Accelerated Bilateral Hip Arthroscopy (1 Week Apart)

Outcomes Compared With Delayed Bilateral Procedure (4-12 Weeks) and Case-Control Matched Unilateral Arthroscopy

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Background: Staged bilateral hip arthroscopy is an option for athletes who have symptomatic bilateral femoroacetabular impingement; however, the optimal timing of the second procedure is unknown.

Purpose: To evaluate minimum 2-year outcomes for patients undergoing accelerated bilateral arthroscopy against those undergoing (1) delayed bilateral and (2) unilateral arthroscopy.

Study Design: Cohort study; Level of evidence, 3.

Methods: A retrospective review was performed of prospectively collected data from patients undergoing bilateral primary hip arthroscopy for femoroacetabular impingement between 2009 and 2022. Inclusion criteria entailed competitive athletes with concurrent bilateral symptoms at initial presentation. Exclusion criteria (either hip) were Tönnis grade >1, dysplasia (lateral center-edge angle <25°), Perthes disease, protrusio acetabuli, and avascular necrosis. Two groups were established based on the duration between procedures: within 7 days (accelerated group) and within 4 to 12 weeks (delayed group). Patients from the accelerated group were matched in a 1:2 ratio with patients undergoing unilateral surgery based on age ±2 years, sex, and athletic status. Minimum 2-year postoperative patient-reported outcomes (PROs) (including modified Harris Hip Score, University of California Los Angeles activity scale, 36-Item Short Form Health Survey, and Western Ontario and McMaster Universities Osteoarthritis Index), rates of achieving the minimal clinically important difference, rates of continuing to play main sport, and satisfaction were compared between groups.

Results: A total of 131 athletes (262 hips) with bilateral femoroacetabular impingement were included: 91 in the accelerated group and 40 in the delayed group. Duration between surgeries was 0.99 ± 0.02 and 6.35 ± 2.18 weeks, respectively. All accelerated athletes were each successfully matched to 2 athletes with unilateral procedures (N = 182). All 3 groups demonstrated significant improvement from baseline across all PROs ($P < .001$ for all). Acquired change in PROs was similar and not significantly different between groups ($P > .05$). Satisfaction with relief from pain was achieved by 85.9% of patients in the accelerated group compared with 83.1% in the delayed group ($P = .053$) and 87.3% in the unilateral group ($P = .933$). The minimal clinically important difference for the modified Harris Hip Score was achieved by 84.9% of patients in the accelerated group compared with 91.5% in the delayed group ($P = .212$) and 87.6% in the unilateral group ($P = .456$). At 2 years postoperatively, the continue-to-play rate was 73.6% for the accelerated group compared with 77.1% for the delayed group ($P = .577$) and 73.0% for the unilateral group ($P = .903$). There were no increased complications associated with the accelerated group.

Conclusion: Accelerated bilateral hip arthroscopy 1 week apart was a safe and effective treatment option for athletes with bilateral symptoms. Improvement in PROs and continue-to-play rates were comparable with those after a delayed duration between procedures and with those case-control matched athletes undergoing unilateral arthroscopy.

Keywords: hip arthroscopy; femoroacetabular impingement; bilateral; athletes; staged surgery

Femoroacetabular impingement (FAI) is a mechanical hip disorder characterized by abnormal bony morphology of the femoral head-neck junction (flattening/loss of sphericity; cam) and/or the acetabulum (global or focal acetabular overcoverage of the femoral head; pincer). The presence of these deformities and the repetitive abutment between

The American Journal of Sports Medicine
1–12
DOI: 10.1177/03635465231162647

these opposing structures as the hip moves may result in initial symptoms of pain and stiffness, and may progress to irreversible damage and osteoarthritis if left untreated. Hip arthroscopy (HA) for the treatment of symptomatic FAI is widely reported and results in significant clinical improvement in postoperative outcomes and native hip survivorship for the appropriate candidate in the short, middle, and long term.[8,26,36]

Radiographic signs of bilateral FAI are not uncommon, yet their presence is not always associated with bilateral symptoms. Azboy et al[3] reported a 31% prevalence of bilateral radiographic FAI, half of which entailed bilateral symptoms. Allen et al[1] reported that 78% of patients presenting with unilateral symptoms had radiographic evidence of FAI in the contralateral hip, of which 26% required subsequent contralateral arthroscopic intervention. Certain risk factors can increase the progression toward FAI requiring bilateral surgical intervention, including male sex, higher alpha angles indicating larger cam deformities, younger age, and higher level of physical activity.[1,16]

There has been an increased focus within the literature on assessing the effect of HA for patients undergoing bilateral FAI correction, with 2 systematic reviews published on this topic recently.[12,19] For the most part, outcome-based studies reporting on patients undergoing bilateral HA for FAI are not specific to the management of patients being evaluated for bilateral FAI. For example, 34% to 45% of patients undergoing bilateral staged HA presented initially with unilateral symptoms, but the contralateral side subsequently developed symptoms at a later date,[15,17] which raises the question of whether such patients should be considered truly bilateral or rather should be considered symptomatic with unilateral FAI at 2 separate time points.

As such, for patients with symptomatic bilateral FAI, the optimal timing of the second procedure is unknown. The average time between surgeries for patients undergoing bilateral HA is reported to be approximately 7 months[12,19]; however, recommendations of standard time frames for staged procedures are reported to range from 2 to 4 weeks[18] to 6 to 16 weeks.[11,25] Hassebrock et al[14] compared outcomes from athletes undergoing bilateral HA, whereby 4 to 6 weeks between procedures was defined as accelerated surgery and >6 weeks was considered standard staged surgery. Simultaneous bilateral HA is also an option that results in similar postoperative outcomes compared with staged procedures.[10,25] Simultaneous arthroscopy may have an advantage of shorter recovery time and faster return to activity[23]; however, disadvantages include longer time under anesthesia[25] and increased time under traction, which can increase the potential for complications, particularly where more extensive bony correction is required.[23]

Existing studies within the literature have shown that a shorter duration between staged procedures will result in better outcomes for patients with symptomatic bilateral FAI.[11,17] This may be particularly true for those with known risk factors of disease progression, in particular the more susceptible athletic population with morphological characteristics of FAI. Delaying contralateral surgery in these patients may result in increased progression of chondrolabral pathology.

The primary purpose of this study was to evaluate the minimum 2-year outcomes for patients undergoing staged bilateral HA for symptomatic bilateral FAI. Those undergoing accelerated HA (contralateral surgery within 7 days) were compared against 2 separate groups: (1) delayed HA (contralateral surgery 4-12 weeks after index procedure) and (2) unilateral HA. We hypothesized that (1) outcomes from a consecutive series of patients undergoing accelerated HA would be comparable with the outcomes of those undergoing delayed HA and (2) a consecutive series of patients undergoing accelerated HA would be comparable with a case-control matched series of patients undergoing unilateral HA at 2 years.

