

# Hip Cartilage Defects in Elite Athletes: Their Association with Specific Sports and 'At-risk' Motions

Spencer M. Comfort, MD, Aaron J. Casp, MD, Hannah K. Day, MD,  
Karen K. Briggs, MPH, Marc J. Philippon, MD



Steadman Philippon Research Institute  
Vail, Colorado, USA

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# DISCLOSURES

- SMC, AJC, HKD, KKB have nothing to disclose
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# BACKGROUND

- High impact activities such as athletics has been found to be associated with chondral injuries, and repetitive loading or trauma can lead to osteoarthritis over time
- Chondral lesions of the hip in athletes cause pain and worsening of their performance
- Chondral lesions of the hip usually do not occur in isolation, and are often associated with labral tearing, loose bodies, or hip instability
- Femoroacetabular impingement (FAI) has been shown to be associated with chondral defects in the hip

Relationship between offset angle alpha and hip chondral injury in femoroacetabular impingement.

Johnston TL, Schenker ML, Briggs KK, Philippon MJ.

Arthroscopy. 2008 Jun;24(6):669-75. doi: 10.1016/j.arthro.2008.01.010. Epub 2008 Mar 17.



**TABLE 3. Hip Damage Versus Offset Angle Alpha**

Area of Damage	Mean Offset Angle Alpha (Range)
Acetabulum	
No cartilage defect	49° (38°-72°)
Cartilage defect (any size)	55° (29°-80°)
Large defects (>1.5 cm)	63° (35°-76°)
No cartilage delamination	51° (29°-75°)
Full-thickness delamination	60° (35°-80°)
Labrum	
No labral tear	50° (34°-79°)
Labral tears	56° (29°-80°)
Midsubstance tear	51° (34°-79°)
Labral base tear	57° (29°-80°)
Femoral head	
No cartilage defect	54° (29°-75°)
Cartilage defect (any size)	57° (35°-80°)

Cutting, Impingement, Contact, Endurance, Flexibility, and Asymmetric/Overhead Sports: Is There a Difference in Return-to-Sport Rate After Arthroscopic Femoroacetabular Impingement Surgery? A Systematic Review and Meta-analysis.

Bolia IK, Ihn H, Kang HP, Mayfield CK, Briggs KK, Bedi A, Jay Nho S, Philippon MJ, Weber AE.

Am J Sports Med. 2021 Apr;49(5):1363-1371. doi: 10.1177/0363546520950441. Epub 2020 Sep 10.



Return to Sport After Hip Arthroscopy for Femoroacetabular Impingement Syndrome in NCAA Division I Athletes: Experience at a Single Institution.

Weber AE, Nakata H, Mayer EN, Bolia IK, Philippon MJ, Snibbe J, Romano R, Tibone JE, Gamradt SC.

Orthop J Sports Med. 2020 May 22;8(5):2325967120918383. doi: 10.1177/2325967120918383.



**TABLE 5**  
Distribution of Arthroscopic Hip Procedures Among the 6 Sport Categories Based on the Studies<sup>a</sup>

Procedure	Cutting	Impingement	Contact	Endurance	Flexibility	Asymmetric / Overhead
Rate of studies reporting						
Procedures performed	5/8 (62.5)	4/6 (66.6)	3/7 (42.8)	4/5 (80)	2/3 (66.6)	5/9 (55.5)
Management of hip capsule	3/8 (37.5)	0/6 (0)	1/7 (14.2)	4/5 <sup>b</sup> (80)	1/3 (33.3)	3/9 (33.3)
Labral						
Debridement	19/185 (10.2)	19/258 (7.4)	20/304 (6.5)	13/207 (6.2)	2/116 (1.7)	73/356 (20.5)
Repair	88/185 (47.5)	106/258 (41)	87/304 (28.6)	169/207 (81.6)	107/116 (92.2)	100/356 (28)
Reconstruction	11/185 (5.9)	7/258 (2.7)				4/356 (1.1)
Microfracture (any site)	20/185 (10.8)	12/258 (4.6)	26/304 (8.5)	4/207 (1.9)		3/356 (0.8)
Ligamentum teres debridement	20/185 (10.8)			24/207 (11.5)		37/356 (10.3)
Subspine decompression	4/185 (2.2)		28/304 (9.2)			

<sup>a</sup>Values are presented as n/N (%).

