

EHF medical & scientific conference , Bukarest, Romania, 11-2015

# Knee injuries in handball

Prof. Romain Seil, MD, PhD

Orthopaedic  
Surgery



Centre Hospitalier  
de Luxembourg

Sports Medicine  
Research Laboratory



Luxembourg  
Institute of Health





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Κύπρος

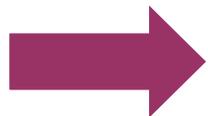
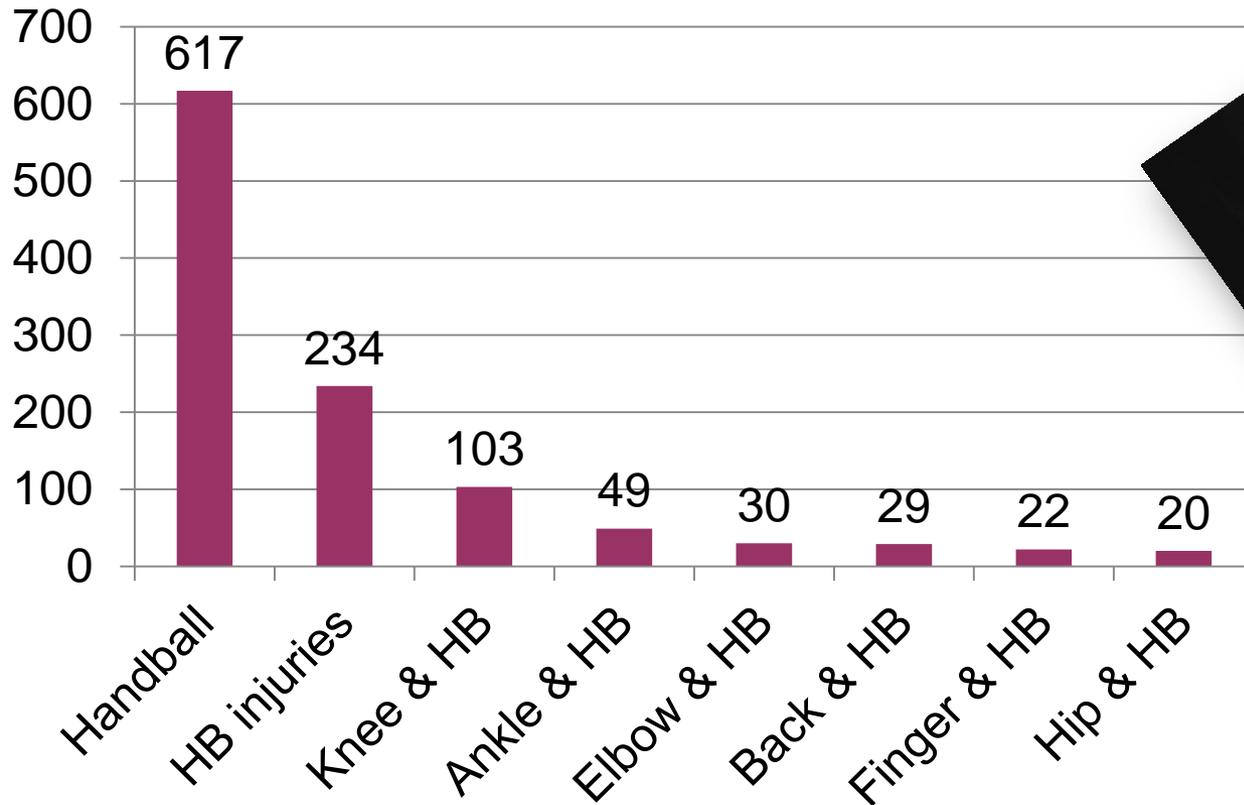
Kypros

Kıbrıs

Luxembourg:

0,5 mill.people

2.500 km<sup>2</sup>

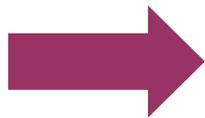


Sports injuries = 36.628; Football = 6.387



- ❖ Jorgensen 1984
- ❖ Fagerli 1990
- ❖ Wedderkoop 1997
- ❖ Myklebust 1998
- ❖ Seil 1998
- ❖ Nielsen 1998
- ❖ Asembo 1998
- ❖ Petersen 2002
- ❖ Olsen 2006
- ❖ Langevoort 2007

# Injury locations



Knee = No. 1 injured joint



Table 20.3 Absolute numbers, percent comparisons, or both of injury locations among female and male handball players.

Body Part/Type of Injury	Fagerli et al. (1990) <sup>a</sup>		Jørgensen (1984)	Seil et al. (1998)	Asembo & Wakasa (1998)		Langevoort et al. (2007) <sup>b</sup>		Olsen et al. (2006), Junior Data <sup>c</sup>		Nielsen & Yde (1988), Senior Data		Nielsen & Yde (1988), Junior Data		Wedderkopp et al. (1997), Junior Data
	Women	Men	Men	Men	Women	Men	Men	Women	Women + Men	Women	Men	Women	Men	Women	Men
Injured body part	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Knee	25 (9)	18 (10)	18 (10)	18 (10)	27 (12)	35 (13)	24 (27)	2	3 (7)	4 (18)	1 (7)	31 (15)			
Lower leg															
Ankle			45 (16)	14 (8)	22 (9)	28 (12)	22 (24)	9	12 (27)	10 (45)	4 (27)	56 (27)			
Foot/toe			—	3 (2)	5 (2)										1 (0.5)
Others			20 (7)							2 (9)	2 (13)				0

18 to 35 %

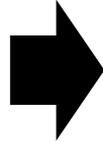
# Injury mechanisms



- ❖ Valgus collapse
- ❖ Hyperextension
- ❖ Hyperflexion
- ❖ Contact / non-contact ?
- ❖ Velocity ?
- ❖ Rotation ?

## 2 main injury mechanisms

Plant & cut

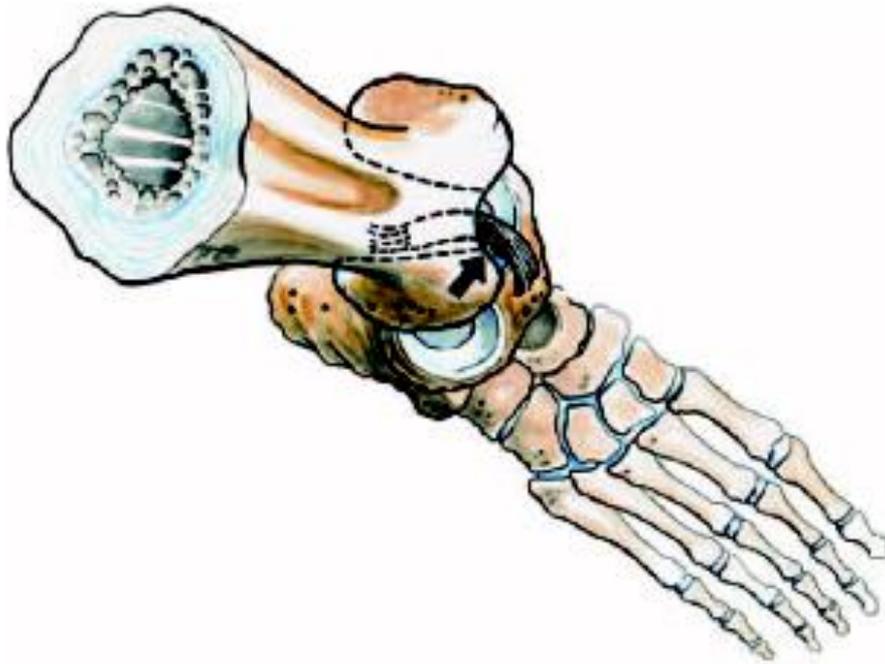


1-legged  
jump shot  
landing



Olsen OE, Am J Sports Med 2004

## 2 main injury mechanisms

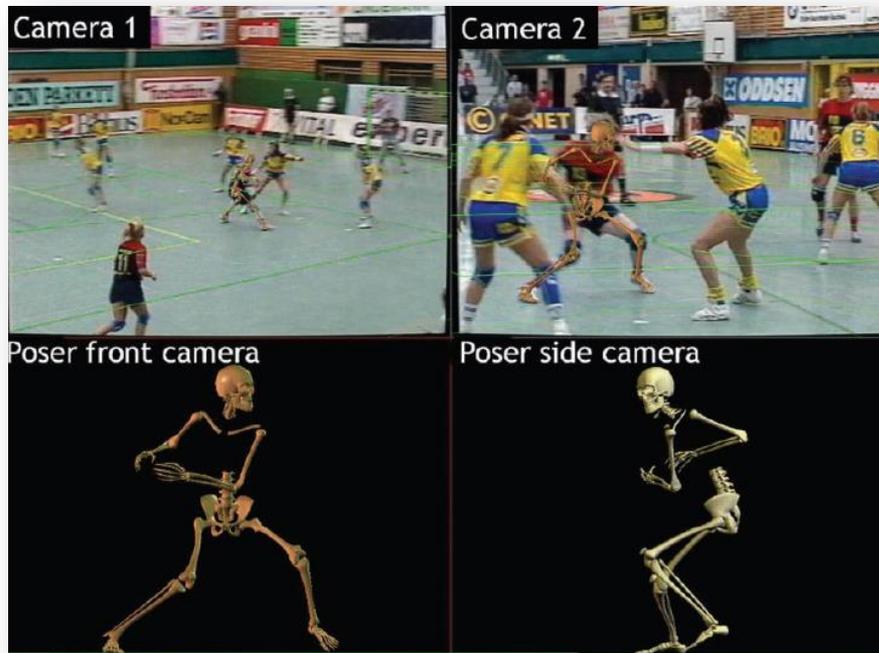


Forceful valgus collapse  
+  
Knee close to extension  
+  
Internal/external rotation tibia

