball court is represented as a grid of cells with a resolution of 40cm×20cm and the goal is to estimate, at each frame, which grid cells are occupied and by whom. For this, the system is composed by three core components: detection, identification and tracking. Detection is based on a generative model which can effectively handle occlusions in each time frame independently. This produces a Probability Occupancy Map (POM). The detection algorithm is developed for multiple people detection from multiple cameras (Fleuret, Berclaz, Lengagne, & Fua, 2008) and also applicable for a single camera as well (Ben Shitrit, Raca, Fleuret, & Fua, 2013). The detected location of the players is then used by the next components of the tracking system. The identification component recognizes the identity of the person according to his color histogram, facial descriptor and his/her jersey number. In this case only the shirt colors were used in order to distinguish between the role of the players (attack and defense). In the final tracking component, the multi-player tracking problem is formulated as a multi-commodity network flow problem (Ben Shitrit, Berclaz, Fleuret, & Fua, 2011; Ben Shitrit, Berclaz, Fleuret, & Fua, 2013). The tracker links the detections of players in individual frames across time, while taking into account the appearance and identity constraints, obtaining the players' trajectory movement.

Players' positional data collected by this algorithm can be considered to calculate spatial metrics to describe the behavior of attack and defense teams (Lopes, Florêncio, Ben Shitrit, Fua, & Fonseca, 2013), namely, the area of the convex-hull (Lopes, Fonseca, Leser, & Baca, 2013), the area of the bounding rectangle (Lopes, Fonseca, Leser, & Baca, 2013) and the Voronoi area (Kim, 2004), all reported in percentage relative to the field area and calculated using routines implemented in Matlab R2008a software.

Quality of data

Internal and content validity of the observation instrument was achieved by four Handball expertise: two Handball PhDs (with high performances coaching experience) and two high performance Handball coaches graduated in Physical Education and Sport, which proved the consistency, mutual exclusivity and relevance of the category system and field format. The stability and consistency of the observation instrument were verified by intra and inter-observer reliabilities, by calculating the Kappa Cohen's value (Ribeiro, 1999). To calculate the reliability it were used 1/3 of the games randomly from the competition samples (2012 London Olympic Games and 2nd leg of the Portuguese Men's National 1st Division Championship). They were chosen to ensure the level of play and the relevance of the observed conducts.

Development & Results

The purpose of this work is to show how the evolution of technological tools for Handball game analysis can be effectively applied in order to give real-time game data information to support coaches' decision making process during a match or a training session. In this chapter we will describe the evolution and application of two types of technological tools: Videobserver® and Playfulvision. Three case studies will be presented to show the evolution of the Videobserver® platform in order to give real-time and meaningful information to coaches; and one case study that uses the Playfulvision algorithm to collect positional data and considers spatial metrics as new approach that can provide more information about the game.

Videobserver®

As stated previously, Videobserver® is an online platform software with a set of application built original and specifically for Handball that allows users to record technical and tactical events and to view the respective data with video synchronization. This platform has 3 different applications: the Game Editor (post-match), the Live Observer and the Smartcoach application. They allow to collect and record the players' actions and code them in categories. The software has a set of predefined technical categories but allows customization, such as add tactical categories.

Case Study 1: Game Editor - 2012 London Olympic Games – Women Handball Tournament

In this first case study, we used the Game Editor to collect players' data from post-match videos from the Women Handball Olympic Tournament in London, 2012. A database with all the team information was built and game data from the games was collected. With the Game Editor it was possible to quickly collect/correct data and to synchronize it with the video (Figure 1).

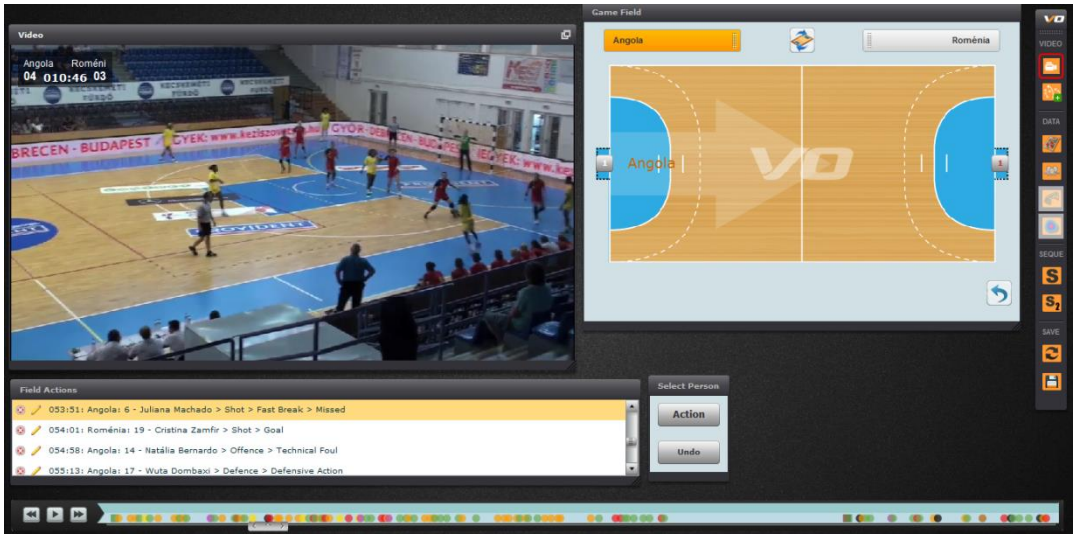


Figure 1 - Game Editor data collection

Having the game data gathered, it was possible to show a playlist from the predefined or the customized actions collected (Figure 2) in a few clicks.

Figure 2 - Game Editor shot playlist

In the Game Editor it was possible to check the statists from the match and, when needed, to visualize each in action of interest, just by clicking in the player number on the game field or in the goal (Figure 3).

Figure 3 - Game Editor Statistics and visualization

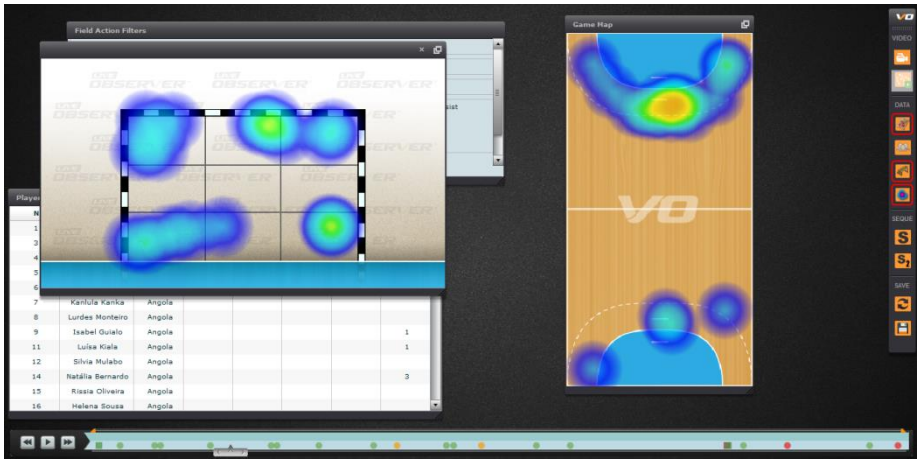


Figure 4 - Game Editor Statistics and heat map visualization

The data collected in the Game Editor is shown in frequencies and in percentage by team, and by player, per game. To have access to the full potential of the statistics and video database (i.e. to have a cumulative statistics, cumulative playlist actions) it is necessary to have access the web service. In this platform all the game videos, statistics (Figure 5) and custom actions are available and can be combined and sorted by kind or type of action, for instance, to compile into a playlist and share with the team (players or coaches), or view a player performance in certain game (Figure 6), to compare player's data from several games (Figure 7).

Figure 5 - Example of basic match report in the web platform

In the basic team match report it's possible to have access in to more information regarding usual Handball data indicators, and as well the shot direction of each player, that can be filtered by a timeline.

Roménia

No.	Name	Position	Total			Goals / Shots						Discipline				
			Gols	Shts	%	Asst	FB	7m	6m	Wng	9m	YC	RC	2m	F	FS
1	Mirela Pasca	GK	0	0	0	0	0/0	0/0	0/0	0/0	0/0	0	0	0	0	0
6	Crina Pintea	NP	0	0	0	0	0/0	0/0	0/0	0/0	0/0	0	0	1	0	0
7	Adriana Nechita	NP	3	5	60%	0	3/4	0/0	0/0	0/1	0/0	0	0	1	0	0
9	Aurelia Bradeanu	NP	1	5	20%	0	0/0	1/1	0/1	0/1	0/2	1	0	0	0	0
11	Oana Manea	LP	2	2	100%	0	0/0	0/0	1/1	1/1	0/0	0	0	0	0	0
14	Laura Olten	NP	1	1	100%	0	0/0	0/0	0/0	1/1	0/0	1	0	0	0	0
15	Valentina Elisei-Ardean	NP	4	6	67%	0	4/4	0/0	0/0	0/2	0/0	0	0	0	0	0
19	Cristina Zamfir	NP	4	5	80%	0	0/1	0/0	1/1	1/1	2/2	0	0	0	0	0
23	Daniela Babeanu	NP	0	0	0	0	0/0	0/0	0/0	0/0	0/0	0	0	0	0	0
26	Nicoleta Tudir	NP	0	0	0	0	0/0	0/0	0/0	0/0	0/0	0	0	1	0	0
27	Camelia Hotea	NP	3	4	75%	0	1/1	0/0	1/2	1/1	0/0	0	0	0	0	0
30	Paula Lingureanu	GK	0	0	0	0	0/0	0/0	0/0	0/0	0/0	0	0	0	0	0
77	Gabriela Perianu	NP	1	3	33%	0	0/0	0/0	0/0	0/0	1/3	1	0	0	0	0
85	Florentina Chintoan	NP	4	5	80%	0	1/1	0/0	2/3	0/0	1/1	0	0	1	0	0
89	Laura Chiper	NP	7	9	78%	0	3/4	0/0	1/1	3/4	0/0	0	0	0	0	0
93	Eliza Buceschi	NP	0	2	0%	0	0/0	0/0	0/0	0/1	0/1	0	0	1	0	0
0	Incognito	NP	0	0	0	0	0/0	0/0	0/0	0/0	0/0	0	0	0	0	0
		Total	30	47	64%	0	12/15	1/1	6/9	7/13	4/9	3	0	5	0	0

No.	Name	Total				Goals / Shots				
		Goals	Sav	Shts	%	FB	7m	6m	Wng	9m
1	Mirela Pasca	26	9	36	25%	9/12	4/4	4/6	5/7	4/6
30	Paula Lingureanu	0	0	0	0	0/0	0/0	0/0	0/0	0/0

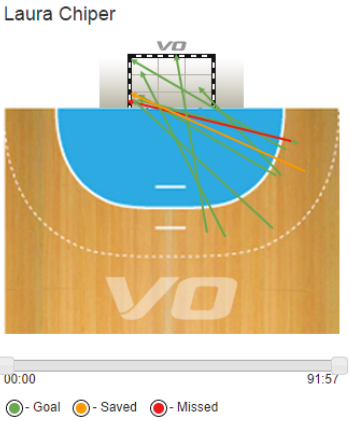


Figure 6 - Example of basic team match report in the web platform

In order to verify how players' performance indicators varied or was maintained during a tournament or championship.

1 Ivete Simão

	Remates			Golos / Remates					7 I.	T
	Defendidos	Sofridos	% Efic	CA	7m	6m	9m	Pnt		
Hungria B x Angola	2	20	8%	5/5	4/5	-/-	-/-	-/-	-	-
Angola x Hungria A	-	-	-	-/-	-/-	-/-	-/-	-/-	-	-
Angola x Roménia	11	30	26%	12/13	1/1	6/7	4/8	7/12	x	60"
Total	13	50	19%	17/18	5/6	6/7	4/8	7/12	1	60"

3 Lisandra Carvalho

	Remates					Golos / Remates					Defensiva						Ofensiva							Disciplina			7 I.	T
	Falh	Def	Blc	Golos	% Efic	CA	7m	6m	9m	Pnt	Blc	Int.	F 7M	6m V	F	FS	Ass	Dri	Jl	6m V	M. Rec	F 7M	FS	AM	VM	2m		
Hungria B x Angola	2	-	-	-	-	-/-	-/-	-/-	-/-	-/-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-
Angola x Hungria A	-	3	1	-	-	0/1	-/-	-/-	-/-	-/-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-
Angola x Roménia	2	1	-	2	40%	1/1	-/-	-/-	1/1	0/3	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	x	60"
Total	4	4	1	2	18%	1/2	0/0	0/0	1/1	0/3	0	0	0	0	0	0	0	0	0	0	0	3	0	1	0	1	1	60"

4 Marta Santos

	Remates					Golos / Remates					Defensiva						Ofensiva							Disciplina			7 I.	T
	Falh	Def	Blc	Golos	% Efic	CA	7m	6m	9m	Pnt	Blc	Int.	F 7M	6m V	F	FS	Ass	Dri	Jl	6m V	M. Rec	F 7M	FS	AM	VM	2m		
Hungria B x Angola	-	2	-	1	33%	-/-	-/-	-/-	-/-	-/-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-
Angola x Hungria A	-	1	-	2	67%	1/1	-/-	-/-	-/-	-/-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Angola x Roménia	-	1	-	4	80%	3/3	-/-	-/-	-/-	1/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	60"
Total	0	4	0	7	64%	4/4	0/0	0/0	0/0	1/2	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	1	60"

Figure 7 - Example of individual player detailed statistic report in the web platform grouped by player

In Figure 7 it possible to observer the statistics of different players across different games, as in Figure 8 it is displayed the detailed statistic of each player during a match.

Hungria B x Angola - 10-08-2014

	Shots					Goals / Shots					Defensive						Offensive							Discipline			I. 7	T
	Fai	Def	Blk	Goals	% Effic	FB	7m	6m	9m	Wng	Blk	Int	F 7m	6m V	F	FS	Ass	Dri	St	6m V	Bad Rec	F 7m	FS	YC	RC	2m		
Lisandra Carvalho	2	-	-	-	-	-/-	-/-	-/-	-/-	-/-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-
Marta Santos	-	2	-	1	33%	-/-	-/-	-/-	-/-	-/-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-
Iracelma Silva	-	-	-	1	100%	-/-	-/-	-/-	-/-	-/-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Juliana Machado	-	-	-	2	100%	-/-	-/-	-/-	-/-	-/-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Kanlula Kanka	-	1	-	-	-	-/-	-/-	-/-	-/-	-/-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lurdes Monteiro	-	2	-	3	60%	-/-	0/1	-/-	-/-	-/-	-	-	-	-	-	-	-	-	-	-	-	2	-	1	-	2	-	-
Isabel Guialo	6	3	-	2	18%	0/1	-/-	-/-	-/-	-/-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Natália Bernardo	1	1	-	3	60%	1/1	-/-	-/-	-/-	-/-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Rissia Oliveira	-	1	-	-	-	-/-	-/-	-/-	-/-	-/-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wuta Dombaxi	-	1	-	3	75%	1/1	-/-	-/-	-/-	-/-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	1	-	-
Total	9	11	0	15	43%	2/3	0/1	0/0	0/0	0/0	0	0	0	0	0	0	0	0	0	0	0	7	0	3	0	4	0	0"

	Shots			Goals / Shots					I. 7	T
	Saved	Suffered	% Effic	FB	7m	6m	9m	Wng		
Ivete Simão	2	20	8%	5/5	4/5	-/-	-/-	-/-	-	-
Silvia Mulabo	-	-	-	-/-	-/-	-/-	-/-	-/-	-	-
Helena Sousa	4	6	36%	2/2	0/1	-/-	-/-	-/-	-	-
Total	6	26	17%	7/7	4/6	0/0	0/0	0/0	0	0"

Figure 8 - Example of individual player detailed statistic report in the web platform grouped by match

The amount of data collected led to an increase interest of this tool, since it allowed to easily merge statistics and video analysis. The next step was to verify if it was possible to have the data in real time. So, Live Observer software application was created, which led us to case study 2.

Case Study 2: Live Observer - Portuguese Men's National 1st Division Championship and 1st leg of Sport Lisboa e Benfica

During the 2012/2013 season, the Handball Portuguese Federation in the Men's National 1st Division Championship implemented the Live Observer to make available matches reports in all of season games. The author, as performance analyst of the men first team of Sport Lisboa e Benfica, used this version with this team during the 1st leg of the national championship.

Figure 9 - Live Observer data collection panel

This version, besides having the same features that the Game Editor and the web platform provided it allowed to collect data in real-time data. This was due to an easier user interface coding system which allowed to collect at same time and in less of it data from two teams at once. Regardless the simplicity of the user interface it was possible to complement the data in the Game Editor as well to synchronize the video with the actions collected. Another main innovation to this version was the possibility to generate match and player reports to coaches at the end of the match and send them to a matchcentre.

Still, the game speed was an important issue when regarding two teams' data coding during a live match. Since touch screen technology is an emergent and affordable solution, an application was designed to improve the data collection capability. The match and player report still needed some improvement as the game is not all about cumulative statistics, but most of the time about the contextual statistics and data visualization. Hence, Smartcoach application was developed to minimize these issues.

Case Study 3: Smartcoach application – Women National Team of Angola – Four Nation Cup in Hungary

The Smartcoach application was an *app* produced to ease data coding using touch screen technology. Using tablet devices, it was possible to test a beta version of this application with the Women' National Team of Angola, during the Four Nation Cup organized by the Hungarian Handball Federation. During the tournament, data coding was more easy to use since de user interface changed in both hardware and software. The coding system has been minimized to essential standard performance indicators and organized in a colored fashionable way, thus facilitating the data collection. In this way it was possible to gather live data and present it to the coach during the match, time-out and/or half time.

Another pending subject was the data visualization on the tables or fields and that was cumulative. In that order, dynamic reports were created to both teams and players. These dynamic reports are easy to generate as to read, since they have the data already organized in a predefined model with a mix of table (numerical) and field (image) data. Beside they are easy to understand, it is possible to choose the time frame that you would like to see the statistics. For instance, in Figure 10, you can see the Romanian goalkeeper performance from the 16 to 30 minutes of the 1st half in a game against Angola National team.

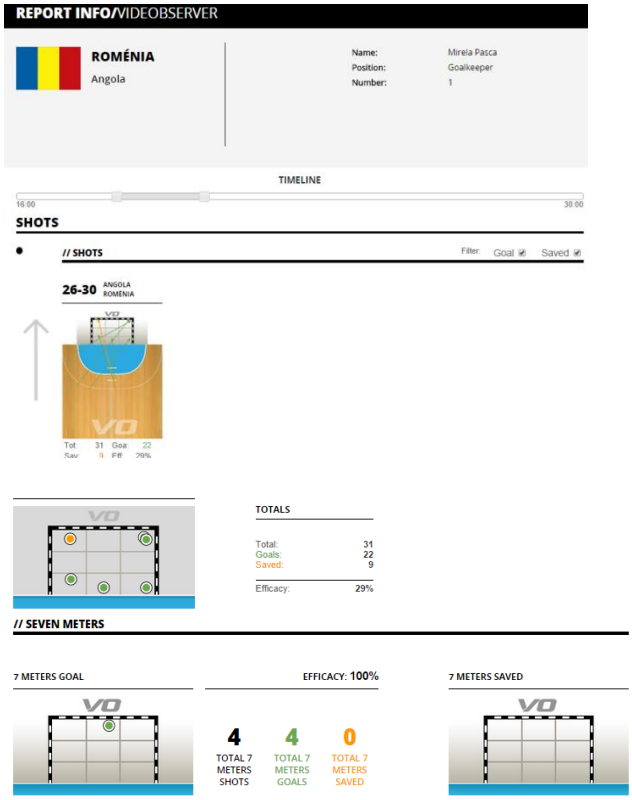


Figure 10 - Romania goalkeeper report from 16 to 30 minute of 1st half match against Angola

In Figure 11, it is possible to observe full match report of a Hungarian player, and in this particular case the action filtered are the shots (goal, missed, saved and blocked).

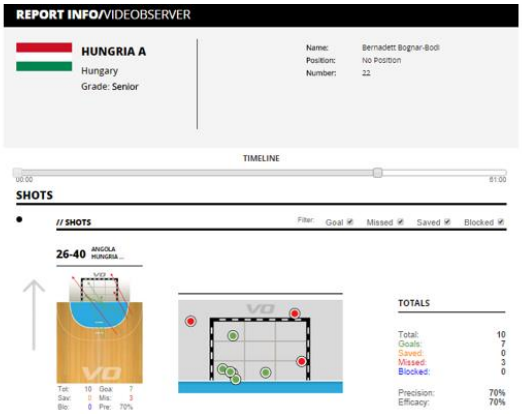


Figure 11 - Full match report of a Hungarian player

A full or half time match dynamic report is also possible to obtain (Figure 12).

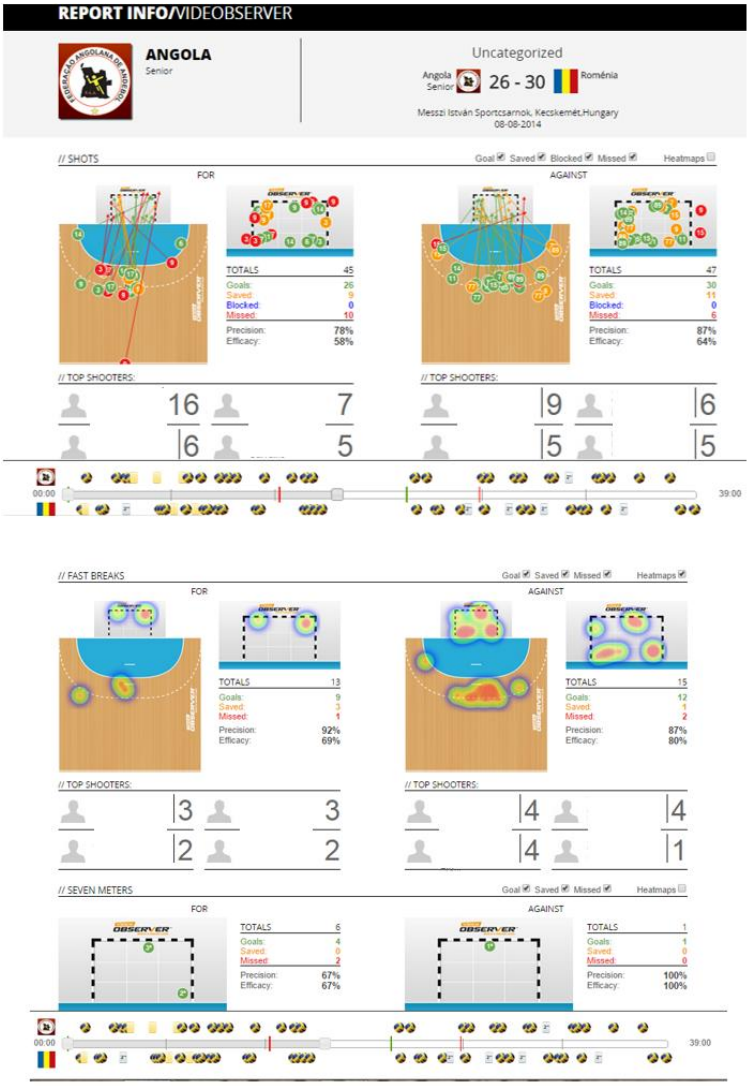


Figure 12 - Full match dynamic report visualization

Another topic in discussion is about which indicators or data should appear and when. The future of Smartcoach application is to deliver, not only the possibility the access to a dynamic report, but also to include new metrics and routines that can alert automatically the coach and/or the analyst of a specific player based on data of past performances.

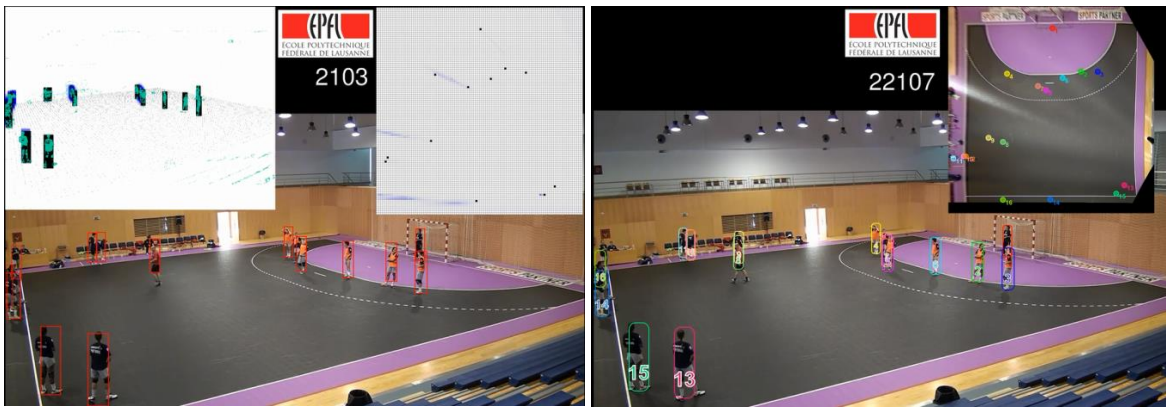
As stated previously, category systems can generate data and are still one of the main sources of information that the coaches rely on. But there is still no hard evidence on the proficiency use of this kind of information and relate it with player or team performance, since that they have some limitations. Other sources of information that may influence the course of the action are under study, in other team sports, such as the position of the teammates and opponents as well the tactical context of the play. The next case study applies to this a new type of analysis in search for objective metrics that allows to assess tactical behaviors of teams and players.

Playfulvision

Case Study 4 – Women's National Team of Portugal – Qualifying game preparation against Turkey

This case presents an approach that can help to characterize teams' and players' tactical behavior to aid Handball coaches to assess tactical procedures when using spatial measures derived from players positional data (the obtained movement trajectories can be used for understanding individuals and team plays).

During the preparation for the qualifying game against Turkey to the 2013 Women World Cup, positional data was collected by means of the PlayfulVision algorithm. This type of data collection was tested in order to provide real-time, automatic video analytics and statistics for team-sports at all levels.



During a training session of the Portuguese women's Handball national team, an exercise of attack transition was recorded. The exercise was played during 15 minutes in half court (20m×20m) in a 6×6+GK situation. At the signal of the coach, players would perform one of two types of transition: fast-break or fast throw-off. During the whole session, players' position was tracked using the registry of only one video camera. After applying the spatial metrics described above, results from this work[1] suggested that it is possible to identify tactical spatial differences between fast-attack and fast throw-off sequences even when they have some similarities (e.g.: by identifying tactical perturbations in group of players or in 1x1 situations), since the analysis matches what coaches recognize as relevant to describe and identify tactical concepts in Handball.

This approach may be useful to reduce the time spent in game analysis and to improve coaches' assessment of tactical performance during the training sessions. And with this type of data analytics it is possible to complement the categorical data by reveling meaningful statistics, when combining 3D player position, speed, fitness and skills with and the team tactics, which has been impossible to obtain so far.

[1] For more detailed information please consult the article: Tracking multiple handball players using multi-commodity network flow for assessing tactical behavior (Lopes, Florêncio, Shitrit, Fua & Fonseca, 2013), published in the 2nd EHF Scientific Conference proceedings.

Discussion and final considerations

The game, according to Garganta (1997), develops an interactive process (given the relationship between the players), from the value of teams (it can be larger or smaller than the sums of individual parts), to its complexity (due to the unpredictable relationship possibilities between players) and to its organization (because its structure and functionality are represented from the cooperative and opposite relations in order to game's goals, principles and rules). Handball is a team sports characterized by a fast intertwined and dynamic interactions between players. The interaction between Handball attack and defense, in a macroscopic perspective, may be viewed as a self-organized phenomenon on constraints, in particular conditions, emerging from the interaction rules (tactical, strategic, and rule constraints) of the members of both teams (Glazier, Davids, & Bartlett, 2003). The existence of game analysis studies features some gap between theory and its application in the field, whether in training, competition or coaching. Sometimes the information is dispersed and/or inaccessible, or does not present a visible or understandable content, being too complex or too abstract for the coaches.

This work described the evolution of Handball software tools for game analysis from the traditional post-match video editor to the real-time feedback game information to support the coaches' decision making process, during match or a training session. The main findings showed that it was possible to obtain and share meaningful real-time game data and information to coaches during the match, half-time and full-time, in a match report fashion, complemented with a post-sync video analysis to boost the live data coded. The analysis of positional data has been recognized as a promising way to study in depth performance in team sports (Reed, & Hughes, 2006). Although this represents a major breakthrough on Handball game analysis, some adjustments need to be made and cautious considerations need to be addressed when analyzing the data gathered, particularly regarding advanced statistical procedures evolving: live match goal score differences, game time and technical errors, inter and intra players positive and negative interaction, defensive system efficiency. All of these care for human detail and experience attention regarding to contextual information that still is not able to be collected otherwise by the good sense and judgment of coach.

In the future it is expected to integrate positional data for a deeper understanding of the complex dynamic spatial interaction in order to give a quick tactical data visualization to what coaches recognize as relevant to describe and identify tactical concepts in Handball. Moreover, as technology develops the use of new gadgets, such as smart glasses and augmented reality, it could improve the data collection, analysis and feedback information to teams, players, sports agents and fans. The use of simulators with artificial intelligence, in an adaptive and complex nature system, may be the way to improve training and coaching efficiency, to understand youth sports learning, by creating dynamic situations appropriate both to players and coaches. It could be a good way to understand the key play concepts and help the teams and players in a strategic and tactical preparation.

One may argue that, given the stated above, coaches and players have the possibility to acquire and use ground-breaking analytical data, and having their fans to see the game like they have never seen it before.

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DECISION-MAKING - WHAT TOOLS CAN WE USE TO SUPPORT THE DEVELOPMENT

MARIA EUGÉNIA DA COSTA SEMEDO

FEDERAÇÃO DE ANDEBOL DE PORTUGAL

Summary

This work had as objective to realize how players react to the game situations. Under what conditions can make decisions and how we can help develop decision-making skills during the game.

Decision-making is enhanced in the game, soon to be crafted in the vicinity of situations encountered by players in the competition, being that players decide depending on the information you receive from the environment. I leaned on the players of the team social solidarity Association senior female and Assomada, Team Sports and recreation group of Quinta da Princess minis with which they work. Giving them an exercise to each group and analyzing your behavior vis-à-vis the difficulties encountered and their decision-making in offspring of his knowledge.

The analysis concluded that children as well as adults should try various situations until they reach the level of perfection, and take the right decisions at the right time.

It is extremely important to the player know at every moment what gesture should apply depending on the state you live.

Each player is an individual we must take into account the individual needs of each, causing realize all processes of training and equipping it with gambling habits that allow it to evolve.

Keywords: Handball, Decision making, movement, individual technique.

Indice

Introduction

Decision making is present in our day-to-day, is part of our routine to decide what is best for us or not. We constantly choose what is right for us or not, and in the handball is no exception, we are systematically deciding.

The trend of the game is to be ever more offensive, more tactical individual capacity, requests that the player is always to make decisions in a short time and with maximum efficiency.

The game is getting faster, offensive and defensive actions mean that players are constantly experiencing unpredictable situations where they have to choose before various situations presented to them, with an immediate and qualitative response. These decisions are dependent on the individual technical and tactical skills of the player, and the speed at which the game is played.

Normally, we coaches, plan, sketched and visualize systems (actions) in order to gain advantage over the opponent. But using the new technologies, the opponents manage to anticipate our actions, this making our game predictable and therefore an even greater challenge. Consequently, I believe that the individual capacities of the players should always be encouraged both the tactical level and a technical level.

Manolo Laguna believes that "(...) there is a preoccupation with everything that is related to gaming systems and, consequently, a certain oblivion, with respect to the systematic improvement of individual technical and tactical players." Improving decision making is directly related to the athlete's progress and results of its deficit and the potential loss of quality by the player as well as the development of the game. "(...) in reality, not only is the difference in the chosen system, but also as the develop mode, and it depends on the individual skills of the players." (M.Laguna, 2001).

The individual technical and tactical improvement leads to a systematic work and keep essential even for the teams formed by great stars of our sport.

❖ Methods

To support the thesis about decision-making in game we had in mind the work of two teams (Association of Social solidarity Assomada female Senior, Group Culture and Recreation Sports at Quinta da Princesa-Minis). In the first Senior Group, was offered a 3x2 exercise in which the defense was outnumbered (in game confined space), in which the defense would be advanced to nine meters. Given that one of the attackers go into a pivot taking advantage of the game with the same. The defense wasn't with the pivot would make immediate pressure on the player with the ball. From this situation they have to make goal.

The second group were proposed minis 2x1, in all the field of minis. The attackers were asked to obtain goal, but could not use the dribble. The defense only can defend the attacker who hadn’t possession of the ball. And from these exercises, we explore decision-making by the players.

We filmed the performance of Seniors for further analysis and the minis just observe your performance during the exercise.

❖ Development

➢ Decision making

The Decision making is choosing among alternatives with the aim of overcoming obstacles and / or confronting and resolving situations. Think of a short time, alternatives and choose the one which has a higher successful.

The handball as dynamic game provides to players several decisions while running the game.

The game is constantly changing, players are faced constantly with premeditated but also unpredictable which must respond quickly and successfully situations.

In a split second the player has to decide and the quality of response depends on the speed at which executes its actions and knowledge that holds of the game. As the years pass, the player acquires knowledge and this will help in your decision shape.

In the game of Handball at the same time a team tries to create situations to score, the other tries to destabilize the opposing team, either by team action or by individual actions, in order to win the game.

Therefore, the ability to enhance "thinking" players, full of creativity will always be targets of the training process.

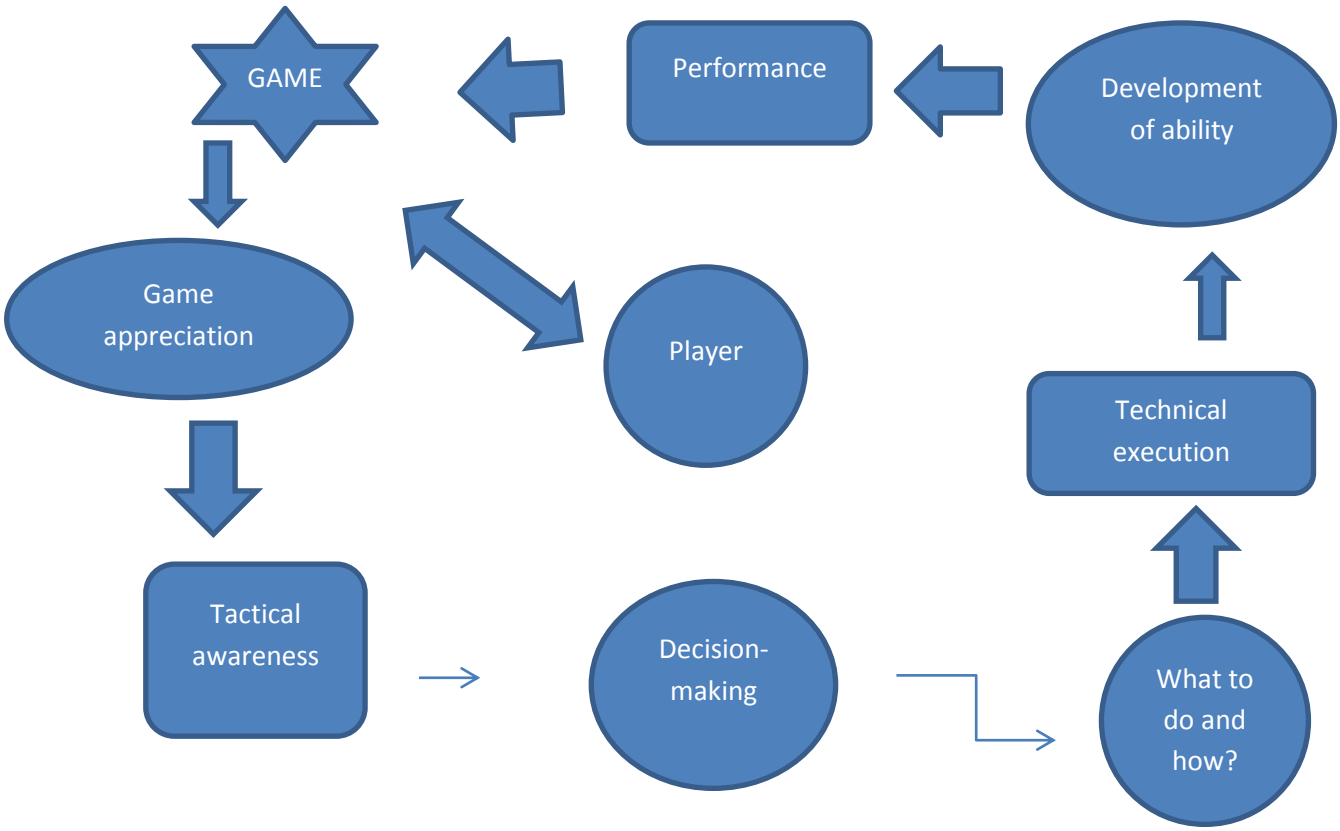
➢ Movement

The motion is present in every sport. When an individual moves, interrelates with the surroundings. All significant stimuli for their movement are picked up by the Sensory system (part of the nervous system responsible for processing sensory information), transforming the external stimuli into nerve impulses. That is, it is through them that the senses are the translations of the physical world for the mind.

Through the sensory system the individual captures what the surrounds (Perception) and has the ability to know where every part of your own body in space, he captures its own position (Proprioception).

All information captured is analyzed by the brain, which makes the decision of how the individual will act. The decision is transmitted to the locomotors system, and it performs the movement.

The process of realization of the movement Figure 1 (Adaptation of bunker e Thorpe (1982))



The process of executing a movement requires the action of three mechanisms:

• The mechanism of perception (sensory);

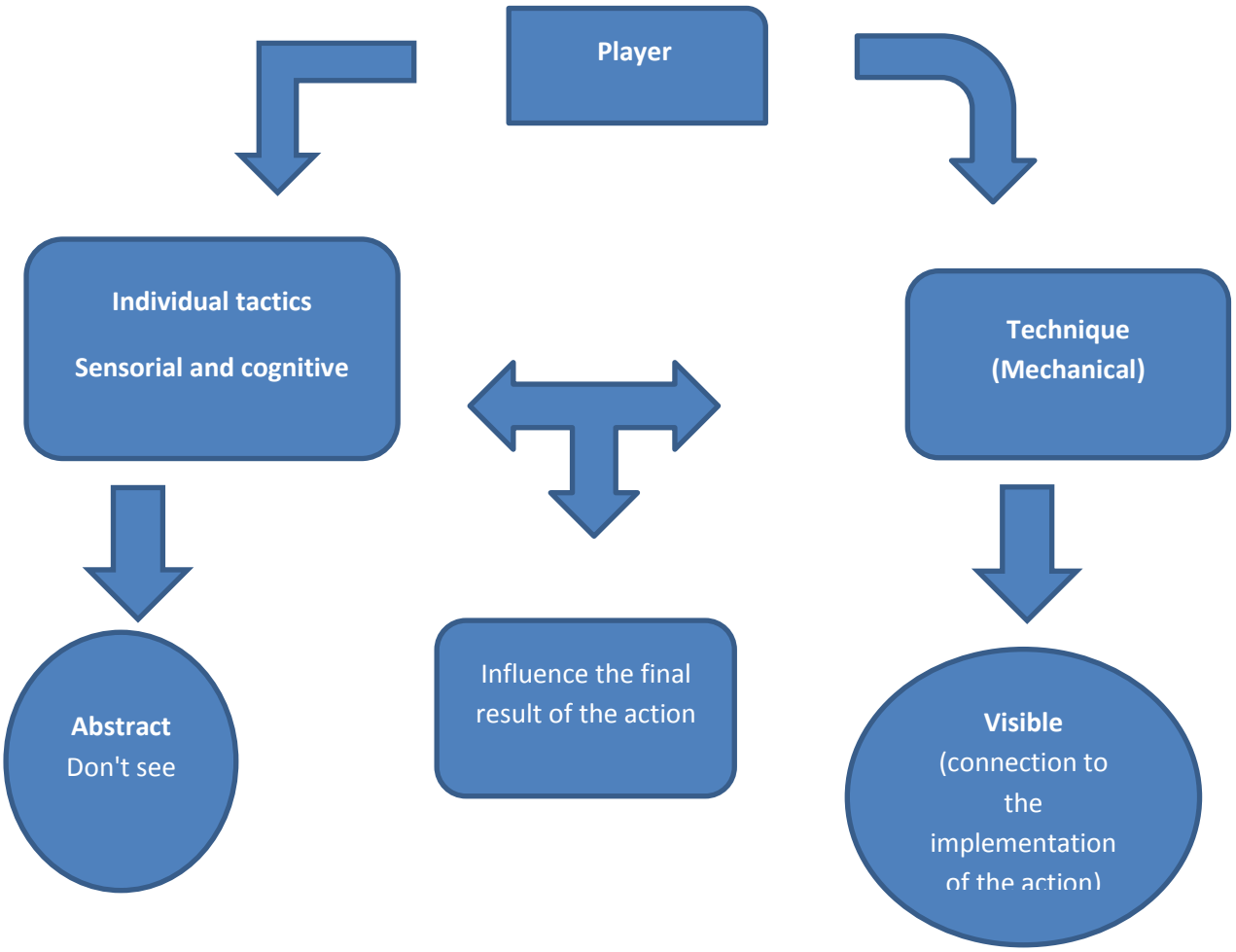
• The mechanism of decision (cognitive);

• The mechanism of implementation (locomotor).

