# Femoroacetabular impingement

**Sebastiaan Naessens**

# Case

- A high level ballet dancer walks into the practice. J.H. is 18 years old and normally trains 5 days/week and some weeks she has to perform during the weekends. She has been doing ballet since she was 6, but hasn't had any major injuries yet.
- Since a few years, J.H. had the feeling that her right hip was more stiffened in comparison with her left side. In addition, she always had the feeling her right leg was more instable than her left. Six months ago, she started to feel a dull, aching feeling in het right lateral thigh when doing certain movements during ballet. She remembers it started while doing a lot of split leaps during training for a show.

# Case

- Although it was painful in her thigh, she didn't pay a lot of attention to it and just pursued dancing and doing her normal daily life activity. During a performance 1 month ago, she felt a sudden 'pop' in her hip and could no longer move normally afterwards due to stinging pain in her groin while standing on the affected leg. She describes it as having a knife stabbed in her groin. The days following the trauma she also had pain in rest and during the night. That's why she went to see her general practitioner, who prescribed ibuprofen (3X daily, 600mg) for 4 weeks and advised her to temporary quit her sports. After these 4 weeks of rest, she could start her rehabilitation process guided by a physiotherapist. The GP referred her to you with the diagnosis: pubalgia.

# Case

- Status praesens: Now, four weeks later, J.H. has no more pain in rest, but still has a lot of pain in her lateral thigh during certain movements. What typically provokes her pain is sitting on a chair with her legs crossed and squatting deeply for f.e. tying her shoes. Although it is still present, the pain in her groin is already feeling better, although some movements still provoke a painful click.

Universiteit Antwerpen

# Hip pain in young athletes

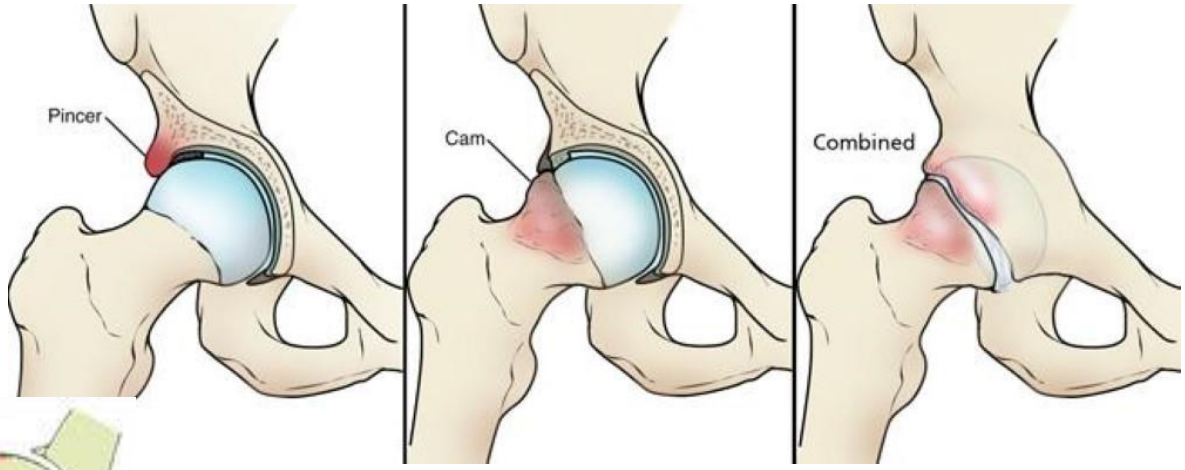
- Very frequent
- Hip pain => first exclude extra-articular causes
  - Pathology around the hip joint
    - Adductors, Tensor fascia lata,  Gluteus medius tendinopathy (cfr. rotator cuff pathology), Piriformis syndrome,  Trochanter bursitis
  - Reffered pain
    - Sacro Iliacal Joint
    - Lumbar spine
    - pelvis
    - Tumors
    - Vascular disease
    - …

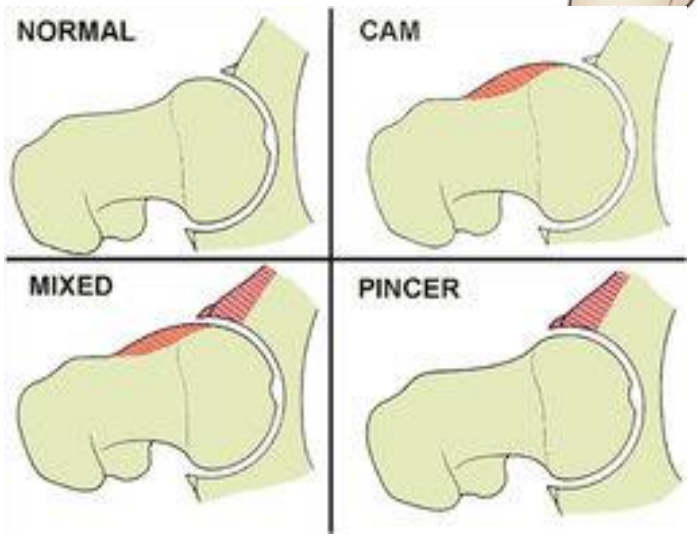
# Articular hip pain

In young athletes: articular hip pain is often the result of…

Femoro acetabular impingement syndrome
(FAI syndrome)

# FAI: types



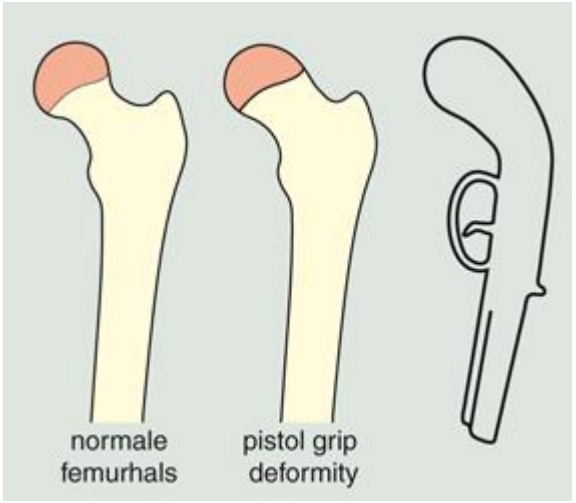




Universiteit Antwerpen

# Cam

Stulberg (1975):

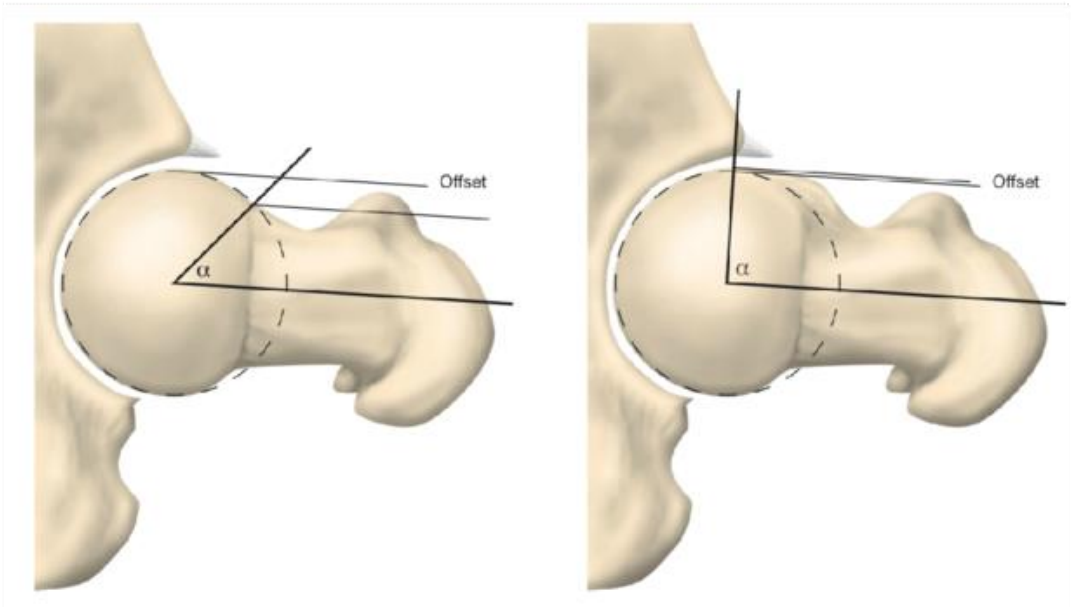
- Abnormal ratio between femoral head and neck
- Pistol deformity
- Bump




Universiteit Antwerpen

# Cam measurement

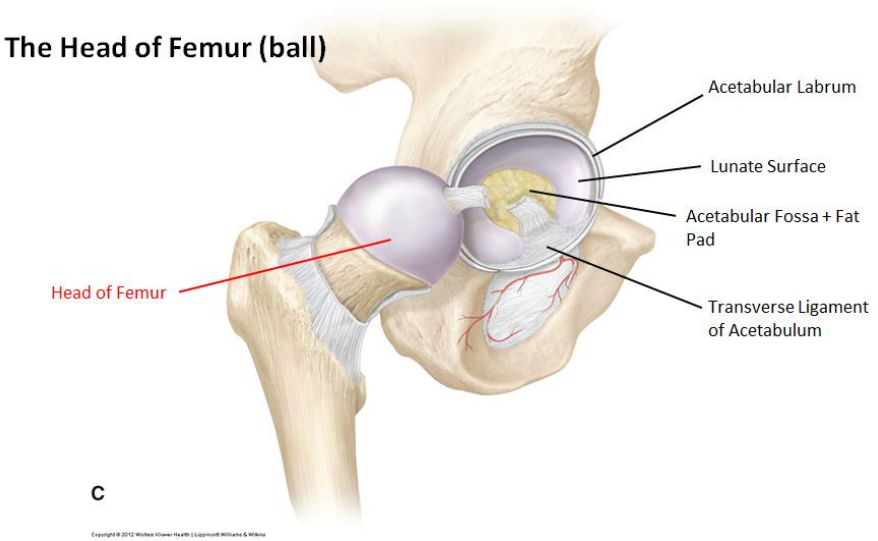
- Alpha-angle
- Head-neck offset

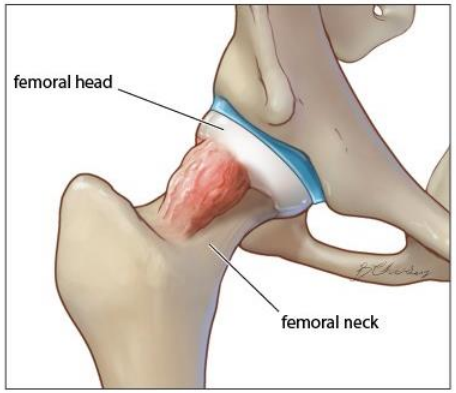



Universiteit Antwerpen

# Consequences of Cam type FAI

- The diameter of the femoral head increases with flexion
- Bump or larger diameter causes pressure on the chondrolabral junction and on the rim



