Cyclists Have Greater Chondromalacia Index Than Age-Matched Controls at the Time of Hip Arthroscopy

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Purpose: To evaluate the clinical symptoms and intraoperative pathology associated with hip pain in the cyclist compared with a matched hip arthroscopy surgical group. **Methods:** In an institutional review board—approved study, we retrospectively reviewed a prospective database of 1,200 consecutive hip arthroscopy patients from 2008 to 2015. Adult patients were identified who reported cycling as a major component of their activity. Patients were age, gender, and body mass index matched to a control, noncycling group. Pain symptoms, preoperative examinations, radiographic and operative findings were compared. Primary outcome variables included the femoral and acetabular Outerbridge chondromalacia grade. Additional outcome measurements included the involved area and the chondromalacia index (CMI; the product of the Outerbridge chondromalacia grade and surface area [$mm^2 \times$ severity]). **Results:** A total of 167 noncyclists were matched to the cycling group ($n = 16$). Cyclists had significantly greater femoral head chondromalacia grade (2.0 [95% confidence interval (CI), 1.5-2.5] *v* 1.4 [95% CI, 1.3-1.6], $P = .043$), femoral head chondromalacia area (242 mm^2 [95% CI, 191-293 mm^2] *v* 128 mm^2 [95% CI, 113-141 mm^2], $P < .001$), and femoral head CMI (486 [95% CI, 358-615] *v* 247 [95% CI, 208-286], $P = .001$) assessed intraoperatively. Hip pain in cyclists positively correlated with an increased acetabular center-edge angle ($R = 0.261$, $P < .001$) and an increased Tonnis grade ($R = 0.305$, $P < .001$). Cyclists were also more likely to have a coxalgic gait on physical examination ($R = 0.250$, $P = .006$). **Conclusions:** Cyclists had a greater degree of femoral chondromalacia than a matched group of noncyclists. Cycling activity positively correlated with the presence of femoral chondromalacia with clinically significant gait alterations. These data support the hypothesis that cyclists with hip pain have more chondral pathology than a similar group of other patients with hip pain. Ultimately, cyclists with hip pain should be identified as higher risk for more advanced chondral damage. **Level of Evidence:** Level III, case-control study, therapeutic.

Cycling continues to grow in popularity as a recreational and competitive sport. The number of Americans riding 100 days or more in the United States increased by 12% from 2000 to 2010.[1] USA Cycling reported steady increases in competitive cycling licenses, with a 78% increase between 2002 and 2013.[2] Although tendonitis and bursitis about the hip and the knee are attributed to abnormal repetitive motion, poor positioning, or inadequate recovery time,[3] intra-articular hip pain in cyclists remains poorly studied.

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Hip joint pain in active sporting populations is widely recognized and is frequently attributable to intra-articular pathology.[4] In a review of more than 890 cases, Rankin et al.[4] identified that the majority of intra-articular hip pain in the sporting population was related to femoroacetabular impingement (40%), labral tears (33%), and osteoarthritis (24%). Hip arthroscopy is effective in treating hip pain in athletes and returning them to a high level of sporting activity.[5,6] The majority of the successful hip arthroscopies and return to sport did not focus on endurance athletes or low-impact exercises. A case series of elite long-distance runners identified a high rate of labral tears with an increase in chondral wear.[7] In light of these findings, we sought to examine cyclists undergoing hip arthroscopy and compare them to a matched surgical noncyclist group. A better understanding of the etiology of hip pain in cyclists would improve preoperative consultation and postoperative expectations, especially if cyclists had a greater degree of chondromalacia. The purpose of this study was to evaluate clinical symptoms and intra-operative pathology associated with hip pain in the cyclist compared with a matched hip arthroscopy surgical group. We hypothesized that cyclists would have a higher hip chondromalacia grade than noncyclists in a matched hip arthroscopy surgical group.