Thus we can complete the process of contraction of the muscles or other biomechanical evaluation.

Within the sport, we can say that the movement has a sensory-cognitive abstract- and other visible part - the mechanics.

We can then draw a conclusion by viewing Figure 2:



The player will have a good individual technique, if its actions during the game are success. The greater their perceptive capabilities the better the decisions are.

When the player is efficient in its mechanical action, managing to have control over their actions, we can say that the player is technically good. Sometimes it is hard to find player with both skills (technical and tactical individual). Witnessed many times the players do not attack and just defend or players who only attack and not defend, or even players who have excellent reading of the game but technically are slow, or vice versa.

For all this, we must adapt the workout, keeping in mind the training of young players as well as the training of adults considering players improve their individual technical skills and tactics.

The technique focuses on the implementation mechanism, the movements performed are not predictable, so you should seek a great movement that inspires confidence to maximize your player and mechanical efficiency in the field.

However, only adopting a technique is not sufficient. To achieve success, there must be "a sound basis of physical and motivational preparedness" (Manolo Laguna, 2001) to be able to improve the individual skills of the player.

- **The tactical-individual training**

"... The player is good tactically when their decisions in the game are usually appropriate to the circumstances and the purpose of it." (Manolo Laguna, 2001)

It is wrong to think that the decision making is not exercisable, so all players should enhance the improvement of their individual tactics.

Of course, there are players that internalize more easily, this type of work than others, but this is usually the case in all areas of physical activity (strength, endurance, speed, coordination, etc.). In general, teach them to systematically analyze situations and make logical decisions.

The individual tactical training must be present, such aspects as:

• Increased capacity Perceptual

• Improving the information captured

Play is essentially learning to capture and process information concerning the game.

- **The increase of perceptive ability**

We speak of perception in a way which, being the ability of the player to capture the information. But the individual captures information from everything that surrounds it (perception) as capture information about himself (proprioception).

However, all this information is rendered at the same time, so we have noted that the individual must work their capacities (proprioception perception) at practice specifying an improvement in other areas.

The peripheral senses are essential to understand what surrounds us, because according to Manolo Laguna (2001) vision is the peripheral sense "Star" more used, increasing the need to work the visual field both in breadth as on depth. Not putting aside the other senses such as hearing and peripheral touch, enhance its usefulness to the extent that supplement the information received, guiding the training accordingly.

On the other hand, the synesthetic sense is the perception that we have of ourselves, providing players with excellent tactical progress, when well developed.

- **Development of selective attention**

Manolo (2001) argues that thinking that the purpose of the perceptive work is able to control everything that happens in the game is a mistake, because there are situations in which having complete control of things is not beneficial, since most of them are not of great importance.

Focus on development of **selective attention**, otherwise, develop the ability of the player to read the game, whose objective will be to pay special attention to facts determinants of game situation, forcing the player to be permanently attentive to new

situations, which will cause you to know when to extend or not extend your perceptive field.

- **Development of anticipation, perceptual**

Being handball a dynamic game, the player awakens various stimuli sometimes difficult to interpret, leaving the unsecured athlete with all available information. There is a need to develop interpretive ability, because these stimuli have two functions: one to confuse / mislead opponents and the other helping teammates.

Handball is an interactive sport that allows players to send opponents misleading and confusing signals and their colleagues signs of mutual aid, making the player will be constantly looking for the correct interpretation in relation to incoming messages. Capturing and interpreting the stimuli in the correct way the player will be able to predict accurately what will happen and due to this capture anticipate the answer.

Of course the player cannot always anticipate their actions, but to develop the ability of perceptual anticipation is a crucial advantage in the evolution of the player.

- **Improvement of information captured**

Will be of the utmost importance to select and apply the best information to transmit to the players so that they can acquire knowledge, which then can use it in game situations. So try to fit in training information that players can grasp, understand and interpret properly.

- **Technical training**

In handball, the technique must be adaptive. And the adaptation requires a capacity for improvisation, giving the player the opportunity to, at the exact moment, choose the best alternative and execute it flawlessly. As we discussed above, any information collected is analyzed by brain (tactics) that makes the decision on how the individual will act. The decision is transmitted to the locomotors system, and this runs the movement (technical). Well, I believe that an action leads to another and vice versa. Focusing on the execution engine, the movements executed are not predictable, therefore, must seek a great movement, that inspires confidence in the player and

maximize your income in the mechanical field. Having said that, what we can teach and insist on our workout plan, to develop the decision-making capacity of the player?

We can divide the offensive actions of the player in 2 parts boosting them in the workout:

- **The attacker without a ball**

  - **Clearing** - is fundamental in the attack on the zonal defense, looking for more offensive areas, taking advantage of the imbalance of the defenses, creating a pass line or so, deceiving our Defender with a feint of change of direction.

  - **Help** – even without the ball player is important because it can create spaces through a screen or so block making passage of his colleague with ball.

- **The attacker with ball**

- **Pass** – it is extremely important to the player to master the pass, it is the essence of the entire gaming system. A long or short pass makes a big mess. On a team that strikes back or even if you are on offense. Depending on the player's ability to conceal, deceive or even improvise. The pass can be magical. (Ex. Pass without looking, pass in the back, pass in thread, etc.)

- **Feint** -is the Act of "deceiving the opponent" in all its essence. The player who dominates the feints got halfway to the evolution, as long as they don't abuse, making excessive use of them. Face the anticipation of Defense, if the player feel comfortable with them, is a good way to dispose of the defense. The player can obtain a variety of feints, with deceptive and trajectories simulations feature of pass or trim, matching feints, etc.

- **Shot-** In all positions, mastering this technique is essential, this is the only way to achieve the goal. And often, we caught goalkeeper ahead of that obliges us to pull our best form and commitment. Here the force is important but, there are times that with strength aren’t enough, forcing us to make decisions, to retreat and reflect about our technique and often lead the player to pull for their ability to creativity.

Giving the same attention to defensive actions must maximize the player:

- **A forward-looking capacity**
    - Control of the actions of the opponent's
    - deterrence attackers
    - intercept
- **the fighting capacity 1 x 1 –** do not allow the attacker to make goal
- **Recovery the ball -basic principle of Defense**
- **Knowledge about defense** - knows your role in the defensive system, cooperate with their colleagues, knowing the rules of game and know your opponent.

All players must be in a position to defensive technique (landslides, blocks, footwork, etc.), having the physical and coordinative condition necessary and also being strong psychologically.

Creating exercises identical to that, players are in games we can say that we expand your understanding of game, if the exercise is repeatedly executed, what will help them familiarize themselves and to be more effective. The player must maintain the effectiveness and develop the ability to adapt.

❖ Results and Discussion

During the exercises that we witnessed in the first group, the more experienced players, in particular the most hardworking, presented the best decision-making.

The faster physically produced fewer errors and resorted to use of feints and dribble to reach the goal, playing more individually.

It was noted in most attackers, the awkward situation of "pressing" the defenses, resulting in successive errors in attack.

The first to defend, they've had no success being a bit slow and not accompanying the attackers in the fight 1 x 1.

The fastest anticipated to have provoked a series of bad passes among the attackers, benefiting from bad decisions attackers. Namely, the ablest defenders had the forward-looking capacity by inducing the attackers in error.

As for the second group (Minis), it was difficult for them to do without dribbling and without explanation the exercise taking steps and losing the ball constantly. But after a short speech, reminding them about the principles of clearing and space occupation. Few were those who didn't reach goal during exercise, some less fast and others with some lack of physical coordination, had more difficulties in obtaining a goal, once the defense, in some situations might anticipate and be faster. Clearing was the most widely used tactic, accompanied by changes of direction and speed of the players. Most assimilated the alternatives quickly and managed to adapt quickly and succeed, what has been proposed. In minis, it would be easier, provide them access to the dribble but in a situation of 2 x 1 tried the job was as a team. Looking for clearing, the "give and go" the occupation of spaces in order to achieve the goal.

❖ Conclusion

To conclude, we made the analysis of decision making in groups, different ages, and work varied stimuli and situations that can live in a game.

And we can say that, on the prospect of the players, they all have a different way of playing the game, different abilities and therefore must be adaptive technique not finding similarity in way of "thinking" of any player.

During the exercises, successful in most of the situations the speed of the attackers was greater than the speed of the defenders.

There was a set of bad decisions of both the attack and the defense, but we did see a great read, and offset pivot game.

Arguing that should enhance decision making scales of both the younger and adults, always trying to improve their interpretive reading and playing skills.

We must adapt the training, bearing in mind the formation of young players as well as the training of adult players considering improving their individual skills tactics and techniques. It is important to the player have knowledge with some logic and sense, and he himself will take them in their own way, noting the need to experience the game.

Knowing interpret the actions of opponents, the player will anticipate, but it can happen the other way around as well.

So, the player must have resources to disguise what you're doing and when you're going to do it, for they can deceive the opponents avoiding anticipate their movements.

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Appendix

Figure 3- Equipa Associação de Solidariedade Social Assomada.

THE IMPORTANCE OF THE INDIVIDUAL TRAINING FOR 9M PLAYERS

EMIL VLAD CABA - Romanian handball federation

1. SUMMARY

This thesis intends to prove the importance of the individual practice for the backcourt players and to show how to use it in order to give more clarity and efficiency to the attack play by respecting the fundamental principles of the attack play.

The teams of today are made by players from different country, with different culture, different handball formation. We can remind here the French school, the Danish school, the Spanish school, Yugoslavian or others. It's on us, like coaches, to reunite the qualities of these players in order to find a common field for everybody and to lead the team to the success. The individual practice is a very good method, to improve the quality of personal performances and also to establish good playing relation between different players. But of course, each player has different needs (different age, different formation, different experience). I will try to demonstrate that the individual practice can offer solutions to improve the performances in three directions:

- Individual technique
- Individual efficiency
- Relation between backcourt players (9m players)

2. KEY WORDS: handball, back player, individual practice, improving, fundamental principles in positional attack

3. METHODS – observation, analysis, video analysis, planning, practical application

4. DEVELOPMENT

The importance and the actuality of the subject:

''Formalized in the late 1950's by Matveiev's model of periodization of training was quickly circulated around the sports world. Kenyan runner or Scandinavian, Brazilian or German dribbler, Chinese or American gymnast, expert or beginner, impossible to escape the impression of the model. It was so successful that today all sports technicians are influenced by the fathers of periodization. Yet the model of periodization is a myth; high building on knowledge profoundly changed in half a century. Knowledge is now mature enough to provide a more integrated regulatory approach more and more individualized to the organization of the training load. The time has come to move from planning to development strategy performance qualities.'' (Michel Dufour – Football. L'enigme athletique 2013).

Statistics observations regarding the backcourt player's contribution of the team efficiency

By using the EHF statistics made on the Men's Euro 2010 in Austria, we observe important things concerning the importance and contributions of the back players in the game.

9th MEN'S EUROPEAN HANDBALL CHAMPIONSHIP

EURO 2010

Individual Statistics

As of 31 JAN 2010

GOALSCORERS BY AVERAGE (top 40)

Rank	No	Name	Team	Goals	Shots	Avg	MP
1	18	ONUFRIYENKO Sergiy	UKR	27	56	9.0	3
2	9	JICHA Filip	CZE	53	88	8.8	6
3	15	BURKA Sergii	UKR	21	39	7.0	3
4	20	ZVIZEJ Luka	SLO	41	64	6.8	6
5	10	TVEDTEN Håvard	NOR	39	58	6.5	6
6	35	IGROPULO Konstantin	RUS	35	60	5.8	6
7	14	SZILAGYI Viktor	AUT	34	60	5.7	6
8	10	FILIP Jan	CZE	33	46	5.5	6
8	7	KAVTICNIK Vid	SLO	33	49	5.5	6
10	13	ILIC Momir	SRB	15	30	5.0	3
10	13	KARABATIC Nikola	FRA	40	73	5.0	8
10	15	KJELLING Kristian	NOR	30	71	5.0	6
10	5	SESUM Zarko	SRB	15	26	5.0	3
14	7	ATLASON Arnór	ISL	39	66	4.9	8
14	24	HANSEN Mikkel	DEN	34	65	4.9	7
14	18	ROMERO Iker	ESP	34	63	4.9	7
14	9	SIGURDSSON Gudjón Valur	ISL	39	62	4.9	8
18	21	KAUFMANN Lars	GER	29	66	4.8	6
19	10	EKBERG Niclas	SWE	14	22	4.7	3
19	13	KRIVOKAPIC Milorad	HUN	14	26	4.7	3
19	21	SCHLINGER Roland	AUT	28	45	4.7	6
19	23	VUCKOVIC Nenad	SRB	14	19	4.7	3
19	7	WEBER Robert	AUT	28	51	4.7	6
24	2	ENTRERRIOS Alberto	ESP	32	61	4.6	7
25	27	CUPIC Ivan	CRO	36	53	4.5	8
25	10	GUDJONSSON Snorri Steinn	ISL	36	56	4.5	8
25	15	JANSEN Torsten	GER	27	38	4.5	6
28	20	CHIPURIN Mikhail	RUS	26	32	4.3	6
28	18	GUNNARSSON Róbert	ISL	34	44	4.3	8
28	8	TOMAS Victor	ESP	30	44	4.3	7
28	17	WILCZYNSKI Konrad	AUT	26	41	4.3	6
32	15	RASTVORTSEV Alexey	RUS	25	53	4.2	6
32	19	ZVIZEJ Miha	SLO	25	38	4.2	6
34	11	EGGERT JENSEN Anders	DEN	29	40	4.1	7
35	13	AGUINAGALDE Julen	ESP	28	38	4.0	7
35	5	ANDERSSON Kim	SWE	12	21	4.0	3
35	9	GANCHEV Oleksii	UKR	12	18	4.0	3
35	11	GLANDORF Holger	GER	20	45	4.0	5
35	19	MALMAGRO Cristian	ESP	28	56	4.0	7
40	11	STEFANSSON Olafur	ISL	31	71	3.9	8

- From first 40 ranked top scorers, 21 of them are backcourt players
- From 40 top scorers by average, 23 are backcourt players
- Top 3 – all three are are backcourt players:

1. Onufriyenko Sergii (UKR) = 27 goals / 56 shots / average 9.0 %
2. Jicha Filip (CZE) = 53 goals / 88 shots / 8.8 %
3. Burka Sergii (UKR) = 21 goals / 39 shots / 7.0%

Final Standings EURO 2010 – Austria:

1 FRA – France
2 CRO – Croatia
3 ISL – Iceland
4 POL – Poland
5 DEN – Denmark
6 ESP – Spain
7 NOR – Norway
8 CZE – Czech Republic
9 AUT – Austria
10 GER – Germany
11 SLO – Slovenia
12 RUS – Russia
13 SRB – Serbia
14 HUN – Hungary
15 SWE – Sweden
16 UKR – Ukraine

- Goals and assist (40 players) = 27 are backcourt players
- Top scorers (40 ranked) = 22 of them are backcourt players
- Total goals (40 players) = 1040
- Backcourt players scored = 623 (more then 50%)
- 1141 shots in 8 matches
- In top 10, there are 7 backcourt players
- In top 20 = 13 back players
- Goals scorer by average (40 players) = 27 are backcourt players
- Assists (40 players) = 35 backcourt players
- Goal and assist (40 players) = 31 backcourt players
- Overall team statistic (14 teams) – 9m shots = 1916 / 849 goals

Using video analysis and statistics from Euro 2010, we can make some remarks:

- the back players are the "key" players in the team
- The 9m line players are involved in almost all tactical movements of the team
- We observe that more than 50% of the goals are scored by the backcourt players and they make the most of assists (35 of 40 players)
- Generally, but not as a rule, the team efficiency depends of the backcourt players efficiency. There are some interesting aspects regarding the connection between individual efficiency and team final results :
  - Ukraine – despite the fact that they have 2 backcourt player, placed on top 3 – Onyfrenko and Burka – the team reach only the 16-th place, the last one in the final standing
  - The 2nd ranked top scorer – Filip Jicha – reach with his team, CZE the 8-th place in the final standing
  - Regarding the teams final standing, we observe that the first 2 nations – France and Croatia – have each only 1 player in top 40 – France with Nicola Karabatic, ranked nr.10 and Croatia with Ivan Cupic as wing player, ranked nr.27
  - Poland – 4th ranked on final standing, did not have any player, in the top 40
- If we take in consideration the number of the backcourt players that reach top 40 on the top scorers ranking – 21 backcourt players – it´s not surprising that we have to pay a special attention to the backcourt players. I think that making better backcourt players, mean to spend more time with them, to focus more on individual aspects, on the individual needs!
- This work must be very accurate, explained very clean to the players and even though it takes a lot of time to develop and to improve all the important aspects. These are the reasons why I use this method of individual training.

Individual training: definition, objectives, organization, planning, practical work

Definition:

This form of training has more definitions so I chose one of the most simple that could bring clarity on the subject:

Individual training can be define like being part of the general formation of the athletes – beginner or experimented – with the particular characteristic of exclusive orientation on the player's personal needs.

The main objectives of the individual training:

1. To improve the individual technique
2. To improve the efficiency
3. To improve the playing relations between the 3 backcourt players
4. To improve the tactical vision of the 9 m line
5. To optimize and increase the physically condition

Organization:

- Individual training can be made in several forms:
  - With 1, 2, 3, 4 players (the objective of the training is to put the accent on the individual technique)
  - Groups or small groups (objectives of the training is orientated on tactical aspects: the relations between players, tactical vision)
  - Individual tasks, during the collective training (1 or 2 players have individual tasks, while the team is making his own program; we use this form of training for the players that came back in the team after injuries but they are not "ready" to join the collective work)

Planning:

- When using the individual training?

This depend of:

- The team's level
- The championship schedule
- The age of the team's players

For the high level teams, the individual training made in groups or small groups of players is more use, because of the tactical aspect of this kind of collective and global work situations.

For the junior teams or teams having a lot of young players, the individual training, in all forms of work, must be a constant during the season. It's really difficult to say exactly when it must be done. Like mentioned, that's depends of the championship schedule, of the time you have for working with the team etc. In this thesis, I took the example of a seniors professional men's team, who can plan freely the trainings schedule of the week, month etc. During the season, I use individual training at least 2 times in a week.

Very often the first training in the week is reserved for the 2, 3, 4 players that didn't play very much or not at all, on the official match. I use also the individual training with a group of 6, 7 players (9m players or 6 m players, or other couples) in the morning sessions, 1 time in the week, depending if the schedule allow to do this. In other periods of the season, when the championship it's stopped (W.CH, Euro, Qualif. etc) I take profit of this time by letting the collective work on a secondary plan and I make 3 or 4 times individual and group trainings in a week.

For the physical training, especially for the power/strength training, made in a fitness studio or even in the sport hall, I use the groups training with 6, 7 players; the groups are made by the results of the physical evaluation tests, that give us the possibility to calculate the charges of the trainings. It's much more simple and efficient to work in the same group with "big guys" or the "light weight guys".

Example of a week planning (micro-cycle)

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
10.00-11.30	10.00-11.30	10.00-11.00	10.00-11.30			
Individual training with 9 m players (6 players +1 golkeeper)	Power training the players work on groups of 2, 3 or 4 players according to the physical tests	Individual training for "young players" (1 pivot, 1 golakeeper, 1 backplayer, 1 wing)	Specific force /explosive power combined with specific mouvements and positional shoots 2 groups training : group 1=9m players; groups 2=6m players	____	____	____
18.00-20.00	18.00-20.00	18.00-20.00	18.00-19.30	18.00-19.30	18.00	
Collective training (all team)	Collective training	Combined training physical work + handball 1st part – intermittent run, made by groups of 4, 5 players according to the specific tests (30"/15" intermittent fitness test – Martin Buchheit) 2nd part - handball, tehnik and tactical aspects, with all team	Collective training	Collective training	Match	____

From this example of micro-cycle, in this week I use several forms of individual training:

1. Monday morning - individual training for group tactic – relations between 9m players (90 minutes)
2. Tuesday morning – power training – small groups (90 minutes)
3. Wednesday morning – individual training only for 3 young players – improving individual technique (60 minutes).
   In the evening I have split the team for the first part of the training in several groups (3 or 4) for making conditional training – intermittent running (20 minutes)
4. Thursday morning – specific power combined with shoots – I have split the team in 2 groups: 9 m players and 6 m players where every group has specific task regarding the lifting exercises, jumping and shooting (90 minutes)

Practical work – Hypothesis – using the individual training for developing the individual technique and increase the efficiency

Lexicon: GK = goalkeeper, LW= left wing, RW= right wing, PV = pivot, LB = left back, RB= right back, CB = central back

In my opinion the backcourt player must develop his play under 3 aspects:

A) Be dangerous
B) Be quick
C) Be various

A) "Being dangerous"

- Mean that every time when the backcourt player has the ball, in front of a defender, he must represent a "potential danger!"

In "being dangerous" for a backcourt player, there are some "must":

- He must be able to shot as quick (and efficient) as possible, without showing totally his intention of doing that.
- "For a backcourt player running – attacking – jumping for shooting is fundamental and in the mean time he must be able to decide in the last moment if he will shoot or make pass without modifying his body balance. Running – attacking – shooting or running – attacking – passing must be done permanently by being dangerous. The backcourt player must give to his direct opponent (the defender) the sensation of uncertainty" (Daniel Costantini – Handball)
- ''He must be always orientated to the goal by taking information about the defender's and the goalkeeper's position. He must be able to win the "double battle" against the defender and than the goalkeeper'' (FFHB – "Le jeux de la base arriere"). We see very often players that are only passing very automatic, without showing this potential danger, playing too far from the defender or not looking to the goal, etc.

Example 1:

From the moment that 1 back player has received the ball, he must search a good position to take a shoot; he must be dangerous

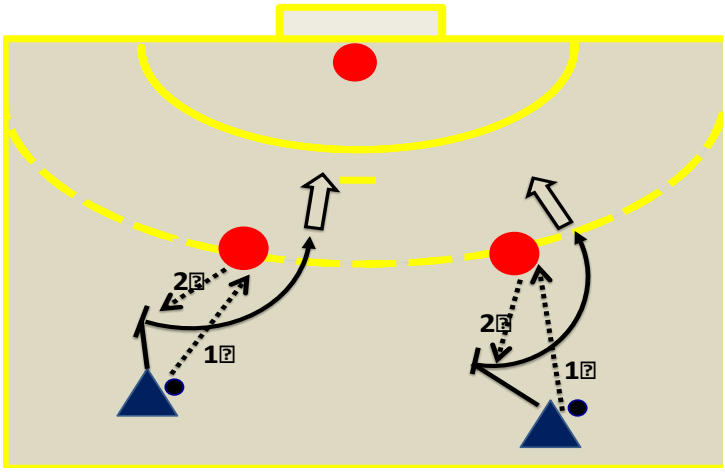

Figure 1

Observation:

- receiving the ball in movement
- attacking the goal

Example 2

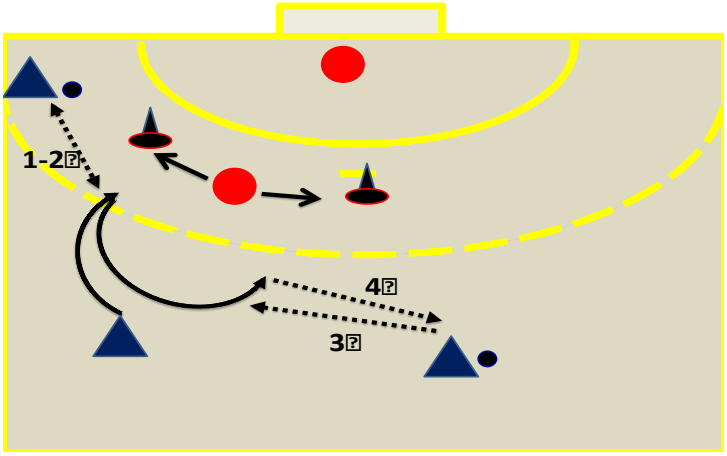

Figure 2

Observation:

- Fixing the defender
- Take information about the goalkeeper
- Be able to shoot if the defender offers him a free space
- Look to the goal (head up)! Have a good body balance! Don't slow down when receive the ball

Example 3:

The backcourt players must have a good body balance in order to take a shoot as quick as possible, in any moment

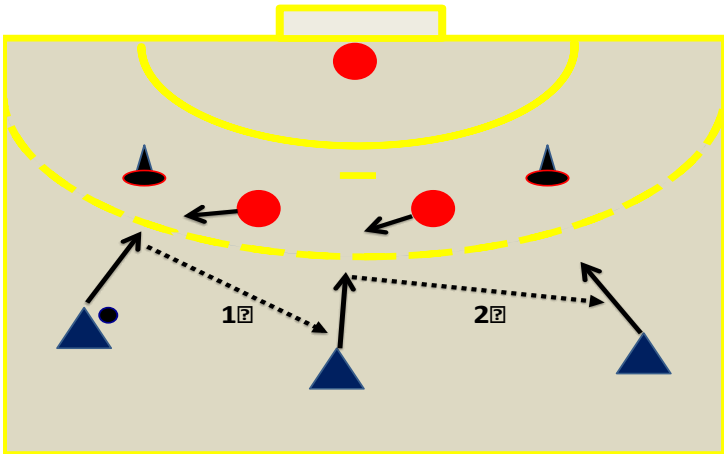

Figure3

Observation:

- Place you arm up so you can shoot from that position
- The feet must be orientated to the goal
- Don't lose time with body preparation for shooting!
- Speed is important but don't lose your body balance! Always take information about the defender and goalkeeper position.

B) Be quick

- Means that the player must be quicker then the defender in moving with and without the ball! Being fast with the ball is very clear but playing quick without the ball, means that he has to take good a position, in front of a free interval, before receiving the ball and repositioning himself in opposite direction after passing the ball. '' RE from repositioning does not mean to turn back in the exactly same position but to occupied the best position in order to be capable to continue the action''. (Pierre Alba – Former l'élite de demain - 2002)

Example 1:

LB attacking inside make pass to the CB and take external position immediately after passing the ball to CB. Be quick in your replacement.

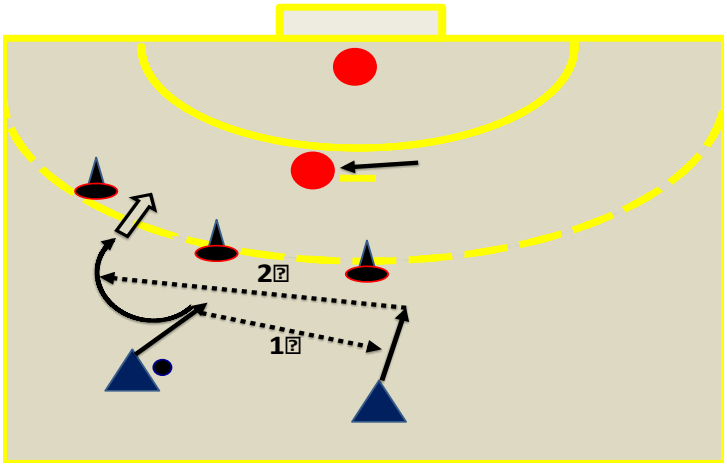

Figure 4

Variations: take internal position after passing to the wing (put 1 wing player in the corner)

Example 2:

Use 1 LB, 1 W, 1 PV and 1 CB and 3 balls. The LB make double pass and take back his position "in the deep" after passing the ball to the LW, to the PV and to the CB.

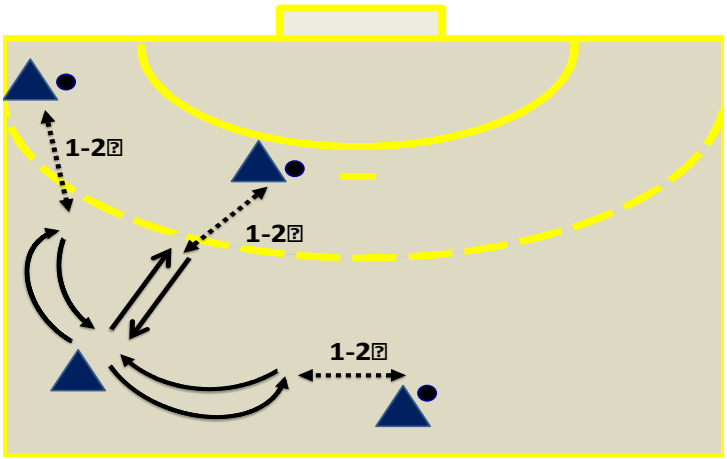

Figure 5

Observations for LB:

- Move quickly your legs.
- Stay orientated to the goal.
- Don't lose the visual contact with the goal.

C**)``Be various``**

- In his actions (shooting, passing and 1x1 actions) – the backcourt players can not "be dangerous and quick" without "being various"! We cannot imagine a good and efficient 9m player who shoots every time in the same corner, who makes the same 1x1 actions without adapting his actions according to the situation. The backcourt player must avoid to be predictable in his actions, must not repeat too often the same moves and shoots because it will be easy for the defenders to learn his play! The backcourt player must be various and unpredictable in order to surprise the defenders and the goalkeeper!

Example 1: (figure 6)

The LB is making pass to LW, and make a shoot after receiving the ball back from LW; he receives the ball in movement and takes a shot by using various forms of shoot:

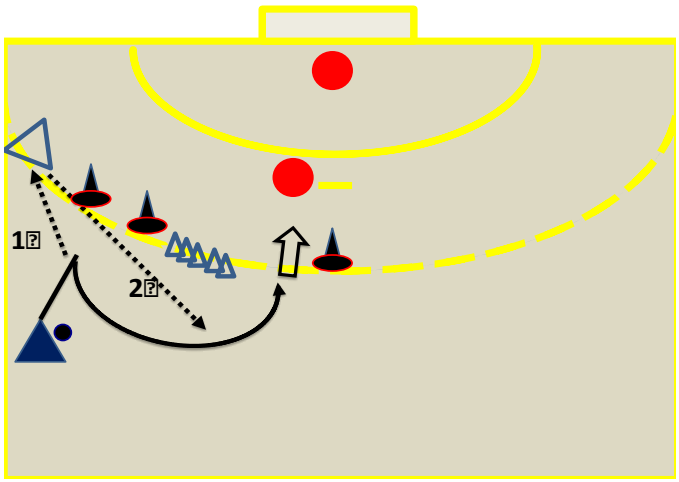

Figure 6

- jumping shoots
- quick shoot (long corner)
- late shoot (short corner)
- shoot from running
- stand shoot (first foot, second foot…)

The player must concentrate himself in order to win the two battles: against the defender and against the goalkeeper!

Practical work – Hypothesis - Using small groups in individual training in order to improve the playing relations between 9m player as well as their tactical vision

In this case I will take the group of the 9m players (6 backcourt players + 1 goalkeeper) and put them in some more complex situations. I will present 6 standard situations where the players must coordinate their actions in a 3 against 3 situation.

3 defenders and 3 back players are disposed as left back, center back and right back.

The 3 back players must act very collective, as a "trio" but without forgetting all task concerning the individual aspects (like presented in the previous chapter 3.6: be dangerous, be quick, be various).

This is very much a tactical work that gives them, in time, by practicing a lot, a better vision of the collective play.

I think that if we can organize very well the relations between the 9m players, the team can solve not all but most of the problems in the positional attack.

In all 6 situations I use the same organization of exercises: 3 back players – left back, right back and central back (LB, RB, CB), 3 defenders on the central zone, acting between 6 and 9-10m and 1 goalkeeper (GK).

Situation 1

"Attacking the goal – be dangerous – repositioning after the pass"

This situation (figure 7) it's a very classic one. We intend to review some of the main important demands concerning the back player's behavior.

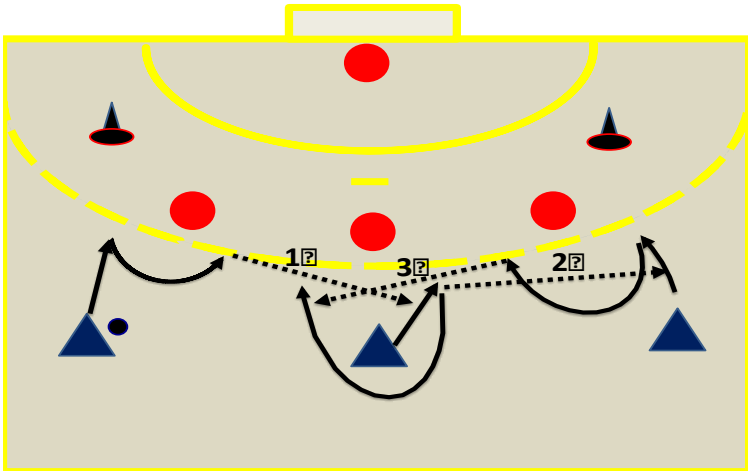

Figure 7

Observation:

- receive the ball in movement in front of a free interval;
- protect your arm with the ball from the defender
- after the pass, take back your position
- be dangerous every time you have the ball
- if you are not in front of a free interval try to take 1x1 and search for your chances to shoot if your arm is free
- don't shoot if the situation is not good enough!

Situation 2

"2 attackers will cross on a side and will put 2 defenders in a small sector in order to put the 3rd back player in a 1 x 1 situation on a big space"

2.1. **The CB will cross, with the LB in order to put 2 defenders very close in a small sector (fig 8)**

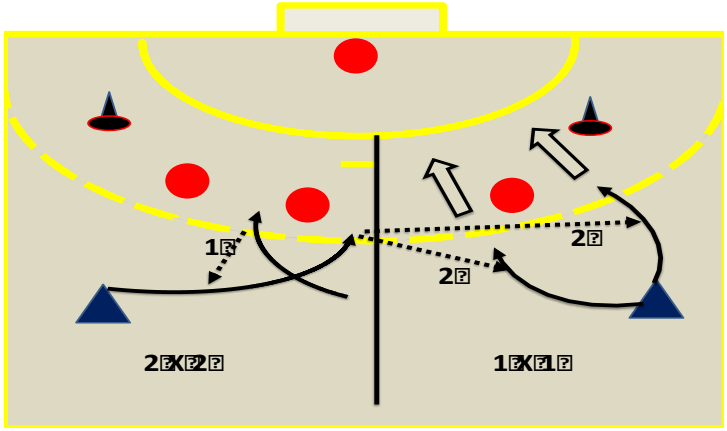

Figure 8

Observations:

- the LB doesn't go too much "inside" but make a quick parallel pass to the right back
- the RB must have normally a lot of space for 1x1
- 2x2 situation on one side of the field (LB+CB)
- 1x1 situation on a big space at the opposite side.(RB)
- The right player can take advantage from this situation by taking a shoot either intern or extern or by taking an 1x1

2.2**. The LB passes the ball to the CB and goes inside the defense between 2 defenders**

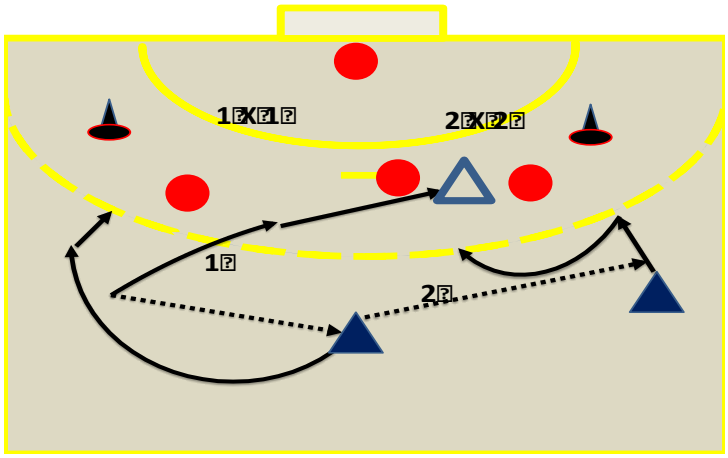

Figure 9

Observation: (figure 9)

- the LB , must act now like a pivot (blocking, sliding, etc.)
- the CB will take the free position on the LB ;
- the RB and the PV are now in a 2x2 situation ;
- if the situation is not good enough to take a shoot or pass the ball to the pivot, the RB will continue by passing the ball back to the CB witch is in a 1x1 relation on a big space!

Situation 3

"Shooting after crossing and changing the sector"

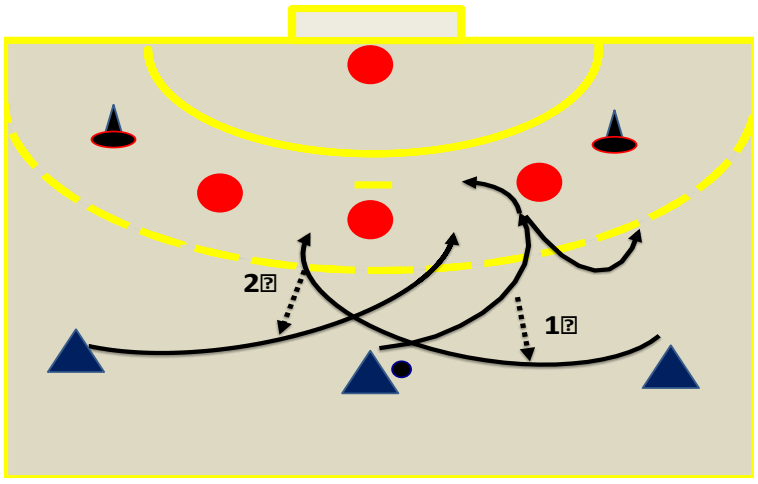

Figure 10

Double crossing: CB + RB + LB

Observation: (figure 10)

- keep the maximum space of playing
- use the width of the field
- make the 2 crossings and search for the optimal solution: shoot, pass, 1x1
- keep the continuity of the action
- “play free” if you don’t find a solution immediately

Situation 4

“Changing the initial positions by using the <long cross> – LB/ RB /CB ”

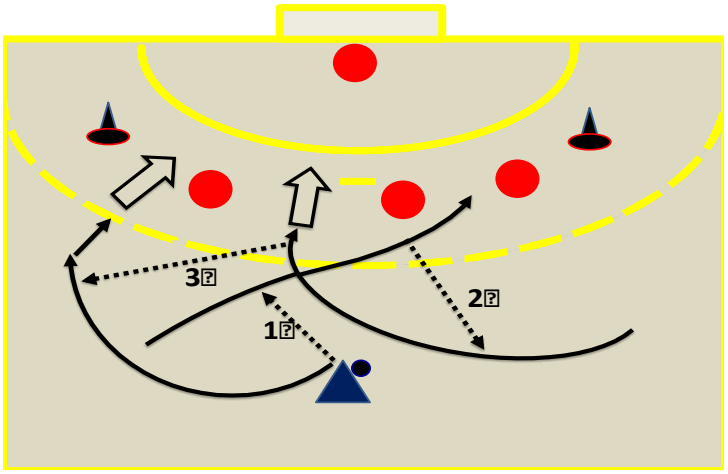

Figure 11

4.1. Long cross (figure 11)

Observation:

- use the maximum space
- receive the ball by moving in front of a free interval
- good timing in receiving the ball
- you must have all 3 positions occupied all the time, so be carful in repositioning after crossing!
- the center back - must take the place of the first back player who made the cross with the other back player
- the first backcourt player who made the cross, will take position on the opposite side.
- the second backcourt player, will take the central position.
- don’t be to close from the defenders
- Look for the intervals
- Don’t shoot if the interval it’s not free
- Play free if the situation is not good enough for shooting and be patient

Situation 5

"Changing the sector by using the cross without ball between center back and left back <Yugo cross>"

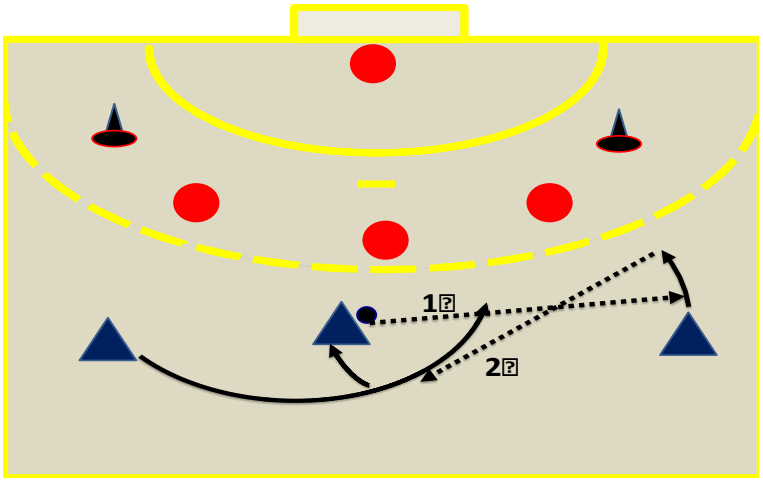

Figure12

Observation: (figure 12)

- use maximal space
- be dangerous when you have the ball
- good timing
- attack in free interval
- use eventually the 2-nd cross if you can not find a solution after the first cross!

Situation 6

"Using a coordinate relation between center back and 1 back player; the CB in using a fake pass and the back player is using the movement without ball, changing directions before receiving the ball from the CB "

Observation: (figure 13)

This action is known under different names: "induction" for the French school, "pass tauchung" for the German school). It's a very nice and efficient move but it´s not easy to learn it. The moves between players must be very well synchronized.