METHODS

Patient Selection Criteria

Our prospective, institutional HA registry, which has received institutional board approval, was retrospectively reviewed for all patients undergoing primary HA on both hips for symptomatic FAI between 2009 and 2022. Patients were considered for HA if symptoms did not improve after a period of nonoperative management (minimum 3 months), including physical therapy, activity modification, and rest. Diagnostic criteria included clinical findings such as loss of internal rotation; loss of adduction; pain on flexion, adduction, and internal rotation; and magnetic resonance arthrography findings of labral and chondral pathology as well as abnormal FAI-associated bony morphology on radiographs. All surgeries were performed by the senior author (P.C.), a high-volume hip arthroscopic surgeon. Patients who underwent HA on both hips were identified within the registry from their unique hospital register number, in which case each patient was enrolled twice. The duration between surgeries on opposing hips was calculated, and patients were grouped relative to defined intervals between procedures (Table 1). Patient exclusion criteria consisted of any procedure other than primary HA for FAI, Tönnis grade >1, dysplasia identified by a lateral center-edge angle (LCEA) <25°[5,21] on anteroposterior (AP) radiograph, Perthes disease, avascular

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Submitted September 20, 2022; accepted February 3, 2023.
The authors declared that they have no conflicts of interest in the authorship and publication of this contribution. AOSSM checks author disclosures against the Open Payments Database (OPD). AOSSM has not conducted an independent investigation on the OPD and disclaims any liability or responsibility relating thereto.

TABLE 1
Distribution of Duration Between Procedures for All Patients Undergoing Bilateral Hip Arthroscopy for Symptomatic Femoroacetabular Impingement at a Single Center

Duration Between Bilateral Surgeries	No. of Patients Before Exclusion	No. of Patients After Application of Exclusion Criteria	Athletic Status, Competitive/ Recreational/Nonsporting, n	Competitive Athletes Only: Comparison Groups
0-1 weeks	165	110	**91/16/3**	Accelerated group
1-2 weeks	137	112	100/9/3	
2-3 weeks	82	62	54/5/3	
3-4 weeks	45	30	26/2/2	
4-5 weeks	32	18	**16/2/0**	Delayed group
5-6 weeks	18	16	**11/5/0**	
6-7 weeks	8	3	**2/1/0**	
7-8 weeks	6	5	**5/0/0**	
8-9 weeks	5	3	**1/2/0**	
9-10 weeks	3	1	**0/1/0**	
10-11 weeks	3	2	**1/1/0**	
11-12 weeks	5	4	**4/0/0**	
3-6 months	16	11	7/3/1	
6-9 months	17	13	9/3/1	
9-12 months	16	13	11/2/0	
1-2 years	27	9	6/1/2	
2-3 years	20	15	11/3/1	
3-4 years	12	8	6/2/0	
4-5 years	5	3	2/1/0	
5-6 years	4	1	0/1/0	
6-7 years	3	2	1/0/1	
7-8 years	1	0	0/0/0	
8-9 years	1	1	0/0/1	
Total	631	442	364/60/18	

necrosis, protrusio acetabuli (in either or both hips), and patients who had not yet reached the 2-year postoperative time point. For this study, we sought to evaluate only those patients involved in competitive sports at the time of initial presentation who had concurrent bilateral symptoms. Athletes with bilateral symptoms were assigned to 1 of 2 groups based on the duration between staged arthroscopies: the accelerated group included those who underwent staged bilateral HA procedures within 1 week of each other, and the delayed group consisted of those who underwent staged bilateral HA procedures 4 to 12 weeks apart (Figure 1). Early in the evolution of our hip preservation practice, a more conservative approach to patients with bilateral symptoms was undertaken. Patients would have their first side surgery, and once they had fully recovered they would be scheduled for second side surgery. With increased experience and good surgical outcome, the time between surgeries was progressively shortened in an attempt to reduce the total rehabilitation time and time out from sports (given that the majority of our cohort consists of male athletes). This eventually evolved into an accelerated program of surgeries 1 week apart. The accelerated group represented our primary study/comparison group. The time frame for the delayed group was chosen to allow for a distinct demarcation against our primary study group, in addition to being based on previous literature and relative to our standard clinical practice. Hassebrock et al[14] evaluated patients who underwent bilateral surgeries within 4 to 6 weeks and those who underwent second surgery at >6 weeks, thus guiding our lower cutoff. The upper cutoff (12 weeks) was chosen because (1) this is the time point when patients are permitted to return to full, uninhibited activity and (2) including patients beyond this time point may inadvertently capture those who subsequently developed contralateral symptoms (where they initially had a unilateral problem).

For the case-control matched analysis, cases were defined as patients who underwent staged bilateral HA 1 week apart, whereas controls were defined as patients who underwent unilateral HA. An additional exclusion criterion for the unilateral group was patients who underwent surgery within a different period (before 2014) from the primary (accelerated) study group. Patients from the final bilateral accelerated group (as determined previously) were then fuzzy matched in a case-to-control ratio of 1:2 ratio with eligible patients from the unilateral group based on age (±2 years), sex, and athletic status. For the matching process, each hip from every individual patient from the bilateral surgery group was matched with a different patient undergoing unilateral surgery.

Surgical Technique

The surgical technique has previously been described in detail.[6,9] Patients were administered a general anesthetic and positioned supine on the operating table with a well-padded perineal post positioned between the legs. Each foot was generously padded and firmly restrained in a leather boot attached to an approved mechanical hip

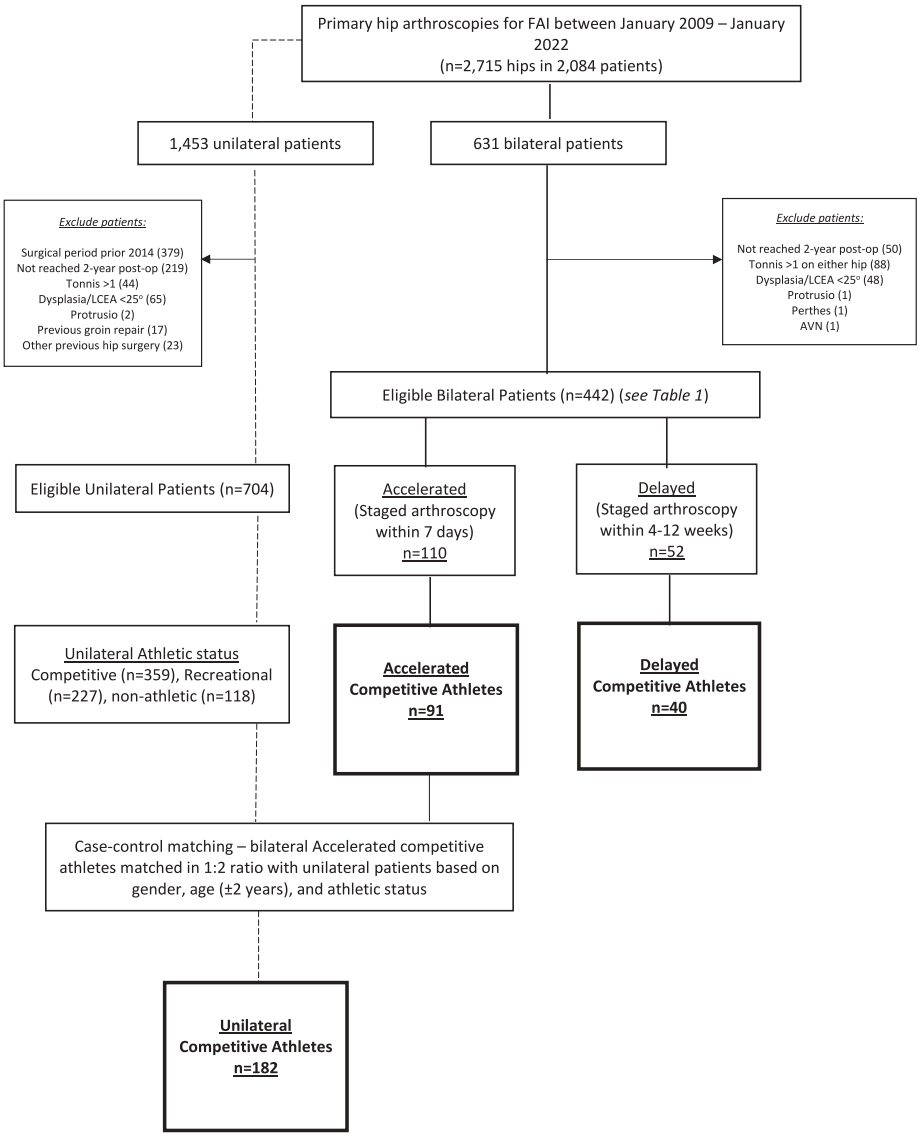

Figure 1. Patient selection, flow diagram. AVN, avascular necrosis; FAI, femoroacetabular impingement; LCEA, lateral center-edge angle.

distractor system. The procedure was undertaken with image intensifier support throughout.