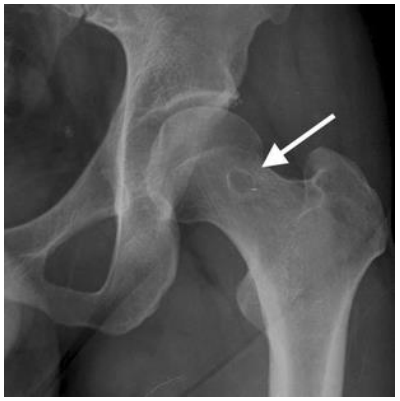

Universiteit Antwerpen

# Consequences of Cam type FAI

Universiteit Antwerpen

# Consequences of Cam type FAI

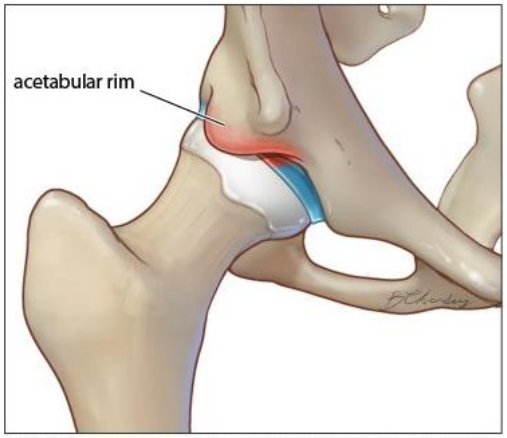
- Cartilage detaches from acetabulum
- Labrum separates from chondrolabral junction
- Hernia pits on femoral neck
- > men

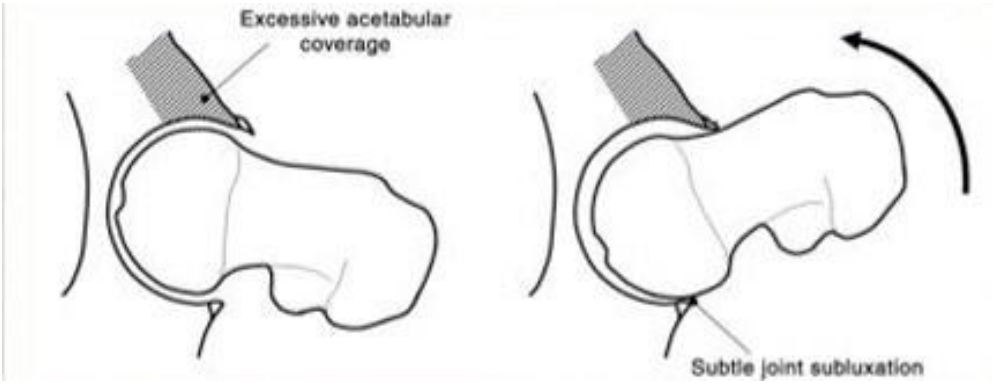


- => early hip OA & risk of hip replacement
- => screening of young athletes on reduced hip flexion/rotation?

# Pincer

- acetabular overcoverage
- > women



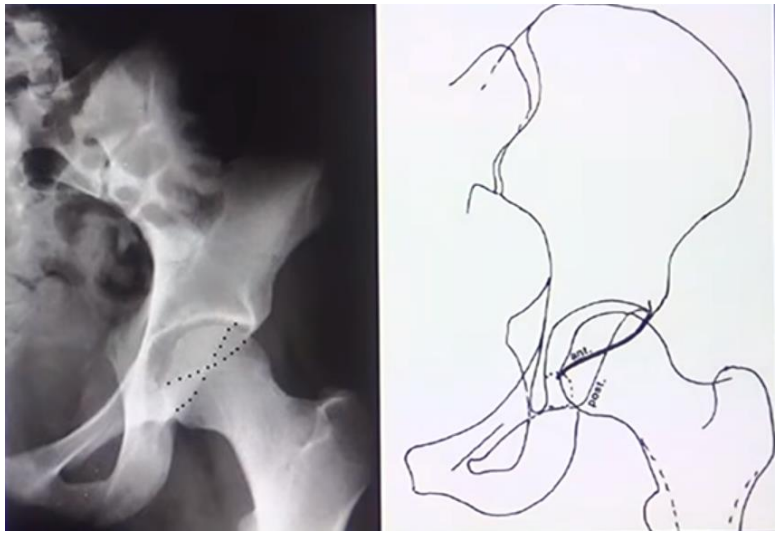



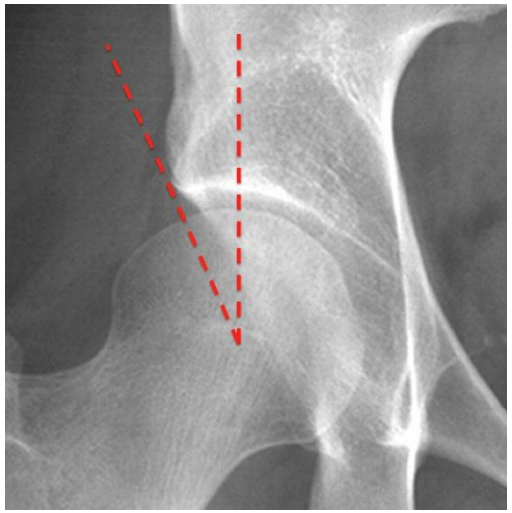

Universiteit Antwerpen

# Pincer measurement

- Cross-over sign:
  Anterior rim of the acetabulum projecting more laterally than the posterior rim, but correcting more distally with more medial projection

- Center-edge angle

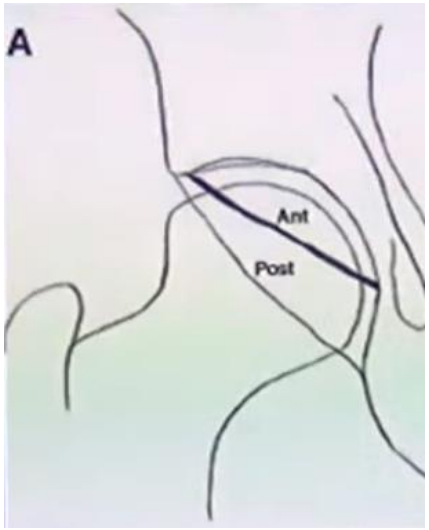


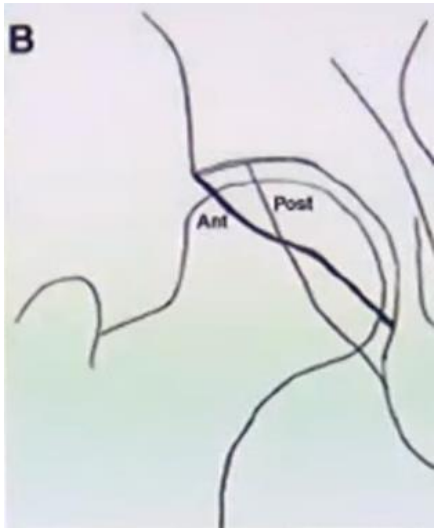



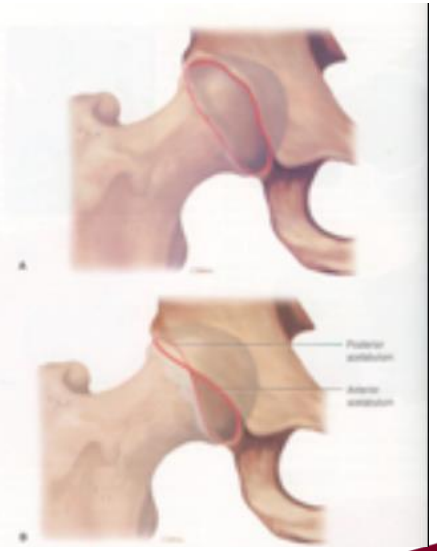
# Pincer measurement

- Cross-over sign:

  Anterior rim of the acetabulum projecting more laterally than the posterior rim, but correcting more distally with more medial projection

