Hip Arthroscopy for the Treatment of Femoroacetabular Impingement Syndrome in Hips With Mild Osteoarthritis (Tönnis Grade 1)

A Matched Comparative Cohort Analysis at Minimum 5-Year Follow-up

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Background: There is a paucity of information in the literature on midterm outcomes from the arthroscopic treatment of femoroacetabular impingement syndrome (FAIS) with concomitant labral treatment in patients with mild osteoarthritis (OA) using modern surgical techniques.

Purpose: To compare outcomes of hip arthroscopy for the treatment of FAIS between patients with mild OA (Tönnis grade 1) and patients without OA (Tönnis grade 0) at minimum 5-year follow-up.

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

Methods: Patients were identified who underwent primary hip arthroscopy for FAIS with routine capsular closure between January 2012 and December 2015. Patients with Tönnis grade 1 were matched 1:3 by age, sex, and body mass index to patients without OA. The Hip Outcome Score–Activities of Daily Living (HOS-ADL), HOS–Sports Subscale (HOS-SS), modified Harris Hip Score, and 12-item International Hip Outcome Tool were collected preoperatively and at 5 years postoperatively and compared between groups using an independent *t* test. Survivorship rate and percentage achievement of a Patient Acceptable Symptom State (PASS) or minimal clinically important difference (MCID) were compared using a Fisher exact test.

Results: A total of 50 patients (54 hips) with Tönnis grade 1 were matched to 162 patients (162 hips) with Tönnis grade 0. The mean ± SD age and body mass index of the Tönnis grade 1 group were 44.5 ± 9.6 years and 28.5 ± 5.5, respectively. Patient-reported outcome (PRO) scores improved significantly for both groups from presurgery to 5 years postoperatively for all PROs ($P \leq .03$). There were no significant differences in preoperative PROs between the groups. Patients with Tönnis grade 1 had significantly lower postoperative scores on the HOS-ADL (74.7 ± 22.6 vs 83.0 ± 20.1; $P = .04$) and HOS-SS (58.8 ± 33.7 vs 71.8 ± 29.3; $P = .03$) than patients with grade 0. Patients with Tönnis grade 1 also had significantly lower rates of achievement of the MCID (57.1% vs 80.2%; $P < .01$) and PASS (34.1% vs 53.4%; $P = .03$) for any PRO when compared with patients with Tönnis grade 0. Gross survivorship was significantly lower for Tönnis grade 1 versus grade 0 (77.8% vs 96.9%; $P < .001$).

Conclusion: Patients with Tönnis grade 1 arthritis experienced significant improvement in PROs after hip arthroscopy for the treatment of FAIS. However, they had significantly lower postoperative HOS-ADL and HOS-SS scores with significantly lower rates of achievement on the MCID and PASS, with a significantly lower gross survivorship rate at a minimum 5 years postoperatively in comparison with those with Tönnis grade 0 changes.

Keywords: hip arthroscopy; hip: femoroacetabular impingement; aging athlete; clinical assessment/grading scales

Hip arthroscopy is a typically performed procedure for the treatment of femoroacetabular impingement syndrome (FAIS). It is commonly thought to be a procedure reserved primarily for younger patients and athletes. However, even older patients may have good benefit from the procedure, in the absence of osteoarthritis (OA).[18] Outcomes after hip arthroscopy are generally positive with a relatively low complication rate. Yet, patient selection is key to obtaining good outcomes after hip arthroscopy. Risk factors for poor outcomes and/or conversion to total hip arthroplasty

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(THA) include patient obesity, presence of OA, and having the procedure performed by a low-volume surgeon.[20]

The results of hip arthroscopy in the setting of advanced OA are at best unpredictable.[10,30] Patients with a lateral joint space <2 mm are more likely to have poor outcomes after hip arthroscopy.[29] Chandrasekaran et al[7] found that patients with Tönnis grade 2 OA were 7.73 and 4.36 times more likely to undergo conversion to THA than patients with Tönnis grade 0 and grade 1 OA, respectively. However, more research is needed to determine whether patients with more mild OA achieve sustained long-term benefit after hip arthroscopy.