Methods

This study was approved by our institutional review board. A surgical database containing 1,200 patients treated between 2008 and 2015 was retrospectively reviewed. Patient inclusion criteria included adult patients (age ≥18 years), unilateral hip pain caused by chondrolabral dysfunction that was not alleviated by conservative management for a minimum of 12 weeks. Included patients were without or with limited evidence of radiographic osteoarthritis as defined by Tonnis grade 0 or 1. Patient exclusion criteria included previous ipsilateral hip arthroscopy or prior hip surgery, radiographic evidence of osteoarthritis (Tonnis grade >1), congenital hip deformity, and no prior disease such as avascular necrosis or slipped capital femoral epiphysis. We defined a high rate of cycling as at least 100 miles per week.[8] This level of cycling is based on the results from a cycling club survey, regional cycling club training trends, and the authors' personal experience.[8] This distance accommodates 1 to 2 training rides during the workweek and 1 to 2 long rides on the weekend, which is consistent with cycling club rides (www.usacycling.org/clubs). Patient-reported pain symptoms, preoperative examinations, radiographic markers, and operative findings were compared. Pain symptoms analyzed included the location of the pain, the presence of mechanical symptoms, the timing of the pain, and activities that produced the pain. All patient-reported symptoms and physical examination findings were collected by the senior author (A.J.S.) during the initial interview and physical examination using a standardized induction sheet and history and physical examination sheet. Pain on physical examination was identified as tenderness to palpation in the reported anatomic site or as pain with a provocative test when applicable. Straight leg raise is graded using the standard Medical Research Council 5-point muscle grading system and was manually determined by the senior author.[9] Radiographic Tonnis grading was completed to exclude advanced osteoarthritis and all patients presented with or underwent magnetic resonance imaging prior to surgical intervention.

Our primary outcome variables were the femoral and acetabular Outerbridge chondromalacia grade determined at the time of hip arthroscopy. Secondary outcome variables include the chondromalacia area and the chondromalacia index (CMI). The CMI is calculated as a product of the Outerbridge chondromalacia grade and surface area ($mm^2 \times$ severity) and serves as a method for quantifying early arthritic change.[10]

All hip arthroscopy was performed in the supine position using a standard 2-portal technique as described.[11,12] Additional procedures were performed as indicated.

Statistical Analysis

Patient characteristics, symptoms, and physical examination findings were analyzed with Levene test for variance and subsequently analyzed by independent-sample t tests with bootstrapping (n = 1,000). Correlations were determined using Spearman rho. Comparisons between operative findings were performed using the Mann-Whitney test. Significance was set at $P \leq .05$, and all confidence intervals are reported at 95%.

Results

Of the 1,200 operative patients reviewed, 726 patients met the initial inclusion criteria. Sixteen patients reported cycling as a major component of their activity as defined by cycling more than 100 miles per week. A total of 710 adult patients then remained eligible for inclusion in the study. The remaining patients were age, gender, and body mass index matched to the cycling group to form a control, noncyclist operative group (n = 167). Demographic parameters were not significantly different. Mean age in the cycling group was 38.6 years (standard deviation = 9.55 years) and 36.0 years (standard deviation = 8.57 years; $P = .256$). Body mass index was not significantly different between cyclists and controls ($P = .276$). The cyclist group consisted of 31% women and the control group was 36% women, which was not significantly different ($P = .711$). Female patients with symptomatic hip pain amenable to arthroscopic intervention comprise a significant majority of the senior author's practice, and a

Table 1. Demographic Comparison Between Cyclists and Controls

	Controls	Cyclists	*P* Value
Number	167	16	
Age, yr, mean ± SD	36.0 ± 8.57	38.6 ± 9.55	.256
BMI, mean ± SD	24.5 ± 2.83	25.3 ± 3.58	.276
Gender, % female	36	31	.711
Operative extremity, % right	53	56	.787
Duration of pain, months, mean (range)	33.1 (3-213)	22.6 (3-69)	.578
Known traumatic event	24	60	.090
Previous intra-articular hip injection	45.7	30.7	.389
Previous ipsilateral hip arthroscopy	0	0	>.99
Previous contralateral hip arthroscopy	0.6	0	>.99
History of previous ipsilateral knee surgery	10	25	.083
History of previous contralateral knee surgery	6	0	.608

NOTE. Values are percentages unless otherwise noted.
BMI, body mass index; SD, standard deviation.

greater number is consequently available to precisely match the cycling group. The operative lower extremity did not differ between cyclists and control patients ($P = .787$). A discrete history of pain associated with a traumatic event was not significantly different between cyclists and controls (Table 1; $P = .090$); however, 5 of 6 cyclists who reported a traumatic association experience pain onset during cycling.