<sup>b</sup>The capsule procedure was provided for 194 hips in the endurance subgroup: capsule release in 21 (11%) and capsule closure or plication in 173 (89%).

**TABLE 1**  
Characteristics and Preoperative and Intraoperative Data for Collegiate Athletes by Sport Type<sup>a</sup>

	Cutting	Flexibility	Contact	Impingement	Asymmetric/ Overhead	Endurance	Total
Total index hips [athletes]	2 (4.1) [1 (2.6)]	0 (0.0) [0 (0.0)]	16 (32.7) [15 (38.5)]	13 (26.5) [8 (20.5)]	7 (14.3) [6 (15.4)]	11 (22.4) [9 (23.1)]	49 (100) [39 (100)]
Sex							
Male	0 (0.0)	0 (0.0)	14 (87.5)	12 (92.3)	7 (100)	5 (45.5)	38 (77.6)
Female	2 (100) <sup>b</sup>	0 (0.0)	2 (12.5)	1 (7.7)	0 (0.0)	6 (54.5) <sup>b</sup>	11 (22.4)
Preoperative data							
Laterality (right)	1 (50)	0 (0.0)	10 (62.5)	8 (61.5)	6 (85.7)	6 (54.5)	31 (63.3)
FAI type <sup>c</sup>							
Mixed	0 (0.0)	0 (0.0)	12 (75.0)	9 (69.2)	3 (42.9)	8 (72.7)	32 (65.3)
Isolated cam type	2 (100)	0 (0.0)	4 (25.0)	4 (30.8)	3 (42.9)	3 (27.3)	16 (32.7)
Isolated pincer type	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (14.3)	0 (0.0)	1 (2.0)
Intraoperative data <sup>c</sup>							
Labral tear	2 (100)	0 (0.0)	16 (100)	13 (100)	7 (100)	11 (100.0)	49 (100.0)
Labral repair	2 (100)	0 (0.0)	8 (50.0)	11 (84.6)	5 (71.4)	10 (90.9)	36 (73.5)
Labral debridement	0 (0.0)	0 (0.0)	8 (50.0) <sup>b</sup>	1 (7.7)	2 (28.6)	0 (0.0) <sup>b</sup>	11 (22.4)
Synovectomy	0 (0.0)	0 (0.0)	10 (62.5)	7 (5.4)	5 (71.4)	9 (81.8)	31 (63.3)
Acetabular rim trimming	0 (0.0)	0 (0.0)	6 (37.5)	5 (38.5)	2 (28.6)	2 (18.2)	15 (30.6)
Femoral osteochondroplasty	2 (100)	0 (0.0)	15 (93.8)	11 (84.6)	6 (85.7)	5 (45.5) <sup>b</sup>	39 (79.6)
Microfracture/abrasion chondroplasty	0 (0.0)	0 (0.0)	6 (37.5)	1 (7.7)	2 (28.6)	1 (9.1)	10 (20.4)
Other—loose body, HO removal, iliopsoas release	0 (0.0)	0 (0.0)	1 (6.3)	1 (7.7)	1 (14.2)	0 (0.0)	3 (6.1)

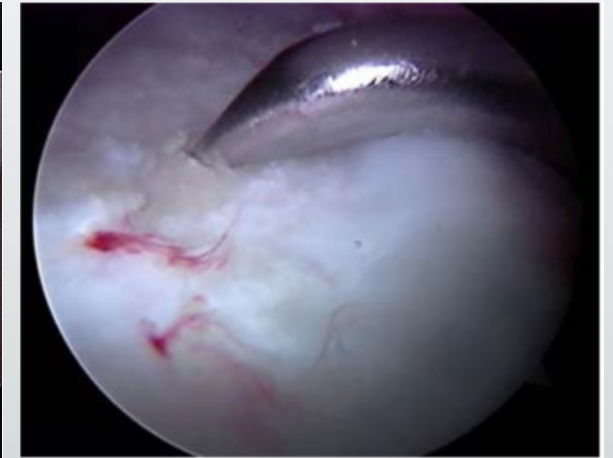
<sup>a</sup>Data are expressed as n (%). FAI, femoroacetabular impingement; HO, heterotopic ossification.