*From: Bahr R, Maehlum S: A clinical guide to sports injuries, 2004*

*Olsen OE, Am J Sports Med 2004*

## Quantification of knee joint motion



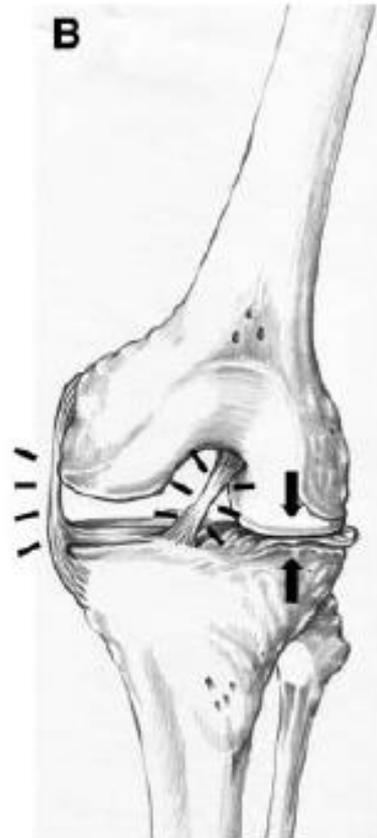
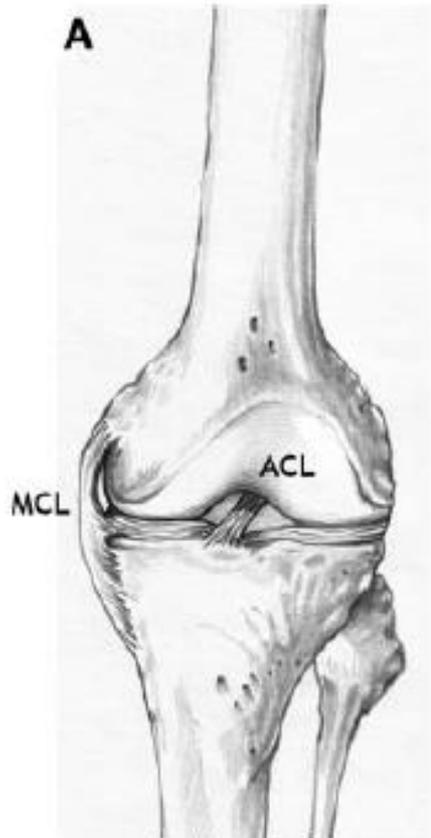
*3-D knee joint kinematics*

*Model-based image matching technique*

- ❖ ACL # within 40 ms after landing
- ❖ Knee flexion angle
  - @ landing: 23° (11-30)
  - @ 40 ms: + 24° (19-29)
- ❖ Rotation
  - 40 ms: 5°ER → 8°IR
  - After 40 ms: 17° ER
- ❖ GRF @ 40 ms: 3.2 x body weight

*Koga H, Am J Sports Med 2010*

## Understand the injury mechanism



Forceful valgus



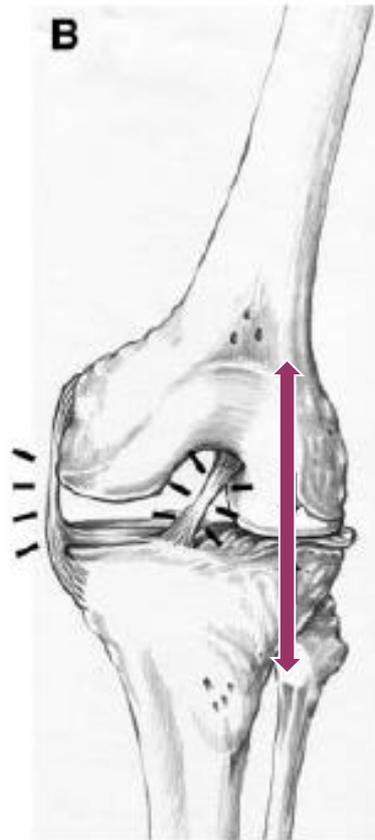
ER femur  
→ ACL#



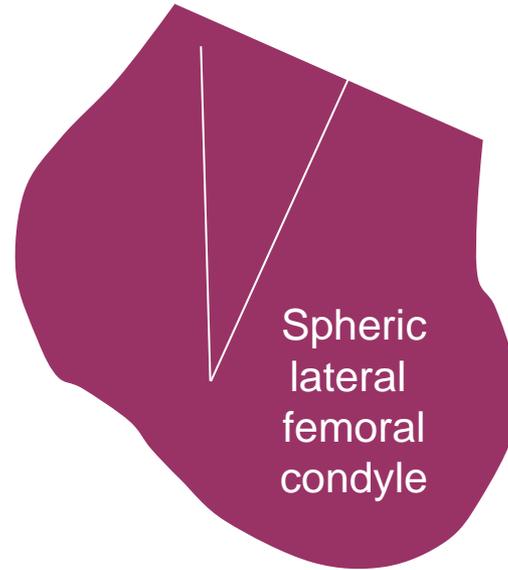
Reflex reposition  
IR femur

Koga H, Am J Sports Med 2010

# Understand the injury mechanism



Forceful valgus



Spheric lateral femoral condyle



Convex lateral tibial plateau

*Koga H, Am J Sports Med 2010*

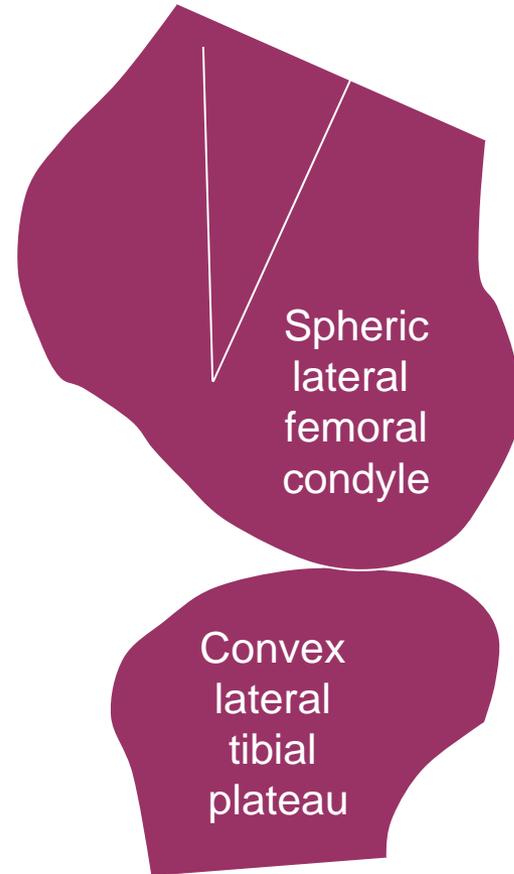
# Understand the injury mechanism



ER femur  
→ ACL#



Reflex reposition  
IR femur



*Koga H, Am J Sports Med 2010*

# Understand the injury mechanism



*Seil R, Arthroscopie SFA 2015*

# Hyperextension



*Courtesy of Dr. B. Galaud, France*

## Tibia plateau fracture



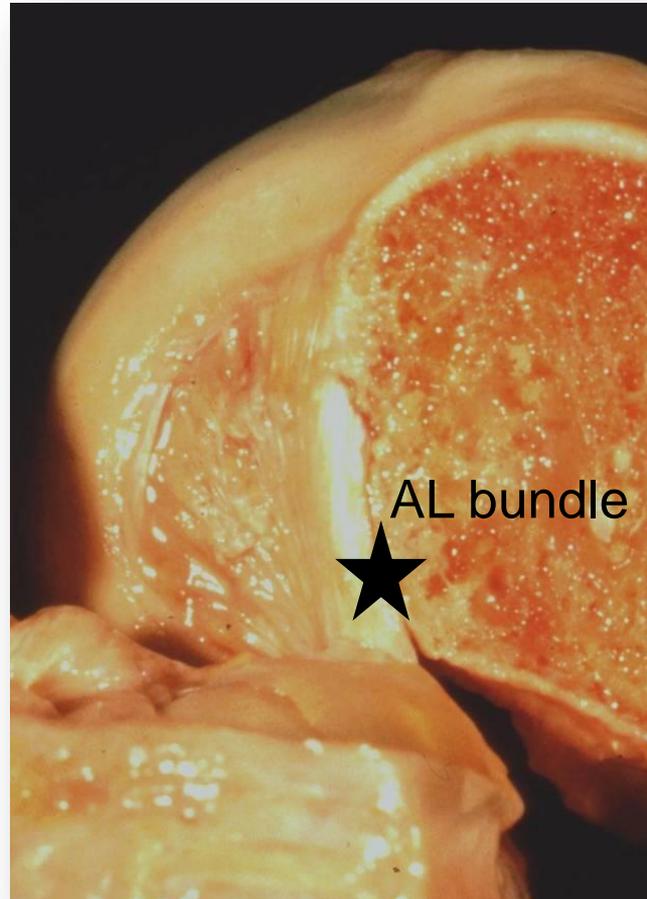
*P. Hens  
Germany-Iceland  
Olympic Games Beijing 2008*