In the uncommon situation whereby a patient experienced any traction-related paresthesia after the initial unilateral HA, contralateral surgery would be postponed until this had fully resolved. Of note, this protocol was not required for any of the patients in the current study.

Rehabilitation Protocol

A standardized, self-administered home rehabilitation program covering a 12-week postoperative time frame was provided to all patients. This program was the same irrespective of whether unilateral or bilateral surgery was performed. Postoperatively, patients were mobilized 4 hours after surgery and were permitted to fully bear weight as comfortable with the aid of crutches for 5 days. Early movement was encouraged with the use of a stationary bicycle from day 1, and hydrotherapy was recommended once incisions had healed, usually at day 10 postoperatively, at which time patients were permitted to return to work. The breaststroke and full hip rotation were introduced at 4 weeks. Return to running was permitted at 6 weeks, sprinting at 8 to 10 weeks, and full return to sports training by 12 weeks. Patients were permitted to supplement the standardized rehabilitation program with the aid of their own club or team physical therapist, if desired.

Surgical Outcomes

Patient-reported outcomes (PROs) were evaluated at baseline and 2 years postoperatively (after latest procedure in

the case of bilateral surgery). PRO measures consisted of the modified Harris Hip Score (mHHS), University of California Los Angeles (UCLA) activity scale, 36-Item Short Form Health Survey (SF-36), and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). For the bilateral surgery group, PRO measures were completed specific to the functional state of each hip separately.[27] The minimal clinically important difference (MCID) was calculated specific to each group using 2 techniques: (1) a distribution-based technique (one-half standard deviation of the change in score from baseline to follow-up),[30,31] which establishes a specific absolute score change, and (2) an anchor-based technique (percentage of possible improvement [POPI]), which is derived from the percentage of observed improvement from baseline relative to the total scope for improvement corresponding to the minimal patient-reported subjective rating of change. The POPI has been previously reported[7] and has the benefit of negating the associated ceiling effect limitations of using an absolute value cutoff. Patient satisfaction relative to alleviation of pain, meeting expectations, and ability to perform activities of daily living, including sports, was evaluated. The proportion of athletes who were able to continue to play (CTP) their main sport was evaluated through the use of a dichotomized response to the following question: "Have you returned to your main (preoperative) sport or activity following your surgery?" Where CTP was not achieved, reasons for this were explored. Incidents of revision surgery and postoperative complications were documented where applicable.

Statistical Analysis

Data were checked for normality using the Shapiro-Wilk test. Independent-samples t test and chi-square/Fisher exact test were used to test for differences between groups for continuous and categorical data, respectively. Where normality of data was violated, nonparametric analysis (median and interquartile range) was used to examine between-group (Mann Whitney U test) and within-group (Wilcoxon signed-rank test) differences both preoperatively and 2 years postoperatively. Case-control matching was performed for the primary study group (accelerated group) and unilateral cases only. All patients in these 2 groups underwent surgery over the same time period (a set matching criterion) and therefore were more contemporaneous in terms of surgical technique over time. Matching was not performed for the 2 bilateral groups due to a reduced number of patients (15%) who underwent surgery during the same time period. Statistical analyses were performed using SPSS Version 28.0 (IBM). $P < .05$ was considered significant.

RESULTS

Patient Characteristics

In total, 631 patients underwent primary HA for FAI to both hips, representing 30% of all comparable patients. After application of study inclusion and exclusion criteria, 131 competitive athletes with bilateral FAI were eligible: 91 patients (182 hips) in the accelerated group and 40 patients (80 hips) in the delayed group. All 91 athletes undergoing accelerated HA were successfully matched to 182 athletes undergoing unilateral HA. Patient characteristics are displayed in Table 2. The mean age was similar between comparison groups: 25.2 ± 6.0 years for the accelerated group, 25.9 ± 7.5 for the delayed group (P = .423), and 25.2 ± 6.2 for the unilateral group (P = .984). There was a predominance of male sex in all groups: 95.6% in the accelerated group, 95.0% in the delayed group (P = .760), and 95.6% in the unilateral group ($P \geq .999$). The majority of competitive athletes participated in field-based, team sports. The mean time between surgeries was 0.99 ± 0.02 weeks for the accelerated group and 6.35 ± 2.18 weeks for the delayed group ($P < .001$). Surgical procedures performed and intraoperative findings are displayed in Table 3.

Radiographic Measurements

Accelerated Versus Delayed. Preoperatively there was no difference in alpha angle (AP view) or Tönnis grade between the 2 staged HA groups. LCEA was larger for the accelerated group than the delayed group (37.4° ± 5.8° vs 35.7° ± 5.8°, respectively; $P < .001$). Postoperatively, the delayed group, when compared with the accelerated group, had larger alpha angle on AP view (63.8° ± 15.2° vs 47.4° ± 10.2°, respectively; $P < .001$) and a larger LCEA (33.2° ± 5.9° vs 29.2° ± 5.8°, respectively; $P < .001$) (Table 2). For both groups, LCEA ($P < .001$ for both) and alpha angle on AP view (P = .001 and P = .010 for accelerated and delayed groups, respectively) were significantly reduced postoperatively (Table 4).

Accelerated Versus Unilateral. Preoperatively, the accelerated group, when compared with the unilateral group, had larger alpha angle on both Dunn (63.3° ± 13.5° vs 58.5° ± 12.5°, respectively; $P < .001$) and AP views (67.4° ± 19.1° vs 61.6° ± 17.7°, respectively; P = .004) and larger LCEA (37.4° ± 5.8° vs 35.9° ± 6.7°, respectively; P = .020). Postoperatively, alpha angle on Dunn view and LCEA were similar for both groups (Table 2). Alpha angle on AP view was larger for the unilateral group postoperatively than for the accelerated group (51.5° ± 13.5° vs 47.4° ± 10.2°, respectively; P = .001) (Table 2). Both groups had significant reductions in deformity correction from baseline ($P < .001$ for all measured angles for both groups) (Table 4).

Patient-Reported Outcomes

Accelerated Versus Delayed. Preoperatively, mHHS and SF-36 scores were similar between the accelerated and delayed groups. The delayed group had a higher UCLA score (P = .018) and better WOMAC score (P = .027) at baseline. Both groups demonstrated significant improvements for all PROs ($P < .001$) (Table 5). The acquired change was similar for mHHS (14 points for the accelerated group vs 15 points for the delayed group; P = .667), SF-36 (11.7 vs 13.4, respectively; P = .682), and WOMAC (7 vs 9, respectively; P = .725).