<sup>b</sup>Significantly different from group by post hoc testing of chi-square-adjusted residuals.

<sup>c</sup>According to number of hips.

# BACKGROUND

- Treatment of these full thickness lesions can be controversial, though microfracture has demonstrated good return to sport rates and functional outcomes in athletes
- there is a relative gap in the literature associating specific sports with corresponding cartilaginous injuries of the hip in elite or professional athletes
- Understanding the associations of sports with their risks of chondral injury in the hip is clinically valuable to appropriately tailor treatment strategies and patient counseling

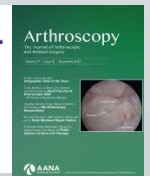


Return to play after hip arthroscopy with microfracture in elite athletes.

McDonald JE, Herzog MM, Philippon MJ.

Arthroscopy. 2013 Feb;29(2):330-5. doi: 10.1016/j.arthro.2012.08.028. Epub 2013 Jan 3.

PMID: 23290181



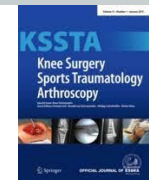
- 77% (30/39) elite athletes returned to play

Performance outcomes in professional hockey players following arthroscopic treatment of FAI and microfracture of the hip.

McDonald JE, Herzog MM, Philippon MJ.

Knee Surg Sports Traumatol Arthrosc. 2014 Apr;22(4):915-9. doi: 10.1007/s00167-013-2691-9.

Epub 2013 Oct 17.



- 82% (14/17) athletes returned to play

# PURPOSE

To determine the prevalence of chondral defects among elite athletes and determine the association between type of biomechanical stress in a sport and corresponding articular cartilage injury patterns in the hip

# METHODS

## **Study Design:** Case series

## **Patient Selection:**

- Underwent primary hip arthroscopy for treatment of FAI between January 2005 and November 2018

## **Exclusion Criteria:**

- Prior ipsilateral hip surgery
- Age <18
- Presence of advanced osteoarthritis (Tonnis grade >1 or joint space <2 mm)

## **Study Measurements:**

- Demographics (Age, Gender, Sport)
- Chondral Damage Data
  - Outerbridge score
  - Location of lesion (Acetabulum, Femoral head)
  - Size of lesion (area in mm<sup>2</sup>)
  - Cartilage pattern (Diffuse, Delamination, Wave Sign)
- Arthroscopic Hip Procedures Performed

# METHODS

Patients were then classified by their sport into a novel classification system based on 'at-risk' hip motions: rotational, repetitive loading, extreme ROM, contact, and high speed



Sport	Motion Classification
Baseball	Rotational, Repetitive
Basketball	Rotational
Cycling	Repetitive, High-speed
Dance	Rotational, Repetitive, Extreme
Equestrian	Repetitive
Field Hockey	Rotational
Football	Contact, Rotational
Golf	Rotational, Repetitive
Gymnastics	Rotational, Repetitive, Extreme
Hockey	Contact, Rotational, Repetitive
Figure Skating	Rotational, Repetitive, Extreme
Kayak	Repetitive
Martial Arts	Contact, Rotational, Repetitive, Extreme
Rodeo	Contact
Shooting	Repetitive
Ski/Snowboard	Rotational, High-speed
Soccer	Rotational
Softball	Rotational, Repetitive
Speed Skating	Repetitive
Tennis	Rotational, Repetitive
Track/Run	Repetitive
Triathlete	Repetitive, High-speed
Weightlifting	Repetitive
Wrestling	Rotational, Contact, Extreme

# RESULTS

- 431 hips met inclusion criteria
- 107 female, 324 male
- Mean age at time of surgery:  $26.8 \pm 5.1$  years (range: 18.2 – 44.5)
- 24 sports represented
  - Most common: hockey, football, baseball

