

Recovery After Hip Arthroscopy in Patients With Combined Femoroacetabular Impingement and Labral Tears Compared With Isolated Pathology

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Background: Outcomes for patients with femoroacetabular impingement (FAI) treated with hip arthroscopy can differ depending on whether there is underlying intra-articular pathology.

Purpose: To evaluate the outcomes of patients after undergoing hip arthroscopy depending on their underlying pathology (isolated FAI, isolated labral tear, or combined FAI and a labral tear) using the 12-Item International Hip Outcome Tool (iHOT-12).

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

Methods: A total of 75 patients diagnosed with FAI with or without labral tears and isolated labral tears who underwent hip arthroscopy performed by the same surgeon at a single institution from January 2014 to December 2019 were included in this study. All patients had at least 2 years of follow-up data. Patients were divided into 3 groups as follows: patients with FAI and an intact labrum; patients with an isolated labral tear; and patients with combined FAI and a labral tear. The iHOT-12 scores at 1.5, 3, 6, 12, 18, and >24 months postoperatively were compared and analyzed. Outcome scores were also evaluated in terms of the substantial clinical benefit (SCB) and the patient-acceptable symptomatic state (PASS).

Results: Of 75 patients who underwent hip arthroscopy, 14 had FAI, 23 had labral tears, and 38 had both. All groups showed significant improvements on the iHOT-12 from preoperative to the final follow-up (FAI, from 37.64 ± 3.77 to 93.64 ± 1.50 ; labral tear, from 33.70 ± 3.55 to 93 ± 1.24 ; combined, from 28.55 ± 3.15 to 93.03 ± 0.88) ($P < .001$ for all). However, compared with other groups, the patients with FAI and a labral tear had lower scores at 1.5, 3, 6, and 12 months postoperatively ($P < .001$), highlighting a slower rate of recovery. For all groups, recovery to normal function according to the SCB was 100% at 12 months, and satisfaction according to the PASS was 100% at 18 months postoperatively.

Conclusion: The final iHOT-12 scores were similar at 18 months regardless of the pathology treated; however, patients with FAI and a labral tear took longer to reach their plateau.

Keywords: arthroscopy; femoroacetabular impingement; labral tear; 12-Item International Hip Outcome Tool

Femoroacetabular impingement (FAI) is a bony abnormality of the acetabulum and femur that results in hip pain. As an intra-articular pathology, it damages the hip cartilage and eventuates in labral tears—a known cause of early hip osteoarthritis in young adults.^{3,7,9} A labral tear may occur after a traumatic event, and often another underlying cause may be already present, predisposing the patient to

injury. In a study reporting hip arthroscopy for an atraumatic labral tear, 87% of patients demonstrated radiographic evidence of an osseous abnormality, including FAI, arthritis, or hip dysplasia.^{11,12,35}

Hip arthroscopy represents a less invasive alternative to hip procedures that would otherwise require the surgical dislocation of the hip,²¹ and it has proven to be an effective method for the management of intra-articular hip lesions.²¹ Hip arthroscopy for labral repair and labral debridement is a well-established technique and a durable joint-preserving treatment in those patients with a labral tear whose

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nonoperative treatment has failed, especially in young adults.^{5,6,16} Hip arthroscopy for FAI has also been successful in patients >55 years.²

With the development and increased use of hip arthroscopy techniques, additional functional and clinical evaluations will be required, and the definition and evaluation of postoperative outcomes have become increasingly important.¹⁰ The 33-Item International Hip Outcome Tool (iHOT-33) was developed to assess the management of nonarthritic hip problems in young and active patients.¹² This tool captures their various problems, goals, and expectations of treatment.¹² The iHOT-12, a shorter version, uses only 12 items. Despite being one-third the length, the iHOT-12 has similar characteristics to the original 33-item questionnaire and has been shown to be valid, reliable, and responsive to change.¹² Each item is scored from 0 to 100, with a score of 100 indicating the best function and fewest symptoms, and the final score is the mean of all scores.³²

Hip arthroscopy has been used in patients with FAI, a labral tear, and combined FAI with a labral tear.²⁴ However, there is a lack of sufficient postoperative evaluation using the iHOT-12 score and analysis of clinical outcomes until recovery of normal function. Using the iHOT-12, this study aimed to examine the efficiency of surgery and the time required for treatment by analyzing the pre- and postoperative capacity of patients diagnosed with FAI, a labral tear, and FAI with a labral tear who underwent hip arthroscopy treatment. According to an early study, FAI can cause secondary effects, including labral tears and chondrolabral delamination because of repetitive edge loading.^{14,17,20,25,30} We assumed that the group with FAI and a labral tear would have more severe impingement than other groups. Therefore, we hypothesized that the clinical score of FAI with a labral tear would be lower preoperatively and demonstrate slower improvement postoperatively.