The purpose of this study was to compare the outcomes of patients undergoing hip arthroscopy for the treatment of FAIS with mild OA (Tönnis grade 1) versus patients without OA (Tönnis grade 0) at minimum 5-year follow-up. Our hypothesis was that patients with Tönnis grade 1 OA would experience significant clinical benefit from arthroscopy but less so than patients with Tönnis grade 0 OA. Secondary objectives were to determine if patients with mild arthritis had higher rates of conversion to THA or were less likely to achieve the minimal clinically important difference (MCID) or Patient Acceptable Symptom State (PASS) at 5-year follow-up.

METHODS

Patient Selection

Patients were retrospectively selected from a prospectively maintained single-institution database. Consecutive patients with signs of mild OA (Tönnis grade 1) who underwent primary hip arthroscopy for FAIS, labral tear, or other intra-articular pathology by the senior author (S.J.N.) from January 2012 through December 2015 were eligible for inclusion. Patients were required to have completed at least 1 patient-reported outcome (PRO) at a minimum 5 years postoperatively to be eligible for inclusion. Patients with a history of pediatric hip disease (eg, slipped capital femoral epiphysis, Legg-Calve-Perthes disease, or congenital hip dislocation) or those who underwent revision hip arthroscopy were excluded from the study.

Evaluation of Hip OA

Preoperative radiographs were independently reviewed by 2 orthopaedic surgeons (L.S. and N.S.H.) to grade the severity of OA. The Tönnis classification system was used as previously described, with Tönnis grade 0 defined as no evidence of OA and Tönnis grade 1 defined as slight narrowing of the joint space, slight lipping of osteophytes at the joint margin, or slight sclerosis of the femoral head or acetabulum (Figure 1).[5,21,24] Interrater reliability was assessed using the Cohen kappa statistic (κ). Agreement was categorized a priori as follows (κ/intraclass correlation coefficient): 0.81 to 0.99, excellent; 0.61 to 0.80, substantial; 0.41 to 0.60, moderate; 0.21 to 0.40, fair; and ≤0.20, poor.[23] The 2 surgeons agreed on 84.5% of cases for a κ of 0.831, indicating excellent agreement.

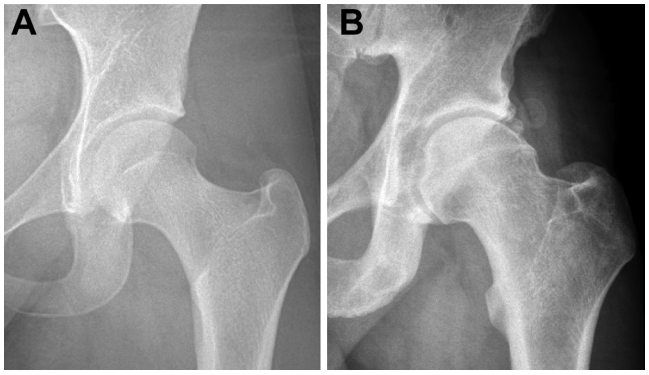

Figure 1. Preoperative anteroposterior radiographs demonstrating examples of patients with (A) grade 0 and (B) grade 1 osteoarthritis according to the Tönnis osteoarthritis classification system.

Hips with Tönnis grade 1 were matched with Hips with Tönnis grade 0 in R (Version 1.2.5042; R Core Team). A 1:3 ratio was selected per previous literature,[25,33] and patients were matched on the basis of age, sex, and body mass index: 54 hips with Tönnis grade 1 and 162 without clinical or radiographic signs of OA (Tönnis grade 0) (Figure 2).

Data Collection and Analysis

Patient demographic data were recorded (eg, age, sex, and body mass index). Preoperative radiographic characteristics were also recorded: alpha angle as measured on anteroposterior and Dunn lateral plain radiographs, lateral center-edge angle, and Tönnis angle. Indications for surgery and intraoperative procedures performed were noted. Intraoperative findings were documented, such as cam or pincer impingement deformities, articular cartilage condition or delamination, and Outerbridge classification. Continuous variables were reported as mean and standard deviation and compared between cohorts using Fisher

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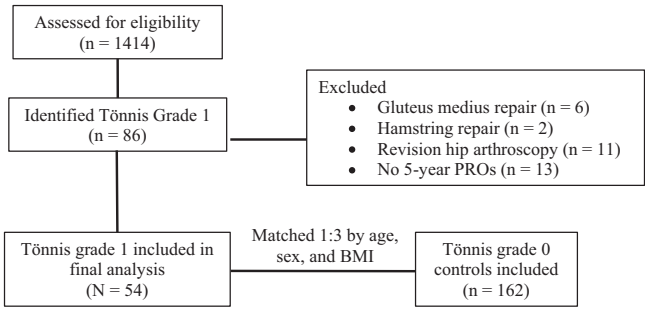

