

**VOETBALMEDISCH SYMPOSIUM**  
**DIEPTE VOOR BREEDTE**  
 PRAKTISCHE WETENSCHAP

CAM-vorm van de heup: reden tot zorg of normaal?  
 Dr. Pim van Klij | Orthopaedic Surgeon

A musculoskeletal approach for hamstring injury risk reduction  
 Dr. Abbas Lakhal | Strength & Conditioning Coach / PFC / PNF

Een functionele benadering van hamstring- en adductorlesies  
 Dr. Frank Baerens | Sports Medicine & High Performance Coach / PFC / Care / PNF

Neurowetenschappen bij de KNVB: De SCN-Pull  
 Dr. Marco Kluge | Embedded scientist KNVB


Scenen met voetbal  
 Ronald Bultmann | Journalist / FC Utrecht / KNVB

Growing pains: the impact of physical maturation on development in football  
 Jan Verbeek | Embedded Scientist KNVB

Deinde be'it | Netwerkopbouw & Netwerkborrow!

INSCRIBEREN VIA  
[www.soccercare.nl/ams22](http://www.soccercare.nl/ams22)

13 APRIL 2022 VAN 13:00 TOT 19:00  
 KNVB CAMPUS  
 WOUDBERGSSEWEG 96 | 3707 HK ZEIST



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2

**Voetbalmedisch Symposium 2022**

**CAM-VORM VAN DE HEUP:  
 REDEN TOT ZORG OF NORMAAL?**

13<sup>th</sup> of April, 2022

Pim van Klij, MD PhD  
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3

**NO DISCLOSURES**





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4

**Who am I?**

- Pim van Klij
- Sports Medicine Physician Resident, Isala Zwolle
- Medical doctor at Feyenoord U21 and Landstede Hammers
- Erasmus MC Orthopaedic Surgery & Sports Medicine
  - PhD defense 10<sup>th</sup> March 2021





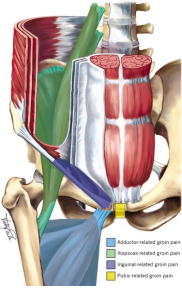



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5

**Doha Agreement**

- Groin entities
  - Adductor related
  - Iliopsoas related
  - Inguinal related
  - Pubic related
  - Hip related



1. Weir et al. BJSM 2015

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6

## The hip joint

- Bony hip joint
  - Socket
  - Ball
- Several other structures

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7

## The hip joint

- Bony hip joint
  - Socket
  - Ball
- Shape of the hip
  - Acetabular 'roof'
  - Head-neck junction

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8

## FAI syndrome

Consensus statement

The Warwick Agreement on femoroacetabular impingement syndrome (FAI syndrome): an international consensus statement

D R Griffin,<sup>1,2</sup> E J Dickenson,<sup>1,2</sup> J O'Donnell,<sup>3,4</sup> R Agricola,<sup>5</sup> T Awan,<sup>6</sup> M Beck,<sup>7</sup> J C Clohisy,<sup>8</sup> H P Dijkstra,<sup>9</sup> E Falvey,<sup>10,11</sup> M Gimpel,<sup>12</sup> R S Hinman,<sup>13</sup> P Hölmich,<sup>3,14</sup> A Kassirjian,<sup>15,16</sup> H D Martin,<sup>17</sup> R Martin,<sup>18,19</sup> R C Mather,<sup>20</sup> M J Philippon,<sup>21</sup> M P Reiman,<sup>20</sup> A Takla,<sup>3,22,23,24</sup> K Thorborg,<sup>14</sup> S Walker,<sup>25</sup> A Weir,<sup>9,26</sup> K L Bennell<sup>23</sup>

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9

## FAI syndrome<sup>1</sup>

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10

## FAI syndrome<sup>1</sup>

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11

## FAI syndrome<sup>1</sup>

Imaging for hip-related groin pain: don't be hip-notised by the findings

Kieran O'Sullivan,<sup>1,2</sup> Ben Darlow,<sup>3</sup> Peter O'Sullivan,<sup>4</sup> Bruce B Forster,<sup>5</sup> Michael P Reiman,<sup>6</sup> Adam Weir,<sup>7,8</sup>

