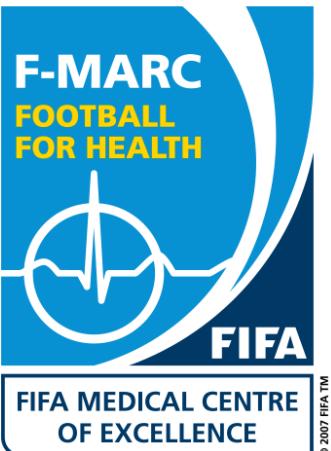




P. Lubiatowski , P. Kaczmarek, E. Lisiewicz, P. Cisowski,  
M. Grygorowicz, W. Dudziński, L. Romanowski

# **Shoulder rotational profile and occurrence of rotation deficits among professional handball players**

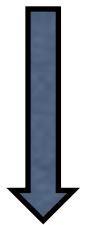
*Rehasport Clinic  
Department of Traumatology, Orthopaedics and Hand  
Surgery, University of Medical Sciences in Poznan*



# Throwing



1,9 s



Ball  
Velocity:  
140-144 km/h

*GIRD and TAMD vs pathology*

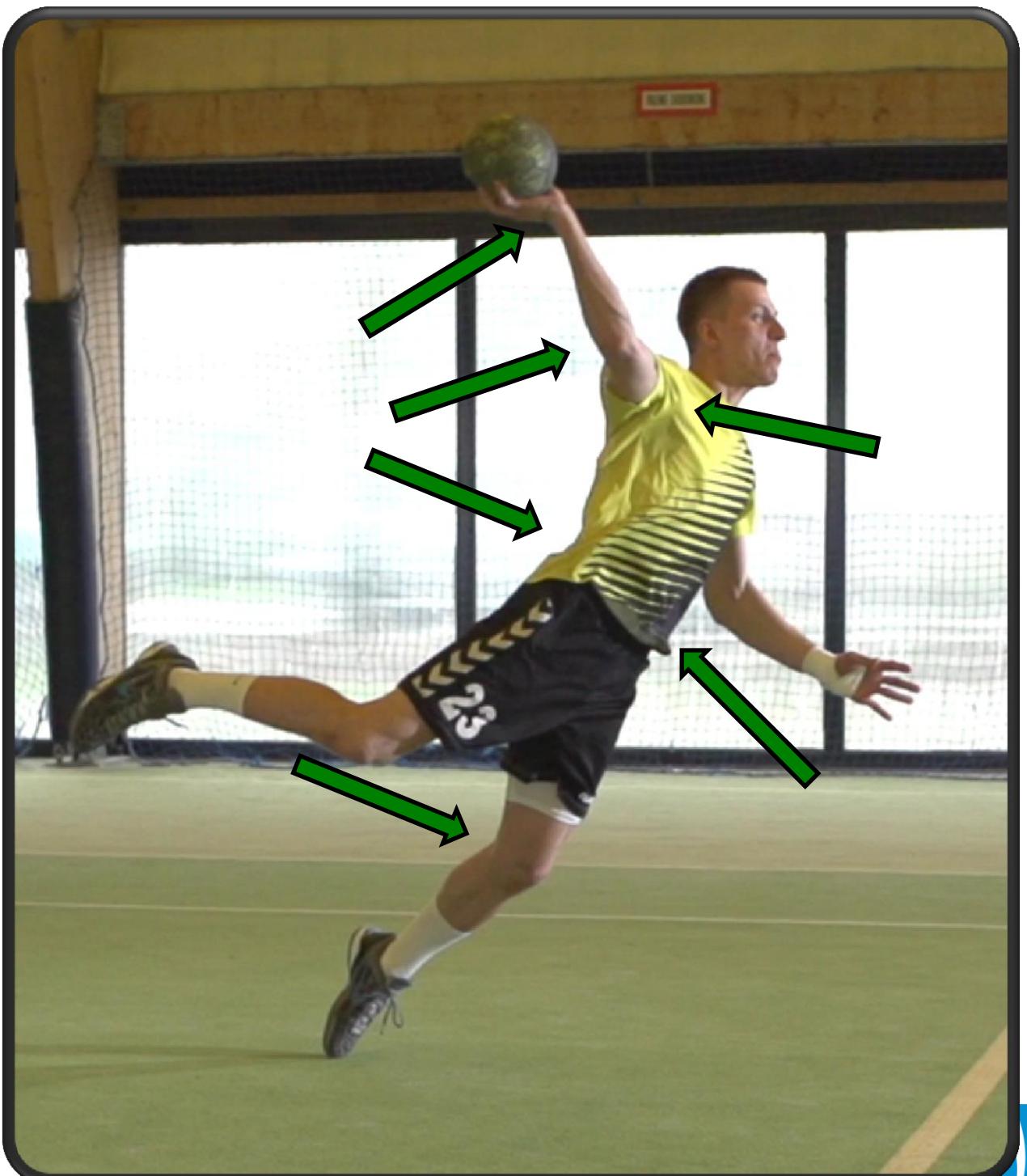
# Throwing

Multiple part of the body involvement

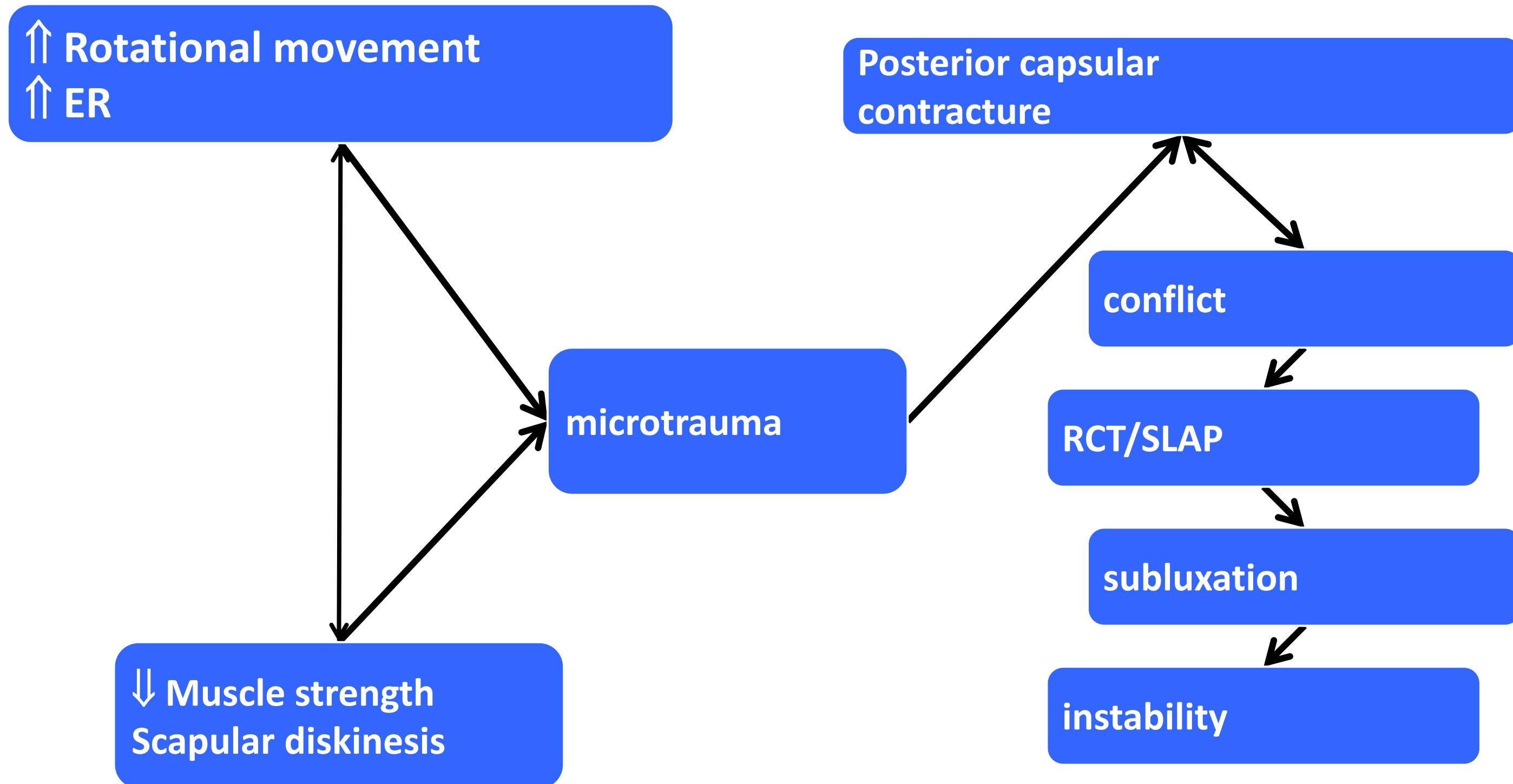
Generating of force pushing the ball

Transfer of force and load to distal parts of kinetic chain

Proper positioning of the joint to decrease overload



# Throwing pathology



*GIRD and TAMD vs pathology*

# Throwing pathology



## Early cocking

- ABER
- Internal impingement
- RC compression
- ant. capsule stretching



## Acceleration

- Muscle contracture
- Over-tension
- SIS



## Deceleration

- Tendon stretching
- SLAP
- Scapular diskinesis
- Posterior instability

## Glenohumeral Internal Rotation Deficit

- loss of shoulder internal rotation in abduction compared with non-throwing shoulder of the same player (Burkhart)

What level is significant ?