# Hyperextension



*P. Hens, Germany-Iceland  
Olympic Games Beijing 2008*

## PCL injury



## Posterolateral instability



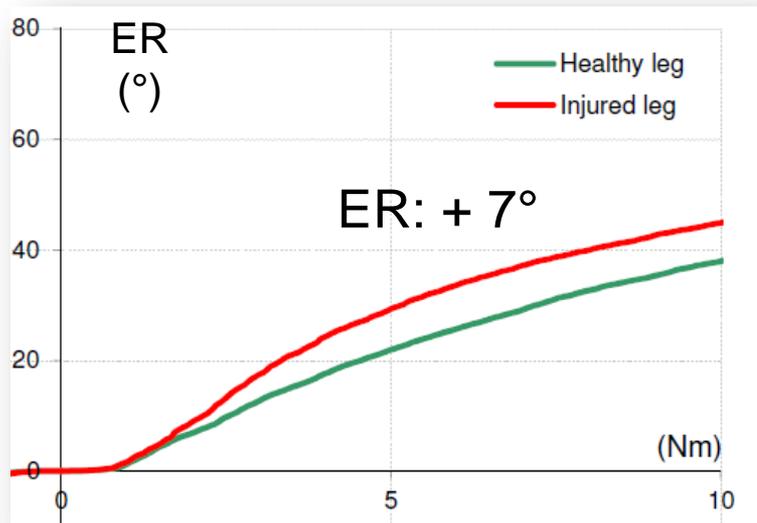
♂, 22 y.: LCWO in 2002; professional handball player

## Tibia plateau fracture



*Nührenbörger C, submitted*

## Traumatic proximal tibiofibular joint instability



♂, 19 y.





## **Structural / anatomic**

- ❖ Ligaments
- ❖ Meniscus
- ❖ Cartilage
- ❖ Tendons
- ❖ Bone

## **Appearance**

- ❖ Acute
- ❖ Chronic



## 12 håndball-jenter har ødelagt knærne

Figure 1. Répartition des blessures par âge et par sexe

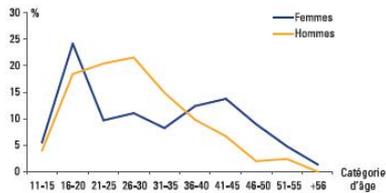
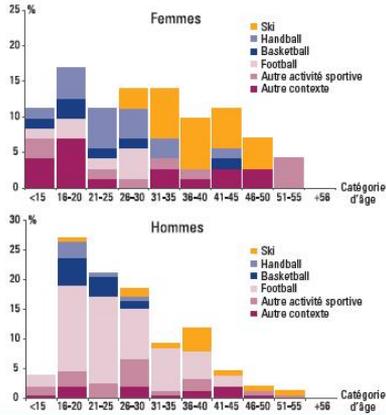


Figure 2. Répartition par activité au moment de la blessure



### Le Saviez-vous ?

- En Norvège : au Handball féminin, les ruptures du LCA ont pu être réduites de 50 % grâce à un entraînement préventif visant quelques gestes techniques.
- Il existe des programmes de prévention mis en place par certaines fédérations internationales : il est possible de réduire les blessures au football de 30 à 50 % grâce à un programme spécifique axé sur 10 points : [www.f-marc.com](http://www.f-marc.com)
- La campagne [www.STOPSportsInjuries.org](http://www.STOPSportsInjuries.org) permet de sensibiliser le public et les milieux sportifs au problème des blessures et encourage l'initiation des mesures de prévention.
- [www.tipsps.lu](http://www.tipsps.lu) plateforme de surveillance mise en place au Luxembourg a permis de sensibiliser les jeunes athlètes ainsi que leur entourage scolaire et sportif aux blessures sportives. Le Luxembourg est un pionnier dans le domaine : c'est une des premières fois qu'un tel système d'enregistrement de l'entraînement physique a été mis en place. Ce programme a été développé grâce à une collaboration très étroite entre le Laboratoire de Recherche en Médecine du Sport du CRP-Santé, du Département Ministériel des Sports et du Centre Hospitalier de Luxembourg. Il est accessible à toute personne intéressée. Son accès est facile et son utilisation est gratuite.



### Contact :

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 Chef du Département de l'Appareil Locomoteur  
 Centre Hospitalier de Luxembourg - Clinique d'Eich  
 76, rue d'Eich, L-1460 Luxembourg  
 Tél.: +352 44 11 75 11  
 Fax: +352 44 11 76 25  
 E-mail: [sell.romain@chl.lu](mailto:sell.romain@chl.lu)

## L'épidémie des lésions du ligament croisé antérieur : comment vaincre un fléau ?

CRP SANTÉ  
CENTRE DE RECHERCHE PUBLIC  
LABORATOIRE DE RECHERCHE EN MÉDECINE DU SPORT

CENTRE HOSPITALIER DE LUXEMBOURG

CLINIQUE DU SPORT  
.lu

Hun er en av dem som virkelig har fått en hard belastning på kroppen.  
 Først tok venstre kne, et trettitts deltok i A-1 mot Gjerpe fremre kors knæet. Det er også ødelagt.  
 -Det er 2 jeg opererte knæet.  
 forklarer 19-åringen.

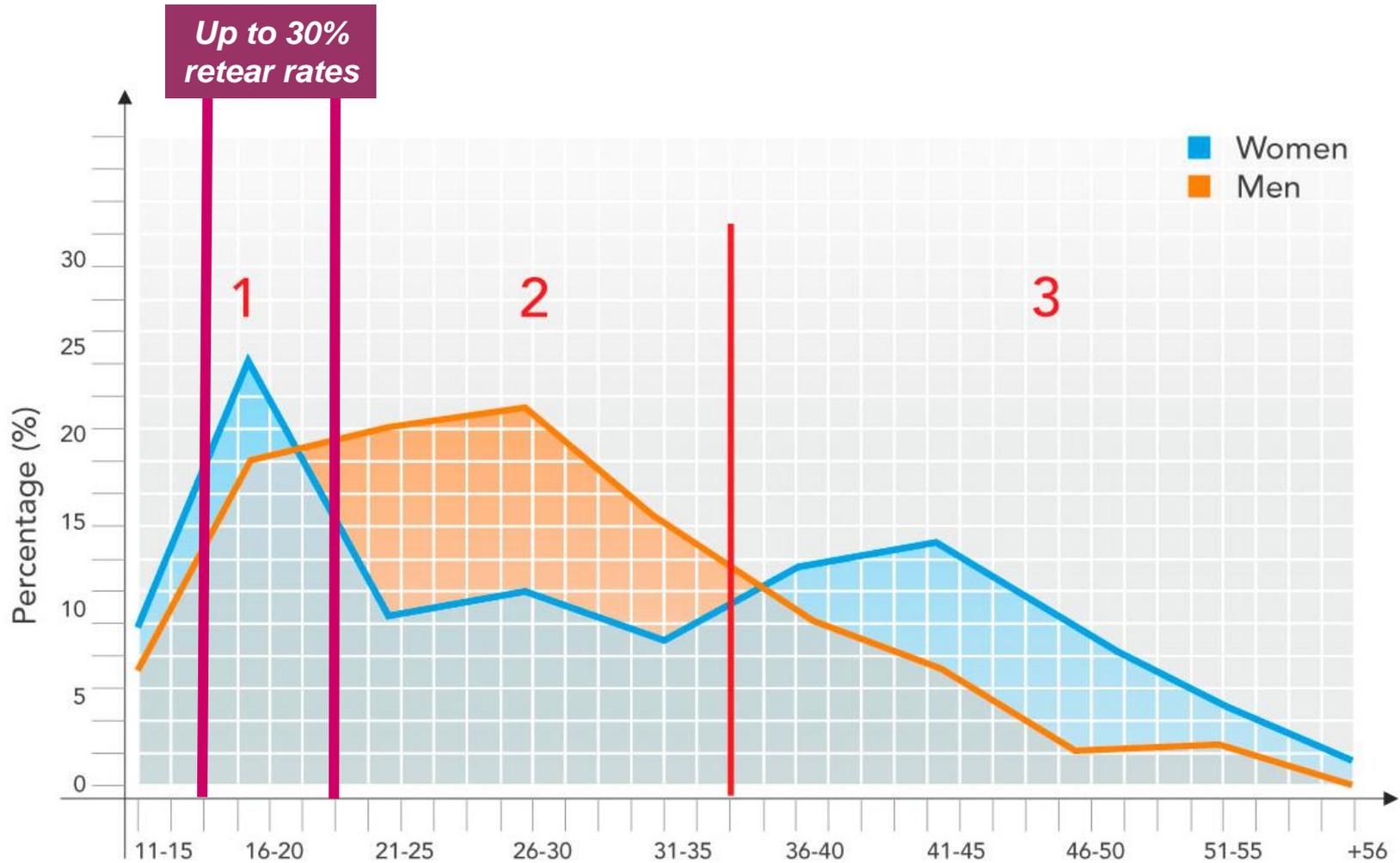
Rammet. Alle disse spillerne har tatt ett eller flere korsbånd i knærne. Hege Skatrud (foran) gjorde det på 19-årsdagen sin ny-

# EPIDEMIC !

kne og menisk.  
 i høyre kne.  
 yre kne.  
 kne.  
 kne.  
 nstre kne og menisk  
 bånd.