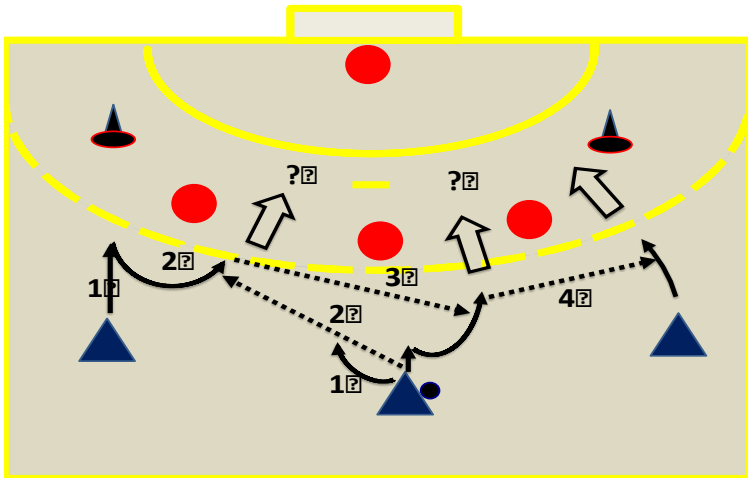

Figure 13

Description:

1. The fake move between CB and LB; simultaneous movements CB with the ball is making a fake pass to LB and exactly in the same time, LB is making a fake change of direction outside
2. LB after changing direction is coming “very strong” inside and receives the ball from CB in front of a free interval; in the same time, the CB, after the short pass to LB, must move immediately to the right in front of the next free interval and must be ready to receive the pass from LB
3. RB must be placed on external position and ready to continue the action if he will receive the ball

- Everybody must be quick on the positioning and ready for a quick shoot
- The first moves 1 and 2 are essential
- Don’t use too much speed for ``faking`` the defenders because they will not react like you expect to. Change the rhythm in the second part of the action (2, 3, 4)
- CB must stabilize his legs on the floor when he makes the fake pass

5. RESULTS AND INTERPRETATIONS:

The observation was made during one season on the efficiency of three back players

Statistics after the first half of the championship:

	1	2	3	4	5	6	7	8	9	10	11	TOTAL	%
Back player 1	5/9	4/8	5/7	2/5	5/10	7/10	7/13	2/4	4/7	8/13	6/9	55/95	57%
Back player 2	2/5	3/4	2/6	5/9	2/4	7/12	2/4	5/9	3/7	1/3	5/8	37/71	52%
Back player 3	4/6	2/5	3/5	1/4	2/4	4/6	3/5	4/7	6/10	2/5	2/3	33/60	55%
TOTAL	11/20	9/17	10/18	8/17	9/18	18/28	12/22	11/20	13/24	11/21	13/20	125/226	55%
EFFICENCY (%)	55%	52%	55%	47%	50%	64%	54%	55%	54%	52%	65%	55%	

Statistics after the second half of the championship:

	1	2	3	4	5	6	7	8	9	10	11	TOTAL	%
Back player 1	3/5	4/6	5/9	7/8	7/9	3/7	4/8	5/7	9/12	6/8	4/6	57/85	67%
Back player 2	5/8	4/5	2/6	5/6	3/4	5/9	2/4	3/6	1/4	3/4	8/13	41/69	59%
Back player 3	4/7	3/4	3/7	5/9	2/3	7/12	3/8	5/9	3/7	1/3	5/8	41/77	53%
TOTAL	12/20	10/15	10/22	17/23	12/16	15/28	9/22	13/22	13/23	10/15	17/27	139/231	60%
EFFICENCY (%)	60%	66%	45%	73%	75%	53%	40%	59%	56%	66%	62%	60%	

Back player 1 - in the second half of the championship he scored 2 more goals but he increase his efficiency by 10%

Back player 2 – in the second half of the championship he scored 4 more goals and he increase his efficiency by 7%

Back player 3 – in the second half of the championship he didn't increase his efficiency (-2%) but he scored more goals

6.CONCLUSIONS

1. The backcourt players score more than 50% of the goals
2. The backcourt player's efficiency can be improve by using the individual training
3. The backcourt player´s technique can be improve and correct by using individual training
4. The technical relations between the 3 backcourt players can be improve by using fundamental exercises in individual training
5. The tactical vision of the 9 meter players, recognizing the different type of defense, playing proper in face of an open defense or a close defense, can be improved and developed by using the 3 against 3 relation
6. If the team has good playing relation between the 3 backcourt players, they have already a basis for building up the positional attack
7. Even a very high individual efficiency of a backcourt player or any other player can not substitute completely the strategy and the collective play of the team (see the ranking of 40 top scores and the nations final standing - Austria Euro 2010)
8. The frequency of the individual training for the young players must be from 3 to 4 units per week
9. The frequency of the individual training for the senior players must be from at least 2 units per week

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AGGRESSIVE HIGH-MAN ADVANTAGE DEFENSE WITHOUT FOULS

BY

AIHAN OMER

ROMANIAN HANDBALL FEDERATION

TABLE OF CONTENTS

List of Abbreviations

BC – Back Center

LB – Left Back

RB – Right Back

AGGRESSIVE HIGH-MAN ADVANTAGE DEFENSE WITHOUT FOULS

Summary: This system of defense set play is dedicated for a team that plays in numerical superiority in defense. The aim is to regain control over the ball within 15-20 seconds maximum (the length of the passive-attack), without committing a foul, and to trigger a contra-attack. This can be a surprise element for the opponents that do not expect such an aggressive defense system and will try to penetrate through the defenders´ formation.
This is exactly the trap set for the attackers in which they will fall by either committing:

- Fault in attack
- Steps
- Passive
- Fault in passing
- Shot from afar

This defense system can become the winning tactic if implemented at the end of the game, in the last 2 minutes, when the opponent has an advantage of 1 or 2 goals and one man eliminated.

Keywords: aggressive, defense, high-man, advantage, fouls.

INTRODUCTION

The idea of this advanced, aggressive defense system came to me in 1985 when I was still a player during a game, in which I was playing defense against "BOROS IOSIF" who, at that time, was the Back Center of the Romanian National Team and was considered unstoppable in 1-on-1 situations. In order to prevent him passing me and scoring, I called for one of my teammates to come and stand beside me so we can both play the defense against him. Obviously, as soon as he saw 2 players in front of himself, the Back Centre just passed forward and one of his colleagues scored a goal. This turned into a scolding from the coach for me and my fellow teammate.
That was the moment I realized that this technique would work even better if we were to have a numerical superiority while playing defense.

I kept that idea in mind and in 1990's, when I became a coach, I started to develop that particular defense system. First it was on a primary basis with amateur players but as I started to advance in my career the quality of the players I had to work with started to increase and so did the quality of the defense system.

The system has suffered many transformations along the way and during time.
At the beginning, the system was withdrawn at the 6m line. Then it became positioned at 8m, but as the teams we were playing against became better and better, we started to concede goals from 9m or further, as they had good Left Back and Right Back players that could shoot from very far away. Because of this, I was forced to push the defense further to the 9m line and try to avoid getting goals from 9m.

Now the system is very well structured and since 2004 I started to use it in the Champions League and in 2009 at the World Championship in Croatia.
I chose several video examples to support my paper; Champions League against Pick Szeged and Barcelona and from the 2009 World Championship with Spain, Russia, Argentina, France, Slovakia, Hungary, Poland, Sweden, etc.

I believe these video images with top handball teams in the world exemplify best how this defense system works.

METHODS

The Coach has to know very well how the AGGRESSIVE HIGH-MAN ADVANTAGE DEFENSE WITHOUT FOULS functions in order to implement it properly with the team.

There are two types of training methods – Direct and Indirect

Direct Methods imply that:

- The Coach thinks for the players
- The Coach explains to the players
- The Coach shows the players
- The Coach corrects the players
- The Coach coordinates the players by signals and commands

Indirect Methods imply:

- EXPERIMENTING: Here a number of possibilities are tested.

- SELECTING: Here the best defense system is selected.

- PERFECTING: Here the best defense system and its substituting solutions are implemented and perfected.

- ASSIGNING TASKS: Here The Coach sets objectives for each player that must be thoroughly respected.

In order to fulfill the objectives set by The Coach, the players must satisfy 3 requirements:

1. Individual Tactics
2. Individual Techniques
3. Collective Work

1. Individual Tactics - require the player to have:

- Field Orientation
- Field Positioning : How is the player positioned with respect to:
  - The goal
  - The rest of the players
  - The ball

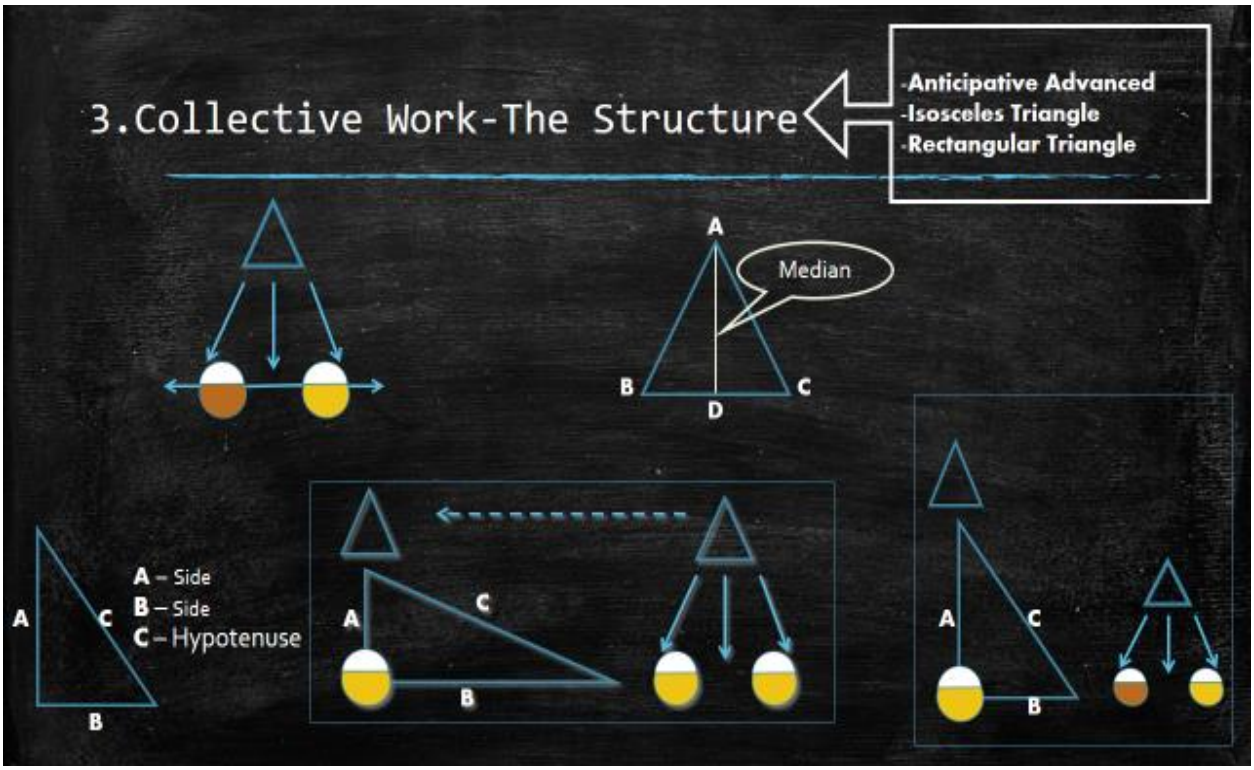
- The opponent

2. Individual Techniques are with respect to:

- The proper body position in defense
- Arm movements
- Body posture

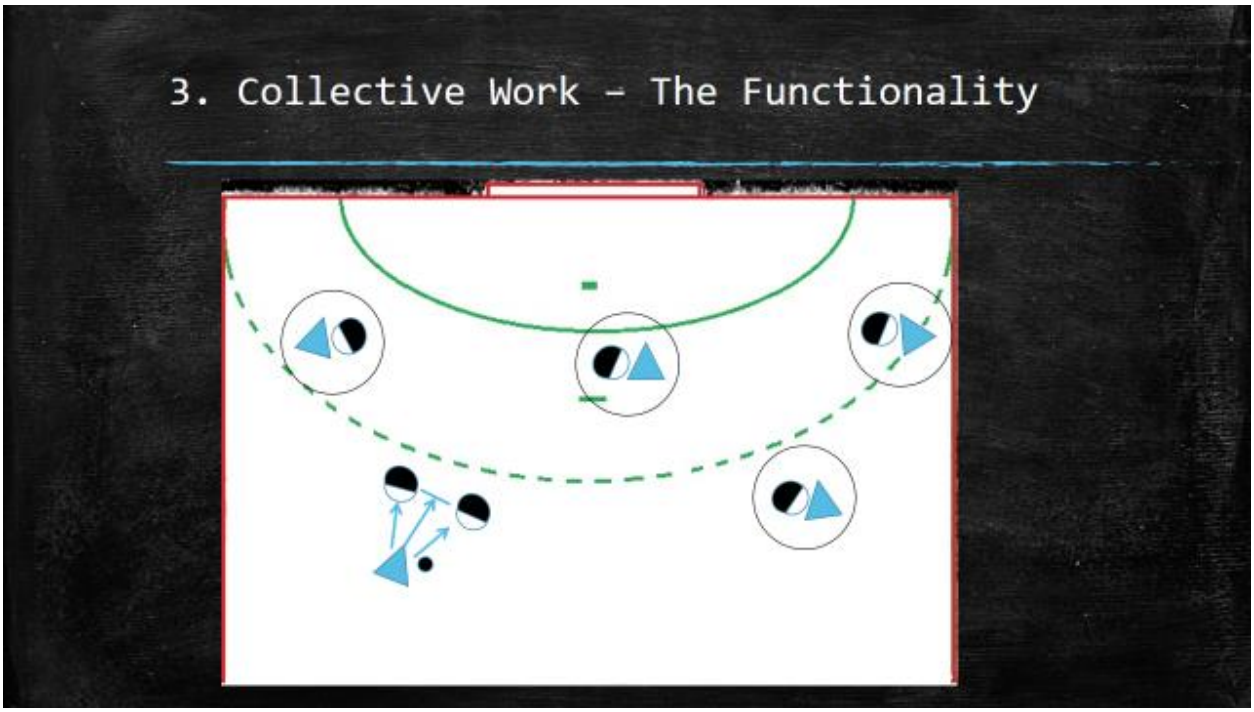
3. Collective Work :

- The Structure :
  - Anticipative Advanced
  - Isosceles Triangle
  - Rectangular Triangle



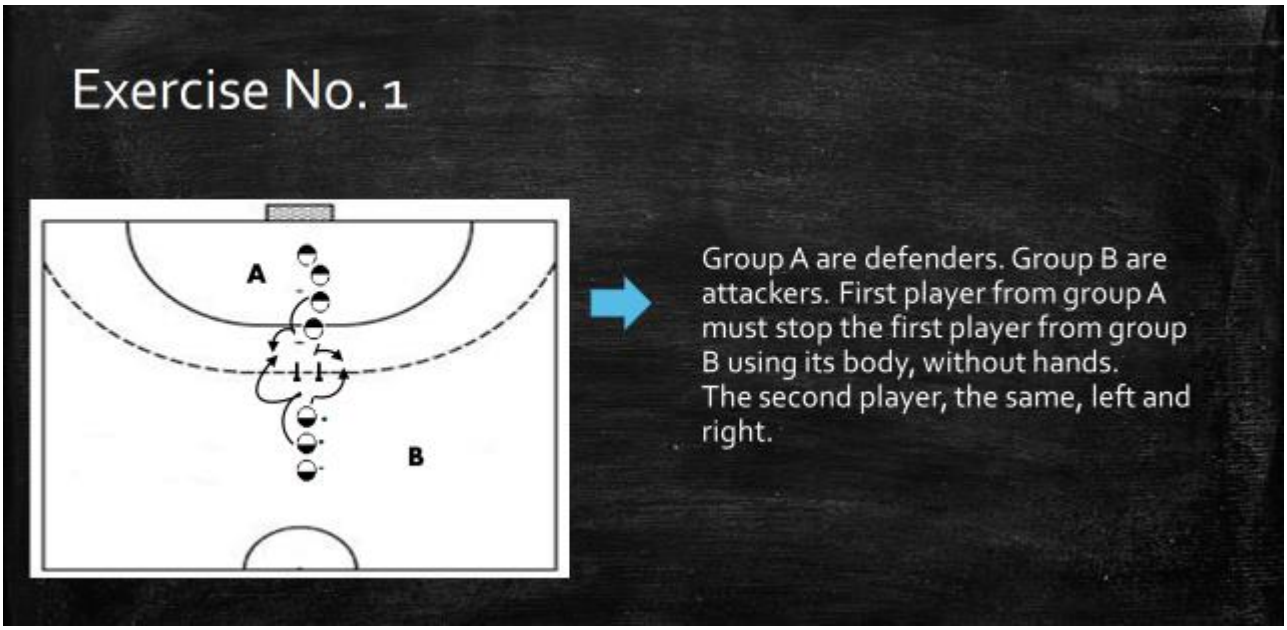
- The Functionality :

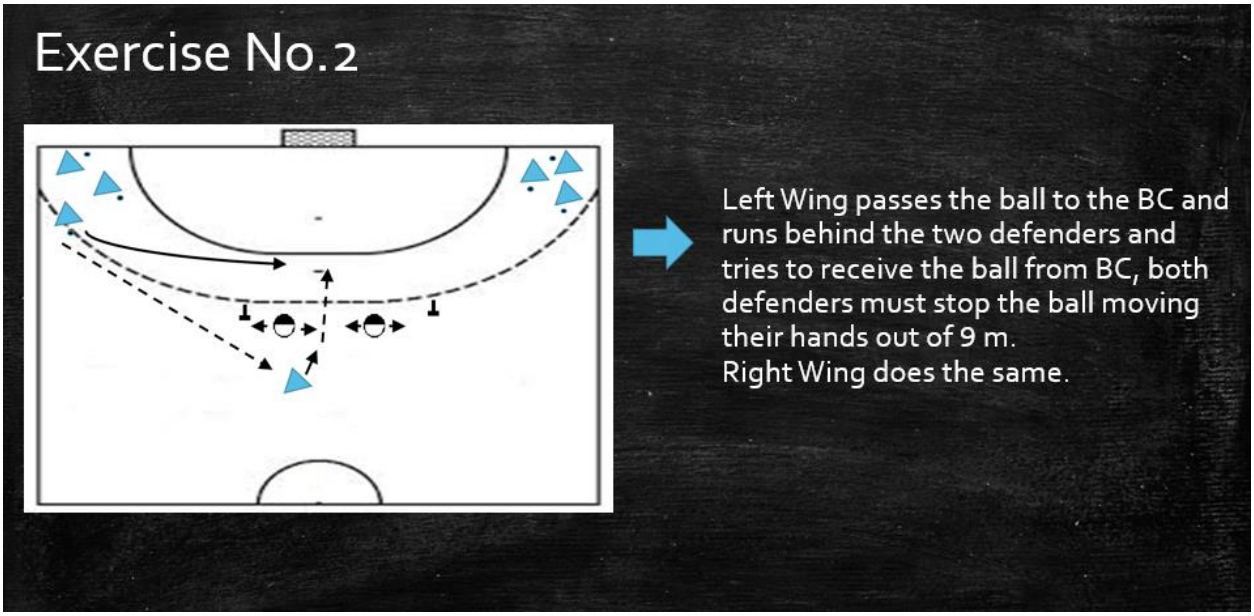
    - How much do I have to play advanced?
    - How do I have to play advanced?
    - When do I have to play advanced?
    - How to play the defense against the pivot
    - How to play the defense to the Left Wings and Right Wings
    - How to make the switch between players



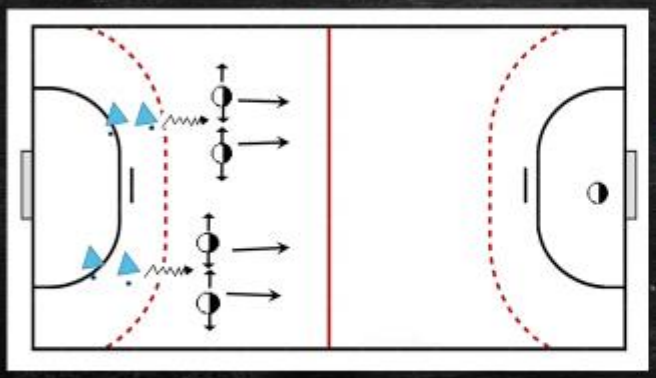
DEVELOPMENT

In order to get the maximum from the AGGRESSIVE HIGH-MAN ADVANTAGE DEFENSE SYSTEM - WITHOUT FOULS, there are several exercises that can be used in its implementation and development. Further I will list and explain several of these exercises.



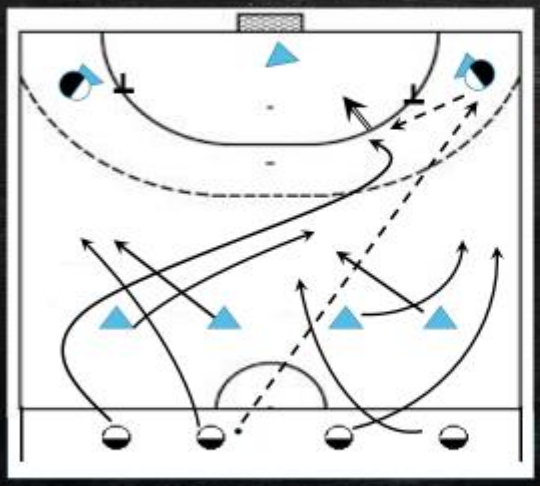


Exercise No.3



One player runs in dribbling and tries to score. The two defenders must try to stop him using their bodies or take the ball from dribbling.

Exercise No.4



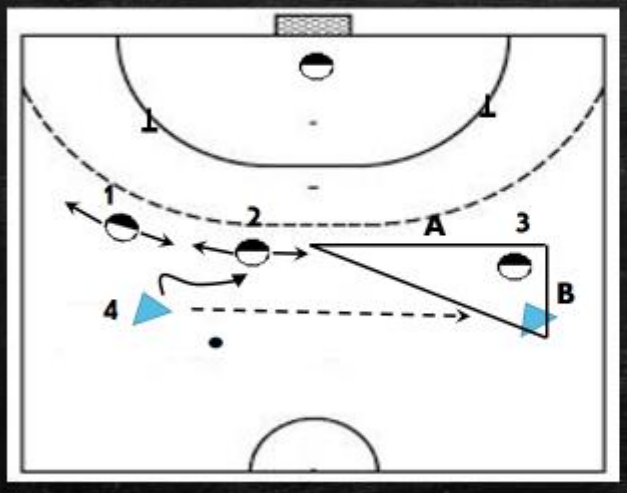
4 against 4
Defense man to man very tight.

- The attackers must score only from 6m
- Is not allowed for defenders to change the attackers
- The Wings can wait more than 3 sec. to pass the ball
- If the attacker get the ball outside of 9m must pass to the other wing and continue to run to get position on 6m

Exercise No.5

- 3 defenders against 2 attackers without fouls out of 9m
- The defenders 1 and 2 try to stop the attacker 4 only with their body
- The defender No.3 is staying on 9m only if line B is longer then line A

Exercise No.6



3 defenders Vs 2 attackers

- 3 defenders Vs 2 attackers same like in exercise No.5 but if the line A is longer then line B the defender 3 must go out and stay very close to the attacker 5 and do not let the ball arrive to him

Exercise No.7

4 defenders Vs 3 attackers

- One of attackers is pivot)
- The same position like exercise No.5 and No.6 but defender no.4 is man to man with the pivot (7)

Exercise No.8

6 defenders Vs 5 attackers (one pivot, two wings, one LB and one RB)

- The same position like exercise No.5 and No.6 but defender no.4 is man to man with the pivot (7)
  - The wings man to man
  - The pivot man to man
  - The right back man to man
- Two defenders are waiting the left back to attack

Exercise No.9

6 defenders Vs 5 attackers (two wings, one BC, one LB, one RB)

- If the LB run in to the 6m area the defender must run with him everywhere

Exercise No.10

- 6 defenders Vs 5 attackers -> the situation when the Left Wing runs from out of 9m.
- The defender must follow him from the 6m line and catch him inside 9m

Exercise No.11

- 6 defenders Vs 5 attackers the situation when the right wing from out of 9m.
- The defender follows him from the 6m line and catch him inside 9m

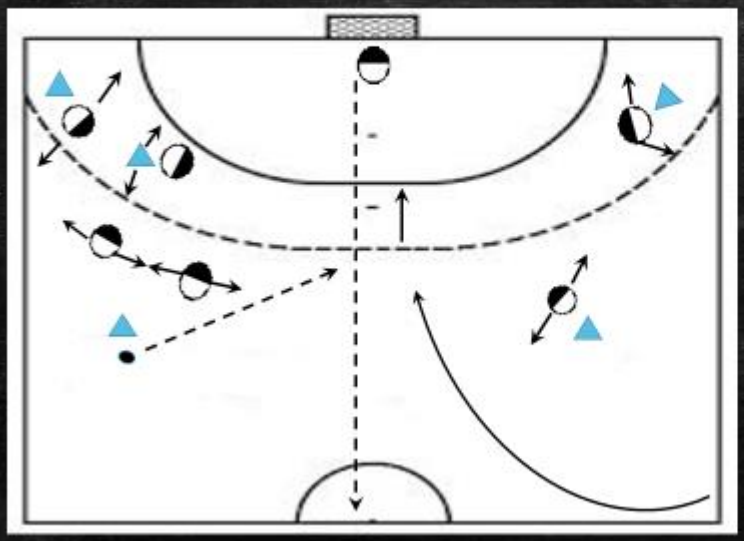
Exercise No.12

- 6 defenders Vs 5 attackers -> the situation when the pivot is coming to block to 9m.
- The defender comes with him and stays in line with defender No.1 and No.2 and make 3 against 2.

Exercise No.13

- 6 defenders Vs 5 attackers -> the situation when the right wing runs in 6m line, the defender follows him very close everywhere.

Exercise No.14



- 6 defenders Vs 5 attackers -> the situation when one player from attack substituted the goalkeeper.
- We let this player score freely because we score back very fast from center directly if there is no goalkeeper.

RESULTS AND DISCUSSION

I first used this defense system in the Romanian National League in 1995. In order for it to function well, the defense system must be prepared and trained for at least 3 months.
All players must be fully comfortable with basic principles regarding the High-Man Aggressive Defense System:

- The principle of the Triangle
- The principle of the Rectangular Triangle
- Man – to – Man Defense
- Substitution of players when necessary

These principles cannot be implemented in just a few weeks because they will fail to provide the expected performance and make the players lose their faith in the system by taking goals easily. In the first 2 months, the time that should be allocated during training to this defense system, is around 30 minutes each session.
This also represents a form of specialized training of the man-to-man pressing during defense. After this initial phase, the system needs to be trained in 30 minutes sessions 3 times a week, using all the possible options and team-combinations that the Coach believes exist.
After training it very well, the system should first be used in a friendly match against a weaker team so that the system can work successfully and the players gain trust it by associating a joyous feeling to its first usage.

The system is based heavily on the element of surprise. The opponent teams see huge spaces in the advanced defense at 9-10-11m and think it will be easy to score. Here is where the surprise lies as they are heading into a trap. The trap has taken as victims' great teams and trainers as they were unable to decipher how this type of defense is broken into. Naturally, there were instances where the opponent team scored while the defense team was using this system. These were instances characterized by the inattentiveness of one player that for a few moments forgot the principle of the triangle.

According to my own statistics, this high-man advanced defense system has had 83% success rate in the games that I have used it in. I can fairly say that I have always used this system when having the numerical advantage, at all the teams that I was a coach for, except for the very first months from my arrival to that respective new team. With every team that I was a coach, I first trained the system for 3 months and then used it in a game.
This training period necessary for the system to work, represented a bit of an issue while I was at the Romanian National Team as the time allowed for National Teams to prepare was limited. However, by having trained the Champion Teams for so long and having the best players under my command, the majority of the players that were summoned to the National Team were familia with the system which eased the workload significantly.

So far, this whole theoretical part may or may not be understood. But, the most important feature is represented by the video file with actual images from the games played by teams I have trained.
In the video file I will show when presenting this Master Coach Thesis, I have selected the most illustrative examples of numerical superiority in defense against some household teams in worldwide handball, as the games against teams in the Romanian Championship could be considered biased or not as challenging.

The 1st Video Example -> Pick Szeged – HCM Constanta in Champions League

The 2nd Video Example -> HCM Constanta – F. C. Barcelona in Champions League

The 3rd Video Example -> ROMANIA – FRANCE at World Championship in Croatia
ROMANIA – SPAIN at World Championship in Croatia
ROMANIA – RUSSIA at World Championship in Croatia
ROMANIA – SLOVAKIA at World Championship in Croatia
ROMANIA – HUNGARY at World Championship in Croatia
ROMANIA – ARGENTINA at World Championship in Croatia

The 4th Video Example -> ROMANIA – POLAND at European Championship Qualifications
-> ROMANIA – SWEDEN at European Championship Qualifications

I tried to shorten the videos as much as I could and I managed to make a 20 minutes video that captures all the moments I believe are important and still fits the time allowed for presenting the thesis.

CONCLUSION

At the beginning the idea was to prevent the opponent from scoring and try to score a goal. As time passed by and the system became more developed, I managed to change it from “don’t get a goal - score a goal” to “don’t get a goal – score 2-3-4 goals” during the 2 minutes of numerical superiority.

In the 3 Challenge Cups I won, this high-man advance defense system without fouls became a lethal weapon, as the majority of coaches did not understand what was going on.
At first sight, it looked like a purposeless Brownian – Movement, but the Principles of the Isosceles Triangle and Rectangular Triangle were where the opponent players fell into trap. During a single game where we had 4 times of numerical superiority for 2 minutes we scored at least 8 easy goals on contra-attack , which does weigh heavily in the economy of the game and turned out to be crucial at the end of it.

Of course there were also coaches who reacted immediately when seeing this type of defense. For example, Claude Onesta, during the game ROMANIA – FRANCE at the World Championship in Croatia reacted promptly by sending Karabatic to the Left Wing, who, from a very small angle passed the ball to Narcisse in the CB, who scored from an “inflight”.
Also in a game against Denmark, Ulrik Wilbek was playing with Nøddesbo as a pivot who was very tightly guarded by a central defender. Seeing this, in the next attack where we had a numerical superiority, Wilbek replaced the Left Wing with Rene Toft Hansen, who then left to the 6m line with a smaller defender covering him and scored. This happened as I did not have a chance to put a 2nd central defender to play the defense against him.

This system has to be very well understood, in first instance by the Coach, who has the hardest job in making the players understand the defense system and subsequently trust it. They need to use their best methods to train their players in a relatively short time period of 2-3 months. The system can be used all the time when the team playing defense has a numerical advantage or at the end of the game when the opponent team had the lead and your team needs to recover balls without committing any fouls.

This is also a very spectacular defense system as it seems like a very chaotic movement of 6 defenders against 5 attackers. However, as long as the principles of the triangle are being respected the attacker with the ball will fall in the trap, which was ingeniously set.
(See video examples)

ASPECTS OF THE PREPARATION OF THE OFFENCE TACTICS

MASTER COACH

Stefan Constantin **Romanian Handball Federation**

TABLE OF CONTENTS

1. INTRODUCTION

The game of handball is constantly changing and evolving in all areas and aspects of the game, and also in conducting training there are many elements of progress and improvement, some being novelties and some updates and adaptations to higher parameters.

Due to fierce competition, ways and means of improving the game and the training process are always sought and researched. All this will be accompanied by the constant concern to also observe sport ethics.

The notion of tactics includes all the principles and rules according to which the members of an attacking team are playing in order to achieve a united game against the opponent game system.

2. **ASPECTS ON THE EVOLUTION OF MODERN HANDBALL**

Starting from the analysis of the game of the teams participating in the largest European and global competitions, we can summarize the main aspects of modern handball:

POSITIVE ASPECTS

Due to the increasingly higher circulation and technical and tactical expression speed is already a dominant trend in all the individual actions of the players, which causes a noticeable increase in the pace of the game.

The counter-attack and phase II are a constant concern, a fast and efficient scoring weapon for all strong teams, trying to constantly and strongly catch the defence unorganized and vulnerable.

An increase of the players' technical and tactical mastery is obvious in the full compliance with the increased game speed. There are a number of new procedures, some readapted to the faster game, the efficiency of execution having an increasingly larger rate, but not to the detriment of the game.

For each position on the team a remarkable technical and tactical amount of knowledge has been developed and perfected, a model of player per position being outlined, while the player must act effectively on other two or three positions, without diminishing its specialization to a certain position in any way.

The perfect mastery of the court-positioning and player-driving mechanisms, the adaptability to the concrete game conditions is materialized through a great variety of using game systems in defence and attack.

Training or parts thereof with emphasis on physical training is frequently used today in most elite teams, regardless of the training method. An excellent physical condition, subject to a special movability processed at its peak is today an absolute and indispensable condition in practice. In the training process the focus is now on resistance in a system driven by speed and strength.

NEGATIVE ASPECTS

There are some elements (however in smaller numbers) to be known and analysed that stifle game development in handball and diminishes its spectacle.

Of these the most numerous are those belonging to the defender's game, namely: intentional fouls, the illegal blocking of an opponent, clinging, pushing, holding, shoving, brutal game which aims at endangering the physical integrity of the opponent by hitting, injury or intimidation.

There are some items related to the attack game such as the pivot of the attacking team holding the defender at the line, pushing or thrusting the defender into the goal area, the illegal blocking of the defender, forced entry or through the defenders, hitting the defender after throwing, passive game and delayed resumption of the game.

3. THE GAME CONCEPT

The game concept means how to apply the tactics by a team. The game concept treats the basic milestones of handball practice in a certain stage of it. Therefore it should be regarded in a continuous evolution. In establishing the game concept it is necessary to take into account the following aspects:

The features of the game performed by the top teams in the world. The characteristics that are strictly necessary will be chosen, without which no international achievements can be obtained, as well as those that fit the specifics of the trained athlete and teams.

Worldwide game development trends: these trends should be anticipated, identified and adapted to the team's play style, in order to permanently maintain contact with the attributes of the modern game.

Harnessing the talent of Romanian handball players: Romania has given many talented players to high performance handball who became famous over time.

All three aspects must act in connection to amplify their efficiency, and the coach's creativity has an important role in this plan. This involves establishing the best suited game ideas following efficient criteria, able to exploit the team's full performance availability to eliminate their deficiencies and exploit those of the opponent.

The attack game concept

Each team player in the defence and going into the attack phase should be concerned about unleashing the counter-attack as soon as possible that needs to be used whenever an opportunity arises. It has to be done so as not to give the opponent a chance to respond. In some situations if a player starts for the fast break it must be made in anticipation, even before the completion of the action.

Players who must trigger the counter-attack are the wingmen, especially those on the opposite side of the opponent's attack action and the forward defenders, and never the central players in the defence.

To initiate a counter-attack, the players must have a good knowledge of the way of performing it, one-peak, double-peak, directly or through an intermediary. In many situations the ball may not be passed to the counter peaks as they are marked by the opponent. This does not mean stopping the players, but to keep on sprinting to the opposite goal in order to make it difficult for the opponent's defender withdrawing in defence.

The counter peaks will be supported by the players in the second line (9-meter) and they go from defence to attack, for the very purpose not to give the opponent time to organize. In this case the ball will be taken from defence to attack by short, fast, confusing passes and at a steady running pace.

This action was called an extended fast break, as scoring can be achieved remotely or by a player infiltrated in the opponent's semicircle. In this case the players on the line receive a double task, to permanently clear and at the same time make blocks or screens for the players in the second line.

The playmaker or one of the players who has noticed the failure of the fast break or of the extended fast break, stops the game, going into the attack organization phase. In this phase, the players are forced to stay on the positions that they hold in the team and act orderly in the positional attack, characterized by the intense, precise and fast ball circulation.

Following the permanent and consecutive penetrations by the 9-meter line players and the rapid ball circulation, the defenders are forced to move constantly in the court and be very careful, which weakens their energy and alertness, marking the transition from one attack

phase to another, namely the set play attack with a precise positioning in the court, depending on the system (with one or two pivots) and the tactics adopted by the team.

Given the defence system, it should be acted with one or two pivots in circulation or positionally. A lot of attention is required for scoring, using the most appropriate means of individual or collective tactics, coordinated with a lot of intelligence. An unsuccessful attempt to achieve a goal is mandatorily followed by the organizational phase while keeping the ball.

In the set play attack, any individual action must be performed with great determination, speed and strength, especially as final element of a collective action. The individual penetration action must be subordinated to the team's collective game and general interests. All players of the attacking team, regardless of system, are required to act on a broad front, to also place themselves at the same time in depth, allowing for the timely use of a set combination.

The attack system will be chosen according to the potential and specificity of the players who make up their own team and to the peculiarities of the opposing players. Regardless of the system used, the attack must be carried out in several ways, by continuously changing the pace and the means of collective tactics.

4. HANDBALL TACTICS

Tactic is a system of actions selected, planned and prepared in advance to be used in the game depending on the opponent, game conditions and regulation limits, in order to capitalize on the qualities and characteristics of the players but also on the training shortcomings of the opponents.

In conducting modern handball at a higher level (seniors; national teams) where there already is a tactical thinking and game concept, its role can be decisive in determining the winning team. There is an interdependence between the tactics, technics, physical and moral-volitional training.

We cannot speak of a tactical plan or tactical game concept until we form the player's tactical thinking, which consists of "the ability to shift quickly, to choose the most appropriate means" to suppress and dominate the opponent. Tactical thinking is formed and grown in a well-systematized methodical process called tactical training.

A tactical game means to act thoughtfully, to recognize game situations, to weigh, to anticipate, to properly appreciate the opponent's action possibilities and to act as soon as possible with the best option in that situation. All these are not possible if the handball player does not have basic tactical abilities, namely:

the observation ability - the player must have an overview of the events in the game, to quickly receive acoustic and optical signals;

reactivity - consists of transforming the observation ability into action in no time;

sense of space - occupying a secure position in both attack and defence, fully using the game space and additionally, the player must have a sense of movement in the team's general movement space (space orientation);

sense of time - players must have a temporal sense of carrying out game actions;

sense of formation - the correct positioning in different attack formations, recognizing formations changes and balancing concrete game conditions;

adaptability - the players have to predict the sequence of game phases, to process them mentally, to put themselves in the position of attacker, based on possession.

The main creator of tactical progress is the coach who must constantly work with the team. Current research has led to collective team sports (which involve direct contact with the opponent), to splitting tactics into three groups:

The individual tactic - includes individual tactical actions that should increase the ability of the shooter to "mask" its true intentions, surprise the opponent and use various procedures.

Each player must have "operational intelligence" i.e. the ability to easily handle any game situation and on any position it would have because the action is finished by a single player but the construction is also carried out by the other six (including the goalkeeper). All this is based on a great technical support led to mastery, physical and mental skills, elements that have determined the development of exceptional athletes.

The collective tactic – in which this type of actions are intended to simplify game situations or the game as a whole and relies on the players' abilities to make a combination with one or several teammates, harmonizing its own intentions with those of the teammates with whom they carry out the combination.

The collective tactic is decisive especially in situations of superiority in attack and inferiority in defence. Collective actions are aimed at transiting the individual actions towards the team ones and introducing them in its game.

The team tactic – it needs to combine individual and collective actions according to the tactical game concept in a general system, but it will be developed depending on the team (its composition) and its basic structure (the players).

The new trend is to activate the players in the court, which depends on the competence of the coach, by reducing the "dead" game moments (the times when the game is timed and each team sits in its attack formations). This action must be based on the excellent physical training of the players, but it can be easily be countered by a well-made game plan.

Self-activation is a skill that only several players possess and manage to put in practice. It is about a sense of placement, of successive position demarcations always favourable for the reception or possession of the ball, of the conscious "waste" of energy even if these means are ordered by a default system.

5. TACTICS IN THE GAME OF HANDBALL

The aim of tactics is to break the game balance and tip the balance in favour of your own team. Achieving this goal seeks a greater efficiency of individual processes and the use of individual and collective actions and initiatives.

The most important tangible components of tactical training are:

Tactical actions – is the conscious use of technical procedures and basic tactical means (screen, crossings, block, etc.) in order for a player to create a very favourable scoring situation and position. It is done by one or more players observing the tasks of the adopted system and the team's game concept.

Tactical combination - is a series of tactical actions with the exception that several players should participate and each has a default route in order to confuse the opponent's system and achieve anticipated scoring positions.

The game system – is the general form of organization for all the activities of a team.

It comprises:

* Arrangement of players on the court to effectively cover play areas;

* Setting tasks for each position, the relationships between players and major variations depending on the opponent's response and team's response;

* Main tasks for players with an outstanding scoring capacity.

Tactical scheme - is a combination of more complex, rigid and stereotyped tactical combination to highlight a player's skills in decisive game phases. Here every move is calculated and must follow some rules in order to be effective:

* the sequence of actions or combinations to be logical;

* to be performed convincingly for the opponent;
* not be repeated in short intervals, only in the key moments;
* continuous threat towards the goal;
* reversibility of actions (to be executed from both sides);

* availability of the scheme to match the training level and the players' and opponent's peculiarities.

The game concept – is the specificities and characteristics of a team in applying tactics. The tactical chapter is very vast, but the teacher's mastery is based on experience, will select and adopt what he deems essential.

The tactical plan - is the applied part of tactics. This should include an objective analysis of the opponent and of its own forces, drawing special tasks for some players if necessary and establishing hypotheses of how the opponent will react.

5.1. TACTICAL PRINCIPLES

In modern handball, tactical principles, of great importance, remain valid in all circumstances, guiding the players to think, to act consciously and to observe order and discipline and at the same time to ensure the organization of attack actions.