**<20° of IR loss ??**



# GIRD

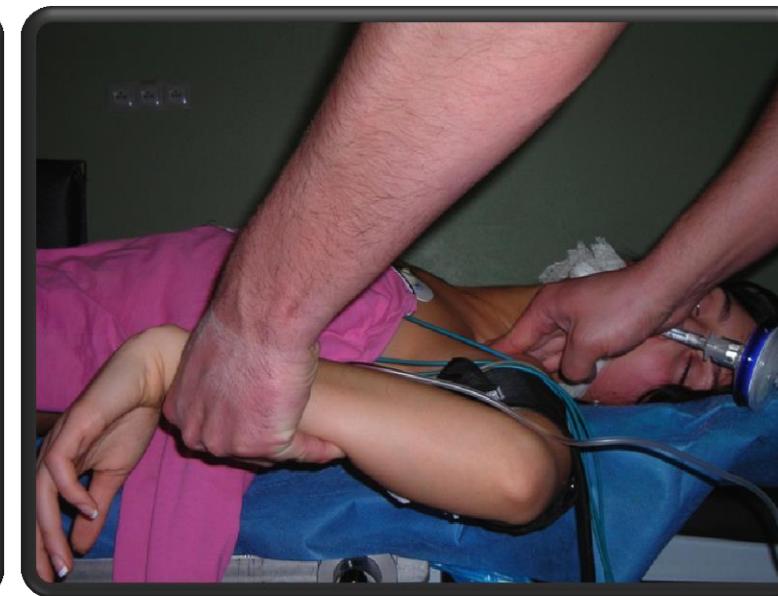
## Typical adaptation

GIRD



P

Internal rotation loss



L

*GIRD and TAMD vs pathology*

ERG- external rotation gain



P

External rotation gain