METHODS

Patients

This study was approved by our institutional review board, and informed consent was obtained from all patients. The

records of 112 patients who underwent hip arthroscopy at our institution between 2014 and 2019 were reviewed. All related surgical procedures were performed by a single senior surgeon (W.C.S.). We excluded patients with diseases other than FAI with or without a labral tear, patients who received additional hip treatment, and patients with a minimum follow-up of <2 years. The indications for surgery had predominantly been the presence of labral tears with mechanical symptoms, a painful hip motion range, the presence of anterior impingement, and failure of nonoperative treatment.^{19,33,35}

Surgical Procedures and Rehabilitation

All patients were treated under general anesthesia based on their condition and preoperative anesthesiologic evaluation. The patients were placed in a modified supine position on a fracture table with the hip in neutral rotation and 10° of hip abduction on the surgical side, confirmed through the C-arm. On the contralateral side, 30° of hip abduction was applied with sufficient padding to prevent pudendal nerve injury.³ While performing surgical side traction using a fracture table, joint space widening and distraction were also implemented. A spinal needle was inserted into the hip joint space while carefully avoiding labral injuries to generate anterolateral and anterior portals, through which a scope was inserted using a dilator to inspect the entire hip joint.

Indications for labral refixation included a hip with pincer-type or combined pincer- and cam-type impingement, labral pathology, and an adequate amount of relatively healthy labral tissue available for refixation. An ideal labrum for refixation was one without significant intrasubstance degeneration, calcification, ossification, or complex tearing and was typically located in the anterosuperior region.²¹ When labral repair was possible, the bone bed was decorated using a bur, followed by fixation according to the acetabular rim margin using two 2.3-mm suture anchors. Thereafter, a sliding knot suture was used for fixation. In cases of irreparable labral tears, debridement was performed selectively on pathologic lesions of the articular side of the labrum while carefully avoiding cartilage damage. This method enabled the preservation of the labral substance on the capsular surface.^{3,8,21,22,31}

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Ethical approval for this study was obtained from Pusan National University Yangsan Hospital (ref No. 05-2022-057).

In all patients who underwent hip arthroscopy, capsulotomy was performed by connecting the anterior and anterolateral portals.³ FAI was confirmed using the hip scope. Acetabuloplasty, femoroplasty, and acetabuloplasty with femoroplasty were performed based on hip type—pincer, cam, or mixed. The margin of the cartilage injury due to impingement was removed using a bur based on femoroplasty and acetabuloplasty.¹⁵ During acetabuloplasty, efforts were made to avoid labral detachment. However, if labral detachment occurred during acetabuloplasty, labral refixation with a suture anchor was performed. A steroid injection was administered at the end of surgery in all patients to reduce pain and attain an anti-inflammatory effect.^{4,13,34}

For postoperative rehabilitation, all patients underwent physical therapy on the second day postoperatively and performed early hip range-of-motion exercises. After labral repair or osteoplasty, partial weightbearing ambulation using a crutch was performed for 6 weeks. All patients were advised against performing extension and excessive flexion movements until 6 weeks postoperatively, and sports activities were gradually encouraged after 3 months.

Assessment of Clinical Outcomes

The study patients were divided into 3 groups as follows: patients with FAI; patients with an isolated labral tear; and patients with FAI and a tear. For all patients, we calculated clinical outcomes using the iHOT-12 at the following time points: 1.5, 3, 6, 12, 18, and >24 months. We also analyzed iHOT-12 scores by the number of patients who achieved the substantial clinical benefit (SCB) and patient-acceptable symptomatic state (PASS) according to cutoff values reported by Martin et al.²³ The SCB addresses improvement in functional outcomes, and the PASS seeks to quantify the health states that patients find satisfactory.^{19,26,27} For the SCB, the cutoff scores of 38, 60, and 86 were considered abnormal, nearly normal, and normal function, respectively; for the PASS, the cutoff scores of 60, 71, and 86 were regarded as patients being $\geq 50\%$, $\geq 75\%$, and 100% satisfied, respectively.^{23,33}

Statistical Analysis

Data are presented as frequencies for categorical variables and as the mean \pm standard deviation for continuous variables. Differences in patient variables, surgical procedures, and time-dependent changes in iHOT-12 scores were compared across groups using the Fisher exact test or the chi-square test for categorical variables and the analysis of variance with the Scheffé post hoc test or the Kruskal-Wallis test with the Dunn post hoc test for continuous variables, as appropriate. The Bonferroni post hoc test was used for pairwise comparisons of the 7 follow-up time points. The Shapiro-Wilk test was used to assess the normality of data distribution.

