The Athlete's Hip: An Update on Athletic Groin Pain

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MEDBRIDGE

Disclosures

- **Financial**
  - Teach a four-course series on MedBridge titled *The Athlete's Hip*
  - Teach a two-day live course titled *The Athlete's Hip: Simplifying Evaluation, Treatment, and Return to Sport*
  - Co-author of *PT Ortho & Sports Questions Volume II: Pass the Test Without Breaking the Bank*
- **Nonfinancial**
  - Manage and frequently contribute to JohnSnyderDPT.com

Learning Goals

- Recognize demographics and additional factors of individuals with groin pain in order to identify those at increased risk of developing groin pain
- Administer an efficient evaluation plan using recent research on special tests to assess athletic groin pain
- Analyze the literature related to conservative and surgical management of femoroacetabular impingement syndrome
- Administer evaluative techniques to determine the underlying pathology or structure involved in the athlete presenting with athletic pubalgia
- Apply the information learned during the webinar to clinical practice in order to more efficiently evaluate and treat this patient population

Chapter 1

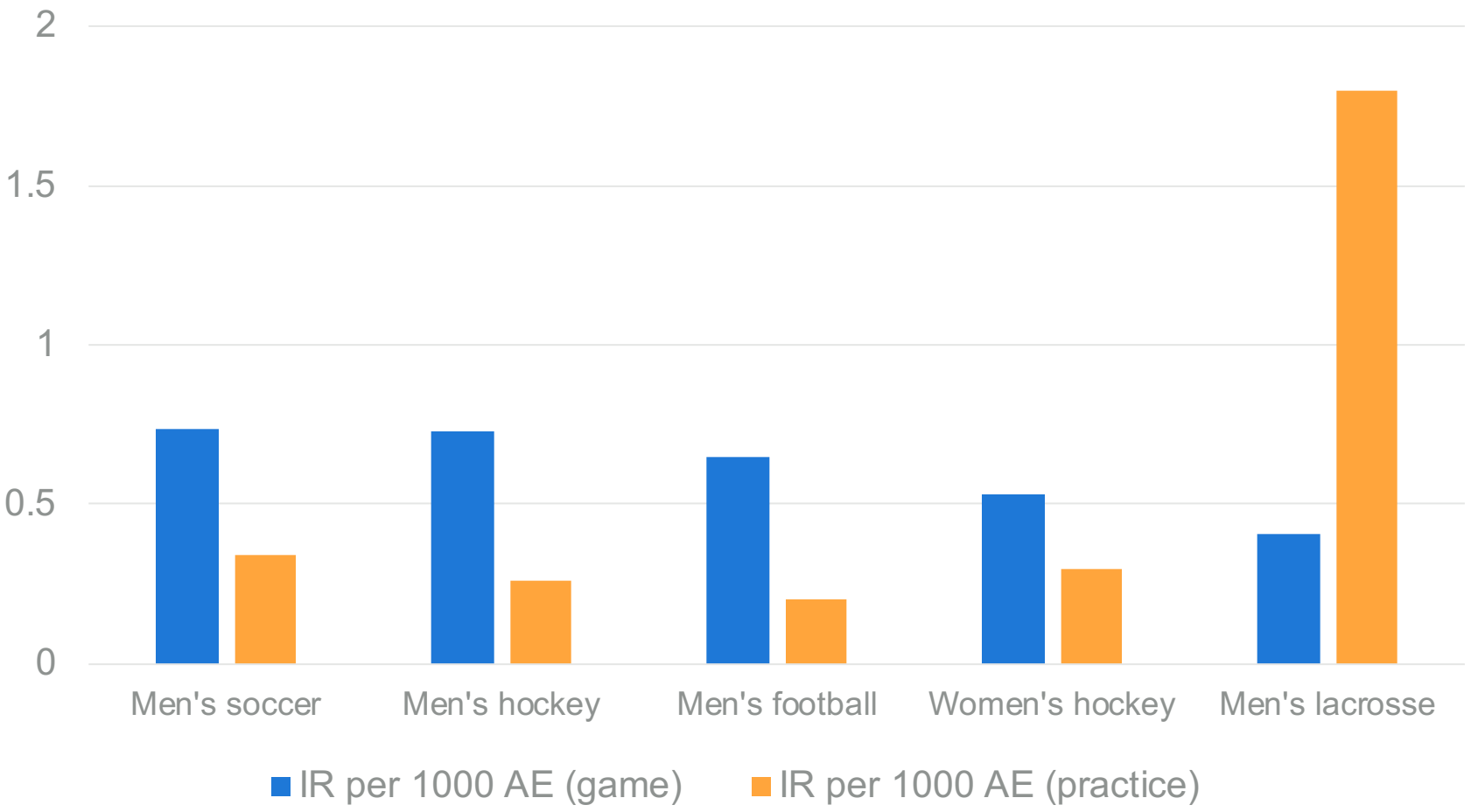
What Is Athletic Groin Pain, and Who Is Affected?

What Diagnoses Are Most Common in Athletes With Groin Pain?

Cause	Patients	Male
FAIS	1510	59.2%
Athletic pubalgia	1122	98.0%
Adductor related	570	99.2%
Inguinal related	473	96.6%
Labral	220	54.3%

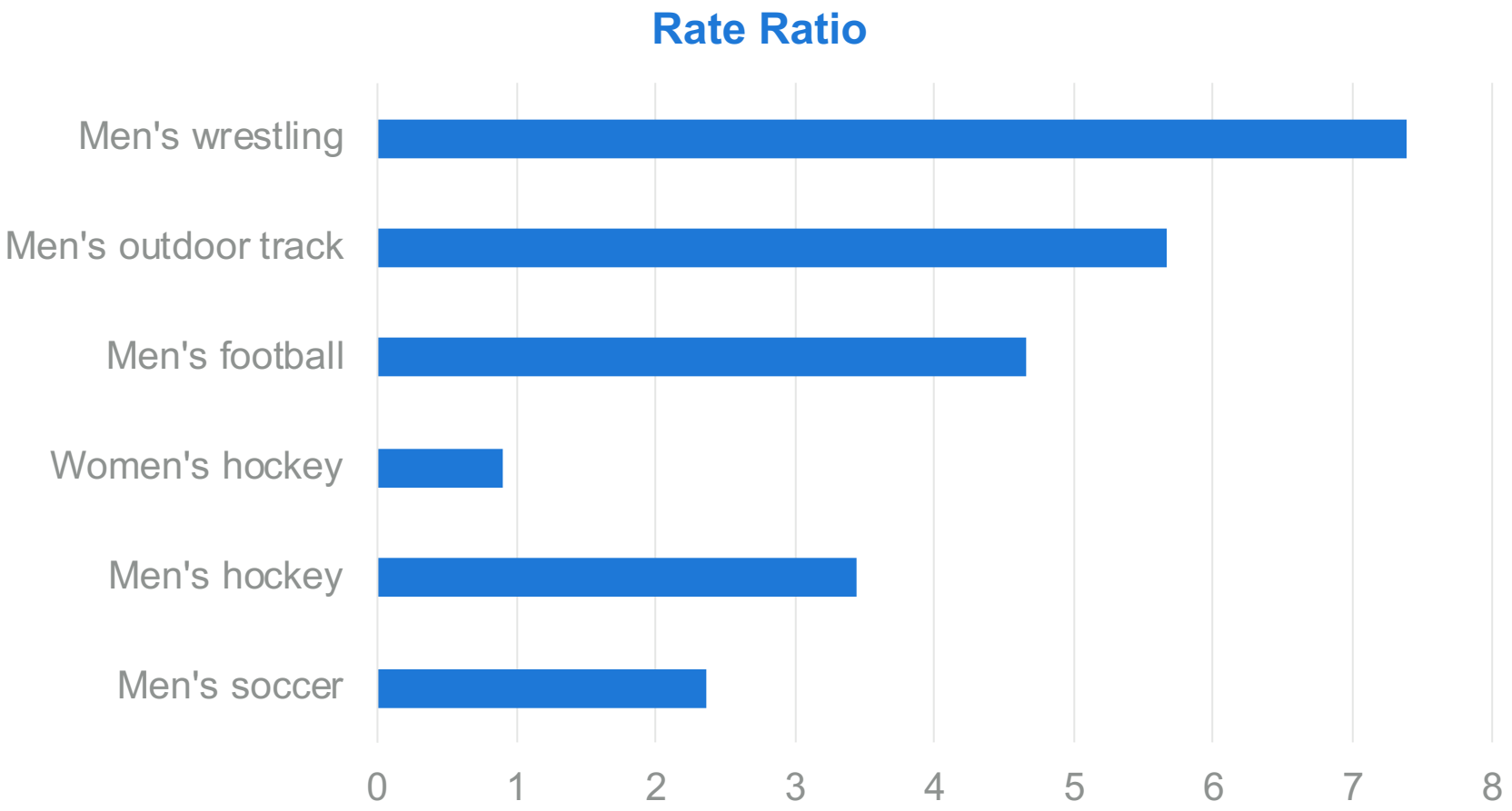
de SA D, Hölmich P, Phillips M, et al. Athletic groin pain: a systematic review of surgical diagnoses, investigations and treatment. British Journal of Sports Medicine. May 2016:bjsports–2015–095137–10. doi:10.1136/bjsports-2015-095137.

What Types of Sports Are Most Common?



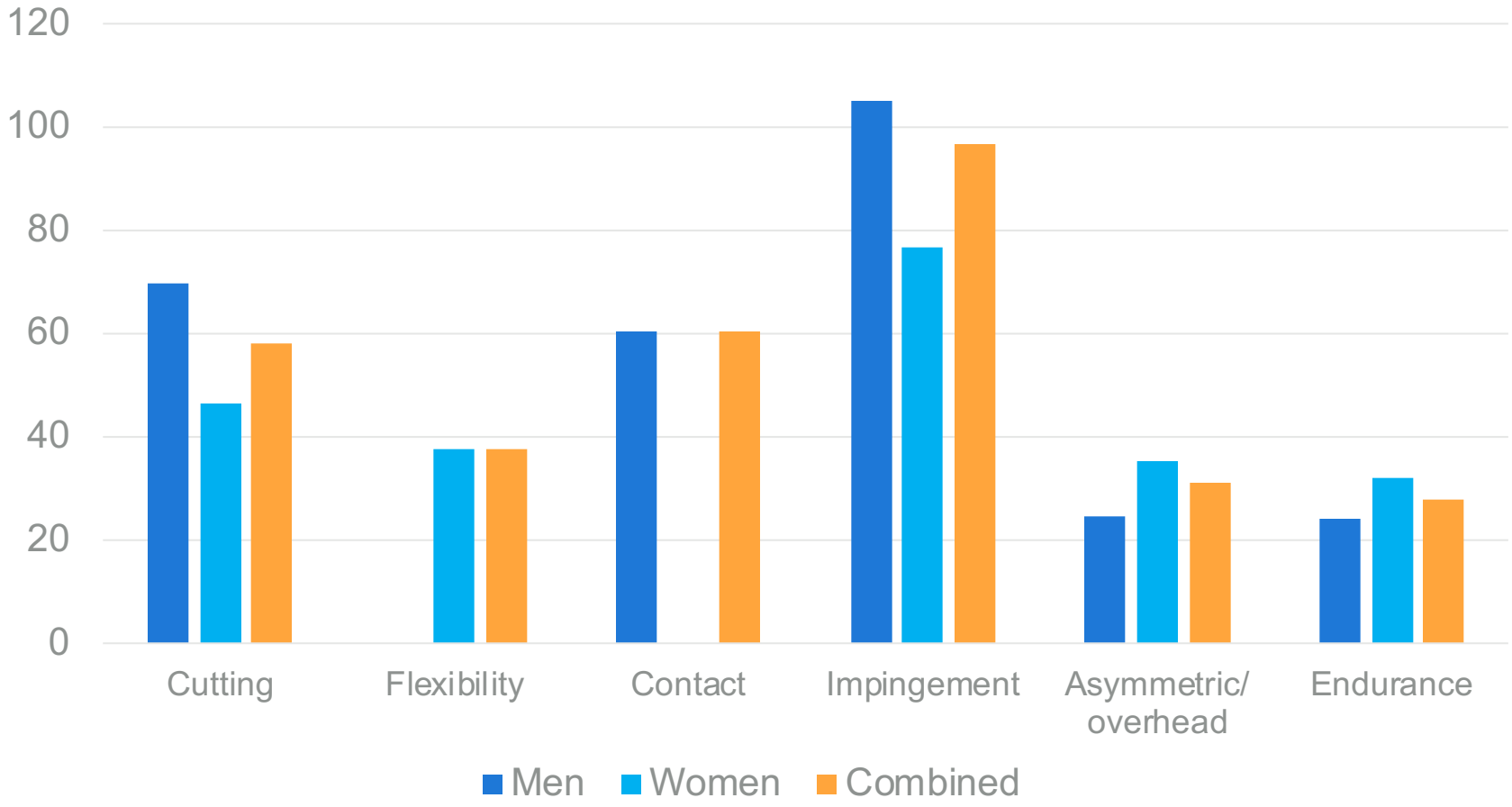
Orchard JW. Men at higher risk of groin injuries in elite team sports: a systematic review. British Journal of Sports Medicine. 2015;49(12):798-802. doi:10.1136/bjsports-2014-094272.

Let‘s Take a Closer Look



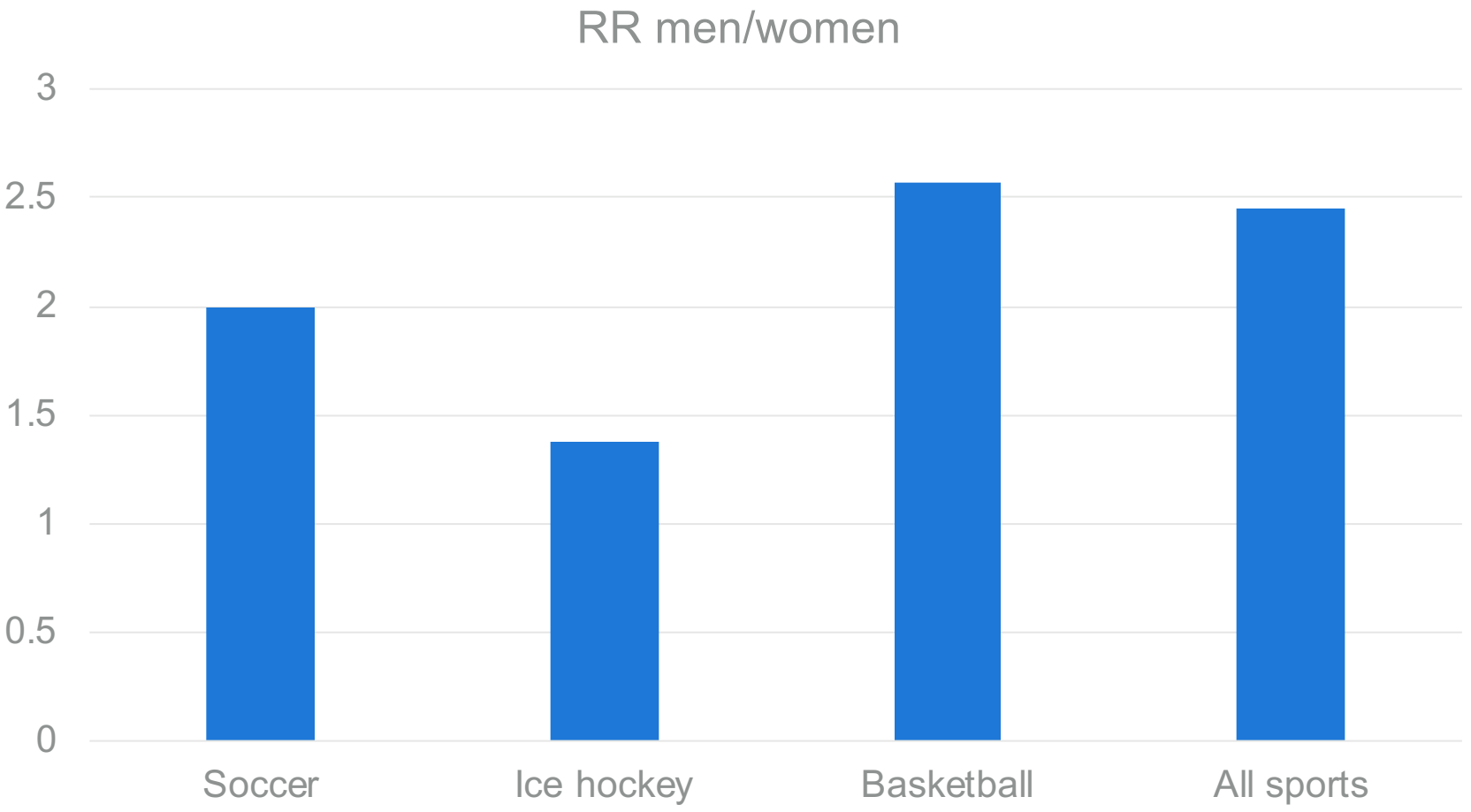
Cruz CA, Kerbel Y, Smith CM, Prodromo J, Trojan JD, Mulcahey MK. A Sport-specific Analysis of the Epidemiology of Hip Injuries in National Collegiate Athletic Association Athletes From 2009 to 2014. Arthroscopy. 2019;35(9):2724-2732. doi:10.1016/j.arthro.2019.03.044.

Type of Sport Characteristics



Cruz CA, Kerbel Y, Smith CM, Prodromo J, Trojan JD, Mulcahey MK. A Sport-specific Analysis of the Epidemiology of Hip Injuries in National Collegiate Athletic Association Athletes From 2009 to 2014. Arthroscopy. 2019;35(9):2724-2732. doi:10.1016/j.arthro.2019.03.044.

What About Gender? Does Groin Pain Discriminate?



Orchard JW. Men at higher risk of groin injuries in elite team sports: a systematic review. British Journal of Sports Medicine. 2015;49(12):798-802. doi:10.1136/bjsports-2014-094272.

Ice Hockey Goaltenders: What Does the Evidence Show?

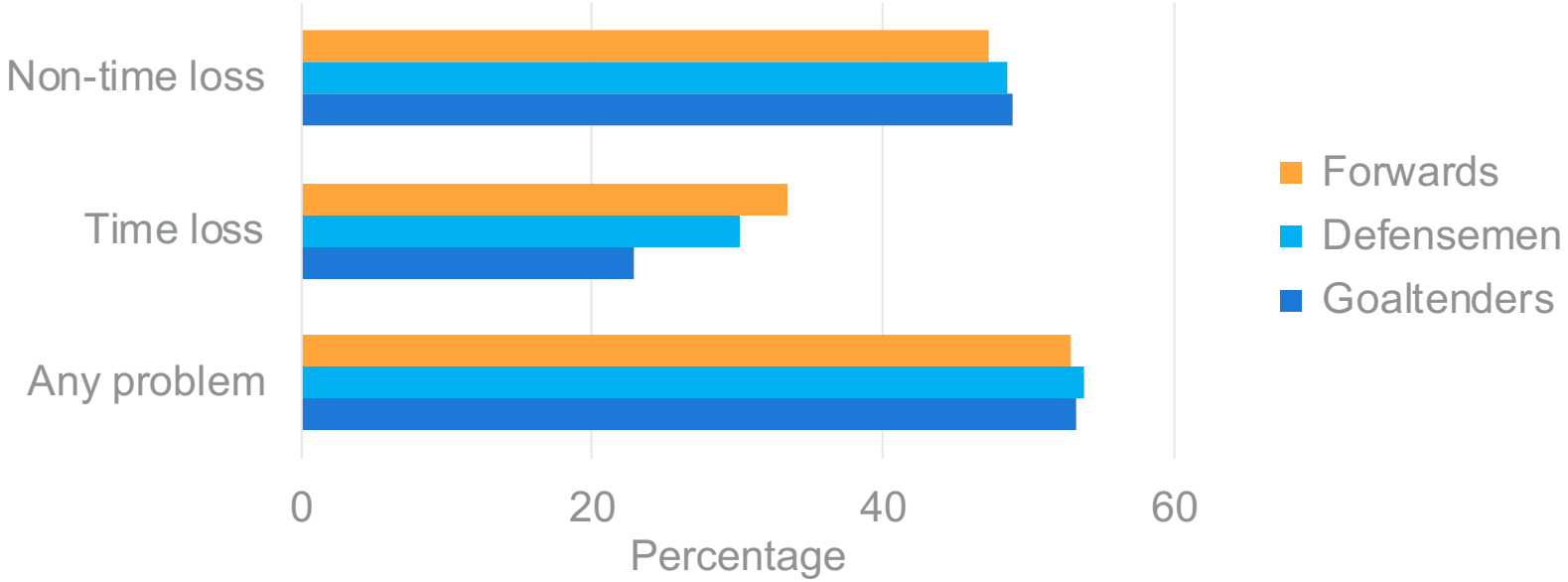
- **69%** of elite goaltenders experienced at least one episode of hip and groin problems
- **36%** experienced at least one episode of substantial problems affecting their performance
- **83.1%** were due to overuse, and 15.5% led to time loss

Wörner T, Clarsen B, Thorborg K, Eek F. Elite Ice Hockey Goalkeepers Have a High Prevalence of Hip and Groin Problems Associated With Decreased Sporting Function: A Single-Season Prospective Cohort Study. *Orthopaedic Journal of Sports Medicine*. 2019;7(12):232596711989258-232596711989259. doi:10.1177/2325967119892586.

Ice Hockey: Does the Position Actually Matter?

Players that reported symptoms during the previous season

- Players with longstanding symptoms (**>6 weeks duration**) presented with most severe impairments in self-reported hip and groin function at the beginning of the new season



Wörner T, Thorborg K, Eek F. High prevalence of hip and groin problems in professional ice hockey players, regardless of playing position. Knee Surg Sports Traumatol Arthrosc. 2019;26(4):451. doi:10.1007/s00167-019-05787-7.

How About Soccer (Football)?

- The average weekly prevalence of all groin problems was **11.7%**
  - **1.3%** with time loss and **10.4%** without time loss
- The traditional time-loss measure **only captured 10% of all groin problems**

Esteve E, Clausen MB, Rathleff MS, et al. Prevalence and severity of groin problems in Spanish football: A prospective study beyond the time-loss approach. Scandinavian Journal of Medicine & Science in Sports. December 2019:sms.13615-sms.13622. doi:10.1111/sms.13615.

What Objective Factors Differentiate Between Those With and Without Groin Pain?

- Pain provocation tests
  - **Adductor squeeze test (OR = 4.31)**
  - Single adductor test (OR = 4.03)
  - Bilateral adductor test (OR = 24.76)
  - Impingement test (OR = 50.62)
- Range of motion (ROM)
  - Hip IR in prone or supine 90/90 position is less in athletes with hip and groin pain (SMD = 0.42, 0.58)
    - The difference between the groups equated to an average of 3.7º–3.8º
  - Bent-knee fallout
    - Reduced ROM in athletes with hip/groin pain
    - 3.6 cm difference (moderate effect size)

Mosler, AB, Agricola R, Weir A. Which factors differentiate athletes with hip/groin pain from those without? A systematic review with meta-analysis. British Journal of Sports Medicine. 2015;49(12):810-823. doi:10.1136/bjsports-2015-094602.

What range-of-motion deficits can be attributed to those with groin pain?

A. Flexion
B. Internal rotation
C. Extension
D. Total rotational range of motion

Closer Look at Range of Motion

- Strong evidence that total rotation of both hips **below 85˚** measured at the preseason screening was a risk factor for groin pain development
- Strong evidence suggested that internal rotation, abduction, and extension alone were **not associated** with the risk/presence of groin pain

Tak I, Engelaar L, Gouttebarge V, et al. Is lower hip range of motion a risk factor for groin pain in athletes? A systematic review with clinical applications. *British Journal of Sports Medicine*. 2017;51(22):1611-1621. doi:10.1136/bjsports-2016-096619.

Bent-Knee Fallout

- Combined test of AROM hip flexion, abduction, and ER
- Strong evidence that a higher score on BKFO (reduced ROM) differentiates athletes with hip/groin pain from those without pain
- Reduced ROM in athletes with hip/groin pain (SMD = 0.7)
- **3.6 cm difference (moderate)**

Mosler, AB, Agricola R, Weir A. Which factors differentiate athletes with hip/groin pain from those without? A systematic review with meta-analysis. British Journal of Sports Medicine. 2015;49(12):810-823. doi:10.1136/bjsports-2015-094602.

Does Cam Morphology Make a Difference?

Hips with a cam deformity showed higher **but nonsignificant** BKFO values than those without a cam deformity

- 17.1 cm vs. 14.2 cm
- 2.9 cm difference

Tak I, Glasgow P, Langhout R, Weir A, Kerkhoffs G, Agricola R. Hip Range of Motion Is Lower in Professional Soccer Players With Hip and Groin Symptoms or Previous Injuries, Independent of Cam Deformities. Am J Sports Med. December 2015. doi:10.1177/0363546515617747.

What About Strength?

Strength

- **Strong evidence** that hip/groin pain was associated with less strength on adductor squeeze testing (SMD = 1.41)
- Limited evidence that when using an isokinetic dynamometer there are small strength differences

Mosler, AB, Agricola R, Weir A. Which factors differentiate athletes with hip/groin pain from those without? A systematic review with meta-analysis. British Journal of Sports Medicine. 2015;49(12):810-823. doi:10.1136/bjsports-2015-094602.

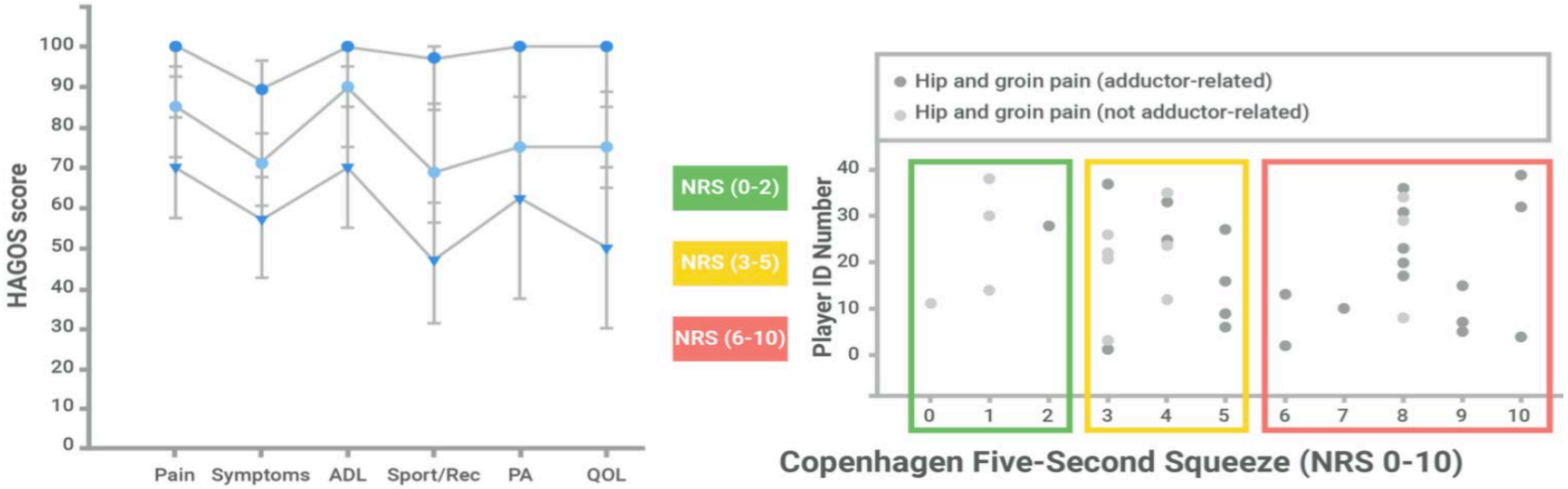
Copenhagen Five-Second Squeeze

- Place one arm between the ankles of the player
- Instruct the player to isometrically and continuously squeeze as hard as possible for five seconds and subsequently rate the pain experienced in the groin during this maneuver (0–10 NPRS)

Thorborg K, Branci S, Nielsen MP, Langelund MT, Holmich P. Copenhagen five-second squeeze: a valid indicator of sports-related hip and groin function. *British Journal of Sports Medicine*. December 2016. doi:10.1136/bjsports-2016-096675.