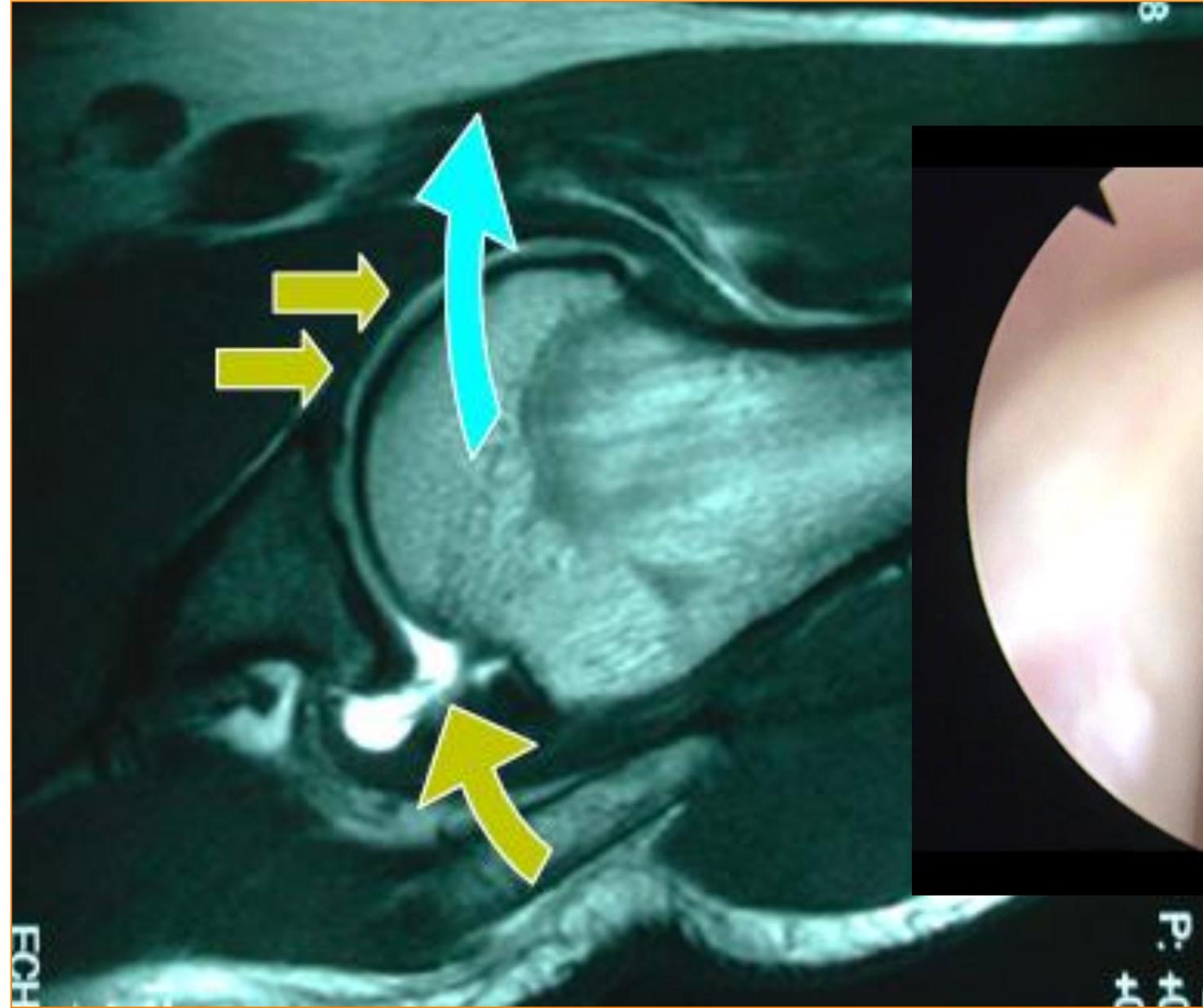


L

# Throwing pathology (Internal impingement)

HH anterior subluxation

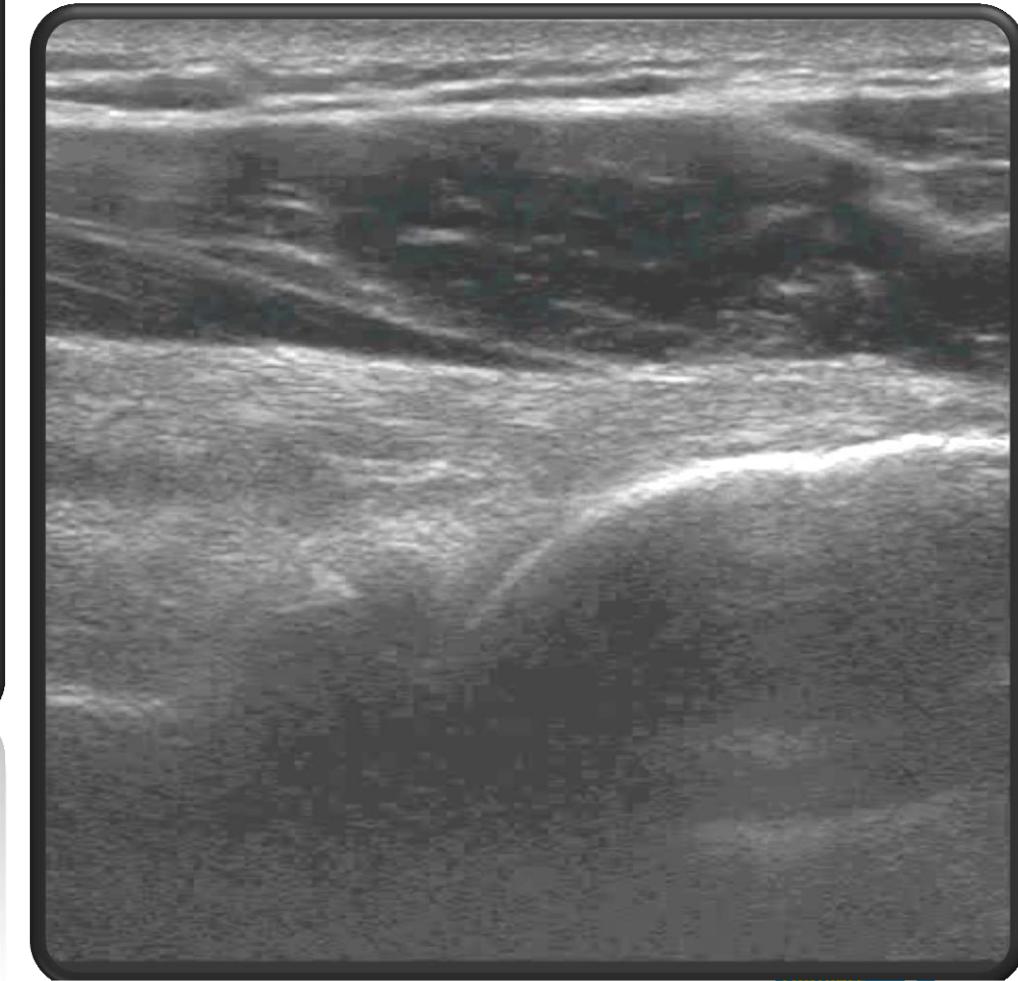
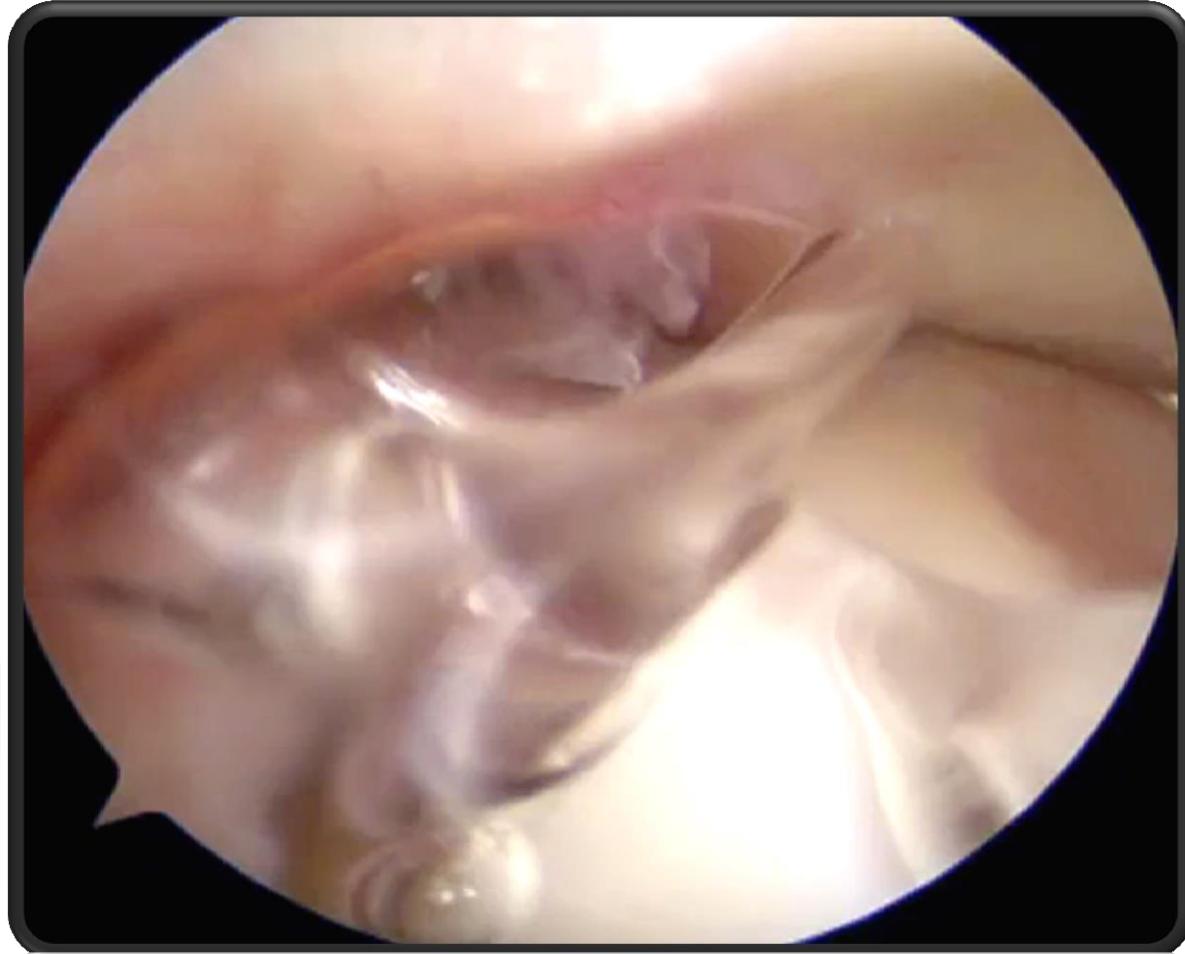
Stretching  
of anterior  
capsule