A generalized linear mixed model was used to compare repeatedly measured numeric variables between and within groups. Time, group, and time \times group interactions

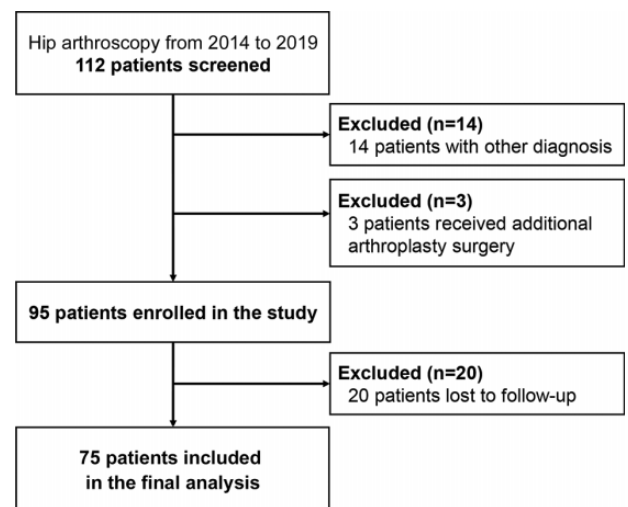


Figure 1. Flowchart of patient selection for this study.

were considered as fixed effects in all models, whereas study participants were regarded as random effects. Statistical analysis was performed using SPSS Version 26.0 (IBM Corp), and $P < .05$ indicated statistical significance.

RESULTS

Patient Characteristics

Of the 112 initial patients, we excluded 14 patients who underwent surgery for other diagnoses, such as septic hip or loose body. Three patients underwent different hip treatments, and 20 patients had iHOT-12 scores that were not observed for at least 2 years, leaving 75 patients for analysis (Figure 1). There were 14 patients in the FAI group, 23 patients in the labral tear group, and 38 patients in the combined FAI and tear group. Patients had a mean age of 39.6 ± 12.9 years; 46 patients were male (61.3%), and 29 patients were female (38.7%). There was a significant sex-based difference between groups, as women were more common in the labral tear group ($P = .006$) (Table 1).

Of the 14 patients with FAI, 7 underwent acetabuloplasty and 7 underwent femoroplasty. In the combined FAI and tear group, 18 patients were treated with acetabuloplasty, 16 with femoroplasty, and 4 with both methods. Repair was done for repairable labral tears and debridement for irreparable labral tears. In the labral tear group, debridement and repair were performed in 12 and 11 patients, respectively. In the combined FAI and tear group, 20 labral debridements and 18 repairs were performed. There was no significant difference in the type of surgical operation between groups (Table 2).

Time-Dependent Changes in Clinical Scores

The iHOT-12 scores by group and across all evaluated time points are shown in Table 3 and Figure 2. The preoperative iHOT-12 score was 37.64 ± 3.77 for FAI, 33.70 ± 3.55 for

TABLE 1
Baseline Characteristics of Patients According to Group^a

	FAI (n = 14)	Labral Tear (n = 23)	Combined FAI and Tear (n = 38)	P	Post Hoc ^b
Age, years	35.21 ± 12.44	41.61 ± 11.14	40.16 ± 12.48	.284 ^d	—
Sex, male	11 (78.6)	8 (34.8)	27 (71.1)	.006^c	A and C > B
BMI, kg/m ²	24 ± 3.91	23.77 ± 3.54	24.26 ± 2.80	.849 ^d	—

^aValues are presented as No. of patients (%) or mean ± SD. The bold P value indicates statistically significant differences ($P < .05$). BMI, body mass index; FAI, femoroacetabular impingement.

^bA, FAI group; B, labral tear group; C, FAI and tear group.

^cChi-square test with Bonferroni post hoc correction.

^dAnalysis of variance with the Scheffé post hoc test.