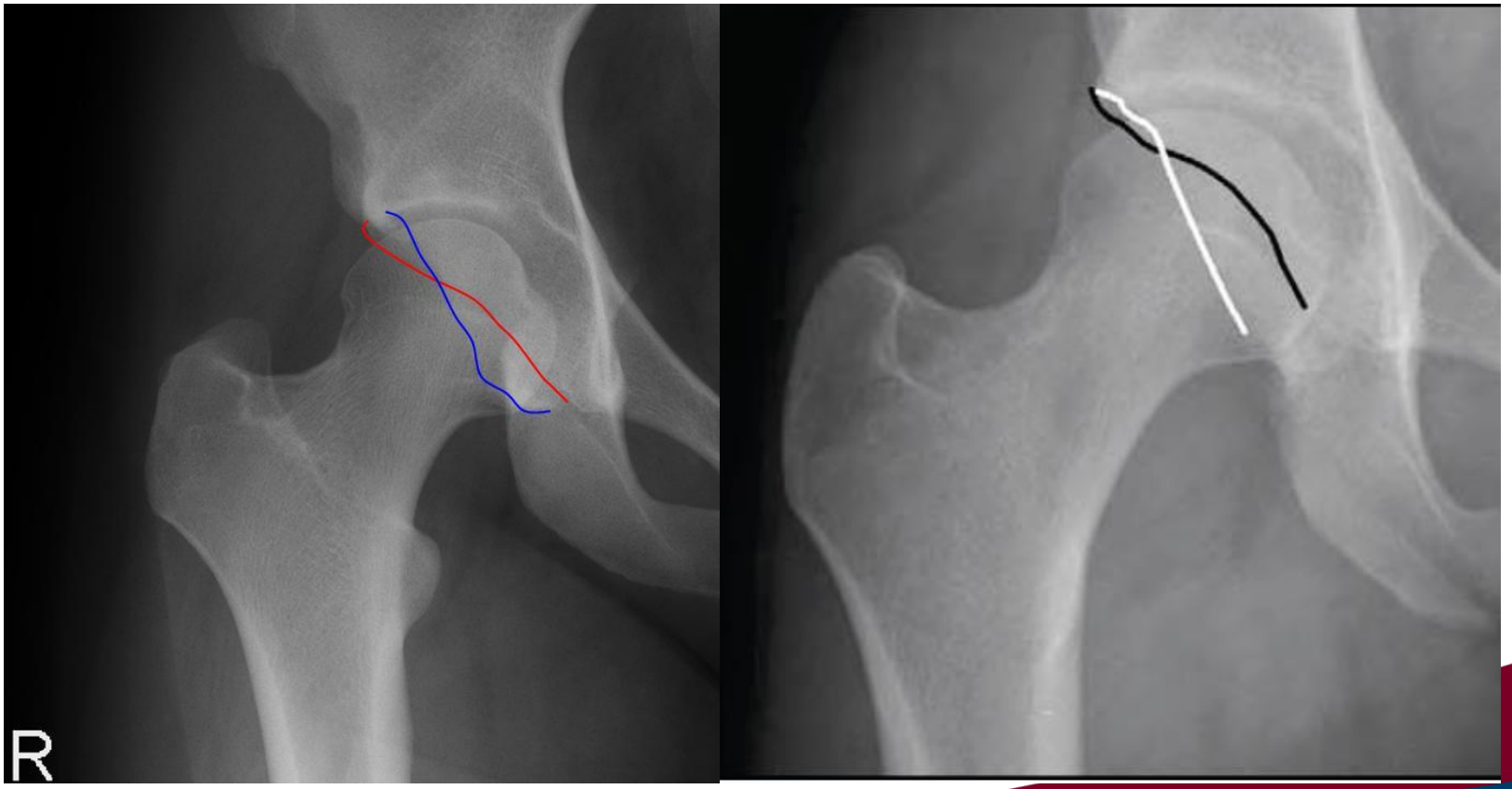


Universiteit Antwerpen

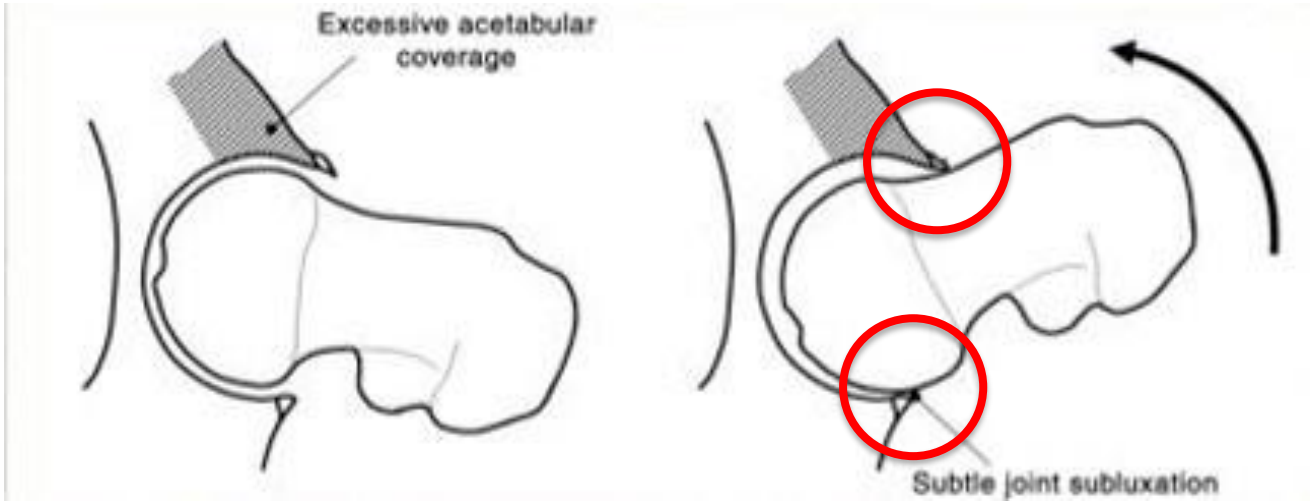
# Pincer FAI



# Consequences of pincer

Universiteit Antwerpen

# Consequences of pincer




Universiteit Antwerpen

# Consequences of pincer

Ruptured labrum → loss of suction force → micro-instability?

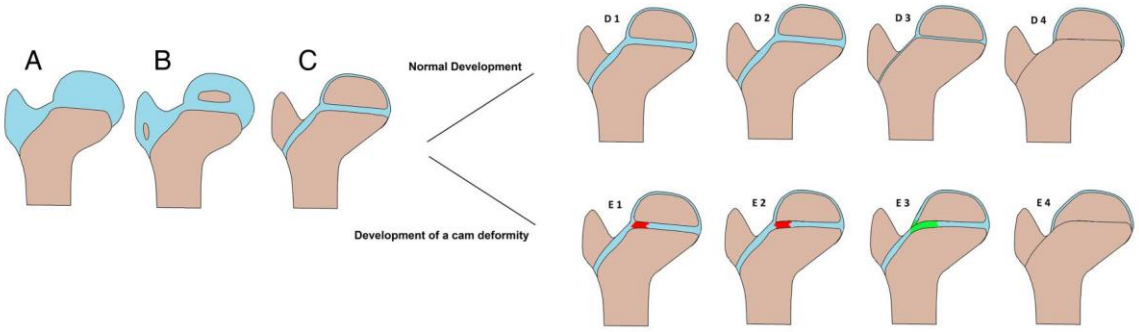
Universiteit Antwerpen

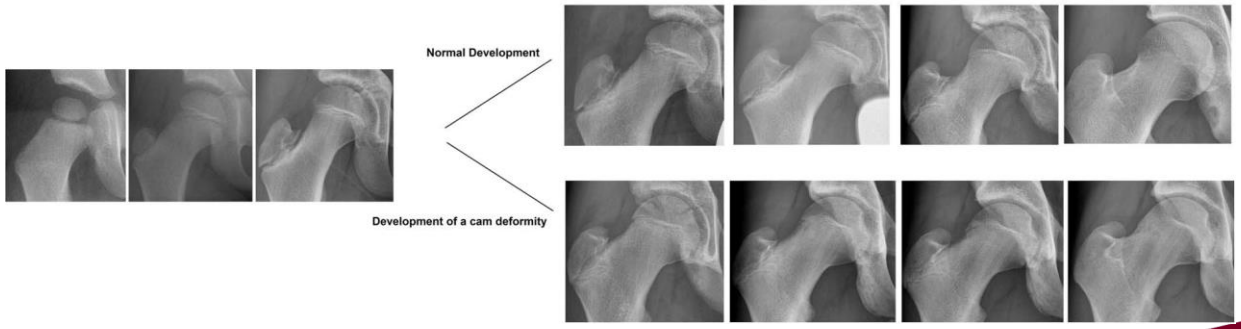
# Causes of FAI

- Strong indicators that a FAI occur during growth in adolesence
- Deviations from the growth disc of the femoral head
- Repeated microtraumata result in damage to the growth plate (flexion – rotation movements)

# Causes of FAI

Abnormal loading on growth plate




Universiteit Antwerpen

# Causes of FAI

de Silva *et al. Pediatric Rheumatology* (2016) 14:16
DOI 10.1186/s12969-016-0077-5

Pediatric R

REVIEW

ccess

CrossMark

Does high level youth ation increase the risk abular impingem the current liter

, Carolyn Broderick[5,6] and Damien McKay[1*]

ADAPTATON OF THE BONE?

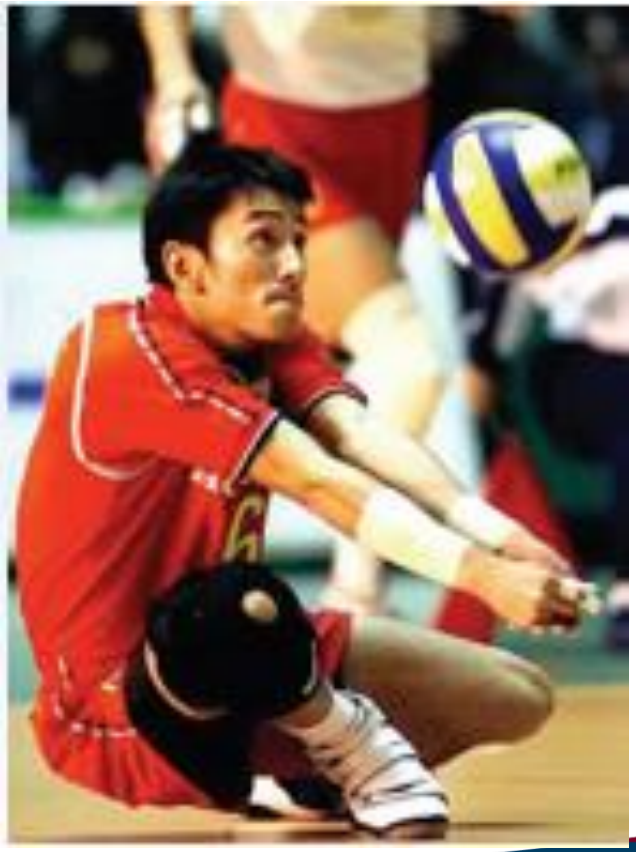
*"This review suggests that adolescent males participating in ice-hockey, basketball and soccer, training at least three times a week, are at greater risk than their non-athletic counterparts of developing the femoral head-neck deformity associated with femoroacetabular impingement.*

Universiteit Antwerpen

# FAI & risk sports

- Deep hip flexion (+rotation)
- Sports that require extreme mobility
- After hip injuries