Internal impingement

*GIRD and TAMD vs pathology*

# Throwing pathology (Internal impingement)



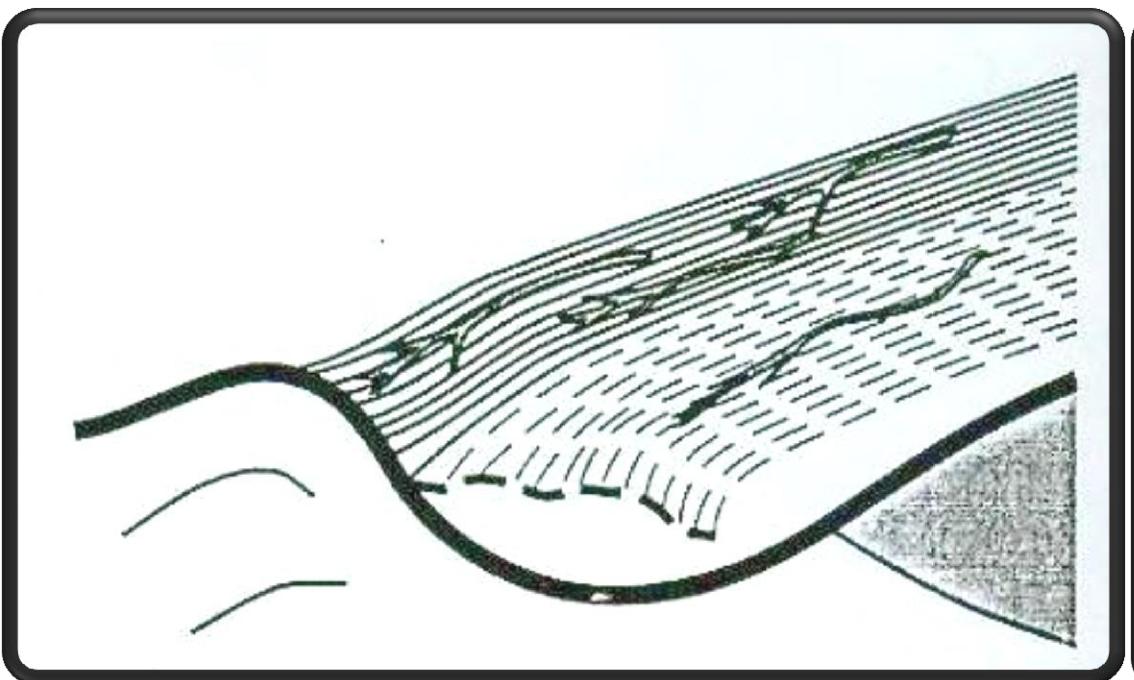
*GIRD and TAMD vs pathology*

# Throwing pathology (rotator cuff tears- partial)

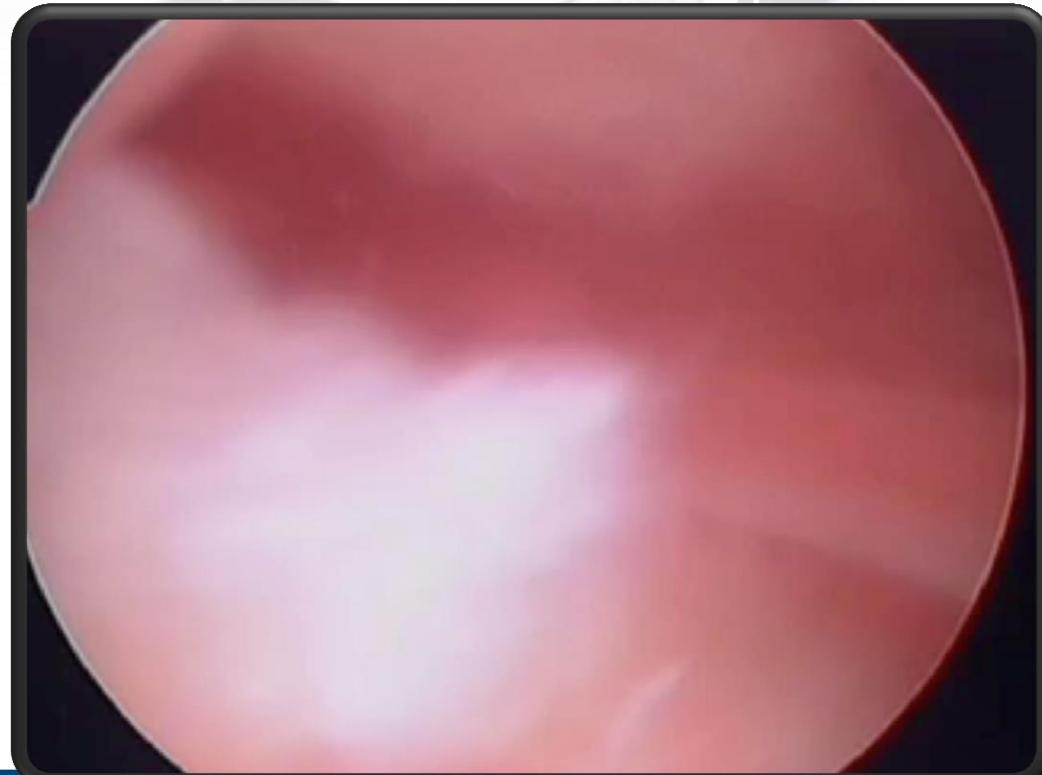
Articular site –

PASTA

(Partial articular supraspinatus  
tendon avulsion)



Bursal side tears



*GIRD and TAMD vs pathology*

# Why handball?

## 1. Typical effects of throwing on shoulder

- Biomechanical adaptation
  - ↑ER, ↓ IR
- Tissue adaptations (stretching, fibrosis, bone remodelling ↑ retroversion)