TABLE 2
Comparison of Surgical Procedures According to Group^a

Variable	FAI (n = 14)	Labral Tear (n = 23)	Combined FAI and Tear (n = 38)	P
FAI				.710 ^b
Acetabuloplasty	7 (50)	—	18 (47.4)	
Femoroplasty	7 (50)	—	16 (42.1)	
Acetabuloplasty + femoroplasty	0 (0)		4 (10.5)	
Labral tear				.972 ^c
Labral debridement	—	12 (52.2)	20 (52.6)	
Labral repair	—	11 (47.8)	18 (47.4)	

^aValues are presented as No. of patients (%). Dashes indicate areas not applicable. FAI, femoroacetabular impingement.

^bFisher exact test.

^cChi-square test.

TABLE 3
Outcome Variables for Each Assessed Parameter, Sorted by Group^a

Time	iHOT12 Score, Mean ± SD			P ^c	Post Hoc ^d	Analysis for Repeated Measures	
	FAI ^b	Labral Tear ^b	Combined FAI and Tear ^b			Crude P ^e	Adjusted P ^f
Preoperative	37.64 ± 3.77	33.70 ± 3.55	28.55 ± 3.15	<.001	A > B > C	<.001	<.001
Postoperative						<.001	<.001
6 weeks	66.21 ± 4.96	65.04 ± 5.53	56.97 ± 5.03	<.001	A and B > C	<.001	<.001
3 months	79.79 ± 7.08	77.91 ± 6.90	66.08 ± 4.02	<.001	A and B > C	<.001	<.001
6 months	88.43 ± 2.50	85.61 ± 4.77	74.26 ± 6.69	<.001	A and B > C	<.001	<.001
1 year	90 ± 2.72	88.96 ± 1.61	84.76 ± 5.26	<.001	A and B > C	<.001	<.001
18 months	92.00 ± 1.18	91.87 ± 1.14	91.18 ± 1.78	.341	—	—	—
>2 years	93.64 ± 1.50	93 ± 1.24	93.03 ± 0.88	.280	—	—	—

^aBold P values indicate statistically significant differences ($P < .05$). Dashes indicate areas not applicable. FAI, femoroacetabular impingement; iHOT-12, 12-Item International Hip Outcome Tool.

^bFor each group, significant improvement in scores were seen at each time point ($P < .05$, Bonferroni post hoc test) except for the following: postoperative 18-month and >2-year follow-up iHOT-12 scores.

^cAnalysis of variance with the Scheffé post hoc test was used for the preoperative comparison, otherwise the Kruskal-Wallis test with Dunn post hoc test was used.

^dA, FAI group; B, labral tear group; C, FAI and tear group.

^eDerived using a generalized linear mixed model.

^fAdjusted for sex.

isolated tear, and 28.55 ± 3.15 for FAI and a tear, with the FAI and tear group having a significantly lower score ($P < .001$). Six months postoperatively, the score was 88.43 ± 2.50 in the FAI group and 85.61 ± 4.77 in the labral tear group; however, the score of the FAI and tear group was significantly lower at 74.26 ± 6.69 ($P < .001$). In the FAI

and tear group, the postoperative iHOT-12 scores were 84.76 ± 5.26 after 12 months and 91.18 ± 1.78 after 18 months, indicating a less steep rise in the clinical score compared with the other groups. The scores at 18 months and 2 years postoperatively were not significantly different among the groups.