Sport	Motion Classification	Number of athletes
Baseball	Rotational, Repetitive	51
Basketball	Rotational	18
Cycling	Repetitive, High-speed	7
Dance	Rotational, Repetitive, Extreme	24
Equestrian	Repetitive	2
Field Hockey	Rotational	2
Football	Contact, Rotational	56
Golf	Rotational, Repetitive	20
Gymnastics	Rotational, Repetitive, Extreme	11
Hockey	Contact, Rotational, Repetitive	90
Figure Skating	Rotational, Repetitive, Extreme	11
Kayak	Repetitive	1
Martial Arts	Contact, Rotational, Repetitive, Extreme	4
Rodeo	Contact	3
Shooting	Repetitive	1
Ski/Snowboard	Rotational, High-speed	35
Soccer	Rotational	29
Softball	Rotational, Repetitive	1
Speed Skating	Repetitive	1
Tennis	Rotational, Repetitive	19
Track/Run	Repetitive	28
Triathlete	Repetitive, High-speed	1
Weightlifting	Repetitive	8
Wrestling	Rotational, Contact, Extreme	8



# RESULTS

- Chondral defects (Grade 1-4) were found in 408 hips (95%)
- Severe lesions (Grade 3 or 4) were seen in 218 hips (51%)
  - Femoral head – 65 hips
  - Acetabulum – 85 hips
  - Bipolar – 68 hips
- Grade 3/4 lesions most commonly found in football, soccer, and baseball players
- Femoral head lesions were most prevalent on the anterior/lateral surface of the peripheral compartment
- Acetabular defects were most prevalent on the anterosuperior position (12 to 3 o'clock)
- Microfracture was performed in 72 (17%) of total cases

<b>Total, n</b>	<b>431</b>
<b>Chondral defect (0-4)</b>	408 (95%)
<b>Chondral defect (3-4)</b>	218 (51%)
Femoral Head Only	65 (15%)
Acetabulum Only	85 (20%)
Both	68 (16%)
<b>Rim Fracture</b>	36 (8%)
<b>Microfracture</b>	72 (17%)
Femoral Head Only	14 (3%)
Acetabulum Only	48 (11%)
Both	10 (2%)
<b>FAI treatment</b>	
Femoral osteoplasty	34 (8%)
Rim trimming	9 (2%)
Both	388 (90%)
<b>Labral treatment</b>	
Debridement	4 (1%)
Repair	400 (93%)
Reconstruction	27(6%)
<b>Loose body removal</b>	63 (15%)
<b>Synovectomy</b>	427 (99%)
<b>Ligamentum teres treatment</b>	406 (94%)
Debridement	5 (1%)
Repair	