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12

## FAI syndrome and hip OA<sup>1,2</sup>

2 to 9 times increased risk of developing OA<sup>2</sup> But...PPV's 'only' 6%-25%<sup>3</sup>

1. Ganz et al. CORR 2003 2. van Kijl et al. JOSPT 2018 3. Agricola et al. Nature rev Rheumatol 2013

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13

## Zürich consensus on hip pain

Consensus Recommendations on the Classification, Definition and Diagnostic Criteria of Hip-related Pain in Young and Middle-aged Active Adults (Zurich, 2018)

Summary of Final Consensus Recommendations

Recommendation Level: 1 (Strong), 2 (Moderate), 3 (Weak)

Expert Backgrounds	For Clinicians	For Clinicians & Researchers
<ul style="list-style-type: none"> <li>1. Radiologists</li> <li>2. Physiotherapists</li> <li>3. Orthopedic surgeons</li> <li>4. Pain specialists</li> <li>5. Sports medicine</li> <li>6. Biomechanics</li> <li>7. Epidemiology</li> </ul>	<ol style="list-style-type: none"> <li>1. Diagnose hip-related pain as a clinical entity and refer to care of the clinician.</li> </ol>	<ol style="list-style-type: none"> <li>1. Research on hip-related pain should be multidisciplinary and should include the patient's perspective and social aspects.</li> </ol>
<p>Research Driven</p> <p>Researcher consensus from previous studies and consensus from the Zurich Hip-related Pain Consensus Conference. Researcher consensus for the Zurich Hip-related Pain Consensus Conference. Researcher consensus for the Zurich Hip-related Pain Consensus Conference.</p>	<ol style="list-style-type: none"> <li>2. Researcher consensus for the Zurich Hip-related Pain Consensus Conference.</li> </ol>	<ol style="list-style-type: none"> <li>2. Researcher consensus for the Zurich Hip-related Pain Consensus Conference.</li> </ol>
<p>Reaching Agreement</p> <p>The Zurich Hip-related Pain Consensus Conference. The Zurich Hip-related Pain Consensus Conference. The Zurich Hip-related Pain Consensus Conference.</p>	<p>100%</p>	<p>97%</p>

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14

## Alpha angle $\geq 60^\circ$ = cam morphology<sup>1</sup>

1. Van Kijl et al. OJSM 2020

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15

## Cam morphology and cartilage lesions

Project FORCE

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## Cam morphology and cartilage lesions

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17

## Cam morphology and cartilage lesions


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18

## Cam morphology factors

- Gender**
  - Females 0-15%, males 15-25%
- Genetics**
  - Asian vs. Caucasian<sup>1</sup>
  - Siblings of patients with cam FAI 2.8 more likely to have a cam morphology than the patients' spouses<sup>2</sup>
- Growth plate orientation**
  - Growth plate orientation towards the femoral neck<sup>3</sup>
- Athletic activity**
  - High impact sporting activities 89%, non-athletic controls 9%<sup>4,5</sup>



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19

## In 1978, Murray already knew..

ATHLETIC ACTIVITY IN ADOLESCENCE AS AN ETIOLOGICAL FACTOR IN DEGENERATIVE HIP DISEASE

R. O. MURRAY and CATHERINE DUNCAN, LONDON, ENGLAND

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20

## Athletic activity & cam morphology

- Prevalence of cam morphology in athletes**
  - Football<sup>1-4</sup>
  - Basketball<sup>5</sup>
  - Track & Field<sup>6</sup>
  - Ice hockey<sup>7</sup>
  - Kapoeira<sup>8</sup>
  - American Football<sup>9</sup>

**Opportunity for prevention?!**

When does cam morphology develop?  
How does it develop (loading patterns)?