Tactical principles guide the players' way of acting in attack letting their creative imagination and improvisation power roam free. Both individual and collective tactical actions takes place on the basis of tactical principles, rules and requirements that if followed during the game, are interdependent and constitute the guiding idea in the team's whole tactical manoeuvre in both offence and defence.

Next I will set out the general tactical principles in the attack game:

Observing tactical discipline

This principle, particularly important in developing an effective game, is mandatory for all athletes and is required to be applied without reservations, interpretations and comments. It requires the absolute subordination of individual and collective tactical actions in view of observing the team tactical principles for performing the tactical plan developed for a specific game.

The tactical plan developed for technical leadership has a chance of success when it is well made concerning the measures and countermeasures taken against the opponent and when they are brought to a conclusion and observed by team members. Any violation of the fundamental tactical rules and the tactical plan represent deviations from tactical discipline and may have serious consequences.

Coaches must act very determined to fight against all actions to violate the principle of observing tactical discipline.

Granting mutual aid

Being a team sports game, the ultimate success in handball is determined by how all the efforts of the players were taken. Providing permanent mutual aid increases the individual performance of the players and the whole team. Aid is given to a player involved in individual actions. Performing a block or a cover are actions that apply to this principle. This principle should apply to every defence game phase. The collective game cannot be designed without applying this general tactical principle, with the conscious participation in any moment of the game.

Initiating and conducting timely actions

This principle refers to all actions that must be promptly conducted by the players in order to react positively to the actions of partners and against the opponents. This principle applies in the attack. Players must be trained to act at the right time, i.e. when the action is indicated in terms of tactics.

The principle can be explained by the rapid and determined onset of a counter or by the timely retreat in defence after losing the ball in attack.

In both cases a moment of indecision can thwart any action. This principle refers to all executions and prompt interventions of players in order to timely fit in the actions of the teammates; e.g. appropriate clearance, engaging the pivot at the line, doubling the defender attacking decisively and others.

Creating man advantage

Numerical superiority is a situation consciously created and organized by the attack game.

The normal ratio between the attackers and the defenders is 6-6; with their game the attackers aim to create favourable situations, making ratios of 6-5; 5-4; 4-3, etc. The best ratio is 2 on 1.

Numerical superiority in attack can be achieved by individual and collective actions. All tactical resources are aimed at achieving the supranumeric ratio. Applying this principle to the organized defence game led to the improvement of the collective game. In all defensive formations players must help each other.

Creating the man advantage ratio underlies all attack actions, so they must be used throughout the game. In every game phase players have to be concerned to act in order to achieve numerical superiority in one part of the court.

Anticipating actions

Based on the tactical knowledge and experience the player must act so that by his placement or by moving in the court he can perform his game tasks in the best conditions or with his opponents and to anticipate by judgment and reasoning what they will be doing in a few moments.

5.2. TACTICS IN THE ATTACK GAME

Attack is the tactical situation when the team is in possession of the ball and is able to score. It runs on a tactical game concept developed by the technical leadership and the total capitalization of this phase is a prerequisite for obtaining victory.

In preparing the attack the team is in a favourable psychological situation, the players are motivated, game enjoyment is satisfied and ball possession makes it possible to play. In the attack game, each player must keep a basic place in the playing area, according to the system adopted, to cover the whole action area and to seek to score from the central free spaces.

Individual attack tactics

All the principles and rules that guide a player of an offensive team when it is in a fight (with or without the ball) with a defender or when he comes in collaboration relationships with 1-2 teammates are individual attack tactics. Tactically, the individual game underlies the collective actions. In order to conduct an effective collective game it is necessary to act as dangerous as possible. Any action performed with an end in it leads to an individualistic game that needs to be avoided.

The tactical use of techniques is mastered by the players by accurate and safe passes to teammates, dribbling and convincing changes of direction to mislead the direct opponent and trigger collective actions and shots on goal to be executed in favourable situations and decisively have an important role. Here we should talk of the desire of physical commitment from all team members, using the sense of anticipation, keeping focus throughout the game and reducing the number of technical and tactical mistakes.

Collective attack tactics

The principles and rules according to which the overall team game is conducted when players collaborate among themselves, act uniformly against the opposing defence system constitute collective attack tactics.

The team carries out offensive actions in a coordinated manner, each player putting his full potential to the benefit of the team.

The coordinated activity of two or more players leads to group tactics. Tactical individual actions are at the core of tactical attack combinations. Subordination of the individual capabilities of each player to the interests of the team plays a role of great importance, as long as the players know the means of collective tactical attack. Each team must have in its arsenal as many basic means of collective tactics as possible, this allowing the team to improvise new game situations, successfully fighting against the opposing defence.

5.3. ATTACK PHASES

The moment a player of a team gains possession of the ball and until its passing to the opponent's possession designates that respective team as attacking. This situation of the allied team in attack was divided conventionally into four phases, namely:

* first attack phase – fast break;

* second attack phase – extended fast break;

* third attack phase – organization;

* fourth attack phase – set play.

This conventional division was made on the basis of studies that have determined the content of each phase in terms of technique and tactics, of physical and mental training. Planning the content of training, the theoretical and practical training of the players receives a content according to the requirements of the modern game. In what follows you can see that each attack phase corresponds to common components, and several distinct elements, which characterize each of them.

5.4 BASIC TACTICAL ACTIONS (= GROUP TACTICAL MEANS)

Basic tactical actions are offensive actions performed by 2-3 players in order to free or create an as favourable as possible opportunity for a player to throw or engage. There are basic concepts in current handball, which must be known to all players and practiced until automation.

The best method is repeating until knowing each action in all game positions and then improvising on them in the bilateral game. Some of these basic tactical actions are:

* give and go;

* clearing;

* screening;

* crossing;

* pick and roll;

5.5. SET PLAY FORMS

In the fourth attack phase, game systems can be applied in two forms:

* positional attack;

* circulation attack.

Both attack forms are indispensable for a handball team that aims to achieve outstanding results. Practice shows that good teams are able to alternatively apply the two attack forms, consciously, with tactical justification.

We cannot say that an attack form is better than the other. We recommend a judicious alternation of the two attack forms in the fourth attack phase.

Positional attack;

This attack form is tactically used in the following situations:

* when the defence had time to organize and cannot be overcome by individual and collective tactical actions;

* when the offence team aims to gain time as it is leading on the scoreboard;

* the team is forced to save energy as it is fighting against an aggressive and well organized defence;

* the players of the attacking team are less tactically prepared and cannot use the circulation attack.

In the first part of the positional attack players move on their positions, push, backward, sideways, depending on the demarcation needs, passing the ball with the known ball circulations, without the intent to cause a penetration or a shot at goal situation too soon.

The fast movement of the ball and the penetration dodges made by some attackers should not allow the defenders to rest. The effort of the attackers in such a movement of the ball is much smaller than that of the defenders.

In order to achieve a positional attack it is imperative that the team positions to be filled by players with adequate skills. Viewed as a whole, the activity of the attackers is limited to misleading, chicken moves and movement in the court area reserved to the position held in the team.

The positional game aims to create scoring chances for every player in the area of the position they are playing.

The positional attack form implies that the backcourts and playmaker are good shooters from the distance.

Positional attack should not be understood as a static, slow game that lacks vigour and dynamism. The positional attack judiciously alternated with the circulation attack amid using means of collective tactics permanently retains its effectiveness. This attack form is learned in the first handball lessons after learning the basic technical elements for the offence play.

Circulation attack

The second form of applying set play systems – the circulation attack - is achieved through the continuous circulation, with speed, with great force of the attackers on known, previously determined or random lanes.

In terms of player circulation we should state that the whole team or only a part of its members can be engaged in attack. In order to successfully apply the circulation attack, the players must benefit from a good technique, a good physical training, multilateral tactical knowledge. In this attack form the very precise player placement in the court is determined by the attack system employed by the team.

The most common is the circulation of the line players combined with successive penetrations of the backcourt players. By the intense circulation of line players, the defenders are forced to remain with the line and are prevented from tackling the 9 meter-line players. The difficulties of the defenders increase with the circulation of the 9 meter-line players.

Collective actions are used consciously, deliberately, with perseverance, in order to determine the defence to make mistakes.

The circulation attack, much more exhausting than the positional one, significantly reduces the physical forces of the opponent and creates favourable situations of shot on goal.

The free circulation attack in the court, based on precise tactical rules is learned simultaneously with the positional attack.

5.6. SET PLAY SYSTEMS

Set play systems differ by player placement in the court, during which player couples and lines are formed. Regardless of the game system used by the team, the basic tactical principles and rules remain valid.

The set play systems can be identified by the number of players acting close to the 6-meter line and those who play outside. The team's game can easily be recognized only in the positional attack.

The players' multilateral training in terms of technique and tactics is needed, but this must be the basis for a training specializing in all factors, depending on position requirements. This specialization by position is required for a maximum performance from all players.

The single pivot attack system

Player placement on the court is determined by the attack system used by the team.

Attackers are placed on two attack lines. The first line is made up of players who act on the 6 meter line. A second attack line stands and acts at a distance of about 10 to 16 meters away from the goal.

The attack line includes the two wingmen and the pivot, the second attack line consists of two backcourts and a centre backcourt. Practice shows that the number of players that form the two lines change depending on the attack system used.

The right wingman and right backcourt positions are usually held by left handed players. In the positional attack the pivot moves between the side and the centre backcourt. The wingmen take over their positions on the court corners. By its positional game, the pivot aims to get one or several defenders next to him, thus easing the game for the backcourt players.

The wingmen constantly move to meet the ball demarcating from the court corner towards the centre line then after passing the ball, they head back to the corner for a new action. The backcourts and the centre backcourt act by successive penetrations, threatening the goal and trying to create a favourable shot on goal situation.

The single-pivot attack system allows the application of the circulation attack form. This attack system is effective against any defence system, apart from the man to man system.

The double-pivot attack system

Regardless of the place of other players, pivots are placed between the side and centre backcourts on either side of the defence.

From time to time the pivots change places between them, depending on ball circulation.

In the double-pivot system, there are two variations of team training:

* two wingmen specialized in acting on the court corners as in the single-pivot attack;

* the wingmen are replaced by backcourt players, in order to increase the force of the shot on goal from the distance.

In both situations, the playmaker is one of the two backcourts. It is necessary to note that, although the player placement in the double-pivot system is the same, system functionality changes according to the team structure with line players or with backcourt players placed in wingmen positions.

5.7. ATTACK AGAINST DIFFERENT DEFENSE SYSTEMS

Each defence system has parts invulnerable to an attack carried out at random and certain weaknesses, vulnerable parts, whose thoughtful exploitation may be the key to success for attackers. Understanding the attack on different defence systems is facilitated by the knowledge of their functioning mechanism.

Attack against the defence system in the 6:0 zone

The double-pivot positional attack system or the single-pivot system circulation attack is successfully used against this defence system, which covers a large area of the line.

In the double-pivot attack system, they are placed at the level of the second defender on each side of defence that is in the area between the half defender and the inside defender.

The backcourts act in line with the pivots and the wingmen on the court edges to maintain a broad attack front.

In order to attack the 6:0 defence formation, the players must know and strictly observe the following tactical rules:

* the 6:0 defence can be overcome by distance goal shooters, to whom the game of the whole team is subordinated;

* the pivots do not engage forcibly because they are not well marked and act in confined spaces;

* the decisive phase is quick and is executed only after a diagonal pass;

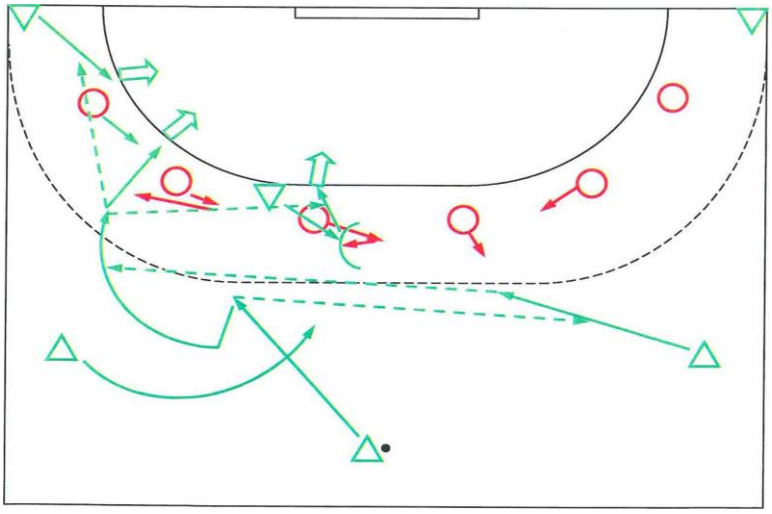
* the backcourt shoots on goal from the distance through the pivot area and only when his defender cannot attack him on time;

* the pivot is engaged only if the direct defender leaves him to attack the distant goal shooter;
* the backcourts place themselves and act on the direction of the pivot's backcourt, thus the two inside defenders become useless.

The single-pivot attack system may be used against the 6:0 defence formation.

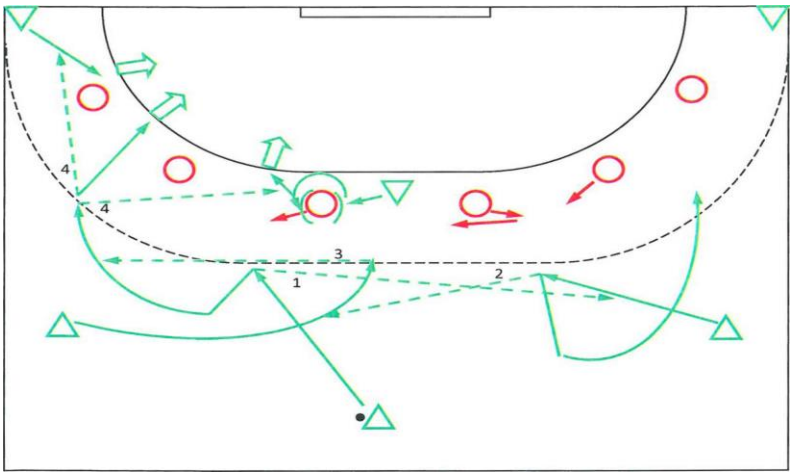
In this case you start with an intense circulation of players and the ball, the backcourts being forced to take over and to pass the wingmen countless times, which determines the situations of numerical superiority. Regardless of the attack system used against the defence in the zone, if the attempt to finalize the attack did not lead to any result, the game is restarted by organizing the attack phase.

Player placement on the court is determined by the defence system used by the opponents, as shown below:



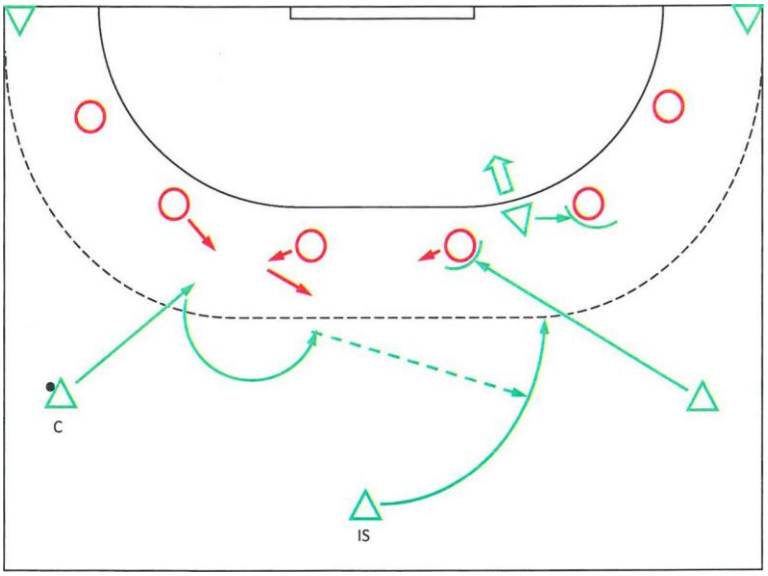
Picture no. 1.

The M.B. passes to the R.B. and crosses ways without the ball with the L.B. The R.B. passes straight to the M.B. who goes into the first lane, and the pivot is in the forefront with the I.R.



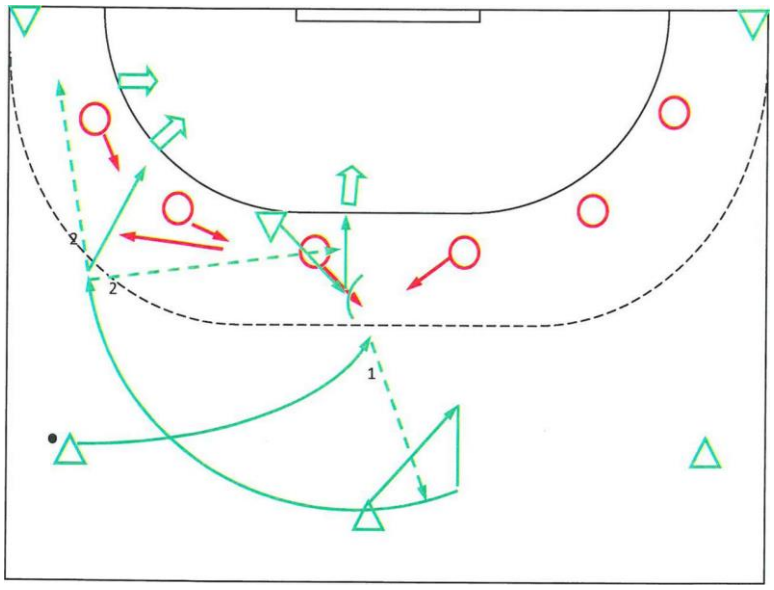
Picture no. 2.

The M.B. passes to the R.B. and crosses without the ball with the L.B. who receives a pass from the R.B. and continues with a shot using the block of the P or passes on to the M.B. who has different options for finalising.



Picture no.3.

Double block set for the L.B. who had changed places with the M.B. When the M.B. begins the action the R.B. blocks the I.L. defender.



Picture no. 4.

The L.B. crosses ways with the M.B. who engages the P. at the I.R. or passes to the L.W.

Attack against the 5-1 defence system

Due to the presence of the point defender in front of the playmaker, changing the ball from one side of the court to another must be done carefully, as there is danger of the opponent intercepting the ball.

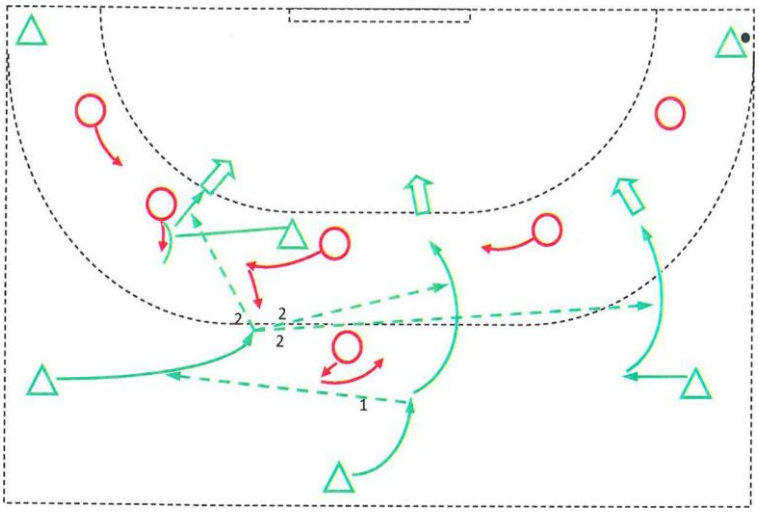
The 5-1 defence system can be attacked also by one or two pivots, using these tactical actions:

* intense player circulation at the goal area line in order to keep the backcourts withdrawn;

* permanent threat of the goal, especially by the backcourts by successive penetrations;

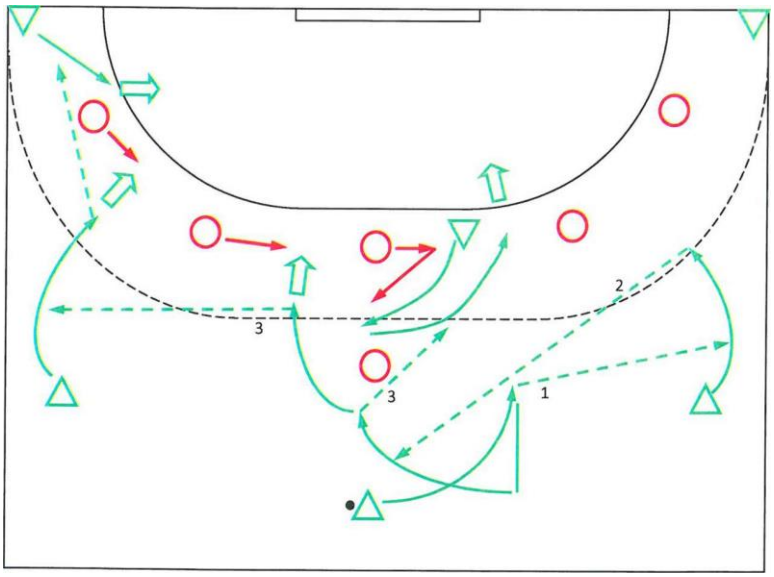
* basic attack tactical combinations at the right moment, when you created a supranumeric ratio favourable to the attackers;
* shot on goal by jumping or through the defenders, made amid intense player circulation at the line;
* collective tactical actions.

Player placement on the court is determined by the defence system used by the opponents, as shown below:



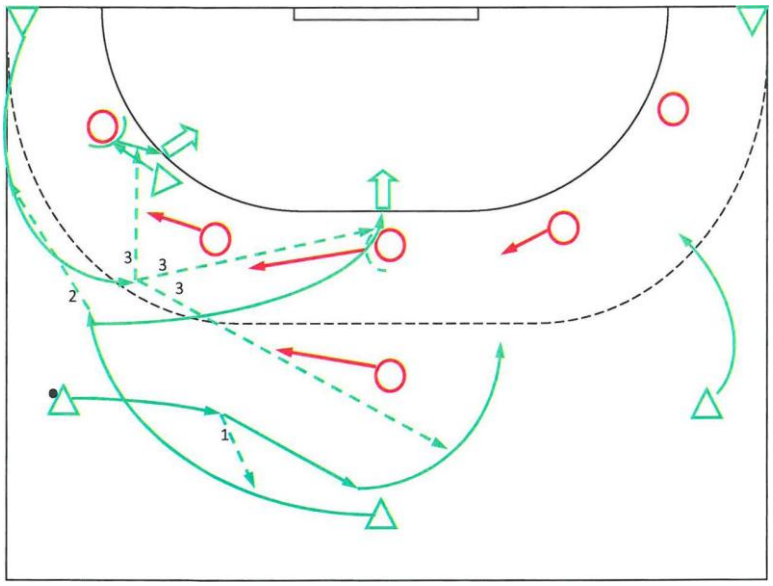
Picture no. 5.

The M.B. passes to the L.B. and penetrates to the line. The L.B. shoots, engages the M.B. or the P, or passes to the R.B.



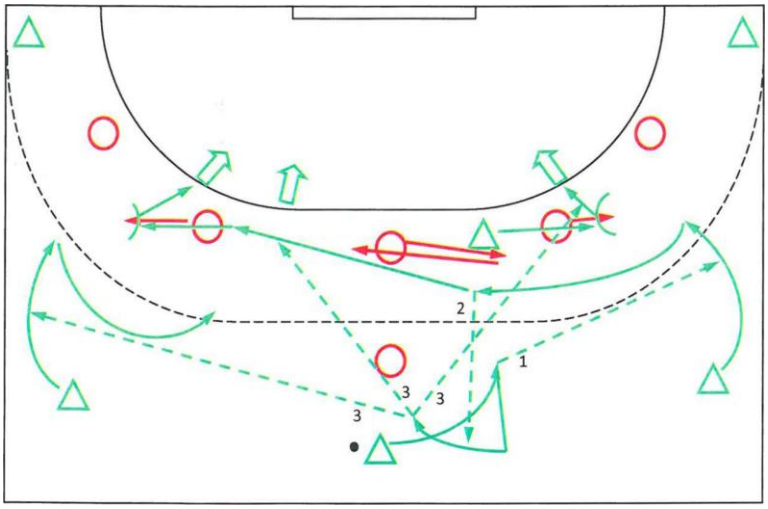
Picture no. 6.

The M.B. overruns the F.C. and creates superiority for the L.B. and the L.W.



Picture no. 7.

The L.B. crosses ways with the middle backcourt, which passes to the L.W. and penetrates to the line. The L.W. may engage the P. to the L.B. or the M.B. at the line in the centre.



Picture no. 8.

The R.B. passes to the M.B. and penetrates to the line. The C.B. may engage the P. or pass to the L.B. who finalizes supported by the block of the R.B.

Attack against the 3:2:1 defence system

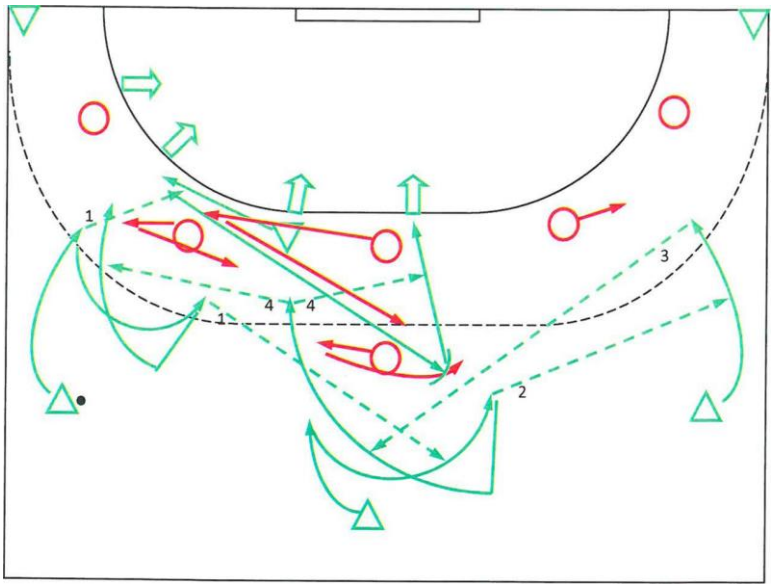
The emergence of the 3: 2: 1 defence system surprises most teams, as it plays randomly in the tackle, relying more on improvisation than on thoroughly prepared actions.

The basic problem in attacking this system is the use of tactical actions of the attackers, by which the two half defenders are obliged to move back to the goal area line.

This can be achieved either by the fast circulation of the players in the semicircle, where the attack is made with a single pivot, or by introducing the second pivot at the line. If by these tactical manoeuvres the defenders were forced to change their defence game, the attackers must act accordingly and use the most appropriate attack tactics for the new situation.

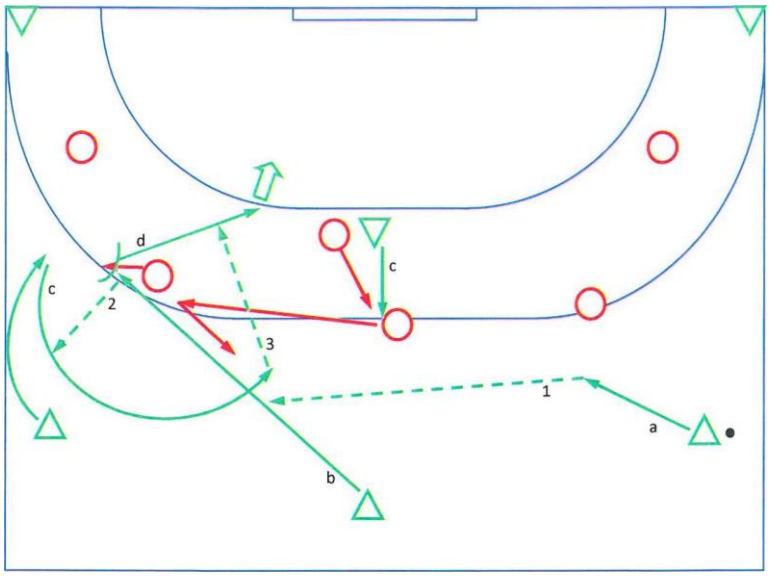
If the half defenders remain advanced, it is the turn of the pivots to demark so as to be engaged. The game of the wingmen should be broad in order to open the opposing defence system.

Placing players on the court is determined by the defence system used by the opponents, as shown below:



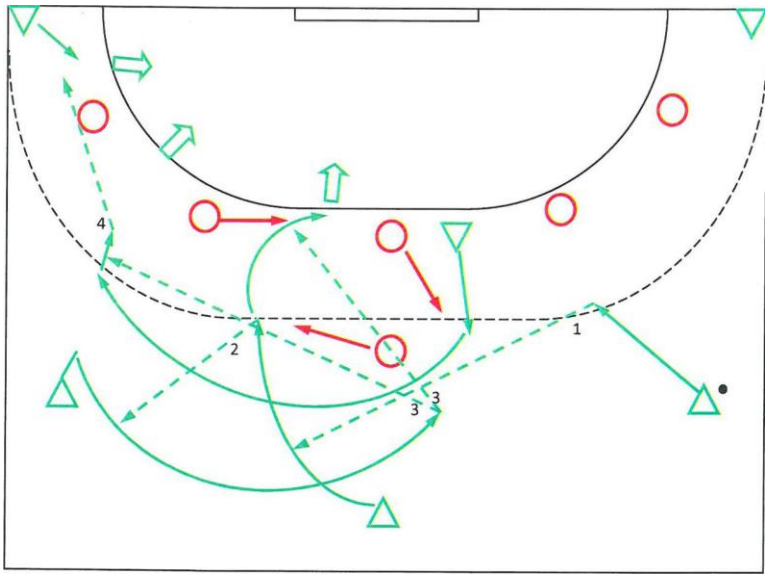
Picture no. 9.

The P will clear from the C.B. and go for the pass of the L.B. If this does not work the L.B. and the M.B. will start parallel thrust for the R.B. The R.B. may engage the P. after the P. blocked the F.C. or continue with the ball back to the M.B. which now will overrun the F.C. and play with the P or the L.B.



Picture no. 10.

The M.B. crosses with the L.B. and demarcates behind the R.H. and at the same time the P. comes up to pull away the B.C.



Picture no. 11.

The M.B. passes the L.B. and penetrates to the line. The L.B. crosses with the P. who tries to pull away the F.C. Now L.B. passes to the P. For continuation or launches a direct pass to the M.B. at the line.

6. CONCLUSIONS

Starting from a basic principle, I wanted to emphasize in this thesis that the tactical aspects are very important and can make a difference in the modern game.

In modern handball all teams want to reach success and this has led to a great concern for tactical attack training because defences have become very compact and work well with goalkeepers.

In my opinion the coach must be in a constant search for tactical solutions in order for the team that he leads to find optimal scoring solutions, regardless of the opponent's defence system (6:0; 3:2:1; 5+1).

Also I consider that the coach must make each player of the team that he trains aware of the fact he needs to have a vast tactical culture in conjunction with individual techniques.

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VOICA ELIODOR

ROMANIAN HANDBAL FEDERATION

EHF MASTER COACH 2014

REZUMAT

Handbalul este un sport caracterizat printr-o rapida si dinamica interactiune untre jucatori, care are nevoie de o profunda intelegere a acestui complex dynamic, spatial, pentru a servi ambelor interese, academic si sportiv.

In acest scop am facut o analiză pe un eşantion de 70 de meciuri in doua sezoane al unei echipe din prima liga masculina de handball din Romania.

Rezultatele cercetarii arată prezenţa insuficientă a atacurilor cele mai eficiente impotriva unei aparari neorganizate şi frecventa realizarilor in atac din poziţii clare, impotriva unei aparari organizate. Atacurile bazate pe cooperarea unui grup de jucători şi combinatii colective sunt mai frecvente, dar mai puţin eficiente decât atacurile bazate pe acţiuni individuale.

Din rezultatele acestui studiu experimental ,considerat ca un exercitiu in handball , sa constatat că V % (coeficient de variabilitate) ar putea fi folosit pentru a descrie cantitativ şi calitativ ,comportamentul tactic al echipei în tipuri distincte de tranziţie .

Rezultatele cercetării pot îmbunătăţi performanţa tactica şi de formare a unei echipe, astfel încât în pregătirea lor sa fie acordată mai multă atenţie celor mai eficiente acţiuni tactice.

ABSTRACT

Handball is a team sport characterized by a fast intertwined and dynamic interactions between players, and a deeper understanding of this complex dynamic spatial interaction is required in order to serve the interests of both academic and sports agents.

To this end we did a sample analysis of 70 matches in two seasons of the first Romanian mens handball league

The results of the research show the insufficient presence of what are otherwise the most efficient attacks on an unorganized defence and the frequent realisation of short position attacks on a set defence.

Attacks based on the group co-operation of a smaller number of players and on the collective combinatory activity are more frequent but less efficient than attacks based on individual actions.

From the results of this experimental study, where an actual handball exercise was considered, it was found that the V % (variability coefficient) could be used to quantitatively and qualitative describe the tactical behavior of the team in distinct types of transition.

The research results can improve the tactical performance of a team and training practice so that in their tactical preparation more attention is paid to the most efficient tactical actions.

THE EFFICIENCY OF ELEMENTS OF COLLECTIVE OFFENCE TACTICS IN HANDBALL

INTRODUCTION

Handball is a sport game characterised by a clearly defined goal: scoring as many goals and conceding as few as possible. The achievement of this aim is determined by technical and tactical knowledge , the physical potential, morphological features and intellectual/emotional characteristics of a player, the opponent's performance and external influences of the environment. Scoring or, alternatively, preventing the opposition from scoring, not only depends on the activity and abilities of the player immediately engaged in finalisation, but is also largely the result of the cumulative actions of other players and their co-ordinated group and collective actions. Therefore, the results in a handball game are determined by numerous factors, where the performance efficiency of tactical actions assumes an important role. Tactical activity is an essential characteristic of sport games, manifested in situation-related competitive circumstances, and it can also be defined as the planned and premeditated managing of all system dimensions to achieve the aim, i.e. to win in the framework of the current conditions and confronting opponent's activity. Tactical performance is used to purposefully apply all of the available potential in a way least suitable for players from the opposing team in terms of time and space. This assumes the optimal use of the specific qualities of every individual by assigning tasks compatible with their abilities and in appropriate time and space terms, depending on the confronting activities of players in the opposing team.

Previous researches in this area were mostly based on the basic detection of individual technical/tactical indicators, most frequently elements of the final attack, without any serious intention to try to establish their efficiency in relation to certain situation-related criteria.

A certain number of previous researches were based on an analysis of the presence of technical/tactical elements in relation to players' positions Technical/tactical elements were equally analysed with regard to time span , but also with regard to the efficiency of their implementation in competitive circumstances.

A few researches analysed differences in technical/tactical elements in relation to the classification of teams in qualitative groups at competitions (Brčić et al. 1997; Rogulj, 2001; Apitzs et al. 1997; Taborsky 2008) or to the influence of technical/tactical elements on the match outcome, while far fewer researches focused on analyses of the latent structure of technical/tactical elements.

By summarising researches in the technical/tactical area, we can gain an insight into previous development of the handball game since it is evident that contemporary handball is characterized by the emphasised tactical variability and variety of game elements, abundance of technical elements, intensification and dynamicity of the game and the dominance of players' physical potential. This is directly reflected in the reduction of technical mistakes with the ball in the attack phase, an increase in the number of shots from longer distances, the more significant influence of defence elements in the structuring of the match outcome, a rise in the number of fast attacks and, generally, the performance efficiency of the attack finalisation.

However, not enough researches analyse the efficiency of implementing individual and particularly group and collective tactical performances in competitive circumstances.

Starting with the importance of establishing tactical efficiency for everyday training competitive practice, the subject of this research is an analysis of the realization efficiency of collective tactical elements in attack, as the dominant factor of good results in handball.

Problems in the analysis of sports games

Analysis of literature shows that – based on fast technological development in the area of computers, video etc. – a large number of methods have been developed to analyse the tactical structure of sports games (Winkler & Freibichler, 1991; Loy, 1994, 1995, 1996a, 1996b; Bernwick & Müller, 1995; Müller & Lorenz, 1996; Remmert & Stein2 höfer, 1998). Most of these game analysis methods use structure oriented observation models. They enable for registering isolated elementary actions of a match, but do not allow for obtaining data about the match process – i.e. about tactical behaviour or concepts (Perl, 2002, p. 92). The elementary actions of a sports game only form the static information basis for the actual play dynamics, which can be monitored and described only by the tactical context and interactions (Hein, 1993, p. 136).

In order to achieve deeper insight into the tactical match structure or the tactics of a team it is necessary to record the substantial tactical actions in a chronological, sequential order. By means of a process oriented model concept the sequence of the structural components (here tactics) - and therefore the tactical behaviour – can be considered (Perl & Uthmann, 1997, p. 54). In a process oriented model the match is characterized by a sequence of events and event-based temporal changes of the system's state. Play phases or temporal tactical behaviour can define states while events are defined by the player's actions or the team's activities, i.e. by tactical actions. It can be distinguished between two kinds of process oriented models, namely the state-transition-models and the state-event-models. If the analysis focuses on the change of states, a state-transition model can be used without the indication of event data. In sport game research state transition models are applied to analyse transition probabilities in the course of the

match (Lames, 1991, Remmert, 2002, Zhang, 2003, Pfeiffer, 2005).
Regarding the sport games research up to now it turns out that – despite the detailed structural resolution – the process of the play structure can only be represented on a high level of abstraction if transition probabilities are to be used (Perl & Uthmann, 1997, p. 59).

MATERIALS AND METHODS

Sample of entities

The research was conducted on a sample of 70 matches of the First Romanian Handball mens League in the 2012-2014 seasons, which represents a total number of 120 mutually opposed periods of tactical activity.

Sample of variables

The sample of variables consisted of 19 elements of collective attack tactics describing the duration, continuity, systems, structure and spatial direction of an attack. As a starting point for defining the prediction variables system, we used qualitative analyses of the structure of tactical activities in a handball game where tactical elements were systemised on a theoretical and empirical basis.