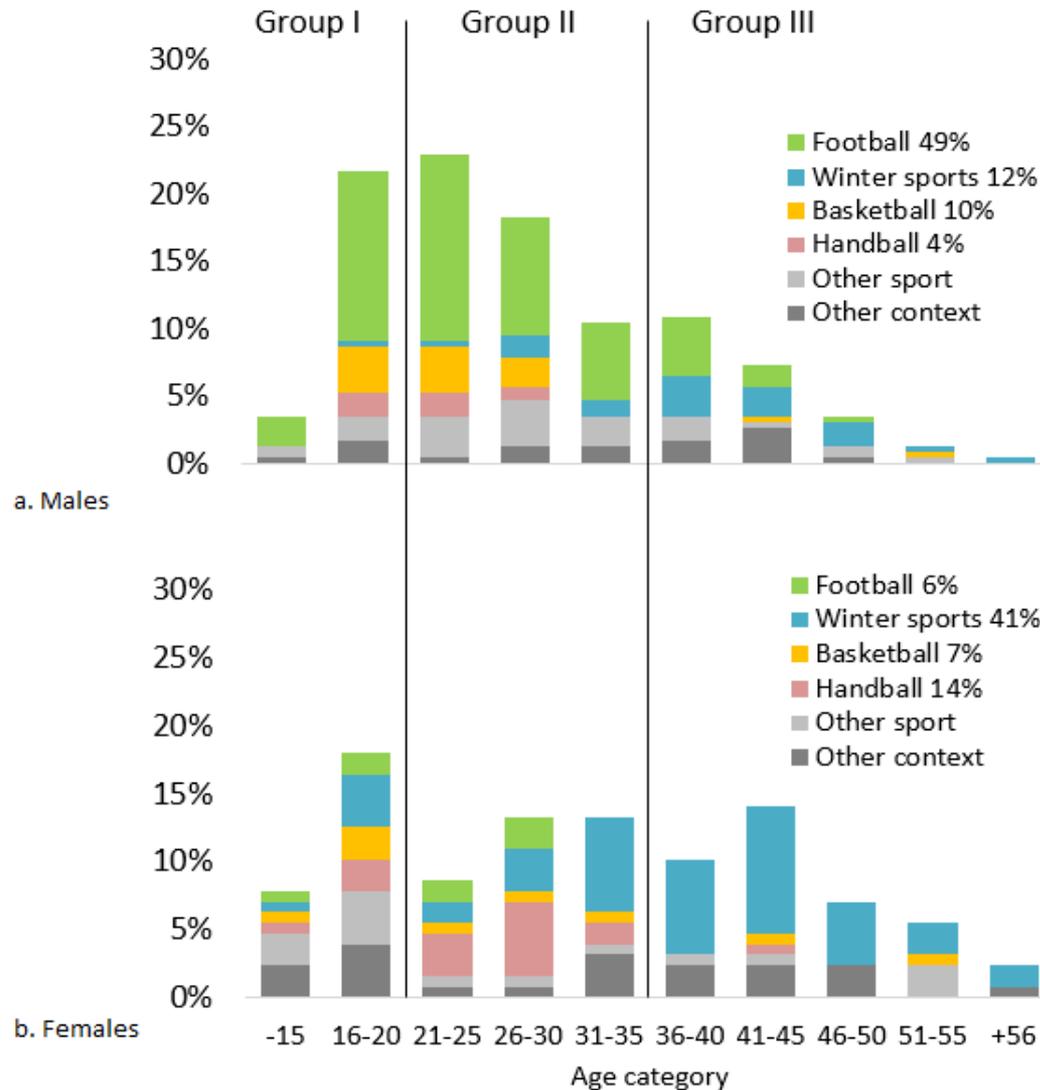
Courtesy of Prof. L. Engebretsen, Oslo, Norway

# Understand the epidemiology



Frobell RB, Scand J Med Sci Sports 2007, Granan LP, Am J Sports Med 2009, Renstrom P, Br J Sports Med 2012; Seil R, OTSR, accepted

# Understand the epidemiology



Seil R, Mouton C, OTSR, accepted for publication

## Understand the associated injuries

% of males	52-68		<p><b>Norway</b></p> <p><b>Sweden</b></p> <p><b>Denmark</b></p> <p><b>Australia</b></p> <p><b>Kaiser-Permanente</b></p> <p><b>MOON</b></p>
Injuries related to sport	72-88%		
Most represented sports	Football 17-50%		
	Basketball 17-20%		
	Ski 13-14%		
Isolated ACL injuries	32-42%		
Associated ACL injuries	Menisci	35-65%	
	Medial menisci	19-40%	
	Lateral menisci	9-44%	
	Cartilage	17-46%	
Revision	6-14%		

*Csintalan et al. Permanente Journal 2008*

*Granan et al. Acta Orthopeda 2009*

*Lind et al. KSSTA 2009*

*Maletis et al. JBJs 2011*

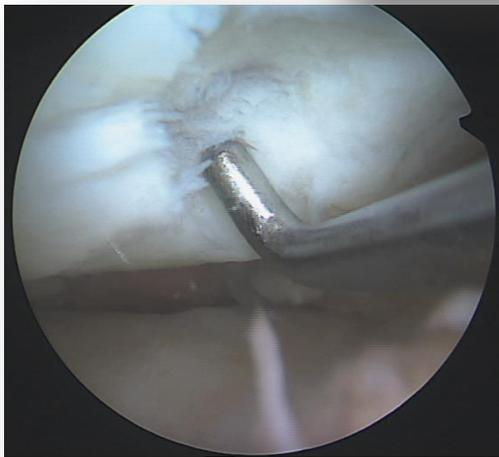
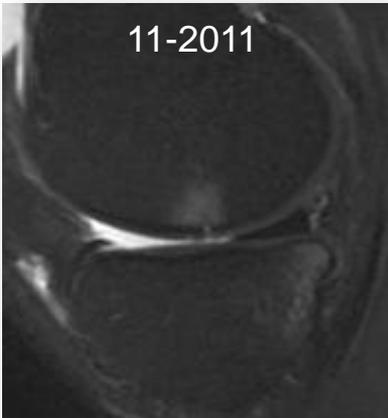
*Granan et al. AJSM 2008*

*Granan et al. AJSM 2009*

*Magnussen et al. KSSTA 2010*

*Janssen et al. Scand J Med Sci Sports 2011*

## Understand the associated injuries

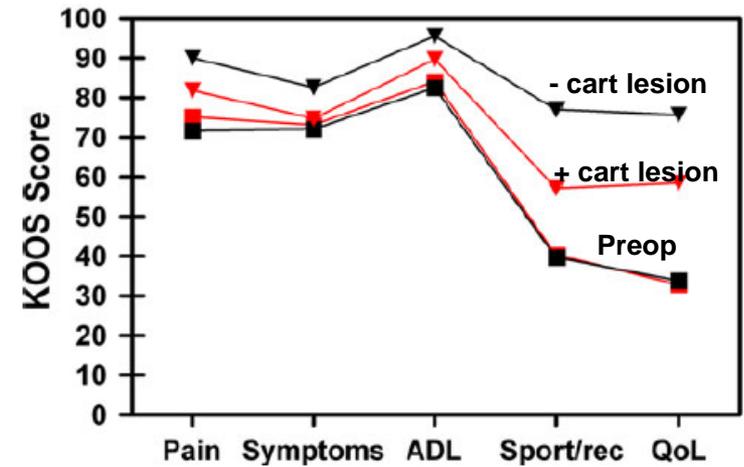


Knee Surg Sports Traumatol Arthrosc (2012) 20:1533–1539  
DOI 10.1007/s00167-011-1739-y

KNEE

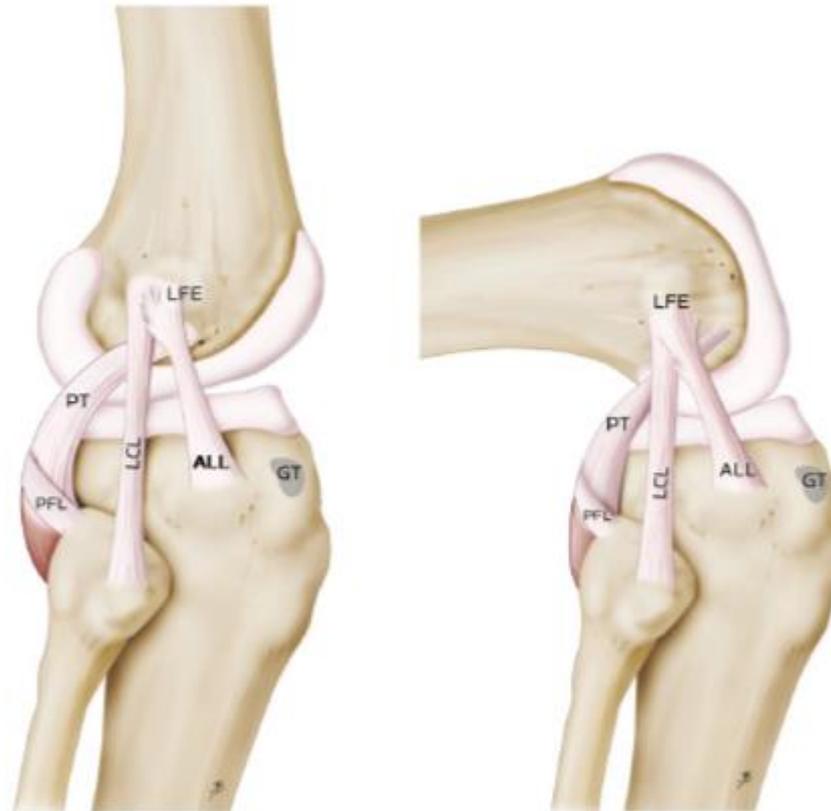
### Patients with focal full-thickness cartilage lesions benefit less from ACL reconstruction at 2–5 years follow-up