- Higher prevalence in athletes compared with non-athletes<sup>3,4</sup>**

1. Johnson et al. 2012	5. Gerhardt 2012	9. Lahner et al. 2014
2. Kappon et al. 2011	6. Nepple et al. 2012	10. Lahner et al. 2014
3. Sieberer et al. 2011	7. Sieberer et al. 2013	11. Ayem et al. 2014
4. Agrigola et al. 2012	8. Marcondes et al. 2014	12. Phalippon et al. 2013

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21



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22

## When does cam morphology develop?

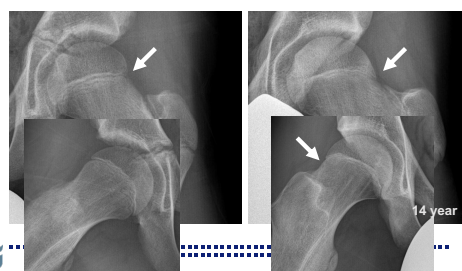
- Academy football players (aged 12-18 year, n=89)**
  - 2.5-years follow-up (n=63)
  - 5-years follow-up (n=49)
- Standardised AP pelvic and frog-leg lateral views**
  - Alpha angle ( $\geq 60$  degrees)
  - Visual scores: normal, flattening, prominence



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## Cam gradually increases in size



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### Cam gradually increases in size

14 year 16 year

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### Development cam morphology in time

Baseline 14 year (1) normal Growth plate open

2.5-year follow-up 16 year (2) flattening Growth plate open

5-year follow-up 19 year (3) prominence Growth plate closed

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26

### Cam develops during growth

Original article

Cam morphology in young male football players mostly develops before proximal femoral growth plate closure: a prospective study with 5-year follow-up

Pim van Kijl,<sup>1</sup> Marinus P Heijboer,<sup>1</sup> Abida Z Ginaï,<sup>2</sup> Jan A N Verhaar,<sup>1</sup> Jan H Waarsing,<sup>1</sup> Rintje Agricola<sup>1</sup>

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27

### Most important findings

- Cam morphology first visible from the age of 12 to 13 years<sup>1</sup>
- Cam morphology gradually increases in size over time<sup>2,3,4</sup>
- Cam morphology develops when the growth plate is open<sup>5</sup>

1. Agricola et al. AJSM 2012 3. Agricola et al. Nature Rev Rheum 2014 5. van Kijl et al. BJSM 2018  
 2. Agricola et al. AJSM 2014 4. Glynn-Jones et al. Lancet 2015

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28

### Cam preceded by cartilage bump?

Physical activity during adolescence and the development of cam morphology: a cross-sectional cohort study of 210 individuals

Antony Paine<sup>1</sup>, Scott Ferguson<sup>1</sup>, Mo Gimpel<sup>1</sup>, Richard Birchak<sup>2</sup>, Andrew Judge<sup>1,3</sup>, John Brownfield<sup>1</sup>, Julia Newson<sup>1</sup>, Iain Wilkerson<sup>1</sup>, Andrew Carr<sup>1</sup>, Sean O'Leary<sup>1</sup>

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29

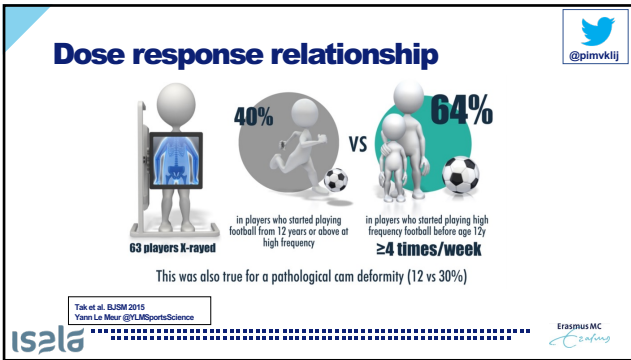
### Why around age of 12-13 years?