TABLE 2
Patient Characteristics[a]

	1. Accelerated Group	2. Delayed Group	*P* (1 vs 2)	3. Unilateral Group	*P* (1 vs 3)
No. of hips (patients)	182 (91)	80 (40)		182 (182)	
Sex, n (%)			.760		≥.999
Male	87 (95.6)	38 (95.0)		174 (95.6)	
Female	4 (4.4)	2 (5.0)		8 (4.4)	
Age, y	25.2 ± 6.0 (range, 15.3-43.1)	25.9 ± 7.5 (range, 17.2-48.2)	.423	25.2 ± 6.2 (range, 15-43)	.984
Tönnis grade, n (%)			.357		.373
0	146 (80.2)	68 (85.0)		139 (76.4)	
1	36 (19.8)	12 (15.0)		43 (23.6)	
Preoperative, deg					
AA (Dunn view)	(n = 182) 63.3 ± 13.5	(n = 44) 57.3 ± 12.1	**.009**	(n = 180) 58.5 ± 12.5	**<.001**
AA (AP view)	(n = 182) 67.4 ± 19.1	(n = 70) 67.3 ± 17.2	.976	(n = 182) 61.6 ± 17.7	**.004**
LCEA	(n = 182) 37.4 ± 5.8	(n = 70) 35.7 ± 5.8	**.039**	(n = 182) 35.9 ± 6.7	**.020**
Postoperative, deg					
AA (Dunn view)	(n = 179) 49.6 ± 11.5	(n = 43) 53.9 ± 11.2	**.027**	(n = 179) 48.4 ± 9.5	.296
AA (AP view)	(n = 182) 47.4 ± 10.2	(n = 76) 63.8 ± 15.2	**<.001**	(n = 179) 51.5 ± 13.5	**.001**
LCEA	(n = 182) 29.2 ± 5.8	(n = 76) 33.2 ± 5.9	**<.001**	(n = 179) 29.8 ± 5.8	.282
First hip operated, n (%)			.351		NA
Right	42/91 (46.2)	22/40 (55)		102 (56)	
Left	49/91 (53.8)	18/40 (45)		80 (44)	
Duration between procedures, wk	0.99 ± 0.02 (range, 0.85-1.0)	6.35 ± 2.18 (range, 4.13-11.97)	**<.001**	NA	NA
Main sport, n (%)			**.027**		**.023**
Hurling	38 (41.8)	20 (50)		49 (26.9)	
Gaelic football	31 (34.1)	8 (20)		77 (42.3)	
Soccer	7 (7.7)	6 (15)		28 (15.4)	
Rugby	6 (6.6)	1 (2.5)		11 (6.0)	
Athletics	4 (4.4)	4 (10)		5 (2.7)	
Other	5 (5.5)	1 (2.5)		12 (6.6)	
Training frequency, n (%)			.093		.862
1-2 days/week	19 (15.4)	3 (7.5)		26 (14.7)	
3-5 days/week	62 (68.1)	27 (67.5)		118 (66.7)	
>5 days/week	15 (16.5)	10 (25.0)		33 (18.6)	
Competition frequency, n (%)			.946	(n = 173)	.671
1-2 times/month	17 (18.7)	7 (17.5)		39 (22.5)	
3-5 times/month	53 (58.2)	24 (60)		98 (56.6)	
>5 times/month	21 (23.1)	9 (22.5)		173 (20.8)	

[a]Values are presented as mean ± SD unless otherwise indicated. Data in parentheses relating to sex, operated hip, main sport, and training/competition frequency indicate the proportion of individual patients for these variables. AA, alpha angle; AP, anteroposterior; LCEA, lateral center-edge angle; NA, not applicable. Statistically significant *P* values are highlighted in bold and correspond to between-group differences.

The accelerated group demonstrated a larger change in UCLA score compared with the delayed group.

Accelerated Versus Unilateral. There was no difference in any of the baseline or 2-year postoperative PRO scores between the accelerated and unilateral groups. The acquired change in outcomes was also similar and not statistically significantly different between groups (Table 5).

Satisfaction

Satisfaction greater than that considered a minimal improvement (ie, good to excellent) was achieved at similar rates between comparison groups. Satisfaction achieved across the domains was as follows for accelerated versus delayed and unilateral groups, respectively: pain relief, 85.9% versus 83.1% (P = .053) and 87.3% (P = .933); increased ability to perform activities of daily living, 88.5% versus 83.6% (P = .697) and 83.0% (P = .079); increased ability to perform sporting activities, 78.5% versus 83.6% (P = .659) and 86.4% (P = .503); meeting expectations, 80.2% versus 82% (P = .392) and 85.4% (P = .075).

Minimal Clinically Important Difference

Calculated MCID thresholds for each of the different outcome measures per group are displayed in Table 6. There was no significant difference in the rate of MCID achievement between groups. Rate of MCID achievement for Accelerated group versus Delayed and Unilateral groups respectively, based on the distribution-based technique in

TABLE 3
Surgical Procedures and Intraoperative Findings[a]

	1. Accelerated	2. Delayed	*P* (1 vs 2)	3. Unilateral	*P* (1 vs 3)
Labral repair	164 (90.1)	73 (91.3)	.772	176 (96.7)	**.011**
Acetabuloplasty	177 (97.3)	76 (96.2)	.701	180 (99.4)	.215
Femoroplasty	181 (99.5)	76 (100)	>.999	168 (93.9)	**.003**
Capsular repair	182 (100)	12 (15)	**<.001**	182 (100)	>.999
Chondrolabral continuity			**<.001**		**.042**
Intact	84 (48.0)	19 (25.3)		69 (47.6)	
Partial separation	35 (20.0)	33 (44.0)		46 (31.7)	
Complete separation	37 (21.1)	18 (24.0)		21 (14.5)	
Deficient	19 (10.9)	5 (6.7)		9 (6.2)	
Cartilage			.712		.130
Flap tear/fibrillation	91 (52.0)	33 (44.6)		74 (54.4)	
Debonding (wave sign)	21 (12.0)	10 (13.5)		18 (13.2)	
Delamination (full thickness)	46 (26.3)	24 (32.4)		40 (29.4)	
Exposed subchondral bone	17 (9.7)	7 (9.5)		4 (2.9)	
Rim fracture	38 (20.9)	11 (14.1)	.200	11 (12.2)	**.025**

[a]Data are displayed as number of observations, where available, and proportion per group (in parentheses). Statistically significant *P* values are highlighted in bold and correspond to between-group differences.

TABLE 4
Radiographic Measured Angles Pre- and Postoperatively[a]

	Preoperative	Postoperative	*P*
Lateral center-edge angle			
Accelerated group (n = 182)	37.4 ± 5.8	29.2 ± 5.8	**<.001**
Delayed group (n = 68)	35.9 ± 5.8	32.7 ± 5.8	**<.001**
Unilateral group (n = 179)	35.9 ± 6.7	29.8 ± 5.8	**<.001**
Alpha angle (Dunn view)			
Accelerated group (n = 179)	63.0 ± 13.4	49.6 ± 11.5	**<.001**
Delayed group (n = 33)[b]	58.8 ± 12.5	53.2 ± 11.2	**.057**
Unilateral group (n = 177)	58.4 ± 12.3	48.4 ± 9.5	**<.001**
Alpha angle (anteroposterior view)			
Accelerated group (n = 182)	67.4 ± 19.1	47.3 ± 10.4	**.001**
Delayed group (n = 68)	66.8 ± 16.9	62.2 ± 15.0	**.010**
Unilateral group (n = 176)	61.9 ± 17.6	51.5 ± 13.5	**<.001**

[a]Data are expressed in degrees as mean ± SD. Statistically significant *P* values are highlighted in bold and correspond to within-group pairwise differences where available.