Jan Harald Røtterud · May Arna Risberg ·  
Lars Engebretsen · Asbjørn Årøen



Rotterud JH, KSSTA 2012

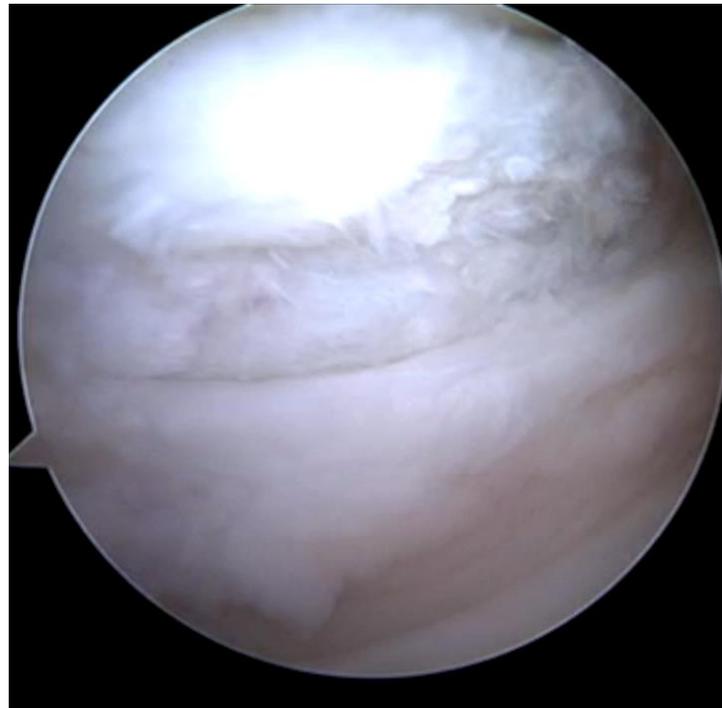
## Understand the associated injuries



*Claes S, J Anat 2013*

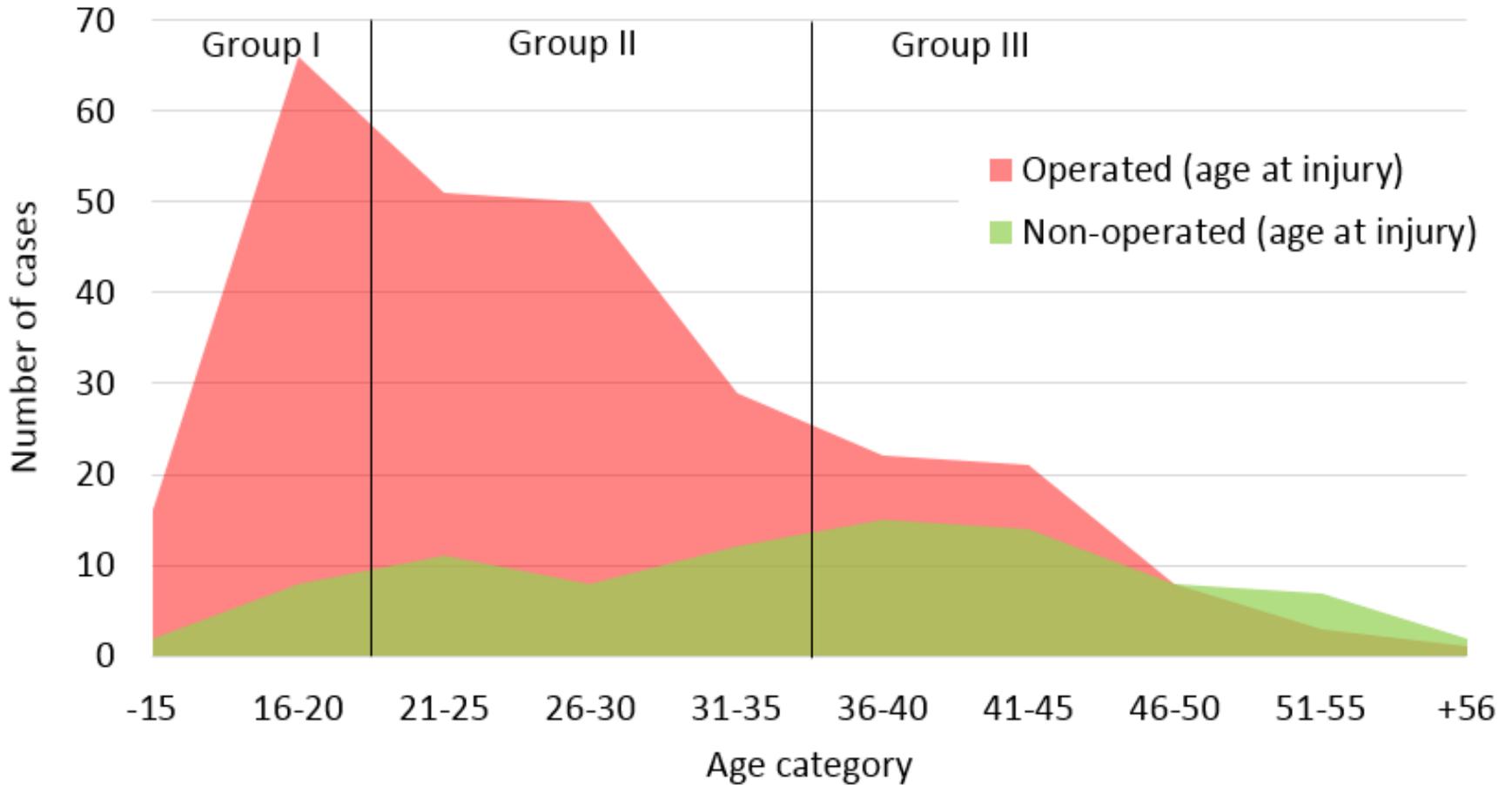
# Understand the associated injuries

## Meniscosynovial lesions Posterior compartment arthroscopy

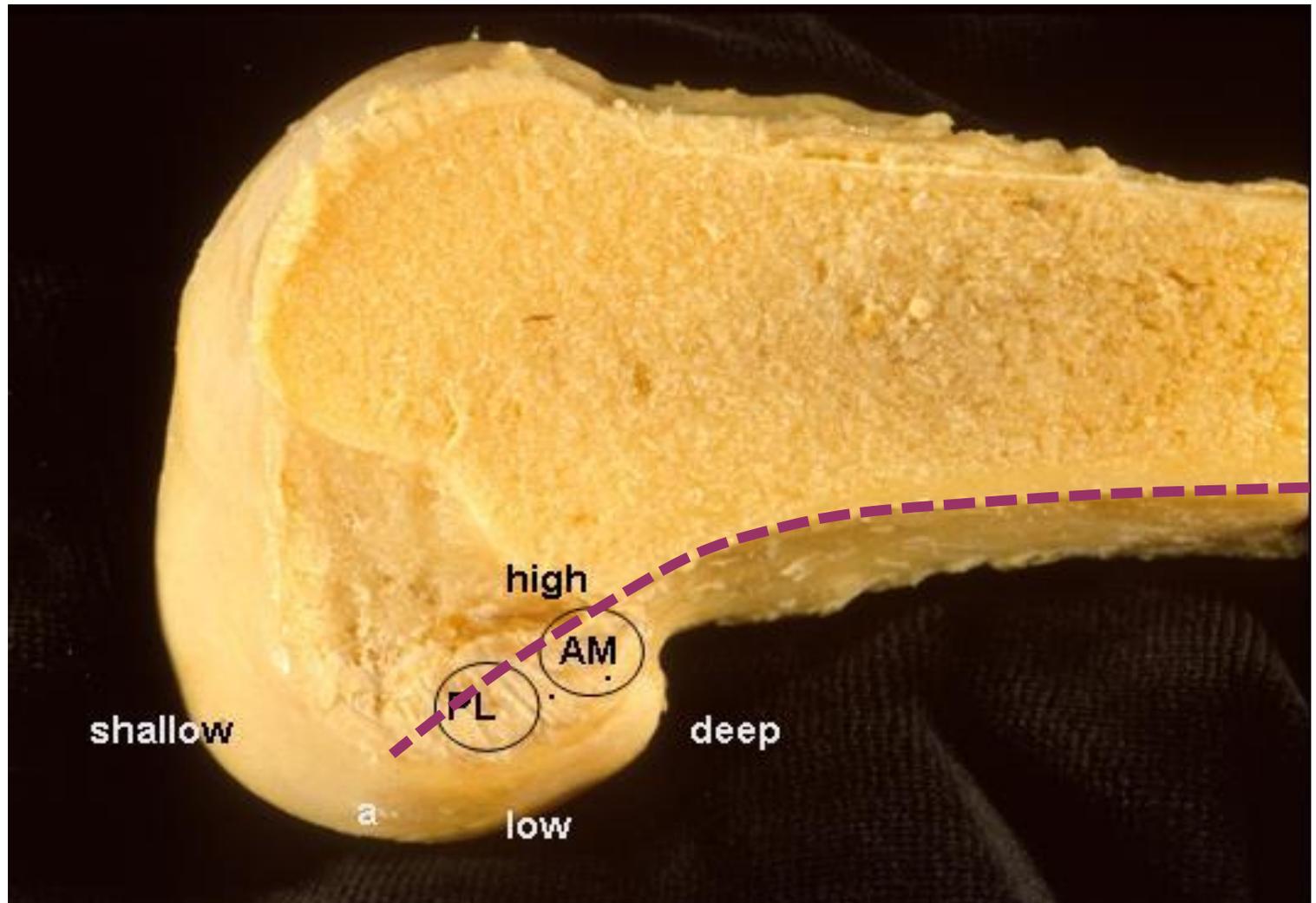


Medial meniscus = secondary stabilizer  
Diagnosis & repairs often insufficient

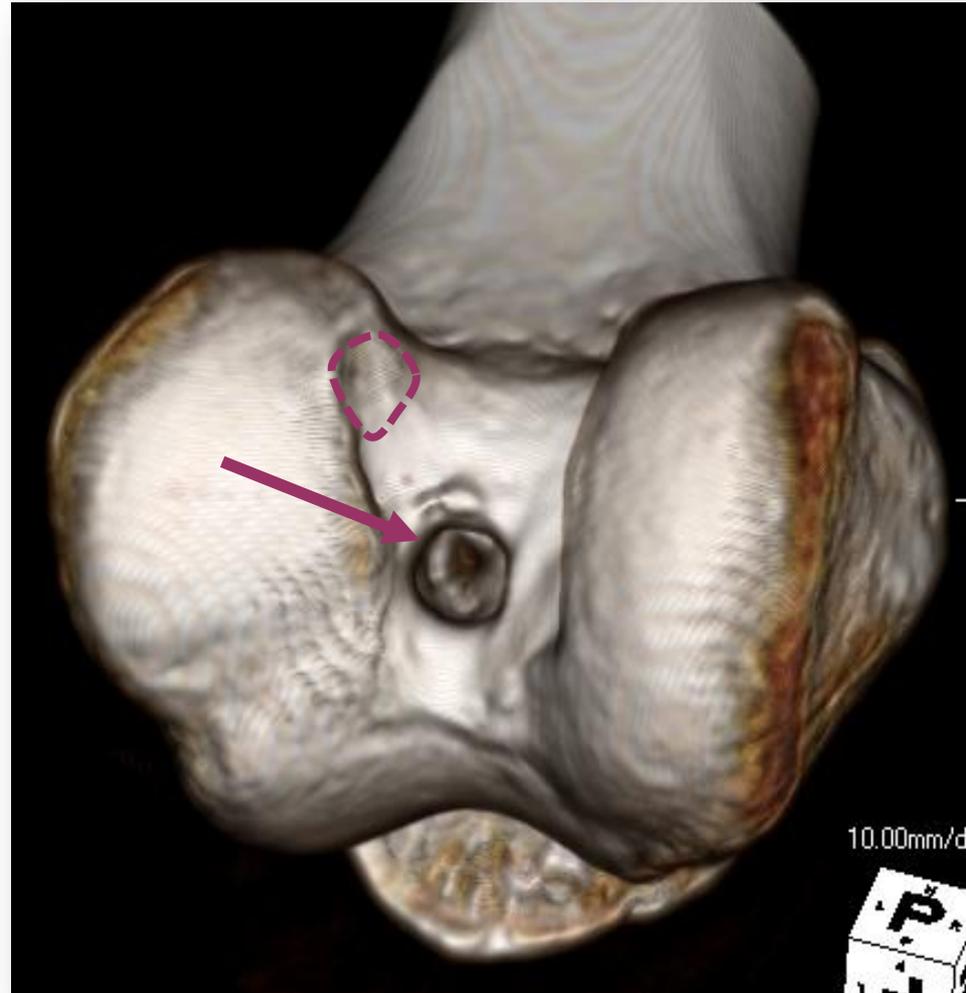
Sonnery-Cottet B, Seil R, AJSM 2014



Seil R, Mouton C, unpublished data



## Nonanatomic placement



The major reason for failure of conventional ACL reconstruction is still incorrect position of the femoral tunnel !



## Extrinsic factors

*Myklebust G, Clin J Sports Med 2003*

*Holm I, Clin J Sports Med 2004*