In the control group, 33% of patients reported significant activity levels above their activities of daily living. Running (14) was most commonly reported, with 5 people reporting high level running for marathon training (3) and competitive track (2). Additional activities reported include gym training and fitness classes (10), soccer (6), golf (5), tennis (4), baseball (4), basketball (3), yoga (3), waterskiing (2), football (2), rowing (2), and one each for ice hockey, skiing, martial arts, volleyball, and dancing.

Both cyclists and noncyclists reported similar symptoms (Table 2). Cyclists were more likely to have tried nonsteroidal anti-inflammatory drugs ($R = 0.178$, $P = .005$). There were no additional statistical differences between reported location of pain about the hip between cyclists and control patients (Table 2).

Table 2. Patient-Reported Symptoms in Cyclists and Matched Controls

	Cyclists, %	Controls, %	*P* Value
Anterior hip pain	63	44	.192
Anterolateral hip pain	44	49	.795
Lateral hip pain	13	13	>.99
Posterolateral hip pain	13	14	>.99
Posterior hip pain	6.3	9.6	>.99
Groin pain (anterior joint line)	0	9.6	.368
Mechanical symptoms	40	57	.279
Pain with sitting	88	86	>.99
Pain in the car	75	77	.767
Pain with walking	88	79	.742
Pain with rising	63	45	.199
Pain with crossing legs	69	60	.599
Pain at night	44	61	.189
Pain with putting on shoes	47	40	.774
Pain with pivoting	73	85	.286
Pain with increased activity	93	97	.456
Pain with running	87	92	.614

Table 3. Physical Examination Findings Between Cyclists and Matched Controls

	Cyclist	Control	*P* Value
Operative side			
Sacroiliac tenderness	56	57	1.00
Greater trochanter tenderness	44	53	.60
Terminal hip flexion, degrees, mean (95% CI)	98 (92-105)	95 (92-97)	.34
Internal rotation, degrees, mean (95% CI)	5.4 (0.41-10)	7.1 (5.3-8.9)	.51
FABER test, cm, mean (95% CI)	28 (22-34)	25 (23-27)	.28
Straight leg raise, out of 5, mean (95% CI)	4.6 (4.1-5.0)	4.1 (3.9-4.3)	.094
FAIR test	88	92	.72
EAER test	56	60	.87
Medial joint line tenderness	69	89	**.041**
Posterior joint line tenderness	67	26	**.002**
Adductor longus tenderness	6.2	40	**.007**
Nonoperative side			
Sacroiliac tenderness	13	18	.74
Greater trochanter tenderness	6.3	10	>.99
Terminal hip flexion, degrees, mean (95% CI)	103 (96-110)	104 (101-106)	.78
Internal rotation, degrees, mean (95% CI)	7.9 (2.8-13)	13 (11-15)	.07
FABER test, cm, mean (95% CI)	17 (13-21)	15 (14-17)	.44
Straight leg raise, out of 5, mean (95% CI)	5.0 (4.4-5.5)	4.6 (4.4-4.8)	.26
FAIR test	38	23	.22
EAER test	6.3	7.8	>.99
Medial joint line tenderness	31	28	.77
Posterior joint line tenderness	6.7	4.6	.93
Adductor longus tenderness	13	10	.67

NOTE. Values are percentages unless otherwise noted. Bold denotes statistical significance. All tenderness values are reported as percent positive. Straight leg raise is graded using the standard Medical Research Council 5-point muscle grading system.[9]

CI, confidence interval; EAER, extension abduction external rotation; FABER test, flexion abduction external rotation; FAIR, flexion adduction internal rotation.