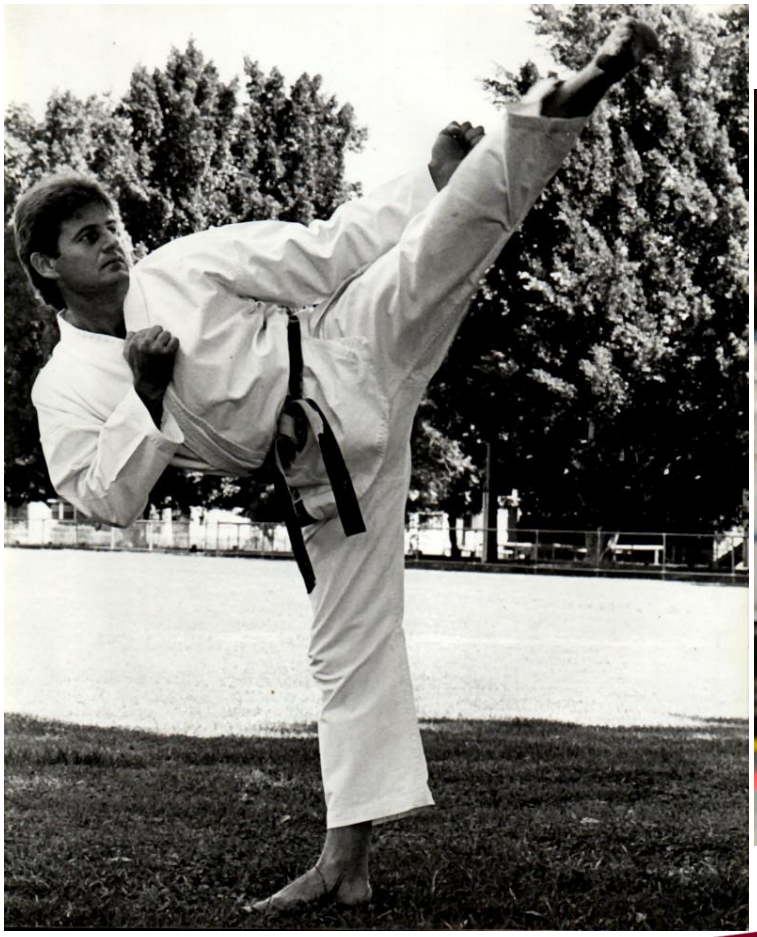
# FAI & risk sports




Universiteit Antwerpen

# FAI & risk sports

# FAI & risk sports




Universiteit Antwerpen


Universiteit Antwerpen


Universiteit Antwerpen

Universiteit Antwerpen

niversiteit
Antwerpen

# Link cam morphology and OA

- 4 X risk
- Large cam: 10X risk
- If combined with hip IR <20°: 18X risk

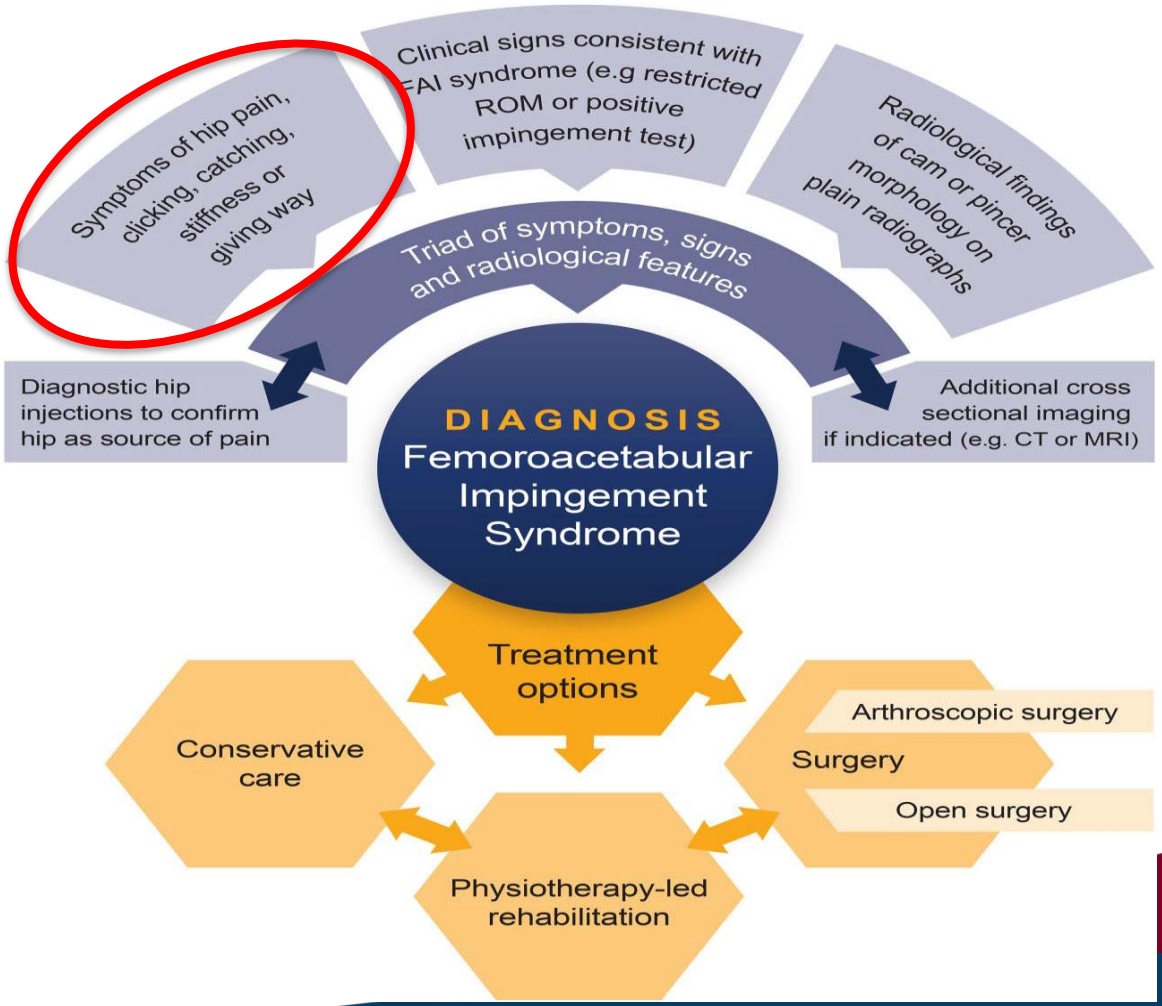
Agricola et al. 2013

# Warwick agreement on FAI syndrome

- 22 experts from around the world (sport medicines, orthopeadic surgeons, physiotherapists, radiologists…)
- Concensus agreement
- British Journal of Sports Medicine, 2016

Universiteit Antwerpen

# Warwick agreement on FAI syndrome



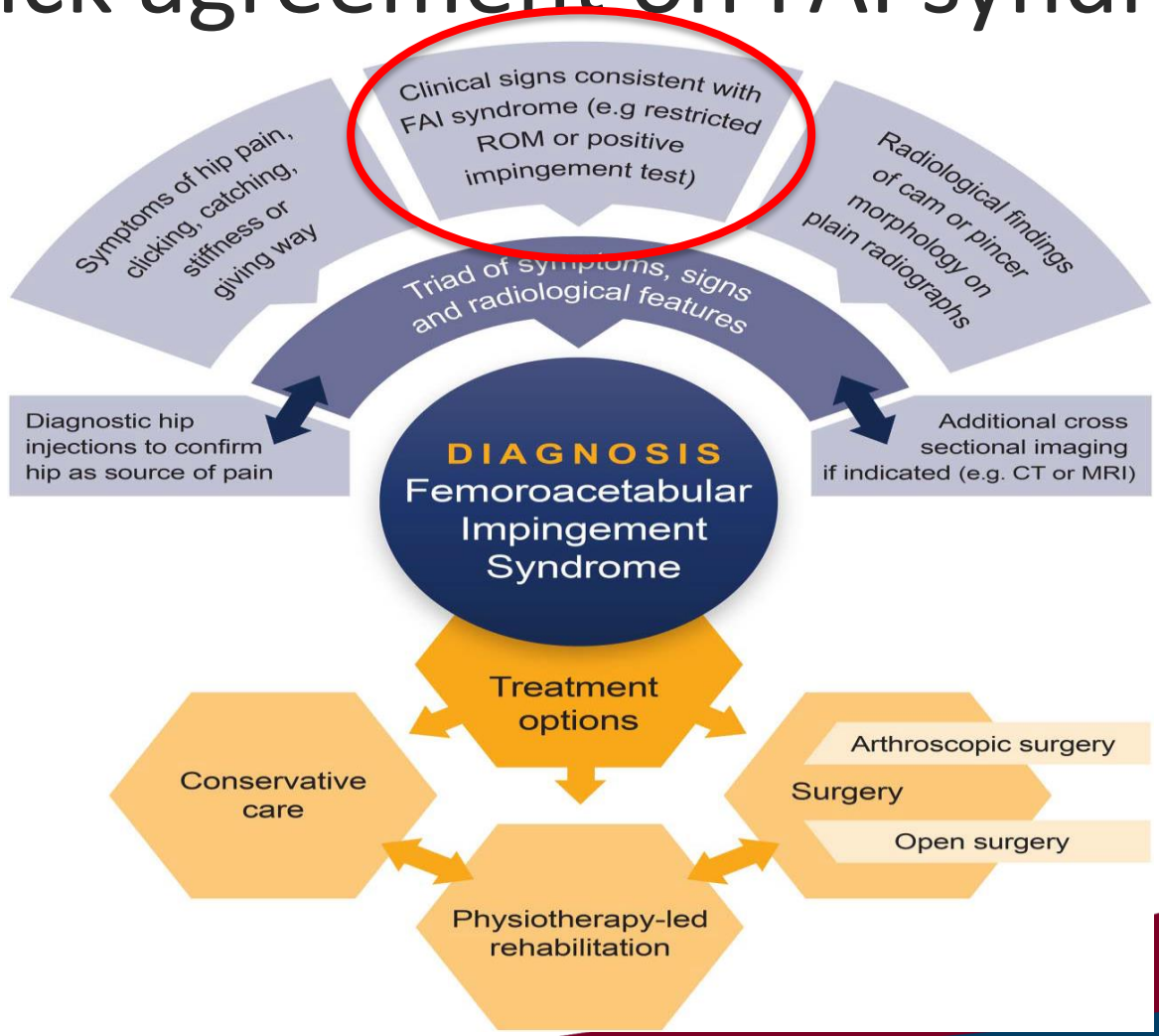

Universiteit Antwerpen

# Symptoms: history taking

- Subjective hip stiffness before pain
- Lack of confidence, instabile feeling, giving way
- Sharp, stabbing, stinging pain
- Localisation: C-sign (>women), groin
- Acute pain associated with intense training in flexion (squats, lunges…)
- Catching, locking, clicking



# Warwick agreement on FAI syndrome




Universiteit Antwerpen

# Clinical signs: examination

Basic function testing:

- Active: -activities that contain deep flexion (s.a. squatting, lunging) painful
  -walking pattern: limped
  -Trendelenburg test may be positive
- Passive: flexion and/or internal rotation: restricted and painful
- Resistance: in some cases weak extensors and/or abductors of the hip

*Before labral/cartillage leasion: little pain, restricted movement*

# Clinical signs: examination

Additional tests:

**FADIR-test (anterior hip impingement test):** FLexion – ADduction – INternal rotation

**IROP-test:** internal rotation with overpressure

Very high sensitivity, very low specificity


Universiteit Antwerpen

# Clinical signs: examination

**FADIR-test**

Universiteit Antwerpen

Universiteit Antwerpen

# Clinical signs: examination

**IROP-test**

Universiteit Antwerpen

Universiteit Antwerpen

# Warwick agreement on FAI syndrome


Universiteit Antwerpen

# Medical imaging

*Cam/pincer morphology:*
X-ray

*Labrum/cartillage:*
Computed tomografy (CT-scan)
Magnetic resonance imaging (MRI)
→ Not needed for diagnosis (Warwick)

Universiteit Antwerpen

# Medical imaging

*BEWARE!*
*Number of positive findings in asymptomatic persons is extremely high!*

**Systematic Review**

## Prevalence of Femoroacetabular Impingement Imaging Findings in Asymptomatic Volunteers: A Systematic Review

Jonathan M. Frank, M.D., Joshua D. Harris, M.D., Brandon J. Erickson, M.D., William Slikker III, M.D., Charles A. Bush-Joseph, M.D., Michael J. Salata, M.D., and Shane J. Nho, M.D., M.S.