ATTACK DURATION :

1 (CATT) NUMBER OF COUNTERATTACKS

a type of attack against an unorganised defence satisfying the following conditions:
– a maximum of four passes, including the goalkeeper
– the longest duration is 5 seconds from the moment of recovering the ball
– at the moment of shooting at the goal, none of the defence players is in front of the attacker

2 (PC) NUMBER OF PROLONGED COUNTERATTACKS
a type of attack against a partially organised defence satisfying the following conditions:
– the attack lasts a maximum of 10 seconds
– all players from the opposing defence have not formed the defence activity within the applied system

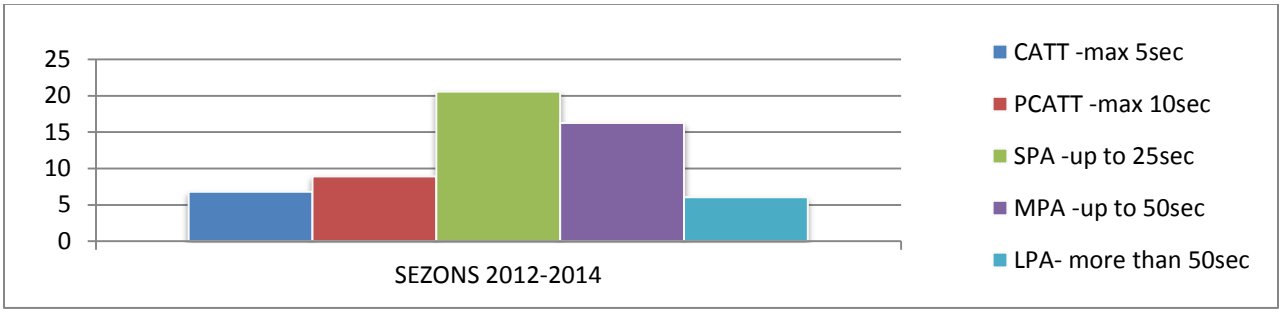
3 (SPA) NUMBER OF SHORT POSITION ATTACKS
an attack against an organised defence lasting up to 25 seconds

4 (MPA) NUMBER OF MEDIUM POSITION ATTACKS
an attack against an organised defence lasting up to 50 seconds

5 (LPA) NUMBER OF LONG POSITION ATTACKS

an attack against an organised defence lasting more than seconds

- ***Duration and efficiency in attack***



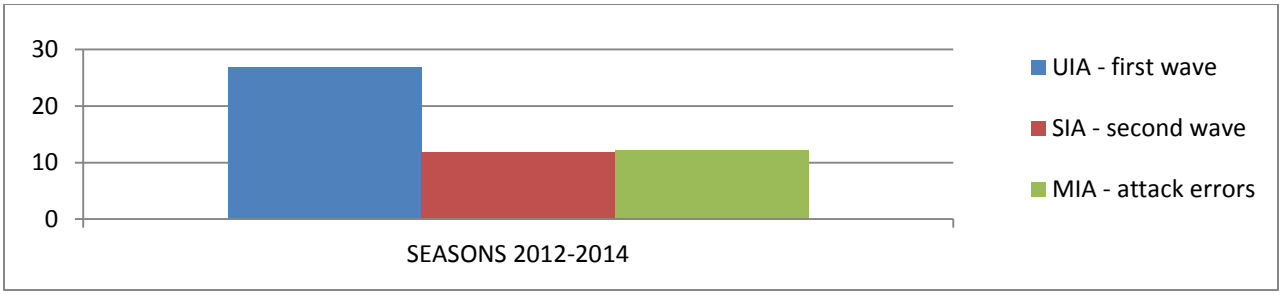
ATTACK CONTINUITY

6 (UIA) NUMBER OF UNINTERRUPTED ATTACKS
a continuous aspect of an attack that ends in the first wave by scoring a goal or losing the ball

7 (SIA) NUMBER OF SINGLE INTERRUPTION ATTACKS
a discontinuous aspect of an attack interrupted on a single occasion by the opposing team or the attacker's error, thus ending in the second wave

8 (MIA) NUMBER OF MULTIPLY INTERRUPTED ATTACKS
a discontinuous aspect of an attack interrupted on several occasions by the opposing team or the attacker's error

- ***Attack continuity , interrupted attack and attack errors***



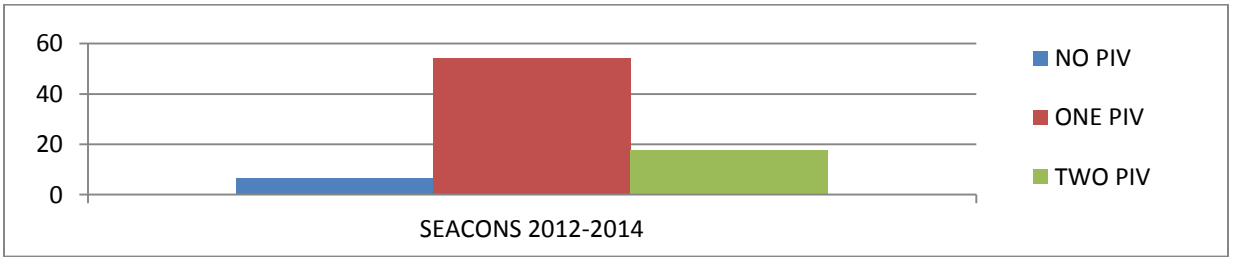
ATTACK SYSTEMS

9 NO-PIV NUMBER OF ATTACKS IN A GAME SYSTEM WITHOUT A LINE PLAYER/ PIVOT
a game system comprising two wing and four back players

10 ONE-PIV NUMBER OF ATTACKS IN A GAME SYSTEM WITH ONE LINE PLAYER/ PIVOT
a game system comprising three back, two wing and one pivot players

11 TWP-PIV NUMBER OF ATTACKS IN A GAME SYSTEM WITH TWO LINE PLAYERS/ PIVOTS
a game system comprising two wing, two back and two pivot players

- ***The systems used in attack and their effectiveness***



ATTACK ORGANISATION

12 (GCOOP) NUMBER OF GROUP-CO-OPERATION-BASED ATTACKS
a partially organised attack based on the group co-operation of a few players, where the position and activity of the remaining players have no direct influence on the engaged group activity

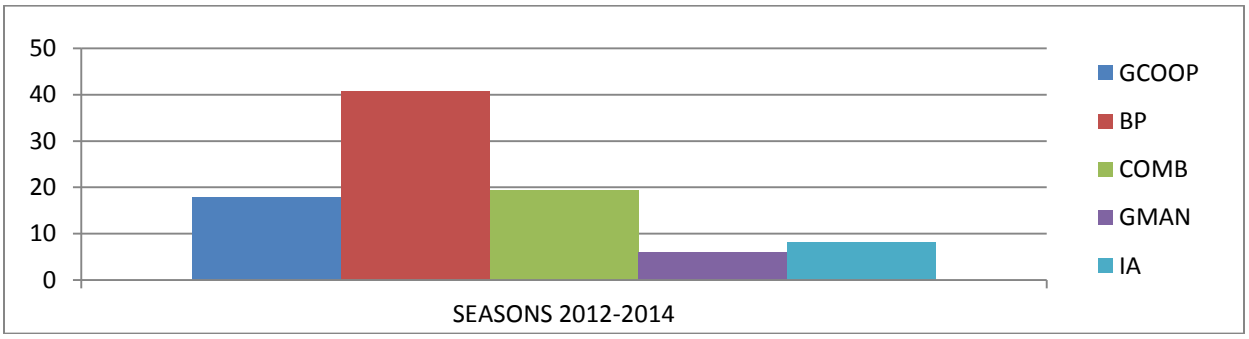
13 (BP)NUMBER OF BASIC-PRINCIPLES-BASED ATTACKS
an organised attack performed by all or almost all players based on elementary tactical principles of width, depth, ball speed and successive gaining the spatial-temporal advantage

14 COMB NUMBER OF COMBINATION-BASED ATTACKS
an attack organised on the basis of combinations in which players change their positions within predetermined actions

15 (GMAN) NUMBER OF GROUP-MANOEUVRING-BASED ATTACKS
an attack based on the group co-operation of a few players on the principle of combinations, i.e. defined actions with the obligatory exchange of playing positions

16 (IA) NUMBER OF INDIVIDUAL-ACTION-BASED ATTACKS
an attack based on an individual action, i.e. an individual's effort to finish the attack

- ***The efficiently of organized attack***



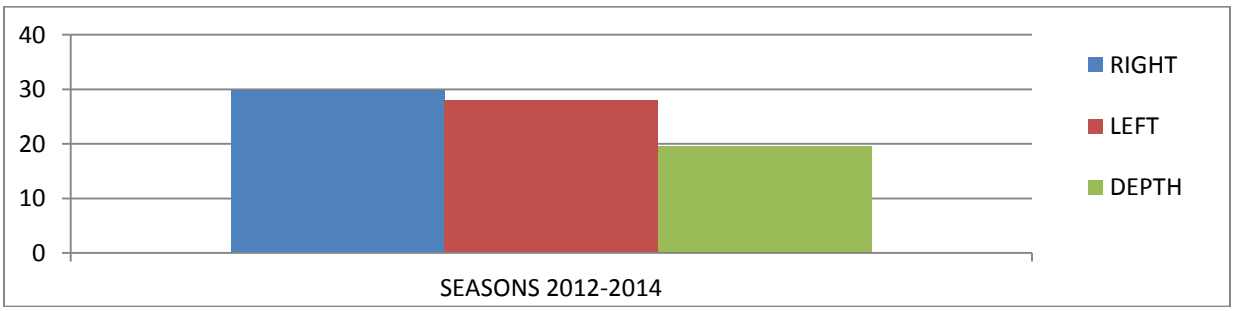
ATTACK DIRECTION

17 RIGHT NUMBER OF RIGHTWARD ATTACKS
the course of an attack, i.e. the ball trajectory is directed from players positioned left to right

18 LEFT NUMBER OF LEFTWARD ATTACKS
the course of an attack, i.e. the ball trajectory is directed from players positioned right to left

19 DEPTH NUMBER OF IN-DEPTH DIRECTED ATTACKS
the course of an attack, i.e. the ball trajectory is directed in depth, from players positioned at the back to the line
Registering the tactical elements in the handball matches was carried out through the observation of video recordings of the matches. Among the position attacks that were interrupted by the opposing defence, each segment was analysed separately. The data in the form of corresponding abbreviations and symbols was manually entered into specially designed forms suitable for computer entry.

- ***Direction and efficient sharing of attack***



Data processing methods

We determined standard descriptive and distribution statistic parameters. To establish the significance of the differences inside the criterion groups, we employed multivariate variance analysis , and a discrimination analysis with appropriate parameters.
Entities were classified in two qualitative groups with regard to the realisation efficiency criterion in competitive circumstances: elements which resulted in a scored goal or a forced 7m penalty shot (efficient), and elements which resulted in a missed goal and the loss of the ball (inefficient).

RESULTS

The basic description parameters of the variables are presented in Table 1. All variables showed a normal distribution, with a mild positive asymmetry being more pronounced in the variables *number of attacks in the game system without a pivot player* (NO-PIV) and *number of individuallaction- based attacks* (IA).
The coefficients of variation were satisfactory, with the exception of the already mentioned variables that showed a high level of dispersion.

Table 1: Basic description and distribution parameters of the prediction variables

	VAR	XA	min	max	sig	V%	a3	a4	md	Z1%	Z2%	m
	VARIABLES OF COLLECTIVE ATTACK TACTICS											
1	***CATT***	6.38	0	19	3.68	54.28	0.73	0.47	0.11	6.93	11.55	*
2	***PCATT***	8.91	1	18	3.93	44.11	0.24	-0.58	0.09	9.11	15.18	*
3	***SPA***	20.57	7	39	5.29	25.72	0.06	0.14	0.06	21.02	35.04	*
4	***MPA***	16.24	6	26	3.65	22.48	0.04	0.15	0.06	16.60	27.67	*
5	***LPA***	6.02	0	16	3.05	50.66	0.51	-0.18	0.11	6.15	10.26	*
6	***UIA***	26.84	9	46	7.69	28.65	0.23	-0.58	0.07	27.43	52.82	*
7	***SIA***	11.84	0	20	3.82	32.26	-0.36	0.83	0.10	12.10	23.30	*
8	***MIA***	12.13	1	28	4.87	40.15	0.38	0.10	0.08	12.40	23.87	*
9	***NO-PIV***	6.51	0	30	4.79	73.58	1.59	3.78	0.15	6.65	8.29	*
10	***ONE-PIV***	54.24	14	105	16.19	29.85	0.20	0.13	0.06	55.43	69.06	*
11	***TWP-PIV***	17.79	2	52	8.86	49.80	0.88	0.9	0.10	18.18	22.65	*
12	***GCOOP***	17.96	4	37	7.63	42.48	0.51	-0.47	0.08	18.35	19.57	*

13	***BP***	40.60	20	81	10.92	26.90	0.90	1.23	0.07	41.49	44.25	*
14	***COMB***	19.30	4	38	6.30	32.64	0.14	-0.11	0.07	19.72	21.04	*
15	***GMAN***	5.94	0	29	4.11	69.19	1.75	5.39	0.17	6.07	6.47	*
16	***IA***	7.95	0	21	4.70	59.12	0.58	-0.31	0.12	8.12	8.66	*
17	***RIGHT***	29.83	15	56	8.19	27.46	0.39	-0.120	0.06	30.49	38.55	*
18	***LEFT***	27.96	10	52	7.82	27.97	0.30	0.04	0.65	28.57	36.13	*
19	***DEPTH***	19.59	7	41	5.73	29.25	0.76	1.90	0.08	20.02	25.32	*

Legend: Arithmetic mean (***XA***), value of the minimal and maximal result (***MIN***, ***MAX***), standard deviation (***SIG***), variability coefficient (***V%***) – SIG/XA*100 (V%), asymmetry coefficient (a_3), distortion coefficient (a_4), maximum deviation of the relative cumulative empirical frequency from the relative cumulative theoretical frequency (***md***), variable percentage in relation to the total number of match segments (***Z1%***), variable percentage within a related group of variables (***Z2%***) and a mark for multivariate processing suitable variables (***m***).

Table 2- presents the results of the variance and discrimination analysis of differences in the performance efficiency of collective attack tactics.

VAR	**XA1**	**XA2**	**F**	**p**	**effect%**	**STRUC**
CATT	2.46	3.56	22.88	0.00	59.14	0.26
PCATT	3.03	3.13	0.21	0.65	50.81	0.03
SPA	10.41	10.16	0.39	0.53	49.39	-0.03
MPA	8.52	7.72	6.90	0.01	47.53	-0.14
LPA	3.46	2.56	15.97	0.00	42.58	-0.22
UIA	14.01	12.83	5.21	0.02	47.79	-0.13
SIA	6.02	5.82	0.51	0.48	49.15	-0.04
MIA	6.47	5.66	6.34	0.01	46.63	-0.14
NO-PIV	1.89	1.16	22.29	0.00	38.03	-0.26
ONE-PIV	14.00	13.34	2.01	0.16	48.79	-0.08
TWP-PIV	5.03	4.53	2.90	0.09	47.39	-0.09
GCOOP	4.77	5.34	4.30	0.04	52.82	0.11
BP	11.86	10.99	4.25	0.04	48.10	-0.11
COMB	5.66	4.90	8.00	0.00	46.40	-0.16
GMAN	1.33	1.74	8.72	0.00	56.68	0.16
IA	2.14	1.94	1.26	0.26	47.55	-0.06
RIGHT	8.38	7.44	8.50	0.00	47.03	-0.16
LEFT	7.71	6.91	6.27	0.01	47.26	-0.14
DEPTH	5.38	7.07	31.68	0.00	56.79	0.31

AM1- arithmetic means first group (unsuccessful), AM2 - arithmetic means second group (successful), F - F values of statistical significance testing, effect% - variable percentages of effective implementation of the elements, STRUC – correlations of variables with a discriminative function.

DISCUSSION

In team sports, the interpretation of game performance has motivated researchers and coaches to develop tactical indicators associated with sports success (Massuça, 2009). In handball, as in basketball, fast break efficiency is the main factor determining success among teams of the same level (Yang, 2006; Fernandez, 2009).

Creating a model of a handball game is a priority of the epistemological investigative work of coaches (Alexandru, 2009). Based on the causal model of performance, it was stated that handball performance results from the complex capacity of combining a set of capabilities (e.g., mental, physiological, technical). These capacities create different and complex actions to solve the problems throughout the game, and within this context, they are essential to present a balanced domain of the factors that influence sports performance (e.g., morphological, physical, technical, tactical and psychosocial) (Massuça 2009

All the variables showed a normal distribution with a mild positive asymmetry being more pronouncedin the variables number of attacks in the game system without a pivot player (NO-PIV) and number of individual-action-based attacks (IA). That was probably due to the low frequency of these variables.

The realisation of an attack finalisation through an individual action is not frequent in the game, and neither is an attack in the system without a pivot. The implementation of an individual action is determined by the specific circumstances of a game, when a defence player is alone in a large space and is far enough from the goalkeeper's line and neighbouring defence players, while the game system without the pivot is mostly applied when there are fewer players in an attack compared to the full formation of defence players.

When analysing the attack duration, the frequency of the counterattack is lower than in the sample of World Championship matches where there were 7.81 counterattacks on average. This may be the result of greater equality, i.e. smaller differences among the teams' qualities in the First Romanian Handball League 6,38 than among national teams at the World Championship.
The emphasised polarisation of teams' values is present among the teams that participate in big international competitions where other national teams with an inadequately developed handball game also take part, and the number of realised counterattacks is the most reliable indicator ofdifferences in the teams' qualities.

The attack continuity analysis shows the dominant frequency of non-interrupted attacks, i.e. in more than half of the cases the attack actions finish in the first wave. On one hand, this is the result of insufficient engagement and defence efficiency, i.e. the attempt of the attacking players to materialise an advantage over an unprepared defence as soon as possible.

The game system with one pivot is the most frequently used in attack. This system enables thecompletion of all three elementary game principles in attack: width (widely set wings), density (equally set outer players), and depth (co-operation with the pivot), it also enables optimal the usage of space and can be used against almost all defences. The implementation of other game systems in an attack is determined by the type of the opponent's defence. Hence, the game system with two pivots is most frequently used against deep defence formations when playing needs to be enhanced on the goalkeeper's line where such defences are the most fragile, while the game system without a pivot, as stated, is the most frequently used when a team is playing in the attack with a smaller number of players with regard to the full formation of the defence players.

The dominant frequency of an attack based on group co-operation proves the fragmentation and isolation as well as the insufficient balance and fluidity of attack actions, unlike the tactical concept of the game in the world's top national teams based on collective performance and basic principles of the game. The lower frequency of individual attacks on a set defence is the result of its rare implementation determined by specific situation-related circumstances and is, in most cases, a reflection of the inferiority quality and tactical insufficiency of the attacking team compared to the defence.

Rightward attacks are somewhat more common than leftward ones since they are technically/tactically more suitable for performing considering that teams have more right-handed than left-handed players. For right-handed players, keeping and distributing balls during fake shooting at the goal is far more convenient on the right side due to them shielding the ball from the opponents with their bodies.

Following the difference analyses results, we determined that the efficiency of an attack decreases the longer it goes on. This is understandable since the opposing defence is the weakest at the beginning and cannot show its maximum potential, most often is not formed in an organized system or is incomplete with regard to the number of defence players engaged and thus the attacking players most easily create a favourable opportunity. In a prolonged attack, the defence activity of opponents is stabilised and adapted to attack actions, especially if they are repetitive and stereotyped.

Counterattack efficiency is particularly emphasised as it is the aspect of attack actions where the opposing defence nearly does not confront at all, and finalisation is performed from a close range, most frequently without any defence players being present.

We had even expected greater than the just over 50% higher counterattack efficiency compared to the efficiency determined for the sample of World Championship matches. We can assume these differences are the result of the physical and technical/tactical inferiority of players in the First Romanian Handball League compared to the players who took part in the World Championship. The idea of the greater efficiency of shorter attacks on an unorganized defence compared to other prolonged position attacks on a set defence is somewhat proven by the attack continuity variables, where discontinuous attacks, multiply interrupted by opposing defence actions, show the lowest efficiency.

Srhoj et al. (2001) analyzed the influence of eighteen predictive variables on the outcomes of eighty top level handball games, to establish the significance of positional direction of the attack end on successful plays. The frequency and the effectiveness of shooting from different playing positions were defined by these predictive variables. They reported that the pivot attacker position, the break-through and fast break shoots had significant influences on resulting success (Srhoj et al., 2001).

As far as the attack system is concerned, the emphasised inefficiency of the system without a pivot, compared to the systems with one or two pivots, is primarily the result of the fact that the attack in the system without a pivot is mostly used when a team plays with one player less compared to the full formation of defence players, and this is when the attack efficiency is generally lower due to the lack of players. In a game with the same and the full number of players, a system without a pivot is almost never used, which only proves that in practice they recognise the importance of depth-directed attacks, which is achieved through the co-operation of the outer players and pivots.

With regard to organisational aspects, an attack based on individual action stands out most for its efficiency. However, this variable includes attacks on an unorganised defence, i.e. counterattacks with the highest percentage of efficiency. An attack based on individual actions, in terms of the breaking through, is particularly efficient when low quality teams intentionally, with tactically justified reasons, engage in a prolonged and non-dynamic attack against a higher quality team and then suddenly apply an individual action as somewhat of a surprising element against a passive defence. We should also take into consideration that in an individual action an attacking player possesses remarkable inertial potential that enables him to efficiently finish from a close range.

An attack based on basic principles of the game in attack also displays a high level of efficiency. Basic attack activity founded on the principles of width and depth of the attack, fast movement of the ball and successive creation of spatial advantage by engaging the defence players shows good efficiency and is a reliable indicator of a quality attack organisation. This basic simple activity is a characteristic of quality teams which manage to spatially/temporally optimise themselves, i.e. purposefully balance the movement of an attacking player and the ball in relation to the defence players. A combinatory activity in an attack in which a certain group of players or all of them take part, although more complex from the kinesiological point of view, is less efficient than a simple basic attack.

The implementation of combinations in terms of the frequent changing of players' positions and stereotyped moving is the primary and dominant form of tactical action in less quality teams, being a result of the inability to perform an attack based on elementary principles. In quality teams, combinatory activity only comes as an addition to the basic attack, most frequently when played with a bigger or smaller number of attacking players in relation to the defence players.

Situational efficiency of players, or of a team, can be observed in different phases and subphases of play during a match. The main phases of handball play are attack and defense, depending on ball possession. Two transitional phases, the phase of returning to defense and the phase of a counter-attack, are derived from the main phases (Gruiç, 1997).

The depth component of an attack activity showing dominant efficiency in relation to a width directed attack is most frequent in an attack on an unorganised defence, i.e. a counterattack and a prolonged attack. During a position attack on a set defence, the depth of the attack is achieved by vertical movements of the outer attacking players in terms of a run-up to the goal and by co-operation between the outer and line players, primarily pivots. In both cases, the player who

performs the finalisation of the attack is most frequently in a favourable situation, possesses an emphasised inertial potential and shoots from a close range, which enables a high level of efficiency in the realisation.
The results of the research, we can conclude the performance of collective tactics in an attack recognised as efficient in competitive conditions should be based on the performance of as many as possible fast attacks on an unprepared defence and on short position attacks, emphasising a deep orientation towards the line players, primarily the pivot, and the organization of simple attacks based on primary principles and individual actions.

By summarising new trends in technical, strategic and fitness development of handball require new technical and motor characteristics of handball players. Handball increasingly requires players to be quicker, more dynamic, versatile in both attack and defense, technically qualified, able to play at each position at least for a short time and to have excellent game perception (Pokrajac, 2007; Taborsky, 2008).

CONCLUSIONS

In this study (one team of Romanian first handball league in two seasons) we determined the performance efficiency of 19 elements of collective tactics describing the duration ,continuity, systems, organisation and spatial direction of attacks in competitive circumstances. We used an analysis of variance and discriminant analysis with appropriate parameters. The results of the research show the insufficient presence of what are otherwise the most efficient attacks on an unorganized defence and the frequent realisation of short position attacks on a set defence.
No significant differences were established in efficiency between the game systems involving one as opposed to two pivots, while the system with no pivots was the least efficient. Attacks based on the group co-operation of a smaller number of players and on the collective combinatory activity are more frequent but less efficient than attacks based on individual actions. Attacks directed at depth with an attempt to finish from line positions (6m) are significantly more efficient than attacks directed at width. The research results can improve the tactical performance of a team and training practice so that in their tactical preparation more attention is paid to the most efficient tactical actions.

In order that such cumulative analyses could be effective in the future, they should provide the coaches and the players with feedback. Considering the findings of the present research, significant statistical differences leading the teams to success are based on the fast break tactics and throwing preferences of the teams in the set offense. Coaches should plan not only tactical training programs but also programs considering the physical, physiological and psychological strength of the players that can endure such an intensive tempo in order to improve the efficiency of the attacks. On the other hand, preferences regarding the positions of the players should be reflected in the practice sessions. Moreover, coaches should consider these variables of success in long-term planning, and apply them in the training of youth players while they raise the elite handball players of the future.

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3 – 2 – 1 DEFENSE

(“BACK TO BASICS”)

Author: Djukic M. Dragan (SRB) Head Coach of Israeli National Team

Summary:

The main reason to choose this subject was the fact that even today, after so many years of "launching" in the world of handball, (Yugoslavian national team led by Mr. Vlado Stenzel - at the Olympic Games in Munich in 1972), there are so many misunderstandings and different interpretations of basic principles of this defense system and at the same time very little literature that deals the analysis and explanation, often resulting in different interpretations of some “basic” principles - even within the members of "Yugoslavian school of Handball", which leads to even more "mystery" and lack of understanding.

I will try, in the pages that follow, to give some basic interpretation, the names and "solutions" to the questions that are imposed, so that even those of us who were contemporaries and witnesses of the original "version", are reminded on some basics and somehow 'forgotten' attitudes and details.

I am aware that at the same time I'm personally also coming into a situation that presents my own "local version" and really hope that this paper will provoke some more serious analysis that will minutely analyze all basic foundations and definitions, which make this great idea, "old" more than forty years, adorned in new splendor and passed on to the new generations, all with the goal of better understanding and further development of this beautiful game called handball.

Keywords:

- The basic principles of defense systems

- Systematization of tech. - tact. preparation

- Requirements

- Characteristics - by positions

- Counterattack - development and prevention

INTRODUCTION:

Reason why we should start with one very important and the game itself a crucial factor that determines the choice of defense systems often put to the side and (in my opinion!)-a key determinant - is primary SELECTION!

Very often, when we select players - in general for handball or for our own team, we choose one with a higher level of technical proficiency primarily for playing in the attack, and at the same time we "do not care" about requirements necessary for specific individual place in defense. This later leads us to a situation that - we either cannot play some defense systems (players by their anthropological characteristics can not meet the requirements necessary to play on their "exact" place), or to change almost the entire lineup (two or more players) - between attack and defense, which significantly disrupt the rhythm of the game, and lead our own team in risky situations - offer opponents counterattack as a "weapon" for easy goals etc. etc.

On the other hand, the lack of money (excuses that we hear most often in recent years!), leads to the fact that the process of selection is done differently than in the past (unclear criteria, often by some "other" reasons), which introduces us into a vicious circle from which it is difficult to see a clear exit.

(Lack of finance = Fewer really talented kids in handball = Reduced criteria for selection = Results going down = Less interest of new children for the handball = Standards and criteria go to lower level = Lack of finance...)

We must, at the same time, clearly say and remember the ways of selection in other areas (consider art!), and help the parents and children with clear criteria for selection to find themselves in what they really love. Love of the handball game is what every handball expert should and must convey to all those who come to the sport, but without putting the selection criteria "under the carpet" We are really lucky that in our sport there are so many different roles (from the goalkeeper to the pivot), and we can find a corresponding role for each young kid, but the selection method should be clearly set requirements in front of young players what is necessary to have to be successful. Giving "false hope" does not lead to the honest relations in the future.

Step, which we in some previous time lost compared to other sports (water polo or football as an example), we can capture with opportunities what "mini handball" provides. Accordingly, we must clearly tell the whole world of sports, that possibilities that handball can offer, almost no other sport can offer for the complete children's development, and it is our advantage that we need to constantly point out.

Of course, that during all that time, we have a clear picture of selection model and prediction of the development of players, as well as everything that the development of the game in a future will bring us. Today, we select the players who will play handball at the top level 10-15 years from now, this means they must be willing and able to play probably different defensive systems, the offensive actions against those same etc. etc.

The coach role in all of these things is crucial and irreplaceable and therefore our responsibility is even bigger in this process.

THE BASIC PRINCIPLES OF DEFENSE SYSTEMS

(Describing this part, I will try not to explain so deep every single detail, because it will lead me to the unnecessary width, which is not the subject of this work, and use the terms just as a way to put some of the elements necessary for clarification of the basic principles of 3-2-1 defensive system.)

For me, there are seven basic principles that each ("modern") defense must include:

- COLLECTIVITY (Syncronisation of all individual activity)

- AGRESSIVNESS (Pressure on player with the ball)

- OVERLOAD (Numerical «advantage» on the ball side)

- ANTICIPATION (predicting, estimating of next attacker activities)

- KEEPING ACTIVE POSITION (to stay “behind” attacker is a crucial mistake)

- COOPERATION WITH THE GOALKEEPER

-DISCIPLINE (Respecting the defensive principles)

In addition to these principles, there are also some basic requirements:

* INDIVIDUALISATION (*Players with good individual skills are easily embedded in any defensive system, and even the best defensive systems are based around individuals, every attack is always completed in a 1 on 1 situation!)*

* VERSATILITY *(of the players for defence and attack; playing without the ball - attack, defence; motivation to improve)*

* MOTIVATION TO PLAY DEFENCE *(“destroyers” like modern trend or ?)*

* SELECTION *(Do we have this game segment as a primary vision?)*

* REFEREES INTERPRETATION *(Why to train defense if we can use a “shortcut”!)*

SYSTEMATIZATION OF TECHNICAL - TACTICAL PREPARATION

(From the beginning I want to say that in modern handball we must clearly separate technical-tactical preparation of the players and the goalkeepers, and hereafter I will deal mainly with the technical and tactical preparation of the players!)

TECHNIQUE («teach» us HOW to do it!)

* BASIC STANCE («diagonal» defense stance like a basic in 3-2-1 defence)

* MOVEMENT in defensive stance (lateral and depth)

* STOPPING

* DIRECTIONAL CHANGES (with and without opponent)

* LANDING (after defensive action)

* AVOIDANCE of screen

* MOVING OUT TO HINDER OPPONENT

* MOVING OUT TO CLOSE THE SPACE

* GAINING THE BALL:
CUT PASSING DIRECTION, SWIPE THE BALL WHEN DRIBBLING, STEAL THE BALL WHEN DRIBBLING, BLOCKING

TACTICS (tell us WHEN to do it!)

INDIVIDUAL:

* COVERING: (ATTACKER, SPACE, BALL)

* GAINING THE BALL

* CONTROLLING ATTACKER

* PREVENTION OF THE FAST BRAKE

GROUP:

* HAND OVER – TAKE OVER

* COLLABORATION IN MOVING OUT AND CLOSING

TACTICS

We can divide tactics in general on:

* TACTICS IN DEFENSE

* TACTICS IN ATTACK

(From this moment I should speak more about tactics in defense because it is subject of this work, and tactics in attack will just be the part that talks about specific situations in attack against 3-2-1 defense).

TACTICS IN DEFENSE - almost all authors separate in three primary segments:

INDIVIDUAL:

* Covering the player
* Gaining the ball
* Intercepting the ball
* Obstruction
* Blocking
* Controlling the player
* Stopping the fastbreak

GROUP:

* Hand over/Take over
* Moving out to gain the ball
* Cooperation with the goalie
* Double/Triple blocking
* Collaboration moving out/closing
* Stopping the fastbreak

COLLECTIVE:

* Moving out to gain the ball
* Playing 5 v 6
* Playing 6 v 5
* Playing 5 v 5
* Stopping the fastbreak

Special part of the collective tactics in defense are DEFENSIVE SYSTEMS.
They can be divided into: ZONAL, INDIVIDUAL and COMBINED.

ZONAL DEFENSE SYSTEMS (6-0, 5-1, 4-2, 3-3, 3-2-1)

Each zonal defense system as its name suggests, tries to protect the area covered, and is based on strict rules. The main task is to protect the SPACE from attackers and bring them to attack from position that defense wants to "allow".
Strength: Good cooperation with the GK, more "economic" by saving energy, favourable position for start of fastbreak.
Weakness: more defensive by structure, opens the chance for attack on the 6m. line.

INDIVIDUAL DEFENSE SYSTEMS (6-0, 5-1, 4-2, 3-3, 3-2-1)

Oriented, as the name suggests to the single MAN, players in defense have to cover their "own attacker" in different ways: defensively, semi-offensively, offensively or in "man to man" version.
Strength: Useful against all attacking systems, increasing responsibility, player is "matched" in advance with opponent with similar technical-tactical individual quality.
Weakness: Un-economical and spend a lot of energy - lead players to fatigue, very complex transition to attack.

COMBINED DEFENSE SYSTEMS (5+1, 4+2, 1+5, 4-1+1)

Attempts to erase the weaknesses of these two different philosophy. Often played in superiority, when defense want to"mark" the shooter or playmaker.
Strength: Useful against all attacking systems, increasing responsibility, player is "matched" in advance with opponent with similar technical-tactical individual quality.
Weakness: Un-economical and spend a lot of energy - lead players to fatigue, very complex transition to attack.

Before all, maybe we should make some basic questions:

WHAT IS DEFENSE? WHEN DOES IT STARTS?

By themselves, impose three basic phases of playing in defense:

* STOP THE FASTBRAKE (individual, group, collective)

* PLAYING IN UNFORMED DEFENSE

* PLAYING IN ORGANIZED DEFENSE

MOST SUCCESSFUL HANDBALL NATION IN LAST DECADE

Like a part of this work I did a small research comparing results on the major handball competitions since 2005 until today (last ten years), and came up with interesting results.

Most successful handball nation in last decade (medal winners in last 12 major events – 2xOG, 5xECh, 5xWCh included), can be separate in two quality group:

LEVEL – I (medal winners at almost every big competition)
FRANCE, DENMARK, CROATION and SPAIN

LEVEL - II: (medal winners from time to time)
ICELAND, POLAND, GERMANY, SWEDEN, SERBIA

Motto: "Attack is the best defence" is changing to "Defence is the best attack"!

There is no recipe for a medal, not a dominant defense system that brings success and results, but fact is that the «secret ingredient» that gives results is just defense. France with 5-1, Denmark with 6-0, Croatia with 3-2-1 or Spain with their specific interpretation of 5-1, confirm that every well-placed defense system delivers the ultimate result. No big results without a good defense!

From analises we can also find some interesting facts and figures:

- No medal winners from non European countries!

- Descent from the world stage of the dominating nations in past: Russia, Romania... (order in 90-s: BEST by far Sweden and Russia, 2nd group of quality: France, Croatia and Spain, 3-rd group: Yugoslavia, Germany and Romania)

- „Waking up" of the big handball nations – GER, DEN, POL (through young age competitions!)

- Domination of France in last years („quadruple" crown 1st time in handball history – OG, WCh, ECh)

That gave us the right to say: MAIN FEATURE OF SUCCESSFUL HANDBALL NATIONS IS A SIGNATURE DEFENSE SYSTEM!

At the same time, this brings us to the question that each of us should first ask ourselves: What is a defensive system characteristic of our team, our nation!?

WHICH DEFENSE SHOULD BE CHOSEN?

Copy-paste "system" in this case would not lead to success! We saw from the preceding analysis that there is no defense that "guarantees" results, and to choose best defense system for your own team you need to keep some small "rules":

- CHARACTERISTIC OF (YOUR OWN) PLAYING STAFF

- CHARACTERISTIC OF YOUR OPPONENT

- PHYSICAL PREPARATION OF TEAM AND INDIVIDUALS

- PREPARATION TIME

Always keep in mind that 3:2:1 IS A PRIMARILY ZONE! That means to protect the space - independent from the number of players inside!

Like every other ZONE must satisfy 3 (on the end contradictory!) principals. To be:
* COMPACT (basic and most important),
* DEEP and
* WIDE

Here we immediately face with some prejudices that maybe were right in the past but now it would be foolish to think in that way, 3-2-1 is deep and aggressive, 6-0 shallow and densely defense etc..

(Let's be honest and say that MODERN 6:0 ALSO MEETS PRINCIPLES OF DEPTH, BUT BECAUSE MOVING OUT IS CARRIED OUT BY 4 PLAYERS HAS TO BE PERFECTLY COORDINATED (when one of the players is moving out - two players has to cover his back) and SOMETIMES MISTAKES HAPPEN (two players going out, nobody goes etc...)

WHY 3-2-1? HOW 3-2-1? WHEN 3-2-1?

WHY 3-2-1? Weaker against “stronger”, gives defenders an advantage!

Originally was created by YUG-coach – Mr. Vlado STENZEL, as a response to the domination of the Soviet school of handball, very tall players on back position with extreme physical potential what was almost impossible to stop with defense systems that were generally shallow and based on the blocks. The idea was (and still is!), to face this «giants» with fast players who can stop them before they start to attack at full speed - using their mobility and speed, turned «luck» into an advantage! Today's rules provide even greater advantage, because you can move in a counter-attack a lot earlier than in the past, even after conceding a goal.

HOW 3-2-1?

(pivotman is a “problem” of all – pass on; diagonal defensive stance – movement; reaction and movement with the ball)

BASIC PRINCIPLES:

- PROPER MOVEMENT AND PATHWAYS WHERE PLAYERS MOVE

- MOVEMENT WITH BALL (mutual reaction)

- CLOSING THE PASSING CHANNEL OF THE BALL

- CLOSING THE PLAYERS BREAKTHROUGH CHANNEL

Constant “dilemma” what should defender stop the PLAYER or the BALL?

Common TARGET, coordination, no misunderstanding, few errors - more success!

ADVANTAGES:

- only one TARGET – BALL, better teamwork
- clear individual and common tasks fewer possibilities for misunderstanding
- DEEP AND COMPACT creates conditions to assist the team-mates
- Successful against good SHOOTERS, make a difficulty to individual attacks
- advantageous position to start fast break

DISADVANTAGE:

- PHYSICALLY AND MENTALLY demanding
- demands DISCIPLINE and respecting the rules
- “offer” more chance for 6m shoots
- “bigger risk” of sanctions

There is no need to transform to another def system when attack plays 4:2(with 2 PV), uncertainty coming from BAD PHYSICAL PREPARATION for LACK OF TEAM COORDINATION!

REQUIREMENTS:

- EXTREME PHYSICAL PREPARATION

- EXCELLENT FOOTWORK (Player in defence NEVER STOPS! Something like in boxing, good defense coming with the “sounds from the shoes”)

- KNOWLEDGE OF COMPLETE TACTICAL TASKS (of your own team, opponent)

- KNOWLEDGE OF INDIVIDUAL TACTICAL TASKS (your own, opponent)

- SYNCHRONIZE (small details) AND COMMUNICATION!

Something that is definitely specific of this defense system is that: “THRIVES” FROM AGGRESSION (“attacking” attackers!)

In my opinion defense is the easiest way to bring the player onto the court! Why then young players just "like" to attack?

POSITIONS:

As the name suggests, the players are based in three lines. The first line is made up of three players (OL/OR and C), second from two (LH / RH) and third one from only one (FC). It should be pointed that players are in exact 3-2-1 position, only in a situation when playmaker is in ball possession!

LINE «3» (OL/OR and C)

* OUTERS (“back's”, OL/OR) – Use lateral movement on 6m. Prevent penetration of the winger, and help to compress, help about the PV when the ball is on the opposite side.

* CENTRE (C) - Use lateral movement on 6m. Conductor and Corrector, always between the ball and goal, primary blocker and direct “cover” of the PV. ”Sweeper”!

LINE «2» (LH and RH)

* HALFS (LH/RH) - Prevent the shoot and breakthrough of back players, prevent diagonal pass to the PV, movement is the shape of the number ”1” and opposite («1» in mirror)

LINE «1» (FC)

* FRONT-CENTRE (FC) – Responsible for PM, help to both half’s and prevent pass to the PV, have a widespread perception, make plenty fouls, good peripheral vision and NEVER GIVES GROUND!

CHARACTERISTICS BY POSITION

Characteristics - for all positions:
Common tasks required for effective system: Prevent direct shot from opponent; Prevent passes to the 6m. line; Prevent feints and breakthroughs.

1-st Line of defense (Outers and C)

(Basic: Side movement on the 6m. line, 2-nd wave in fastbreak)

CENTRE:
* COLLECTIVE SENSE
* EXPERIENCE
* TACTICAL INTELLIGENCE
* GOOD IN COVERING AND ANTICIPATING
* EXCELLENT IN BLOCK
* EXCELLENT LATERAL MOBILITY
* HIGH LEVEL OF SPECIFIC ENDURANCE

OUTERS:
* COLLECTIVE SENSE
* SPEED AND INTUITION
* GOOD ONE VS. ONE
* SPECIFIC ENDURANCE

2-nd line of defense (LH/RH)

(Basic: aggressive against the player with the ball, help to cover the PV when the ball is on the opposite side - pass on/takeover, first wave in fast break).

* SPEED AND GOOD ACCELERATION IN SHORT DISTANCE
* GOOD IN BLOCK
* GOOD ONE VS. ONE WITH AND WITHOUT FOULS
* GOOD IN AVOIDING SCREENS

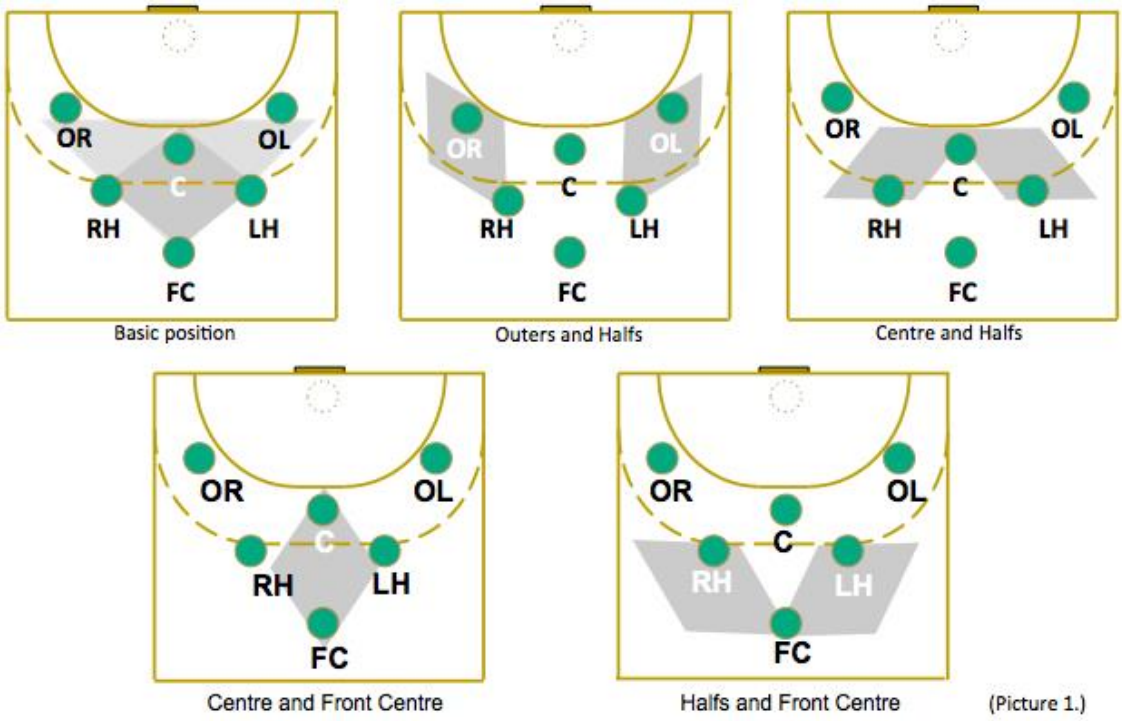
3-rd line of defense (FC)

(Basic: wide perception, aggressive to the ball channel and attackers, special role to correct mistakes, 1-st wave in fastbreak)

* SPEED OF MOVEMENT AND INTUITION
* GOOD ONE VS. ONE WITH AND WITHOUT FOULS
* GOOD AGILITY
* GOOD ENDURANCE
* HAVE SPEED AND CAPACITY TO STOP ALL TYPES OF FEINTS
* GOOD IN BLOCK
* GOOD IN AVOIDING SCREENS

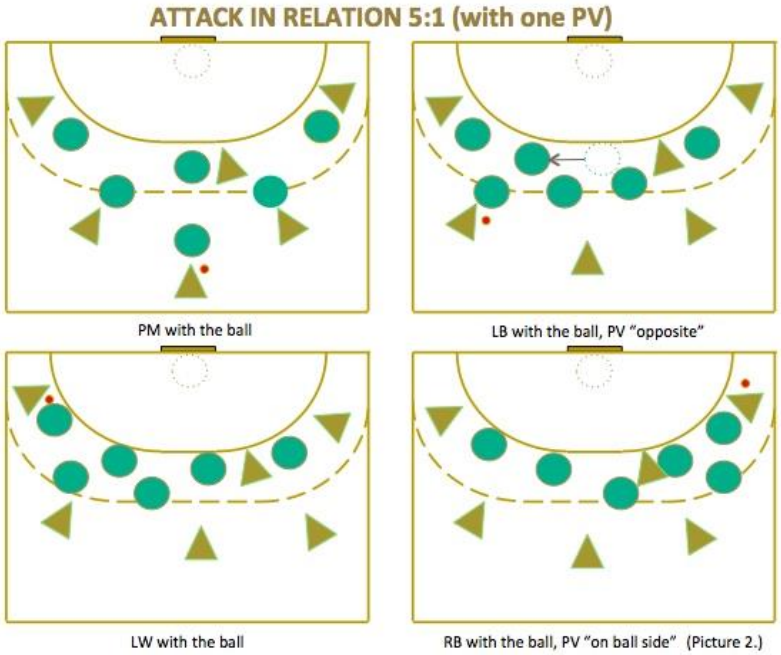
COOPERATION IN DEFENSE:

Dynamics of 3:2:1, require respect of the principles of cooperation and mutual assistance. Efficiency of the system is the product of synchronized action of all players, from the geometrical point of view it is in the form of a parallelogram or “concentric triangles”, always pointing at the player with the ball.
In picture no. 1 we see different situations how 3-2-1 formation behaves in accordance to the attackers activity - the movement of the ball. Gray marked space shows us cooperation - correlation between "adjacent" places in defense.