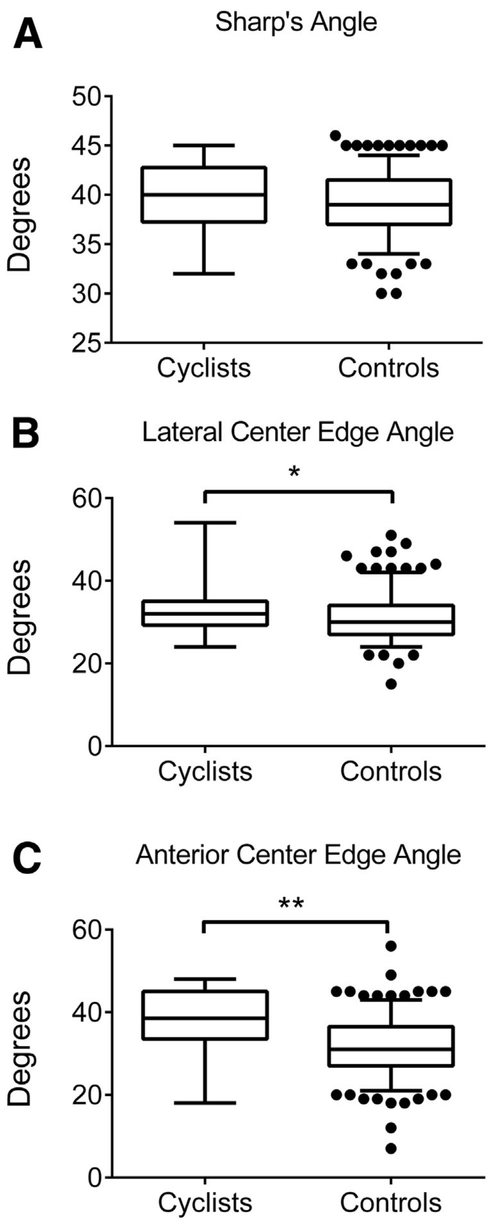

Fig 1. Radiographic measurements in cyclists and controls undergoing hip arthroscopy. (A) Sharp angle. (B) Acetabular lateral center-edge angle. (C) Acetabular anterior center-edge angle. All box and whisker plots have the box at the 25th-75th percentile and the whiskers from the 5th to 95th percentile. Outliers are denoted by the dots. $^{*}P < 0.05$; $^{**}P < .01$.

On physical examination, cyclists were more likely to have a coxalgic gait ($R = 0.250$, $P = .006$). Terminal hip flexion on the operative side was greater than controls (100° *v* 94°, $P = .046$; Table 3). Cyclists had greater hip flexor strength than control patients, but the difference was not statistically significant ($P = .094$; Table 3). Cyclists had greater anterior and posterior joint line tenderness (respectively, $P = .041$ and $P = .002$; Table 3) but less adductor longus tenderness on the operative extremity ($P = .008$; Table 3). Physical examination of the nonoperative extremity did not differ significantly between groups (Table 3).

Cycling positively correlated with the presence of acetabular chondromalacia on magnetic resonance imaging ($R = 0.200$, $P = .009$) but was not significantly correlated with radiographic femoral head chondromalacia ($R = -0.066$, $P = .390$). Symptomatic hip pain in cyclists was positively correlated with an increased acetabular center-edge angle ($R = 0.261$, $P < .001$) and an increased Tonnis grade ($R = 0.305$, $P < .001$). Sharp angle did not significantly correlate with cycling ($R = 0.058$, $P = .437$). The Tonnis grade was significantly different between cyclists (0.93, 95% confidence interval [CI], 0.75 to 1.0) and controls (0.38, 95% CI, 0.31-0.46) ($P < .001$). Cyclists had a greater anterior center-edge angle (37.7°, 95% CI, 32.7°-41.7°) than controls (31.1°, 95% CI, 30.1°-32.2°) ($P = .001$; Fig 1). Cyclists also had a greater lateral center-edge angle than controls (33.4° [95% CI, 29.6°-37.6°] *v* 30.1° [95% CI, 29.5°-30.8°]) ($P = .020$; Fig 1). Neither the alpha angle nor the Sharp angle significantly differed between the 2 groups (respectively, $P = .791$ and .221).