## 2. Majority of studies on baseball

## 3. Handball specificity

# Specificity of handball throw (different throws)



jump throw



hip throw

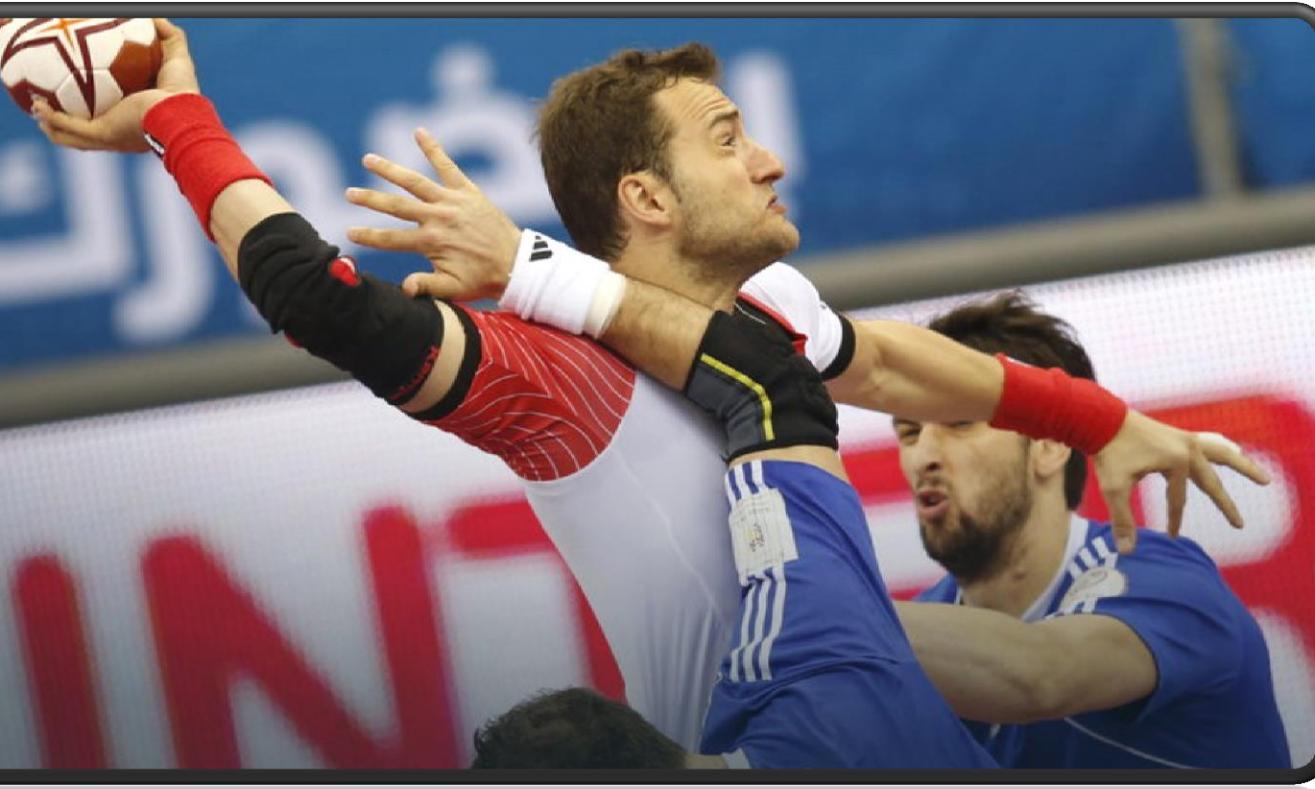


pivot throw



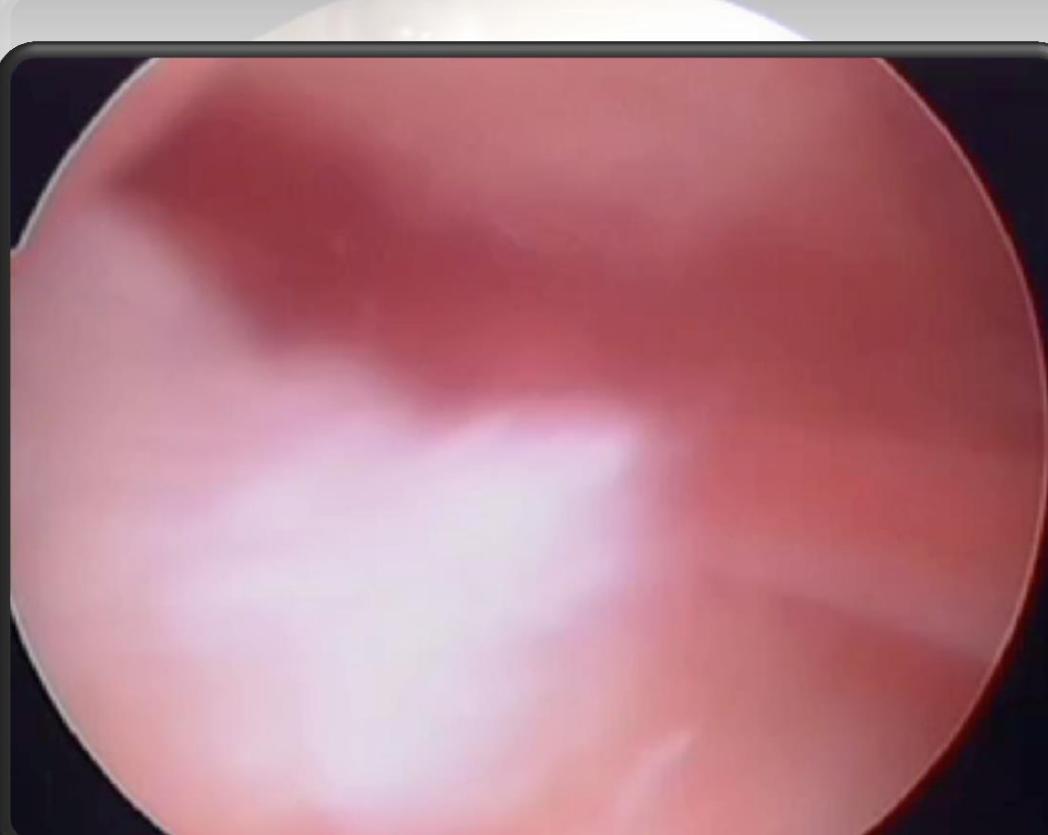
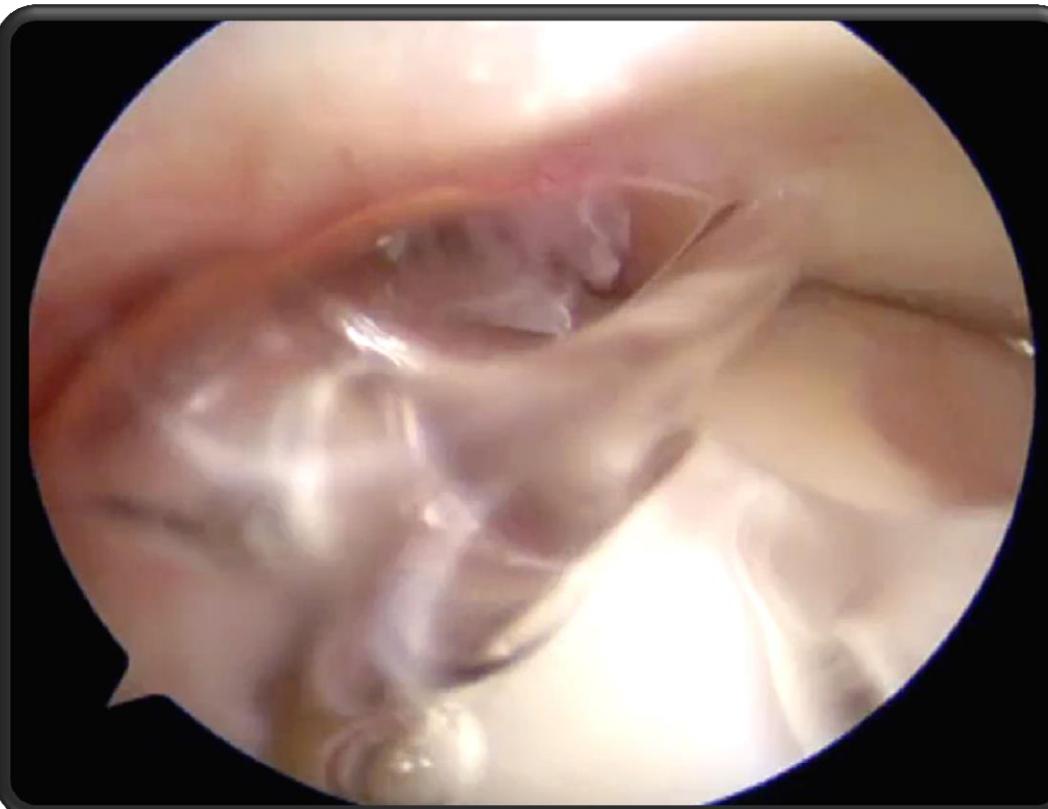
penalty/runup throws

# Specificity (high risk of injury)



*GIRD and TAMD vs pathology*

# Specificity of handball throw (multiple repetitions)



*GIRD and TAMD vs pathology*

- to explore the shoulder rotational parameters
  - to correlate them with the presence of shoulder pain and shoulder morphological changes