(Picture 1.)

3-2-1 AND ATTACK WITH ONE PIVOT - Most of the analyzer find 3-2-1 defense like pretty strong when attack play in relation 5-1 (with one pivot), let’s see position of the defenders in relation of the ball movement – picture 2. show us four typical situations

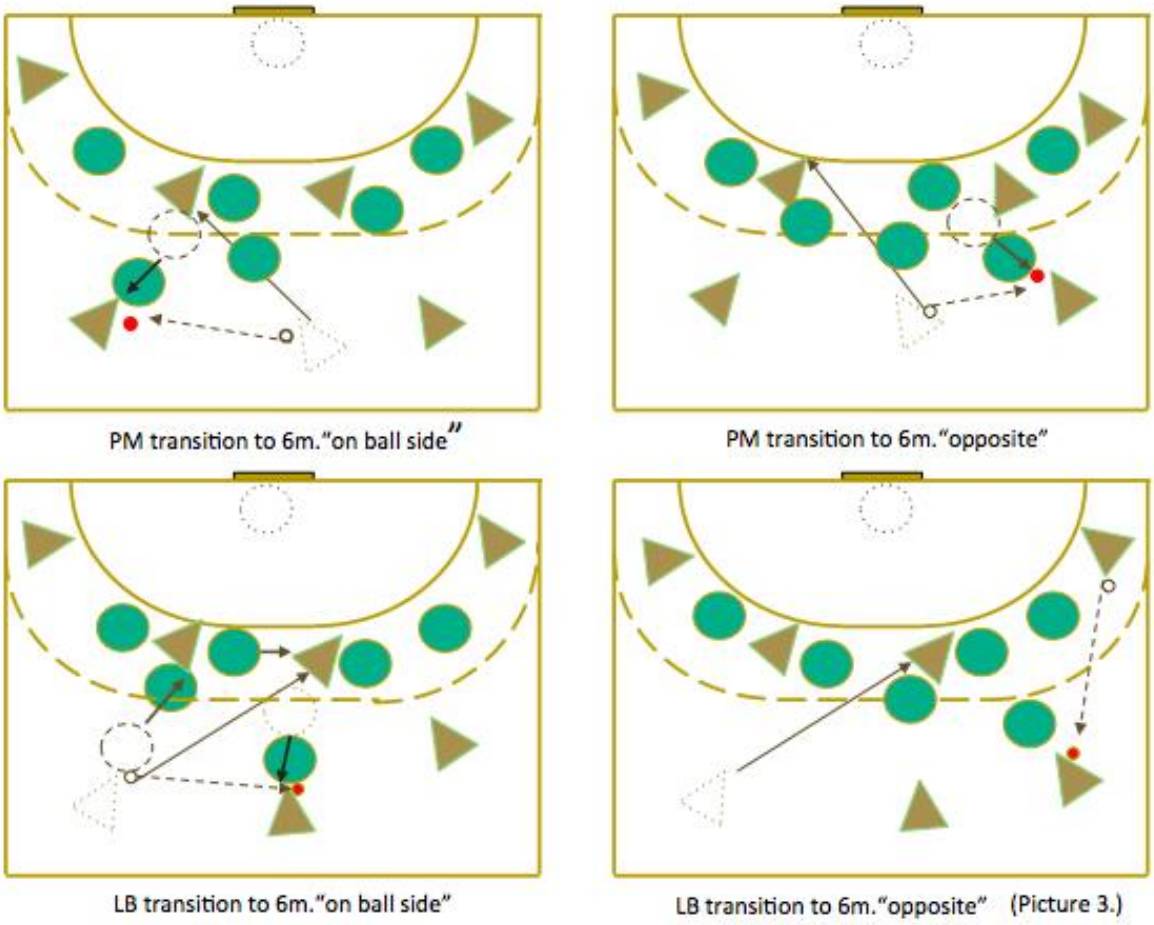


(Picture 2.)

ATTACK IN RELATION 4-2

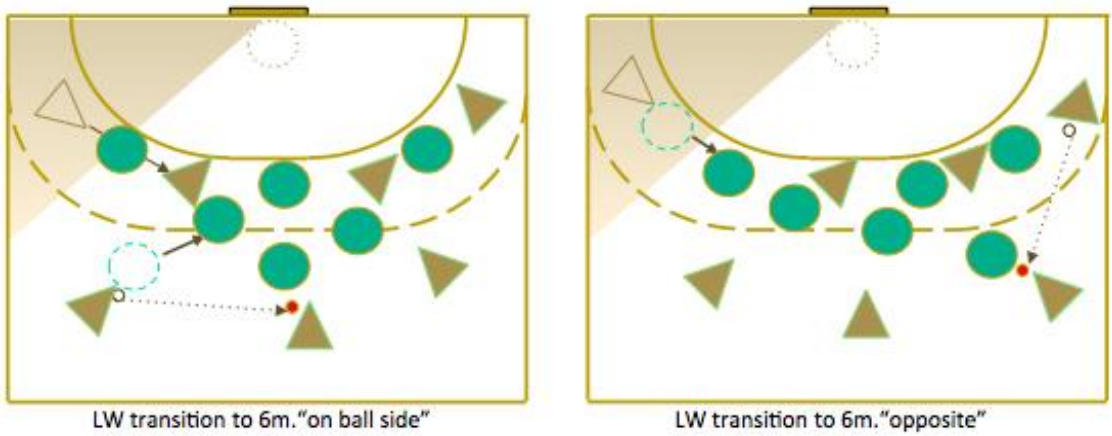
There are two different situations, (presented on the picture 3.a and b.), when some of the back players are coming inside, and another when some of the wingers are coming into the 6m.

(FC moves back (not too much!), prevent diagonal passes and (eventually) attack across the middle, HALFS play even more aggressive – force backs further from the zone of shoot and prevent diagonal passes)



(Picture 3.)

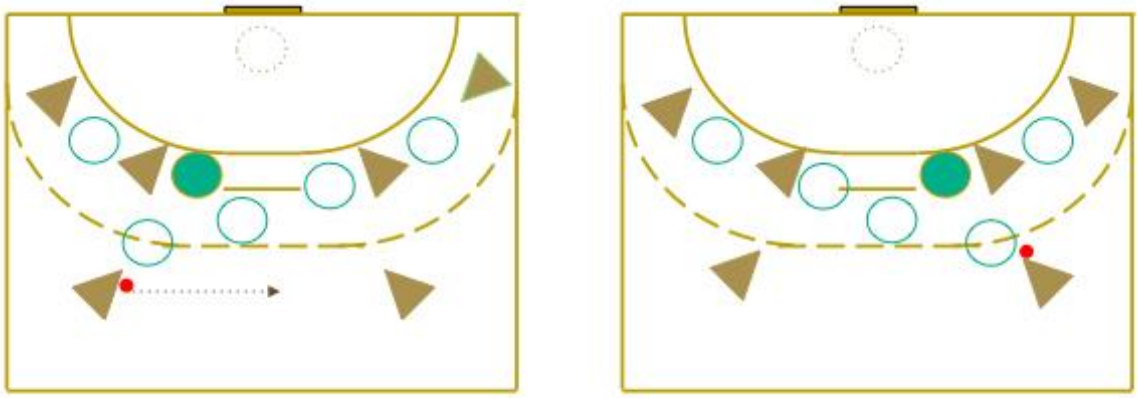
OUTER from the wing penetrates side help to C, WITHOUT EASY penetration



ATTACK IN RELATION 4:2 and reaction of C

Role of Central defender (C) is the most demanding in moments when opponent plays with two pivots. His reaction must be on time, and he is obliged to cover the pivot on the ball side. To do this successfully, there must be a full synchronization of complete defense, which in this situation depends on the timely reaction of all defensive players and their concentrations.

Group of researches from University of Zagreb (Croatia), led by prof. D. Vuleta analyzed whether it is at all possible, taking into account the speed of the ball in the shoot and the pass, the speed of the players, the distance between each line of attack etc. etc. and came to the conclusion that with the synchronized activity of the entire defense is entirely possible that the Center cover both pivots and the entire defense works successfully (see the analysis from Picture 4).

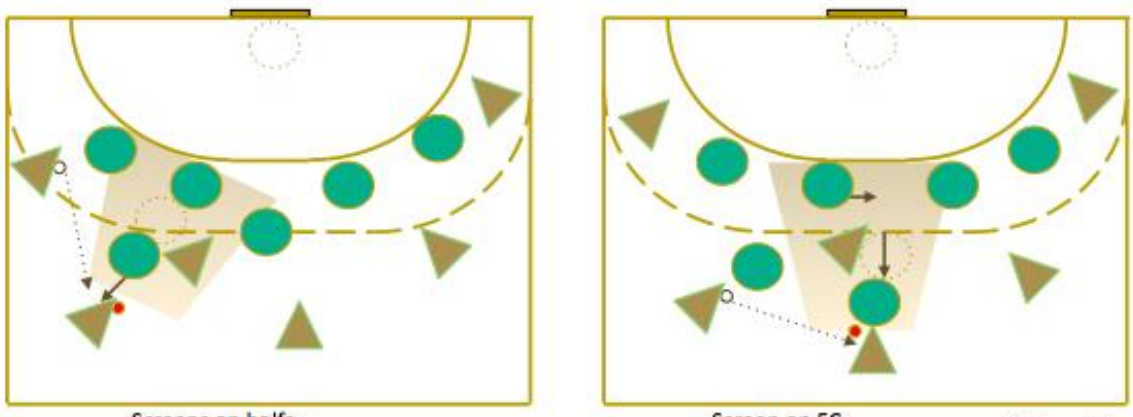


(Picture 4.)

Analysis of the speed of the shot, speed of passes and movement of defender:

Shot.speed(100km/h) = 3 x	Pass.speed(34km/h) = 2,5 x		Speed mov.(13,6km/h)
OL/OR	Pass wing-wing (18-19m)	➡ Duration (2")	➡ Def. move 7,5m!
LH/RH	Pass back-back (8-9m)	➡ Duration (1")	➡ Def. move 3,7m!
C/FC	Pass back-pivot (4m)	➡ Duration (0,5")	➡ Def. move 1,9m!

"SCREENS" - FREE from the screen (even if happens should happen "deep"), see the picture no.5. down. Some Centre will push out attackers!



Screens on halfs

Screen on FC

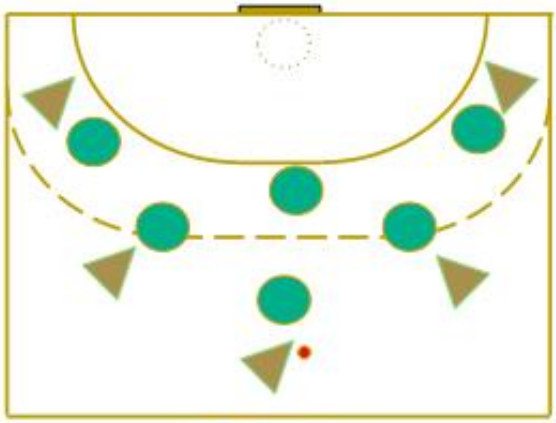
(Picture 5.)

“AGGRESSIVENESS” OF DEFENCE

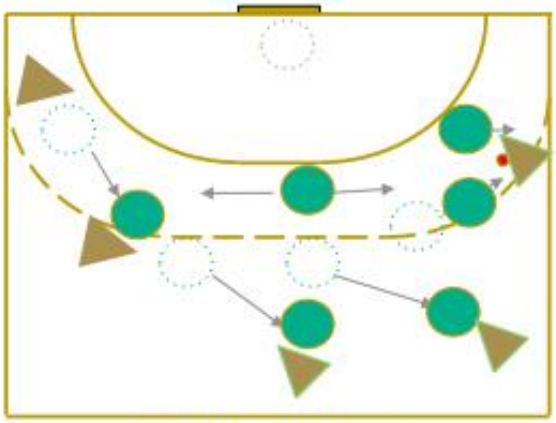
Can be divided into active and passive, depending on whether you want to steal the ball from the opponent or just to get him into a situation that has no solution and thus win the ball.

WHEN TO PLAY? There is just one simple answer, always! With superiority or inferiority, this defense system provides us solutions for different situation more than any other defense system.

NUMERICAL SUPERIORITY: Centre now has the role of “sweeper”, he fixes and corrects mistakes of the others and makes almost impossible to breakthrough creating a surplus of players on the side where the ball is on.

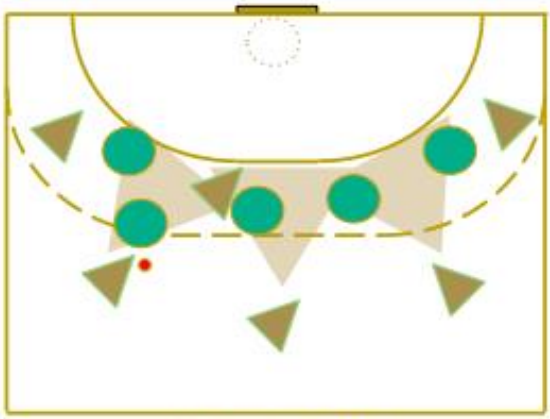


C like “sweeper”

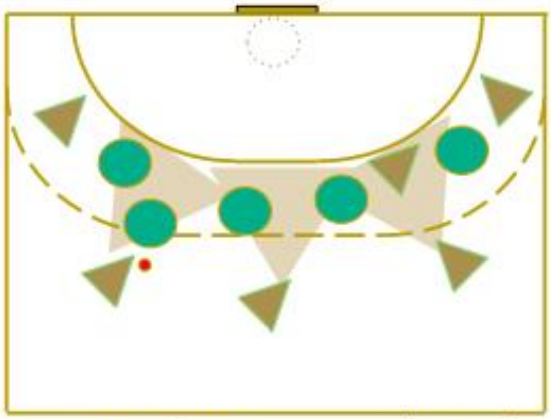


“Double team” on wing

NUMERICAL INFERIORITY - specific situations when defense plays without the Centre and its role is taken over by other players whose movement is covering all the attackers and creates the "illusion" of the numerical equality.



PIVOT “on ball side”



PIVOT “opposite” (Picture 8.)

DEVELOPMENT OF THE FAST BREAK

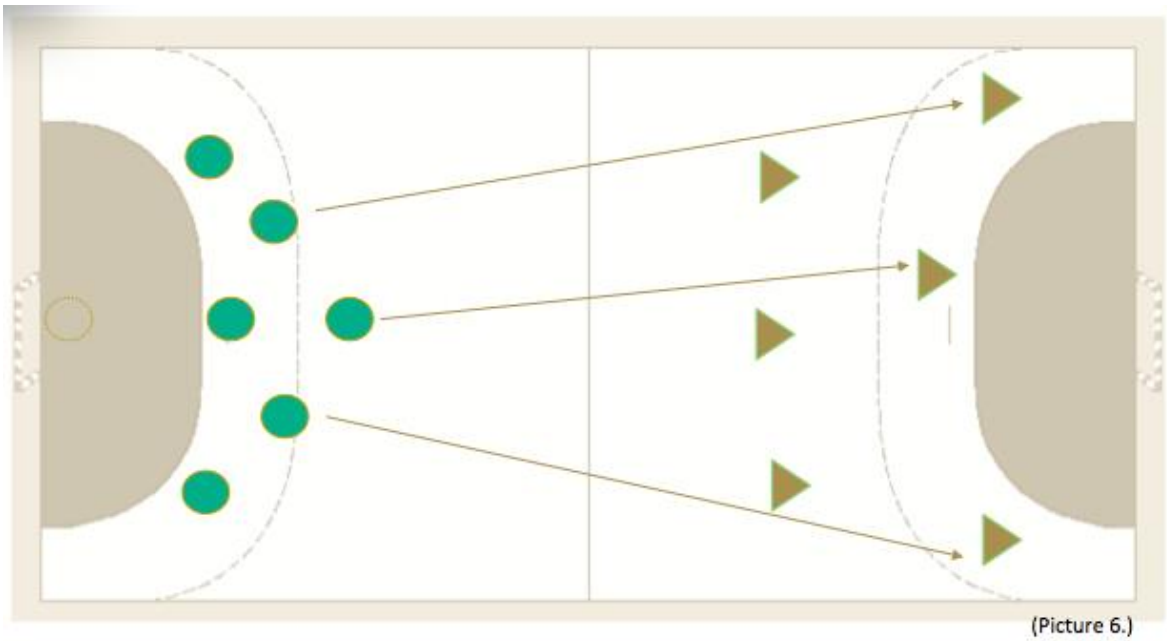
We already defined that defense starts when a team loses the ball and attack begins with the gained ball. Let's say clearly that counterattack is an inseparable part of defense, and why should we practice defense if we don't use it?

There are four different ways to go in counterattack:
INDIVUDAL, GROUP, COLLECTIVE and EXTENDED.

GK'S ROLE (technique of saves - ball has to stay close to the GK's and be ready to come back to the court, speed of returning the ball to play and precision, GK in role of playmaker - selection of "free" player).

WELL TIMED START GIVES A GOAL CHANCE! Also early :) because offers the attackers a possibility to score from rebound.

PLAYING WITH & WITHOUT BALL (Basic & "specific" technique,
Ball reception & transmission in full movement, dribbling with weak hand, pass with weak hand, pass from the weak leg etc.)



(Picture 6.)

What should be emphasized here is that the 3-2-1 by its conception - gives fast players an advantage over opposing backs - by their speed and distance they have to run especially in relation to other zonal formations, as well as timing for it, because they are in the front line and have an accurate insight into the attackers attempt.

FAST BREAK PREVENTION

(EHF SEMINAR - SKOPJE 2008, with interesting topics, C. Onesta: "LESS SPEED MORE SUCCESS IN THE FUTURE" & "FAST TRANSITION FROM ATTACK TO DEFENSE" was a right place to speak about importance to "as soon as possible" transform and establish defense)

- INDIVIDIVUDAL TACTICS OF PREVENTION
- GROUP TACTICS
- COLLECTIVE TACTICS

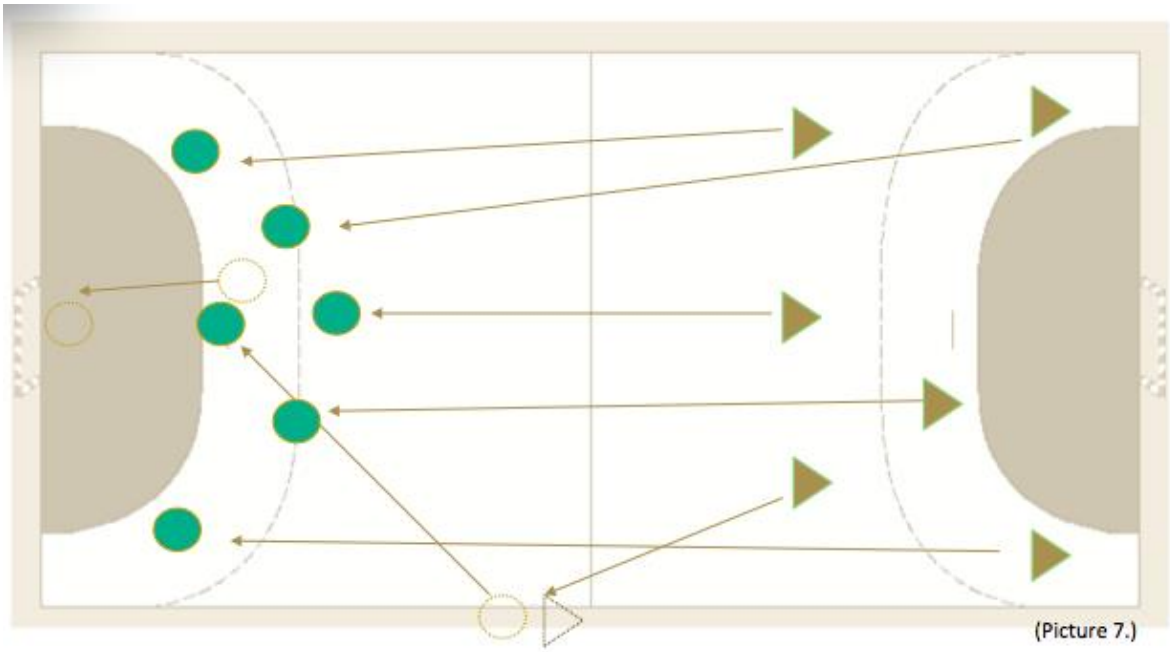
Aims:
SET UP AS SOON AS POSSIBLE IN STANDARD DEFENSIVE SYSTEM

"Golden" rules:
* IT IS NEVER TOO LATE!
* BALL IS THE AIM, BUT NOT JUST BALL!
* ERASE THE MISTAKE OF A TEAMMATE!
* TURN AT THE RIGHT TIME!

Attacker with the ball can be stopped: Raised arms, (Passive & Active block) Move to and make a foul

GK's technique of prevention: RUNNING OUT, MOVEMENT FORWARD and WAITING
Defender' technique of prevention: PENETRATION, FOLLOW – without ball, HINDER HIS WAY, MAKE A FOUL, OBSTRUCTION…

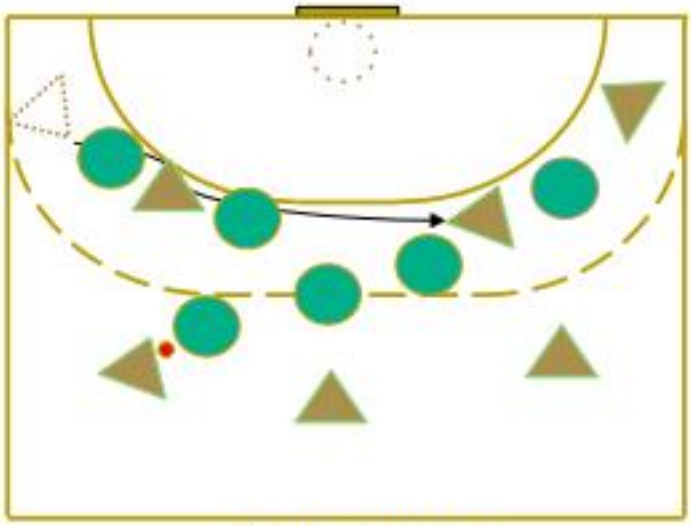
Picture below shows the way that the players returning to the defense as well as one of the most common examples of replacement of shooters (RB) with defense specialist.



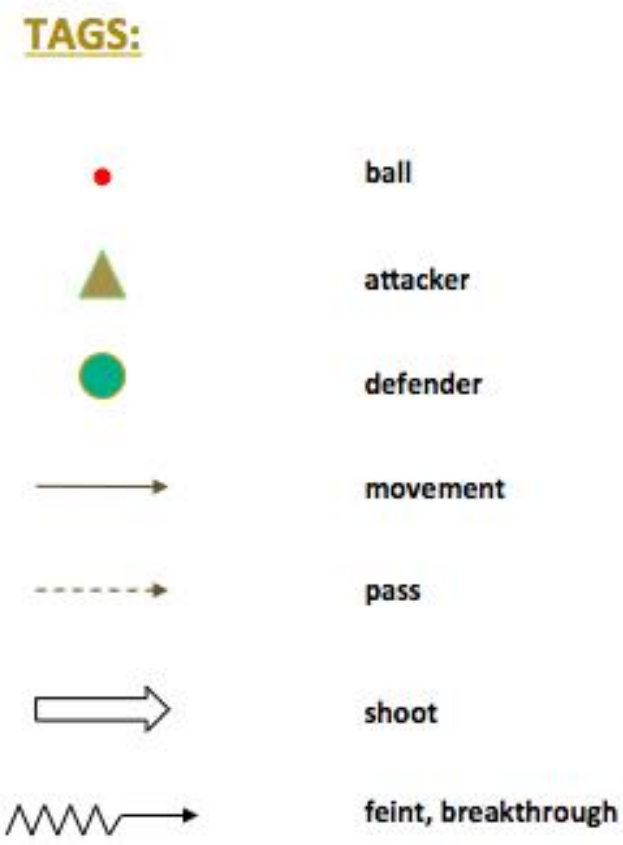
(Picture 7.)

EASILY SOLVE THE COMPLEX ACTIONS OF THE ATTACK

Often play moves against all defensive systems, when PV play between 1 & 2 in defense and attack wants to use the physical superiority of their PV against defenders on positions 1 and 6.
In this situation it is not applicable because our outers (OR/OL) are equally strong, and C is also in that space and can help to resolve the “problem” (see the picture down).



Follow the basic rules!



CONCLUSION:

3-2-1 as almost no other defense systems provides solutions for different situations in the game. It can be played in the shallow and the deeper formation and is extremely successful against teams that base the game on high quality of individuals. Due to the lack of written works that would say more about the basic rules, it is often considered as "too aggressive" defense and people do not realize the advantages offered by their characteristics. Changing the rules of modern handball just gave more importance to this defense system and I think that it will continue to evolve. Nevertheless it is very important not to forget the basic rules and principles, because it gives clear and distinctive solutions that are time-efficient and easier to learn and apply.

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REPLACE THE GOALKEEPER BY AN ADDITIONAL PLAYER

Peter Bachmann

Swiss Handball Federation

Switzerland

Hilterfingen, 12th September 2014

Contents

1. Summary

The fact that the rules allow the replacing of the goalkeeper by an additional player brought me to think about integrating these possibilities tactically into my playing concept.
Basically, there are three reasonable situations to make use of this possibility: with a numerical minority (5-6), with a numerical equality (5-5) and with a numerical equality (6-6).
On the one hand, our team may resort to this instrument when we are under pressure on the other hand, we can exert pressure on the opponent.
Because of the fact that these possibilities have rarely been used so far, it seems important to me to act deliberately and to implement the actions in a well organised manner.
The aim is that the team feels strengthened so that the measures taken are successful and effective.

So far, we have been successful considering our expectations with the 5-6 and 5-5 situations. In the following championship we also want to use the ordinary 6-6 situation to deploy the additional player.

2. Keywords

WHY do we replace the goalkeeper by an additional player?

WHEN do we replace the goalkeeper by an additional player?

HOW do we replace the goalkeeper by an additional player?

WHAT do we play, if we replace the goalkeeper by an additional player?

AND THEN? In case of a goal / in case of a miss / in case of mistakes?

3. INTRODUCTION

3.1 WHY do we replace the goalkeeper by an additional player?

The rules allow the replacing of the goalkeeper by an additional player.

In my function as a coach, I have always been interested in considering the game from an innovative point of view. This is the reason why I have always thought about developing our team's game in a rather unusual way and that is the reason why I came up with this possibility.

It is not my intention to be particularly original, but to find means which the opponent does not get to see every day.

Consequently, the opponent has to prepare for our team in a special way. What ultimately will count are efficiency, effectiveness and success.

3.2 WHEN do we replace the goalkeeper by an additional player?

In my view, there are basically three numerical situations, in which it makes sense to replace the goalkeeper by an additional player during a game:

- Numerical minority 5-6 → 6-6: we equalize the number of players.

- Numerical equality 5-5 → 6-5: we create a numerical majority.

- Numerical equality 6-6 → 7-6: we create a numerical majority.

We basically applied situations 1 and 2 during the last championship, whereas we only used situation 3 in pressure situations, i.e., in cases of negative scores, in critical moments or, additionally, after a time-out before half time. In the following championship we want to deploy the third situation more often.

4. METHODS

4.1 HOW do we replace the goalkeeper by an additional player?

The possibility to replace the goalkeeper by an additional player is rarely used as a tactical measure by coaches. That's why the introduction was very important to me in both teams (2009 BSV Bern Muri, 1st. League, men, Switzerland / 2013 Rotweiss Thun, 1st. League, women, Switzerland). I want to make sure that the team feels the security and believes in the new measure. It's very important for success that the team is committed to this tactical measure.

Particularly in 2009 when I was the first coach in Switzerland, who operated with this new tactic, we could demonstrate to the team during some internal games that there is no loss of time by changing back the goalkeeper. If there is a technical mistake in the attacking action though, this will lead to a counter attack goal, which the team has to take into account.

In the beginning we also had to consider the home-spectators in our thoughts:
If a coach tries such an outlandish measure, it has to be successful from the beginning.
To keep the new measures a secret from our opponents; we first deployed them successfully in a European Cup Game in Belgium.

Here, I need to add that at that time, we replaced the goalkeeper in the case of a numerical minority (5-6) in favour of the sixth court player.

When I took over the women's team Rotweiss Thun in 2013, they already knew that I was a coach, who resorts to this tactical measure and we applied it immediately.

It was clear to me from the beginning that we can only make a replacement with players situated near the bench; for example wing-player, a back player or someone playing in the back court. Because all my playing concepts are associated with crossings in the back court, we do all the rotations with the wing next to the bench. An alternative is to make an exchange with the centre back, always considering the constellation of the defence. Furthermore, it depends if the team plays from the left to the right or from the right to the left.

In these special situations we normally use the attacking elements we would also use in an ordinary 6-6 offensive.

All the following tactical elements illustrate the way we play, when we play from the right to the left.

All the elements are inverted when we play from the left to the right. There is a possibility of slight changes if we do not play with two right-handed and one left-handed player as it would normally be the case**.**

The purpose of all initial actions is to end up on the side away from the bench. The player replacing the goalkeeper and playing on the side near the bench should be close to the bench and not be involved in the final situation.

5. Development

5.1 WHAT do we play if we replace the goalkeeper by an additional player?

The following is probably the most interesting part for every coach:

What tactical elements are we playing? When are we playing which ones? These questions also arise when replacing the goalkeeper by an additional player.

As already mentioned in the introduction, I basically see three numerical situations, in which it makes sense to replace the goalkeeper by an additional player:

- Numerical minority 5-6 → 6-6: we equalize the number of players.
- Numerical equality 5-5 → 6-5: we create a numerical majority.
- Numerical equality 6-6 → 7-6: we create a numerical majority

In my present team, which I have been coaching for the second season now, we have basically replaced the goalkeeper by an additional player in the first case.

The second case is less frequent but, regularly, we have also replaced the goalkeeper by an additional player.

In case of the numerical equality 6-6, there are different possibilities to take away the goalkeeper. Above all, this happens in pressure situations; i.e. in cases of negative scores in match-winning situations. Our aim is to apply the measure also as a sign of strength or we may be able to enlarge our lead.

A small and a very effective possibility may arise shortly before the break, when an additional player is brought into the game for the last 15-20 seconds after a team time-out.

On the following pages I will present offensive set-play with regard to the three situations mentioned above.

The following needs to be considered:

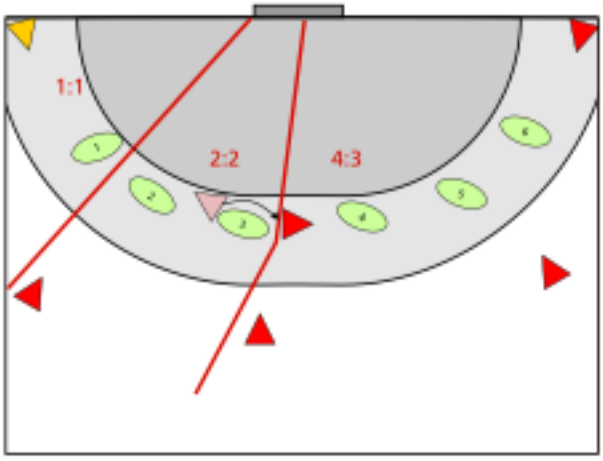
- All the initial actions used in these situations have elements we also use in ordinary situations. It makes no sense to integrate and invent other elements for the special situations.

- In all my explanations, I illustrated the situations of a 6-0 defence. Of course, we normally play the elements also against a 3-2-1 defence. In case the opponent team changes to a 5-1 or a 4-2 defence, we are prepared to play other elements, which are not considered here.

5.1.1 Numerical minority 5-6 → 6-6: create numerical equality

To guarantee a fast and accurate process, the replacement is well structured.

When we get a 2-minute penalty, the wing near the bench is taken out and we redeploy the attacking position.
Then the goalkeeper is substituted. The concerned wing player sitting on the bench has the bib with the colours of the goalkeeper with him from the beginning, and then acts as an additional player.

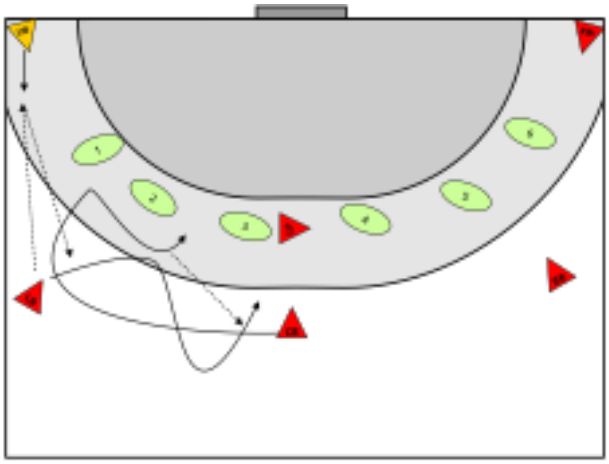


The tactical elements are built on the following intentions:

Defender 1 is responsible for the person wearing the bib and cannot approach to the left back.

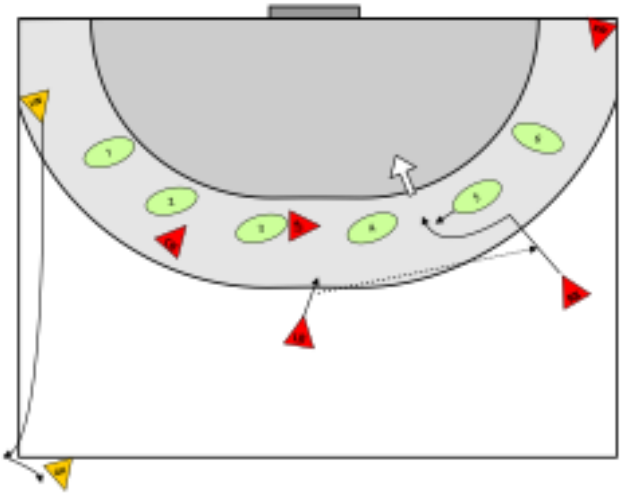
Through specific initial actions, we want to achieve a 2-2 with a supporting block of the line player. This line player shifts his position to the inside of defender 3, so that we get a 4-3 situation due to the block on the right side which has to be played to the end.

5.1.1 Numerical minority 5-6 → 6-6: create numerical equality



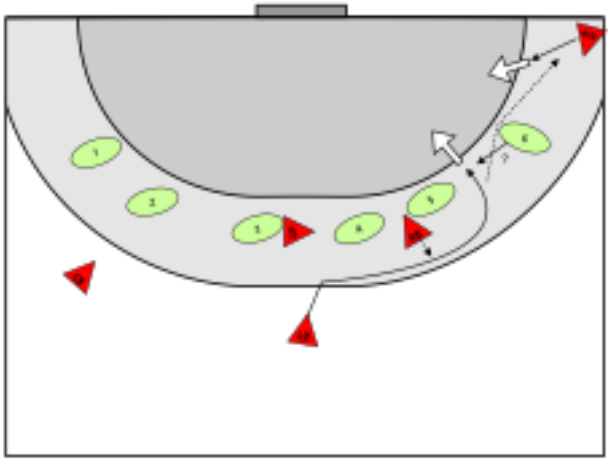
Initial action 1 **HOTTI LEFT EXTRA**

During this attacking element, the left back heads back to the centre back after a pass to the left wing. At the same time, the centre back makes a curve to the left back position and puts pressure on 2, so that 3 is fixed as well. The line player blocks him to the inside, while the left back in the centre position of the back gets the ball from the left back player…



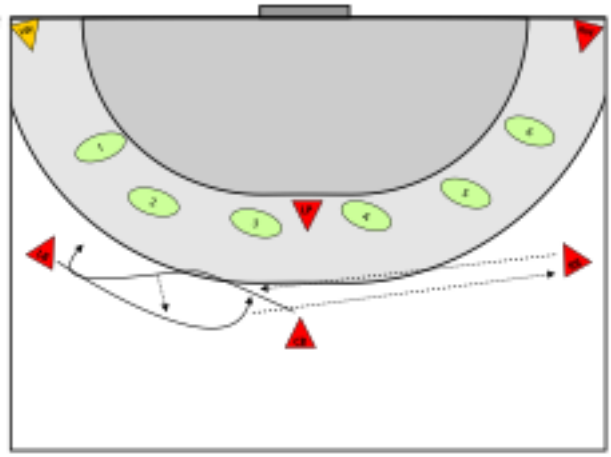
... And, continues playing on the right back, while the other player makes a right-left feint, while crossing for the left back.

If the centre back has put pressure on 2 and 3 on the left back position and the ball is passed to the left back, the left wing can run to the middle, so that the goalkeeper can take over his position again.



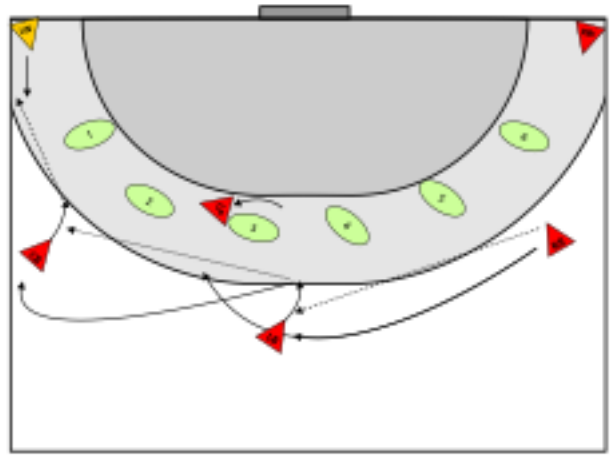
The left back benefits from the gap between 5 and 6. If 6 will close the gap, the left back plays a pass to the right wing that completes the action.

5.1.1 Numerical minority 5-6 → 6-6: create numerical equality

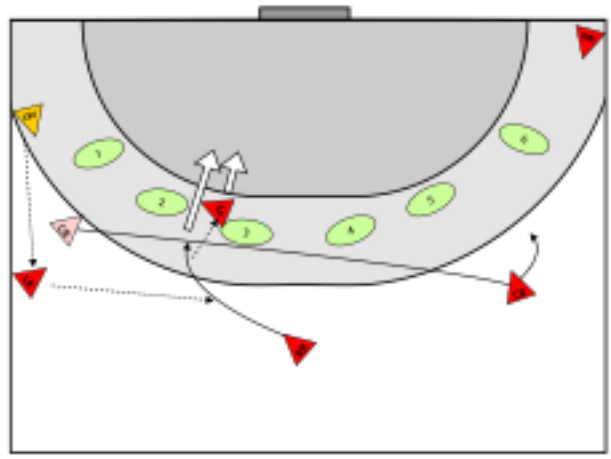


Initial action 2 ESSEN LEFT

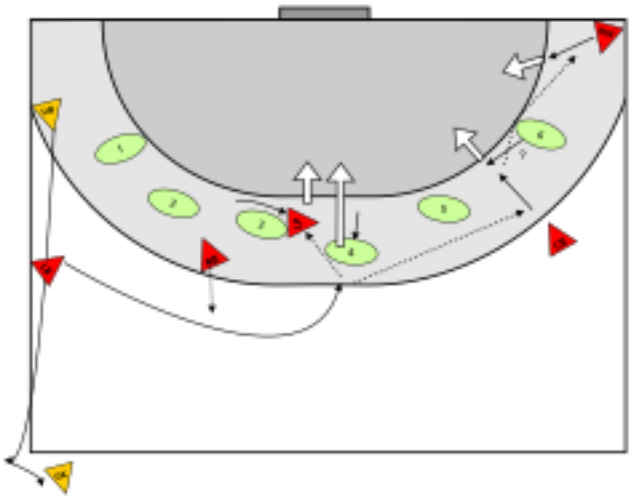
In this case, the centre back crosses with the left back to begin. With a pass sequence of left back-right back-left back, the ball gets back to the centre back in the left back position.