*Olsen OE, BMJ 2005*

*Petersen W, Arch Orthop Trauma Surg 2005*

*Odegaard TT, Risberg MA, Austr J Physiother 2005*

## Intrinsic factors

*Garrick JG, Requa R, Clin J Sports Med 2005*

*Myklebust G, Instr Course Lect 2007*

*Panics G, Br J Sports Med, 2008*

*Zebis MK, Clin J Sports Med 2008*

*Barendrecht M, J Strength Cond Res 2011*



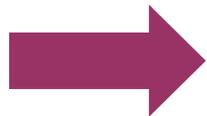
Increasing evidence that  
neuromuscular  
training can decrease  
ACL injury rates

### Modifiable

- Fitness level
- Sport-specific training/warm-up
- Muscle strength
  
- Biomechanical factors
- Balance and proprioception

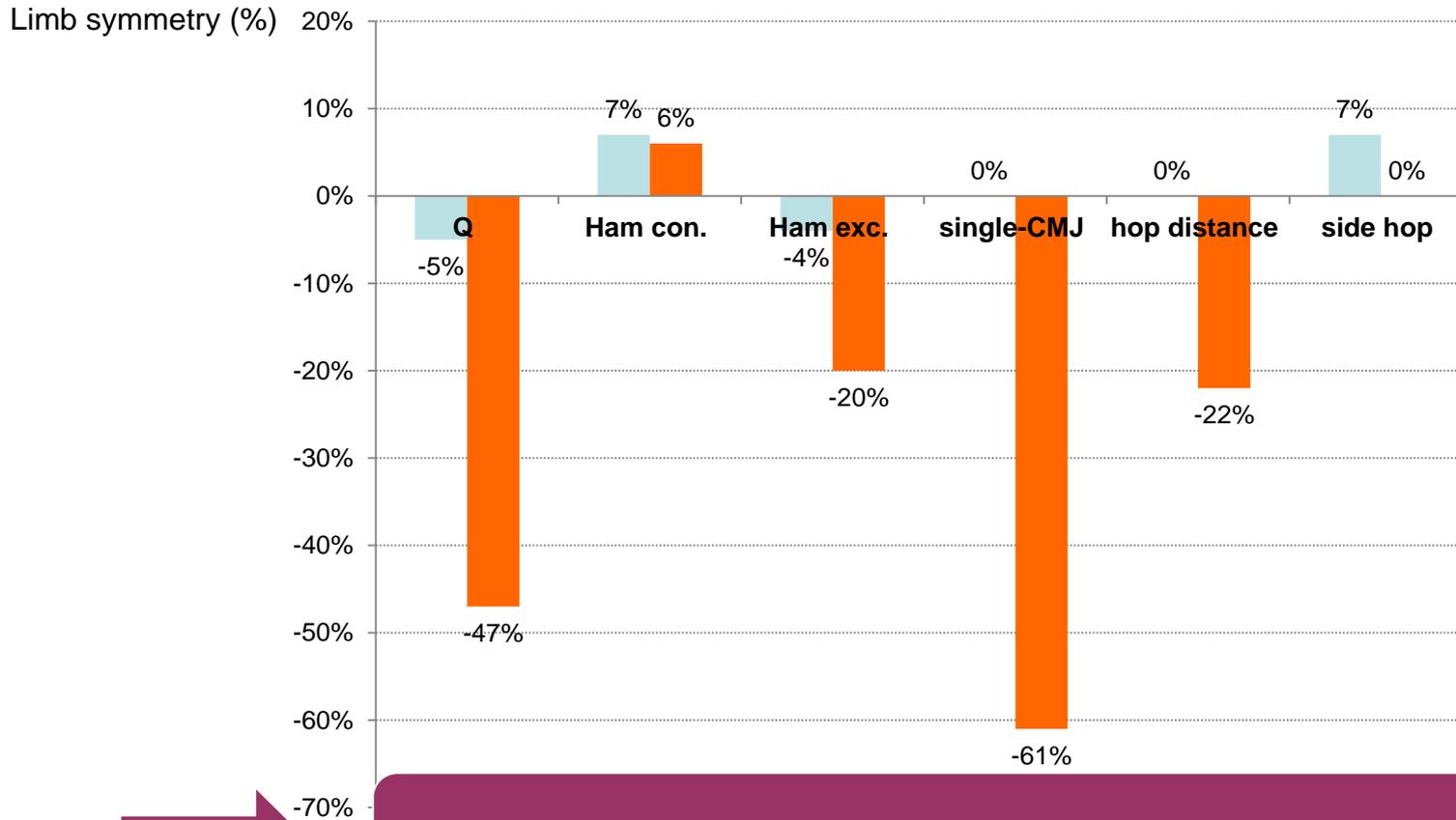
## **Noninjured Knees of Patients With Noncontact ACL Injuries Display Higher Average Anterior and Internal Rotational Knee Laxity Compared With Healthy Knees of a Noninjured Population**