- among professional handball players



## Material

87 professional male handball players

4 Super League (first polish division) teams and 1- 1st League (the second polish division)

no fresh or current disabling shoulder injury or overuse

age:  $25 \pm 5$  (18-38)

Height:  $188 \pm 6$  (175-202)

Weight (kg):  $92 \pm 11$  (64-125)

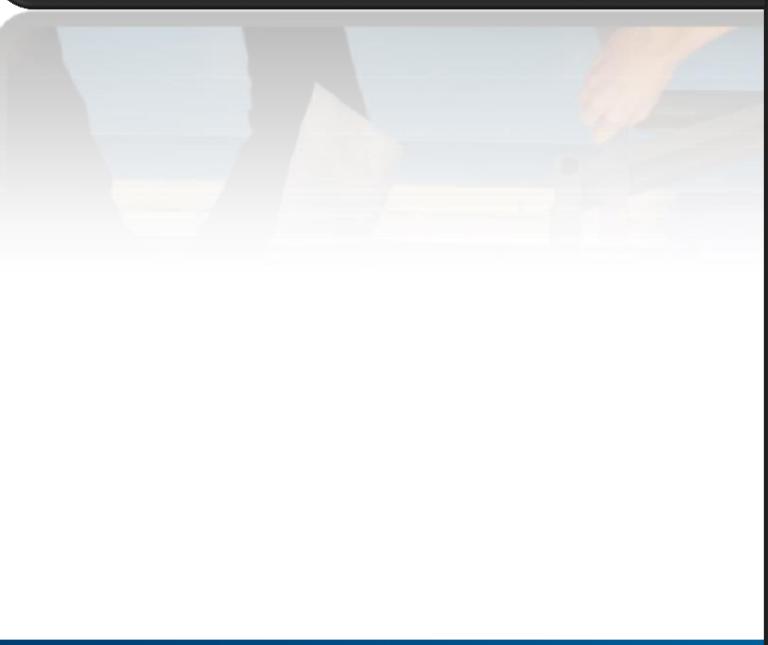
Dominance: R 68 / L 19

# Methods

## GH Rotation

- Patient is lying supine
- Shoulder is abducted to 90° in the plane of the body
- Scapula is stabilized (pressed against the table with simultaneous palpation of coracoid process)
- Visual control