“Copenhagen Five-Second Squeeze: A Valid Indicator of Sports-Related Hip and Groin Function”

- 667 Athletes (age: 24 ± 4)
- Increased groin pain intensity correlated significantly with lower scores on HAGOS: sport, symptoms, pain, activities of daily living, physical activity, and quality-of-life subscales



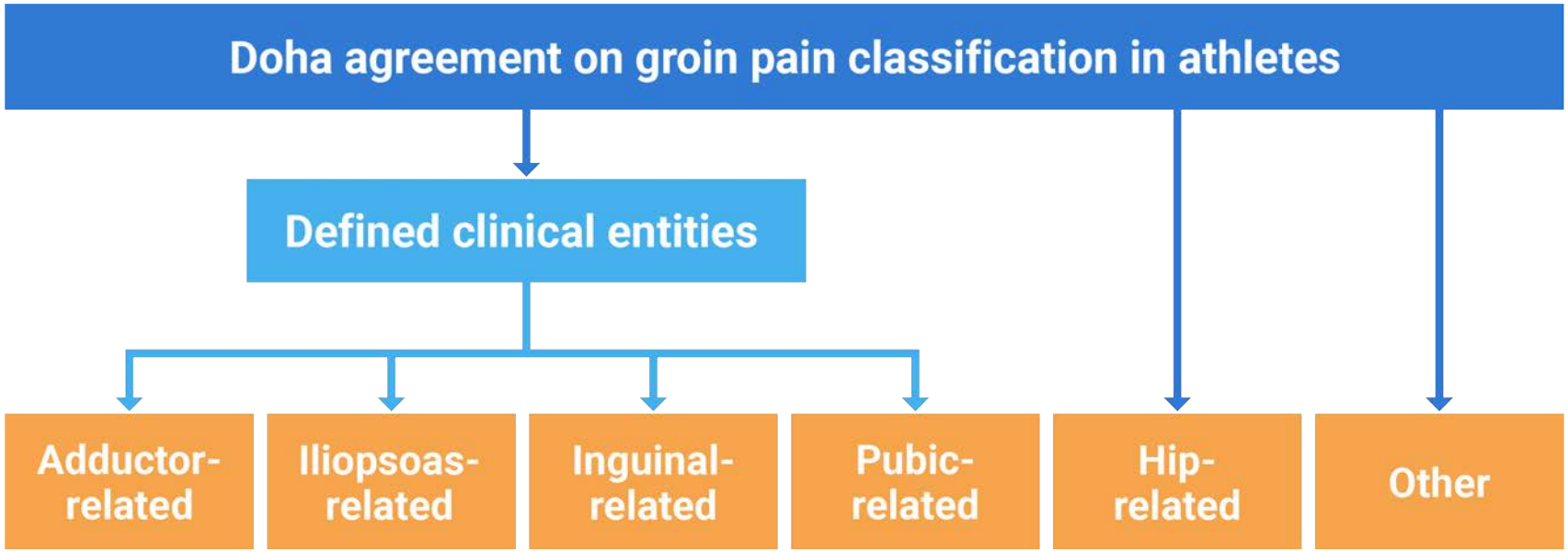
Thorborg K, Branci S, Nielsen MP, Langelund MT, Holmich P. Copenhagen five-second squeeze: a valid indicator of sports-related hip and groin function. *British Journal of Sports Medicine*. December 2016. doi:10.1136/bjsports-2016-096675.

"Five-Second Squeeze Testing in 333 Professional and Semiprofessional Male Ice Hockey Players"

- Players differed significantly from each other regarding self-reported sporting function depending on category
  - Rho:–0.319; P < .01
- Negative correlations were found between the 5SST result and all strength measurements and the HAGOS Sport score
  - Rho:–0.157 to–0.305; P < .01•
- Players in the yellow or red category during the 5SST were significantly weaker than players in the green category

Wörner T, Thorborg K, Eek F. Five-Second Squeeze Testing in 333 Professional and Semiprofessional Male Ice Hockey Players: How Are Hip and Groin Symptoms, Strength, and Sporting Function Related? Orthopaedic Journal of Sports Medicine. 2019;7(2):2325967119825858. doi:10.1177/2325967119825858.

How Do We Organize Our Evaluation?



1. Taylor R, Vuckovic Z, Mosler A, et al. Multidisciplinary Assessment of 100 Athletes With Groin Pain Using the Doha Agreement: High Prevalence of Adductor-Related Groin Pain in Conjunction With Multiple Causes. Clin J Sport Med. June 2017. doi:10.1097/JSM.0000000000000469.
2. Weir A, Brukner P, Delahunt E. Doha agreement meeting on terminology and definitions in groin pain in athletes. British Journal of Sports Medicine. 2015;49(12):768-774. doi:10.1136/bjsports-2015-094869.

Summary

- Groin pain presents primarily in male athletes who participate in multidirectional team sports
- Soccer and hockey players are among the most impacted
- Both the bent-knee fallout and Copenhagen five-second squeeze can be used to differentiate between those with and without groin pain
- Groin pain can be subdivided into several key categories per the Doha agreement

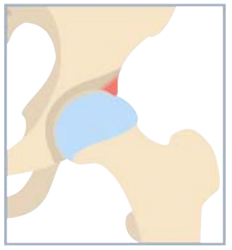
Chapter 2

Femoroacetabular Impingement Syndrome

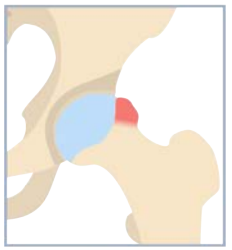
Femoroacetabular Impingement Syndrome (FAIS)

Criteria needed for diagnosis

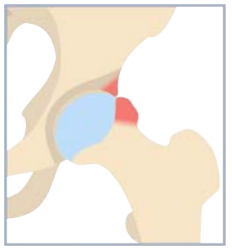
- Abnormal morphology of the femur and/or acetabulum
- Abnormal contact between these two structures
- Especially vigorous supraphysiologic motion that results in such abnormal contact and collision
- Repetitive motion resulting in the continuous insult
- Presence of soft-tissue damage



Pincer



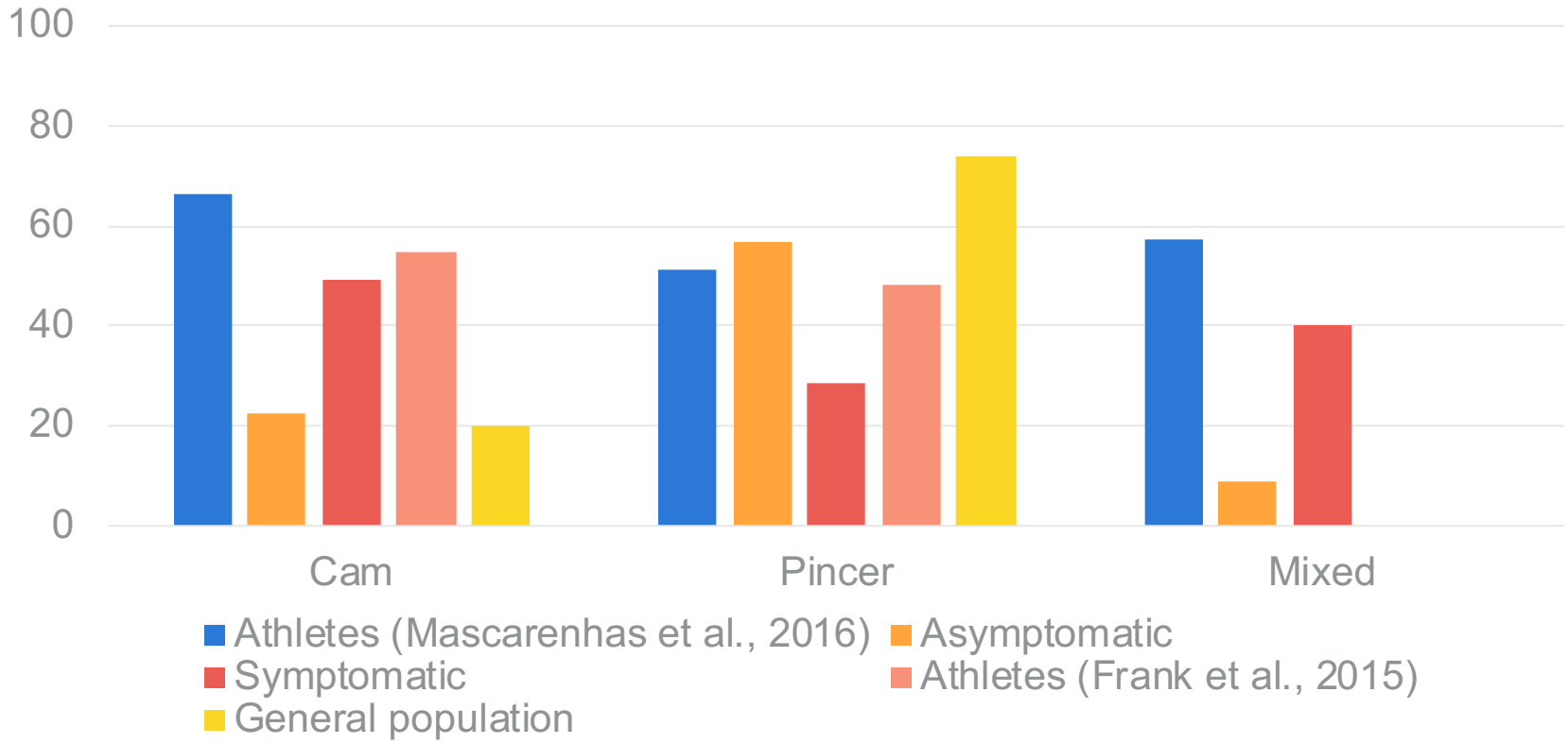
Cam



Mixed

1. Ganz R, Parvizi J, Beck M, et al. Femoroacetabular impingement: a cause for osteoarthritis of the hip. Clin Orthop Relat Res 2003;417:112–20.
2. Sankar WN, Nevitt M, Parvizi J, et al. Femoroacetabular impingement: defining the condition and its role in the pathophysiology of osteoarthritis. J Am Acad Orthop Surg 2013;21(Suppl 1):S7–S15.

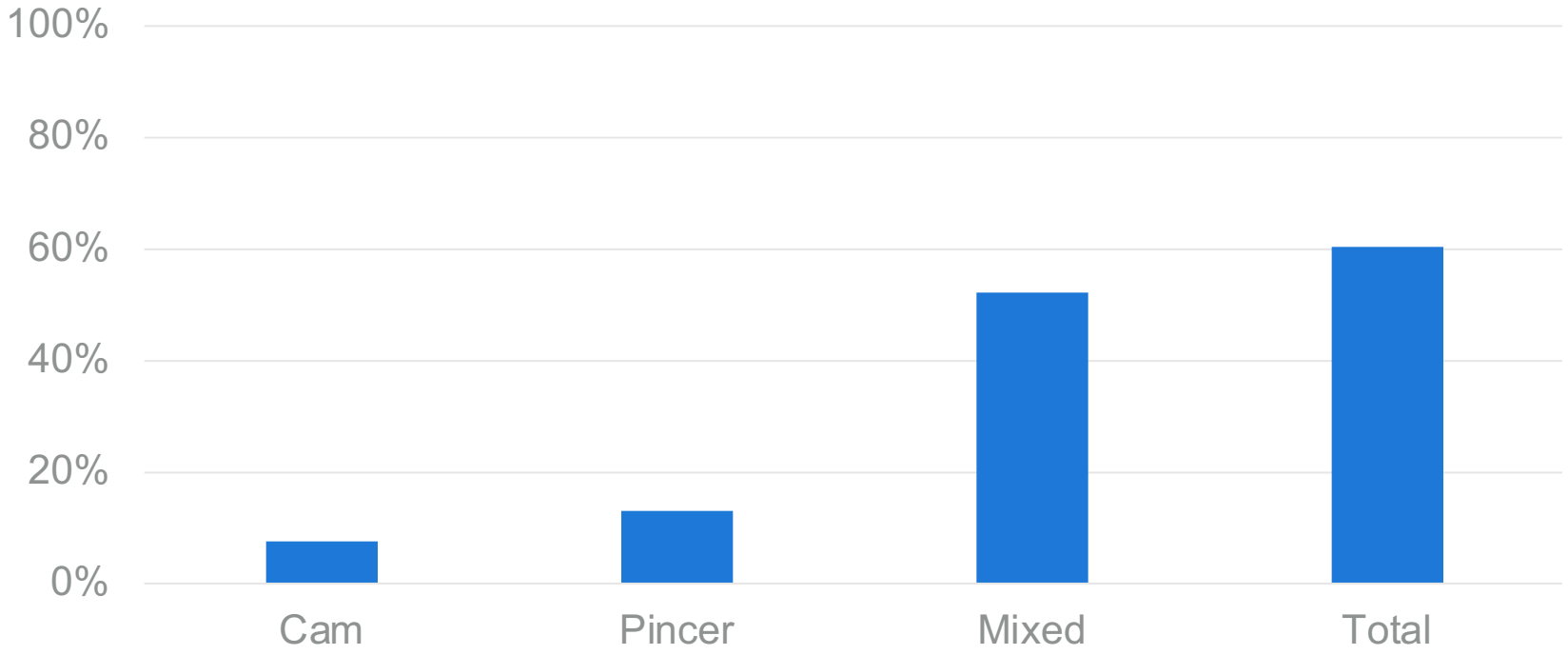
Morphology = Pathology?



1. Frank JM, HARRIS JD, Erickson BJ, et al. Prevalence of Femoroacetabular Impingement Imaging Findings in Asymptomatic Volunteers: A Systematic Review. *Arthroscopy*. 2015;31(6):1199-1204. doi:10.1016/j.arthro.2014.11.042.
2. Mascarenhas VV, Rego P, Dantas P, et al. Imaging prevalence of femoroacetabular impingement in symptomatic patients, athletes, and asymptomatic individuals: A systematic review. European Journal of Radiology. 2016;85(1):73-95. doi:10.1016/j.ejrad.2015.10.016.

What About People With Hip/Groin Pain?

1,893 patients evaluated with hip/groin pain



Zhou J, Melugin HP, Hale RF, et al. The Prevalence of Radiographic Findings of Structural Hip Deformities for Femoroacetabular Impingement in Patients With Hip Pain. American Journal of Sports Medicine. 2020;417(2):036354651989635-036354651989637. doi:10.1177/0363546519896355.

Radiology: How Important Is It?

Radiological findings	P-value
COS	0.300
ISS	0.413
PWS	0.180
PGD	0.626
CEA	0.639
AEA	0.333

Only predictors included a **positive FADIR test** and **younger age** at evaluation

Yamauchi R, Inoue R, Chiba D, et al. Association of clinical and radiographic signs of femoroacetabular impingement in the general population. *J Orthop Sci*. November 2016. doi:10.1016/j.jos.2016.09.014.

What is the most common important factor in persistent postoperative pain in those with FAIS?

A. Hip adductor to abductor strength ration
B. Hip flexion ROM
C. Psychosocial factors
D. Cam morphology size

What Matters?

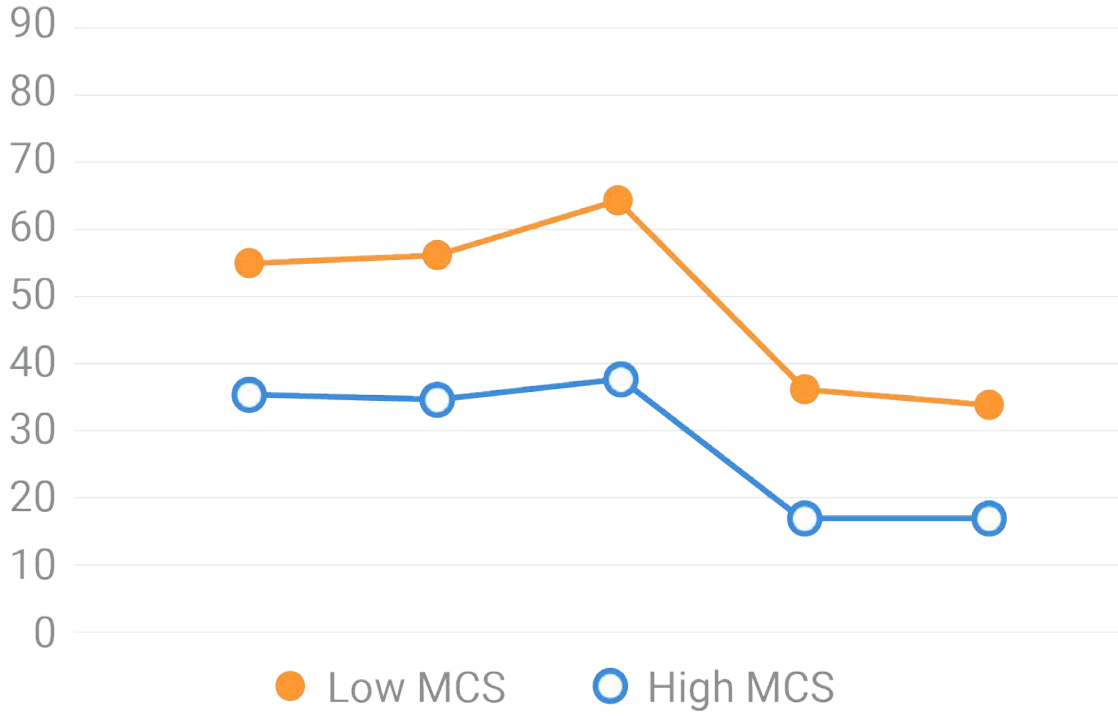
- There was no statistically significant difference in alpha angle (P = .340) and LCEA (P = .412)
- Independent predictors for persistent postoperative pain include revision hip arthroscopy and **mental health history positive for anxiety and depression**

Stone AV, Malloy P, Beck EC, et al. Predictors of Persistent Postoperative Pain at Minimum 2 Years After Arthroscopic Treatment of Femoroacetabular Impingement. American Journal of Sports Medicine. 2019;47(3):552-559. doi:10.1177/0363546518817538.

And Again…

64 patients undergoing arthroscopic surgery for labral pathology and/or cam morphology

- Symptom severity was **significantly more** related to **mental health status** than either the size of labral tear or FAI deformity



Jacobs CA, Burnham JM, Jochimsen KN, Molina D, Hamilton DA, Duncan ST. Preoperative Symptoms in Femoroacetabular Impingement Patients Are More Related to Mental Health Scores Than the Severity of Labral Tear or Magnitude of Bony Deformity. *The Journal of Arthroplasty*. July 2017. doi:10.1016/j.arth.2017.06.053.

And Again...

- Female sex, lower education levels, smoking, **lower mental health scores**, and lower activity-level scores predicted HOOS pain preoperatively
- Patient factors associated with worse baseline HOOS-PS include smoking, additional years of education, **lower mental health**, and activity scores
- **No instance** where an arthroscopic variable or pathologic finding proved statistically significant

Westermann RW, Lynch TS, Jones MH, et al. Predictors of Hip Pain and Function in Femoroacetabular Impingement: A Prospective Cohort Analysis. Orthopaedic Journal of Sports Medicine. 2017;5(9):232596711772652-232596711772658. doi:10.1177/2325967117726521.

And Again… A Systematic Review

	Subjects	Value
Studies reporting ORs	3,727	0.74
Studies reporting PROMs	1,909	-20.2 (WMD)

Cheng AL, Schwabe M, Doering MM, Colditz GA, Prather H. The Effect of Psychological Impairment on Outcomes in Patients With Prearthritic Hip Disorders: A Systematic Review and Meta-analysis. American Journal of Sports Medicine. 2019;5(1):036354651988324-036354651988328. doi:10.1177/0363546519883246.

Femoroacetabular Impingement Syndrome

Previous definitions by Ganz et al. and Sankar et al. **did not** adequately present the need for positive symptoms, clinical signs, and imaging findings

What is FAI syndrome?

FAI syndrome is a motion-related clinical disorder of the hip with a triad of symptoms, clinical signs, and imaging findings. It represents symptomatic premature contact between the proximal femur and the acetabulum
Level of agreement: mean score 9.8 (95% CI 9.6 to 10)

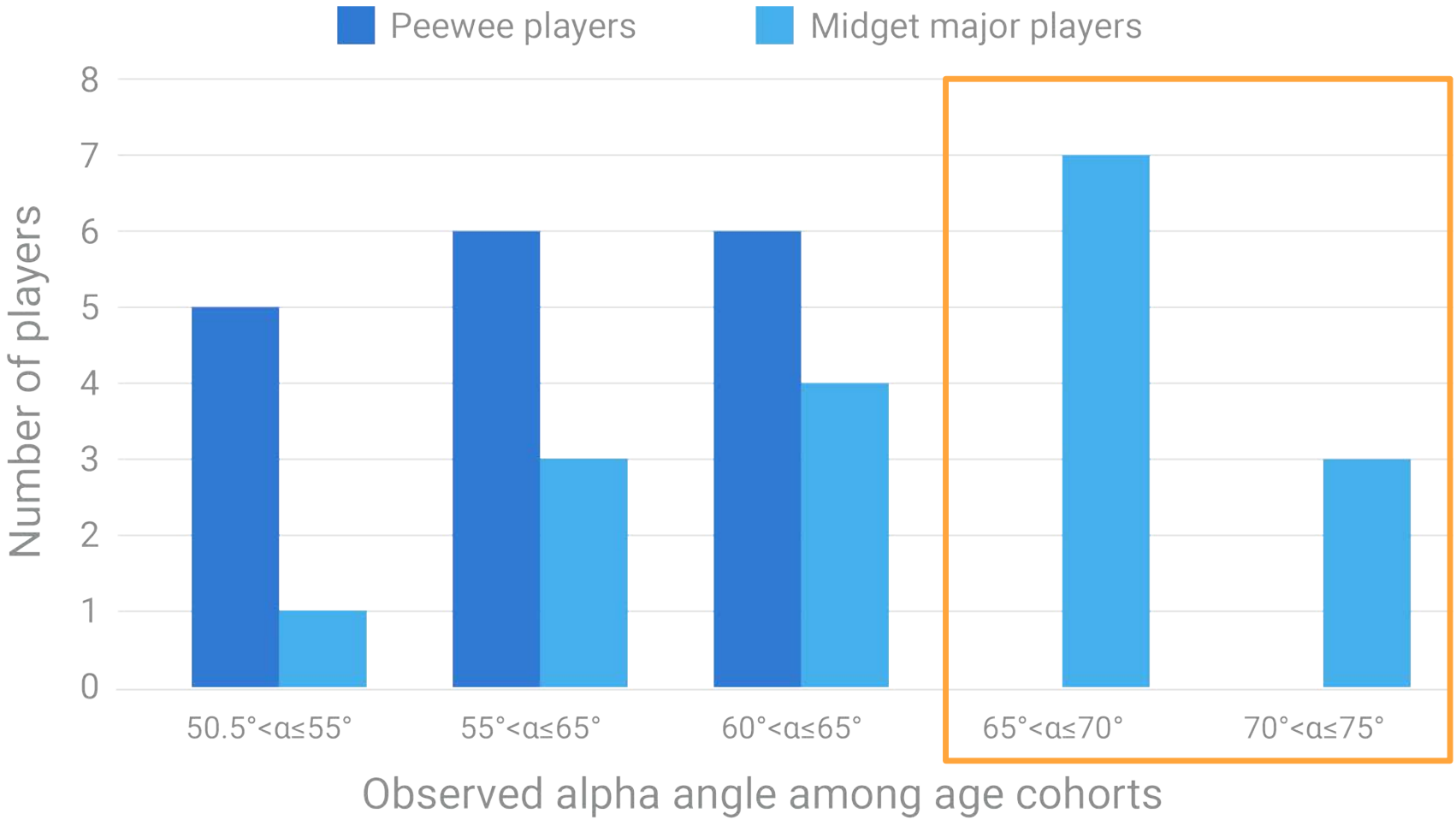
Griffin DR, Dickenson EJ, O'Donnell J, et al. The Warwick Agreement on femoroacetabular impingement syndrome (FAI syndrome): an international consensus statement. *British Journal of Sports Medicine*. 2016; 50(19): 1169-1176. doi:10.1136/bjsports-2016-096743.

How Is It Developed?

Group	Number of hips	1 o'clock	2 o'clock
All athletes	77	54.1 ± 10.3	51.7 ± 9.9
Growth plate			
Open	34	49.1 ± 6.1	47.6 + 6.9
Closed	43	58.2 ± 11.3	55.0 ± 10.8
Symptomatic			
Yes	15	62.0 ± 14.5	47.6 + 6.9
No	62	52.2 ± 8.0 P < .001[b]	55.0 ± 10.8 P < .001[b]

Siebenrock KA, Kaschka I, Frauchiger L, Werlen S, Schwab JM. Prevalence of Cam-Type Deformity and Hip Pain in Elite Ice Hockey Players Before and After the End of Growth. American Journal of Sports Medicine. 2013;41(10):2308-2313. doi:10.1177/0363546513497564.

How Is It Developed? (cont.)



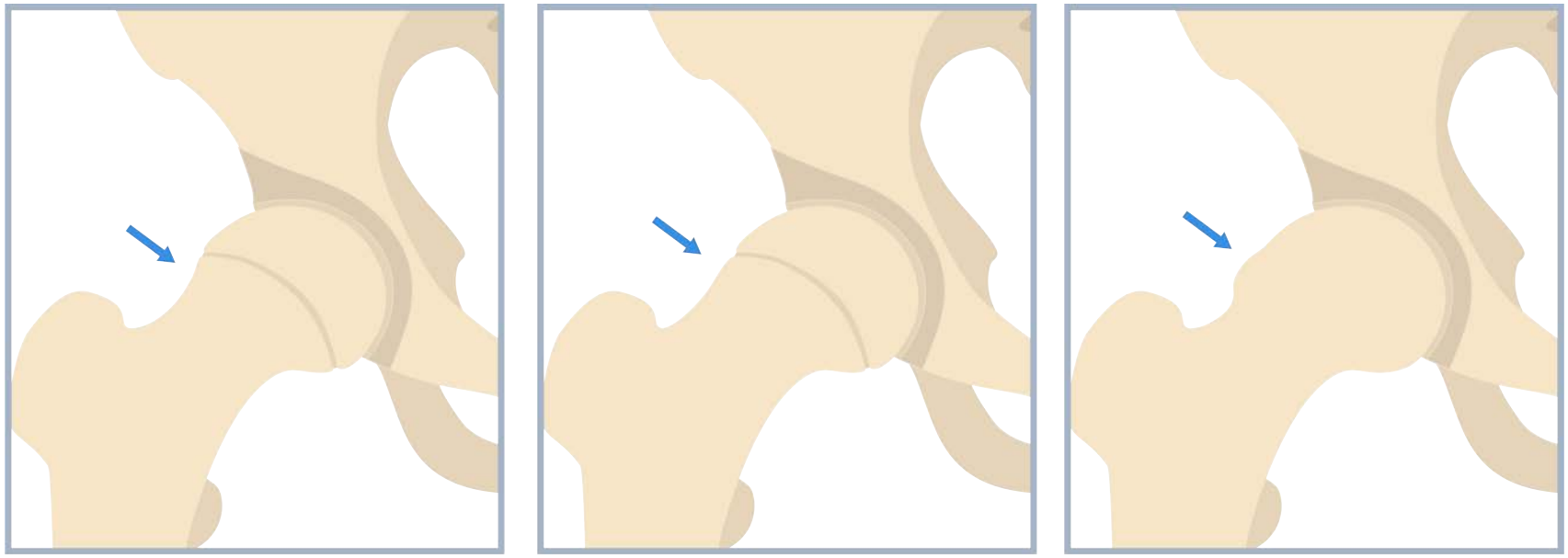
Philippon MJ, Ho CP, Briggs KK, Stull J, LaPrade RF. Prevalence of Increased Alpha Angles as a Measure of Cam-Type Femoroacetabular Impingement in Youth Ice Hockey Players. *American Journal of Sports Medicine*. 2013;41(6):1357-1362. doi:10.1177/0363546513483448.

How Is It Developed? (cont.)

- Alpha angle and epiphyseal extension increased most rapidly between **ages 12 and 14 years**
- Compared with individuals who play no regular sport, alpha angles were 4.0 degrees higher
- **7.7 degrees higher in individuals competing at a national or international level**

Palmer A, Fernquest S, Gimpel M, et al. Physical activity during adolescence and the development of cam morphology: a cross-sectional cohort study of 210 individuals. *British Journal of Sports Medicine*. August 2017. doi:10.1136/bjsports-2017-097626.

“Cam Morphology in Young Male Football Players Mostly Develops Before Proximal Femoral Growth Plate Closure: A Prospective Study With 5-Year Follow-Up”



14 Years
Baseline
Normal
Growth plate open

16 Years
2.5-year follow-up
Flattening
Growth plate open

19 Years
5-year follow-up
Prominence
Growth plate closed

van Klij P, Heijboer MP, Ginai AZ, Verhaar JAN, Waarsing JH, Agricola R. Cam morphology in young male football players mostly develops before proximal femoral growth plate closure: a prospective study with 5-yearfollow-up. British Journal of Sports Medicine. October 2018. doi:10.1136/bjsports-2018-099328.

Early Sport Specialization

How much is too much?

Youth Sport Specialization Recommendations

- Delay specializing in a single sport for **as long as possible**
- One team at a time
- Less than **eight months** per year
- No more hours/week than the athlete's age in years
- Two days of rest per week
- Rest and recovery time from organized sport participation

Does Early Sport Specialization Influence Injury Rates?

- **1,190 athletes between the ages of 7 and 18 years old**
- Sports-specialized training was an **independent risk factor** for
  - Injury (OR = **1.27**)
  - Serious overuse injury (OR = **1.36**)
- Young athletes whose **ratio of organized sports to free play time** was 2:1 hours/week had **increased odds of having a serious overuse injury** (OR = 1.87)

Jayanthi NA, LaBella CR, Fischer D, Pasulka J, Dugas LR. Sports-specialized intensive training and the risk of injury in young athletes: a clinical case-control study. Am J Sports Med. 2015;43(4):794-801. doi:10.1177/0363546514567298.

Does Early Sport Specialization Influence Injury Rates? (cont.)

- Injury risk
  - High competition volume (> 60/yr): **2.08**
  - Moderate specialization: **2.38**
  - High specialization: **2.58**
- **1,544 high school athletes**
- **High specialization** defined as “year-round, intensive training in a single sport at the exclusion of other sports”

Post EG, Bell DR, Trigsted SM, et al. Association of Competition Volume, Club Sports, and Sport Specialization With Sex and Lower Extremity Injury History in High School Athletes. Sports Health: A Multidisciplinary Approach. 2017;34:1941738117714160. doi:10.1177/1941738117714160.