Caroline Mouton,\* MSc, Daniel Theisen,\* PT, PhD, Tim Meyer,<sup>†</sup> MD, PhD, Hélène Agostinis,\* MSc, Christian Nührenbörger,<sup>‡</sup> MD, Dietrich Pape,<sup>\*\*‡</sup> MD, PhD, and Romain Seil,<sup>\*\*§</sup> MD, PhD  
*Investigation performed at Centre Hospitalier de Luxembourg–Clinique d’Eich, Luxembourg*



Hyperlax patients at higher risk for severe knee injury

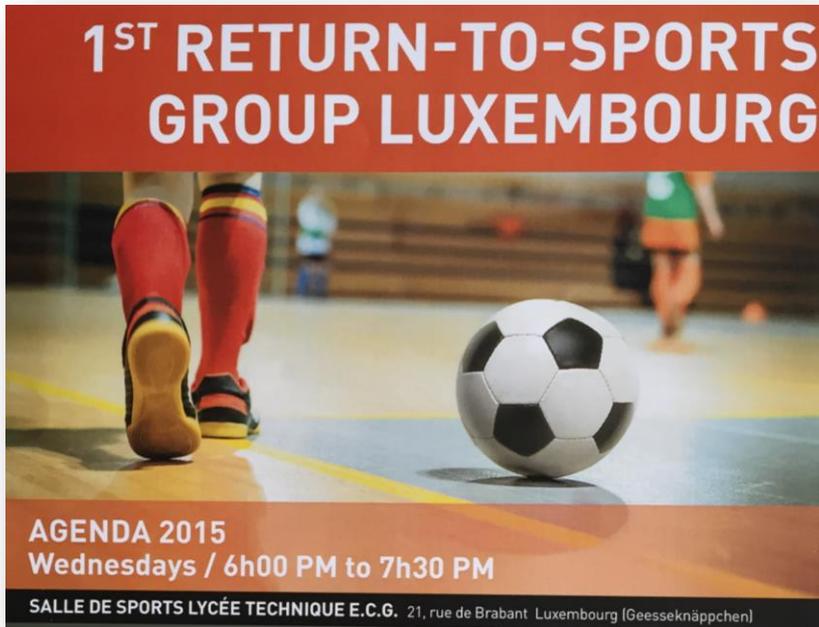
## Does return to sport in good physical condition prevent reinjury ?



Proove efficiency of secondary prevention

♂ 17 y, perfect rehab, retear

## RTS group



**1<sup>ST</sup> RETURN-TO-SPORTS  
GROUP LUXEMBOURG**

**AGENDA 2015**  
Wednesdays / 6h00 PM to 7h30 PM

SALLE DE SPORTS LYCÉE TECHNIQUE E.C.G. 21, rue de Brabant Luxembourg (Geeseknäppchen)

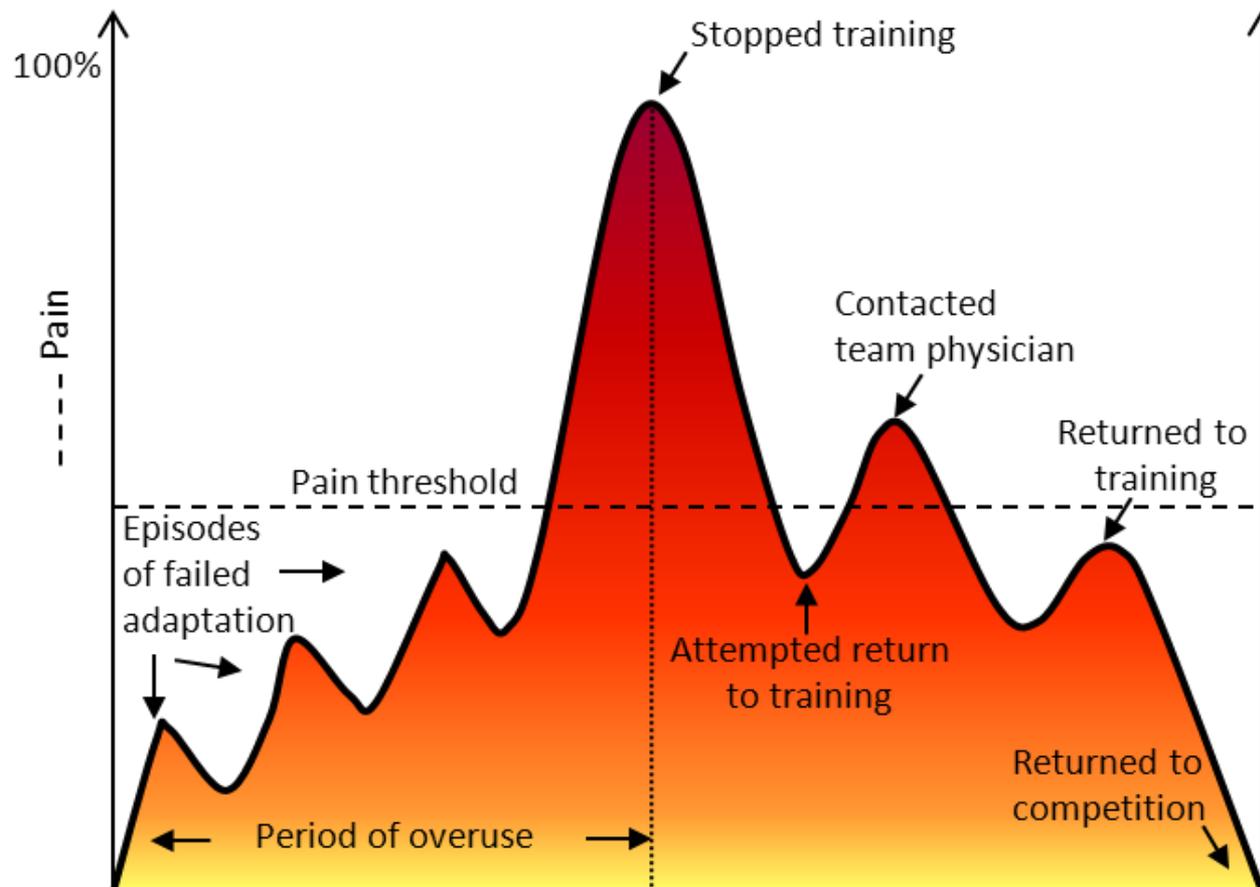
### Goals:

- ✧ Get athletes safely back to the field
- ✧ Restore function of injured limb
- ✧ Minimize risk of re-injury
- ✧ Teach injury prevention

### Inclusion criteria:

- ✧ 6 months after ACLR
- ✧ Sufficient functional scores for strength and stability
- ✧ Medical clearance
- ✧ Signature of participation agreement