There, the centre back passes to the left wing and runs to a 'sham transition' on the line. At the same time, the left back makes a curve from the centre back to the left side…

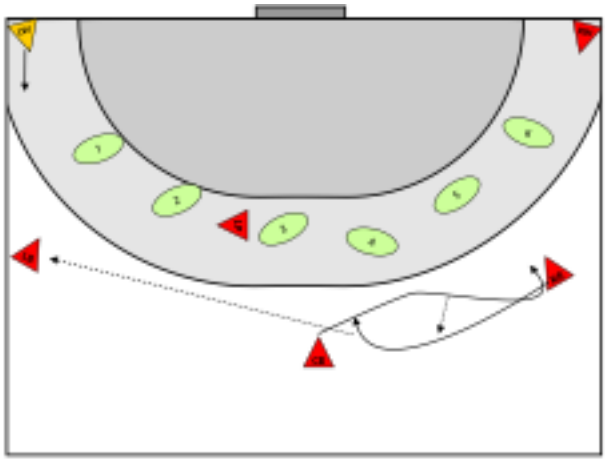


... And gets the ball from the left wing, while the right back has made a curve from his position to the gap between 2 and 3 and there he gets the ball from the left back (> 1st shot possibility or pass to the line player).



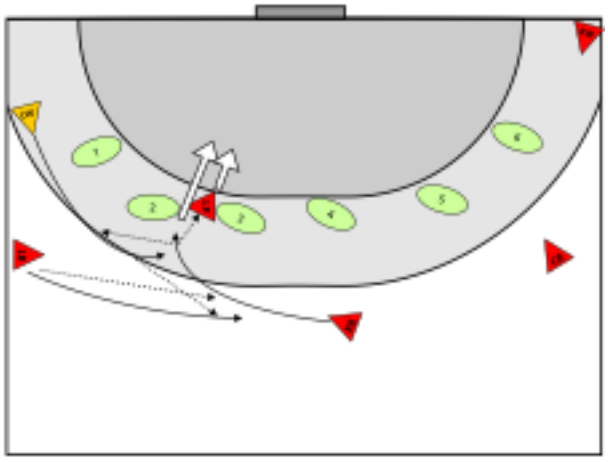
The left back runs to the crossing behind the right back towards the middle (> 2nd shot possibility or pass to the line player). Otherwise, he plays the pass to the centre back in the right back position. The centre back runs to the gap between 5 and 6 or passes to the right wing. Shortly after the pass to the left back, the left wing has moved back to the middle to switch with the goalkeeper.

5.1.1 Numerical minority 5-6 → 6-6: create numerical equality



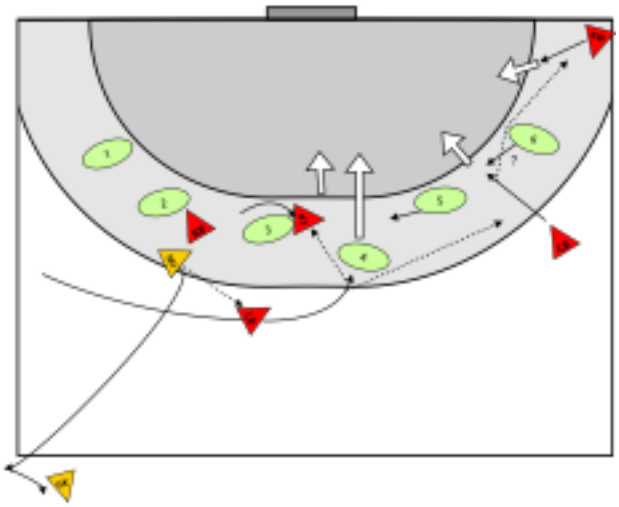
Initial action 3 BEAGLE RIGHT

In this case, the centre back crosses with the right back to begin and this player passes directly to the left back. The right back has to stop shortly on the level of the post…



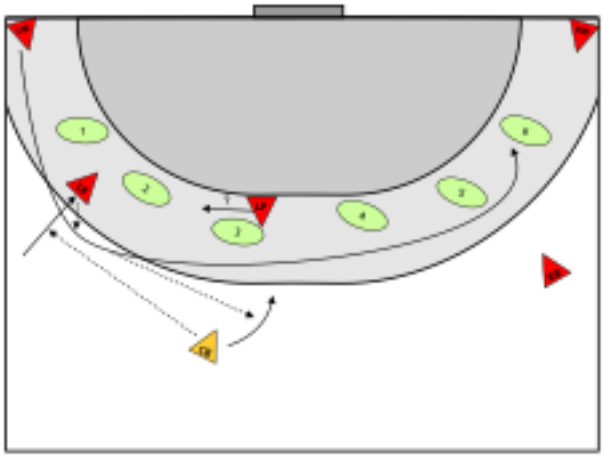
…and then gain speed to attack in the gap between 2 and 3 (> 1st shot possibility or pass to the line player). Otherwise, the right back passes to the oncoming left wing, passing the ball on to the left back.

Subsequently, the left wing runs to the middle to switch with the goalkeeper.



Left back has run determinedly to the middle (coming from the side-line), where he attacks 4 (> 2nd shot possibility or pass to the line). Defender 5 is slightly fixed by the dynamics of the left back, so that the centre back can possibly break through from the right back position or pass to the right wing.

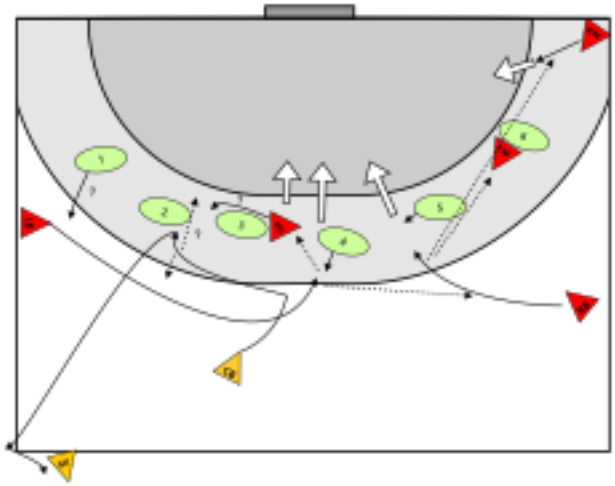
5.1.1 Numerical minority 5-6 → 6-6: create numerical equality



Initial action 4 STOCKHOLM LEFT

For this initial action, the centre back plays with the goalkeeper's bib.

The left back gets a pass from the centre back, who is positioned left of the middle. He pushes between 1 and 2 and passes the ball to the left wing, crossing behind the left back and playing the ball to the centre back who is running to the inside. The left wing runs to the opposite side.

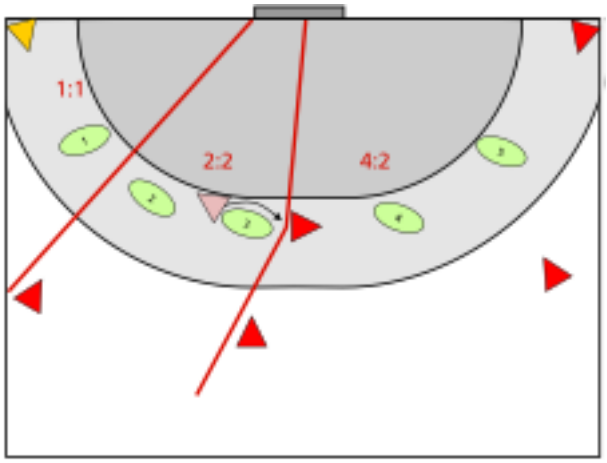


The centre back stops the movement towards the inside and crosses back with the left back, who runs determinedly from the side line to the inside to attack 4 (> 1st shot possibility or pass to the line player). Line player blocks 3 on the inside. Defender 5 is also slightly blocked by the dynamics of the left back. The right back runs inside and attacks the gap between 4 and 5. The right back throws the ball or passes to the left wing, blocking at 6 inside or passes to the right wing.

5.1.2 Numerical equality 5-5 → 6-5: create numerical majority

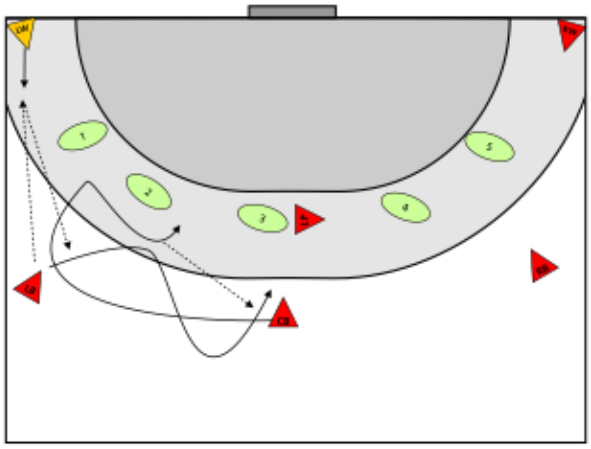
This is a rather rare situation, in which both teams get a 2-minute penalty.

The exchange basically happens in the same way as in the 5-6 situations. First, the wing near the bench is replaced and we occupy the penalized attacking position. Then we replace the goalkeeper, with the wing sitting on the bench and wearing the goalkeeper's bib.



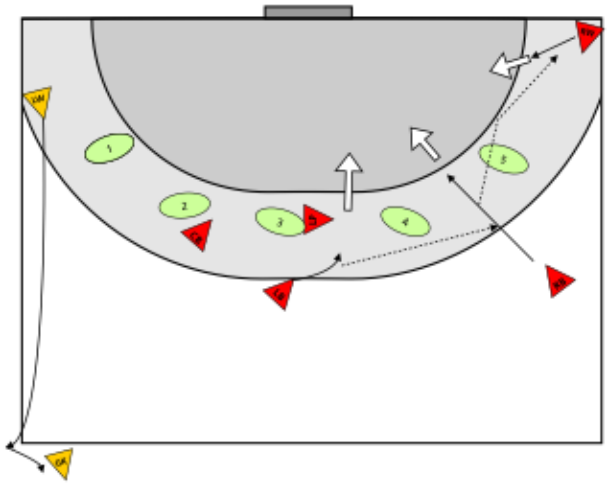
This illustrates the ordinary 6-5 situation, since we want to complete on the right side.

5.1.2 Numerical equality 5-5 → 6-5: create numerical majority



Initial action 1 HOTTI LEFT

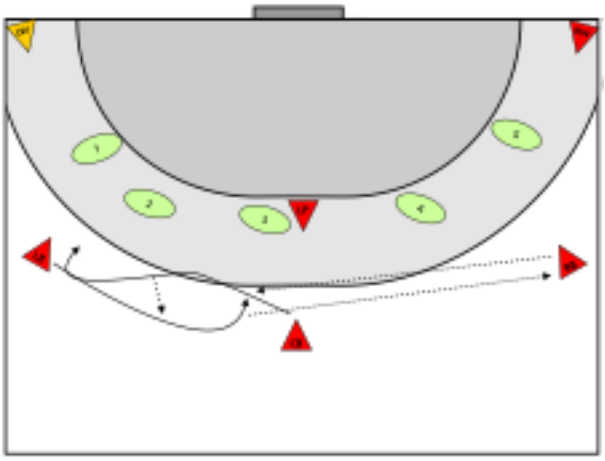
In this situation, we play the initial action without EXTRA, which means, in the end, we do not add a crossing from the right back to the left back on the centre back position. The reason for this is that we only have one defender in the centre, due to the numerical minority.
Again, the left back runs to the centre back after having passed to the left wing. At the same time, the centre back makes a curve to the left back position and puts pressure on 2, so that 3 is also slightly fixed. The line player blocks to the inside, the left back on the centre back position receives the ball from the centre back.



The left back can now directly aim on the goal due to the line player's block. In case of an attack from 4 on the left back on the centre back position, he can still pass to the right back or to the right wing if necessary. The right back passes through or passes on to the right wing**.**

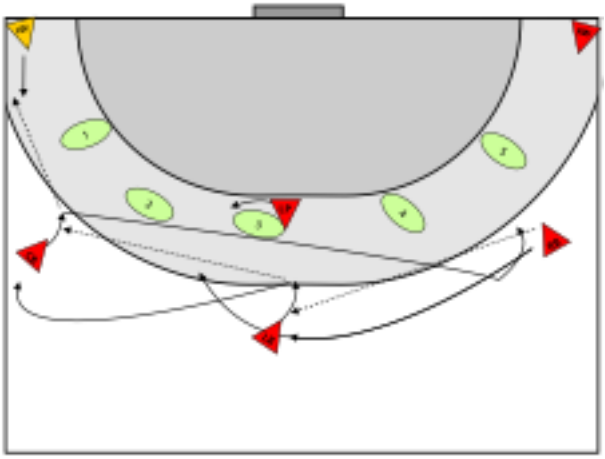
If the centre back on the left back position has put pressure on 2 and 3 and the ball is on its way to the left back, the left wing can run to the middle, so that the goalkeeper can get back to his position.

5.1.2 Numerical equality 5-5 → 6-5: create numerical majority

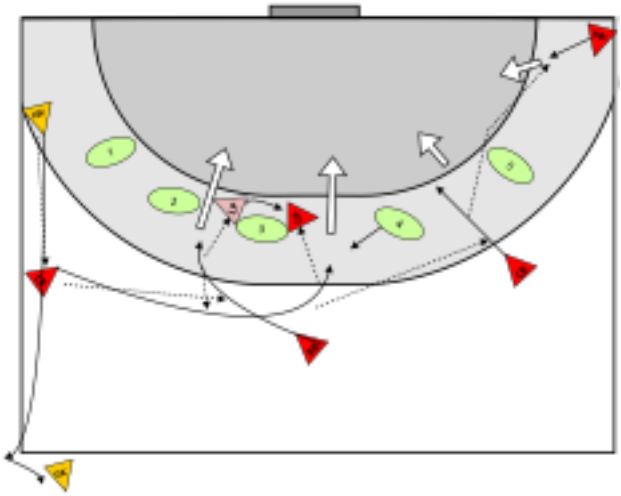


Initial action 2 ESSEN LEFT

Again, the centre back crosses with the left back to begin, with a pass sequence of left back-right back-left back, the ball gets back to the centre back standing in the left back position.



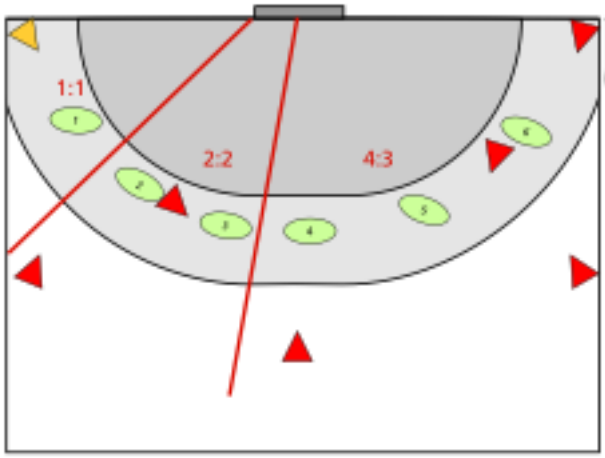
There, the centre back passes on to the left wing and then runs a 'sham transition' to the line. At the same time, the left back makes a curve from the centre back to the left side…



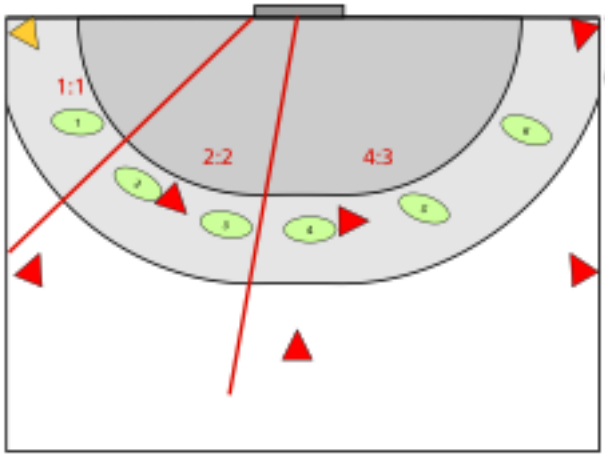
... And gets the ball from the left wing. At the same time, the right back has made a curve from his position to the gap between 2 and 3 and there he gets the ball from the left back (> 1st shot possibility or pass to the line).
The left back runs to the crossing behind the right back towards the middle (> 2nd shot possibility or pass to the line). Otherwise, he plays the pass to the centre back in the right back position.
The centre back breaks through or passes on to the right wing. The left wing runs to the middle after the pass to switch with the goalkeeper.

5.1.3 Numerical equality 6-6 → 7-6: create numerical majority

If the team is complete, a second line player is used. It must be considered whether a replacement between offender and defender should be made under these circumstances. In our case we have both possibilities.

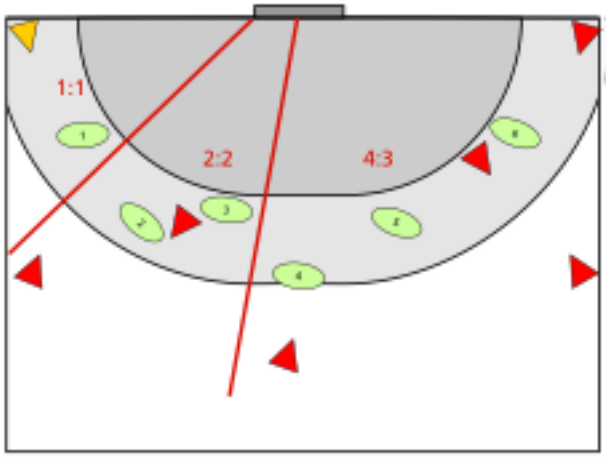


The two illustrations above show the basic principle against a 6-0, the one at the bottom against a 3-2-1 defence.



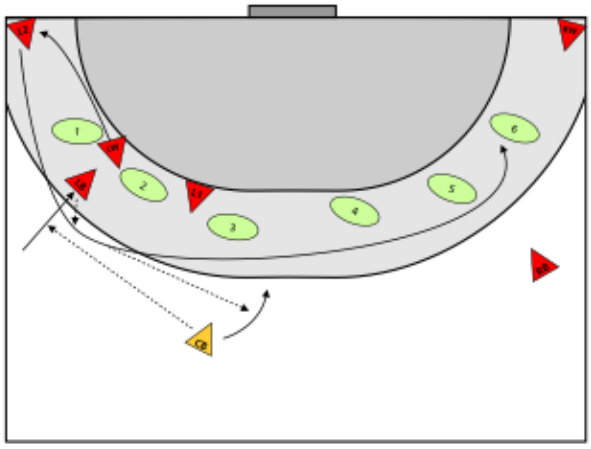
In both defence systems, it is important that defender 1 has to pay attention to the player wearing the bib on the left wing and, therefore, cannot tackle the left back.

Afterwards, we want to achieve a 2-2 on the left side by using systematic actions. As a consequence, there will be a 4-3 on the right side. The team has to finalise this situation with the right decisions.



The 3-2-1 defence as an opponent set is especially interesting for the use of the seventh player, because defender 3 in the middle is in a difficult situation with the two line players.

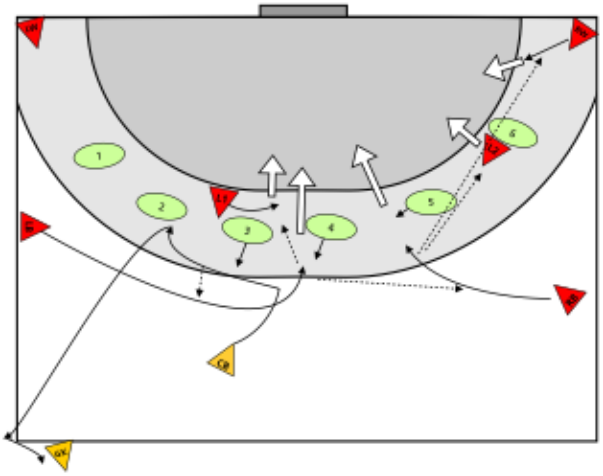
5.1.3 Numerical equality 6-6 → 7-6: create numerical majority



Initial action 1 STOCKHOLM LEFT

For this initial action, the centre back plays with the goalkeeper's bib. The basic formation is special, because the second line player starts from the left wing position and the left wing starts from the line player's position.

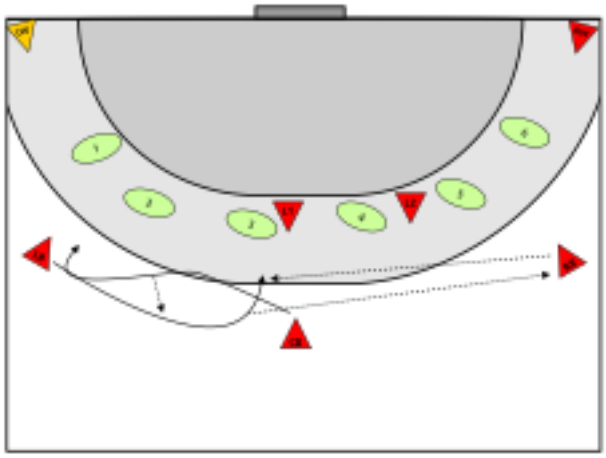
The left back gets a pass from the centre back, who is positioned left of the middle. He pushes between 1 and 2 and passes the ball to the left wing that crosses behind the left back and plays the ball to the centre back, which runs to the inside and the left wing makes a transition to the opposite side.



The centre back stops the movement to the inside and crosses back with the left back, who runs determinedly from the side line to the inside to attack 4 (> 1st shot possibility or pass to the line player). Line player blocks 3 towards the inside.
Defender 5 is also slightly blocked by the dynamics of the left back. The right back runs to the inside and attacks the gap between 4 and 5. The right back throws the ball or passes to the left wing, which blocks 6 inside or passes to the right wing.

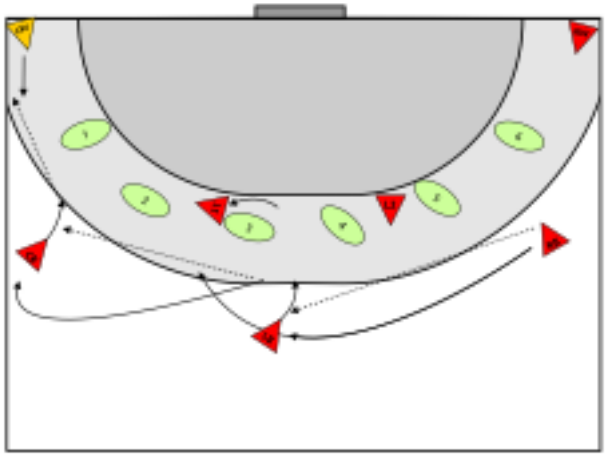
The centre back runs back to the middle after the crossing to create space for the goalkeeper.

5.1.3 Numerical equality 6-6 → 7-6: create numerical majority

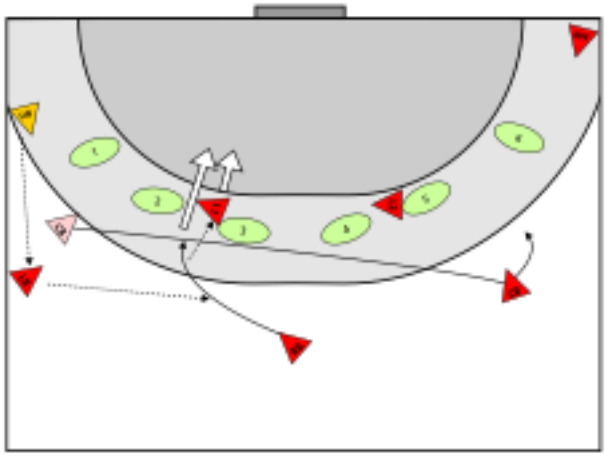


Initial action 2 ESSEN LEFT

The left wing is wearing the goalkeeper's bib. In addition, the second line player is in the position between 4 and 5.
To begin with, the centre back crosses with the left back. With a pass sequence of left back-right back-left back, the ball gets back to the centre back in the left back position.

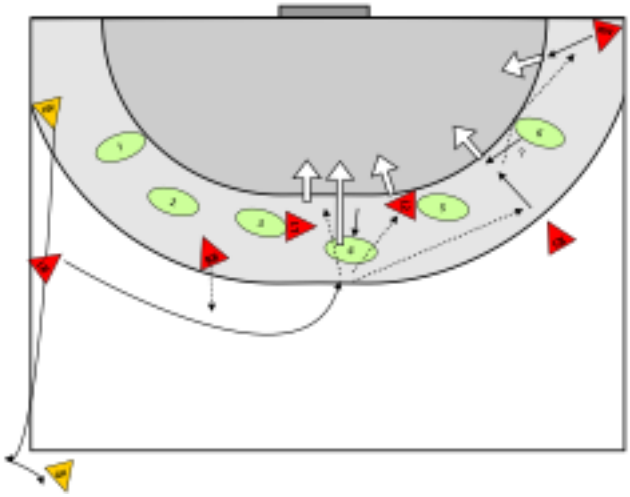


There, the centre back passes to the left wing and runs to a 'sham transition' on the line. At the same time, the left back makes a curve from the centre back to the left side…



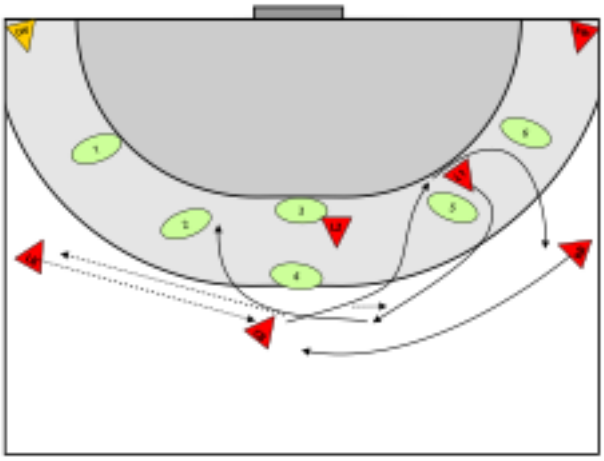
... And gets the ball from the left wing. At the same time, the right back has made a curve from his position to the gap between 2 and 3 and there he gets the ball from the left back (> 1st shot possibility or pass to the line).

Shortly after the pass to the left back, the left wing has moved back to the middle to switch with the goalkeeper.



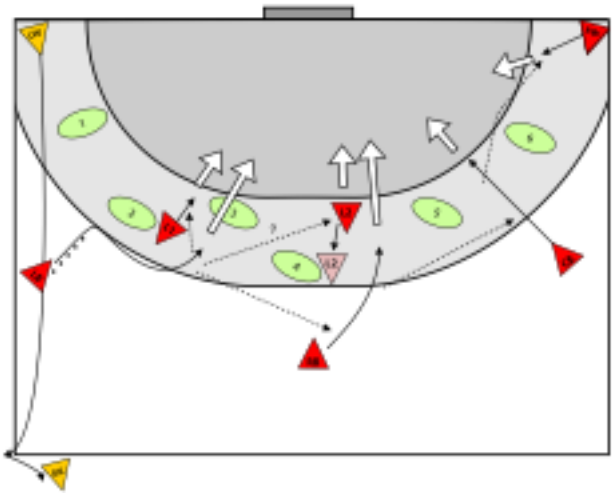
The left back crosses behind the right back towards the middle (> 2nd shot possibility or pass to the line), otherwise he plays the pass to the centre back on the right back position. The centre back breaks through the gap between 5 and 6 or passes to the right wing.

5.1.3 Numerical equality 6-6 → 7-6: create numerical majority



Initial action 2 THUN RIGHT EXPRESS

This illustrates a situation against a 3-2-1 defence. In itself, this is a classic initial action with an interesting constellation. With a pass from the left back, the centre back crosses with line player 1, who gets away from no 5. The centre back breaks the line of defence and goes back to the right back position. Line player 1 passes to the left back…



...And provides a block at 2, while the right back has followed him on the centre back position. The left back starts a 2-2 bouncing with the ball, while line player 1 blocks defender 2.
Defender 3 is forced to move sideways. Subsequently, the left back can possibly play diagonally to line player 2 or this player deploys a block on defender 4 who is in the point position. This creates a 3-2-situation on the right side which has to be played to the end.

With the pass from the left back to line player 2 or to right back onto centre back position, while the left wing can move back to the middle to switch with the goalkeeper.

5.2 AND THEN?

5.2.1 In case of a goal?

In the best case we score with this tactic. If this happens, the re-substitution of the goalkeeper is not a problem, because the process of the attack has been carried out according to plan. It may rarely occur that the player, who replaced the goalkeeper, has to shoot at the goal. If this happens, the switch will be difficult or impossible and the player carrying the bib has to go to the goal.

5.2.2 In case of a miss?

If we miss the goal, it is important whether the ball flies to the goal with a save or a rebound or it lands besides the goal. In the first case, the opponent will achieve ball possession very quickly. In the second case we gain some more time. In both cases, the excellent pullback of the team is as decisive, as it is in an ordinary game.

In all the cases, in which we must prevent the ball from going into the empty goal, a feeling of anticipation is required from all the players. To complicate the shot of the opponent, we have to put the space, where the ball has to pass, under pressure. Additionally, we can block possible shots at the 6 m-line. When the opponent team is playing a fast throw off we try to deny or obstruct a shot with an accurate block 3 metres behind the middle line.

5.2.2 In case of mistakes?

In the worst case, we commit a technical fault during the initial action. The result would probably be a counterattack on the empty goal.

This failure has to be accepted.

With the help of my body language I show the team, the spectators and the opponents, that we accept this weakness and that we stay on course.

We found out that this happens rarely and we accept it because, in an ordinary playing situation, a technical mistake also will result in a counterattack.

6. Results and discussions

It is interesting to see what kind of effect the additional player has on the opposing team:

The fact that our goal is empty is always a mental challenge for them.

- For example, the opponent abandons the option of man-marking or an offensive 3-3 defence with a numerical majority.

- In case of a miss, the opponents risk throwing the ball over the entire field and we get back many balls like that and get a second chance.

Because we regularly and systematically replace the goalkeeper by an additional player, the team acquires security and confidence in this measure and is prepared to apply it in stressful situations.

Because I was not aware of the fact that I would have to write an assignment on this subject during the last championship, I do not have any statistical numbers. The reconstruction would be too time-consuming.

As a coach in competitive sports, I am used to see ranking as the most fundamental indicator for a performance test. That is why I am interested in choosing measures, which are effective and successful.

My assistant coach and I agree that the new measure has proved its worth in the situations 5-5 and 5-6. We did not spend a lot of time on the 6-6 situations and the outcome was not so encouraging.

For this year's championship, we will measure the results statistically to get more precise figures to prove the success of the new measure.

7. Consequences

Numerical minority 5-6 → 6-6: create numerical equality

This application has proved its worth in both of the teams where I employed it. I will continue and develop it with my present team. We still expect it to function just as in an ordinary 6-6 attack, when we use this effective attack measure. As long as there is no opposing team, which diminishes this effectiveness, we do not see any reason to act differently.

Numerical equality 5-5 → 6-5: create numerical majority

This constellation is quite rare but we also want to employ this measure in the future. We achieve a high effectiveness with the element ESSEN, which we also apply in an ordinary game with a numerical majority.

Numerical equality 6-6 → 7-6: create numerical majority

This measure has the largest capacity for development.

Basically, I distinguish between two situations:

1. We are under pressure concerning the result and we have to get control over the game again.
2. We generally want to use this measure more often in the future.

Because we face the second championship with our team, we want to rely more often on this measure of attack. We intend to start applying the new methods during autumn. It seems interesting to me that the three best teams in Switzerland want to start the championship with a 3-2-1 defence. This opponent system suits very well to our use of an additional line player as a field player.

It will be interesting to see, how the opponent teams will react to our measures.

8. References

All the ideas of this assignment are based on my own ideas, because they are all part of my playing philosophy. It was important for me not to use other resources. However, I have not invented this initial actions of attack. ☺

But I can claim with a clear conscience that I always pursued my own tactical ideas. This was also the case, when I was the first trainer in Switzerland who started to use the 'fast throw off' with Wacker Thun in 2002.

Hilterfingen, 12th September 2014

Peter Bachmann

SLOVAK HANDBALL FEDERATION - SVK

MASTER COACH COURSE 2014

INJURY PREVENTION TRAINING IN ELITE YOUTH HANDBALL PLAYERS (Girls)

Mentor:

Author: Miriam Pupalova

Austria, 2014

Summary

In the youth female handball players sports Injury-damage, accompanied by changes in the anatomical structures and functions of the body in female handball can have effect on further development and career as a handball player.

I was injured in a young age and forced to stop playing. Now, when I look back and with my experiences I have from abroad, I see that if I had a coach who understands the importance of Stabilization, Strength and the prevention injury training, maybe I will be another player who can continue to play. I said to myself once: What can I do as a coach, how can I prevent those injuries? Female players are more sensitive when injured and sometimes it makes an influence on the whole team when someone is injured. Real frustrations then come when the best player in a team is injured.

My target is and always will be not only to develop the handball specific skills, team tactics but also the Stability, Coordination, Strength and include injury prevention trainings on a weekly basis. I have educated young female players the importance in analysing the right technique when exercising or working in training, gym or with individual plan at home.

My results in the injury prevention training in youth female handball players have shown that we can prevent injuries and help the youth players to have a healthy career.

Keywords:
Handball, youth female handball players, stabilization, exercises, injury prevention training

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1 INTRODUCTION

The Development of handball game is “amazing” every year. The teams and players are playing faster; more physically and tactically. This brings also more demand on the team physicians, sports doctors and physical supervisors who assist by the reduction of injuries in a game or training.

The term “sports injury,” in the broadest sense, refers to the kinds of injuries that most commonly occur during sports or exercise. Some sports injuries result from accidents; others are due to poor training practices, improper equipment, lack of conditioning, or insufficient warm-up and stretching.

Sports Injuries- Defining exactly what a sports injury is can be problematic and definitions are not consistent. In this chapter a sports injury is defined as any damage to tissues as a direct result of participating in sport and exercise, which causes the frequency and/or intensity of participation to be changed or ceased.

Injury prevention training - in youth handball players is very important because their ligaments, joints, bones muscles, tendons, nerves are still growing and that makes them more prone to injury. A bruise or sprain can be by youth handball players more serious as by an adult.

Overuse injuries- are common in young athletes. Children are most at risk of developing an overuse injury. This is because their bodies are still growing, which can make their bones, muscles and joints unstable and more vulnerable to damage. These injuries happen when the tissue is repeatedly, gradually loaded. Fatigue of the loaded tissue (e.g. muscle, tendon or bone) occurs.

Preventative or rehabilitative measures include: safe exercise practices, wearing appropriate sports footwear, trying orthotics devices, awareness of hygiene and nutrition.
Players most of the time are training in the club, den National team. For them is pre -injury training prevention and the knowledge very important, because it could jeopardize their future.

1.1 Preventing Injuries in youth female athletes

Winning and performance are the key factors for coaches and players. Injured players will not improve their own or the team’s performance. Coach education is a key factor. Well-trained coaches will be able to deliver a new exercise programme in the correct way. Knowledge of sports injuries, injury prevention, attitudes and beliefs around the importance of injury prevention training is quite variable among coaches. Without doubt, injury prevention should[1] be mandatory as part of coach education and certification at all levels.

Preventive training programmes should include strength and power exercises, neuromuscular training, plyometrics and agility exercises: They should be integrated into warm-up routine of the regular training.

Also, “the female triad,” a combination of disordered eating, curtailed menstruation (amenorrhea), and loss of bone mass (osteoporosis), is increasingly more common in female athletes in some sports.
Structured warming up and mobilisation before training and matches, improving the flexibility, core stability and handball specific coordination, and with due care for appropriate shoes and flooring.
Regular training programme dealing with balance, coordination, jump and strength exercises as part of warm-up routine in handball training (pre-seasonal, season-attending) to prevent knee and ankle injuries.

Important is prevention of ACL injuries through neuromuscular training in female handball players. Success depends on full compliance of players with training schedule. It is recommended to pick up 5-6 exercises per session covering knee and shoulder stabilisation and coordination elements as integral part of the warm-up routine.

During pre-season the programme should be included in each session, during regular season twice a week. Neuromuscular training may assist in the reduction of ACL injuries in females athletes if:
(a) Plyometrics, balance, and strengthening exercises are incorporated into a comprehensive training
(b) The training sessions are performed more than 1 time per week;
(c) The duration of the training programme is a minimum of 6 weeks in length.

Injury prevention tips

Tulloh (1995) [27] and Anderson (1995) [28] identified the following tips to help an athlete avoid injury:

1. Increase your consumption of carbohydrate during periods of heavy training
2. Increase in training should be matched with increases in resting
3. Any increase in training load should be preceded by an increase in strengthening
4. Treat even seemingly minor injuries very carefully to prevent them becoming a big problem
5. If you experience pain when training STOP your training session immediately
6. Never train hard if you are stiff from the previous effort
7. Pay attention to hydration and nutrition
8. Allow lots of time for warming up and cooling off
9. Check over training and competition courses beforehand
10. Train on different surfaces, using the right footwear
11. Shower and change immediately after the cool down
12. Be extremely fussy about hygiene in hot weather
13. Monitor daily for signs of fatigue, if in doubt ease off.
14. Have regular Sports Massage

1.2 Difference between young and adults female Injuries

The young athlete is particularly vulnerable to sports injuries because of the physical and physiological processes of growth. Body areas especially affected in adolescents compared with adults are the bone tissue and the muscle-tendon units.

Adult female players:
The survey (Prof. Hans Holdhaus), from the EHF Women's Euro 2008 - 2010 in Denmark and Norway, was based on the injury reports provided by the teams' physicians. They provide information about the time, the type and the location of injuries, but equally important, about the estimated length of the required break period.
In the **(Table 1)** we can see the location of injury (lower part of the body) how many players injured and the %.

Table 1: Location of injury	**Euro 2008**	**Euro 2010**
Legs (muscle)	11 players (20.8%)	15 players (17.5%)
Knee	4 players (7.5%)	6 players (7.0%)
Foot	4 players (7.5%)	7 players (8.5%)

Additional to the injuries, which occurred during the Euro 2008 games, 8 injuries have been reported during training sessions, as well as during the preparation for the tournament.
In addition to the injuries that were suffered during the Euro 2010 matches, another 4 injuries were reported during training sessions between the matches.

Specific factors related to injury of the musculoskeletal system include:
•The growth cartilage, a type of dense connective tissue, is at higher risk of injury with repetitive stress.
• Joint tightness can develop when bones lengthen faster than the muscle-tendon units, creating relative lack of flexibility and muscle imbalances, which can lead to injury.
•Increased load and force at the tendons can also cause injuries in the young player, especially at the knee, ankle and elbow.

Young players:

Girls experience their adolescent growth spurt and peak height velocity on average about two years earlier than boys. In children, cardiovascular adaptation is efficient and similar to adults; muscle structure is identical to adults; and glycogen storage mechanics and values are similar to adults.
(Research from Borms, J. (1986). The child and exercise: an overview. ***Journal of Sports Sciences, 4,*** 3-20.) *"In the prepubescent age, muscle weight is about 27% of the total body weight and the effect of training on muscle hypertrophy is small so that strength gains are perhaps more the result of an improvement in coordination . . . . After sexual maturation [the onset of the adolescent growth spurt], muscular development is influenced by androgenic hormones and the percentage of muscle weight then increases to over 40%.*
"Speed *" . . . a yearly increase in sprint velocity has been noted from age 5 years until age 16 years for boys and until age 13 to 15 years for girls. The rate of development of speed seems to accelerate in two phases. A first phase occurs around 8 years of age; both in boys and girls . . .*

Probable reasons for this are the development of the nervous system and improved coordination of arm and leg muscles. A great variety of exercises involving the whole body should be offered to children to stimulate improvement of this ability. A second phase . . . occurs around 12 years of age for girls and between 12 and 15 years for boys . . . related to the increase in body size with age and the concomitant increase in muscular strength, power, and endurance . . . slightly higher performance levels for boys than for girls until the onset of adolescence when the differences favoring the boys becomes more marked."

Early Maturation

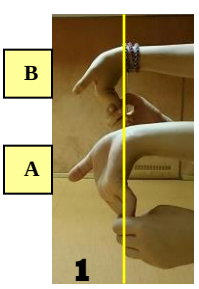
" . . . early maturation in boys is an advantage in some sports, but the opposite applies in girls . . . there is an apparent delay in maturity in sports where females who maintain preadolescent physique seem to have an advantage. An ordering of sports on a continuum from participants demonstrating early maturation through to late maturation might be as follows: alpine skiing, field events, swimming, synchronized swimming, track events, diving, figure skating, gymnastics . . . "

In the book "Women's Health and Fitness Guide," Dr. Michele Kettles says: During puberty, females undergo bone and muscle changes that often create laxity, or joint instability, that limit neuromuscular control in lower extremities. To compensate for this lack of control, female knee joints tend to rotate inward as weight is applied. This places strain on tendons and ligaments that increases the risk of tear and injury."

The child differs in some aspects from the adult and is comparable in others. The training principles appropriate for both groups are generally different.

1.3 Female players have a higher joint range of motion and their muscles

When coaching female youth players, we have to think and have the knowledge of different range of motion, mobility and flexibility. Every female player is different.



In the following examples we can see the differences between my two female handball players- 16 and 18 years old. The differences in elbow, hand, fingers, wrists, range of motion and also increased flexibility.