[b]Throughout the study period, standard radiographs for the assessment of femoroacetabular impingement were gradually incorporated into our practice, which accounts for the reduced number of Dunn view radiographs available in the delayed group (comprising predominantly earlier patients).

each PROM, was as follows: mHHS, 84.9% versus 91.5% (*P* = .212) and 87.6% (*P* = .456); UCLA, 73.3% versus 78.3% (*P* = .635) and 75.6% (*P* = .744); SF-36, 67.4% versus 70% (*P* = .558) and 60.6% (*P* = .439); WOMAC, 72.5% versus 84.2% (*P* = .125) and 81.6% (*P* = .249). For the anchor-based technique, rates of MCID achievement for Accelerated group versus Delayed and Unilateral groups respectively was as follows: mHHS, 72.7% versus 77.6% (*P* = .456) and 68.5% (*P* = .456); UCLA, 53.6% versus 53.8% (*P* = .980) and 52.8% (*P* = .912); SF-36, 54.5% versus 62.5% (*P* = .315) and 50.7% (*P* = .621); WOMAC, 68.0% versus 60.3% (*P* = .330) and 69.7% (*P* = .823).

Continue to Play. There was no difference in CTP rate between comparison groups: 73.6% versus 77.1% (*P* = .577) and 73.0% (*P* = .903) for accelerated versus delayed and unilateral groups, respectively. Where CTP in main sport was not achieved at a minimum of 2 years, reasons were as follows (for accelerated, delayed, and unilateral groups, respectively): same symptoms as present before surgery, 32%, 50%, 25%; other symptoms related to the hip, 21%, 12%, 19%; other symptoms not related to the hip, 11%, 0%, 6%; could return but decided or was advised not to (eg, age, family, lifestyle choice), 26%, 38%, 44%; no reason provided, 10%, 0%, 6%.

Revision Surgeries and Complications

There was 1 case of conversion to total hip arthroplasty within 2 years, occurring in the unilateral group. Five

TABLE 5
Patient-Reported Outcomes[a]

	1. Accelerated Group	2. Delayed Group	*P* (1 vs 2)	3. Unilateral Group	*P* (1 vs 3)
mHHS					
Preoperative	80 (73-93)	81 (73-93)	.382	76 (70-86)	.114
Postoperative	100 (93-100)	100 (96-100)	.207	96 (94-100)	.875
P	**<.001**	**<.001**		**<.001**	
Improvement	14 (4-24)	15 (4-25)	.667	17 (4-27)	.078
UCLA					
Preoperative	7 (5-10)	9 (7-10)	**.018**	6 (5-9)	.112
Postoperative	10 (9-10)	10 (9-10)	.729	10 (9-10)	.951
P	**<.001**	**.018**		**<.001**	
Improvement	1 (0-3)	0 (0-2)	**.040**	1.5 (0-4)	.108
SF-36					
Preoperative	73.0 (63.9-87.8)	75.4 (63.8-86.0)	.197	74.5 (60.3-84.4)	.091
Postoperative	89.6 (81.6-95.0)	92.4 (82.9-96.5)	.114	90.3 (79.7-93.3)	.811
P	**<.001**	**<.001**		**<.001**	
Improvement	11.7 (2.9-22.1)	13.4 (1.2-18.1)	.682	12.2 (1.0-25.9)	.965
WOMAC					
Preoperative	15 (5-32)	12 (5-17)	**.027**	16 (5-32)	.681
Postoperative	3 (0-8)	1 (0-5)	.353	3 (0-11)	.656
P	**<.001**	**<.001**		**<.001**	
Improvement	7 (1-19)	9 (1-16)	.725	9 (2-18)	.770

[a]Data are displayed as median (interquartile range). mHHS, modified Harris Hip Score; SF-36, 36-Item Short Form Health Survey; UCLA, University of California Los Angeles activity scale; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index. Statistically significant *P* values are highlighted in bold.

hips (3.3%) from 4 patients in the accelerated group underwent repeat HA (adhesions for 2 patients, bony regrowth for 1 patient, capsular plication for 1 patient). Two hips (2.7%) from 2 patients in the delayed group underwent repeat HA (adhesions and capsular plication for both). Six patients (4.1%) in the unilateral group underwent repeat HA (3 for adhesions, 1 for subspinal impingement, 1 for residual lateral cam, and 1 for localized femoral head chondrolysis). No significant difference was observed in the rates of repeat HA between groups ($P > .999$ and $P = .336$ for accelerated vs delayed and unilateral groups, respectively).

No traction-related complications were reported in either the delayed or the unilateral groups. In the accelerated group, 1 patient had numbness in the foot lasting 3 weeks after the second procedure, and 1 patient experienced some erectile dysfunction that fully resolved within 3 days. No significant difference was found between accelerated versus delayed ($P = .558$) or accelerated versus unilateral ($P = .248$) groups. Two further patients in the accelerated group developed mild heterotopic ossification in both hips, with reduced objective range of motion, but were asymptomatic.

DISCUSSION

The results of this study indicate that athletes undergoing accelerated staged bilateral HA, whereby the contralateral side undergoes surgery 1 week after the first side, achieved clinically and statistically significant improvements in PROs at minimum 2-year follow-up. Our hypotheses were confirmed such that at 2 years after accelerated staged arthroscopy, all PROs including acquired change from baseline, rates of achieving MCID, satisfaction, and rates of CTP were comparable with those of athletes undergoing a delayed surgical intervention and those undergoing unilateral surgery.

Our overall rate of patients undergoing HA to both their hips (30%) is marginally higher than that reported in the literature. Klingenstein et al[16] reported a 21% rate of bilateral symptomatic FAI in patients who underwent surgical treatment for FAI, and Nawabi et al[29] similarly reported a rate of 21.7%. Kuhns et al[17] reported that 15% of patients underwent bilateral surgery. Reasons for discrepancies may include our larger sample size (>2000 patients) spanning a wider time frame (~12 years), as well as the population's being a predominantly male, competitive athletic cohort.

Bilateral HA is becoming increasingly recognized within the literature; however, the optimal time frame between procedures is ambiguous and less well defined. Furthermore, it is important that there be a distinction between bilateral symptoms and bilateral arthroscopy, where the latter can often include patients undergoing HA on both hips for effectively unilateral symptoms on separate occasions. When a patient presents with symptoms in both hips simultaneously, this patient may be suitable for bilateral surgery in a planned staged manner. In contrast, when a patient presents with 1 symptomatic hip, this patient may undergo surgery for this hip only. The same patient may at a later date have symptoms in the contralateral side requiring surgery in a completely different episode of care including a separate rehabilitation period. This distinction is particularly important when establishing groups for the purpose of assessing

TABLE 6
MCID Achievability[a]