Figure 2. CONSORT (Consolidated Standards of Reporting Trials) flow diagram of case selection methods. BMI, body mass index; PRO, patient-reported outcome.

exact or independent 2-tailed Student *t* tests. Categorical variables were reported as percentage of the total cohort and compared between cohorts using Fisher exact or chi-square analyses. The significance level for all statistical measurements was set at $P < .05$. Statistical analyses were conducted using SPSS Statistics (Version 27.0.0; IBM Corp). Approval for the conduct of this research was obtained from the local institutional review board, and all patients provided informed consent to the use of their data for the conduct of this study.

Operative Technique

All patients underwent primary hip arthroscopy at a high-volume academic center by a fellowship-trained hip arthroscopic surgeon (S.J.N.) as previously described.[15,16] Briefly, a standard anterolateral portal was established under fluoroscopic guidance and an anterior portal under direct arthroscopic visualization. An interportal capsulotomy was performed allowing access to the central compartment of the hip, and procedures were conducted as indicated: acetabuloplasty, labral debridement, labral repair, debridement of chondral lesions to stable margins, and/or microfracture. After treatment of central compartment pathology, hip traction was released, and a T-capsulotomy was performed to assess the proximal femoral morphology. A comprehensive cam resection was done to address abnormal femoral morphology. Under fluoroscopic guidance and direct arthroscopic visualization, a dynamic examination of the hip was performed to ensure that a complete cam resection was completed. After treatment of peripheral compartment pathology, the T-capsulotomy was repaired starting at the base of the vertical portion, followed by the interportal segment.[4] Rehabilitation was initiated on postoperative day 1 and followed a 4-phase protocol as previously described.[26]

Postoperative Outcome Analysis

PRO measures were recorded preoperatively and at a minimum 5 years postoperatively: Hip Outcome Score–Activities of Daily Living (HOS-ADL) and HOS–Sports Subscale (HOS-SS), modified Harris Hip Score (mHHS), and 12-item International Hip Outcome Tool (iHOT-12). Pre- and postoperative scores were compared between cohorts. Clinically significant outcomes were defined by achievement or failure to achieve an MCID or PASS for each PRO. Previously defined literature values of the MCID and PASS thresholds for patients undergoing hip arthroscopy for FAIS were used. MCID values were as follows: HOS-ADL, 10.2; HOS-SS, 15.2; mHHS, 11.4; and iHOT-12, 15.1.[28] PASS thresholds were as follows: HOS-ADL, 99.2; HOS-SS, 80.9; mHHS, 83.6; and iHOT-12, 74.3.[28]

TABLE 1
Preoperative Demographic and Radiographic Patient Characteristics[a]

Characteristic	Tönnis Grade 1 (n = 54 Hips)	Tönnis Grade 0 (n = 162)	*P* Value
Age, y	44.5 ± 9.6	44.7 ± 9.5	.94
Sex: female	53.7	53.7	.92
Body mass index	28.5 ± 5.5	28.1 ± 5.4	.78
Smoker	11.1	11.1	≥.99
Workers' compensation	9.4	6.8	.55
Psychiatric history	17.4	16.7	≥.99
Low back pain	25.0	21.6	.69

[a]Values are presented as mean ± SD or percentages.

Survivorship Analysis

At the time of most recent follow-up, all patients were asked whether they underwent revision hip arthroscopy or conversion to THA. Postoperative complications were also recorded, such as persistent pain requiring additional corticosteroid injections and development of hip or groin pain in the contralateral hip. Survivorship was calculated for the total study population. A Kaplan-Meier survivorship curve, with conversion to THA and revision hip arthroplasty as the definitive endpoints, was created using SPSS Statistics Version 27.0.0 (IBM Corp).

RESULTS

Consecutive patients numbering 62 (67 hips) with radiographic evidence of mild OA (Tönnis grade 1) underwent primary hip arthroscopy for FAIS or labral pathology between January 2012 and December 2015 by the senior author. PRO scores at a minimum 5 years were available for 50 patients (54 hips; 81% compliance rate). The matched cohort of patients with Tönnis grade 0 included 162 patients (162 hips). A majority of hips belonged to female patients (53.7%) in both cohorts. The mean ± SD age and body mass index were 44.5 ± 9.6 years and 28.5 ± 5.5 for the Tönnis grade 1 cohort and 44.7 ± 9.5 years and 28.1 ± 5.4 for the Tönnis grade 0 cohort, respectively (Table 1). There were no statistically significant differences between the groups in current or former smoking status, workers' compensation status, psychiatric history, or history of low back pain ($P > .05$ for all).