# Medical imaging

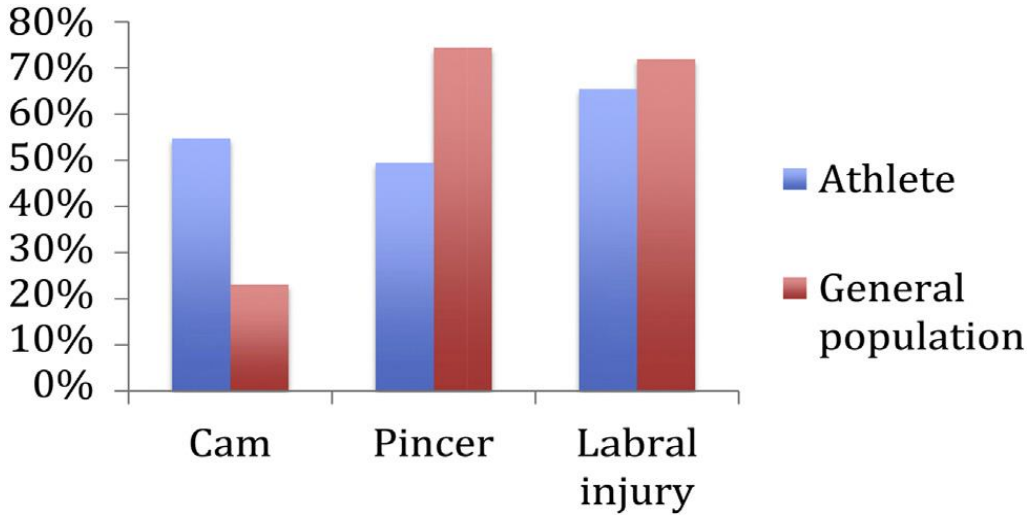


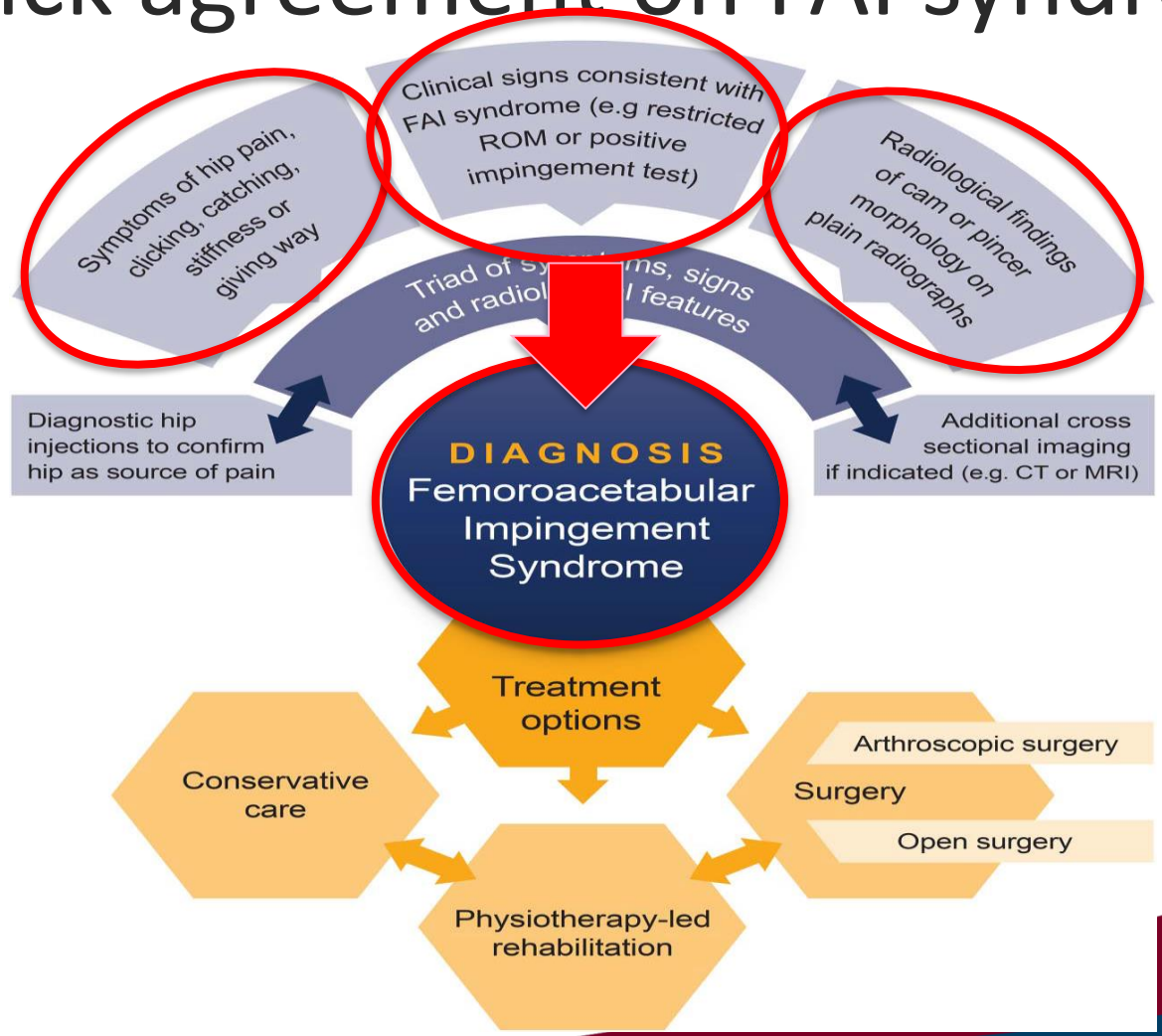

Fig 2. Comparison of prevalence of femoroacetabular impingement (FAI) morphologic characteristics and labral injury between the athletic and general populations (asymptomatic).

# Medical imaging

- More training → more risk on cam morphology
- Prevalence cam morphology (63%) semi-professional footbalplayers higher than amateurs (27%)

Lahner et al. 2012
Tak et al. 2015

# Warwick agreement on FAI syndrome




Universiteit Antwerpen

# FAI syndrome conclusions

- Cam/pincer deformity → cam/pincer morphology
- FAI → FAI syndrome (triad)
- Symptomatic premature contact between femur and acetabulum
- Groin pain ≠ adductor injury

# Warwick agreement on FAI syndrome


Universiteit Antwerpen

# Conservative care

**Nonoperative Treatment for Femoroacetabular Impingement: A Systematic Review of the Literature**

Peter D.H. Wall, MBChB (Hons), MRCS (Edin), Miguel Fernandez, PhD, MBBS, MRCS,
Damian R. Griffin, MA (Cantab), MPhil (Oxon), FRCS (Tr&Orth),
Nadine E. Foster, DPhil, BSc (Hons)

# Conservative care

*“The review literature appears to promote initial non-operative treatment for FAI. Although the available literature with experimental data is limited, there is a suggestion that physical therapy and activity modification confer some benefit to patients.”*

Universiteit Antwerpen

# Conservative treatment VS surgery

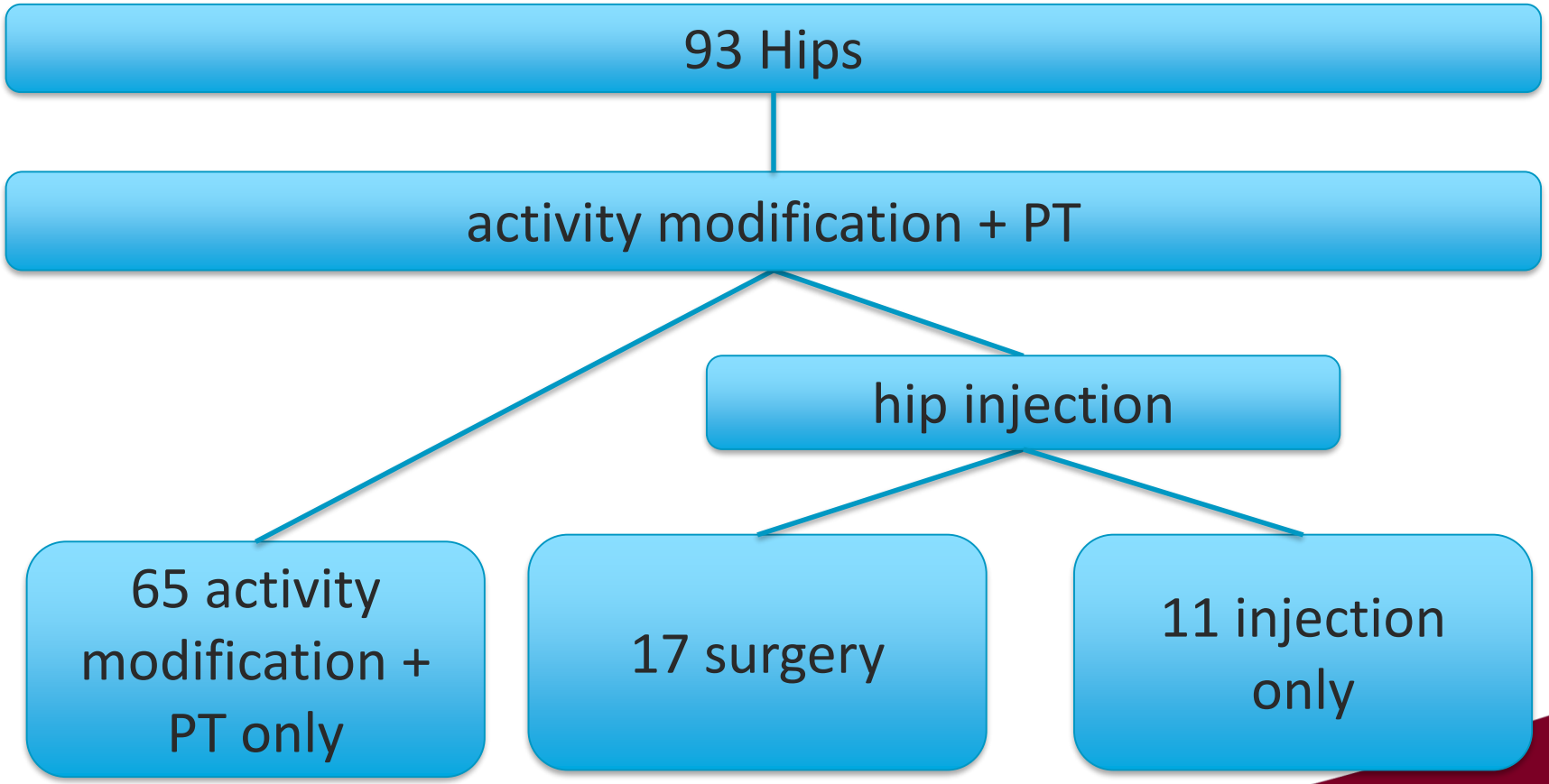
## Nonoperative Management of Femoroacetabular Impingement