	1. Accelerated	2. Delayed	*P* (1 vs 2)	3. Unilateral	*P* (1 vs 3)
½ SD Technique					
mHHS			.212		.456
MCID (score change)	6.2	8.2		7.0	
Outcomes available, n	144	67		131	
Baseline ≤100 – MCID value, n	106	47		105	
MCID achieved, n (%)	90 (84.9)	43 (91.5)		92 (87.6)	
UCLA			.635		.744
MCID (score change)	1.3	1.2		1.4	
Outcomes available, n	144	64		131	
Baseline ≤10 – MCID value, n	75	23		86	
MCID achieved, n (%)	55 (73.3)	18 (78.3)		65 (75.6)	
SF-36			.558		.439
MCID (score change)	8.1	9.4		7.8	
Outcomes available, n	101	64		72	
Baseline ≤100 – MCID value, n	89	50		66	
MCID achieved, n (%)	60 (67.4)	35 (70)		40 (60.6)	
WOMAC			.125		.249
MCID (score change)	7.2	6.7		7.1	
Outcomes available, n	103	59		71	
Baseline ≥0 + MCID value, n	69	38		49	
MCID achieved, n (%)	50 (72.5)	32 (84.2)		40 (81.6)	
Percentage of Possible Improvement Technique					
mHHS			.456		.456
MCID, %	59.5	69.2		75.5	
Outcomes available, n	144	67		131	
Baseline <100, n	132	67		127	
MCID achieved, n (%)	96 (72.7)	52 (77.6)		87 (68.5)	
UCLA			.980		.912
MCID, %	88.2	88.9		91	
Outcomes available, n	144	64		131	
Baseline <10, n	97	39		106	
MCID achieved, n (%)	52 (53.6)	21 (53.8)		56 (52.8)	
SF-36			.315		.621
MCID, %	49.1	33.7		48.3	
Outcomes available, n	101	64		72	
Baseline <100, n	99	64		71	
MCID achieved, n (%)	54 (54.5)	40 (62.5)		36 (50.7)	
WOMAC			.330		.823
MCID, %	57.3	69.2		49.6	
Outcomes available, n	103	59		71	
Baseline >0, n	97	58		66	
MCID achieved, n (%)	66 (68.0)	35 (60.3)		46 (69.7)	

[a]The proportion of cases in each group achieving MCID are displayed in parentheses. MCID achieved was calculated as the number of cases with an improvement ≥ to the calculated MCID divided by those who could achieve this change relative to baseline scores. MCID, minimal clinically important difference; mHHS, modified Harris Hip Score; SF-36, 36-Item Short Form Health Survey; UCLA, University of California Los Angeles activity scale; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.

postoperative outcomes. When the contralateral side is operated on >3 months after the first side, this may more closely resemble the experience of patients who undergo unilateral surgery.[2]

Kuhns et al[17] compared bilateral versus unilateral outcomes after HA. In their study, the bilateral group comprised a mix of patients who had bilateral symptoms (65%, undergoing staged bilateral surgery) and those who had symptoms unilaterally but developed symptoms on the contralateral side at a later date (35%). The timing between surgeries was 5.2 months for the simultaneous bilateral symptomatic group compared with 7.8 months for those presenting initially with unilateral symptoms. Haviv and O'Donnell,[15] in a study of only bilateral cases, grouped patients based on whether symptoms were present unilaterally or bilaterally, at initial presentation, with an overall mean time frame between procedures reported to be 5 months (range, 0.3-30 months). In their bilateral symptomatic group, the contralateral, less symptomatic side was operated on within 3 months of the first side. More recent studies reporting outcomes for patients undergoing staged bilateral HA continue to vary, with

the timing of surgery to the contralateral hip ranging from between 7.8 and 9.3 months (range, 1.0-69.7 months)[2,33,35] to 15 months.[11] Although none of these studies indicate whether symptoms were present bilaterally at the time of initial presentation or whether symptoms to the contralateral limb developed at a later date, it is likely there is a mix of patients grouped as "bilateral," owing to the extended time frame between procedures. A staged approach to bilateral HA, as opposed to incidental subsequent contralateral surgery, has been referenced to be performed within 6 weeks of the first,[18,19] but recommendations of 6 weeks[16] and 3 months[11] as a minimum after the index procedure have also been made.

In a recent study, Mehta et al[24] showed that immediate hip arthroscopy is preferred over delayed arthroscopy for FAI, with restoration of good function postoperatively being the most notable contributor to this difference. A cutoff with which to optimize outcomes for patients, and particularly athletes with bilateral symptoms requiring surgical intervention, is unavailable. Attempts have been made based on cohorts of patients who have undergone arthroscopy to both hips, and there is a consensus that a shorter delay between procedures results in improved outcomes. Thresholds of <10 months[17] and <17 months[11] have been evaluated to support the benefits of earlier intervention on postoperative outcomes. For both of these studies, the cutoff was established using receiver operating curve analysis relative to the predictive ability to achieve a Patient Acceptable Symptom State, but notably, the specificity and sensitivity of these thresholds as determined by the area under the curve (AUC) were less than the optimal value considered to be acceptably discriminatory (all AUCs were <0.7[22]). As these thresholds are based on a mix of patients who presented initially with bilateral symptoms and those who developed contralateral symptoms at a later date, results should be interpreted with caution and not used as a guide with which to manage patients who are bilaterally symptomatic.

By comparison, the current study evaluating bilateral HA is exclusive to patients who had bilateral symptoms. More specifically, the results are relative to an athletic population, which is at greater risk of developing bilateral symptoms[1,16] owing to greater demands such as multidirectional twisting and turning, for example, through the hips. Staging bilateral HA procedures either 1 week apart or at an average of 6 weeks apart (range, 4-12 weeks) resulted in comparable postoperative PROs at 2 years. Similarly, the acquired change from baseline for mHHS, SF-36, and WOMAC was comparable between bilateral groups. There was a statistically significant difference in the acquired change for the UCLA activity scale; however, considering that both groups achieved the maximum score (10) in this PRO at 2 years, the ceiling effect attributable to this PRO may have contributed to the statistical significance observed between groups' delta change. In the current study, staged bilateral arthroscopy 1 week apart demonstrated comparable outcomes with unilateral arthroscopy across all outcome measures. It appears, therefore, that the time interval between procedures does not influence outcomes, a finding that has been previously demonstrated.[2,14] A key point of consideration, however, is that both staged groups in the current study underwent their procedures within the generally accepted literature-based time frame for management of bilaterally symptomatic FAI.[11,19] What this study adds to the literature is that an accelerated time between procedures (1 week) is a safe and effective strategy to improve symptoms and functional ability in athletes presenting with bilateral FAI symptoms and describes a novel time period for bilateral management. Hassebrock et al[14] compared outcomes from a shortened interval between staged procedures in athletes. In their study, an accelerated time frame was defined as 4 to 6 weeks after the first procedure (mean, 1.2 months), which was compared against a delayed surgery >6 weeks (mean, 9.3 months). That study, however, had no buffer period between comparison groups, which would allow for a clearer demarcation of groups; also, there was no upper cutoff, which may introduce the potential that patients who developed symptoms on the contralateral side subsequently may have been included in the delayed group. Nonetheless, Hassebrock et al reported similar PROs between groups at various time points up to final follow-up (2 years).

In the current athletic cohort, higher preoperative alpha angles, representing larger cam deformities, were observed in patients undergoing accelerated HA compared with those undergoing unilateral surgery. Furthermore, the accelerated group had a higher proportion of rim fractures, indicative of a more chronic underlying pincer impingement, and a higher proportion of completely detached and deficient labra (not amenable to repair), reflecting a more advanced pathology in athletes who have bilateral symptoms. Previous studies have demonstrated better outcomes in patients with unilateral FAI undergoing surgical intervention early after symptom onset compared with delayed surgical treatment.[20] It is possible that the same rationale could be incorporated into the management of patients who have bilateral symptoms, particularly as the current study shows that pathology is more advanced in those with bilateral symptoms. Reducing the time between procedures, however, may be dictated by several distinct factors, including surgeon experience, intraoperative procedures performed, rehabilitation guidelines, and patient characteristics, desires, and motivations.