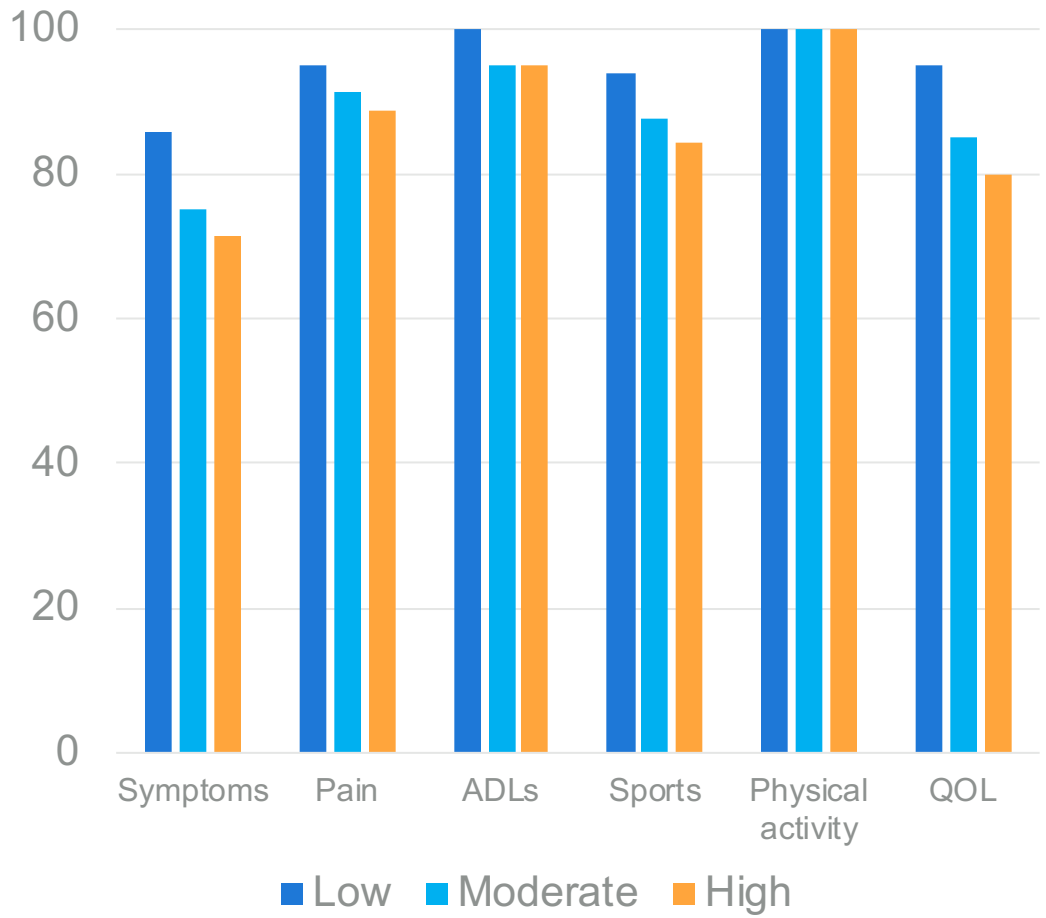
Does Early Sport Specialization Influence Injury Rates? (cont.)

- High specialization
  - Any injury: **1.59**
  - Overuse injury: **1.45**
  - UE overuse injury: **1.91**
  - LE overuse injury: **1.27**
- **2,011 athletes between the ages of 12 and 18 years old**

Post EG, Trigsted SM, Riekena JW, et al. The Association of Sport Specialization and Training Volume With Injury History in Youth Athletes. Am J Sports Med. 2017;45(6):1405-1412. doi:10.1177/0363546517690848.

What About the Hip and Sport Specialization?

- **205 collegiate hockey athletes** between the ages of 18 and 30 years
- Women's and men's NCAA Division III ice hockey teams; American Collegiate Hockey Association Divisions I, II, and III



Sheppard M, Nicknair J, Goetschius J. Early Sport Specialization and Subjective Hip and Groin Dysfunction in Collegiate Ice Hockey Athletes. Journal of Athletic Training. February 2020:1062–6050–0375–19–6. doi:10.4085/1062-6050-0375-19.

But… Little Timmy Wants to Play in College!

But… Little Timmy Wants to Play in College!

- Mean age of sports specialization was **14.3 years old**
  - Professional (**14.1 years old**)
  - NCAA Division I (**14.5 years old**)
  - NCAA Division III (**14.6 years old**)
- Age at time of specialization
  - **Before 14**
    - Professional: 24%
    - NCAA Division I: 24%
    - NCAA Division III: 28%
  - **Before 12**
    - Professional: 5%
    - NCAA Division I: 12%
    - NCAA Division III: 12.5%

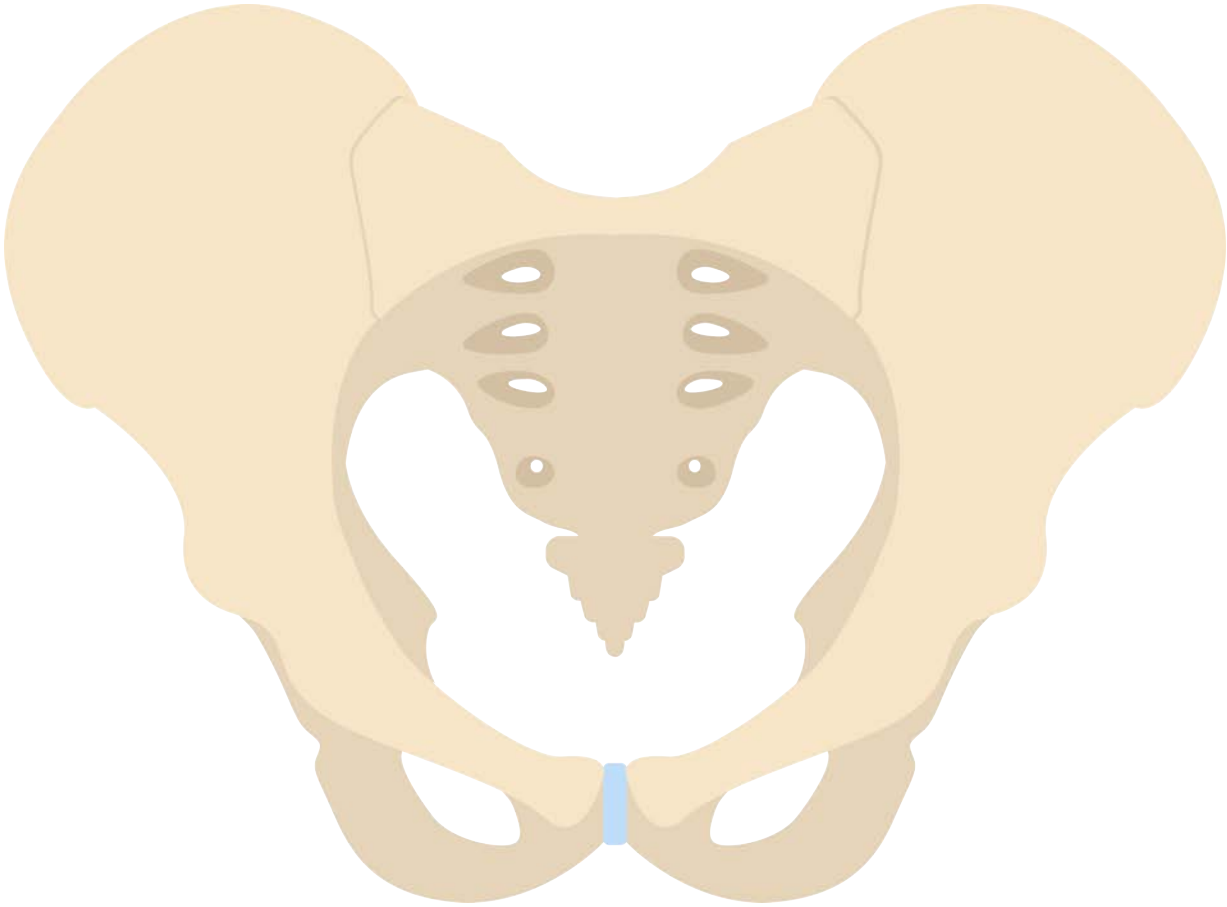
Black S, Black K, Dhawan A, Onks C, Seidenberg P, Silvis M. Pediatric Sports Specialization in Elite Ice Hockey Players. Sports Health. 2018;8:194173811880044-194173811880045. doi:10.1177/1941738118800446.

But… Little Timmy Wants to Play in College! (cont.)

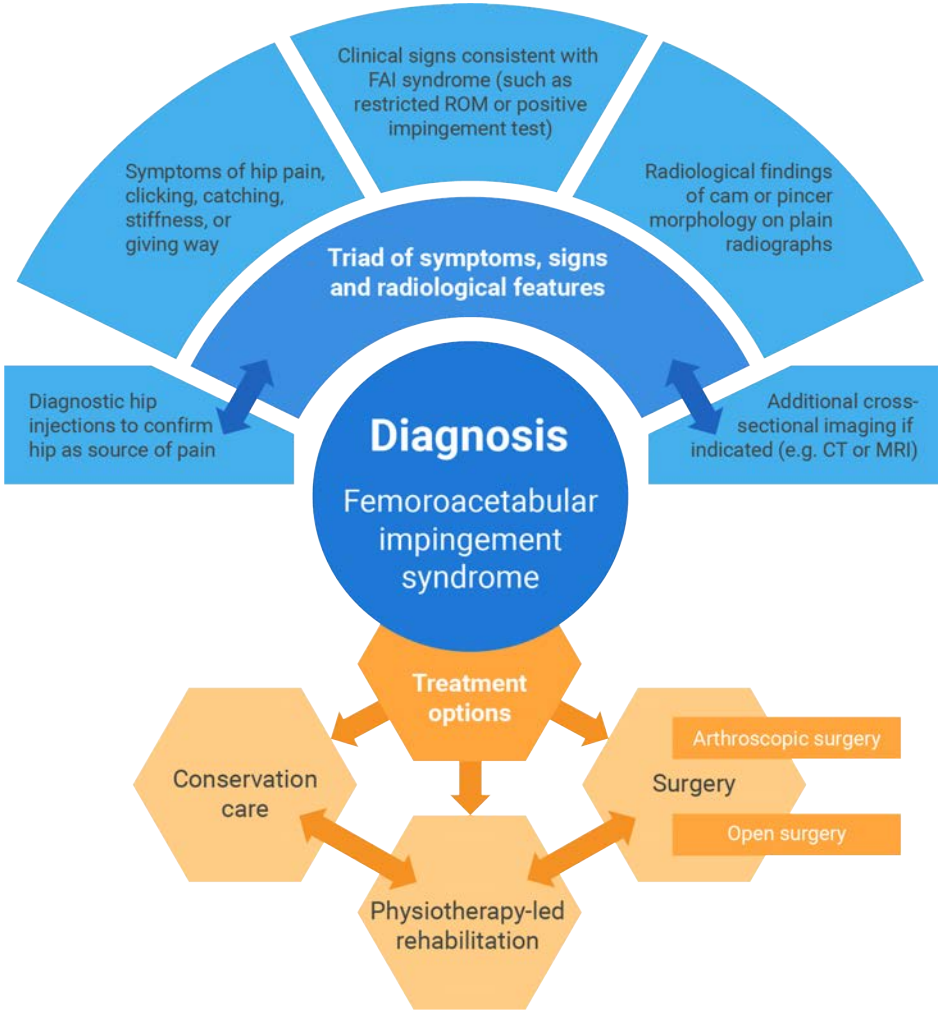
- Elite athletes often specialized between the ages of 14 and 15
- Non-elite or semi-elite peers specialized prior to 13 years
- **Six studies included, with 5,803 athletes**

Kliethermes SA, Nagle K, Côté J, et al. Impact of youth sports specialisation on career and task-specific athletic performance: a systematic review following the American Medical Society for Sports Medicine (AMSSM) Collaborative Research Network's 2019 Youth Early Sport Specialisation Summit. British Journal of Sports Medicine. November 2019. doi:10.1136/bjsports-2019-101365.

Tangent Over—Back to Hip Things



How Do We Accurately Diagnose FAIS?



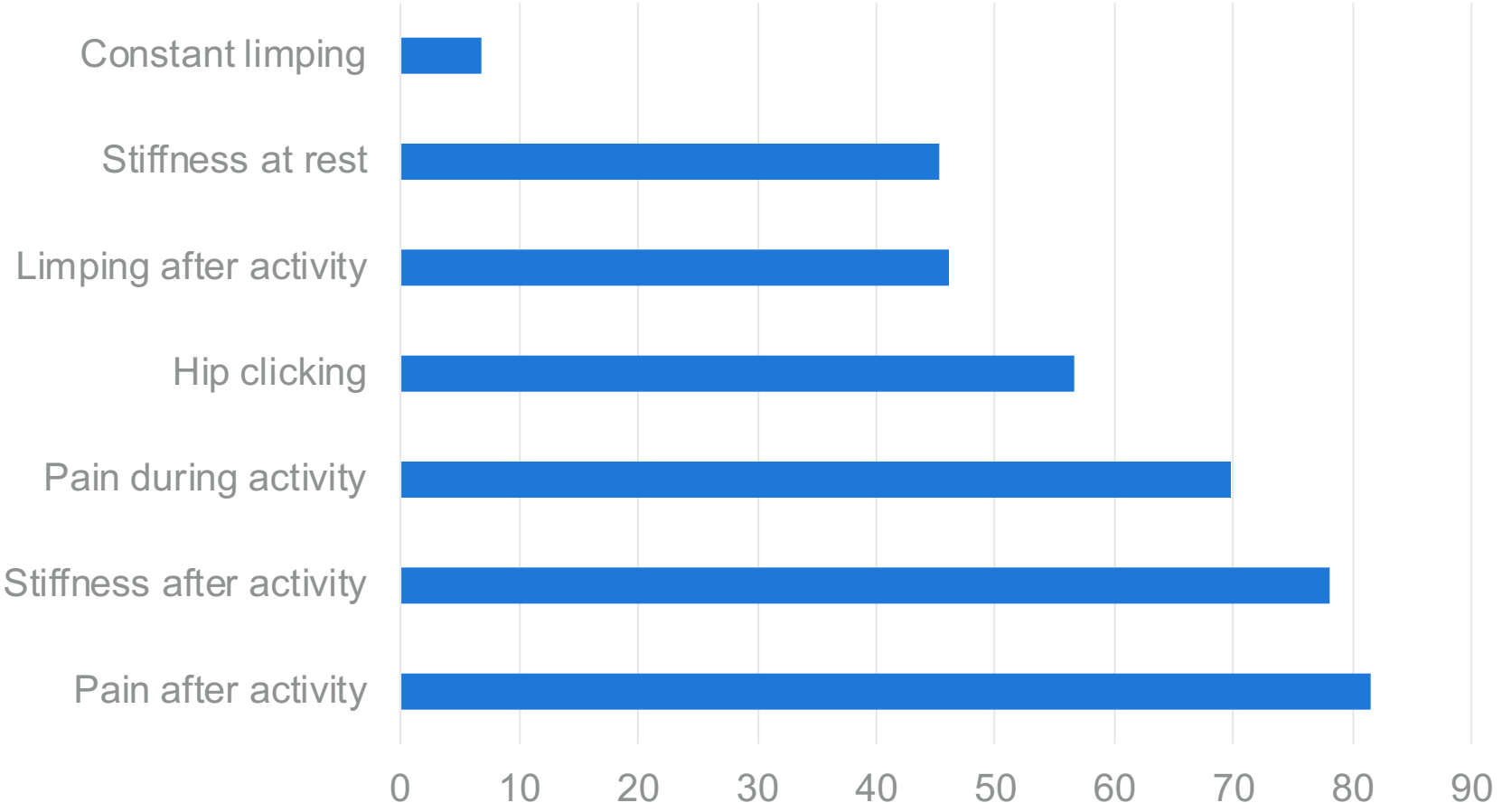
Kemp JL, Beasley I. 2016 international consensus on femoroacetabular impingement syndrome: the Warwick Agreement—why does it matter? British Journal of Sports Medicine. 2016;50(19):1162-1163. doi:10.1136/bjsports-2016-096831.

FAIS: Patient Presentation

- **Onset of symptoms**
  - Insidious (65%)
  - Trauma (21%)
  - Acute (14%)
- **Characteristic of pain**
  - Sharp (73%)
  - Ache (73%)
  - Constant (46%)
- **Mechanical symptoms**
  - Pop (46%)
  - Snap (44%)
- **Aggravating factors**
  - Activity-related (71%)
  - Running (69%)
  - Sitting (65%)
  - Pivoting (63%)

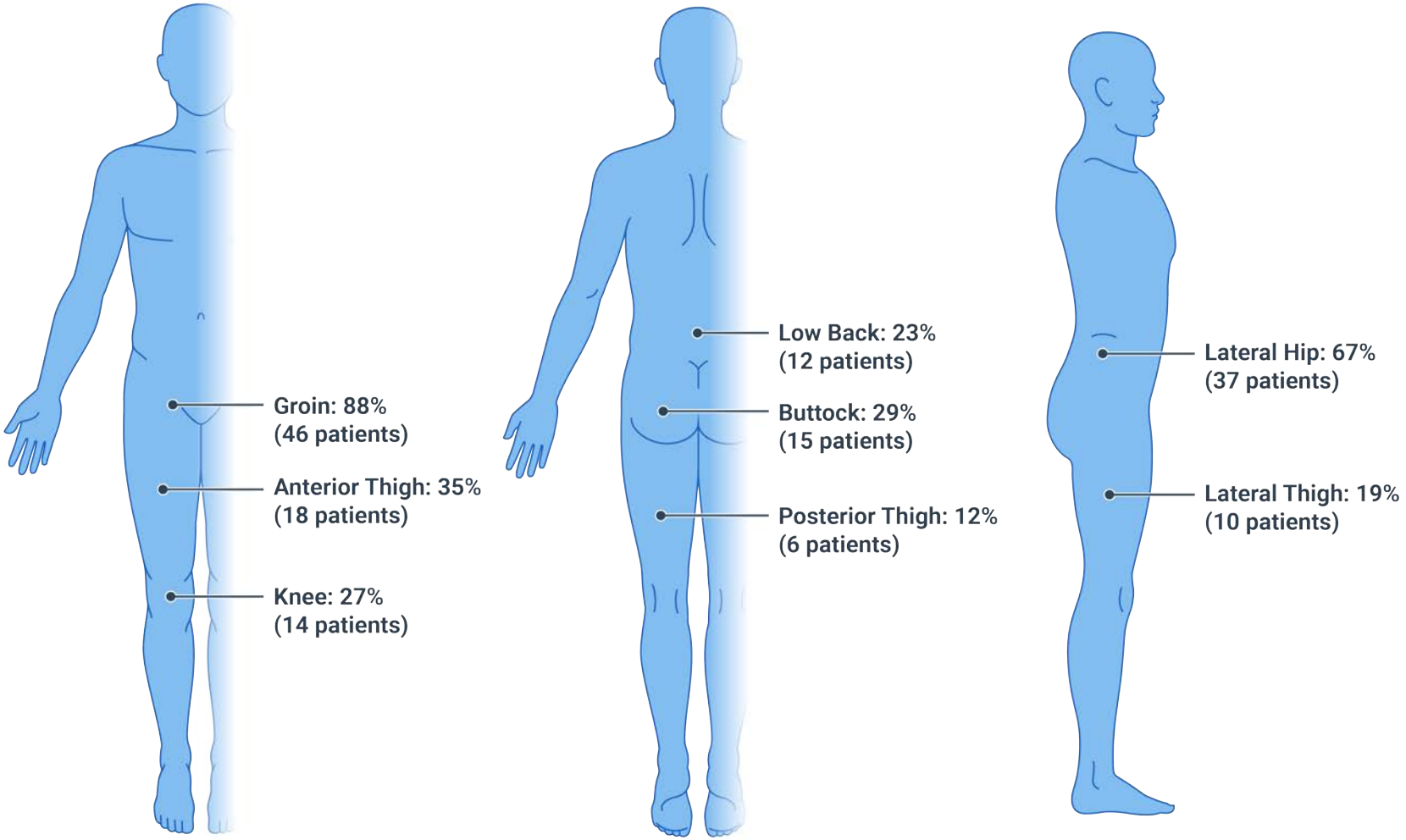
Clohisy JC, Knaus ER, Hunt DM, Lesher JM, Harris-Hayes M, Prather H. Clinical Presentation of Patients with Symptomatic Anterior Hip Impingement. *Clinical Orthopaedics and Related Research*. 2009;467(3):638-644. doi:10.1007/s11999-008-0680-y.

FAIS: Patient Presentation (cont.)



Carton PF, Filan DJ. The clinical presentation, diagnosis and pathogenesis of symptomatic sports-related femoroacetabular impingement (SRFAI) in a consecutive series of 1021 athletic hips. Hip Int. February 2019:1120700018825430. doi:10.1177/1120700018825430.

FAIS: Pain Distribution



Clohisy JC, Knaus ER, Hunt DM, Lesher JM, Harris-Hayes M, Prather H. Clinical Presentation of Patients with Symptomatic Anterior Hip Impingement. *Clinical Orthopaedics and Related Research*. 2009;467(3):638-644. doi:10.1007/s11999-008-0680-y.

"Physical Impairments in Symptomatic Femoroacetabular Impingement: A Systematic Review of Evidence"

- SR included 22 studies and 819 patients
  - Case series and case-controlled studies; no RCTs
- Main findings
  - **No significant limitation in ROM or difference between pre-/postsurgical ROM**
    - One low-quality case series showed significant improvement in ROM following PT
  - Significant hip strength deficits in **all planes** (excluding extension and flexion in a few studies)

Freke MD, Kemp J, svege I, Risberg MA, Semciw A, Crossley KM. Physical impairments in symptomatic femoroacetabular impingement: a systematic review of the evidence. *British Journal of Sports Medicine*. June 2016. doi:10.1136/bjsports-2016-096152.

"Standardized Measurement of Physical Capacity in Young and Middle-Aged Active Adults With Hip-Related Pain"

- Evaluate hip adduction, abduction, flexion, internal rotation, and external rotation
  - Measuring strength using objective methods is recommended (e.g., HHD)
- Evaluate ability to perform functional tasks
- Understand patient's expectations for treatment and recovery

Mosler AB, Kemp J, King M, et al. Standardised measurement of physical capacity in young and middle-aged active adults with hip-related pain: recommendations from the first International Hip-related Pain Research Network (IHiPRN) meeting, Zurich, 2018. British Journal of Sports Medicine. December 2019. doi:10.1136/bjsports-2019-101457.

FAI: Special Testing

Flexion adduction internal rotation test (FADIR)

Sensitivity	Specificity	+LR	−LR
0.91-0.99	0.05-0.09	1.02-1.04	0.14-0.45

Flexion internal rotation test

Sensitivity	Specificity	+LR	−LR
0.96	0.25	1.28	0.15

1. Reiman MP, Goode AP, Cook CE, Holmich P, Thorborg K. Diagnostic accuracy of clinical tests for the diagnosis of hip femoroacetabular impingement/labral tear: a systematic review with meta-analysis. *British Journal of Sports Medicine*. 2015;49(12):811-811. doi:10.1136/bjsports-2014-094302.
2. Tijssen M, van Cingel REH, de Visser E, Holmich P, Nijhuis-van der Sanden MWG. Hip joint pathology: relationship between patient history, physical tests, and arthroscopy findings in clinical practice. *Scandinavian Journal of Medicine & Science in Sports*. February 2016. doi:10.1111/sms.12651.

FADIR: What Is the Evidence?

Compared to the asymptomatic cohort, FAIS patients had

- **Decreased adduction and internal rotation during the impingement exam**
- During the rotational profile, only the FAIS patient with the most severe deformities demonstrated considerable rotation deficits

Kapron AL, Aoki SK, Peters CL, Anderson AE. In-vivo hip arthrokinematics during supine clinical exams: Application to the study of femoroacetabular impingement. Journal of Biomechanics. 2015;48(11):2879-2886. doi:10.1016/j.jbiomech.2015.04.022.

FADIR: What Is the Evidence? (cont.)

- Seventy-four ice hockey players
- Presence of cam and pincer morphology was evaluated using the FADIR test and magnetic resonance imaging (MRI)
- **Very low sensitivity**
  - 0.41 to 0.60
- **Positive and negative LRs hovering around 1.00**
  - −LR: 0.78 to 1.24
  - +LR: 0.78 to 1.24
- **Out of 74 athletes "screened," there were 30/31 false positives**

Casartelli NC, Brunner R, Maffiuletti NA, et al. The FADIR test accuracy for screening cam and pincer morphology in youth ice hockey players. J Sci Med Sport. June 2017. doi:10.1016/j.jsams.2017.06.011.

Beyond FADIR

Criteria	Sensitivity	Specificity	PPV	NPV
FABER distance test (>3.7 cm difference between hips) for radiographic large alpha angle (≥78°)	**0.85**	0.38	35%	**86%**

Trindade CAC, Briggs KK, Fagotti L, Fukui K, Philippon MJ. Positive FABER distance test is associated with higher alpha angle in symptomatic patients. *Knee Surg Sports Traumatol Arthrosc*. 2019;27(10):3158-3161. doi:10.1007/s00167-018-5031-2.

Beyond FADIR (cont.)

Deep Squat Test

Sensitivity	Specificity	+LR	−LR
0.75	0.41	1.3	0.6

How can we improve the applicability of this test?

Ayeni O, Chu R, Hetaimish B, et al. A painful squat test provides limited diagnostic utility in CAM-type femoroacetabular impingement. Knee Surg Sports Traumatol Arthrosc. 2013;22(4):806-811. doi:10.1007/s00167-013-2668-8.

Acetabular Labral Pathology

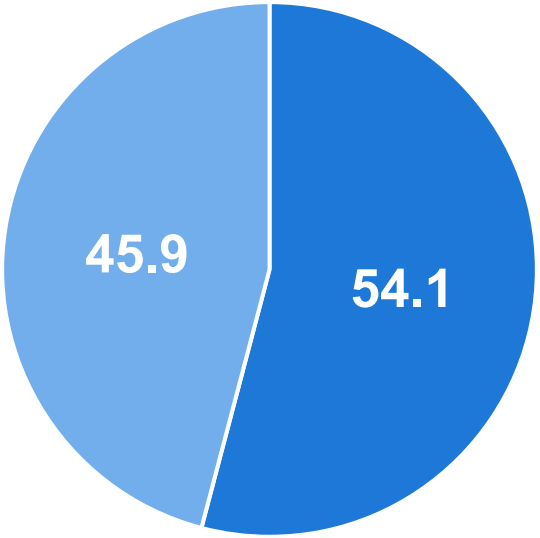
- Most commonly present via **nontraumatic mechanism** (74%)
  - Repetitive motions into the position of FAI **may** cause the acetabular labrum to undergo excessive shear and compressive forces
- **Traumatic mechanisms** described involve rapid twisting, pivoting, or falling motions
  - Forceful rotation with the hip in a hyperextended position

1. Groh MM, Herrera J. A comprehensive review of hip labral tears. *Curr Rev Musculoskelet Med*. 2009;2:105-117. http://dx.doi.org/10.1007/ s12178-009-9052-9
2. Dorfmann H, Boyer T. Arthroscopy of the hip: 12 years of experi- ence. *Arthroscopy*. 1999;15:67-72. http://dx.doi.org/10.1053/ar.1999. v15.015006
3. Mason JB. Acetabular labral tears in the athlete. Clin Sports Med. 2001;20:779-790.

Pathology or “Normal” Structural Changes?