Intraoperative findings revealed similar involvement of the acetabular cartilage in cyclists as in controls. The acetabular chondromalacia grade was similar between cyclists (2.8, 95% CI, 2.3-3.3; Fig 2A) and controls (2.8, 95% CI, 2.7-3.0; $P = .987$). The area of chondral involvement was mildly increased in cyclists (157 mm^2, 95% CI, 106-207 mm^2) versus controls (145 mm^2, 95% CI, 129-160 mm^2), but this was not significantly different (Fig 2B, $P = .66$). Cyclists had a similar mean acetabular CMI (500, 95% CI, 271-748) as the control group (515, 95% CI, 443-588) ($P = .96$).

Cycling was associated with increased femoral head chondromalacia. Cycling significantly and positively correlated with operative findings of increased femoral head chondromalacia grade ($R = 0.155$, $P = .037$), femoral head chondromalacia area ($R = 0.284$, $P < .001$), and femoral head CMI ($R = 0.251$, $P = .001$). Femoral head chondromalacia grade was significantly greater in cyclists (2.0, 95% CI, 1.5-2.5) than controls (1.4, 95% CI, 1.3-1.6) ($P = .043$; Fig 3A). Cyclists had significantly greater femoral head chondromalacia area (242 mm^2, 95% CI, 191-293 mm^2) than controls (128 mm^2, 95% CI, 113-144 mm^2) ($P < .001$; Fig 3B). The femoral head CMI was also significantly larger in cyclists (486 [95% CI, 358-615] *v* 247 [95% CI, 208-286]) ($P = .001$; Fig 3C). Cyclists had a significant correlation with larger femoral head chondromalacia area ($R = 0.248$, $P < .001$) and CMI ($R = 0.220$, $P < .001$). Furthermore, cyclists underwent more femoral head chondroplasty than controls ($P = .043$).

Intraoperative findings were also analyzed in the context of gender (Table 4). Men had a higher grade of acetabular chondromalacia than women but the

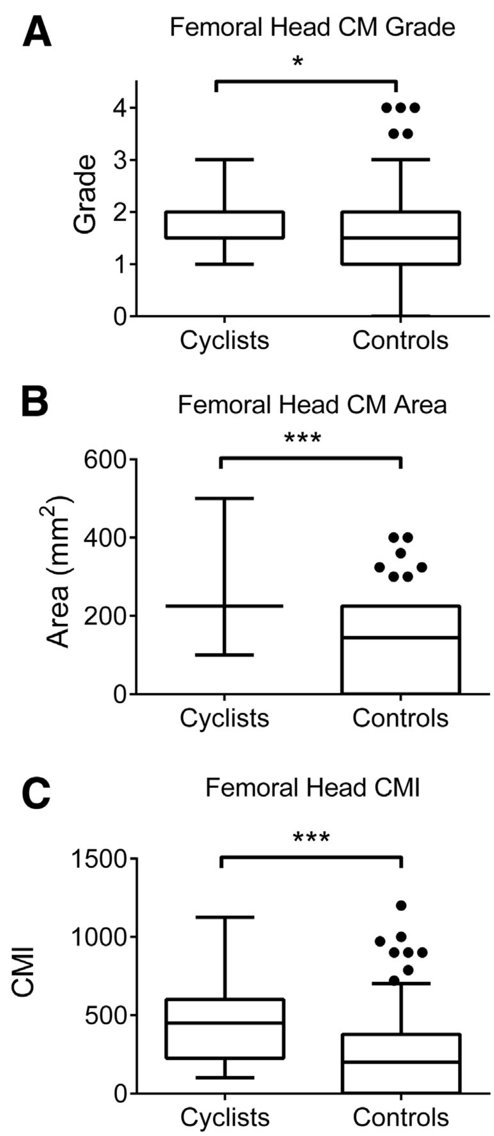

Fig 2. Acetabular chondromalacia identified during hip arthroscopy in cyclists versus controls. (A) Acetabular chondromalacia (CM) grade (Outerbridge grade). (B) Acetabular chondromalacia (CM) area. (C) Acetabular chondromalacia index (CMI). CMI is calculated as the grade times surface area identified during hip arthroscopy. All box and whisker plots have the box at the 25th-75th percentile and the whiskers from the 5th to 95th percentile. Outliers are denoted by the dots. $^*P < 0.05$; $^{***}P < 0.001$.