'Period in which bone is most responsive to exercise'

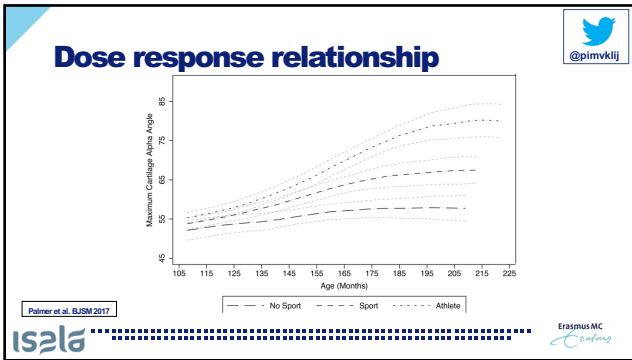
Figure adapted from: MacGillivray et al. BJSM 2004

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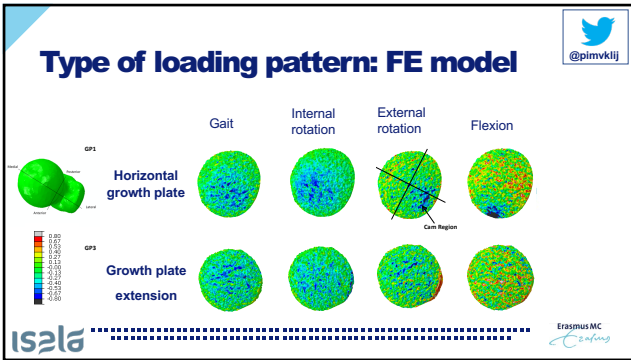
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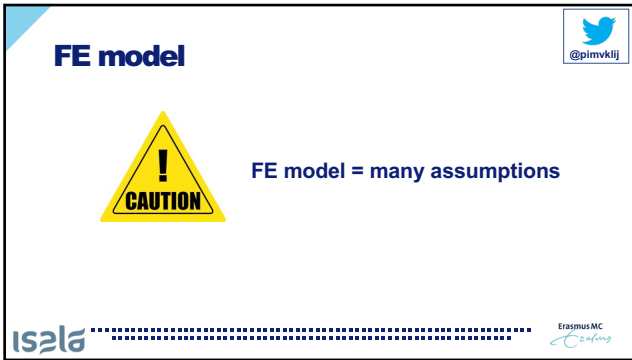
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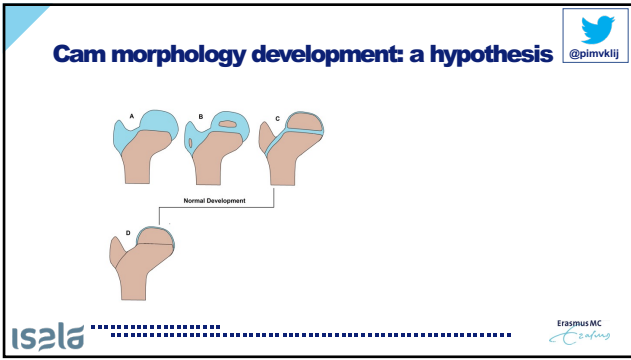
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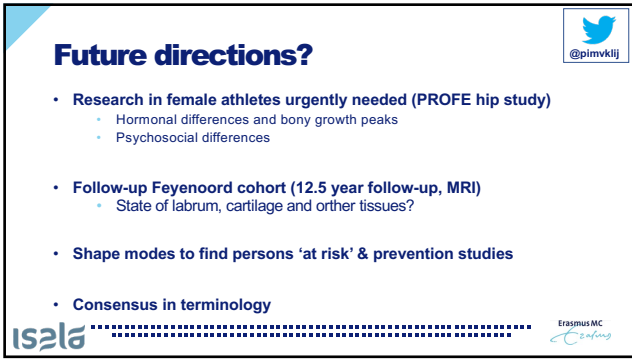
33



34



35



36

## Take home messages



- Cam morphology is:
  - Acquired during skeletal growth during 2<sup>nd</sup> growth spurt
  - Developed as an adaptive response to loads applied to the hip and dependent on type and frequency of activities
  - Considered a normal bone shape which sometimes can lead to FAI syndrome

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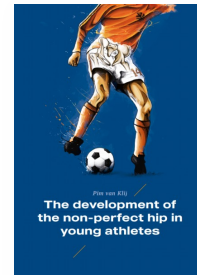
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37

## Questions?



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- Pim van Klij
  - [p.vanklij@erasmusmc.nl](mailto:p.vanklij@erasmusmc.nl)



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38