“What Is the Prevalence of Hip Intra-Articular Pathologies and Osteoarthritis in Active Athletes With Hip and Groin Pain Compared With Those Without? A Systematic Review and Meta-analysis”[1]

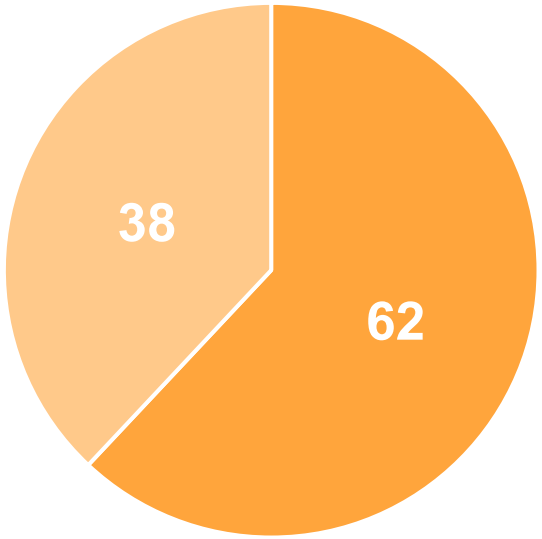
Labral tears per person



54.1 out of 100 **asymptomatic** people

“What Is the Prevalence of Imaging-Defined Intra-articular Hip Pathologies in People With and Without Pain? A Systematic Review and Meta-analysis”[2]

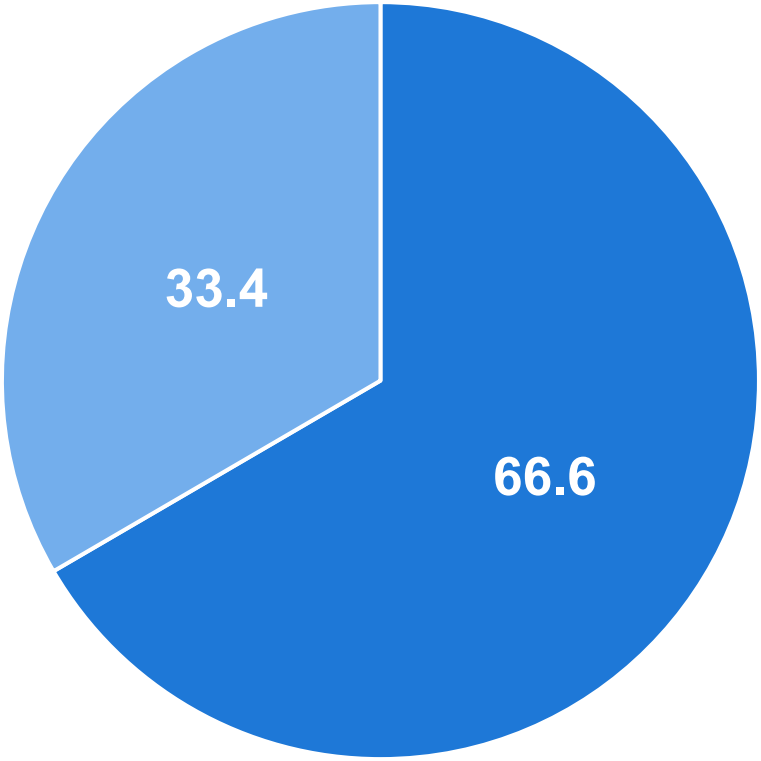
Labral tears per person



62 out of 100 **symptomatic** people

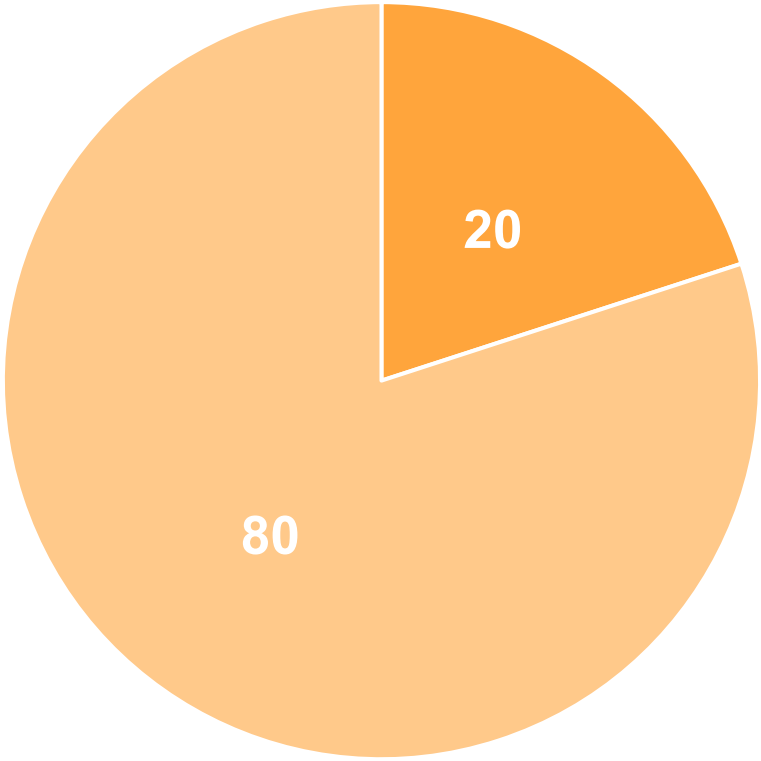
Pathology or ”Normal” Structural Changes? (cont.)

Labral tears per hip



66.6 out of 100 **asymptomatic** people

Labral tears per hip

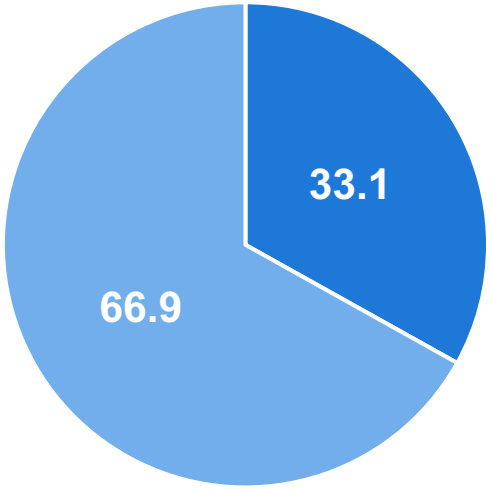


20 out of 100 **symptomatic** people

Heerey JJ, Kemp JL, Mosler AB, et al. What is the Prevalence of Hip Intra-Articular Pathologies and Osteoarthritis in Active Athletes with Hip and Groin Pain Compared with Those Without? A Systematic Review and Meta-Analysis. Sports Med. 2019;49(6):951-972. doi:10.1007/s40279-019-01092-y.

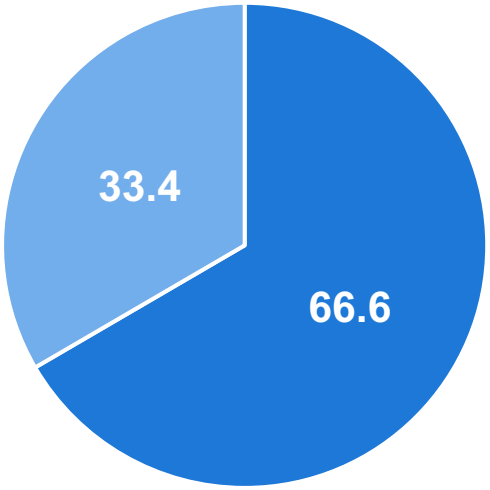
Pathology or "Normal" Structural Changes? (cont.)

Labral tears per person (cutting sports)



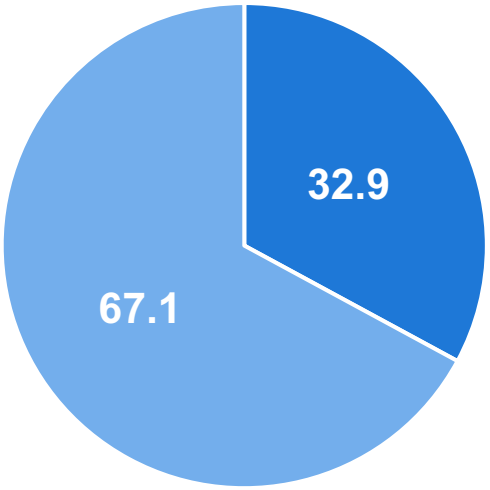
33.1 out of 100 **asymptomatic** people

Labral tears per person (impingement sports)



66.6 out of 100 **asymptomatic** people

Labral tears per person (asymmetric sports)



32.9 out of 100 **asymptomatic** people

Heerey JJ, Kemp JL, Mosler AB, et al. What is the Prevalence of Hip Intra-Articular Pathologies and Osteoarthritis in Active Athletes with Hip and Groin Pain Compared with Those Without? A Systematic Review and Meta-Analysis. *Sports Med*. 2019;49(6):951-972. doi:10.1007/s40279-019-01092-y.

Do Asymptomatic Findings Progress to Symptomatic Over Time?

- 21 NHL/AHL players without hip/groin pain
  - Only four players (19%) had no pathology identified on MRI
- 90% remained actively playing at four-year follow-up
  - Fourteen players (67%) remained at the same level of play
  - Four (19%) advanced to a higher level of play
  - Only one (5%) was demoted
- Hip and/or pelvis symptoms only developed in three players (14%)
  - Neither missed any games related to hip/groin symptoms

Gallo RA, Silvis ML, Smetana B, et al. Asymptomatic hip/groin pathology identified on magnetic resonance imaging of professional hockey players: outcomes and playing status at 4 years' follow-up. Arthroscopy. 2014;30(10):1222-1228. doi:10.1016/j.arthro.2014.04.100.

Are There Structural Changes That DO Matter?

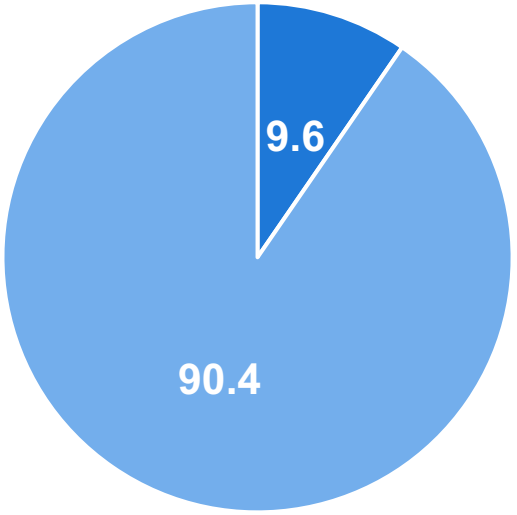
- **Increasing BMI** was correlated with a more severe acetabular cartilage grade
- **Increasing femoral cartilage damage** in the anterosuperior femoral head region correlated with worse scores on the HOOS activities of daily, symptoms, and pain subscales
- **No correlation between PRO scores and acetabular cartilage damage or labral tearing found on quantitative MRI or during arthroscopic surgery**

Grace T, Samaan MA, Souza RB, Link TM, Majumdar S, Zhang AL. Correlation of Patient Symptoms With Labral and Articular Cartilage Damage in Femoroacetabular Impingement. Orthopaedic Journal of Sports Medicine. 2018;6(6):2325967118778785. doi:10.1177/2325967118778785.

Cartilage: The Structural Factor That DOES Matter

"What Is the Prevalence of Hip Intra-Articular Pathologies and Osteoarthritis in Active Athletes With Hip and Groin Pain Compared With Those Without? A Systematic Review and Meta-analysis"[1]

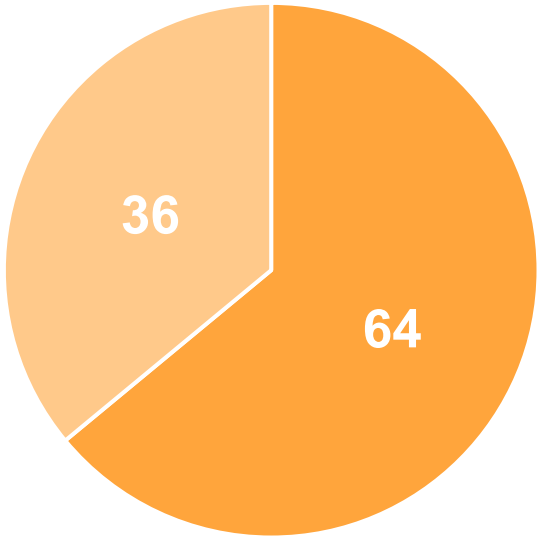
Cartilage defects per person



9.6 out of 100 **asymptomatic** people

"What is the Prevalence of Imaging-Defined Intra-articular Hip Pathologies in People With and Without Pain? A Systematic Review and Meta-analysis"[2]

Cartilage defects per person



64 out of 100 **symptomatic** people

Heerey et al., 2019; Heerey et al., 2018

Who Is at Risk?

Associated with moderate to severe cartilage injury

- Increased **cam severity** (OR = 4.82)
- **Male sex** (OR = 4.42)
- Higher age (OR = 1.70)
- Borderline dysplasia (OR = 3.19)

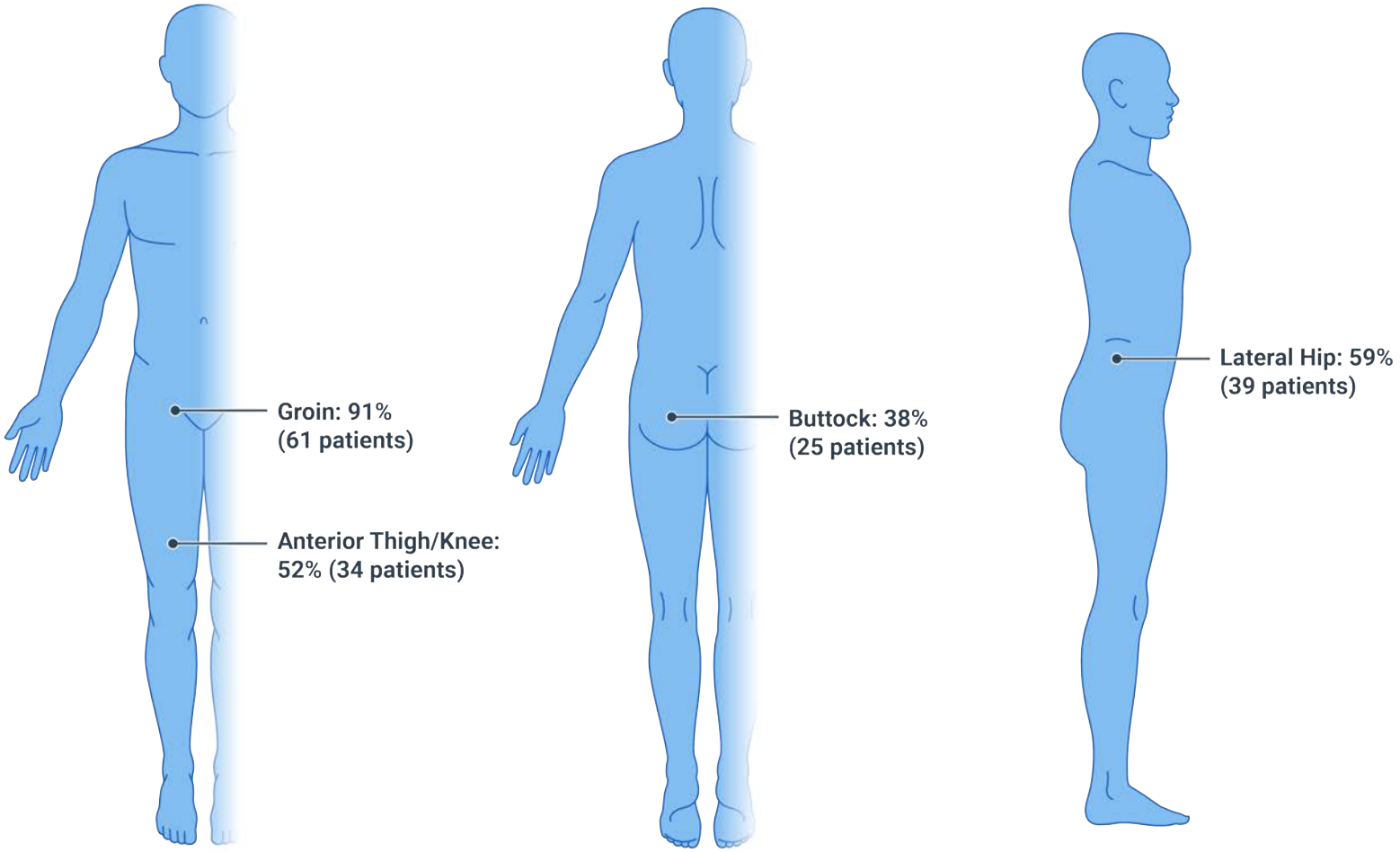
Ishøi L, Thorborg K, Kraemer O, Lund B, Mygind-Klavsen B, Hölmich P. Demographic and Radiographic Factors Associated With Intra-articular Hip Cartilage Injury: A Cross-sectional Study of 1511 Hip Arthroscopy Procedures. American Journal of Sports Medicine. 2019;5(3):036354651986108-036354651986109. doi:10.1177/0363546519861088.

Labral Pathology: Clinical Presentation

- **Onset of symptoms**
  - Insidious (61%)
  - Acute (30%)
  - Trauma (6%)
- **Characteristic of pain**
  - Sharp (86%)
  - Dull (80%)
  - Night pain (71%)
- **Mechanical symptoms**
  - Painful locking (89%)
  - Locking (77%)
  - Snap/pop/lock (53%)
- **Aggravating factors**
  - Activity-related (91%)
  - Walking (70%)
  - Pivoting (70%)
  - Impact activities (62%)

Burnett RSJ. Clinical Presentation of Patients with Tears of the Acetabular Labrum. *J Bone Joint Surg Am*. 2006;88(7):1448–11. doi:10.2106/JBJS.D.02806.

Labral Pathology: Pain Distribution



Burnett RSJ. Clinical Presentation of Patients with Tears of the Acetabular Labrum. *J Bone Joint Surg Am*. 2006;88(7):1448–11. doi:10.2106/JBJS.D.02806.

Anterosuperior Labrum: Special Testing

Fitzgerald test (anterior labrum)

Sensitivity	Specificity	+LR	−LR
0.72–0.98	0.00–0.33	1.08	0.83

Thomas test

Sensitivity	Specificity	+LR	−LR	PPV	NPV
0.11–0.89	0.67–0.92	0.33–11.1	1.34–0.12	94%	86%

1. Reiman MP, Goode AP, Cook CE, Holmich P, Thorborg K. Diagnostic accuracy of clinical tests for the diagnosis of hip femoroacetabular impingement/labral tear: a systematic review with meta-analysis. *British Journal of Sports Medicine*. 2015;49(12):811-811. doi:10.1136/bjsports-2014-094302.
2. Burgess RM, Rushton A, Wright C, Daborn C. The validity and accuracy of clinical diagnostic tests used to detect labral pathology of the hip: A systematic review. *Manual Therapy*. 2011;16(4):318-326. doi:10.1016/j.math.2011.01.002.
3. Leibold MR. Concurrent Criterion-Related Validity of Physical Examination Tests for Hip Labral Lesions: A Systematic Review. *Journal of Manual & Manipulative Therapy*. 2008;16(2):E24-E41.
4. Tijssen M, van Cingel REH, de Visser E, Holmich P, Nijhuis-van der Sanden MWG. Hip joint pathology: relationship between patient history, physical tests, and arthroscopy findings in clinical practice. *Scandinavian Journal of Medicine & Science in Sports*. February 2016. doi:10.1111/sms.12651.

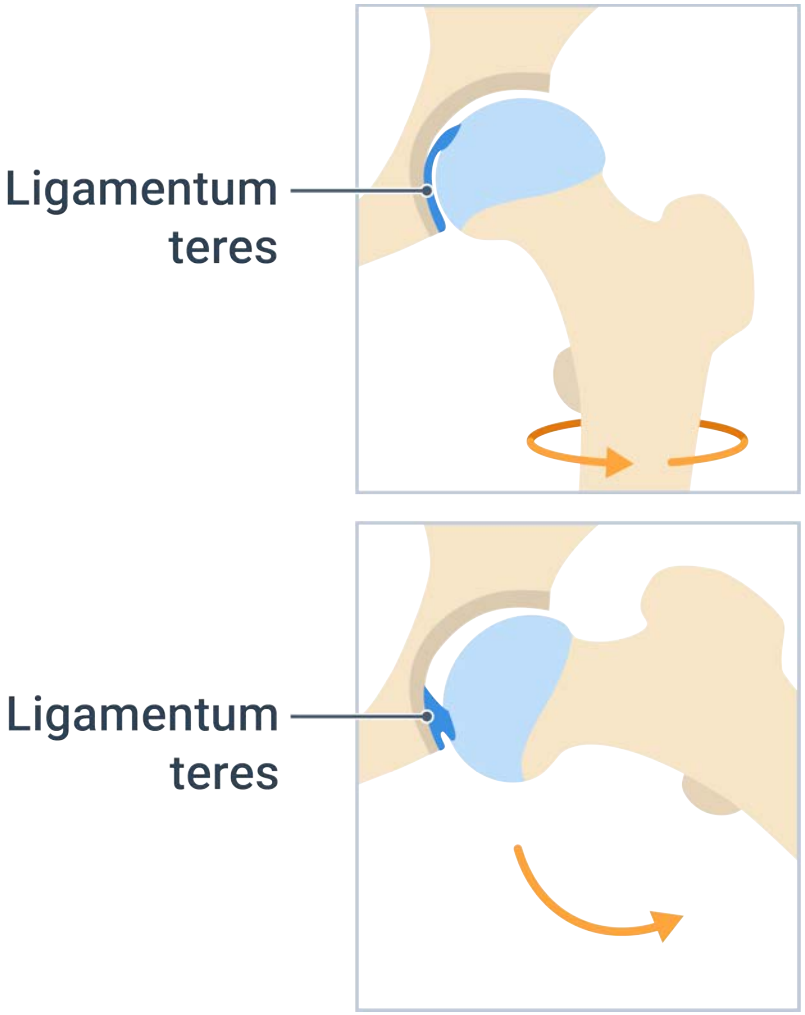
"The Modified Thomas Test Is Not a Valid Measure of Hip Extension Unless Pelvic Tilt Is Controlled"

- Designed to evaluate the "tightness" of the anterolateral hip/thigh structures
  - **Sn = 0.32, Sp = 0.57**
- Accounting for pelvic tilt **may** improve test
- **Yes** for ruling in a labral tear, **no** for assessing soft-tissue restrictions

Vigotsky AD, Lehman GJ, Beardsley C, Contreras B, Chung B, Feser EH. The modified Thomas test is not a valid measure of hip extension unless pelvic tilt is controlled. *PeerJ*. 2016;4(2):e2325–12. doi:10.7717/peerj.2325.

Ligamentum Teres Pathology

- Significant role in maintaining **rotational stability** of hip
  - Especially evident when hip is in 90˚ or 120˚ of flexion
- **Mechanism of injury**
  - Ligament is taut with flexion, adduction, and external rotation
    - Could reflect a mechanism of twisting injury
  - Hyperabduction also identified as potential MOI
  - Common pathology following traumatic dislocation of hip



Byrd et al., 2004; Philippon et al., 2009; Martin et al., 2014; Martin et al., 2018; Martin et al., 2019

Ligamentum Teres: Patient Presentation

- Older age
  - **1.51 higher** for individuals older than 30 years of age
- Gender
  - **Women three times more likely to have LT tear**
- BMI
  - Those with a low BMI more likely to have LT tear
- **Clinical presentation**
  - **Theoretical** limitations in hip flexion, **excessive IR**
    - Literature shows only small differences in comparison to those without LT pathology
  - Deep anterior groin pain
    - 23/23 (100%)
  - Mechanical symptoms (catching, popping, locking, giving away)
    - 19/23 (83%)
  - **Complaint of hip instability**

Chahla et al., 2016; Byrd et al., 2004; Martin et al., 2019

Ligamentum Teres: Special Testing

Ligamentum teres test

Sensitivity	Specificity	PPV	NPV
0.90	0.85	84%	91%

*Those with a positive LT tear were 7.5x more likely to have a (+) FADIR Test

O'Donnell et al., 2014; Chahla et al., 2016

FAIS: To Cut or Not to Cut?

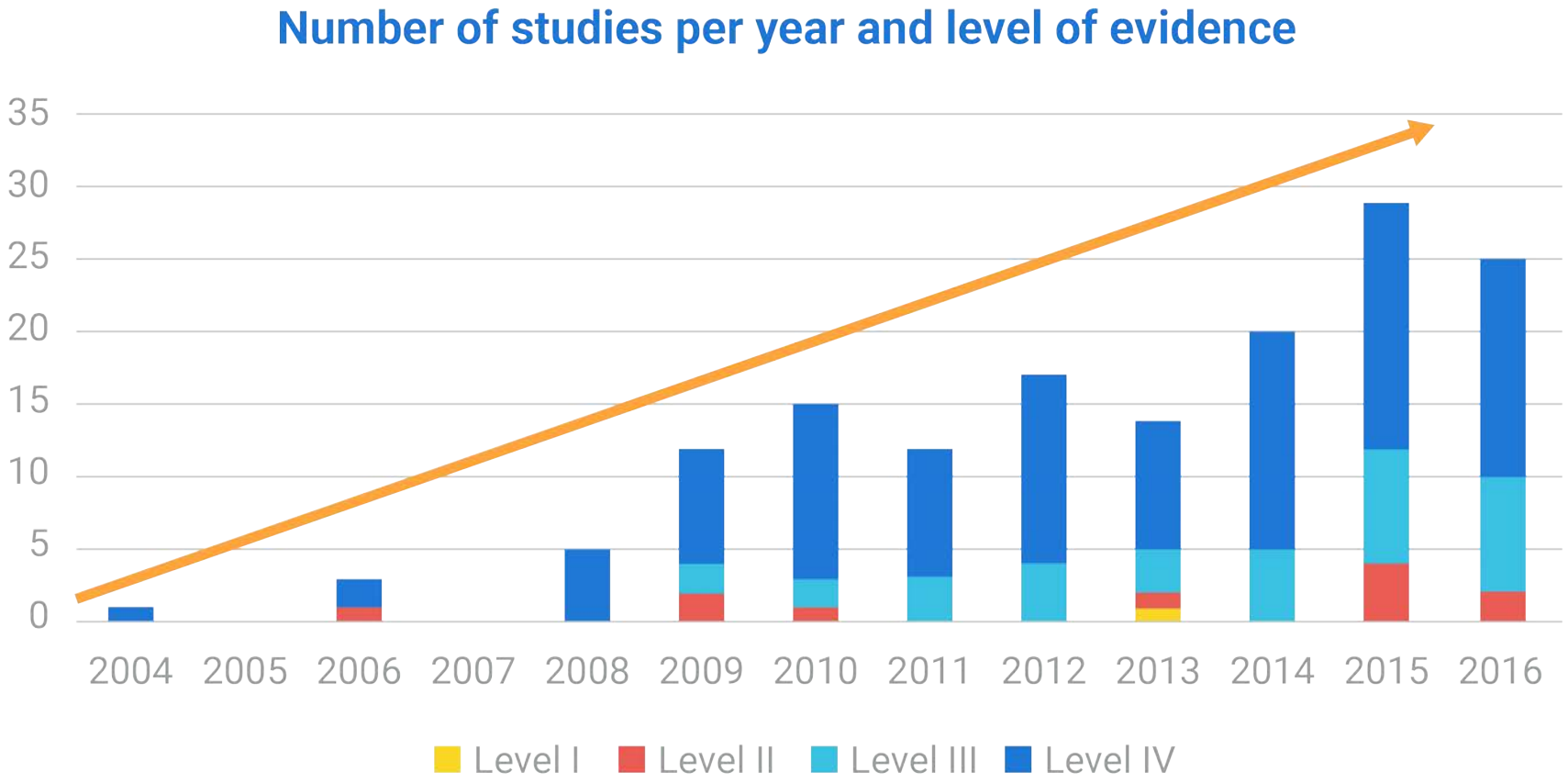
The Athlete's Hip: Simplifying the Evaluation of Hip Pathology

"Femoroacetabular Impingement Surgery Is on the Rise: But What Is the Next Step?"

- **18-fold increase** in FAI surgery between 1999 and 2009
- Only **25%** of surgeons were willing to consider a trial randomizing patients with FAI for operative versus nonoperative treatment
- **21%** of patients were not willing to try conservative therapy for six months

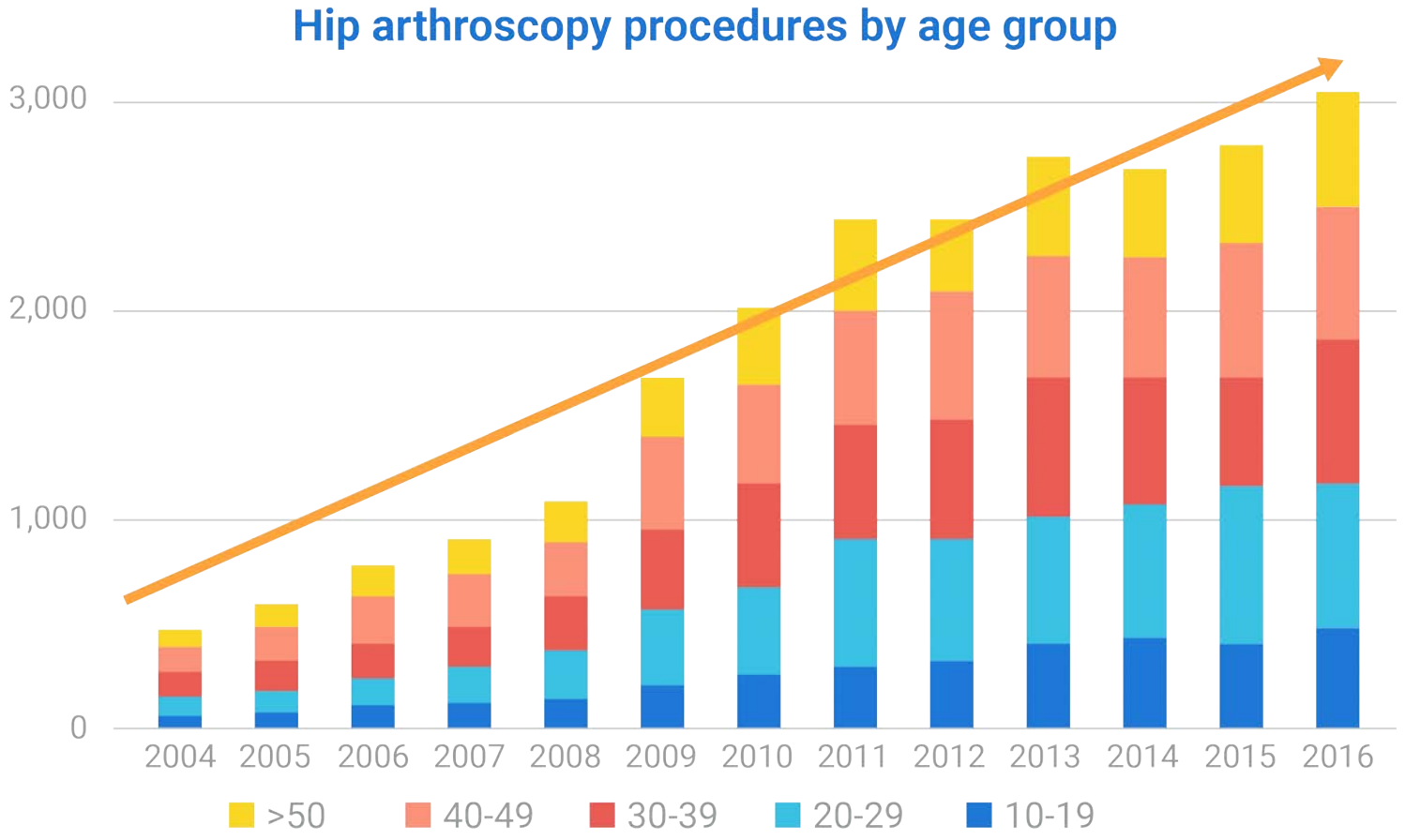
Reiman MP, Thorborg K, Hölmich P. Femoroacetabular Impingement Surgery Is on the Rise—But What Is the Next Step? *Journal of Orthopaedic & Sports Physical Therapy*. 2016;46(6):406-408. doi:10.2519/jospt.2016.0605.