Observed differences in postoperatively measured radiographic angles in the current study reflect the evolution of surgical technique and experience. In the past, our target was to reduce the alpha angle to <55° on Dunn view and <65° on AP view; this was achieved for the delayed group (ie, mean postoperative angles were within the normal range). However, as the surgical technique has evolved and results remain good, our bony corrections have become more aggressive with the aim now to full regain anatomic morphology, which is demonstrated by the lower postoperative angles in the more recent accelerated and unilateral groups.

As part of the standardized rehabilitation protocol at our practice, patients are permitted to fully weight bear without crutches after 5 days; this strategy perhaps allows for patients adhering to this protocol to be more prepared for an accelerated staged procedure. Detailed postoperative rehabilitation protocols are inconsistently reported[34];

however, where an overview is provided, progression in the early postoperative period is generally more conservative than that described in the current study.[14,28] In a recent scoping review,[34] weightbearing restrictions after osteoplasty and labral repair were indicated for an average of 3 weeks, which may be extended depending on intraoperative procedures such as microfracture for $\geq$6 weeks.[4] For certain patients (eg, older, sedentary individuals) and relative to intraoperative procedures performed (eg, microfracture), this rehabilitation trajectory may be advisable; however, it may not be feasible or warranted for others (eg, athletes). The focused effect of rehabilitation protocols is beyond the scope of the current study; however, it is an important consideration when planning staged surgical intervention to manage bilateral pathology in an athletic population. Naturally, the time at which contralateral surgery is performed, where symptoms are present bilaterally, will dictate when an athlete is capable of returning to play. Delaying the staging between procedures for patients with bilateral symptoms will result in 2 periods of time off from work and sport. A more extended delay may additionally increase the potential for further chondral damage. Accelerated surgery may reduce this factor significantly. Also, when considering the postoperative rehabilitation period, accelerated surgery allows both hips to progress simultaneously rather than at different rates.

An interesting finding reported by Hassebrock et al[14] in their athletic cohort was that total playing time lost due to surgical recovery was significantly shorter for their accelerated group compared with those whose staged surgery was separated by a longer period. Considering that PROs are for the most part similar irrespective of when the second procedure is performed, this component of recovery alone may be an important factor specifically for athletes. A systematic review[32] reported a mean duration of return to play after HA as 7.4 months, with a recommended guideline of 3 to 4 months where this information was provided. Information on time loss due to recovery and return to sport is poorly described across the literature. Rosinsky et al[35] suggested that when calculating the rate of return to sport among competitive athletes after bilateral arthroscopy, this is similar to the mathematical square of return to sport rates published after unilateral arthroscopy. Among studies describing athletes with bilateral surgery specifically, the return to sport rate has been reported as 53.7% at 1 year[35] and 81.7%[33] to 90%[14] at 2 years. In the current study of competitive athletes managed for bilateral symptoms, the continued engagement in their main sport at 2 years was similar irrespective of whether surgery was accelerated (73.2%) or delayed (78.8%).

The theoretical benefits (quicker return to play, less time off work, simultaneous progression of recovery, reduced risk of progressive chondral damage) of reducing the time between staged surgeries should be weighed against the potential for increased complications, such as traction-associated neurapraxia with surgeries in close succession. A second procedure for any type of surgery naturally predisposes a patient to an additional risk of acquiring a complication. However, previous comparative studies have evaluated complication rates between simultaneous versus staged[10,25] and further unilateral arthroscopies[25] and found there to be no such risk of increased complications. In the current study also, we found no increased complications for those undergoing accelerated arthroscopy compared with delayed or unilateral arthroscopy, demonstrating this staged approach to be a safe and viable option for the treatment of athletes with bilateral symptoms.

Limitations

This study has some limitations. Although all data were prospectively collected, the retrospective analysis introduces some bias. All procedures were performed by a single high-volume hip preservation surgeon. Although this improves the consistency of the comparisons between groups, it may reduce the generalizability of results to the wider population. There was a predominance of male athletes included in this study (reflective of the athletic footfall through the clinic), which may also reduce the generalizability of the results. Although attempts were made to reduce any effects on outcomes posed by advancing surgical technique, which has undoubtedly changed and evolved over time, this was achievable only for the comparison between accelerated and matched unilateral cases (for both groups, surgery was performed after 2014); this was not possible for the comparisons between accelerated and delayed groups due to the small number of patients in the delayed group who underwent surgery after 2014 (15%), when capsular repair was incorporated routinely into the surgical technique. The outcomes of routine interportal capsular repair have been previously reported.[13] Due to the retrospective nature of the study, not all patients had pre- and postoperative radiographs available for review at the time of this study, resulting in reduced cases available for subsequent preoperative to postoperative pairwise comparisons. Additionally, observed differences in radiographically measured angles between accelerated and comparative groups is a limitation. As a result, the delayed group was not as contemporaneous as the comparative accelerated group. The PRO measures used in this study are not a comprehensive sample of the many different outcome measures used within the hip arthroscopy literature, and other PRO measures are available. Despite this, of the PRO measures included in this study, the mHHS as a hip-specific outcome measure is regarded as the most widely used within the hip arthroscopy literature, allowing for comparisons to be made across the literature. As well, the WOMAC has formed the basis for the development of a number of recent "disease-specific scores," such as the Non-Arthritic Hip Score, the Copenhagen Hip and Groin Outcome Score, and the Hip disability and Osteoarthritis Outcome Score, the main difference being the addition of sports- and activity-related and quality of life–related sections, for which we have separately used the UCLA score and the SF-36.

CONCLUSION

Accelerated bilateral HA 1 week apart was a safe and effective treatment option for athletes with bilateral

symptomatic hips. Improvement in PROs and CTP rates were comparable with a delayed duration between procedures and with those case-control matched athletes undergoing unilateral arthroscopy.