TABLE 2
Preoperative Imaging Findings on Plain Radiographs[a]

Finding	Tönnis Grade 1	Tönnis Grade 0	*P* Value
Alpha angle			
Anteroposterior	78.1 ± 17.8	67.3 ± 16.4	<.01[b]
Dunn	70.7 ± 15.3	61.8 ± 12.1	<.01[b]
Center-edge angle			
Lateral	32.4 ± 5.8	32.1 ± 7.1	.80
Anterior	34.0 ± 6.4	33.5 ± 8.1	.83
Tönnis angle	7.0 ± 5.4	6.4 ± 4.5	.52
Joint space width, mm	12.4 ± 2.4	13.1 ± 1.8	.06
Apical	4.3 ± 1.0	4.5 ± 0.8	.09
Medial	4.0 ± 1.1	4.1 ± 0.9	.60
Lateral	4.1 ± 0.9	4.5 ± 0.8	.02[b]

[a]Values are presented as mean ± SD.
[b]$P < .05$.

TABLE 3
Intraoperative Findings and Procedures per Cohort[a]

Finding and Procedures	Tönnis Grade 1	Tönnis Grade 0	*P* Value
Outerbridge grade			<.01[b]
0	48.1	77.2	
I/II	16.7	6.8	
III	7.4	8.6	
IV	27.8	7.4	
Cartilage delamination	66.7	31.6	<.01[b]
Labral treatment			.02[b]
Debridement	13.0	3.7	
Repair	87.0	96.3	
Femoral osteochondroplasty	96.3	99.4	.15
Acetabular rim trimming	87.0	91.4	.42
Synovectomy	87.0	92.6	.27
Trochanteric bursectomy	1.9	4.9	.46
Capsular plication or repair	100.0	100.0	≥.99
Microfracture	7.4	0.6	<.01

[a]Values are presented as percentages.
[b]$P < .05$.

The Tönnis grade 1 cohort had significantly higher average alpha angles measured on anteroposterior and Dunn lateral plain radiographs ($P < .01$ for both). There were no statistically significant differences in lateral center-edge angle, anterior center-edge angle, or Tönnis angle (Table 2). Reduced joint space width in the Tönnis grade 1 group was appreciated when compared with the Tönnis grade 0 group; however, only the difference in lateral joint space width was statistically significant ($P = .0172$).

There was a significant difference between groups in the severity of cartilage damage appreciated on the intraoperative evaluation ($P < .01$) (Table 3). Patients with Tönnis grade 1 had an increased frequency of cartilage delamination as compared with patients with Tönnis grade 0 ($P < .01$). Additionally, between-group differences were appreciated in labral treatment (labral debridement vs repair) as well as the proportion of patients who underwent arthroscopic microfracture ($P < .01$).

A majority of Tönnis grade 0 cases (61.2%) had normal articular cartilage on intraoperative examination in contrast to Tönnis grade 1 cases (18.5%) ($P < .01$). Similarly, a majority of Tönnis grade 0 cases (77.2%) had no signs of chondromalacia, whereas more than half (51.9%) of Tönnis grade 1 cases had signs of chondromalacia, with more than one-third (35.2%) having Outerbridge grade III or higher ($P < .001$). Femoral chondral defects were also more common in Tönnis grade 1 group, with grade IV defects occurring in 24.1% of cases as opposed to just 3.7% in the Tönnis grade 0 group ($P < .01$). The 2 groups differed significantly on labral treatment, with 96.3% of Tönnis grade 0 group undergoing labral repair as compared with 87.0% of Tönnis grade 1 group ($P = .02$). There were no statistically significant differences between the groups for any of the remaining intraoperative procedures.