### A Prospective Study

Andrew T. Pennock,*†‡§ MD, James D. Bomar,† MPH, Kristina P. Johnson,†‡ ATC, OPA-C, Kelly Randich,†‡ DPT, and Vidyadhar V. Upasani,†§ MD
*Investigation performed at Rady Children's Hospital, San Diego, California, USA*

Universiteit Antwerpen

# Conservative treatment VS surgery




Universiteit Antwerpen

# Conservative treatment VS surgery

TABLE 2
Initial and Most Recent Patient-Derived Outcome Measures[a]

| | Modified Harris Hip Score | | | Nonarthritic Hip Score | | |
|---|---|---|---|---|---|---|
| | Initial | Most Recent | *P* Value | Initial | Most Recent | *P* Value |
| Treatment | | | | | | |
| Activity modification | 69.9 ± 13.9 | 90.0 ± 11.8 | <.001 | 74.1 ± 16.3 | 87.1 ± 14.3 | <.001 |
| Injection | 68.3 ± 12.2 | 90.0 ± 10.2 | .003 | 72.8 ± 13.7 | 86.3 ± 10.4 | .011 |
| Arthroscopic surgery | 68.4 ± 9.4 | 89.0 ± 9.9 | .013 | 72.8 ± 10.8 | 86.7 ± 13.1 | .052 |
| *P* value | .888 | .582 | | .81 | .463 | |
| FAI | | | | | | |
| Cam | 68.8 ± 11.2 | 90.3 ± 10.5 | <.001 | 71.5 ± 17.4 | 86.9 ± 13.5 | <.001 |
| Pincer | 73.1 ± 11.0 | 86.1 ± 13.3 | .002 | 76.8 ± 13.2 | 84.6 ± 15.0 | .008 |
| Combined | 66.8 ± 15.6 | 92.8 ± 9.1 | <.001 | 72.8 ± 14.8 | 89.1 ± 12.2 | .003 |
| *P* value | .158 | .276 | | .434 | .568 | |

[a]Values are presented as mean ± SD. FAI, femoroacetabular impingement.

Universiteit Antwerpen

# Conservative care

**A Prospective, Randomized, Controlled Trial Comparing Conservative Treatment With Trunk Stabilization Exercise to Standard Hip Muscle Exercise for Treating Femoroacetabular Impingement: A Pilot Study**

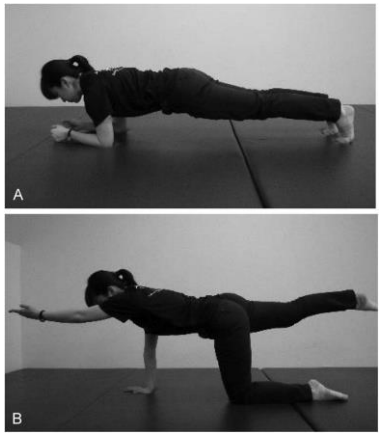
Michihisa Aoyama, PT,* Yasuo Ohnishi, MD, PhD,† Hajime Utsunomiya, MD, PhD,† Shiho Kanezaki, MD, PhD,† Hiroki Takeuchi, PT,* Makoto Watanuki, MD, PhD,* Dean K. Matsuda, MD,‡ and Soshi Uchida, MD, PhD†

Universiteit Antwerpen

# Conservative care

**TABLE 1. Rehabilitation Protocol for the Trunk Training Group and the Control Group**

| | Control Group | Trunk Training Group |
|---|---|---|
| General exercise | (1) Hip abduction exercise, 15 times × 5 set | (1) Hip abduction exercise, 15 times × 1 set |
| | (2) Buttock elevation exercise, 20 times × 5 set | (2) Buttock elevation exercise, 20 times × 3 set |
| | (3) Pelvis tilting exercise, 10 times × 3 set | (3) Pelvis tilting exercise, 10 times × 2 set |
| Trunk stabilization exercise | | (4) Plank, 30 s × 5 set |
| | | (5) Bird dog, 20 times × 3 set |




Universiteit Antwerpen

# Conservative care

Significantly different improvements in:

- Strength hip flexors
- Strength hip abductors
- Hip flexion ROM
- Patient-reported outcome score

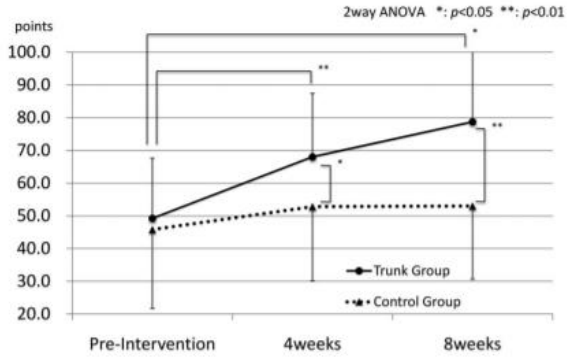



**Figure 3.** Patient-reported outcome score iHOT12 at preintervention and 4 weeks and 8 weeks after the intervention. Error bur: standard deviation. Two-way analysis of variance and Bonferroni post hoc test, $^{**}P < 0.01$; $^{*}P < 0.05$.

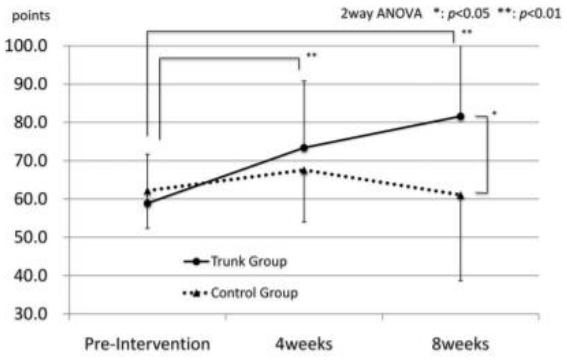



**Figure 4.** Patient-reported outcome score Vail hip score at pre-intervention and 4 weeks and 8 weeks after the intervention Error bur: standard deviation. Two-way analysis of variance and Bonferroni post hoc test, $^{**}P < 0.01$, $^{*}P < 0.05$.

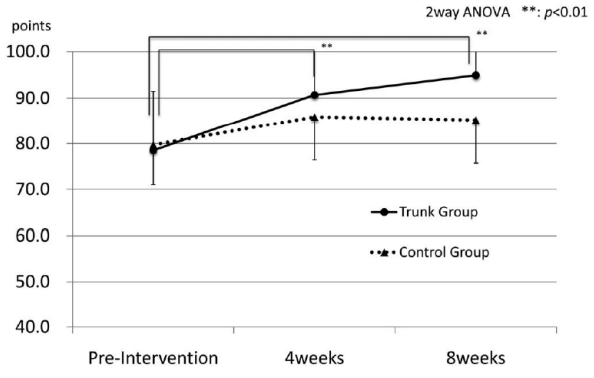



**Figure 5.** Patient-reported outcome score modified Harris hip score at preintervention and 4 weeks and 8 weeks after the intervention. Error bur: standard deviation. Two-way analysis of variance and Bonferroni post hoc test, $^{**}P < 0.01$.

Universiteit Antwerpen

# Conservative care

*“The addition of trunk stabilization exercises to a typical hip rehabilitation protocol improves short-term clinical outcomes and may augment nonoperative and postoperative rehabilitation.”*

Universiteit Antwerpen

# Conservative care

Knee Surg Sports Traumatol Arthrosc (2014) 22:750–755
DOI 10.1007/s00167-014-2862-3

HIP

## Limited therapeutic benefits of intra-articular cortisone injection for patients with femoro-acetabular impingement and labral tear

Aaron J. Krych · Timothy B. Griffith · Joshua L. Hudgens · Scott A. Kuzma · Rafael J. Sierra · Bruce A. Levy

*“In patients with symptomatic FAI and labral tear, intra-articular cortisone injection has limited clinical benefit as a therapeutic modality. Average duration of pain relief was 9,8 days.”*