Photo 1: the difference in wrist movement/flexibility in Girls. A) 18 years old Handball player, B) 16 years old Handball Goalkeeper

Photo 2: the difference in finger movement/flexibility s in Girls. A) 18 years old Handball player-with less flexibility B) 16 years old Handball Goalkeeper -with more flexibility

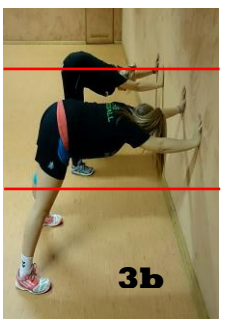


Photo 3: The difference in movement/flexibility in 16 and 18 years old Handball Players
a) The difference in movement/flexibility in Legs
b) The difference in movement/flexibility in Back
c) The difference in movement/flexibility in Shoulder, Elbow and Wrist
d) The difference in movement/flexibility in Ankle

Photo 4: The flexibility, higher range of motion in 16 years old Handball Goalkeeper

Photo 5: The difference in movement/flexibility in 16 and 18 years old Handball Players
A) The difference in movement/flexibility in Legs and Knee-lying
B) The difference in movement/flexibility in Legs and Knee-sitting

1.4 Appropriate footwear

Over the past few decades the Sports shoe manufacturing industry has exploded. There are plenty of options, when it comes to purchasing shoes for different athletic activities. Selecting the correct shoe for Running, Handball Training and Gym is one of the most crucial things an elite or young handball player can do to prevent a foot injury.

As shock absorbers, the feet are subjected to nearly one million pounds of pressure during one hour of strenuous exercise or training. Proper footwear is important to cushion these loads. Different sports have different requirements for footwear, and it is beneficial to wear sports-specific shoes. For example, a running shoe has more cushioning for shock absorption than a basketball shoe, which provides more lateral ankle support for sudden stops and starts on the court. In any case, wearing the proper shoes is important in preventing injury to your feet, and shoes need to be tailored to each individual's anatomy.

Every player is anatomically different, foot is different and every Ankle is different. Each player has more or less balance/power in an ankle. When running outside, the players are, should have the appropriate running shoes or for the Hall training –Hall sports footwear. Some coaches do not pay enough attention sometimes, but the importance is also here.

6

Improper workout footwear can cause a number of injuries. The more obvious injuries include ankle strains and fractures. Worn out sport shoes, (very often seen by youth athletes), do not provide feet the adequate protection during training. Correct footwear for different types of surface and weather help reduce risk of injury.
Youth Handball Athletes must be also observed by coach when running to keep the right technique. **(Photo 6)**

Choosing specific shoes which fit the player perfectly can help:

- To protect players against common injuries
- improve player's performance, enabling, for example, quick direction changes
- lessen the impact of jump or step and cushion the foot from heavy landings

External key risk was also identified between shoes and the playing surface. Handball is played on different floor types with varying friction characteristics and shock absorbing ability. Floors are usually of two types: parquet (wooden floor) or artificial floors. One study has shown that the risk of ACL injury is 2.4× greater when competing on artificial floors (with an increased coefficient of friction) compared with wooden floors.

Therefore, it seems reasonable to suggest that players should have at least two different pairs of shoes, one more 'slippery' pair suitable for high-friction floors and one pair with more traction for slippery floors.

2. Methods

The participants consisted of 20 youth female handball players (age: 13-16 years) and 4 Handball Academy players (Age: 14-15 years old). The Girls practiced five to seven times per week for an hour and a half or two hours and competition match once or twice per week. Some players played higher -in two different age groups (max. 2 years difference) twice per week.
I have started season 2012/13 with Girls they had no previous experiences or haven't trained systematically (only max. 2 times per week).

The first year, I have started with own Body weight, Running Technique, Strengthening exercises with Theraband and Medicinballs.

Second year, I have started to combine Gym training (2 times per week) with Running, Stabilisation and Coordination. Another 6 players who are training 2 times more as Academy players, showed also no knee or ankle injury.

Table 2: Provides overview of the summary of Training, Running, Stabilisation, Gym and Games played (in Minutes)

Second Year: 2013/14

Week Day:	Minutes Training	Minutes Running	Minutes Stabilisation	Minutes Gym	Minutes Games
Monday		30	30	60	
Tuesday	80	20	20		
Wednesday		30	30	60	
Thursday	80	20	20		
Friday	80	20	20		
Saturday					50
Sunday					50
TOTAL per week:	**240**	**120**	**120**	**120**	**100**

2.1 Injury prevention training structure

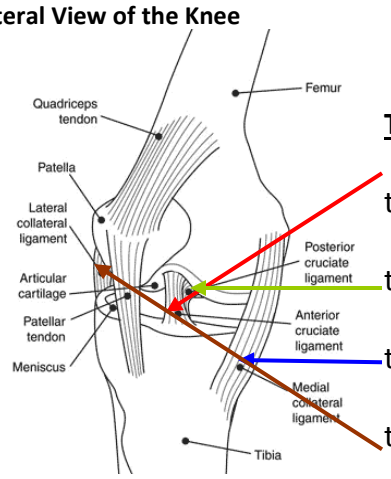
I have always included all those aspects in my trainings during my season or week training:

- ***Training:*** 5 times per week, 2hrs training
- ***Warm up or Circuit Training:*** The focus was on muscle activation, 30 minutes prior to training, Warm-up and stretching exercises are intended to prepare muscles and joints for training and most importantly to decrease any risk of injury. I develop good warm-up habits and safe technique.
- ***Ankle:*** Balance Board exercises
- ***Stabilisation:*** 2 times per week
- ***Knee:*** education of players, understanding the right technique exercises and the reason why a knee pain occurs, safe landing technique
- ***Running:*** the right technique and appropriate footwear, safe cutting, "stop and go" technique, running exercises with and without ball
- ***Players Plan:*** holidays or stabilization programmes, Home-based programmes
- ***Core stability:*** analyse the videos, understanding the right technique
- ***Gym:*** Push ups, Squats, Jump two or one feet landings, Sit ups, understanding the right technique

2.2 Knee, ACL Injuries and their prevention training

Knee injuries in children and adolescent players may be the result of acute, traumatic injuries, such as a sudden fall, or chronic, repetitive overuse injuries. Occasionally, a knee injury may be the result of a combination of both factors —an athlete may have a chronic knee problem **(Photo 7)** that suddenly becomes worse due to an acute traumatic event. These injuries may result in various symptoms including pain, instability, swelling, and stiffness.

Lateral View of the Knee



<u>The four major ligaments that support the knee are :</u>

the Anterior cruciate ligament (ACL),

the posterior cruciate ligament (PCL)

the medial collateral ligament (MCL)

the lateral collateral ligament (LCL)

Girls who participate in competitive sports are at higher risk for anterior cruciate ligament (ACL) injuries than boys, but through neuromuscular training and knowledgeable coaching these injuries may be preventable.

Estrogen - causes an increased nutrition and liquid retention within the female body and thus an increase of body weight. It enhances the bone formation and most probably causes an increase in muscle mass, too and it does have manifold psychological effects.

Gestagen - generally increases the basic metabolism as well as an elevation of the body temperature of about 0.5 Celsius. Gestagen also has manifold psychological effects extending as far as depression and anxiety stats.

Reasons why Female handball players do have the greatest risk of ACL injuries are:

- Skeletal structure (broader and elongated pelvic bone structure, narrow shoulders
- Begin to participate in sports until a later age
- Hormonal (estrogen and gestagen, during the menstrual cycle)
- Narrower notch
- Less muscle strength
- Overweight

- **Knee injuries can result from**:

- collision two or more players (a blow to knee)
- changing directions (twist of the knee, causing ACL rapture)
- physical contact with opponent when one or another fell on knee (defence or attak)
- without contact with an opponent
- feints
- one-leg landing after a jump or push from opponent
- running too hard, too much, or without proper warm-up.
- Unstable ankle
- The fit of athletic shoes
- Chronic diseases

"During the menstrual cycle hormone levels vary and may affect knee stability. Recent studies have shown that, as specific points within the menstrual cycle, the knee becomes looser than normal, and ACL rupture is more common". (Steven K.Moayad,MD,MBA)

Knee Stabilisation Exercises:

Neuromuscular training programs are designed to both increase the strength of the knee joint and increase the athlete's awareness of proper balance and technique. The programs accomplish this goal by using a number of different exercises to train both the body of the athlete as well as their conscious mind.

8

Photo 8: Trainings Camp for Girls 14-16 years old, 2014, Austria. Players are learning the right technique with 2 educated trainers.
A) 14 years old player, knee and ankle are not stable and further stabilisation exercises must be continued in the future
B) Two players 14 years old, who had no previous experience with Stabilisation training.

"Keeping the knee-over-the-toes position", seems justifiable and should continue to be used. In addition, it also emphasises the importance of teaching young players to perform a narrower cut. Technique training that reduces the knee valgus moment should include a focus on toe landings, a knee-over-toe position and narrow cuts.

2.3 Resistance Band and Knee Injury Prevention Exercises

Resistance Bands (Theraband) were first used in sports medicine for injury prevention and recovery. In training, a common goal is to work with isolated muscles. This can't always be done with strength training or using weight machines in Gym. When the underused muscles are strengthened, this helps to prevent future injuries.

Resistance bands are available in a range of colors **(Photo 9)** that relate to their stiffness or resistance. Color-coding varies between the brands but it typically as follows:

Theraband:
Range of colours

1) **Yellow** (thin)
2) **Red** (medium)
3) **Green** (heavy)
4) **Blue** (extra heavy)
5) **Black** (special heavy)
6) **Silver** (super heavy)

Resistant band knee exercises:

Exercise 1: Resistance Band -Lunges

Photo 10: Exercise-Resistance Band Lunges, work in pairs
One player holds the Theraband. Other player places the Theraband around the knee so that the resistance provided by the band pulls the lateral side of the knee. Player should stand far enough away so that you are somewhat challenged to maintain neutral alignment against the pull of the band. Slowly squat down, allowing the other leg to trail behind while keeping the desired alignment. Pause at the lowest control. Avoid letting the thigh move into adduction or internal rotation by consciously activating the hip abductors. Repeat the exercise for 8 times and then switch sides. Perform two to three sets on each side.

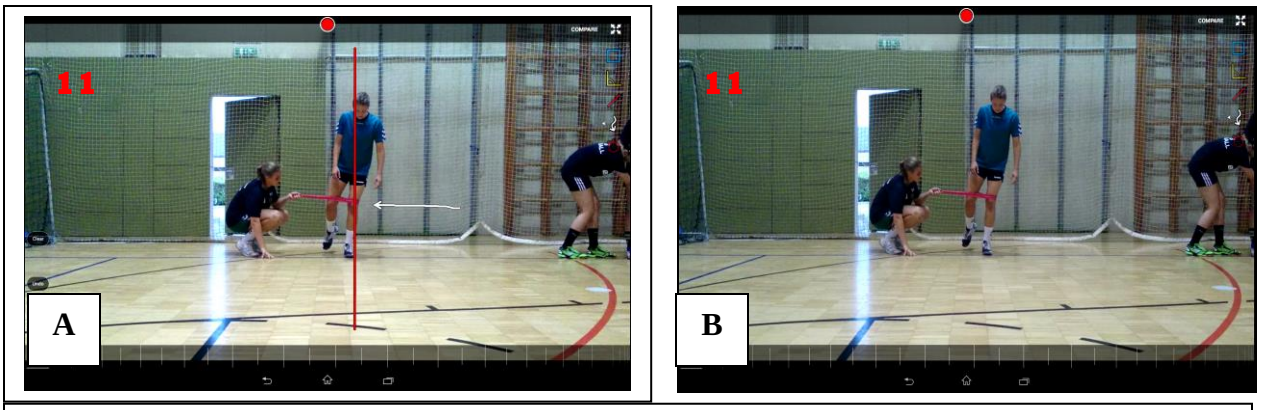


Photo 11: Observations from video recording were evaluated /analysed with each player
A) and B) The aims of those videos were to include the players, in order to ensure that each player can analyse and specify mistakes, patterns and their corrections. Those discussions with differences observed, ensure optimal individual development of elite handball players and each players confidence. During exercises, when working in pairs the right technique is than corrected by team player (convert the findings into practice). However, the coach must always be present: "Without loosing sight of safety"!

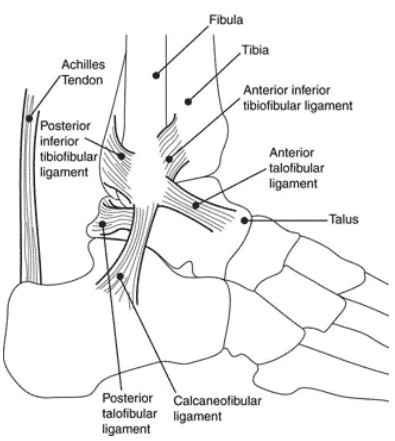
Keep in mind the motion should be performed smoothly and deliberately attempting to facilitate consistent dynamic hip and knee stability. Concentration is important. Do not attempt to lower beyond a point at which proper hip/knee/foot alignment is compromised.

The hip external rotator muscles often need strengthening to aid the body in achieving proper hip and knee alignment with activity.

2.4. Ankle Injuries and their prevention training

The number one cause of ankle injury is previous ankle injury, not enough strength or stability. As Coaches, we have to pay attention to these injuries and increase their prevention. In training we can use uneven surfaces, Theraband or Balance Board.

Lateral View of the Ankle



Typical Injuries in Ankle are:

- Muscle sprains and strains
- Tears of the ligaments that hold joints together
- Tears of the tendons that support joints and allow them to move
- Dislocated Joints
- Fractured bones

Ankle Exercises to prevent Injury:

Using balance board training is effective for pre injury prevention of ankle sprains. We used these exercises 2 times per week.

Exercise 1: Stability training, including balance exercises with Balance Board Player is standing with one foot on a balance Board for as long as she can without toppling over the player must maintain the balance for 30 seconds. Change leg and repeat twice for both legs.

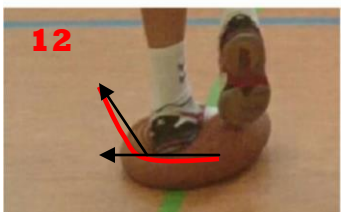


Photo 12: A 14 years old female youth player with ankle instability observed during a training.

Exercise 2: Stability training, including balance exercises for Ankle with Balance Board.

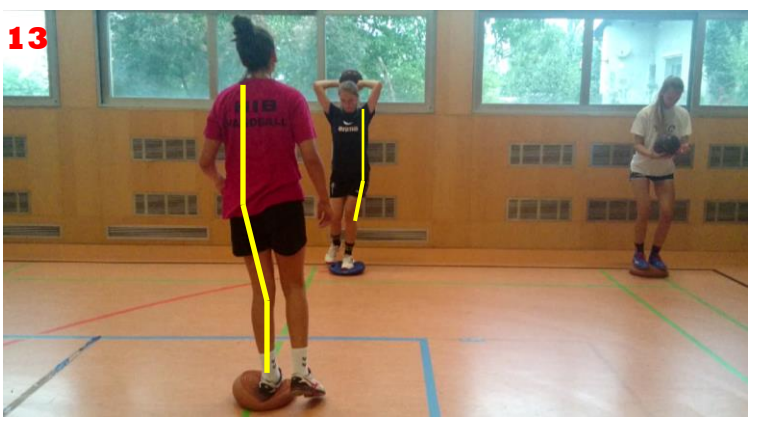


Photo 13: Ankle Stability training .Two players together with Handball or Medicinball- Make pairs. Both players are standing with one feet (Right/Left) on the balance board. Throw and catch a ball 20 times with both hands while maintaining the right balance in Knee, Hip and Ankle. Repeat 3 times.

Low arched Foot:

By preventing injury in Ankle we have to also know about Low-arched, Middle-arched or High-arched foot. Usually in the preteens and teenage years parents bring the children in for treatment of their flat feet because the kids have started playing sports and the demands of a lot of running are now beginning to manifest themselves with foot and leg pain as a result of flat feet. Because the foot is over stetching or flattening out; it is putting excessive strain on the muscles and ligaments that “hold” the foot together. In doing so it forces the muscles in the foot and lower leg to work in an abnormal fashion causing a variety of problems.

In the following example is 13 years old Handball player who had pain in knee, ankle and pain in changing directions or accelerating. After the training, in cool down time when the players are moving or running barefoot, I have noticed that this Girl is having flat feet. She went to Orthopedic who gave her support insole.

14

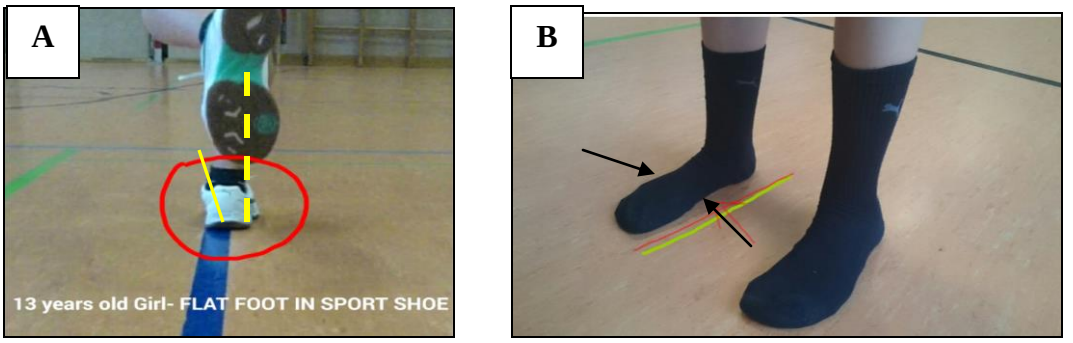


Photo 14: A 13 years old Girl- Youth Handball player with flat foot
A) We can see how by a step forward the arch supported by shoe is moving inwards. The player was educated with the support of the video system about preventing exercises for the foot.
B) Barefoot standing analysis. (Her size shoe is already 41)

Low-arched players are having knee pain, patellar tendonitis and plantar fasciitis. The arch generally will develop during childhood as part of a normal relationship between the foot's muscles, tendons, ligaments and bone. Young children should be given the opportunity to walk barefoot particularly over uneven terrain (eg: the beach) in an effort to help strengthen the muscles that originate in the foot.

15

Photo 15: This foot type is generally characterised by a flat foot or very low arch that rolls inwards excessively. The muscles and tendons tend to be relaxed and supple and the foot is able to absorb shock however the excessive motion of the foot may cause implications through the foot and lower limb. This foot type is best suited to stability or motion control shoes which have medial support devices.

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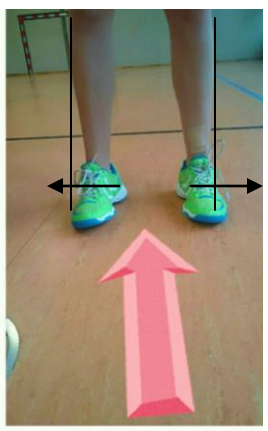

Photo 16: This player is moving the ankle to lateral side when walking or standing. This type of foot is more prone to injuries, the same as a low arch foot. The muscles and tendons move to lateral side. Corrections and the right stabilization exercises must be trained. Player can have pain in knee, ankle and hip. It is important that the entire leg, ankle, hip and foot are trained with stabilization and strength exercises (with or without Theraband or Balance board.

2.5 The right technique - Core Stability

As it has already been observed during handball games, many injuries were actually not the outcome of contact with other players, but rather the result of poor coordination skills. "***Core stability***" describes the ability to control the position and movement of the central portion of the body. Core stability training targets the muscles deep within the abdomen which connect to the spine, pelvis and shoulders which assist in the maintenance of good posture and provide the foundation for all arm and leg movements.

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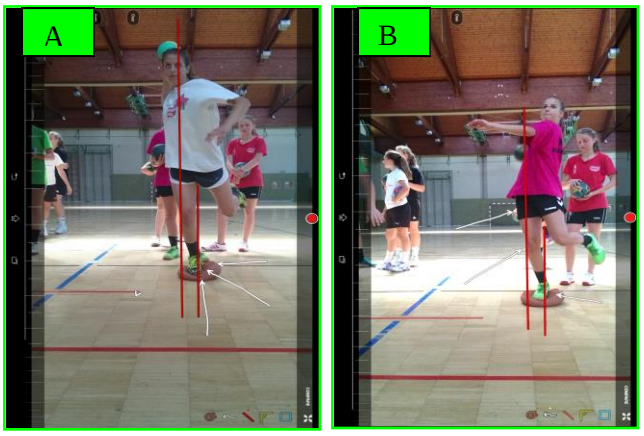


In this both Photos (A and B) we can see two female girls 14 and 15 years old who are standing on soft balance board (unstable surface). The aim was to perform shooting with the right body balance. The exercise was performed 2 times and than further with players discussed what the benefits of core stability and video analysing are. Some players need to visualize, see the mistakes.

Photo 17: The core stability (Hip, Pelvis, Knee, Ankle) and the difference in posture in 15 and 14 years old Handball Players. Is the posture right?
A) The lower limb, knee is strong holding in the right stability. Ankle is less strong.
B) The less developed strength of the thigh muscles (the quadriceps femoris and hamstring), creating a greater risk of anterior cruciate ligament injury. Ankle is also less strong. The hip external rotator muscles often need strengthening to aid the body in achieving proper hip and knee alignment

Good core stability and their right correction can help to maximise the player's performance and prevent injury. Power in shooting, strength and core helps to control, more efficient and better co-coordinated movement.

Moreover, well-conditioned core muscles help to reduce the risk of injury resulting from bad posture. The ability to maintain good posture helps to protect the spine and skeletal structure from extreme ranges of movement and from the excessive or abnormal forces acting on the body.

From the article: American Council of Exercise- Dr. Jinger Gottschall, assistant professor of kinesiology at Penn State University, whose research on the benefits of planks is considered by many to be primary, says that the plank is a superior core exercise to the crunch or sit-up because it provides "more three-dimensional activation, from hip to shoulder, whereas the crunch is an isolated move that hits just your abs." She adds that planks not only strengthen the core, but also the shoulders and hips—and you can improve your balance if you do variations with your arm or leg.

Core Stability Exercises:

Core stability exercises are very important and effective because we activate the whole body and improve the posture. Players must concentrate to hold the balance and keep the body in the right position. The right position in hips, back should be kept straight and the hands can be used for correcting the balance. Those exercises are fun for the players. Coaches must always correct the right positions of a player.Here are examples of the exercises I used:

Exercise 1: Core Exercises with Balance Ball (Swiss Ball)

18

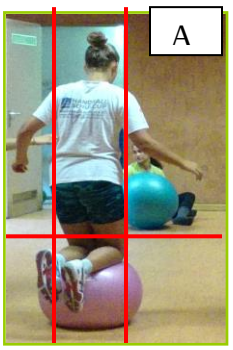


Photo 18: Core Exercises with Balance Ball. Player slowly kneels on the ball. Help of Balance, Coordination get up into kneeling position. Player hold in this position: 30 -60sec.
A) The player should always hold the body in the right position.
B) Players are working as a group. They build a circle. Once they are holding the kneeling position and the right balance, body positioning, they throw around one ball (or Medicinball) around. The player who falls down is doing for example Push ups etc.

Exercise 2: Lying Hamstring exercise with Balance Ball (Swiss Ball)

19

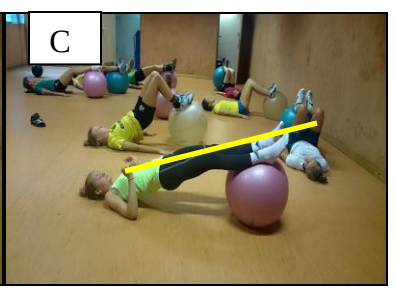


Photo 19: Lying Hamstring exercise with Balance Ball (Swiss Ball): Repeat 10 times,3 sets.
A) Player is lying on the back on the floor with the stability ball at the feet. Place the feet up on the stability ball, with your ankles resting against the ball's surface. Raise your torso up off of the ground, by putting downward pressure on the ball. Place your arms straight or bend for support.
B) Player slowly roll with the feet the ball forward
C) Player comes to straight position with the back, hips, knee in a straight line. Hold for a few seconds. Then slowly return to the start position to complete one rep.
Lie down with feet heels propped on the ball.

Plank exercises:

Plank exercises are a great way to develop abdominal muscles, back musculature as well as the core stability.

Exercise 3: Basic/Front Plank

20

Photo 20: Basic/Front Plank .Start lying down on the floor with feel about shoulder width apart. Place your elbows underneath, push up onto toes and forearms. Draw the belly button in towards your spine, push your neck and sternum up as high as you can. Hold for 15 – 30 seconds, lower and repeat for 5 reps. Hold the back flat in a straight line from head to toes.

Exercise 4: Side Plank

21

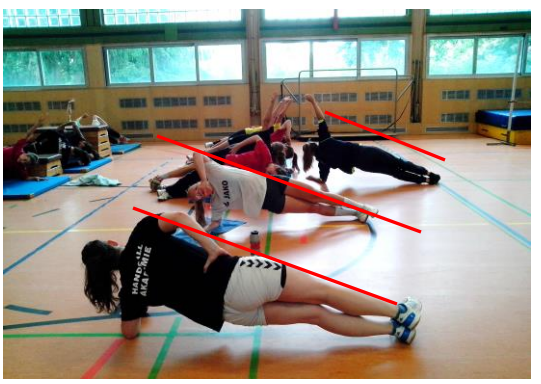


Photo 21: Side Plank Exercise: Lie on your left/Right side with your knees straight. Prop your upper body up on your left elbow and forearm. Brace your core by contracting your abs forcefully as if you were about to be punched in the gut. Raise your hips until your body forms a straight line from your ankles to your shoulders. Hold this position for 20-30 seconds. The head should stay in line with the body.

2.6 Plyometrics and jump training

Plyometrics and jump training is designed to promote proper jumping and landing technique, both of which are vital to prevent ACL-knee, ankle and hip injuries.

In the following three examples we can see how young youth female players are in danger to receive injury when coordination, balance, strength and stabilization are not involved in training. This Girl is 14 years old, position as Goalkeeper. She came from a Handball Club where they trained 2 times per week, no pre-seasonal training, no previous experience with coordination, neither balance or stabilisation. She is so weak and that their knees caved inward when performing a landing jump.

22

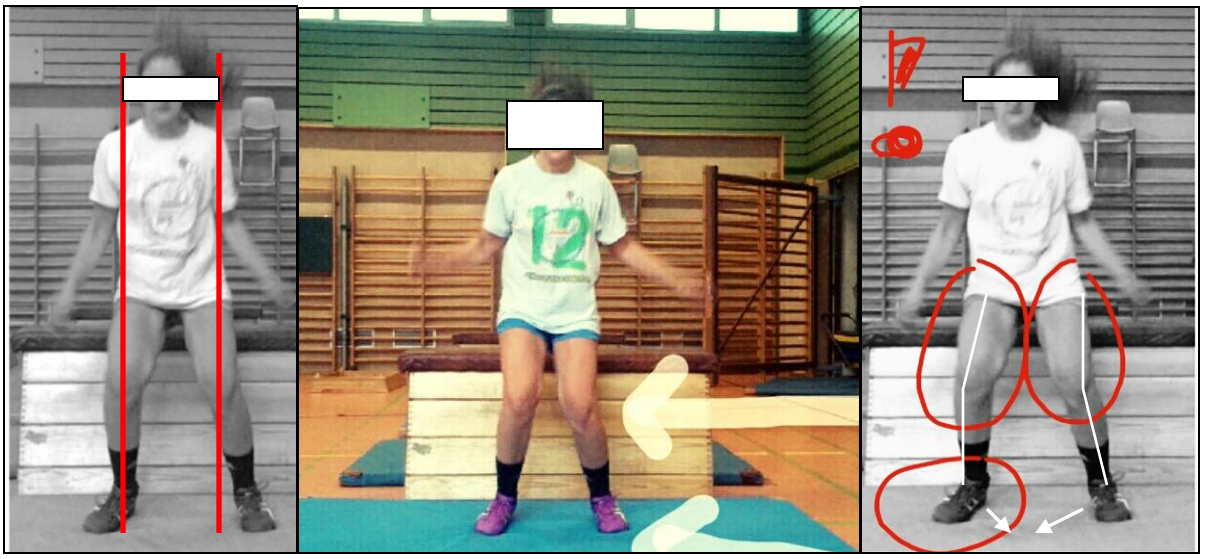


Photo 22: Characteristics: Knee valgus is also referred to as *valgus collapse* and *medial knee displacement*. It is characterized by hip adduction and hip internal rotation, usually when in a hips-flexed position (the knee actually abducts and externally rotates). It can also be thought of as *knee caving* as you sink down into a squat or landing. When standing on one limb, the opposite side pelvis will usually drop during valgus collapse as well.

The problems by these 14 years old youth handball player can be:

1. Weak hips- Inadequate gluteal/hip strength, possibly in conjunction with overactive hip adductors, prevents proper stabilization of the femur. The hips then move into adduction and internal rotation. And when the adductors are overactive in comparison to the glutes/hip external rotators, the knee is similarly pulled into valgus collapse.
2. Tight Ankles- Inadequate ankle dorsiflexion mobility with tight lower leg musculature
3. Inadequate strength- fail to allow for proper knee stabilization, which will cause the knee to track inward.
4. Impaired Hamstring- Inadequate medial hamstrings strength will prevent proper stabilization of the knee, which will lead to some medial knee displacement, similar to what happens with impaired VMO function but on the opposite side of the thigh.
5. Poor Coordination, Stabilisation and Balance

Some youth female players are much more prone to exhibiting valgus collapse than others based on their anatomy. All those aspects need to be corrected and improved in trainings already in a young age.

2.7 The Strength training

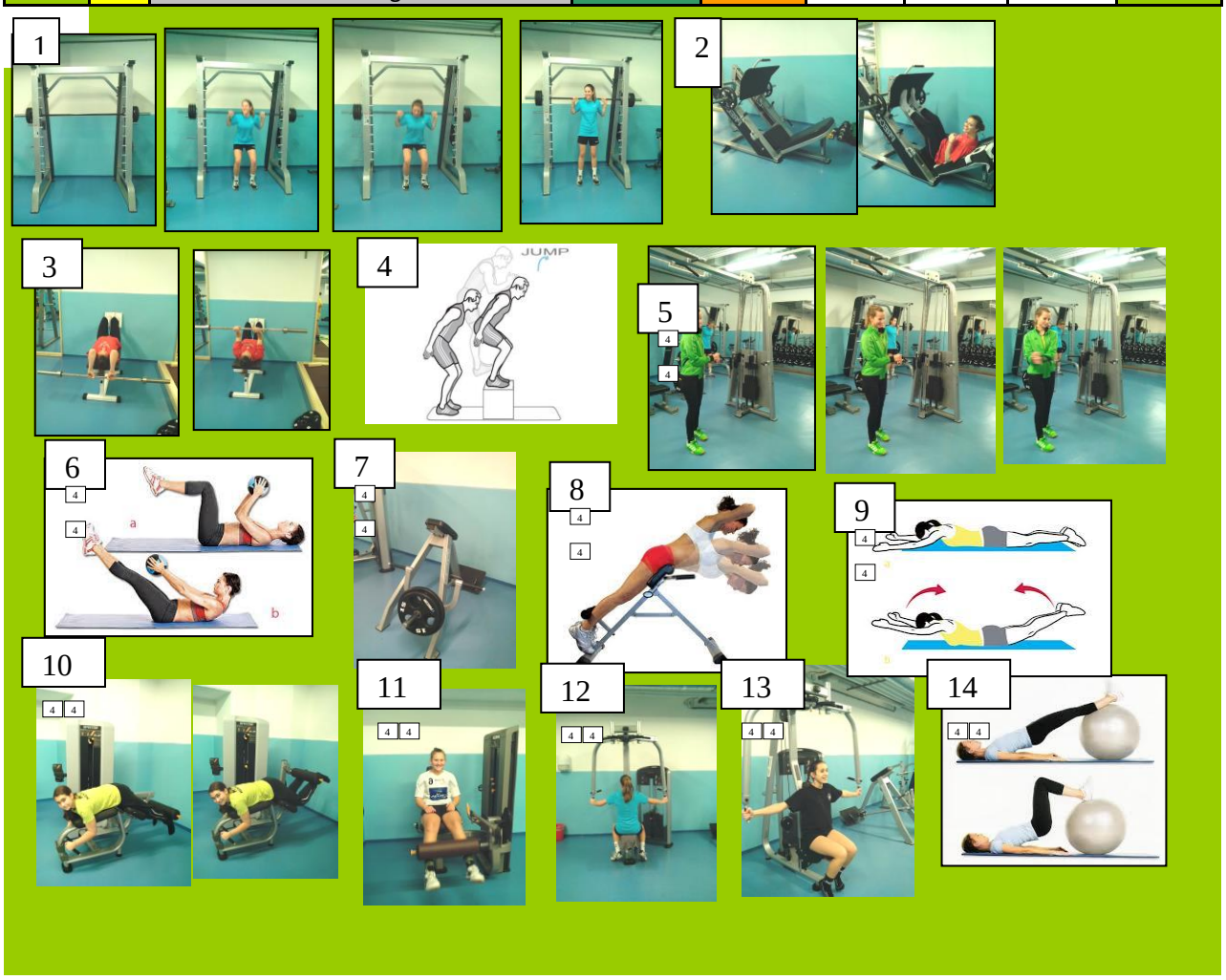
Why should junior female players have strength training? The two major reasons for it are: injury prevention and playing performance at higher level. Following Table shows the Gym programme for youth Handball players who trained in Gym 2-3 times per week.

Table 3: Gym programme used for Girls during the season. (Some exercises have changed during the season to avoid the same repetition)

GYM PROGRAMM

Individual: Always warm up and Stretch (15-20 min): Stationery Bicycle, Skipping-rope

NAME:			***Date:***			
Photo:	***Type of exercise***	***Repetition***	***Tempo***	***KG***	***KG***	***KG***
1	Squat	2x8	60%			
2	Leg Press - (sitting)	3x8	Max			
3	Shoulder-Elbow	3x6	Max			
4	Jump on bench	2x10	Max			
5	Stomach L/R	3x8 (L/R)	60%			
6	Stomach (with Medicinball 2kg)	2x7	60%			
7	Flyer	1x6	Max			
8	Back	2x10	60%			
9	Back -Legs	2x10	60%			
10	Hamstring	4x8	80%			
11	Leg-Kick	4x8	80%			
12	Chest- Sitting (front)	2x8	60%			
13	Chest- Sitting (back)	2x8	60%			
14	Stabi Legs	2x11	80%			



Hippocrates explained the principle behind strength training when he wrote "that which is used develops, and that which is not used wastes away",

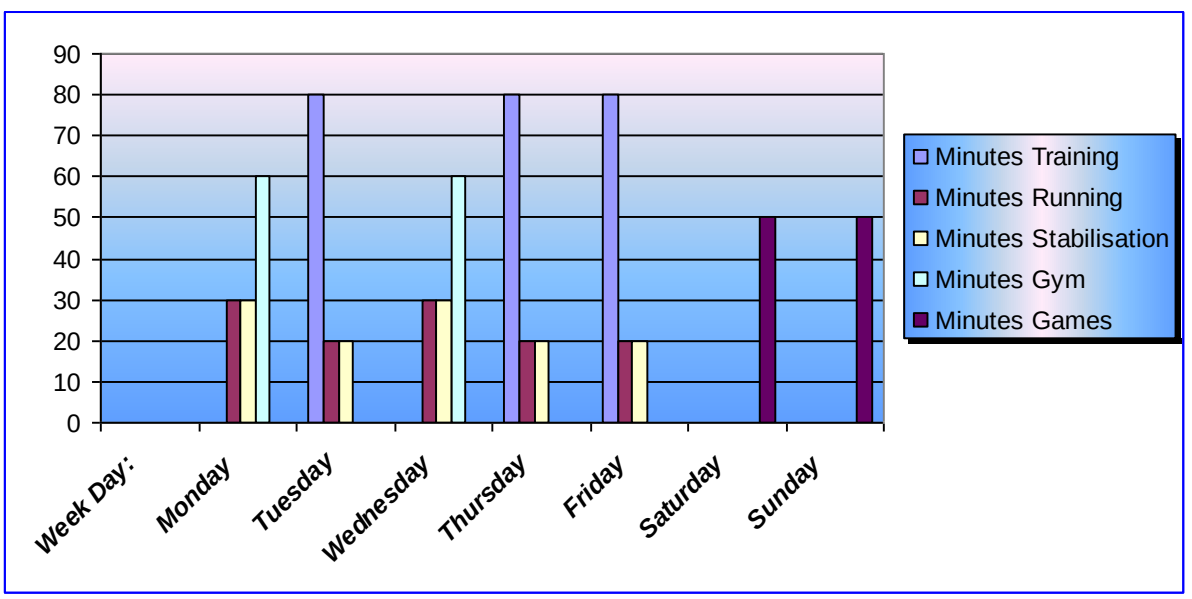
This type of conditioning should start during childhood as a preventive measure to enhance physical fitness and prepare aspiring young athletes for the demands of sports practice and competition. Ideally, athletes should at a young age given correct coaching in conditioning programme. However, this is not the case for younger female athletes; by not starting a strength programme early enough, these athletes may not only increase their chance of injury, but also reduce their ability to play as hard as they otherwise could.

3 DEVELOPMENT

Handball training every day in the week was as follows: Monday -30 minutes running,30 minutes stabilisation and one hour Gym; Tuesday- two hours training with 30 minutes injury prevention exercises , Wednesday-30minutes running,30 minutes stabilisation and one hour Gym; Thursday- two hours training with 30 minutes injury prevention exercises; Friday-30 minutes running and 1,5 hour training; and weekend- games.

The first year was the preparation phase to introduce the handball players to the training environment, develop core and limb strength, to teach safe and effective techniques and also to introduce the training habit. We have started with developing strength with own body weight. The second year was focus on player's education in the right technique, increase strength, coordination, stabilisation and understanding the prevention injury training.

Table 4: The summary of time spent (in Minutes) in Training, Running, Stabilisation, Gym and Games, per week day.

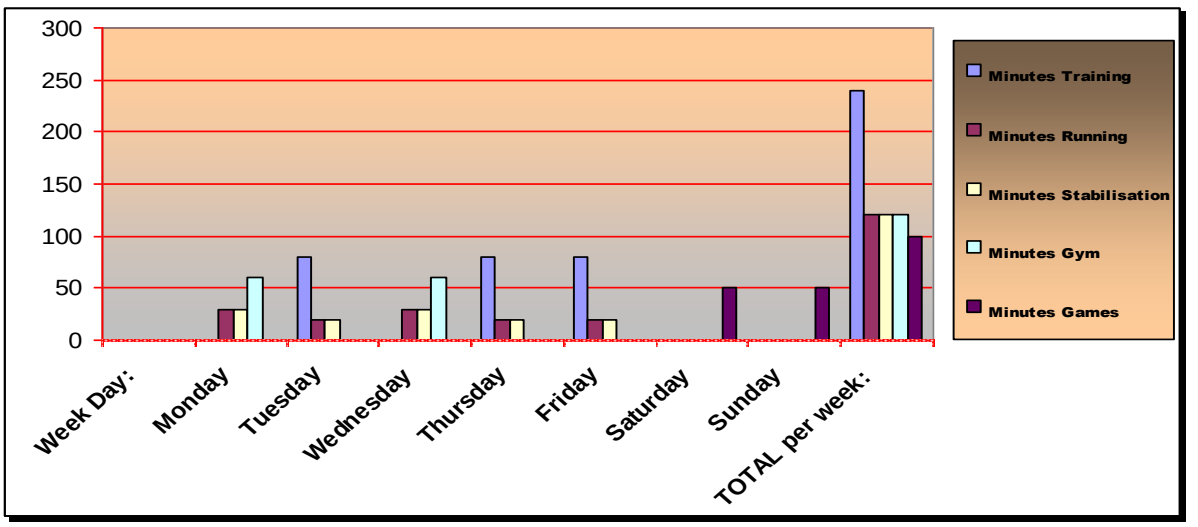


Youth handball players adapted well to the structure (Table 3) and the amount of training sessions. The fitness and the physical development increased by each player. The players were less fatigue, exhausted and faster recovered after exercises.

4 RESULTS AND DISCUSSION

During this year a total training in female youth handball players (13-16 years old) are: Training 240 minutes (4 hours), Running 120 minutes (2 hours), Stabilisation 120 minutes (2 hours), Gym 120 minutes (2 hours), Games 50-100 minutes (1,5 hours). The number of training sessions was 5-7 times per week and 30 minutes of injury prevention exercises, which are described in this study paper. Female players are more vulnerable to injuries but I had no injuries during the year period and this study shows that is possible to prevent injuries in youth handball players with good training structure.

Table 5: The total summary of time spent (in Minutes) in Training, Running, Stabilisation, Gym and Games, per day in a week.



The female players at this age have shown improvement: in strength, coordination, flexibility, stabilisation, running, jumping and played Games more physically.
Important for me as a coach was to teach the players the correct technique, core stability, the right movements in training or from video analysing, but later the players were thought to explain the correct movements and applying the corrections in training. During the season, the progression shown that each player is stronger, faster and more educated. The players are more self confident, motivated and understand the importance of injury prevention programs/trainings.

5 CONCLUSIONS

I have shown and described the structure in injury prevention training and the exercises used in my training during the entire season. The right training, warm up, stabilization, strength and coordination in one year showed in my team that it is possible to prevent injuries in female youth handball players. I have dedicated lots of time and spend lots of time with the players: analysing the videos, teaching the right technique, learning to train right. Analysing the videos is time consuming and we need extra time. Apart from that, I found this type of analysing as very practical tool to continually improve the team and individual player's performance.

I believe including injury preventing programmes early enough in the training process which includes a combination of balance, coordination, strength and the right technique exercises; we will avoid and prevent knee (ACL), Ankle and other injuries in female youth handball players.

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