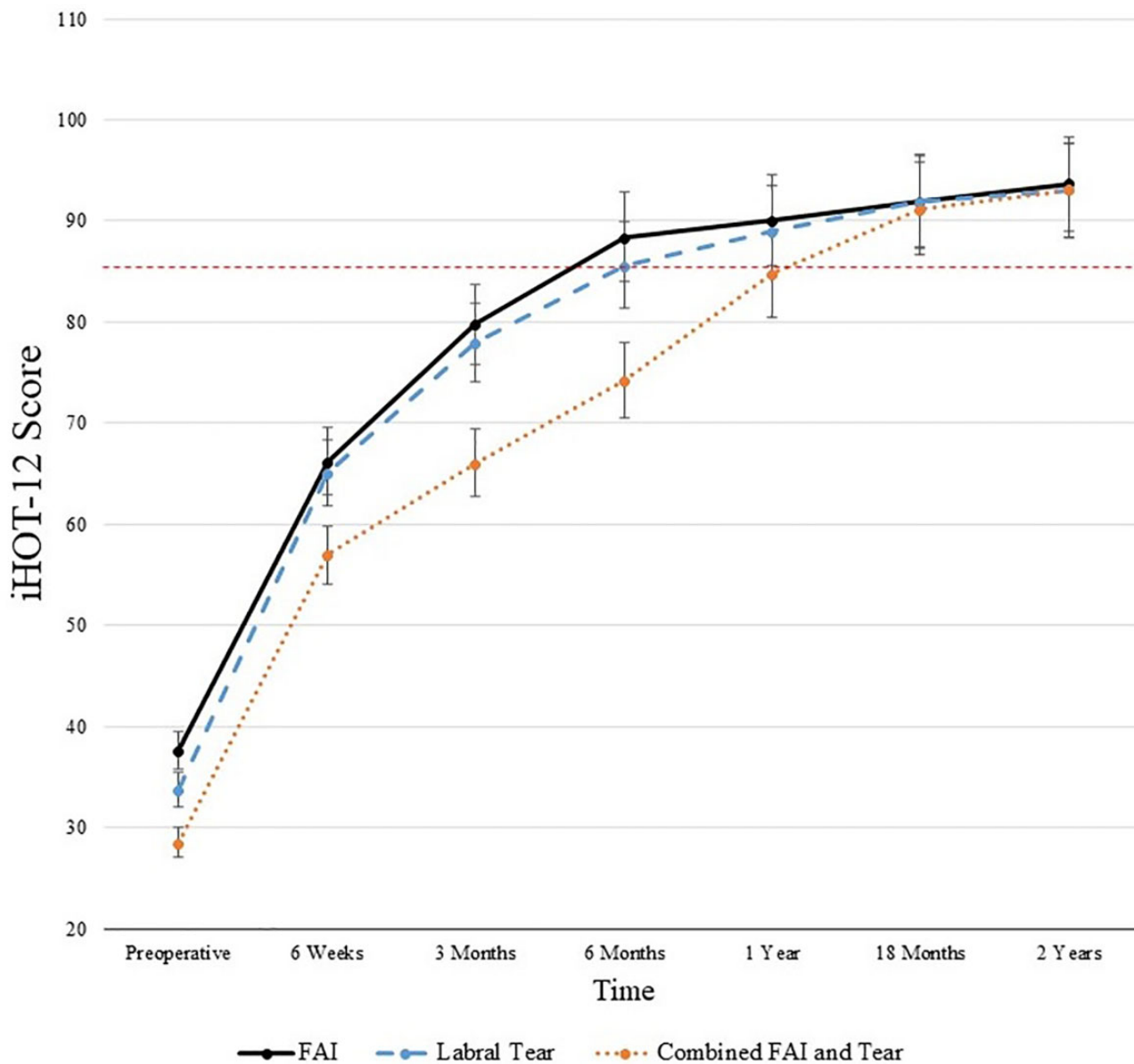


Figure 2. A graph showing iHOT-12 scores across time among the study groups. An iHOT-12 score of 86 indicates 100% satisfaction with treatment and is shown by the dotted horizontal line. Error bars indicate standard error. FAI, femoroacetabular impingement; iHOT-12, 12-Item International Hip Outcome Tool.

TABLE 4
Patients Who Achieved the Absolute SCB and PASS for the iHOT-12 at 2 Years After Hip Arthroscopy^a

Follow-up	Absolute SCB			PASS		
	Abnormal	Nearly Normal	Normal	50% Satisfied	75% Satisfied	100% Satisfied
6 weeks	1.3 (1)	93.3 (70)	5.3 (4)	82.7 (62)	17.3 (13)	—
3 months	—	64 (48)	36 (27)	30.7 (23)	48 (36)	21.3 (16)
6 months	—	30.7 (23)	69.3 (52)	1.3 (1)	44 (33)	54.7 (41)
1 year	—	—	100 (75)	—	13.3 (10)	86.7 (65)
18 months	—	—	100 (75)	—	—	100 (75)
>2 years	—	—	100 (75)	—	—	100 (75)

^aValues are presented as percentages (No. of patients). Dashes indicate areas not applicable. iHOT-12, 12-Item International Hip Outcome Tool; PASS, patient acceptable symptomatic state; SCB, substantial clinical benefit.