# Conservative care

Journal of Science and Medicine in Sport 19 (2016) 716–721

Contents lists available at ScienceDirect

Journal of Science and Medicine in Sport

journal homepage: www.elsevier.com/locate/jsams

Original research

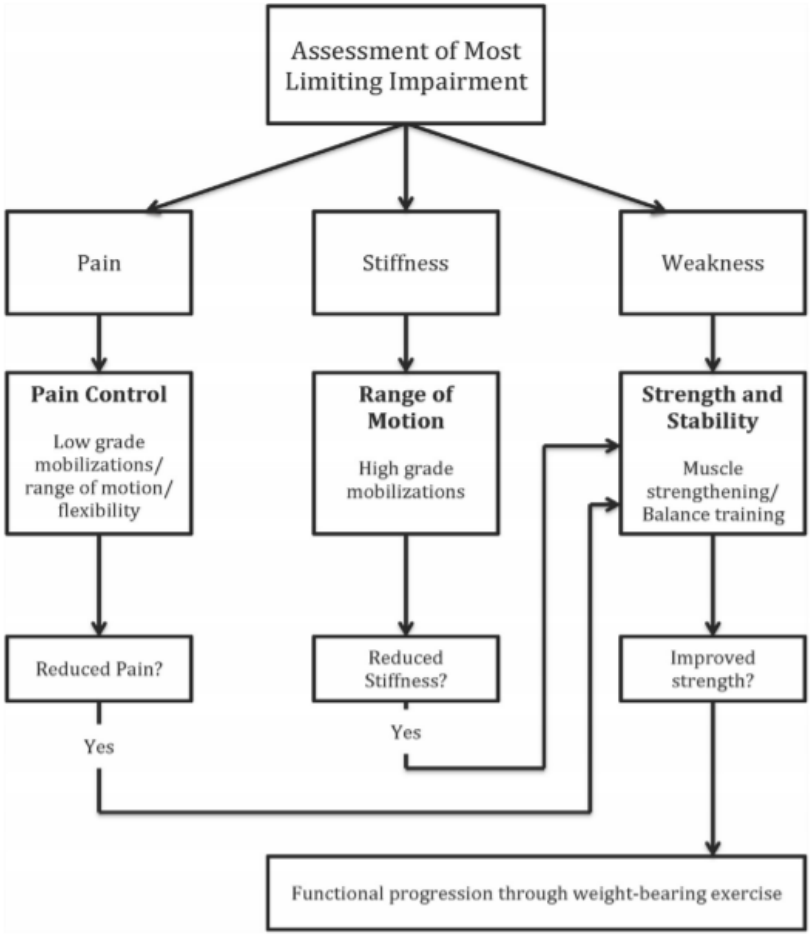
## Non-operative management of femoroacetabular impingement: A prospective, randomized controlled clinical trial pilot study

Alexis A. Wright[a,*], Eric J. Hegedus[a], Jeffrey B. Taylor[a], Steven L. Dischiavi[a], Allston J. Stubbs[b]

[a] Department of Physical Therapy, High Point University, High Point, NC 27268, USA
[b] Department of Orthopaedic Surgery, Wake Forest School of Medicine, Winston-Salem, NC 27157, USA

Universiteit Antwerpen

# Conservative care




Universiteit Antwerpen

# Conservative care

*“In this small pilot study, supervised manual therapy and exercise did not result in greater improvement in pain or function compared to advice and home exercise in patients with symptomatic femoroacetabular impingement.”*

Universiteit Antwerpen

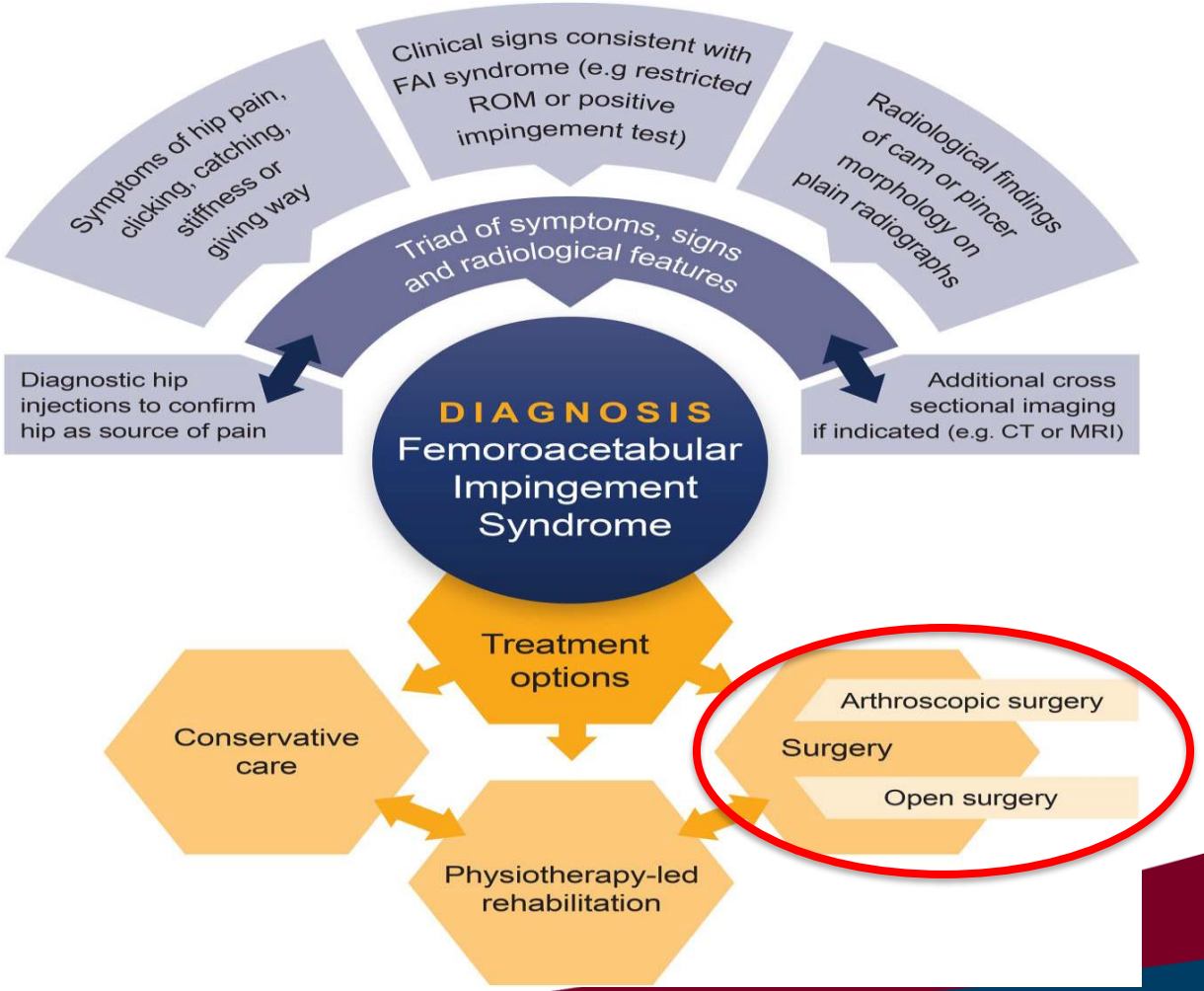
# Conservative care

Acute phase:
- Education
- Relative rest
- Avoid long term sitting, crossing legs, pivoting, deep squats…
- Simple analgetics

Subacute phase:
- Strengthening exercises of the hip (proximal stabilisation)
- Strengthening of the core muscles (core stabilisation)
- Sportspecific exercises (increase ability to load)

→ Home exercise program!

# Warwick agreement on FAI syndrome




Universiteit Antwerpen

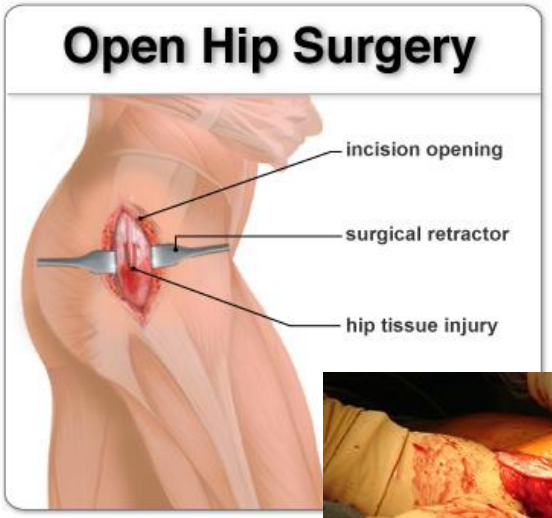
# Surgery

- Purpose:
  - Primum non nocere
  - Treat instabile injuries
  - Optimize morphology
  - Get the patient pain free
  - Avoid progression in the future

# Surgery

Different techniques:

- Open surgery
- Arthroscopic surgery




Universiteit Antwerpen

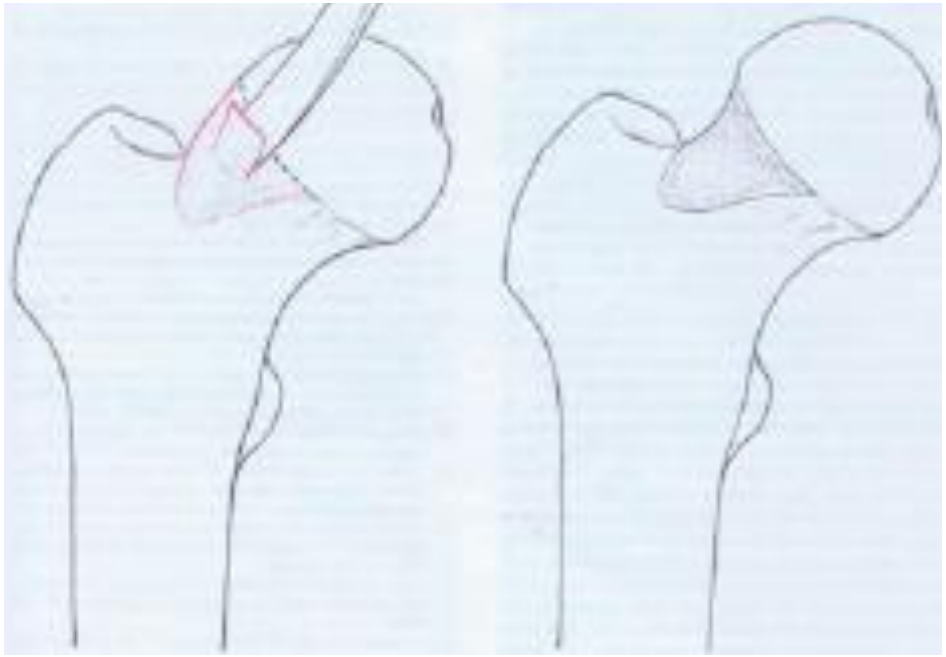
# Arthroscopic approach

- Acetabular:
  - Labral resection/repair/replacement (rimtrimming (acetabuloplasty))
- Femoral:
  - Reconstruction of sphericity /offset