Postoperative Outcomes

Patients with mild OA (Tönnis grade 1) and without OA (Tönnis grade 0) showed statistically significant improvement in all PROs ($P < .05$) (Table 4). The Tönnis grade 1 cohort had lower preoperative and 5 years postoperative HOS-ADL and mHHS scores while the Tönnis grade 0 cohort had lower HOS-SS and iHOT-12 scores (Table 5). However, the differences in preoperative PRO scores were not statistically significant ($P > .05$). Patients with Tönnis grade 1 had significantly less improvement in HOS-ADL and HOS-SS scores from presurgery to 5 years postoperatively ($P < .05$). Accordingly, HOS-ADL scores at 5 years were significantly lower for the Tönnis grade 1 cohort (74.7 ± 22.6) versus the Tönnis grade 0 group (83.0 ± 20.1) ($P = .04$). Postoperative HOS-SS scores were significantly lower for the Tönnis grade 1 cohort (58.8 ± 33.7) versus the Tönnis grade 0 group as well (71.8 ± 29.3) ($P = .03$). There were no other statistically significant differences in PRO scores at 5 years.

Patients with mild OA (Tönnis grade 1) had lower rates of achievement of the MCID for all 4 PROs (Table 6). Significantly lower rates of achievement of the MCID for HOS-SS scores were observed in Tönnis grade 1 patients. Differences in achievement of the MCID for HOS-ADL, mHHS, and iHOT-12 were not statistically significant. The overall achievement of the MCID for any 1 PRO was significantly lower for Tönnis grade 1 cases (57.1%) than for Tönnis grade 0 (80.2%) ($P < .01$). Patients with mild OA (Tönnis grade 1) had also had lower rates of achievement of the PASS for all PROs. Again, differences in achievement of the PASS for individual PROs were not statistically significant. Overall achievement of the PASS for any 1 PRO, though, was significantly lower for Tönnis grade 1 cases (34.1%) than for Tönnis grade 0 (53.4%) ($P = .03$).

Survivorship Analysis

The gross survivorship rate was significantly lower for patients with mild OA (77.8%) in contrast to patients

TABLE 4
Changes in Patient-Reported Outcome Scores From Presurgery to 5 Years Postoperatively for Each Cohort[a]

Outcome	Preoperative	Postoperative	Delta	*P* Value[b]
		Tönnis grade 1		
HOS-ADL	61.9 ± 19.0	74.7 ± 22.6	9.8 ± 21.0	.02
HOS-SS	43.1 ± 25.0	58.8 ± 33.7	11.5 ± 31.9	.03
mHHS	54.0 ± 16.5	72.8 ± 21.3	17.4 ± 26.1	<.01
iHOT-12	33.5 ± 19.1	61.7 ± 30.2	28.2 ± 11.0	.02
		Tönnis grade 0		
HOS-ADL	63.8 ± 19.0	83.0 ± 20.1	19.1 ± 21.8	<.01
HOS-SS	40.7 ± 24.2	71.8 ± 29.3	30.3 ± 32.8	<.01
mHHS	55.4 ± 14.4	78.2 ± 20.1	24.3 ± 22.1	<.01
iHOT-12	32.8 ± 16.6	66.8 ± 28.8	35.8 ± 29.1	<.01

[a]Values are presented as mean ± SD. ADL, Activities of Daily Living; HOS, Hip Outcome Score; iHOT-12, 12-item International Hip Outcome Tool; mHHS, modified Harris Hip Score; SS, Sports Subscale.
[b]Each value: $P < .05$.

TABLE 5
Preoperative and 5-Year Postoperative Patient-Reported Outcome Scores for Patients With Mild Osteoarthritis (Tönnis Grade 1) Versus No Osteoarthritis (Tönnis Grade 0)[a]

PRO Score	Tönnis Grade 1	Tönnis Grade 0	*P* Value
Preoperative			
HOS-ADL	61.9 ± 19.0	63.8 ± 19.0	.58
HOS-SS	43.1 ± 25.0	40.7 ± 24.2	.60
mHHS	54.0 ± 16.5	55.4 ± 14.4	.61
iHOT-12	33.5 ± 19.1	32.8 ± 16.6	.87
Postoperative			
HOS-ADL	74.7 ± 22.6	83.0 ± 20.1	.04[b]
HOS-SS	58.8 ± 33.7	71.8 ± 29.3	.03[b]
mHHS	72.8 ± 21.3	78.2 ± 20.1	.19
iHOT-12	61.7 ± 30.2	66.8 ± 28.8	.37
Delta			
HOS-ADL	9.8 ± 21.0	19.1 ± 21.8	.04[b]
HOS-SS	11.5 ± 31.9	30.3 ± 32.8	.01[b]
mHHS	17.4 ± 26.1	24.3 ± 22.1	.19
iHOT-12	28.2 ± 11.0	35.8 ± 29.1	.15