**PAIN- >2 in VAS (0-10)**



# Methods

## Calculations

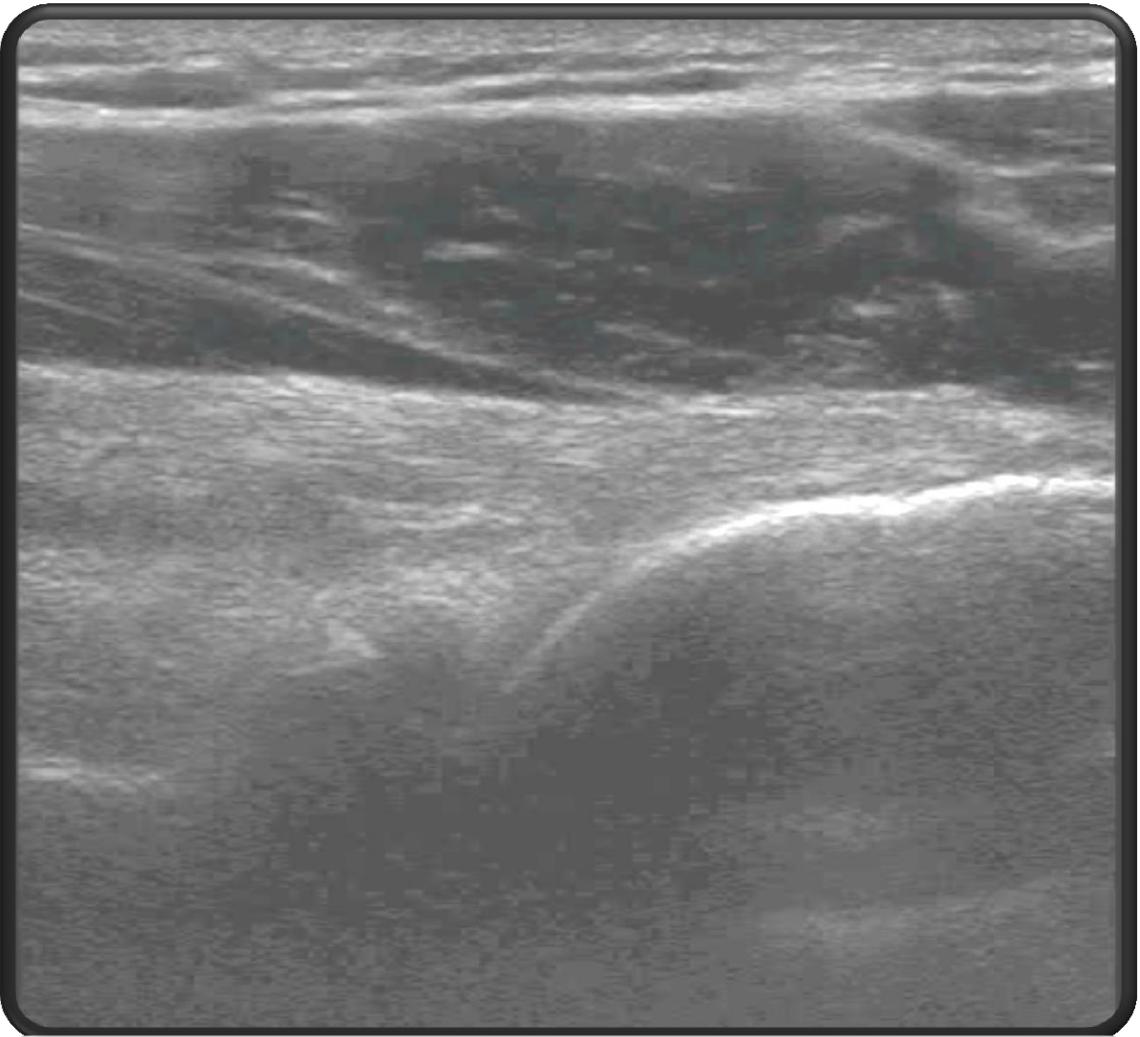
- **IR** (internal rotation)
- **ER** (external rotation)
- **GIRD**= non-dom. IR – dom. IR (GH internal deficit)
- **TAM**= IR + ER (total arch of motion)
- **TAMD**= non-dom. TAM – dom. TAM (total arch of motion deficit)
- **ERG**= dom. ER – non-dom. ER (external rotation gain)
- **TAMG**= dom. TAM – non-dom. TAM (total arch of motion gain)

**Statistics:** power, normality, T-student, Mann-Whitney, Fisher's exact test

# Methods

## Ultrasound scan

- MS radiologist, 5-12 MHz linear transducer HD11 XE system, Phillips
- rotator cuff, posterosuperior internal impingement, LHB, bursitis, ACj



# Results

## Pathological findings

- Pain in 41%
- Ultrasound scan
  - RCT 14%
  - Internal impingement 15%
  - Bursitis 3%, ACj- 2%
  - no statistical difference for the incidence of pain related to the presence or absence of RCT (54% vs. 45%) nor related to internal impingement (62% vs. 38%)
  - no increased risk of the RCT while having internal impingement

# Results (rotations vs. pathology )

measurement		shoulder pain		internal impingement		partial RCTs	
		yes	no	yes	no	yes	no
IR of throwing shoulder	ave. $\pm$ SD	50 $\pm$ 15	52,5 $\pm$ 13,1	36,6 $\pm$ 12,4	53,4 $\pm$ 12	48,7 $\pm$ 12,5	51,7 $\pm$ 14,2
	p value	n.s.		<0,0001		ns	
ER of throwing shoulder	ave. $\pm$ SD	87,7 $\pm$ 21,2	93,9 $\pm$ 14,9	76 $\pm$ 25,5	94,3 $\pm$ 14,1	93,8 $\pm$ 16,4	90,8 $\pm$ 18,1
	p value	p<0,05		<0,0001		n.s.	
GIRD (ND-D)	ave. $\pm$ SD	6,1 $\pm$ 10,8	5 $\pm$ 10,4	6,9 $\pm$ 11,4	5,3 $\pm$ 10,3	3,8 $\pm$ 10,9	5,8 $\pm$ 10,4
	p value	ns		n.s.		n.s.	
ERG (D-ND)	ave. $\pm$ SD	2,5 $\pm$ 10,9	4,1 $\pm$ 11,3	1,1 $\pm$ 16,9	3,9 $\pm$ 9,8	6,8 $\pm$ 6,5	3 $\pm$ 11,5
	p value	n.s.		n.s.		0,05	
TAM	ave. $\pm$ SD	137,7 $\pm$ 32,2	146,4 $\pm$ 24	109,8 $\pm$ 34	148,2 $\pm$ 22,4	142,5 $\pm$ 25,6	142,5 $\pm$ 28,4
	p value	<0,05		<0,0001		n.s.	
TAMD	ave. $\pm$ SD	3,6 $\pm$ 14,2	0,9 $\pm$ 18,3	5,8 $\pm$ 19,9	1,3 $\pm$ 11,1	(-)3,1 $\pm$ 8,7	2,8 $\pm$ 13,2
	p value	ns		0,029		n.s.	