# Rimtrimming

Universiteit Antwerpen

# Reconstruction of normal morphology of the hip neck



Universiteit Antwerpen

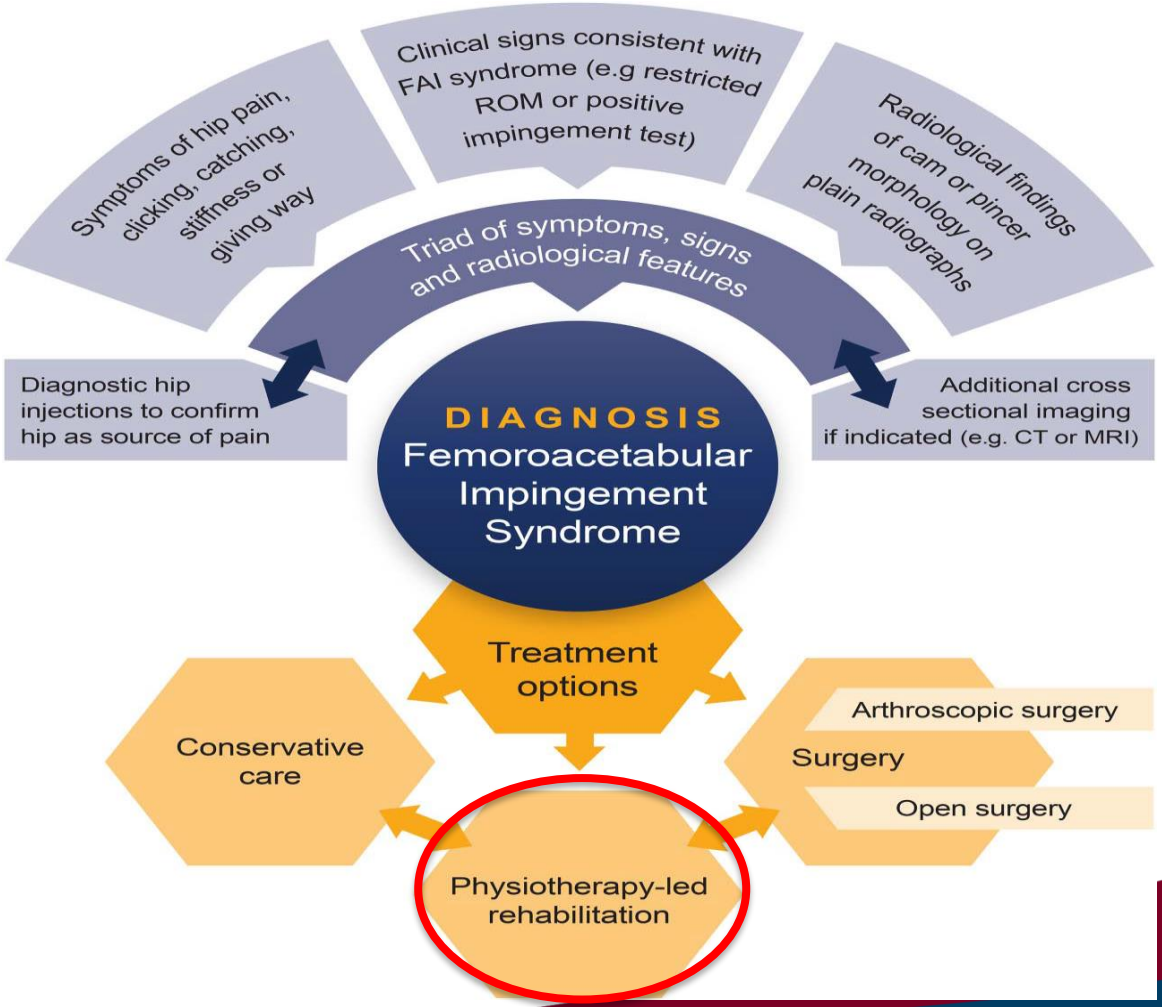
# Conclusion on arthroscopic approach

- Impingement treatment consists of :
  - Treat the injury
  - Treat the conflict

- Hiparthroscopy is safe

- The earlier the intervention, the better the effect

# Warwick agreement on FAI syndrome




Universiteit Antwerpen

# Post-arthroscopy policy

- Basic rules:
  - Weight bearing: in dialogue with surgeon
  - Active assistive mobilisation: early, but no extremes
  - Strengthening: early, but carefull with iliopsoas (cave: tendinopathy)

Universiteit Antwerpen

# Post-arthroscopy policy

Different guidelines!

Mostly 4 phases

- Phase 1 (3-6w): protective phase
- Phase 2 (4-6w): proprioception
- Phase 3 (10-12w): hip stability
- Phase 4 (+12w): return to sport
- Competitive level: 6 months!

# Conclusions post-surgery approach

- All depends on the severity of the condition and on the extent of arthroscopic intervention

- Slow recovery !

# Warwick agreement on FAI syndrome


Universiteit Antwerpen

# Conservative treatment VS surgery

## Hip arthroscopy versus best conservative care for the treatment of femoroacetabular impingement syndrome (UK FASHIoN): a multicentre randomised controlled trial

*Damian R Griffin, Edward J Dickenson, Peter D H Wall, Felix Achana, Jenny L Donovan, James Griffin, Rachel Hobson, Charles E Hutchinson, Marcus Jepson, Nick R Parsons, Stavros Petrou, Alba Realpe, Joanna Smith, Nadine E Foster, on behalf of the UK FASHIoN Study Group**

Universiteit Antwerpen

# Conservative treatment VS surgery

- 348 participants
  - 171 arthroscopy
  - 177 personalised hip therapy

Universiteit Antwerpen

# Conservative treatment VS surgery

| | Hip arthroscopy (n=171) | | Personalised hip therapy (n=177) | | Unadjusted difference | Adjusted difference (95% CI) | p value |
|---|---|---|---|---|---|---|---|
| | Mean (SD) | n | Mean (SD) | n | | | |
| **iHOT-33** | | | | | | | |
| 6 months | 46·6 (25) | 161 | 45·6 (23) | 154 | 1·0 | −0·7 (−5·2 to 3·7) | 0·743 |
| 12 months* | 58·8 (27) | 158 | 49·7 (25) | 163 | 9·1 | 6·8 (1·7 to 12·0) | 0·0093 |
| **EQ-5D-5L (utility)** | | | | | | | |
| 6 months | 0·544 (0·26) | 144 | 0·573 (0·23) | 147 | −0·029 | −0·042 (−0·088 to 0·005) | 0·081 |
| 12 months | 0·615 (0·25) | 152 | 0·578 (0·24) | 147 | 0·037 | 0·020 (−0·027 to 0·067) | 0·397 |
| **EQ-5D VAS** | | | | | | | |
| 6 months | 67·8 (19·3) | 145 | 70·3 (19·3) | 145 | −2·5 | −2·1 (−5·7 to 1·4) | 0·241 |
| 12 months | 71·9 (20·7) | 150 | 69·2 (19·4) | 145 | 2·7 | 2·6 (−1·2 to 6·4) | 0·180 |
| **SF-12 PCS** | | | | | | | |
| 6 months | 43·4 (7·0) | 146 | 44·2 (6·6) | 142 | −0·8 | −0·7 (−2·1 to 0·7) | 0·304 |
| 12 months | 45·1 (6·3) | 145 | 44·2 (6·4) | 132 | 1·0 | 1·1 (−0·2 to 2·5) | 0·099 |
| **SF-12 MCS** | | | | | | | |
| 6 months | 42·1 (7·3) | 146 | 42·1 (7·2) | 142 | −0·1 | −0·1 (−1·5 to 1·3) | 0·929 |
| 12 months | 43·2 (7·1) | 145 | 42·6 (6·9) | 132 | 0·6 | 0·4 (−1·2 to 2·0) | 0·589 |

iHOT-33=International Hip Outcome Tool. VAS=visual analogue score. PCS=physical component score. MCS=mental component score. *Primary outcome.

*Table 2:* **Patient-reported outcome measures**

Universiteit Antwerpen

# Conservative treatment VS surgery

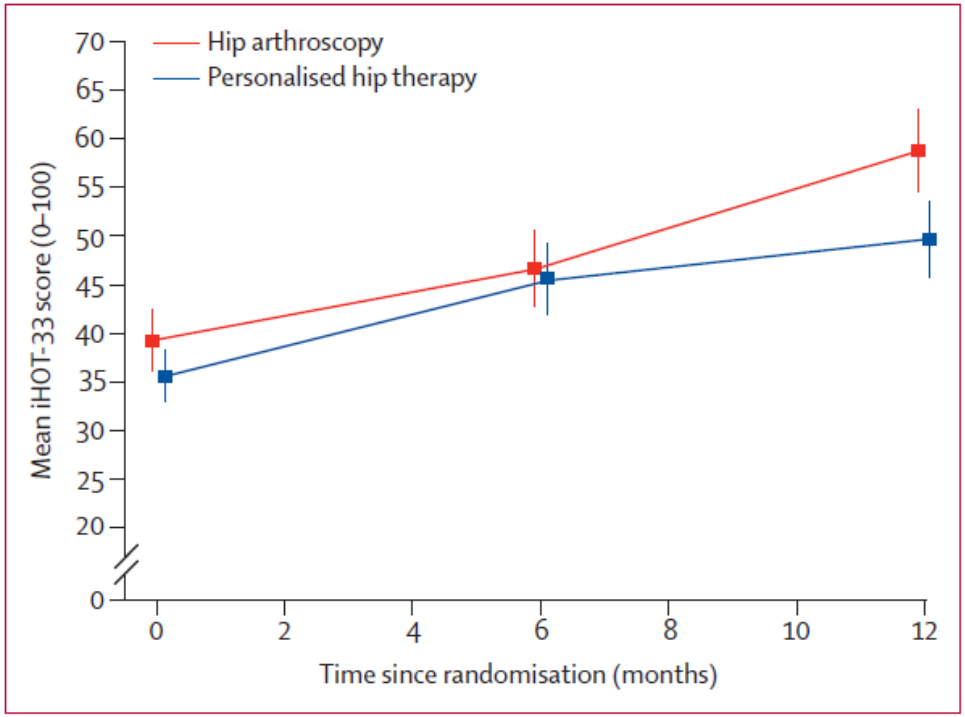



***Figure 2:*** **Changes in mean iHOT-33 score from baseline to 6 and 12 months after randomisation**

Error bars are 95% CIs. iHOT-33=International Hip Outcome Tool.

Universiteit Antwerpen

Universiteit Antwerpen