[a]Values are presented as mean ± SD. ADL, Activities of Daily Living; HOS, Hip Outcome Score; iHOT-12, 12-item International Hip Outcome Tool; mHHS, modified Harris Hip Score; PRO, patient-reported outcome; SS, Sports Subscale.
[b]$P < .05$.

without radiographic evidence of OA (96.9%; $P < .001$) (Figure 3). Nine hips (16.7%) in the Tönnis grade 1 cohort were converted to THA, as opposed to none in the Tönnis grade 0 cohort. Three hips (5.6%) underwent revision hip arthroscopy in the Tönnis grade 1 cohort, as compared with 5 (3.1%) in the Tönnis grade 0 cohort. The overall failure rate was 7.9% between both groups. When survivorship was further analyzed, there was a bimodal distribution in the time to failure, with 53.3% of failures in the Tönnis grade 1 group occurring in the first 26 months postoperatively and the remaining 46.7% of failures occurring after 45 months.

TABLE 6
Achievement of MCID and PASS for Each Patient-Reported Outcome for Patients With Tönnis Grade 1 and Grade 0[a]

PRO Score	Tönnis Grade 1	Tönnis Grade 0	*P* Value
MCID			
HOS-ADL	42.9	62.1	.08
HOS-SS	33.3	62.1	.02[b]
mHHS	56.5	69.1	.33
iHOT-12	50.0	75.3	.10
Any outcome	57.1	80.2	<.01[b]
PASS			
HOS-ADL	11.8	20.7	.33
HOS-SS	33.3	53.7	.08
mHHS	16.7	33.1	.08
iHOT-12	23.3	30.6	.51
Any outcome	34.1	53.4	.03[b]

[a]Values are presented as percentages. ADL, Activities of Daily Living; HOS, Hip Outcome Score; iHOT-12, 12-item International Hip Outcome Tool; MCID, minimal clinically important difference; mHHS, modified Harris Hip Score; PASS, Patient Acceptable Symptom State; PRO, patient-reported outcome; SS, Sports Subscale.
[b]$P < .05$.

DISCUSSION

Arthroscopic treatment of FAIS with concomitant labral treatment in patients with mild OA using modern surgical techniques demonstrated positive outcomes at 5 years postoperatively. In the present study, patients with Tönnis grade 0 and grade 1 were able to reach statistically significant improvements in PROs at a minimum 5 years of follow-up. HOS-ADL and HOS-SS scores at 5 years were significantly lower for the Tönnis grade 1 cohort than the Tönnis grade 0 group. Patients with Tönnis grade 1 arthritis had significantly lower rates of achievement of the MCID and PASS, with a significantly lower gross survivorship rate at minimum 5 years postoperatively.

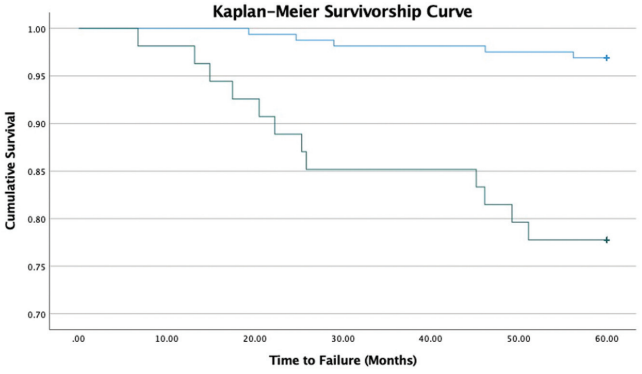

Figure 3. Kaplan-Meier survivorship curve comparing survival at 5 years between patients with Tönnis grade 1 (lower line; 96.9%) and grade 0 (upper line; 77.8%).