difference was not statistically significant (P = .201). Men did have significantly greater acetabular chondromalacia area (P = .042) and acetabular CMI (P = .046). Gender was not a significant factor for femoral chondromalacia grade (P = .831), femoral chondromalacia area (P = .138), or femoral CMI (P = .185; Table 3). When subdivided by gender, the interactions between male and female cyclists and controls were not significantly different (Table 5).

All cyclists were found to have at least partial tearing of the labral cartilage from the acetabular bony rim at the time of arthroscopy, and 4 had complete disruption of the chondrolabral interface and tearing of the labral cartilage from the acetabular bony rim. These tears were located in the anterosuperior portion of the acetabulum (10 to 12 o'clock position in the right hip). All labral tears were repaired with suture anchors at the time of arthroscopy. The rate of labral tears was not significantly different between cyclists and controls (P = .886).

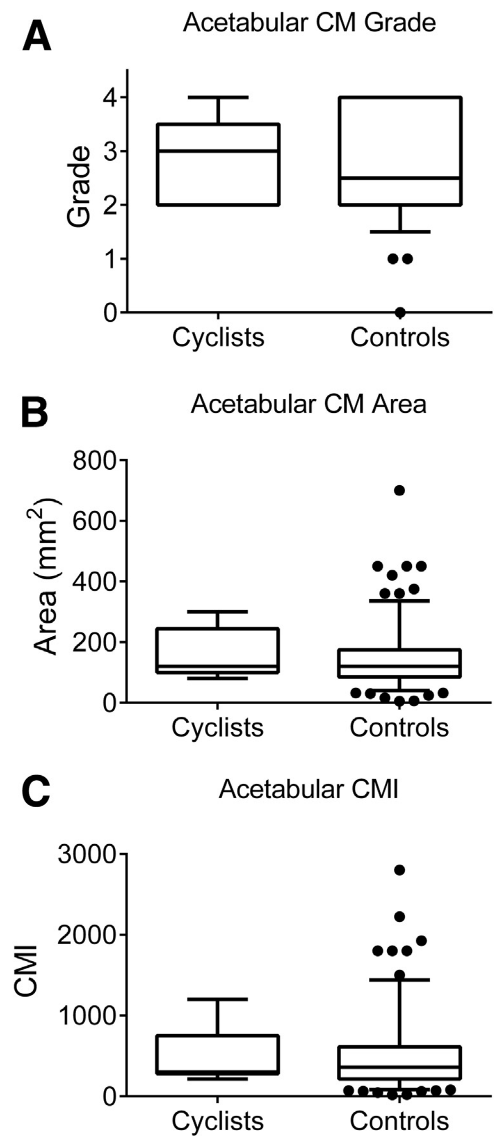

Fig 3. Femoral chondromalacia identified during hip arthroscopy in cyclists versus controls. (A) Chondromalacia grade (Outerbridge grade). (B) Femoral head chondromalacia (CM) area. (C) Femoral head chondromalacia index (CMI). CMI is calculated as the grade times surface area identified during hip arthroscopy. All box and whisker plots have the box at the 25th-75th percentile and the whiskers from the 5th to 95th percentile. Outliers are denoted by the dots.

Table 4. Comparison of Intraoperative Chondromalacia by Gender

	Male	Female	*P* Value
Acetabular chondromalacia grade	3.0 (2.6-3.2)	2.6 (2.1-3.1)	.201
Acetabular chondromalacia area, mm^2	166 (137-194)	108 (62-156)	**.042**
Acetabular CMI	580 (445-715)	316 (96-536)	**.046**
Femoral chondromalacia grade	1.6 (1.3-2.0)	1.6 (1.1-2.1)	.831
Femoral chondromalacia area, mm^2	195 (165-226)	152 (102-201)	.138
Femoral CMI	382 (306-457)	285 (161-408)	.185

NOTE. Values are mean (95% confidence interval). *P* values indicate the significance of the gender differences (regardless of group). Bold indicates statistical significance.