"Prevalence and Consistency in Surgical Outcome Reporting for Femoroacetabular Impingement Syndrome: A Scoping Review"



Reiman MP, Peters S, Sylvain J, Hagymasi S, Ayeni OR. Prevalence and Consistency in Surgical Outcome Reporting for Femoroacetabular Impingement Syndrome: A Scoping Review. Arthroscopy. February 2018. doi:10.1016/j.arthro.2017.11.037.

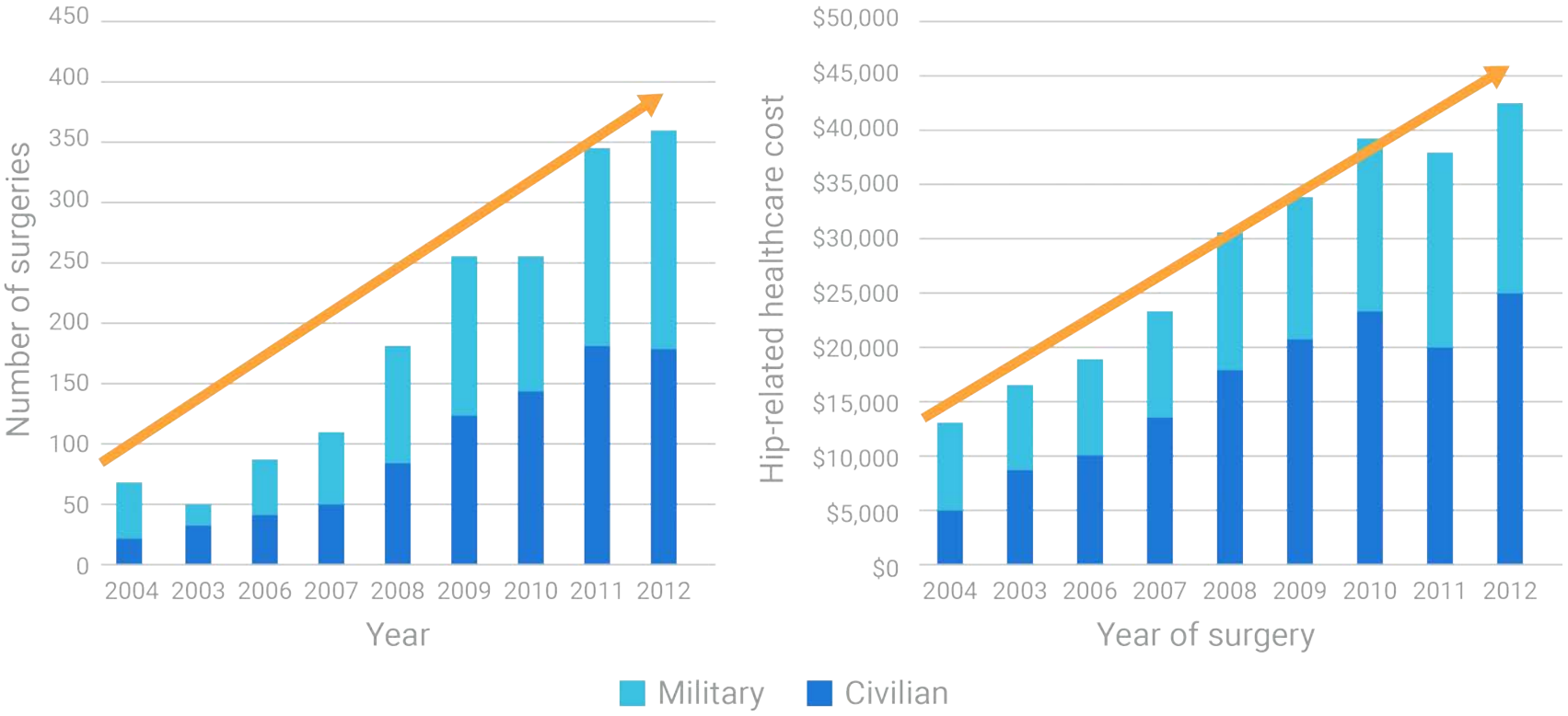
"A Shift in Hip Arthroscopy Use by Patient Age and Surgeon Volume: A New York State–Based Population Analysis 2004 to 2016"



There was a 495% increase in hip arthroscopies from 2004 to 2016

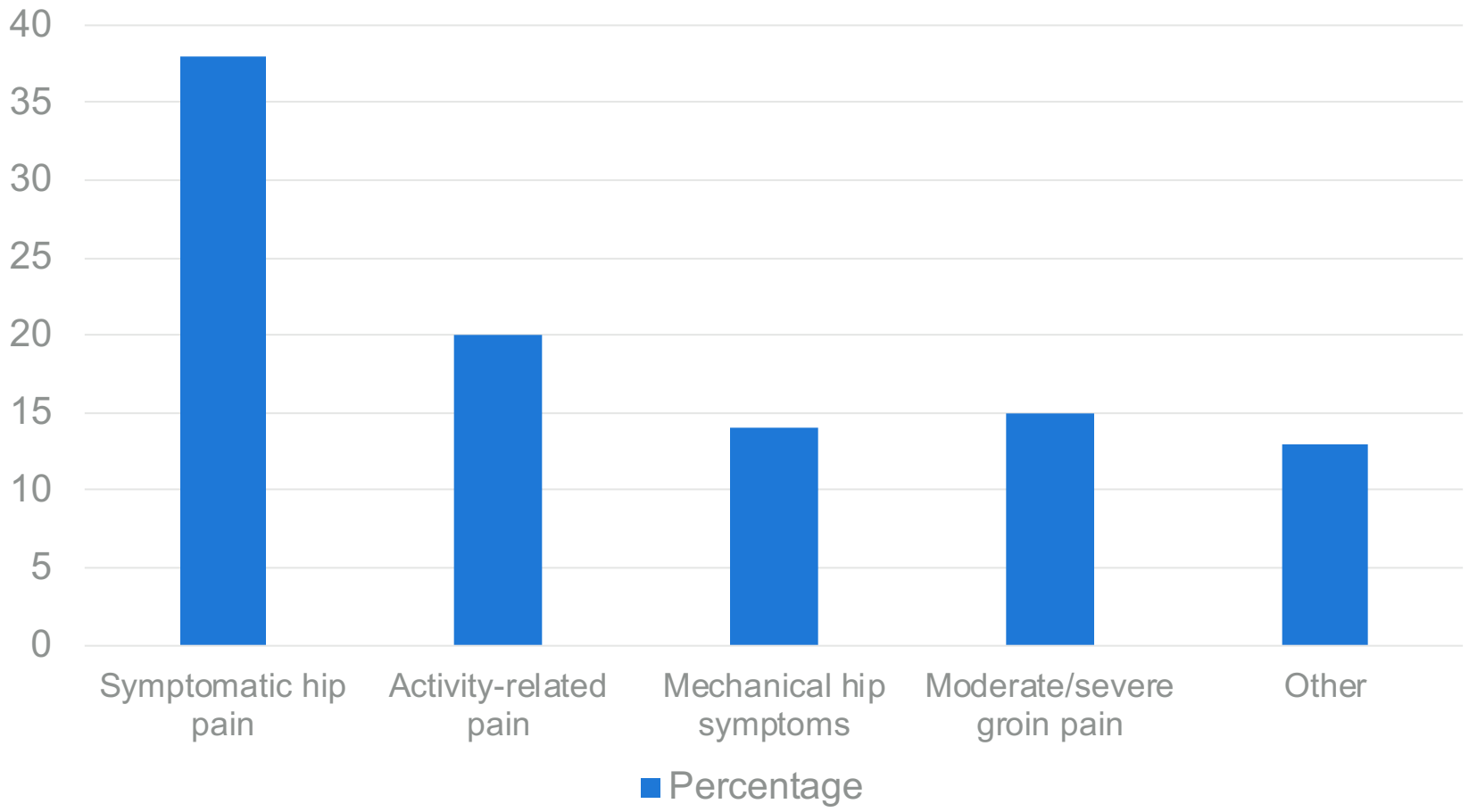
Schairer WW, Nwachukwu BU, Suryavanshi JR, Yen Y-M, Kelly BT, Fabricant PD. A Shift in Hip Arthroscopy Use by Patient Age and Surgeon Volume: A New York State-Based Population Analysis 2004 to 2016. Arthroscopy. 2019;35(10):2847–2854.e1. doi:10.1016/j.arthro.2019.05.008.

“Arthroscopy for Management of Femoroacetabular Impingement Syndrome in the Military Health System: A 10-Year Epidemiological Overview of Cases With 2-Year Follow-Up”



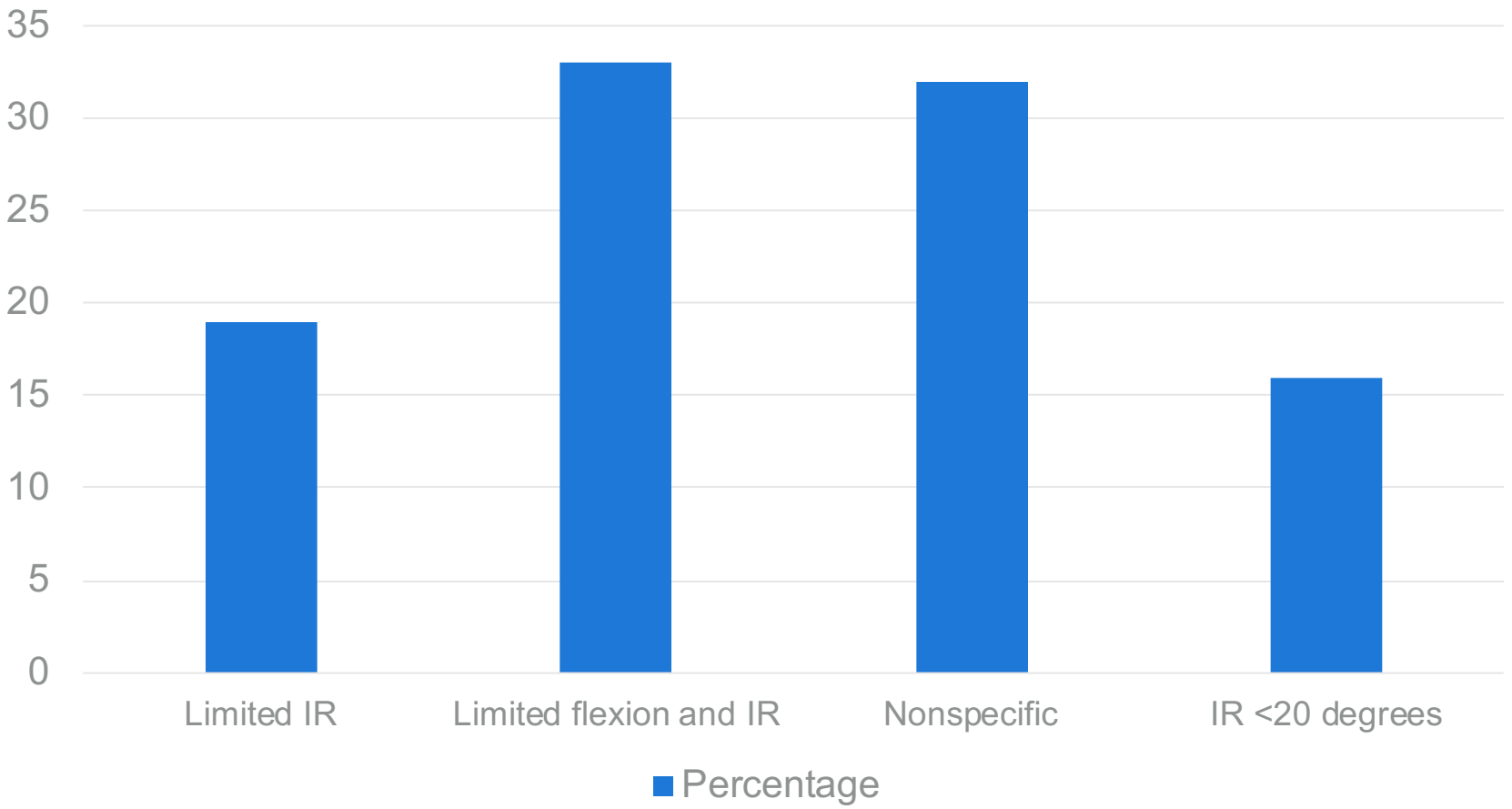
Rhon D, Schmitz M, Mayhew R, Dry K, Greenlee T. Arthroscopy for Management of Femoroacetabular Impingement Syndrome in the Military Health System: A 10-Year Epidemiological Overview of Cases with 2-year Follow-up. Military Medicine. 2019;184(11-12):788-796. doi:10.1093/milmed/usz057.

Surgical Criteria for FAIS



Peters S, Laing A, Emerson C, et al. Surgical criteria for femoroacetabular impingement syndrome: a scoping review. British Journal of Sports Medicine. 2017;51(22):1605-1610. doi:10.1136/bjsports-2016-096936.

Surgical Criteria for FAIS (cont.)



Peters S, Laing A, Emerson C, et al. Surgical criteria for femoroacetabular impingement syndrome: a scoping review. British Journal of Sports Medicine. 2017;51(22):1605-1610. doi:10.1136/bjsports-2016-096936.

Surgical Criteria for FAIS (cont.)

- **44% of studies described failed conservative treatment**
  - **18% described failed physical therapy**
- Only **56%** of included studies utilized the combination of symptoms, clinical signs, and diagnostic imaging for diagnosis of FAIS

Peters S, Laing A, Emerson C, et al. Surgical criteria for femoroacetabular impingement syndrome: a scoping review. British Journal of Sports Medicine. 2017;51(22):1605-1610. doi:10.1136/bjsports-2016-096936.

“Preoperative Physical Examination and Imaging of Femoroacetabular Impingement Prior to Hip Arthroscopy"

Nonsurgical treatment was reported in **25% of patients** (1,264/5,125 patients)

- **7.36%: physical therapy**
- 11.00%: activity modification
- 10.4%: NSAIDs
- 1.99%: intra-articular injection

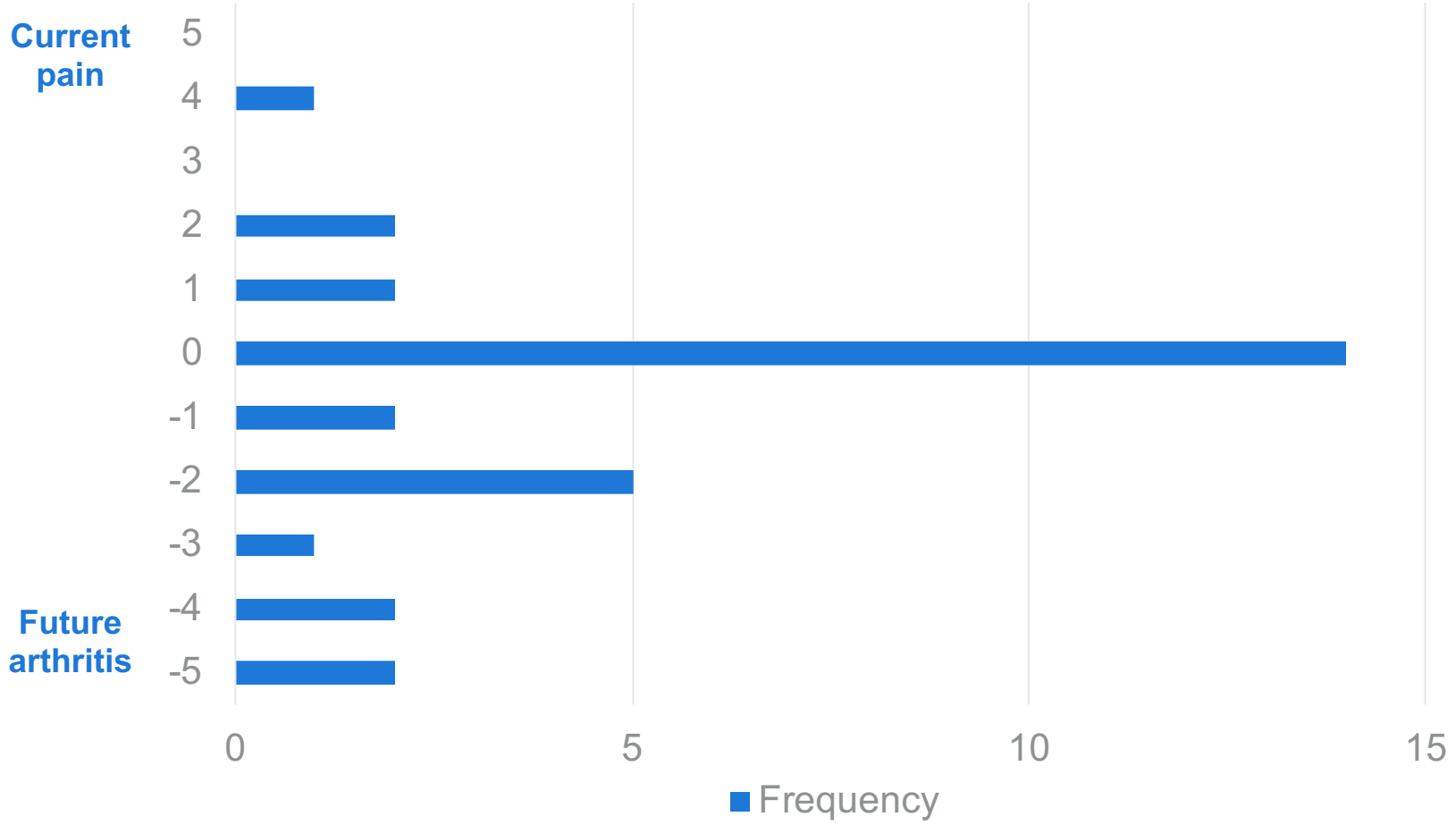
Haldane CE, Ekhtiari S, de SA D, Simunovic N, Ayeni OR. Preoperative physical examination and imaging of femoroacetabular impingement prior to hip arthroscopy—a systematic review. J Hip Preserv Surg. 2017;4(3):201-213. doi:10.1093/jhps/hnx020.

"Nonoperative Management Prior to Hip Arthroscopy for Femoroacetabular Impingement Syndrome: An Investigation Into the Utilization and Content of Physical Therapy"

- 1,870 participants
- **1,106 did not see a PT prior to surgery**
- Of those who did see a PT
  - Average number of visits: **two**

Young JL, Wright AA, Rhon DI. Nonoperative Management Prior to Hip Arthroscopy for Femoroacetabular Impingement Syndrome: An Investigation Into the Utilization and Content of Physical Therapy. Journal of Orthopaedic & Sports Physical Therapy. 2019;49(8):593-600. doi:10.2519/jospt.2019.8581.

What Do Patients Care About?



Palmer AJR, Thomas GER, Pollard TCB, et al. The feasibility of performing a randomised controlled trial for femoroacetabular impingement surgery. Bone & Joint Research. 2013;2(2):33-40. doi:10.1302/2046-3758.22.2000137.

FAIS and Osteoarthritis

- The effect of surgery on the natural history of FAI or the capacity to prevent/delay OA has **not been established**
- In middle-aged patients, moderate (α-angle >60˚) and severe (>83˚) cam morphology was associated with development of end-stage OA at five years
  - Adjusted ORs 3.67 and 9.66
- Pincer-type morphology **was not** associated with the development of OA
  - OR = 0.34

1. Khan M, Bedi A, Fu F, Karlsson J, Ayeni OR, Bhandari M. New perspectives on femoroacetabular impingement syndrome. Nature Publishing Group. 2016;12(5):303-310. doi:10.1038/nrrheum.2016.17.
2. van Klij P, Heerey J, Waarsing JH, Agricola R. The Prevalence of Cam and Pincer Morphology and Its Association With Development of Hip Osteoarthritis. J Orthop Sports Phys Ther. 2018;48(4):230-238. doi:10.2519/jospt.2018.7816.

“Cam Deformities and Limited Hip Range of Motion Are Associated With Early Osteoarthritic Changes in Adolescent Athletes”

OA progression: decreased hip internal rotation, **positive anterior impingement sign**, decreased hip flexion, increased alpha angle, and **presence of a cam lesion**

Wyles CC, Norambuena GA, Howe BM, et al. Cam Deformities and Limited Hip Range of Motion Are Associated With Early Osteoarthritic Changes in Adolescent Athletes: A Prospective Matched Cohort Study. Am J Sports Med. August 2017:363546517719460. doi:10.1177/0363546517719460.

"The Two-Year Incidence of Hip Osteoarthritis After Arthroscopic Hip Surgery for Femoroacetabular Impingement Syndrome"

- Of the 1,870 participants in this young cohort, **21.9% had a postoperative clinical diagnosis of hip osteoarthritis within two years**
  - Mean age 32.2 years at follow-up
- Variables indicative of progression to OA
  - Increased age (OR = 1.037)
  - Male sex (OR = 1.305)
  - Additional hip surgery (OR = 2.330)

Rhon DI, Greenlee TA, Sissel CD, Reiman MP. The two-year incidence of hip osteoarthritis after arthroscopic hip surgery for femoroacetabular impingement syndrome. BMC Musculoskelet Disord. 2019;20(1):266. doi:10.1186/s12891-019-2646-5.

"Radiographic Hip Osteoarthritis Is Prevalent, and Is Related to Cam Deformity 12–24 Months Post Hip Arthroscopy"

Of the 70 participants in this young cohort, **37.0% had a postoperative clinical diagnosis of hip osteoarthritis within 12–24 months**

- Mean age 36.7 years at follow-up

Kemp JL, Crossley KM, Agricola R, Geuskens F, Middelkoop MV. RADIOGRAPHIC HIP OSTEOARTHRITIS IS PREVALENT, AND IS RELATED TO CAM DEFORMITY 12-24 MONTHS POST-HIP ARTHROSCOPY. International Journal of Sports Physical Therapy. 2018;13(2):177-184. doi:10.26603/ijspt20180177.

"An Examination of the Association Between Different Morphotypes of Femoroacetabular Impingement in Asymptomatic Subjects and the Development of Osteoarthritis of the Hip"

Of the 192 participants (96 symptomatic, 96 asymptomatic), **82.3% remained free of a clinical diagnosis of hip osteoarthritis at 18.5-year follow-up**

- Mean age 49.3 years at follow-up

Hartofilakidis G, Bardakos NV, Babis GC, Georgiades G. An examination of the association between different morphotypes of femoroacetabular impingement in asymptomatic subjects and the development of osteoarthritis of the hip. J Bone Joint Surg Br. 2011;93(5):580-586. doi:10.1302/0301-620X.93B5.25236.

If We Are Not Changing the Likelihood of OA, Are We At Least Improving Function?

A total of 1,911 patients and 1,981 hips were assessed in 29 clinical studies

Outcome	Weighted change
mHHS	24.4
HOS-ADL	23.7
HOS-Sport	41.7
NAHS	22.0
WOMAC	12.9
VAS-Pain	-4.5

Minkara AA, Westermann RW, Rosneck J, Lynch TS. Systematic Review and Meta-analysis of Outcomes After Hip Arthroscopy in Femoroacetabular Impingement. Am J Sports Med. January 2018:363546517749475. doi:10.1177/0363546517749475.

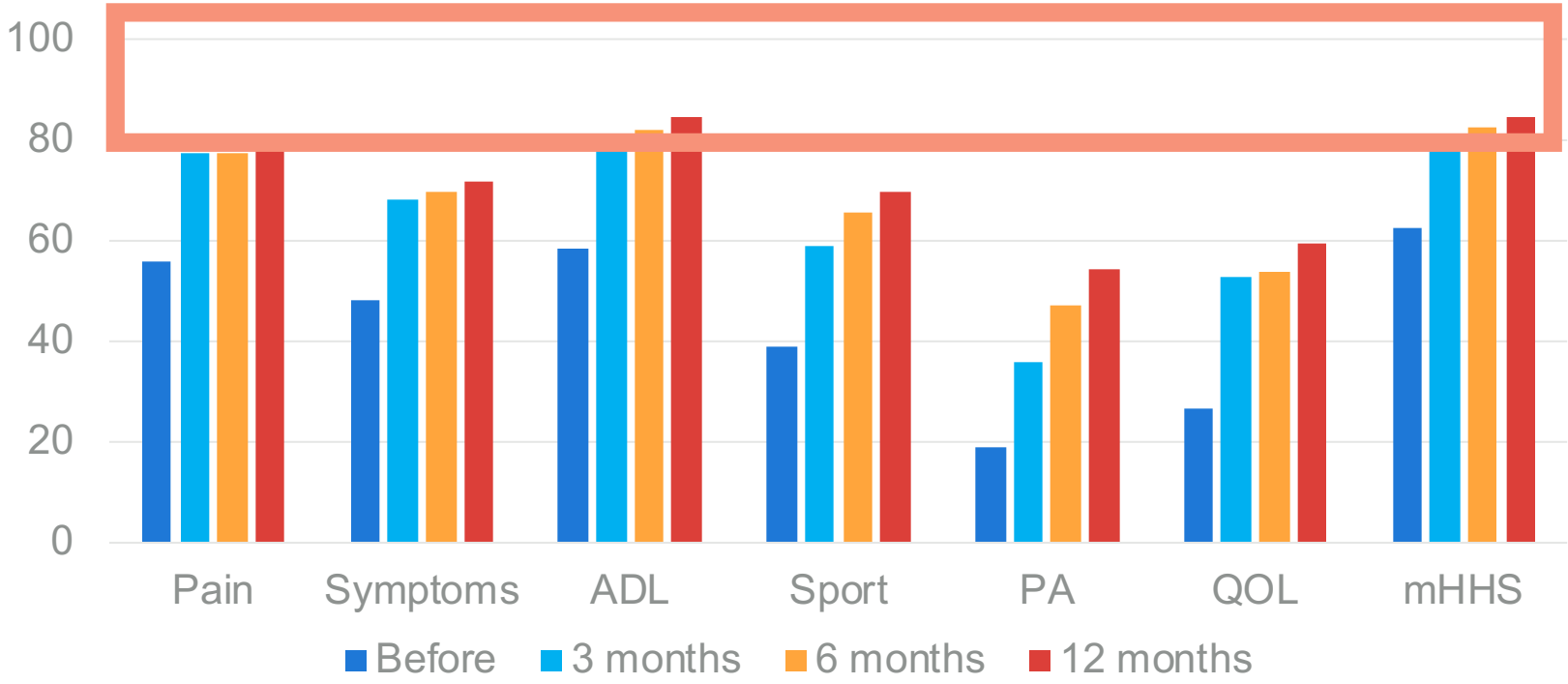
What About Return to Sport?

- A total of 1,296 patients and 1,442 hips were assessed for return to play/sports in 22 clinical studies
- **Return-to-sport rate: 84.6%**
  - 95% CI, 80.4%–88.8%; P = .008
- Sim et al., 2015
  - Only **6.8%** of studies reported RTS data

1. Minkara AA, Westermann RW, Rosneck J, Lynch TS. Systematic Review and Meta-analysis of Outcomes After Hip Arthroscopy in Femoroacetabular Impingement. Am J Sports Med. January 2018:363546517749475. doi:10.1177/0363546517749475.
2. Sim Y, Horner NS, de SA D, Simunovic N, Karlsson J, Ayeni OR. Reporting of non-hip score outcomes following femoroacetabular impingement surgery: a systematic review. J Hip Preserv Surg. 2015;2(3):224-241. doi:10.1093/jhps/hnv048.

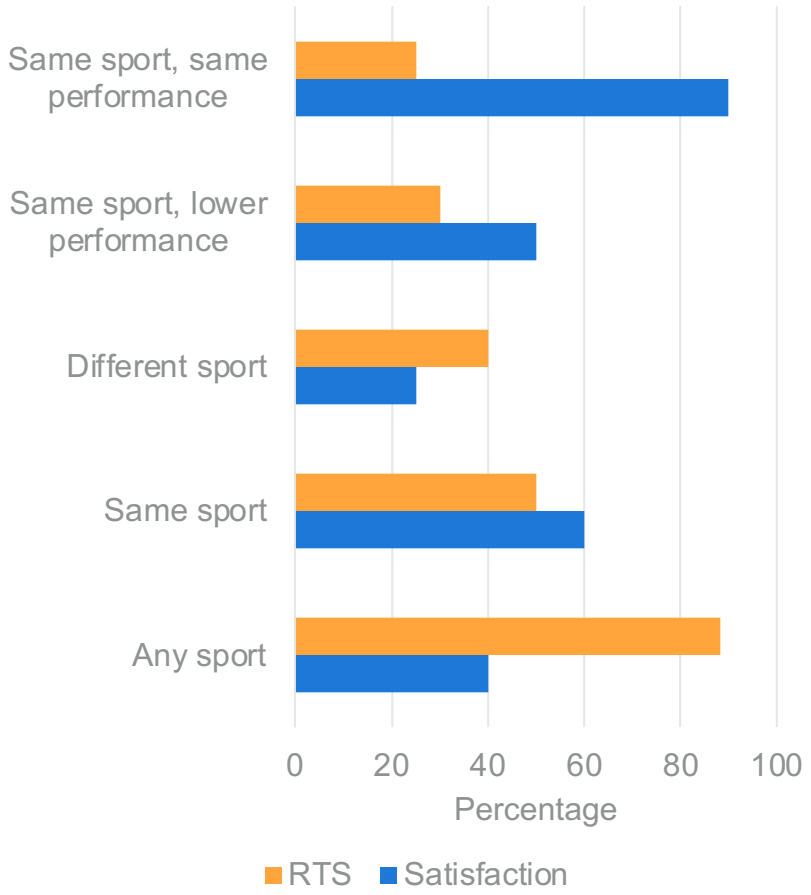
“The Difference Between Getting Better and Getting Back to Normal”

- Statistically and clinically relevant improvements in HAGOS and mHHS results after hip arthroscopy and rehabilitation can be seen at **three months and up to one year**



Thorborg K, Kraemer O, Madsen A-D, Hölmich P. Patient-Reported Outcomes Within the First Year After Hip Arthroscopy and Rehabilitation for Femoroacetabular Impingement and/or Labral Injury: The Difference Between Getting Better and Getting Back to Normal. American Journal of Sports Medicine. 2018;49(22):036354651878697-036354651878698. doi:10.1177/0363546518786971.