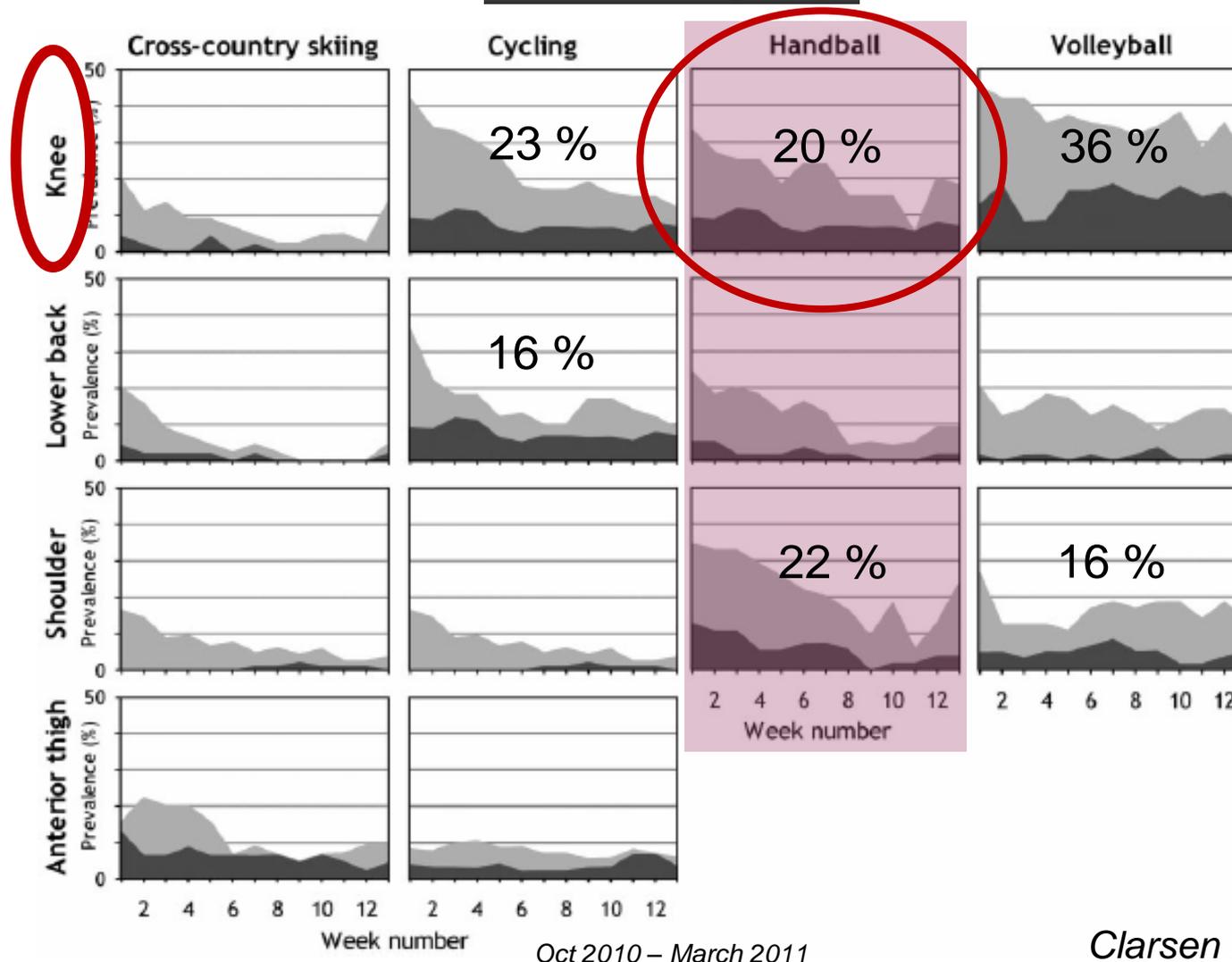
## Overuse injuries



- Repetitive micro-trauma
- Gradual onset

Bahr R, 2009

## Overuse injuries



Clarsen B, Bahr, R, 2014

# Understand the athlete



*Iker Romero  
Füchse Berlin*

« End of career » athlete

Weight: 103 → 93

Knee ROM: + 20°

Performance: sporadic → 60'

Career: + 2 years

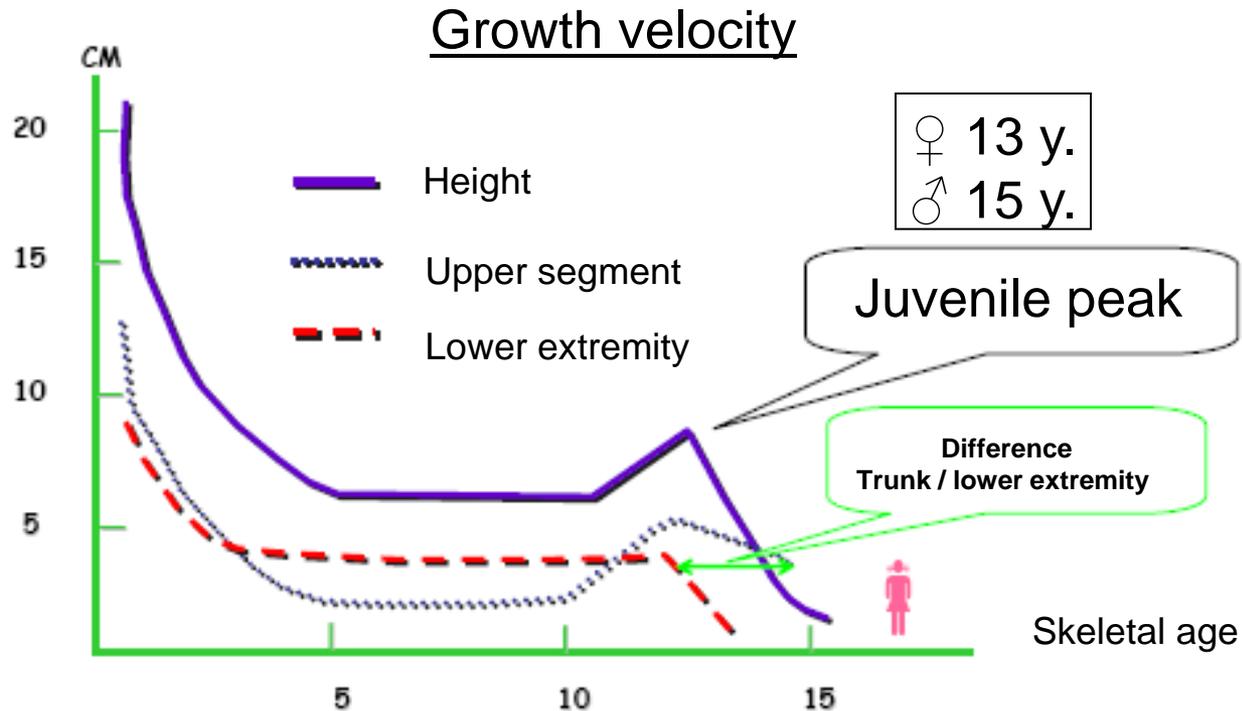
# Youth sports: specificities



- Susceptibility of growth plate
  - Direct mechanical stress
  - Repetitive physical strain
- Growth spurt during puberty
  - Mechanical (over-)loading
- Variation of biological maturity at same age
- Skeletal development precedes muscle & tendon growth
  - Permanent changes of lever arms, imbalances of muscle chains

# Understand knee growth & joint maturation

## Growth of upper & lower segment not proportional



Gicquel P, Rev Chir Orthop 2007

## *The injured knee in the young athlete*

- Incidence of severe knee injuries  
8200 / 100.000 young athletes
- Incidence of ACL injuries (n=8)  
830 / 100.000 young athletes
- Incidence of ACL injuries in general population  
81-85 / 100.000 citizens

Malisoux L, 2012  
Frisch A, 2012  
Theisen D, 2013  
Seil R, unpublished data

Frehall DB, Scand J Med Sci Sports 2007  
s Med 2009  
s Med 2012



Sports injury surveillance in youth sports  
should become mandatory !

# Traction apophysitis



Sinding - Larsen



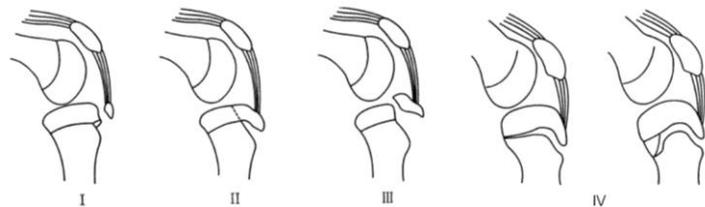
Osgood-Schlatter



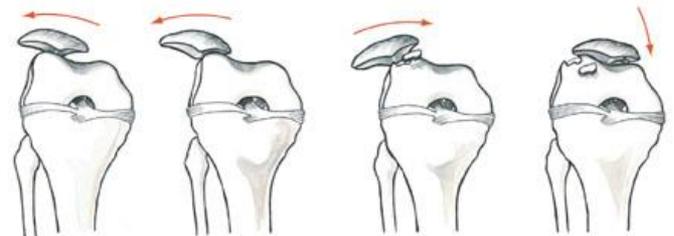
Sever

# Injuries of extensor mechanism

## Watson-Jones fracture



## Patellar dislocations

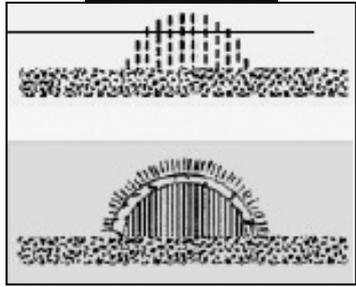


Ryu RKN, CORR; 1985  
Inoue G, Br J Sports Med, 1991  
Watson-Jones R, CORR, 1974

From: Bahr R, Maehlum S  
Clinical guide to sports injuries (2003)

# Juvenile osteochondritis dissecans

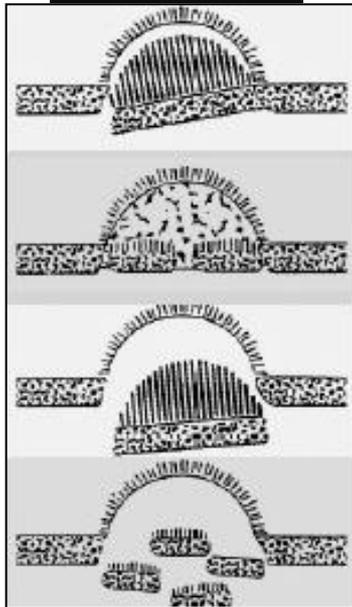
Stable



Nonoperative treatment



Unstable



(Surgery)



Bruns J, 1997



- ❖ Need for more research in handball medicine
- ❖ Injury type & mechanisms
- ❖ ACL problem (injury mechanism, risk factors, prevention and treatment)
- ❖ Specific gender & age differences
- ❖ Multidisciplinary approach





# 17<sup>th</sup> ESSKA Congress

4-7 May 2016

Barcelona, Spain

[www.esska-congress.org](http://www.esska-congress.org)

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Matteo Denti (Italy)

**Congress President**  
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