REFERENCES

1. Allen D, Beaulé PE, Ramadan O, Doucette S. Prevalence of associated deformities and hip pain in patients with cam-type femoroacetabular impingement. *J Bone Joint Surg Br*. 2009;91(5):589-594.
2. Ankem HK, Diulus SC, Kyin C, et al. Outcomes of staged bilateral hip arthroscopic surgery in the context of femoroacetabular impingement syndrome: a nested matched-pair control study focusing on the effect of time between procedures. *Am J Sports Med*. 2022;50(11):2998-3008.
3. Azboy I, Ceylan HH, Groff H, Vahedi H, Parvizi J. Bilateral femoroacetabular impingement: what is the fate of the asymptomatic hip? *Clin Orthop Relat Res*. 2019;477(5):983-989.
4. Bolia IK, Briggs KK, Matheny L, Philippon MJ. Survey results from an international hip course: comparison between experts and non-experts on hip arthroscopy clinical practice and post-operative rehabilitation. *Knee Surg Sports Traumatol Arthrosc*. 2020;28(4):1270-1275.
5. Byrd JWT, Jones KS. Hip arthroscopy in the presence of dysplasia. *Arthroscopy*. 2003;19(10):1055-1060.
6. Carton P, Filan D. Anatomic acetabular labral repair. *Oper Tech Orthop*. 2020;30(1):100777.
7. Carton P, Filan D. Defining the minimal clinically important difference in athletes undergoing arthroscopic correction of sports-related femoroacetabular impingement: the percentage of possible improvement. *Orthop J Sports Med*. 2020;8(1):2325967119894747.
8. Carton P, Filan D, Mullins K. Survivorship rate and clinical outcomes 10 years after arthroscopic correction of symptomatic femoroacetabular impingement. *Am J Sports Med*. 2022;50(1):19-29.
9. Carton PF, Filan D. Labral cuff refixation in the hip: rationale and operative technique for preserving the chondrolabral interface for labral repair: a case series. *J Hip Preserv Surg*. 2018;5(1):78-87.
10. Degen RM, Nawabi DH, Fields KG, Wentzel CS, Kelly BT, Coleman SH. Simultaneous versus staged bilateral hip arthroscopy in the treatment of femoroacetabular impingement. *Arthroscopy*. 2016;32(7):1300-1307.
11. Essilfie AA, Bloom DA, Zusmanovich M, Kester B, Wolfson T, Youm T. Staged bilateral hip arthroscopy compared with a matched unilateral hip arthroscopy group: minimum 2-year follow-up. *Arthroscopy*. 2020;36(7):1856-1861.
12. Fernandez CE, Morgan AM, Sheth U, Tjong VK, Terry MA. Bilateral versus unilateral hip arthroscopy for femoroacetabular impingement: a systematic review. *J Hip Preserv Surg*. 2020;7(2):225-232.
13. Filan D, Carton P. Routine interportal capsular repair does not lead to superior clinical outcome following arthroscopic femoroacetabular impingement correction with labral repair. *Arthroscopy*. 2020;36(5):1323-1334.
14. Hassebrock JD, Chhabra A, Makovicka JL, Economopoulos KJ. Bilateral hip arthroscopy in high-level athletes: results of a shorter interval between staged bilateral hip arthroscopies. *Am J Sports Med*. 2020;48(3):654-660.
15. Haviv B, O'Donnell J. Arthroscopic treatment for symptomatic bilateral cam-type femoroacetabular impingement. *Orthopedics*. 2010;33(12):874.
16. Klingenstein GG, Zbeda RM, Bedi A, Magennis E, Kelly BT. Prevalence and preoperative demographic and radiographic predictors of bilateral femoroacetabular impingement. *Am J Sports Med*. 2013;41(4):762-768.
17. Kuhns BD, Hannon CP, Makhni EC, et al. A comparison of clinical outcomes after unilateral or bilateral hip arthroscopic surgery: age- and sex-matched cohort study. *Am J Sports Med*. 2017;45(13):3044-3051.
18. Kuhns BD, Nho SJ. Editorial commentary: bilateral femoroacetabular impingement syndrome: what we know now and where do we go from here? *Arthroscopy*. 2020;36(7):1862-1863.
19. Kumar MV, Shanmugaraj A, Kay J, et al. Bilateral hip arthroscopy for treating femoroacetabular impingement: a systematic review. *Knee Surg Sports Traumatol Arthrosc*. 2022;30(3):1095-1108.
20. Kunze KN, Beck EC, Nwachukwu BU, Ahn J, Nho SJ. Early hip arthroscopy for femoroacetabular impingement syndrome provides superior outcomes when compared with delaying surgical treatment beyond 6 months. *Am J Sports Med*. 2019;47(9):2038-2044.
21. Lodhia P, Chandrasekaran S, Gui C, Darwish N, Suarez-Ahedo C, Domb BG. Open and arthroscopic treatment of adult hip dysplasia: a systematic review. *Arthroscopy*. 2016;32(2):374-383.
22. Mandrekar JN. Receiver operating characteristic curve in diagnostic test assessment. *J Thoracic Oncol*. 2010;5(9):1315-1316.
23. Matsuda DK, Ching K, Matsuda NA. Simultaneous bilateral hip arthroscopy. *Arthrosc Tech*. 2017;6(4):e913-e919.
24. Mehta MP, Hoffer-Hawlik MA, O'Connor M, Lynch TS. Immediate versus delayed hip arthroscopy for femoroacetabular impingement: an expected value decision analysis. *J Am Acad Orthop Surg Glob Res Rev*. 2020;4(12):e20.00206.
25. Mei-Dan O, McConkey MO, Knudsen JS, Brick MJ. Bilateral hip arthroscopy under the same anesthetic for patients with symptomatic bilateral femoroacetabular impingement: 1-year outcomes. *Arthroscopy*. 2014;30(1):47-54.
26. Menge TJ, Briggs KK, Dornan GJ, McNamara SC, Philippon MJ. Survivorship and outcomes 10 years following hip arthroscopy for femoroacetabular impingement: labral debridement compared with labral repair. *J Bone Joint Surg Am*. 2017;99(12):997-1004.
27. Na YG, Kang YG, Chang MJ, Chang CB, Kim TK. Must bilaterality be considered in statistical analyses of total knee arthroplasty? *Clin Orthop Relat Res*. 2013;471(6):1970-1981.
28. Naessig S, Kucharik M, Meek W, Eberlin C, Martin S. Prehabilitation and rehabilitation program for patients undergoing arthroscopic acetabular labral repair: a comprehensive 5-phase patient-guided program. *Orthop J Sports Med*. 2022;10(2):23259671211071070.
29. Nawabi DH, Bedi A, Tibor LM, Magennis E, Kelly BT. The demographic characteristics of high-level and recreational athletes undergoing hip arthroscopy for femoroacetabular impingement: a sports-specific analysis. *Arthroscopy*. 2014;30(3):398-405.
30. Norman GR, Sloan JA, Wyrwich KW. Point/counterpoint interpretation of changes in health-related quality of life the remarkable universality of half a standard deviation. *Med Care*. 2003;41(5):582-592.
31. Nwachukwu BU, Beck EC, Kunze KN, Chahla J, Rasio J, Nho SJ. Defining the clinically meaningful outcomes for arthroscopic treatment of femoroacetabular impingement syndrome at minimum 5-year follow-up. *Am J Sports Med*. 2020;48(4):901-907.
32. O'Connor M, Minkara AA, Westermann RW, Rosneck J, Lynch TS. Return to play after hip arthroscopy: a systematic review and meta-analysis. *Am J Sports Med*. 2018;46(11):2780-2788.
33. Owens JS, Jimenez AE, Monahan PF, et al. Return to sports and minimum 2-year outcomes of bilateral hip arthroscopy in high-level athletes with a propensity-matched benchmarking against a unilateral control group. *Am J Sports Med*. 2021;49(13):3602-3612.
34. Reiman MP, Boyd J, Ingel N, Reichert A, Westhoven M, Peters S. There is limited and inconsistent reporting of postoperative rehabilitation for femoroacetabular impingement syndrome: a scoping review of 169 studies. *J Orthop Sports Phys Ther*. 2020;50(5):252-258.
35. Rosinsky PJ, Kyin C, Lall AC, Shapira J, Maldonado DR, Domb BG. Rate of return to sport and functional outcomes after bilateral hip arthroscopy in high-level athletes. *Am J Sports Med*. 2019;47(14):3444-3454.
36. Zimmerer A, Ramoser A, Streit M, et al. Osteoarthrosis, advanced age, and female sex are risk factors for inferior outcomes after hip arthroscopy and labral debridement for femoroacetabular impingement syndrome: case series with minimum 10-year follow-up. *Arthroscopy*. 2021;37(6):1822-1828.e1.