GIRD and TAMD vs pathology

# Results (incidence of pathology vs. GIRD level)

		GIRD (any)		GIRD (>5°)		GIRD (>10°)		GIRD (>20°)		GIRD (>25°)		ERG	
		yes	no	yes	no	yes	no	yes	no	yes	no	yes	no
shoulder pain	Incidence (%)	43	38	43	40	38	44	67	37	50	41	35	45
	Fisher's test (p)	n.s.		n.s.		n.s.		<0,03		n.s.		n.s.	
internal impingement	Incidence (%)	17	12	15	15	13	16	27	13	50	13,3	12	17
	Fisher's test (p)	n.s.		n.s.		n.s.		n.s.		0,02		n.s.	
Partial RCT	Incidence (%)	9	21	11	18	9	16	8	15	50	13	25	6
	Fisher's test (p)	n.s.		n.s.		n.s.		n.s.		n.s.		<0,01	

# Results (incidence of pathology vs. TAMD level)

		TAMD (any)		TAMD (>5°)		TAMD (>10°)		TAMD (>20°)		TAMD (>25°)		TAMG	
		yes	no	yes	no	yes	no	yes	no	yes	no	yes	no
shoulder pain	Incidence (%)	47	36	43	40	43	41	50	41	40	41	38	43
	Fisher's test (p)	n.s.		n.s.		n.s.		n.s.		n.s.		n.s.	
internal impingement	Incidence (%)	16	14	20	12	19	14	15	5	20	15	15	15
	Fisher's test (p)	n.s.		n.s.		n.s.		0,01		n.s.		n.s.	
Partial RCT	Incidence (%)	11	17	14	13	5	16	0	8	0	15	35	24
	Fisher's test (p)	n.s.		n.s.		n.s.		n.s.		n.s.		<0,04	

## Discussion

- High incidence of pain in HB players (41%)  
- No association between pain vs. RC tear and internal impingement

### Literature:

- *Myklebust G at al. 2013, Clarsen B at al. 2014, Almeida GP at al. 2013*
- Incidens of shoulder problems or pain 32-52%
  - In 36% missed the game
  - In 68-75% modified the training

## Discussion

→ Tissue lesions  
14% RC tears, 15% internal impingement

Literature:

*Jost B at al. 2005*

- *handball*
- 27% RC tears, 37% internal impingement
  - abnormalities not predictor of pain

*Halbrecht J at al. 1999*

- baseball
- 30% SLAP tears, 40% RC tears

## Discussion

→ What level of rotational deficit is clinically important?

- GIRD > 20-25° → pain, internal impingement
- TAMD > 20-25° → internal impingement
- ERG, TAMG → RC tear

Burkhart S at al. 2003- GIRD > 25° → SLAP

Myers JB at al. 2006- internal impingement → GIRD 19°

Ruotolo C at al. 2006

- shoulder pain → 10°TAMD, 14°GIRD
- no shoulder pain → 1°TAMD, 9°GIRD

Clarsen B at al. 2014- no association between injury and rotation

deficits

# Conclusions

- Larger rotational deficits or gains may be associated with shoulder pathology.
- Handball players affected by pathology
  - commonly by shoulder pain (41%)
  - cuff tears, impingement (14-15%)
- Any larger rotational deficit should warrant medical team's attention, since GI RD > 20-25° or TAMD > 20° coexisted with pathological findings of shoulder pain, partial rotator cuff tear or internal impingement as seen on ultrasound scan.
- Measure and monitor ROM in ABER

Instructional lectures

Scientific presentation

Workshops

Cadavers

17-19.03.2016

Poznan



**IX INTERNATIONAL POZNAN COURSE  
IN UPPER EXTERMITY SURGERY:  
SHOULDER AND ELBOW  
I MEETING OF POLISH SOCIETY  
OF THE SHOULDER AND THE ELBOW**

**DATE:**

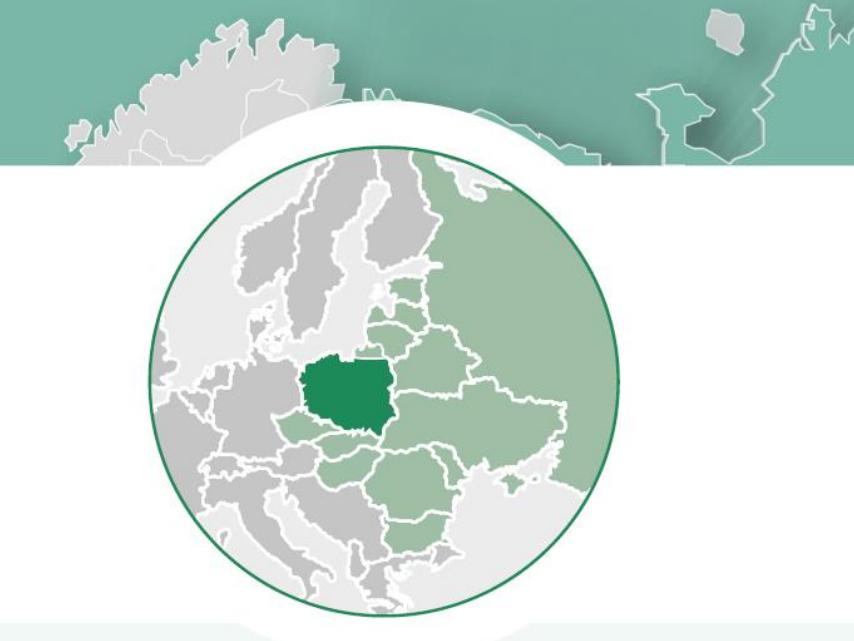
17–19 March 2016

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Thank you

[p.lubiatowski@rehasport.pl](mailto:p.lubiatowski@rehasport.pl)

Multumesc !