A Matter of Definition?



1. Not returned to any sport or exercise
2. Returned to participation in a different sport or exercise than prior to hip symptoms
3. Returned to participation in the same sport or exercise but on a lower performance level
4. Returned to participation in the same sport or exercise on same or higher performance level than prior to hip symptoms

Wörner T, Thorborg K, Stålman A, Webster KE, Momatz Olsson H, Eek F. High or low return to sport rates following hip arthroscopy is a matter of definition? British Journal of Sports Medicine. June 2018. doi:10.1136/bjsports-2018-099154.

"High or Low Return to Sport Rates Following Hip Arthroscopy Is a Matter of Definition?" (cont.)

- **89%** had returned to sport when reporting RTS in traditional fashion (yes/no)
- **Only 28%** participated in the same sport as prior to hip symptoms, but at lower performance levels
- **Only 21%** participated in the same sport at the same or higher performance levels
- **46% reported satisfaction with current RTS level over six months following arthroscopy**

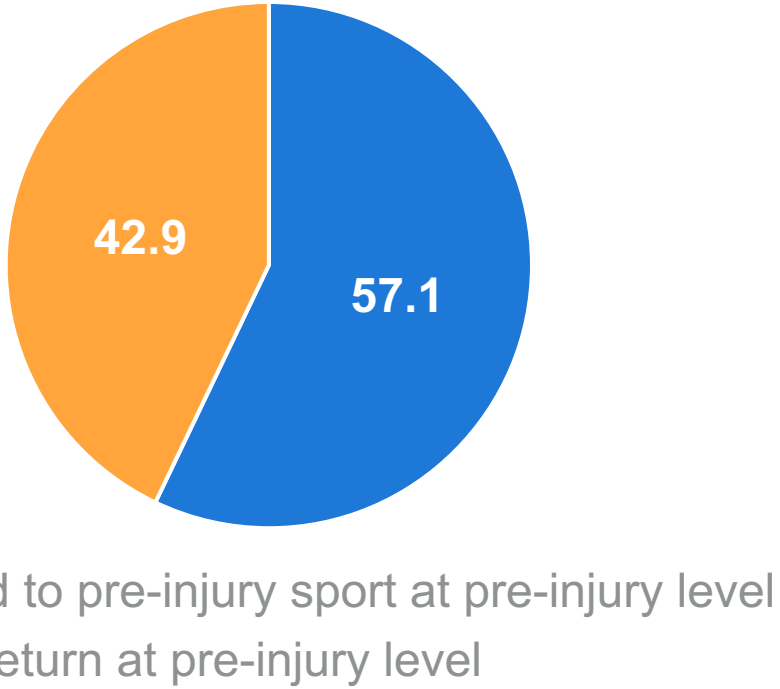
Wörner T, Thorborg K, Stålman A, Webster KE, Momatz Olsson H, Eek F. High or low return to sport rates following hip arthroscopy is a matter of definition? British Journal of Sports Medicine. June 2018. doi:10.1136/bjsports-2018-099154.

"Femoroacetabular Impingement Surgery Allows 74% of Athletes to Return to the Same Competitive Level of Sports Participation but Their Level of Performance Remains Unreported"

- 35 studies (**1,634 athletes/1,828 hips**) included
- Mean time from surgery to RTS was 7.0 ± 2.6 months
- **Only 37%** of studies reported pre-injury level of competition
- **Only 14%** of studies reported on pre-surgery and post-surgery athletic performance

Reiman MP, Peters S, Sylvain J, Hagymasi S, Mather RC, Goode AP. Femoroacetabular impingement surgery allows 74% of athletes to return to the same competitive level of sports participation but their level of performance remains unreported: a systematic review with meta-analysis. British Journal of Sports Medicine. 2018;52(15):972-981. doi:10.1136/bjsports-2017-098696.

“Return to Sport and Performance After Hip Arthroscopy for Femoroacetabular Impingement in 18- to 30-Year-Old Athletes"

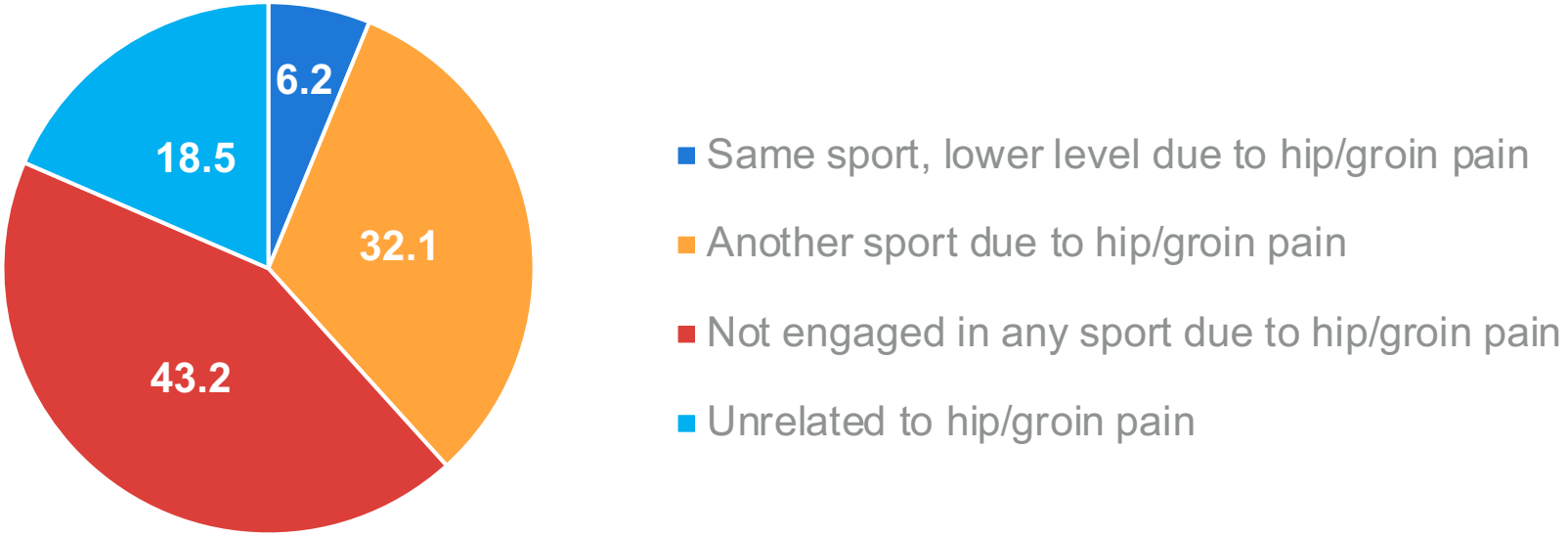


17% returned to optimal sports performance

Ishøi L, Thorborg K, Kraemer O, Hölmich P. Return to Sport and Performance After Hip Arthroscopy for Femoroacetabular Impingement in 18- to 30-Year-Old Athletes: A Cross-sectional Cohort Study of 189 Athletes. American Journal of Sports Medicine. 2018;50(14):036354651878907-036354651878910. doi:10.1177/0363546518789070.

"Return to Sport and Performance After Hip Arthroscopy for Femoroacetabular Impingement in 18- to 30-Year-Old Athletes" (cont.)

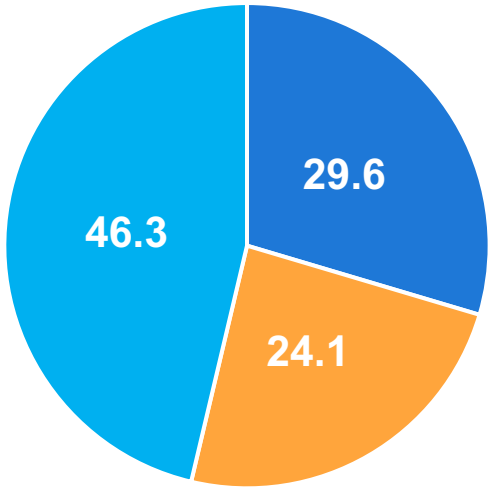
Of those that failed to return to preinjury sport at preinjury level...



Ishøi L, Thorborg K, Kraemer O, Hölmich P. Return to Sport and Performance After Hip Arthroscopy for Femoroacetabular Impingement in 18- to 30-Year-Old Athletes: A Cross-sectional Cohort Study of 189 Athletes. American Journal of Sports Medicine. 2018;50(14):036354651878907-036354651878910. doi:10.1177/0363546518789070.

"Return to Sport and Performance After Hip Arthroscopy for Femoroacetabular Impingement in 18- to 30-Year-Old Athletes" (cont.)

Of the athletes engaged in their preinjury sport at preinjury level at follow-up…



89.5% reported impaired performance due to persistent hip and/or groin pain

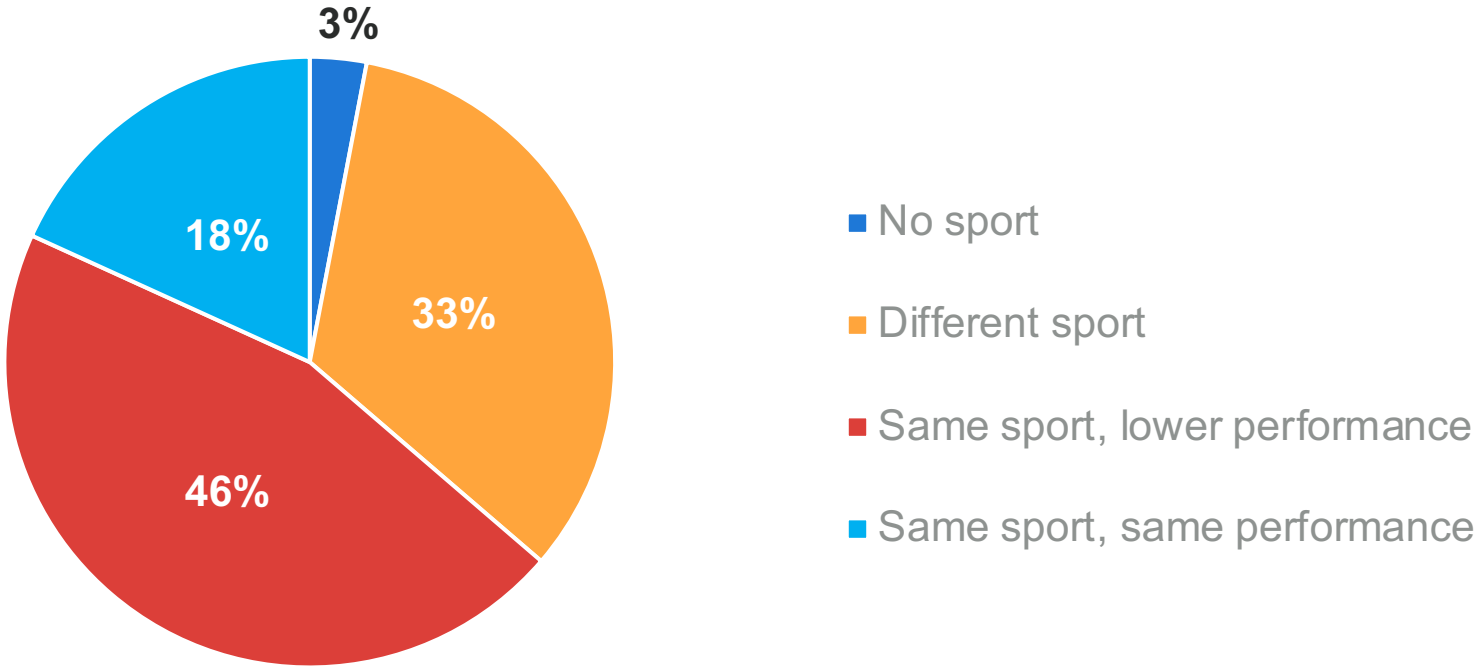
Ishøi L, Thorborg K, Kraemer O, Hölmich P. Return to Sport and Performance After Hip Arthroscopy for Femoroacetabular Impingement in 18- to 30-Year-Old Athletes: A Cross-sectional Cohort Study of 189 Athletes. American Journal of Sports Medicine. 2018;50(14):036354651878907-036354651878910. doi:10.1177/0363546518789070.

"The Association Between Specific Sports Activities and Sport Performance Following Hip Arthroscopy for Femoroacetabular Impingement Syndrome"

- **153/184 athletes (83.2%)** were classified with impaired sport performance
- No differences between sports were observed in the proportion of athletes with moderate-to-extreme difficulties in specific sport activities
- HAGOS sport subscale items
  - SP8 ("stretched into an outer hip position")
  - SP5 ("running as fast as you can")
  - SP7 ("explosive movements")
  - SP2 ("running")
  - SP6 ("kicking, skating, etc.")

Ishøi L, Thorborg K, Kraemer O, Hölmich P. The association between specific sports activities and sport performance following hip arthroscopy for femoroacetabular impingement syndrome: A secondary analysis of a cross-sectional cohort study including 184 athletes. J Hip Preserv Surg. 2019;50:1181–10. doi:10.1093/jhps/hnz017.

"Hip Function 6 to 10 Months After Arthroscopic Surgery: A Cross-sectional Comparison of Subjective and Objective Hip Function, Including Performance-based Measures in Patients Versus Controls"

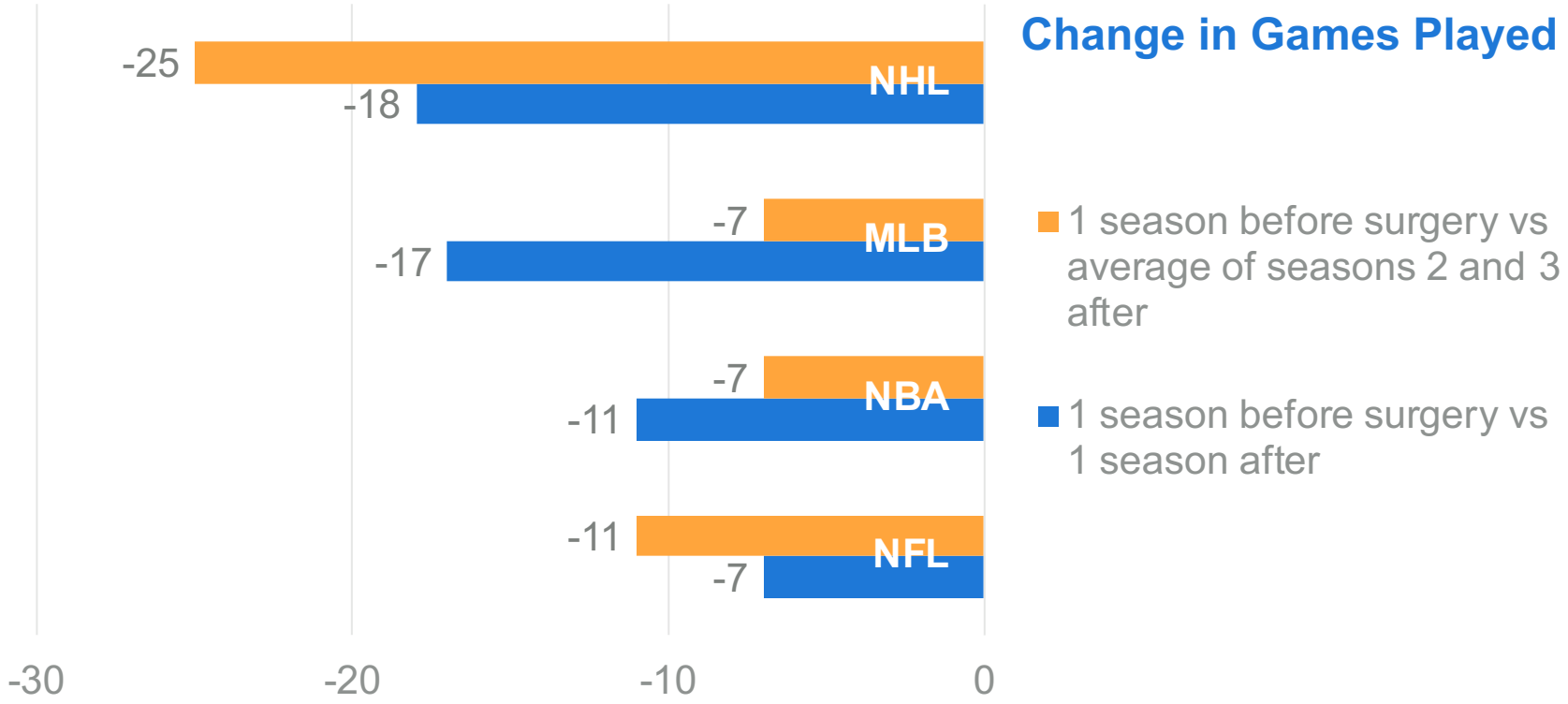


36.4% satisfied with postoperative physical activity level

Wörner T, Nilsson J, Thorborg K, Granlund V, Stålman A, Eek F. Hip Function 6 to 10 Months After Arthroscopic Surgery: A Cross-sectional Comparison of Subjective and Objective Hip Function, Including Performance-Based Measures, in Patients Versus Controls. Orthopaedic Journal of Sports Medicine. 2019;7(6):232596711984482–10. doi:10.1177/2325967119844821.

“Prognosis Following Hip Arthroscopy Varies in Professional Athletes Based on Sport”

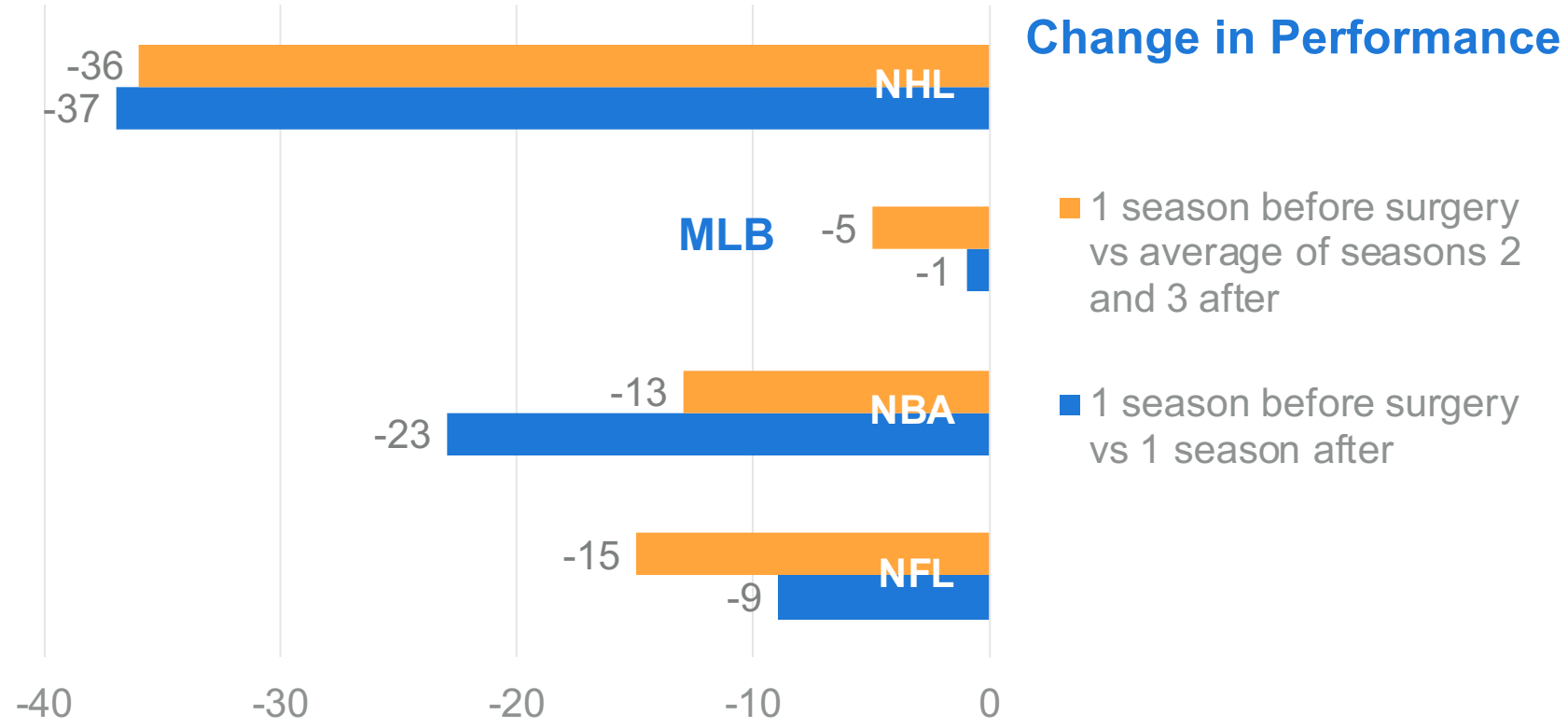
Returned to sport: **88.7%**



Christian RA, Lubbe RJ, Chun DS, Selley RS, Terry MA, Hsu WK. Prognosis Following Hip Arthroscopy Varies in Professional Athletes Based on Sport. Arthroscopy. 2019;35(3):837–842.e1. doi:10.1016/j.arthro.2018.10.113.

“Prognosis Following Hip Arthroscopy Varies in Professional Athletes Based on Sport” (cont.)

Returned to sport: **88.7%**



Christian RA, Lubbe RJ, Chun DS, Selley RS, Terry MA, Hsu WK. Prognosis Following Hip Arthroscopy Varies in Professional Athletes Based on Sport. Arthroscopy. 2019;35(3):837–842.e1. doi:10.1016/j.arthro.2018.10.113.

“Most Military Service Members Return to Activity Duty With Limitations After Surgery for Femoroacetabular Impingement Syndrome”

Studies	Subjects	Returned to duty	RTD without limitations
5	871	75%	**47%**

Reiman MP, Peters S, Rhon DI. Most Military Service Members Return to Activity Duty With Limitations After Surgery for Femoroacetabular Impingement Syndrome: A Systematic Review. Arthroscopy. 2018;34(9):2713-2725. doi:10.1016/j.arthro.2018.05.011.

Patient Expectations

Expectation	Percentage
Improved sport performance	92%
Improved ability to attain athletic potential	88%
Improved ability to exercise	100%
Relieve persistent pain	98%
Relieve pain with sitting	94%
Relieve stress and anxiety caused by hip	93%
Remove my hip from the forefront of my thoughts	96%
Relieve worry that hip damage is getting worse	96%
Resume the lifestyle I had before this problem started	99%

Mancuso CA, Wentzel CH, Kersten SM, Kelly BT. Patients' Expectations of Hip Preservation Surgery: A Survey Study. Arthroscopy. May 2019. doi:10.1016/j.arthro.2019.01.028.

Additional Postoperative Implications

	Total before	Total after	Total new	P-value
Mental health disorder	372	685	391	< 0.001
Chronic pain	174	463	374	< 0.001
Substance abuse	288	453	248	< 0.001
Cardiovascular disease	198	339	195	< 0.001
Metabolic syndrome	297	552	341	< 0.001
Systemic arthropathy	34	79	60	< 0.001
Sleep disorder	256	541	370	< 0.001
Any comorbidity	**973**	**1,347**	**480**	**< 0.001**

Rhon DI, Greenlee TA, Marchant BG, Sissel CD, Cook CE. Comorbidities in the first 2 years after arthroscopic hip surgery: substantial increases in mental health disorders, chronic pain, substance abuse and cardiometabolic conditions. British Journal of Sports Medicine. September 2018:bjsports–2018–099294. doi:10.1136/bjsports-2018-099294.

What Influences Opioid Use?

	Opioid use (< 180 days pre-op)	Opioid use (> 90 days post-op)	Total health care costs
Depressive Sx	36.2%	29.5%	$14,062
No depressive Sx	25.6%	23.4%	$9,582

Jacobs CA, Hawk GS, Jochimsen KN, et al. Depression and Anxiety Are Associated With Increased Health Care Costs and Opioid Use for Patients with Femoroacetabular Impingement Undergoing Hip Arthroscopy: Analysis of a Claims Database. Arthroscopy. January 2020. doi:10.1016/j.arthro.2019.09.048.

Surgery Versus Conservative Management

"Arthroscopic Surgery or Physical Therapy for Patients With Femoroacetabular Impingement Syndrome"

- 80 patients
  - 40 in surgery group, 40 in PT group
- **Supervised PT program:** twice a week for 12 sessions
- **Surgery:** acetabuloplasty, labral repair/debridement, and/or femoroplasty as indicated by the surgeon's clinical judgment

Mansell NS, Rhon DI, Meyer J, Slevin JM, Marchant BG. Arthroscopic Surgery or Physical Therapy for Patients With Femoroacetabular Impingement Syndrome: A Randomized Controlled Trial With 2-Year Follow-up. Am J Sports Med. February 2018:363546517751912. doi:10.1177/0363546517751912.

"Hip Arthroscopy Versus Best Conservative Care for the Treatment of Femoroacetabular Impingement Syndrome"

- 348 patients
  - 171 in surgery group, 177 in PT group
- At initial assessment, participants received a personalized hip therapy information packet
- They then had between six and ten face-to-face contacts with the physiotherapist over 12–24 weeks
- **Some contacts were allowed by either telephone or email**

Griffin D. Hip arthroscopy versus best conservative care for the treatment of femoroacetabular impingement syndrome (UK FASHIoN): a multicentre randomised controlled trial. The Lancet. 2018;391(6):2225-2235. doi:10.1186/isrctn09754699.

"Arthroscopic Hip Surgery Compared with Physiotherapy and Activity Modification for the Treatment of Symptomatic Femoroacetabular Impingement"

- 188 patients (At conclusion of data collection)
  - 100 in surgery group, 88 in PT group
- Maximum of **eight sessions** over five months
  - Emphasis on muscle strengthening to improve core stability and movement control
  - Encouraged to perform exercises at home
  - Participants encouraged to avoid impingement positions
- Acetabuloplasty, labral repair/debridement, chondral microfracture, and/or femoroplasty as indicated by the surgeon's clinical judgment

1. Palmer AJR, Ayyar Gupta V, Fernquest S, et al. Arthroscopic hip surgery compared with physiotherapy and activity modification for the treatment of symptomatic femoroacetabular impingement: multicentre randomised controlled trial. BMJ. 2019;9(406):l185–13. doi:10.1136/bmj.l185.
2. Palmer AJR, Ayyar-Gupta V, Dutton SJ, et al. Protocol for the Femoroacetabular Impingement Trial (FAIT): a multi-centre randomised controlled trial comparing surgical and non-surgical management of femoroacetabular impingement. Bone & Joint Research. 2014;3(11):321-327. doi:10.1302/2046-3758.311.2000336.

And the Verdict Is…

Study	Follow-up	iHOT-33 Difference	HOS-ADL Difference	HOS-Sports Difference
Mansell et al., 2018	24 months	6.3 (-6.1 to 18.7)	3.8 (-6 to 13.6)	1.8 (-11.2 to 14.7)
Griffin et al., 2018	8 months	**6.8* (1.7 to 12.0)**	-	-
Palmer et al., 2019	12 months	**2.0* (1.3 to 2.8)**	**10.0* (6.4 to 13.6)**	**11.7* (5.8 to 17.6)**

The pooled crossover rate from nonoperative to operative care was 14%

1. Dwyer T, Whelan D, Shah PS, Ajrawat P, Hoit G, Chahal J. Operative Versus Nonoperative Treatment of Femoroacetabular Impingement Syndrome: A Meta-analysis of Short-Term Outcomes. Arthroscopy. 2020;36(1):263-273. doi:10.1016/j.arthro.2019.07.025.
2. Nwachukwu BU, Chang B, Adjei J, et al. Time Required to Achieve Minimal Clinically Important Difference and Substantial Clinical Benefit After Arthroscopic Treatment of Femoroacetabular Impingement. American Journal of Sports Medicine. 2018;46(11):2601-2606. doi:10.1177/0363546518786480.

Does This Tell the Full Story?

Study	Scale	Population	90% MDC	95% MDC	MCID
Mohtadi et al., 2012	iHOT-33	Symptomatic Hip Conditions	7.0	-	**6.1**
Hinman et al., 2013	iHOT-33	FAIS	13.2	15.6	-
Kemp et al., 2013	iHOT-33	Hip Arthroscopy	13.9	16.6	10
Jonasson et al., 2014	iHOT-12	FAIS	14.4	-	9
Nwachukwu et al., 2017	iHOT-33	Hip Arthroscopy	-	-	12.1

- **Griffin and Palmer** utilized a MDIC of 6.1
- Mansell utilized a MDIC of 12.1

Does This Tell the Full Story? (cont.)