# RESULTS

Figure 1. Prevalence of Chondral Defects Grade III/IV on Acetabular Surface

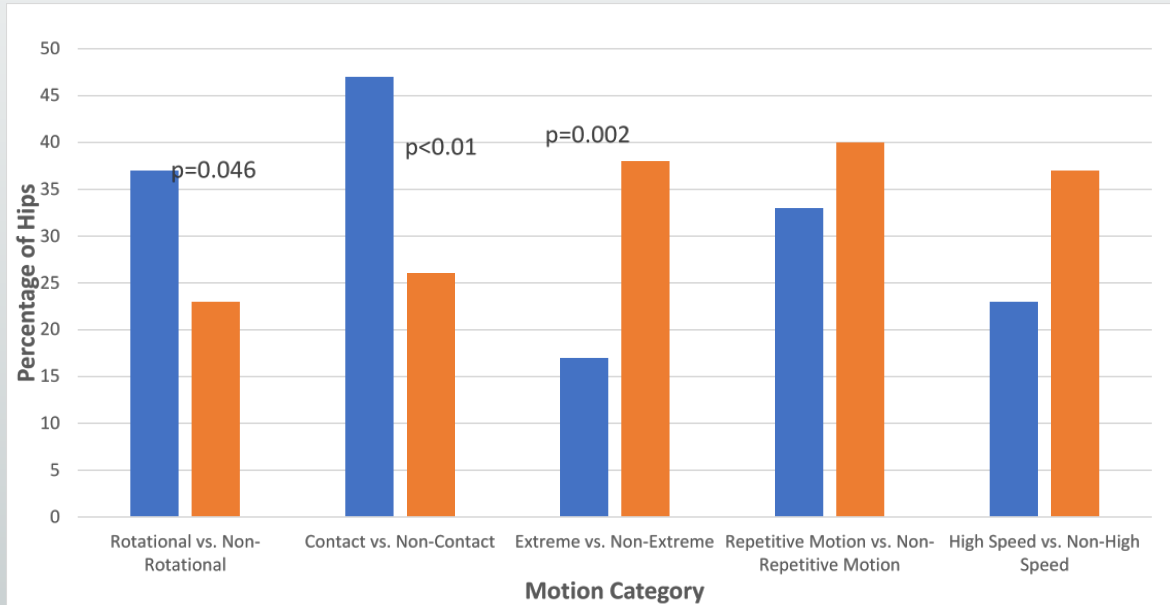
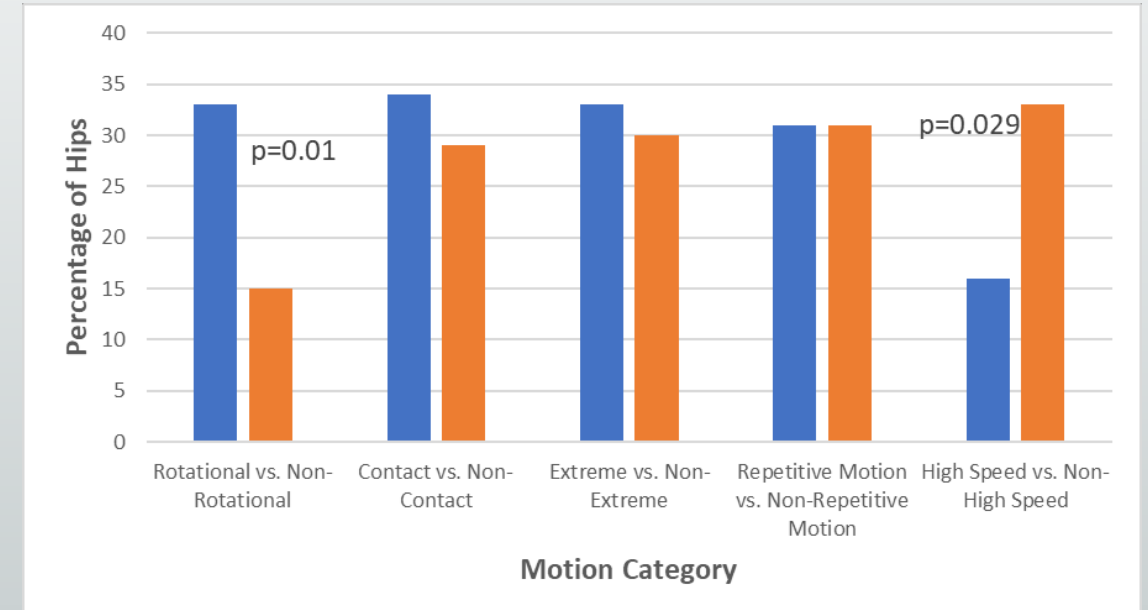


Figure 2. Prevalence of Chondral Defects Grade III/IV on Femoral Head



There was significantly higher prevalence of acetabular ( $p=.046$ ), femoral head ( $p=.038$ ), and combined ( $p=.035$ ) grade III/IV lesions in the rotational versus non-rotational group, as well as acetabular ( $p<.001$ ) and combined ( $p=.018$ ) grade 3/4 lesions in the contact sport group versus non-contact group.

# CONCLUSION

- The prevalence of chondral injuries is high in elite athletes undergoing hip arthroscopy for FAI
- The more severe defects were common in rotational and contact athletes
- This classification system can be used to identify athletes at risk of chondral damage for close monitoring and injury prevention
- Further study is needed to determine how these chondral injuries translate to career longevity

# THANK YOU!



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