CMI, chondromalacia index.

Discussion

At the time of hip arthroscopy, cyclists had a greater degree of femoral chondromalacia. Cycling activity positively correlated with the presence of radiographic acetabular chondromalacia and intraoperative femoral head chondromalacia. Cycling was associated with clinically significant coxalgic gait alterations. These data support the hypothesis that cyclists with hip pain have more chondral pathology than a similar group of noncyclist patients with hip pain. Cycling activity was positively associated with the need for loose body excision but not ligamentum teres debridement. Ultimately, cyclists with hip pain should be identified as higher risk for more advanced chondral injury.

Our cycling group had many symptoms and physical examination findings similar to those reported in elite runners who underwent hip arthroscopy.[7] Guanche and Sikka reported that elite runners in their series had very insidious onset of pain with increasing pain with activity, which was similar to our reported symptoms. Both our study and Guanche and Sikka identified similar rates of mechanical symptoms in the athletes (43% of cyclists and 50% of runners[7]). Both the previously reported runners[7] and the cyclists in our study had normal and symmetrical terminal hip flexion on physical examination, although the FABER test (flexion abduction external rotation) was asymmetric between legs. Symmetric terminal flexion is not surprising, because both running and cycling demand equal leg strength and contributions; asymmetric range of motion may be more common in sports with differential leg contributions from a lead or kicking leg, such as soccer or throwing sports. One potential reason for similar symptoms between the runners and cyclists is the prevalence of labral pathology and associated chondral lesions. Labral tears were identified in all cyclists in our study and all runners. Labral tears were located in the anterosuperior, which is consistent with previous reports[7,13-15] and is postulated to be the result of repetitive loading.[7,15] The range of motion required for running, cycling, dancing, and gymnastics could further insult a portion of the labrum predisposed to tearing.[7,16]

Both cyclists and controls revealed radiographic evidence of chondral damage and differences in radiographic measurements with hip dysplasia; however, although these differences may be statistically significant, the differences in measurement are likely not clinically significant. The acetabular anterior center-edge angle and lateral center-edge angle were both greater in the cycling group, but not beyond reported normal ranges.[17,18] Symptomatic hip pain in cyclists did correlate with acetabular chondromalacia on MRI but this correlation is not indicative of causation. The sensitivity of mild chondral involvement is variable on MRI, and even mild chondral damage identified on MRI can be asymptomatic in active individuals.[16,19]

Chondral damage is frequently seen with labral pathology, and in our study cyclists had a greater severity of chondral damage and surface area than matched controls at the time of arthroscopy. Although the case series of runners did not compare to the matched controls, chondral injury was identified in 75% of runners and all lesions were Outerbridge grade III or greater.[7] This finding suggests that the chondral damage is not directly related to the repetitive impact of running because cycling is considered a low-impact sport. The greater chondromalacia of the femoral

Table 5. Intraoperative Chondromalacia Evaluation by Group and Gender

	Group	Gender	Mean (95% CI)	*P* Value
Acetabular chondromalacia grade	Controls	Male	2.9 (2.8-3.1)	.782
		Female	2.7 (2.4-2.9)	
	Cyclists	Male	3.0 (2.4-3.5)	
		Female	2.5 (1.5-3.4)	
Acetabular chondromalacia area, mm^2	Controls	Male	158 (141-176)	.616
		Female	115 (92-139)	
	Cyclists	Male	173 (118-228)	
		Female	102 (11-193)	
Acetabular CMI	Controls	Male	585 (203-668)	.720
		Female	368 (258-479)	
	Cyclists	Male	574 (317-832)	
		Female	264 (−163 to 690)	
Femoral chondromalacia grade	Controls	Male	1.3 (1.1-1.5)	.299
		Female	1.5 (1.3-1.8)	
	Cyclists	Male	2.0 (1.4-2.6)	
		Female	1.6 (0.7-2.6)	
Femoral chondromalacia area, mm^2	Controls	Male	125 (107-144)	.103
		Female	130 (105-154)	
	Cyclists	Male	265 (208-323)	
		Female	174 (78-269)	
Femoral CMI	Controls	Male	239 (193-285)	.122
		Female	255 (193-317)	
	Cyclists	Male	525 (381-669)	
		Female	314 (75-553)	

P values indicate the significance of the group and gender interaction. There were no significant differences.