Study	Scale	Population	90% MDC	95% MDC	MCID
Martin et al., 2008	HOS-ADL	Hip Arthroscopy	3	-	**9**
Hinman et al., 2013	HOS-ADL	FAIS	15.0	17.8	-
Kemp et al., 2013	HOS-ADL	Hip Arthroscopy	9	-	-
Nwachukwu et al., 2017	HOS-ADL	Hip Arthroscopy	-	-	**8.3**

- **Palmer** utilized a MDIC of nine
- Mansell utilized a MDIC of between six and eight points

Are These Fair Comparisons Between "Physical Therapy" and Surgery?

- **Mansell et al.**
  - Delivered over six weeks
  - Mostly mobility and "therapeutic motor control" exercises
- **Griffin et al.**
  - Average of five sessions over 12–24 weeks
  - 66% of participants attended over eight sessions
  - Primarily non-functional, low-load exercises
- **Palmer et al.**
  - Average of six sessions over five months
  - No specifics on program used

Kemp JL, King MG, Barton C, et al. Is exercise therapy for femoroacetabular impingement in or out of FASHIoN? We need to talk about current best practice for the non-surgical management of FAI syndrome. British Journal of Sports Medicine. 2019;53(19):1204-1205. doi:10.1136/bjsports-2018-100173.

Maybe These Studies ARE Representative of What WE Are Doing

- 220 (**11.8%**) had over six visits utilizing exercise
- Exercise was coded in **52.3%** of the total visits in each individual course of care

Young JL, Wright AA, Rhon DI. Nonoperative Management Prior to Hip Arthroscopy for Femoroacetabular Impingement Syndrome: An Investigation Into the Utilization and Content of Physical Therapy. Journal of Orthopaedic & Sports Physical Therapy. 2019;49(8):593-600. doi:10.2519/jospt.2019.8581.

There Is Hope

- Individuals in both groups attended eight sessions **over a 12-week period**, and **12 weekly supervised gym visits**
  - Participants were also asked to complete **two additional unsupervised exercise sessions per week**
- Program consisted of **progressive loading** program
  - Squats
  - Lunges
  - **Progressive loading**

Kemp JL, Coburn SL, Jones DM, Crossley KM. The Physiotherapy for Femoroacetabular Impingement Rehabilitation STudy (physioFIRST): A Pilot Randomized Controlled Trial. Journal of Orthopaedic & Sports Physical Therapy. 2018;48(4):307-315. doi:10.2519/jospt.2018.7941.

"The Physiotherapy for Femoroacetabular Impingement Rehabilitation Study (physioFIRST): A Pilot Randomized Controlled Trial"

Outcome	Baseline	Follow-up (six months)	Difference	Effect size
iHOT-33	60	87	**27**	**1.34**
HOOS QOL	54	76	**22**	**1.26**
HOOS Pain	63	83	**20**	**1.77**

Other less intensive RCTs

- Palmer et al.: **1.7 (HOS-ADL)**
- Mansell et al.: 15.5 (iHOT-33), 8.5 (HOS-ADL), **3.9 (HOS-Sports)**
- Griffin et al.: 14.1 (iHOT-33)

Kemp JL, Coburn SL, Jones DM, Crossley KM. The Physiotherapy for Femoroacetabular Impingement Rehabilitation STudy (physioFIRST): A Pilot Randomized Controlled Trial. Journal of Orthopaedic & Sports Physical Therapy. 2018;48(4):307-315. doi:10.2519/jospt.2018.7941.

"Physiotherapist-Led Treatment for Young to Middle-Aged Active Adults With Hip-Related Pain: Consensus Recommendations From the International Hip-Related Pain Research Network, Zurich 2018"

How long do you try?

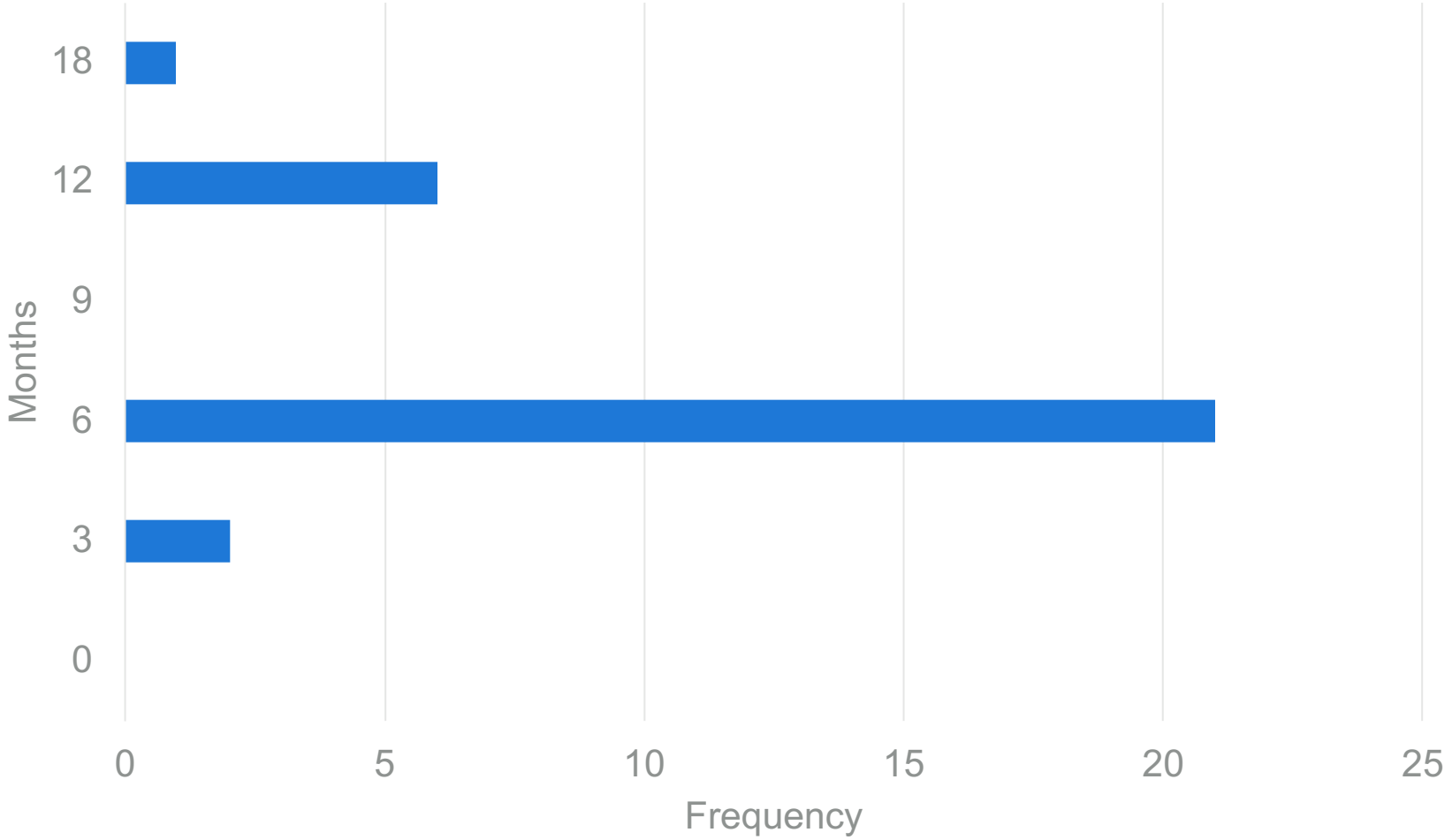
Recommendation	Level of evidence	Median (0–10)	Number of votes
Exercise-based treatments are recommended for people with hip-related pain	Moderate	9	37
Exercise-based treatment should be at least **three months in duration**	Limited	7	37
Clinicians should discuss patient expectations, use shared decision making and provide education	Insignificant	9	37

"Improving Function in People With Hip-related Pain: A Systematic Review And Meta-analysis of Physiotherapist-led Interventions for Hip-related Pain"

- Duration of interventions ranged from 3 weeks to 5 months
- Interventions of 3 months' duration that included targeted strengthening showed moderate pooled effects for function
  - SMD (95% CI): 0.66 (0.09 to 1.23)
- **Interventions of shorter duration (6–8 weeks) showed no significant differences between groups**

Kemp JL, Mosler AB, Hart H, et al. Improving function in people with hip-related pain: a systematic review and meta-analysis of physiotherapist-led interventions for hip-related pain. British Journal of Sports Medicine. 2020;53:bjsports–2019–101690–14. doi:10.1136/bjsports-2019-101690.

Patient Preferences



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Summary

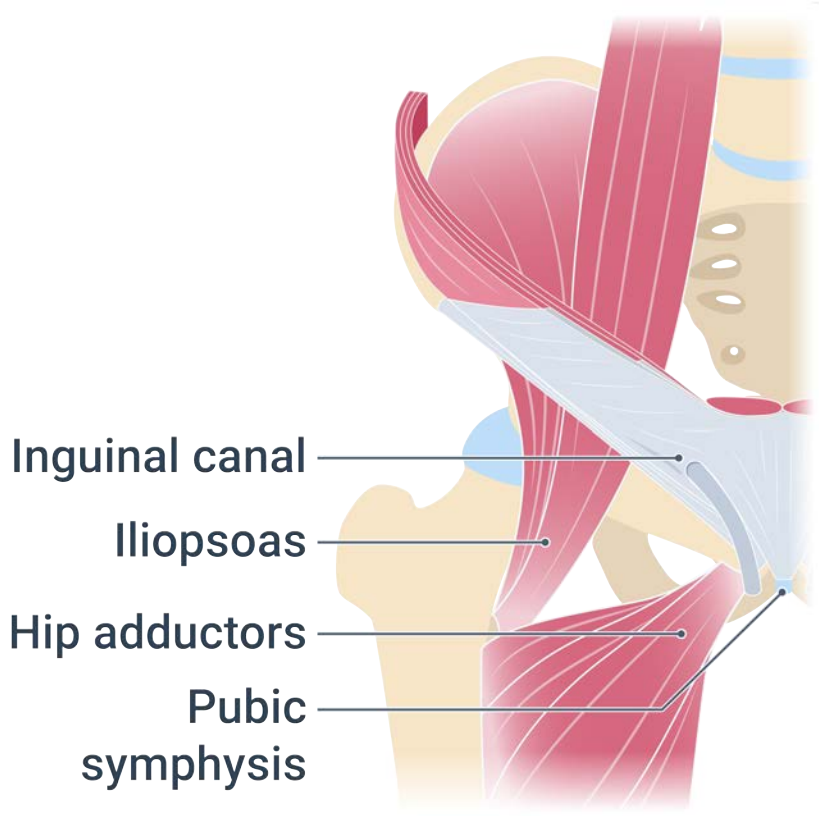
- Asymptomatic morphological abnormalities are very common
- Utilize the criteria set forth by the Warwick Agreement
- Surgery versus conservative management, no clear answer

Chapter 3

Athletic Pubalgia

Defined Clinical Entities

- Athletic pubalgia = sports hernia = osteitis pubis = hockey groin = Gilmore's groin = chronic adductor-related groin pain
- **Catch-all term for soft-tissue pathology localized to groin/pelvic region**
- **Pathology broken down by region**
  - Adductor-related
  - Hip flexor-related
  - Inguinal-related
  - Pubic-related



Weir A, Brukner P, Delahunt E. Doha agreement meeting on terminology and definitions in groin pain in athletes. British Journal of Sports Medicine. 2015;49(12):768-774. doi:10.1136/bjsports-2015-094869.

AP: Structures Involved

- Adductor pathology most prevalent on clinical, MRI, and US evaluation (63%–66%)
  - Adductor longus (93%)
- Negative imaging found in fourth of cases
- **Significant discrepancy between clinical and radiological findings**

Serner A, Tol JL, Jomaah N, et al. Diagnosis of Acute Groin Injuries: A Prospective Study of 110 Athletes. *American Journal of Sports Medicine*. 2015;43(8):1857-1864. doi:10.1177/0363546515585123.

"Multidisciplinary Assessment of 100 Athletes With Groin Pain Using the Doha Agreement: High Prevalence of Adductor-Related Groin Paint in Conjunction With Multiple Causes"

- Multiple causes for groin pain were found in **44% of the athletes**
- Distribution
  - Adductor-related: 61 (**37.4%**)
  - Inguinal-related: 40 (**24.5%**)
  - Hip flexor-related: 31 (**19.0%**)
  - Hip-related: 7 (**4.3%**)
  - Pubic-related: 4 (**2.5%**)
  - Other: 20 (**12.3%**)

Taylor R, Vuckovic Z, Mosler A, et al. Multidisciplinary Assessment of 100 Athletes With Groin Pain Using the Doha Agreement: High Prevalence of Adductor-Related Groin Pain in Conjunction With Multiple Causes. Clin J Sport Med. June 2017. doi:10.1097/JSM.0000000000000469.

AP: Risk Factors

- Level 1 evidence
  - **Previous groin injury**
  - Higher level of play
- Level 2 evidence
  - Decreased hip abductor and adductor strength
  - Lower levels of sport-specific training
- Other potential risk factors
  - Male gender
  - Common sports
    - Ice hockey
    - Soccer
    - Rugby
    - Football

Whittaker JL, Small C, Maffey L, Emery CA. Risk factors for groin injury in sport: an updated systematic review. *British Journal of Sports Medicine*. 2015;49(12):803-809. doi:10.1136/bjsports-2014-094287.

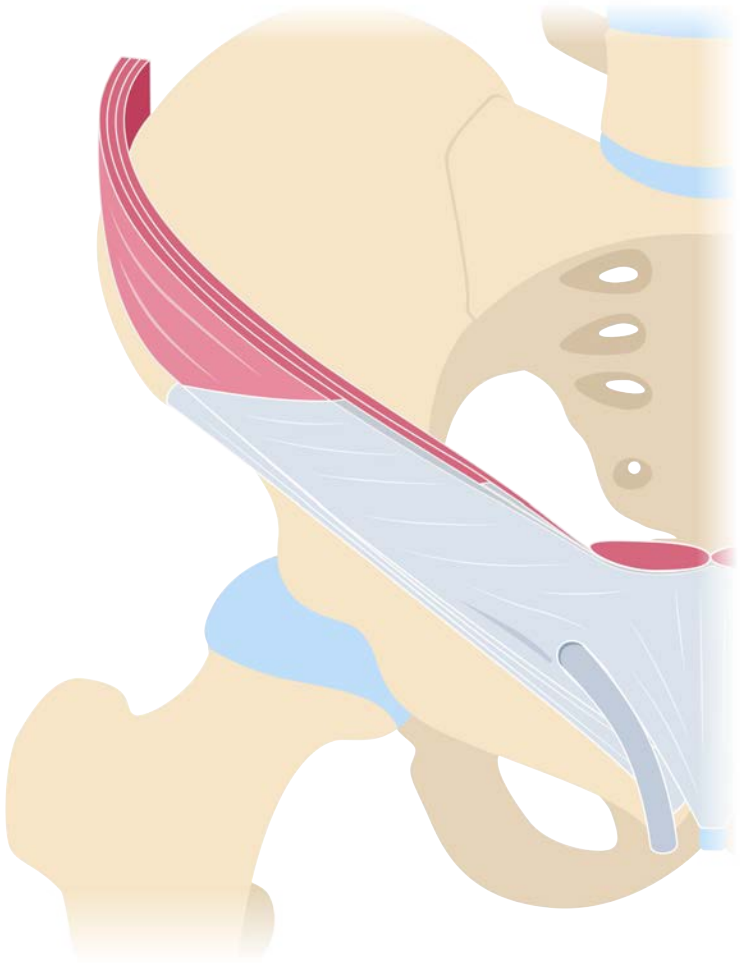
Athletic Pubalgia and FAI

- Bisciotti et al., 2017
  - **Association between cam morphology and inguinal pathologies in 88.6% cases**
- Naal et al., 2015
  - Evidence of AP was found in 34 hips with FAI (41%)
    - **Tendinopathy of the proximal adductor insertion was detected in 19 cases (23%; 11 female, 8 male)**
    - There were no significant differences for any of the radiographic or clinical parameters between patients with or without tendinopathy
- Economopoulos et al., 2014
  - Radiographic evidence of FAI was identified in at least one hip in 37 of 43 patients (86%) diagnosed with AP
    - **Cam lesions were identified in 83.7% of subjects**
    - Pincer lesions were present in 28% of hips

Bisciotti et al., 2017; Naal et al., 2015; Economopoulos et al., 2014

Inguinal-Related: Patient Presentation

- Pain localized to the inguinal canal region
- Tenderness reproduced in the inguinal canal
- Pain aggravated with resistance testing of the abdominal muscles **or** Valsalva/cough/sneeze



Serner et al., 2016; Weir et al., 2015

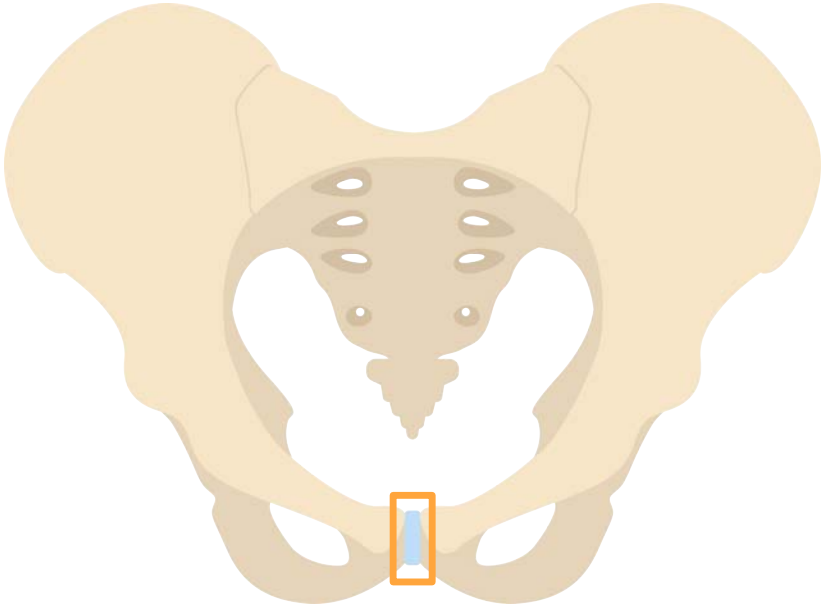
Inguinal-Related: Special Testing

- **Unable to determine statistical properties due to low prevalence**
- Palpation (rectus abdominis, superficial inguinal ring, inguinal canal)
- Resistance
  - Oblique sit-up, straight sit-up, Thomas test + hip flexion
- Stretch
  - Thomas test + passive hip extension

Serner et al., 2016; Weir et al., 2015

Pubic-Related: Patient Presentation

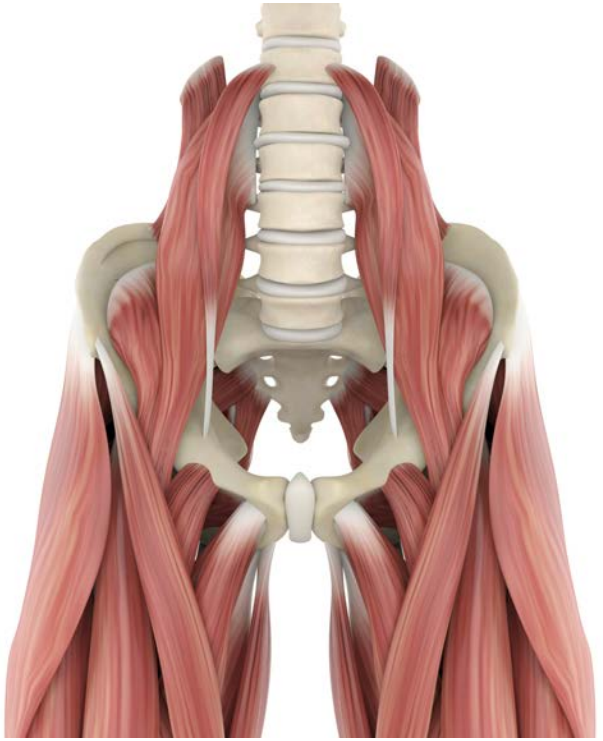
- **Unable to determine statistical properties due to low prevalence**
- Localized tenderness of the pubic symphasis and adjacent pubic bone
- No specific resistive test identified for this population



Serner et al., 2016; Weir et al., 2015

Hip Flexor-Related: Patient Presentation

- Tenderness isolated to iliopsoas and/or rectus femoris
- Pain on resisted hip flexion and/or pain on passive stretch of hip flexor musculature
- A proximal pain referral to the lower abdominal region in 7% of patients



Drew et al., 2017; Serner et al., 2016; Weir et al., 2015

"Rectus Femoris Muscle Injuries in Football: A Clinically Relevant Review of Mechanisms of Injury, Risk Factors and Preventive Strategies"

Risk factors

- No association between age and injury
- Previous injury (hamstring and quadriceps)
- Dominant leg (60%)

Mendiguchia J, Alentorn-Geli E, Idoate F, Myer GD. Rectus femoris muscle injuries in football: a clinically relevant review of mechanisms of injury, risk factors and preventive strategies. British Journal of Sports Medicine. 2013;47(6):359-366. doi:10.1136/bjsports-2012-091250.

"Iliopsoas Disorder in Athletes with Groin Pain: Prevalence in 638 Consecutive Patients Assessed With MRI and Clinical Results in 134 Patients With Signal Intensity Changes in the Iliopsoas"

- Iliopsoas pathology in 134/638 athletes (**21.0%**)
- Soccer is most common sport (88/134; **65.7%**)
- No clear history of trauma (**68.2%**)

Tsukada S, Niga S, Nihei T, Imamura S, Saito M, Hatanaka J. Iliopsoas Disorder in Athletes with Groin Pain: Prevalence in 638 Consecutive Patients Assessed with MRI and Clinical Results in 134 Patients with Signal Intensity Changes in the Iliopsoas. JB JS Open Access. 2018;3(1):e0049. doi:10.2106/JBJS.OA.17.00049.

Hip Flexor-Related: Special Testing

Resisted hip flexion (0˚)

Sensitivity	Specificity	+LR	−LR
0.72	0.60	1.82	0.46

Resisted hip flexion (90˚)

Sensitivity	Specificity	+LR	−LR
0.67	0.79	3.23	0.42

Serner A, Weir A, Tol JL, et al. Can standardised clinical examination of athletes with acute groin injuries predict the presence and location of MRI findings? *British Journal of Sports Medicine*. 2016;50(24):1541-1547. doi:10.1136/bjsports-2016-096290.

Hip Flexor-Related Special Testing: Thomas Test Variations

Resisted hip flexion

Sn	Sp	+LR	−LR
0.72	0.67	**2.20**	0.41

Passive hip extension

Sn	Sp	+LR	−LR
0.61	0.75	**2.49**	0.52

Resisted knee extension

Sn	Sp	+LR	−LR
0.67	**0.82**	**3.80**	0.40

Passive knee flexion

Sn	Sp	+LR	−LR
0.56	**0.89**	**5.28**	0.50

Serner A, Weir A, Tol JL, et al. Can standardised clinical examination of athletes with acute groin injuries predict the presence and location of MRI findings? *British Journal of Sports Medicine*. 2016;50(24):1541-1547. doi:10.1136/bjsports-2016-096290.

"Can Standardized Clinical Examination of Athletes With Acute Groin Injuries Predict the Presence and Location of MRI Findings?"

Only two cases where **all hip flexor tests** were negative, and a positive hip flexor lesion was reported on MRI

Variables	Sensitivity	Specificity	+LR	−LR
Three positive	0.78	0.79	3.69	0.28
All positive	0.33	0.98	19.00	0.68
All negative	0.11	0.53	0.23	1.69

Serner A, Weir A, Tol JL, et al. Can standardised clinical examination of athletes with acute groin injuries predict the presence and location of MRI findings? *British Journal of Sports Medicine*. 2016;50(24):1541-1547. doi:10.1136/bjsports-2016-096290.

Adductor-Related: Physical Examination

- Pubic tubercle pain (75%) and ramus pain (85%) common upon palpation
- General adductor tenderness
  - **Sn: 0.96, −LR: 0.08**
- Valsalva maneuver can occasionally reproduce symptoms
- A proximal pain referral to the lower abdominal region found in 33% of patients

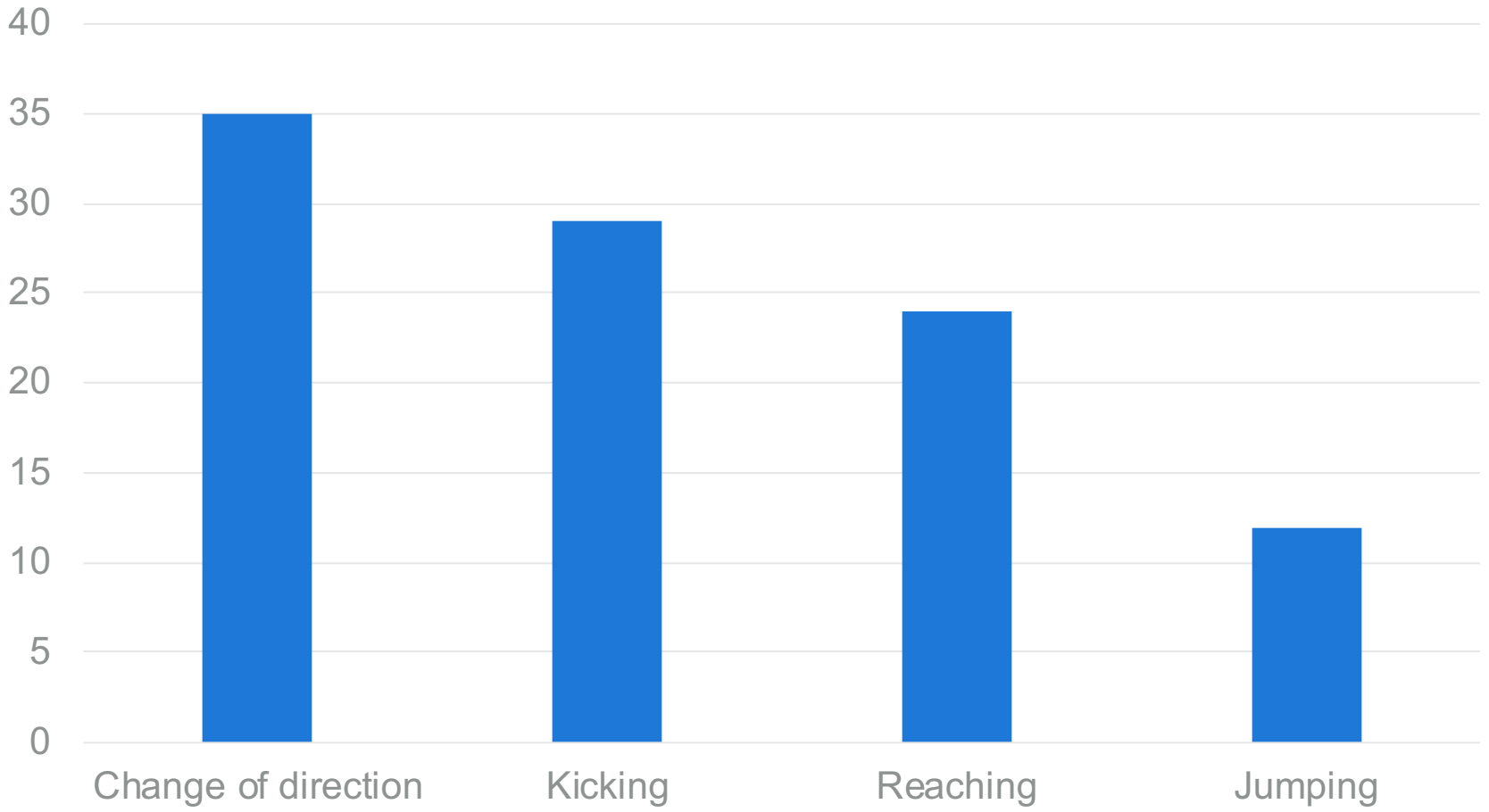
Meyers et al., 2000; Verrall et al., 2005; Slavotinek et al., 2005; Falvey et al., 2015; Hegedus et al., 2013; Serner et al., 2016; Drew et al., 2017

"Mechanisms of Acute Adductor Longus Injuries in Male Football Players: A Systematic Visual Video Analysis"

- Most injuries occurred in **noncontact situations**
  - 71%
- Following a quick **defensive** reaction to a change in play
  - 53%
- No contact
  - Less than two meters away: 47%
  - More than two meters away: 24%

Serner A, Mosler AB, Tol JL, Bahr R, Weir A. Mechanisms of acute adductor longus injuries in male football players: a systematic visual video analysis. British Journal of Sports Medicine. July 2018. doi:10.1136/bjsports-2018-099246.

“Mechanisms of Acute Adductor Longus Injuries in Male Football Players: A Systematic Visual Video Analysis” (cont.)



Serner A, Mosler AB, Tol JL, Bahr R, Weir A. Mechanisms of acute adductor longus injuries in male football players: a systematic visual video analysis. British Journal of Sports Medicine. July 2018. doi:10.1136/bjsports-2018-099246.

Adductor-Related: Special Testing

Resisted outer-range adduction

Sn	Sp	+LR	−LR
0.85	0.89	7.63	0.17

Reiman et al., 2012; Verrall et al., 2005; Serner et al., 2016

"Can Standardized Clinical Examination of Athletes With Acute Groin Injuries Predict the Presence and Location of MRI Findings?"