In terms of absolute SCB, the rate of recovery to a normal level of function was 100% at the 12-month follow-up. As for the PASS, a rate of 100% satisfaction was obtained at 18 months postoperatively (Table 4), although the time point for reaching the PASS was significantly different between groups ($P < .001$). A breakdown of SCB scores by group indicated that at 6 months postoperatively, all patients (100%) in the FAI group and 5 patients (21.7%) in the labral tear group reached the SCB cutoff score of 86; however, no patient in the FAI and tear group reached the SCB cutoff score. After 12 months, all patients (100%) in the labral tear group and 24 patients (63.2%) in the FAI and tear group reached the SCB cutoff score, and all patients in the FAI and tear group reached the SCB cutoff score at 18 months postoperatively.

DISCUSSION

We found that patients with FAI and those with a labral tear, as individual conditions, required a treatment period of approximately 6 months to return to normal function after hip arthroscopy. In contrast, patients with both FAI and a labral tear required a longer recovery period, and similar iHOT-12 scores were not observed among the 3 study groups until 18 months postoperatively. The longer recovery period of patients with FAI and a labral tear should be taken into consideration in clinical practice.

Previous studies have reported outcomes after hip arthroscopy for FAI.^{23,29} Nwachukwu et al²⁶⁻²⁹ reported that a clear effect was observed within 6 months of hip arthroscopy and that pain relief, as well as functional improvement, continued for at least 2 years. A clinical evaluation using the iHOT-12 also reported that the mean preoperative iHOT-12 score increased from 35.6 to 70.7 at 1-year follow-up, when the patient satisfaction scores increased²⁹ from 37.5 to 79 out of 100. Martin et al²³ reported an increase in the preoperative iHOT-12 score from 34 to 73 after 2 years of follow-up, as well as no difference in absolute SCB scores between 1- and 2-year follow-up. Our study showed that the mean iHOT-12 scores surpassed the SCB and PASS cutoff values at 6-month and 1-year follow-up in the FAI and labral tear groups, with no significant differences observed at 1 year and beyond. In the combined FAI and tear group, the iHOT-12 score improved at 6 and 12 months postoperatively but did not reach the SCB cutoff score until 18 months postoperatively.

Using the iHOT-12, Bodendorfer et al¹ studied 3 natural recovery periods in patients who underwent primary hip arthroscopy for FAI. The authors defined these periods as early progression, late regression, and late progression. Preoperative psychiatric conditions, chronic pain, workers' compensation status, and lower iHOT-12 scores were studied as predictors of the late regressor group. Therefore, patients in the combined FAI and tear group in our study with lower iHOT-12 scores would have corresponded to the late regressor group. Kunze et al¹⁸ conducted a study on the treatment outcomes in FAI patients according to the duration of preoperative hip pain. The iHOT-12 scores at 3-6, 6-12, 12-24, and >24 months after the onset of symptoms

were 78.9, 69.6, 70.4, and 62.5, respectively, suggesting that hip arthroscopy within 6 months of the onset of FAI symptoms may be the most effective. When treatment of FAI is delayed, secondary effects—such as intrasubstance degeneration, change in femoral offset, symptomatic tear formation with adjacent propagation, and worsening of chondrolabral delamination—can occur owing to repetitive edge loading.^{14,17,20,21,25} In our study, we hypothesized that in the combined FAI and tear group, the disease would progress with secondary effects leading to lower preoperative iHOT-12 scores as well as delayed achievement of 100% SCB. Further studies to confirm these aspects and our assumptions are warranted. Since labral injury can occur as FAI progresses, a dedicated additional study was needed, and this study indeed aimed to address this still unelucidated issue in the literature. Compared with the study of Kunze et al,¹⁸ our study demonstrated different treatment outcomes, which we classified according to the duration of hip arthroscopy treatment not only in patients with FAI but also in those with a labral tear.

Limitations

This study has several limitations. First, owing to the retrospective nature of the study, selection bias could not be eliminated. Since the present study analyzed patient data from a single orthopaedic surgeon, the generalizability of the study conclusions may be limited. Second, the number of cases could be considered low. Therefore, the results might have been affected by attrition bias and may not represent the entire population. Third, we were unable to specifically analyze different types of FAI. Fourth, we did not assess the technical success of surgery, including whether there were any bumps and so on, and we did not compare the outcomes of labral debridement and labral repairs. Moreover, we did not assess the duration of symptoms or other potential confounders, such as smoking, employment, and sport. Further studies should assess the generalizability of our findings.

CONCLUSION

In the present study, the final iHOT-12 scores were similar at 18 months postoperatively regardless of the pathology treated; however, patients with combined FAI and labral tears took longer to reach their plateau.

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