CI, confidence interval; CMI, chondromalacia index.

head is an interesting finding, and one that was not described in the case series on runners.[7] Chondral lesions may carry a worse prognosis. Bedi et al.[20] performed a systematic review and found that several small series identified patients treated arthroscopically for a chondral injury in conjunction with a labral tear fared worse than patients with a labral tear alone. In their analysis, larger series failed to confirm these findings.[20] One potential advantage of cyclists' ability to return to sport is that cycling is a low-impact activity.

A case series for open treatment for hip pain with femoroacetabular impingement has shown excellent return to sport for cycling.[21] For patients who underwent surgical dislocation of the hip for the treatment of FAI, 75% of patients reported satisfaction with their sports ability. Although the most popular sports in the group preoperatively were downhill skiing, cycling, and jogging, the most common postoperative sports were cycling, fitness/weight training, and downhill skiing. Patients predominately participated in lower-impact activities upon their return to sport. In professional athletes with femoroacetabular impingement, arthroscopic treatment of labral tears and chondral injury returned 42 of 45 professional athletes to professional sport and 35 remained at the professional level for a mean of 1.6 years.[6] This finding is encouraging because all but 2 athletes participated in high-impact sports; the athlete group did not include professional cyclists.[6] During a review of cyclists in our group, we anticipated a high rate of symptomatic FAI; however, our data support that a substantial portion of the cyclists' hip pathology was associated with chondral damage.

Arthroscopy for athletes and labral pathology at large is highly successful[5,6,13,20,22]; however, the presence of chondral damage portends a worse prognosis for all patients regardless of sporting activity.[5,20,23] Because the patients in our cycling group had a greater degree of chondromalacia in both the femoral head and acetabulum, it is important to counsel patients on expectations perioperatively. Postoperative rehabilitation must be focused on preventing exacerbation of chondral symptoms. These strategies might focus on proper positioning, which should be emphasized to the cyclist when the patient is electing to delay operative intervention and for patients returning to sport postoperatively.[24] Additionally, patients may benefit from specific fitting instructions to minimize harmful forces and muscle fatigue across the hip due to improper positioning.[25,26] If the cyclist fails conservative management, then cartilage techniques that indicate some success in the knee for return to cycling and running may be applicable in the hip; however, this strategy has not been investigated.[27]

Limitations

Because our study was retrospective in nature, it carries inherent limitations. Patients who did not undergo hip arthroscopy and reported cycling as a major component of their activity were not captured in our operative database. We chose to focus on operative findings in cyclists in comparison to control patients who underwent operative intervention. The noncycling group did report a lower overall activity rate than our cycling group, which could be influenced by their preoperative hip pain. We recognize the activity differences as a limitation but find it interesting that with increased femoral head chondromalacia and similar acetabular chondromalacia, cyclists still maintained a high level of preoperative activity. Our study is additionally limited by the small number of high-level cyclists defined as >100 miles per week. We reviewed a large sample size of 1,200 consecutive operative cases at a major referral center for hip arthroscopy, so we believe we have captured the less common operative causes of hip pain in the cyclist despite the small sample size. This belief is further supported by the majority of cyclists sustaining overuse injuries to the lower extremity.[3] We also included the CMI in our outcomes measurement, which had not been previously validated.

Conclusions

Cyclists had a greater degree of femoral chondromalacia than a matched group of noncyclists. Cycling activity positively correlated with the presence of femoral chondromalacia with clinically significant gait alterations. These data support the hypothesis that cyclists with hip pain have more chondral pathology than a similar group of other patients with hip pain. Ultimately, cyclists with hip pain should be identified as higher risk for more advanced chondral damage.

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