- **Positive individual adductor tests provide about 80% probability of a positive MRI in the adductors**
- High accuracy (92%–97% probability) of confirming that the injury is located in the adductors on MRI

Variables	Sensitivity	Specificity	+LR	−LR
Three positive	0.85	0.66	2.47	0.23
All positive	0.33	0.91	3.80	0.74
All negative	0.00	0.54	0.00	1.84

Serner A, Weir A, Tol JL, et al. Can standardised clinical examination of athletes with acute groin injuries predict the presence and location of MRI findings? *British Journal of Sports Medicine*. 2016;50(24):1541-1547. doi:10.1136/bjsports-2016-096290.

To Cut or Not to Cut?

"Exercise Interventions for the Prevention and Treatment of Groin Pain and Injury in Athletes: A Critical and Systematic Review"

Three prospective RCTs evaluating **exercise interventions** for the treatment of long-standing groin pain in athletes compared with passive therapy reported favorable outcomes in terms of

- Improved symptoms
- Reduced pain on return to sport
- Improved hip muscle strength

Charlton PC, Drew MK, Mentiplay BF, Grimaldi A, Clark RA. Exercise Interventions for the Prevention and Treatment of Groin Pain and Injury in Athletes: A Critical and Systematic Review. Sports Medicine. 2017;47(10):2011-2026. doi:10.1007/s40279-017-0742-y.

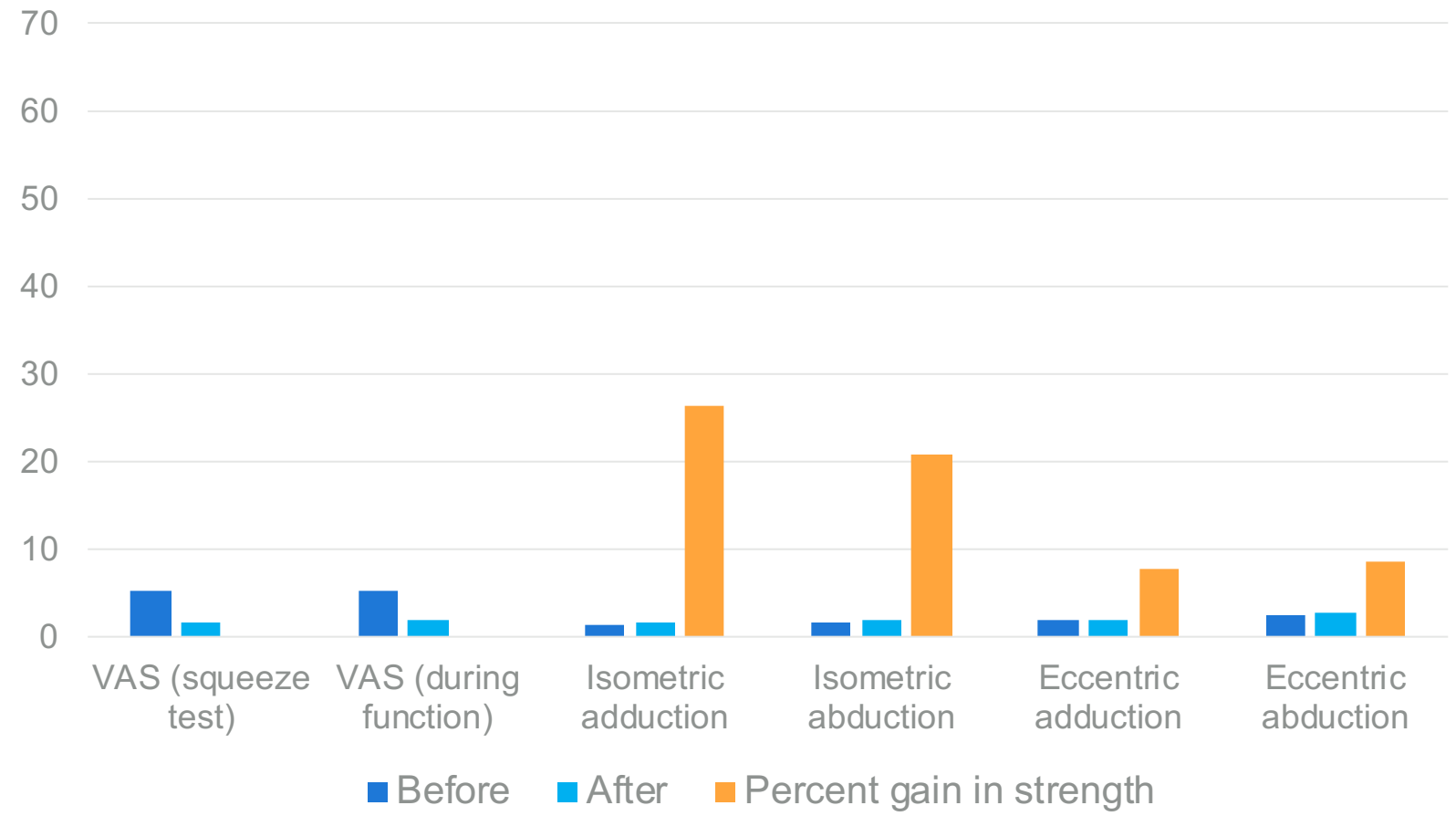
"Exercise Interventions for the Prevention and Treatment of Groin Pain and Injury in Athletes: A Critical and Systematic Review" (cont.)

Exercise programs consist of

- Hip strengthening (Iso, Con, Ecc)
- Abdominal strengthening
- Proprioceptive training
- Return to running program

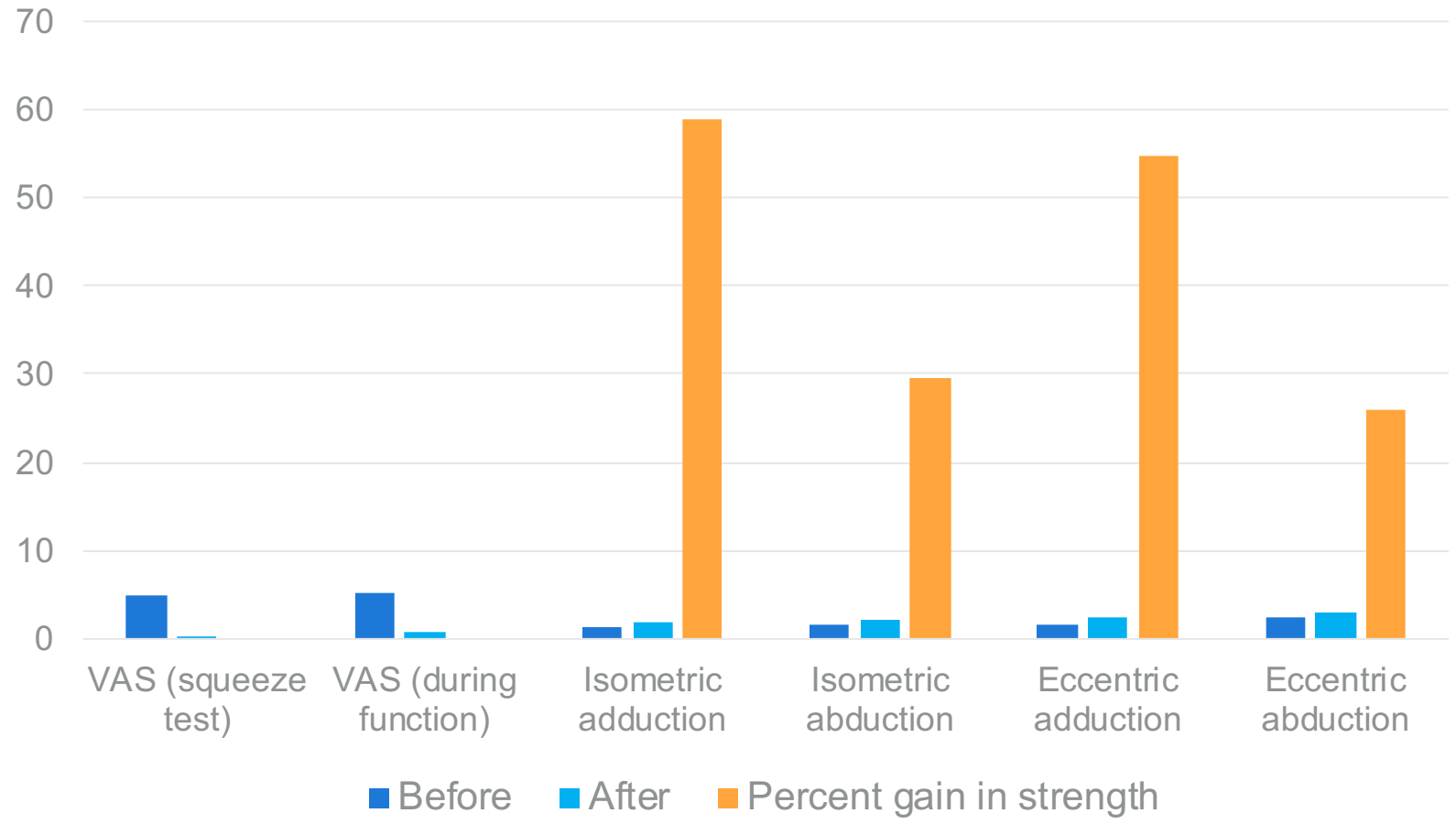
Charlton PC, Drew MK, Mentiplay BF, Grimaldi A, Clark RA. Exercise Interventions for the Prevention and Treatment of Groin Pain and Injury in Athletes: A Critical and Systematic Review. Sports Medicine. 2017;47(10):2011-2026. doi:10.1007/s40279-017-0742-y.

“Effect of Holmich Protocol Exercise Therapy on Long-Standing Adductor-Related Groin Pain in Athletes: An Objective Evaluation”



Yousefzadeh A, Shadmehr A, Olyaei GR, Naseri N, Khazaeipour Z. Effect of Holmich protocol exercise therapy on long-standing adductor-related groin pain in athletes: an objective evaluation. BMJ Open Sport Exerc Med. 2018;4(1):e000343. doi:10.1136/bmjsem-2018-000343.

“The Effect of Therapeutic Exercise on Long-Standing Adductor-Related Groin Pain in Athletes: Modified Holmich Protocol”



Yousefzadeh A, Shadmehr A, Olyaei GR, Naseri N, Khazaeipour Z. The Effect of Therapeutic Exercise on Long-Standing Adductor-Related Groin Pain in Athletes: Modified Hölmich Protocol. Rehabil Res Pract. 2018;2018(2):8146819–10. doi:10.1155/2018/8146819.

"Return to Sport After Criteria-Based Rehabilitation of Acute Adductor Injuries in Male Athletes: A Prospective Cohort Study"

- Program was supervised by a sports PT with face-to-face sessions offered **five times per week**
- Therapeutic ultrasound, lasers, dry needling, and other similar treatments were prohibited
  - **No fluff**
- Program consisted of **progressive loading** program
  - Adductor loading
  - Sprinting/running/agility training
  - Sport-specific training

Serner A, Weir A, Tol JL, et al. Return to Sport After Criteria-Based Rehabilitation of Acute Adductor Injuries in Male Athletes: A Prospective Cohort Study. Orthopaedic Journal of Sports Medicine. 2020;8(1):232596711989724–11. doi:10.1177/2325967119897247.

"Return to Sport After Criteria-based Rehabilitation of Acute Adductor Injuries in Male Athletes: A Prospective Cohort Study" (cont.)

- As many repetitions as possible (volitional failure) within a pain score of 2/10
- Athletes were encouraged to increase loading to perform exercises with minor pain

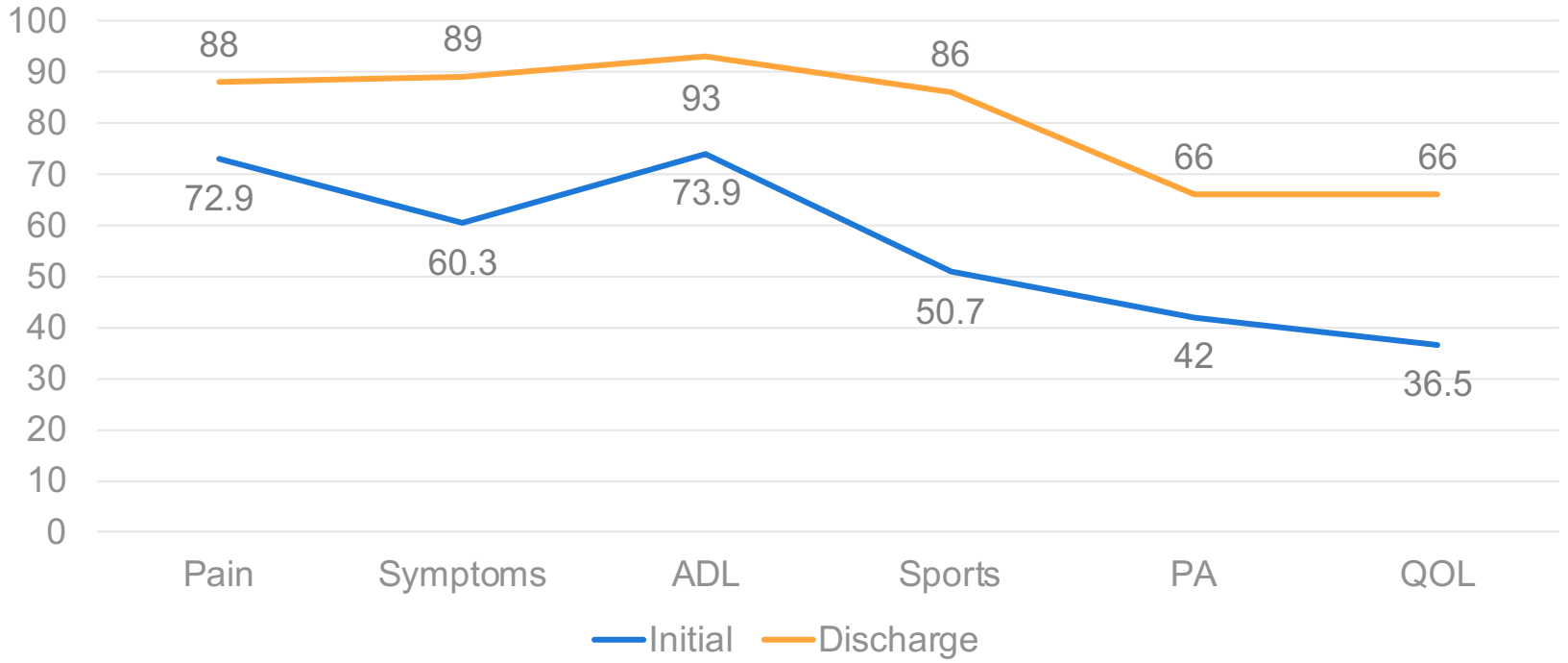
Serner A, Weir A, Tol JL, et al. Return to Sport After Criteria-Based Rehabilitation of Acute Adductor Injuries in Male Athletes: A Prospective Cohort Study. Orthopaedic Journal of Sports Medicine. 2020;8(1):232596711989724–11. doi:10.1177/2325967119897247.

"Return to Sport After Criteria-based Rehabilitation of Acute Adductor Injuries in Male Athletes: A Prospective Cohort Study" (cont.)

- One-year reinjury rate was **8%**
- Athletes who achieved RTS **milestone 1** had a statistically significantly lower reinjury rate
  - **5% vs. 21%**
- Athletes who achieved RTS **milestone 2** had a non-statistically significantly lower reinjury rate
  - **6% vs. 13%**

Serner A, Weir A, Tol JL, et al. Return to Sport After Criteria-Based Rehabilitation of Acute Adductor Injuries in Male Athletes: A Prospective Cohort Study. Orthopaedic Journal of Sports Medicine. 2020;8(1):232596711989724–11. doi:10.1177/2325967119897247.

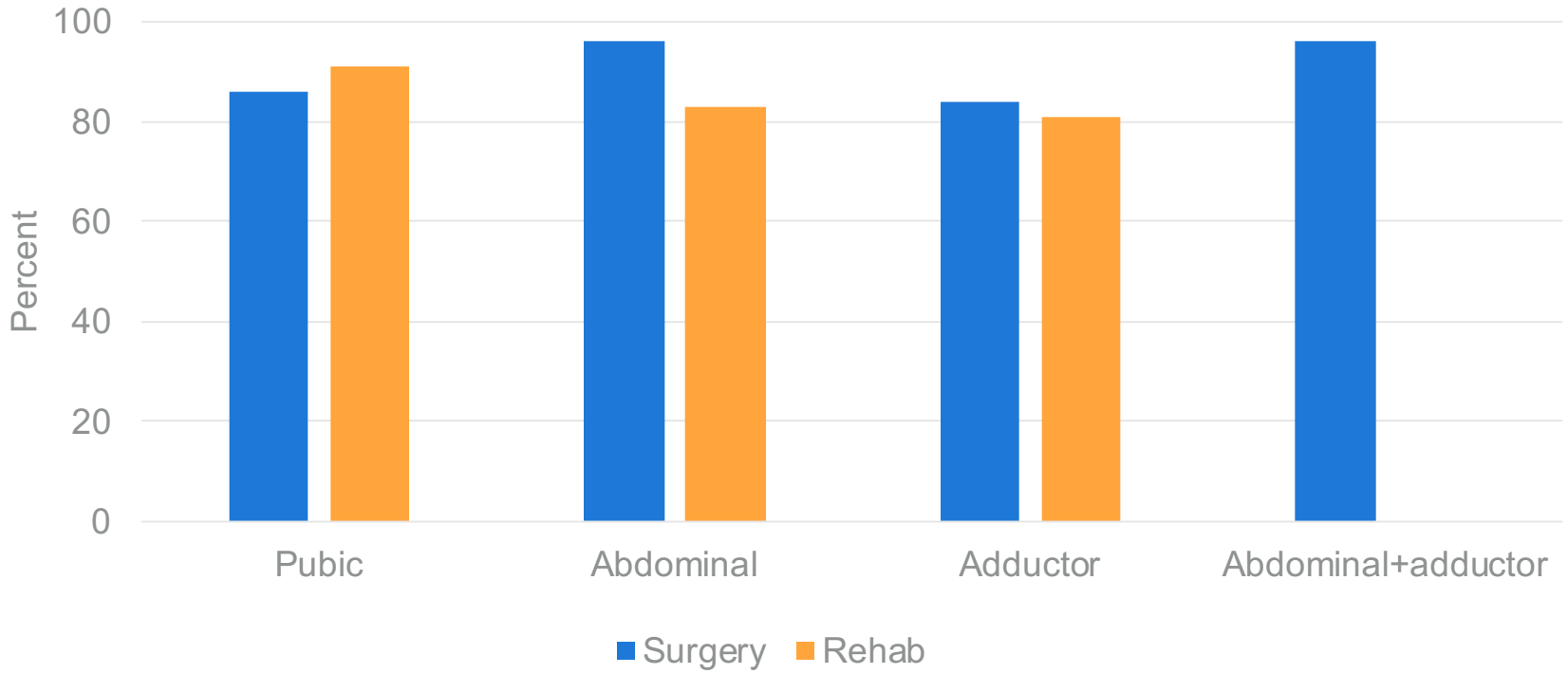
"Clinical and Biomechanical Outcomes of Rehabilitation Targeting Intersegmental Control in Athletic Groin Pain: Prospective Cohort of 205 Patients"



73% of patients returned to play pain-free at a mean of 9.9 weeks (±3.5)

King E, Franklyn-Miller A, Richter C, et al. Clinical and biomechanical outcomes of rehabilitation targeting intersegmental control in athletic groin pain: prospective cohort of 205 patients. British Journal of Sports Medicine. March 2018. doi:10.1136/bjsports-2016-097089.

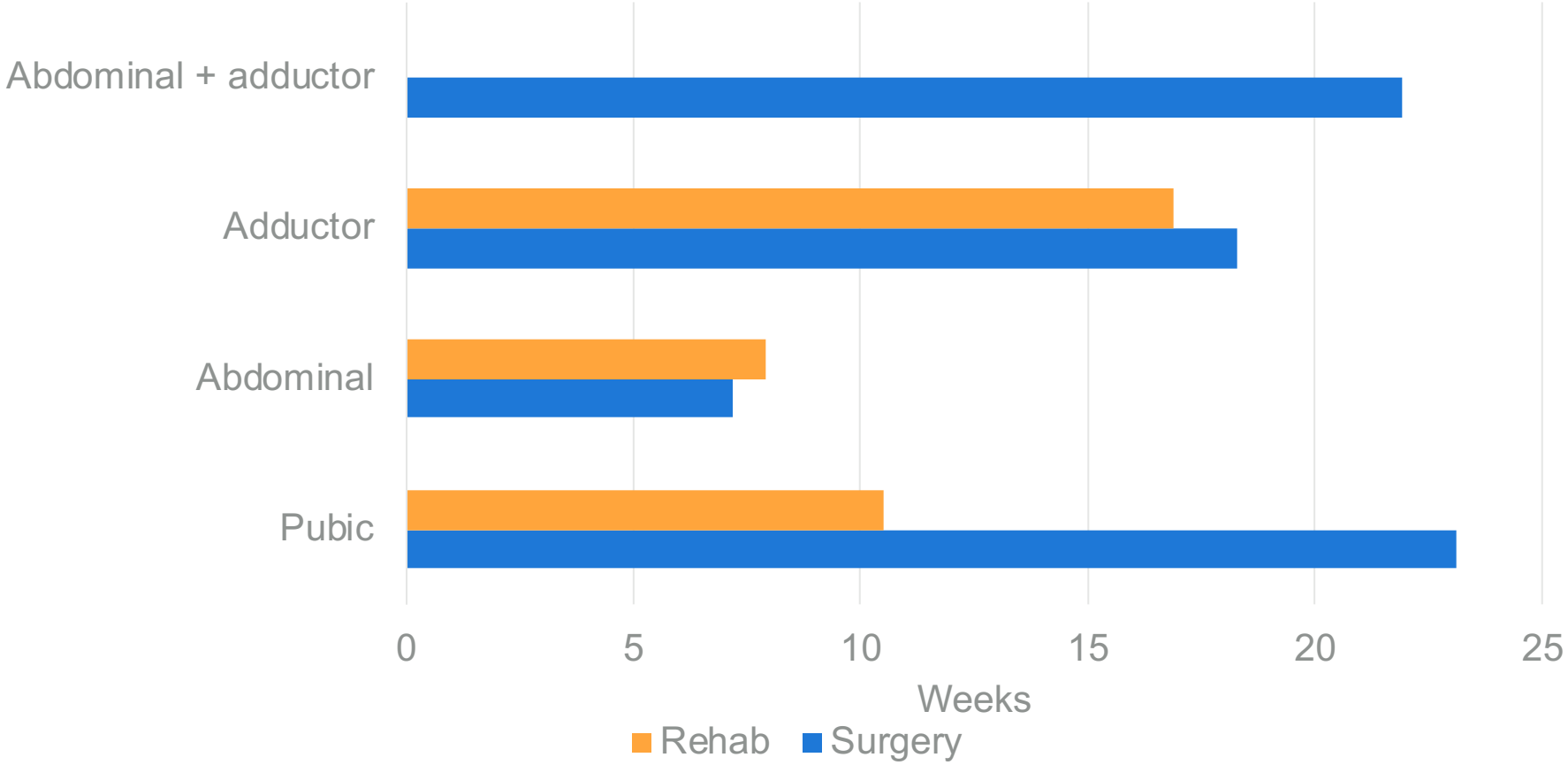
“Athletic Groin Pain: A Systematic Review and Meta-Analysis of Surgical Versus Physical Therapy Rehabilitation Outcomes”



Fifty-six papers (3,332 athletes) were included in the review

King E, Ward J, Small L, Falvey E, Franklyn-Miller A. Athletic groin pain: a systematic review and meta-analysis of surgical versus physical therapy rehabilitation outcomes. *British Journal of Sports Medicine*. 2015;49(22):1447-1451. doi:10.1136/bjsports-2014-093715.

"Athletic Groin Pain: A Systematic Review and Meta-analysis of Surgical Versus Physical Therapy Rehabilitation Outcomes" (cont.)



King E, Ward J, Small L, Falvey E, Franklyn-Miller A. Athletic groin pain: a systematic review and meta-analysis of surgical versus physical therapy rehabilitation outcomes. *British Journal of Sports Medicine*. 2015;49(22):1447-1451. doi:10.1136/bjsports-2014-093715.

Prevention?

"Exercise Interventions for the Prevention and Treatment of Groin Pain and Injury in Athletes: A Critical and Systematic Review"

- Two prospective RCTs (Soccer and hockey players)
- Adductor-related athletic pubalgia
- **Holmich et al., 2010**
  - Low risk of bias
  - Non-significant trend towards a favorable effect (hazard risk reduction)
- **Tyler et al., 2002**
  - Reduction in the incidence of strains compared with pre-intervention seasons was reported
  - Significant improvements in hip strength ratios in a sub-set of athletes who underwent strength reassessment in the subsequent season

Charlton PC, Drew MK, Mentiplay BF, Grimaldi A, Clark RA. Exercise Interventions for the Prevention and Treatment of Groin Pain and Injury in Athletes: A Critical and Systematic Review. Sports Medicine. 2017;47(10):2011-2026. doi:10.1007/s40279-017-0742-y.

Copenhagen Adduction

- The intervention group demonstrated a **35.7% increase in eccentric adduction** (P < .001)
- 20.3% increase in eccentric abduction (P = .003)
- 12.3% increase in EHAD/EHAB ratio (P = .019)
- **Peak normalized EMG**
  - Adductor longus: 108% (dominant), 69% (nondominant)
  - Gluteus medius: 20% (dominant), 48% (nondominant)

1. Ishøi L, Sørensen CN, Kaae NM, Jørgensen LB, Holmich P, Serner A. Large eccentric strength increase using the Copenhagen Adduction exercise in football: A randomized controlled trial. Scandinavian Journal of Medicine & Science in Sports. 2015;26(11):1334-1342. doi:10.1111/sms.12585.
2. Serner A, Jakobsen MD, Andersen LL, Hölmich P, Sundstrup E, Thorborg K. EMG evaluation of hip adduction exercises for soccer players: implications for exercise selection in prevention and treatment of groin injuries. British Journal of Sports Medicine. 2014;48(14):1108-1114. doi:10.1136/bjsports-2012-091746.

What is the most beneficial intervention in the prevention of groin pain in athletes?

A. Hip mobility training
B. Adductor eccentric training
C. Gluteus medius strengthening
D. Soft-tissue mobilization

"Including the Copenhagen Adduction Exercise in the FIFA 11+ Provides Missing Eccentric Hip Adduction Strength Effect in Male Soccer Player"

- Significantly greater increase in **eccentric hip adduction strength** of 0.29 Nm/kg (8.9%; P = .01)
- No within-group change was noted in the group that used the standard FIFA 11+ program

Harøy J, Thorborg K, Serner A, et al. Including the Copenhagen Adduction Exercise in the FIFA 11+ Provides Missing Eccentric Hip Adduction Strength Effect in Male Soccer Players: A Randomized Controlled Trial. Am J Sports Med. August 2017:363546517720194. doi:10.1177/0363546517720194.

"The Adductor Strengthening Programme Prevents Groin Problems Among Male Football Players: A Cluster-Randomized Controlled Trial"

- **Easiest (1A/B):** sidelying hip adduction
- **Moderate (2A/B):** the CA as previously described, but with a shorter lever arm
- **Hardest (3A/B):** the CA as previously described

Harøy J, Clarsen B, Wiger EG, et al. The Adductor Strengthening Programme prevents groin problems among male football players: a cluster-randomised controlled trial. British Journal of Sports Medicine. June 2018. doi:10.1136/bjsports-2017-098937.

"The Adductor Strengthening Programme Prevents Groin Problems Among Male Football Players: A Cluster-Randomized Controlled Trial" (cont.)

Week	Weekly sessions	Sets (per side)	Reps (per side)
Preseason: week 1	2	1	3–5
2	3	1	3–5
3–4	3	1	7–10
5–6	3	1	12–15
7–8	2	1	12–15
In season	1	1	12–15

Harøy J, Clarsen B, Wiger EG, et al. The Adductor Strengthening Programme prevents groin problems among male football players: a cluster-randomised controlled trial. British Journal of Sports Medicine. June 2018. doi:10.1136/bjsports-2017-098937.

"The Adductor Strengthening Programme Prevents Groin Problems Among Male Football Players: A Cluster-Randomized Controlled Trial" (cont.)

- Weekly prevalence of all groin problems
  - Intervention group: 13.5%
  - Control group: 21.3%
  - **41% reduction in control group (statistically significant)**
- Weekly prevalence of 'substantial' groin problems
  - Intervention group: 5.7%
  - Control group: 8.0%
  - **18% reduction in control group (non-significant)**

Harøy J, Clarsen B, Wiger EG, et al. The Adductor Strengthening Programme prevents groin problems among male football players: a cluster-randomised controlled trial. British Journal of Sports Medicine. June 2018. doi:10.1136/bjsports-2017-098937.

Reverse Nordic Hamstring

- **Significant increase** in the RF muscle fascicle length, muscle thickness, pennation angle, and cross-sectional area
- After the detraining period FL, MT, PA and CSA showed a **significant decrease**

Alonso-Fernandez D, Fernandez-Rodriguez R, Abalo-Núñez R. Changes in rectus femoris architecture induced by the reverse nordic hamstring exercises. J Sports Med Phys Fitness. October 2018. doi:10.23736/S0022-4707.18.08873-4.

Summary

- Break your evaluation into the defined clinical entities
- Progressive loading and return to sport programs are effective
- Utilizing the Copenhagen adduction exercise can significantly decrease the likelihood of adductor related pain

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