The results of our study build on previous literature investigating the threshold for preoperative arthritis and PROs in elective hip arthroscopy. Byrd et al[6] cited a mean 20.6-point improvement in mHHS for patients with Tönnis 1 arthritis with minimum 1-year follow-up. This is similar to the mean 17.4 ± 26.1 increase mHHS seen in our sample. Chandrasekaran et al[8] performed a matched-pair analysis of patients with a minimum 2-year follow-up and found that patients with Tönnis grade 1 OA had improvements in mHHS, HOS-ADL, and HOS-SS scores after hip arthroscopic surgery, with no significant difference versus patients with Tönnis grade 0 OA. These results were shared in a study by the same group with a minimum 5 years of follow-up.[12] Although our findings are in agreement with those of Domb et al[12] by showing that patients with Tönnis grade 1 OA are able to achieve to achieve statistically significant improvements in PROs, the clinical significance of these improvements remains in question as patients with Tönnis grade 1 arthritic changes are less likely to achieve the MCID and PASS in comparison with those with Tönnis grade 0.

In a meta-analysis of existing literature, Domb et al[14] cited a 16.3% conversion rate to THA in Tönnis grade 1 cases, as opposed to a 0% conversion rate in cases of Tönnis grade 0. On the basis of these results, they suggested that patients with Tönnis grade ≥1 are less likely to benefit from hip arthroscopy. These results were shared in a sample of patients from a dedicated hip preservation referral center, where Domb et al[12] reported a 2.9% conversion rate to THA for Tönnis 0 versus a 33.3% conversion rate for Tönnis 1 at minimum 5 years postoperatively. The results of our study are in agreement with the matched results of Domb et al, noting a THA conversion rate of 7.4% for Tönnis grade 0 and 27.8% for Tönnis grade 1. Regarding the incidence of failure over time, there was a bimodal distribution of failures, with more than half of all failures in the Tönnis grade 1 group occurring roughly within the first 2 years and with the remaining failures occurring after approximately 4 years. Our overall 7.9% failure rate at postoperative 5 years is comparable with previous literature, which indicated a failure rate of 7% to 15.4% at postoperative 5 years.[13,17] In our 5-year cohort of patients, failures occurred in either the early period, classified as <26 months postoperatively, or the late period, classified as >45 months.

The causative relationship of FAIS as a potential source of hip OA has been well described in the literature[1,2,22,32,34]; however, there is debate on whether correcting cam or pincer morphology prevents the progression of hip OA. In a finite element analysis study of hips before and after cam resection, Van Houcke et al[31] found that peak contact stresses were significantly elevated in patients with cam-type FAIS but peak contact stresses normalized after cam resection, suggesting that cam resection may prevent further chondral injury. Nevertheless, additional studies are necessary to determine the validity of these conclusions or if they remain true in the setting of mild OA (Tönnis 1).

Even though those with a mild degree of arthritis may improve from hip arthroscopic surgery, there is debate on whether patients with more severe arthritis (Tönnis grade ≥2) would benefit from hip arthroscopic surgery. Byrd et al[6] found no significant difference in return to sports for athletes with Tönnis grade 2 (85%) and grade 0 and 1 (93%) arthritic changes but cautioned that patient expectations need to be appropriately measured in these scenarios. In an international survey of 76 orthopaedic surgeons who treat FAIS, 89.5% responded that they were willing to perform surgery in patients 40 to 50 years old with Tönnis 1 OA, but this reduced to 39.5% in patients with Tönnis 2 changes.[33] Future studies and systematic reviews will need to address the question of the optimal management of FAIS in the setting of moderate to advanced hip OA in the young adult.[3]

Limitations

Perhaps the greatest strength of this study is the length of follow-up, where all patients had a minimum 5 years of follow-up. Our 81% compliance rate limits the effects of selection bias. Other strengths include the prospective collection of data and multiple PROs that have been validated for use in patients with FAIS. The addition of a matched comparative cohort also allows for more accurate conclusions. Our sample of patients had a minimum 5 years of postoperative follow-up, with the earliest patient being enrolled in 2012. This relatively recent cohort thus displays outcomes utilizing a modern surgical technique, including proper capsular management.[27] However, given the limited number of patients with 5-year outcomes available, the study was not sufficiently powered to perform advanced statistical analyses that would facilitate the identification of additional predictive variables (ie, patient demographic, radiographic or advanced imaging parameters, intraoperative findings) that may influence long-term outcomes, such as rates of conversion to THA. Furthermore, it is important to note that a higher percentage of patients in the Tönnis 1 group were treated with labral debridement versus labral repair as compared with the Tönnis 0 group, which may have partially contributed to the inferior outcomes observed in patients in the Tönnis 1 group.[9,19] Although the Tönnis classification has been shown to be a good marker of intraoperative cartilage findings as well as a good predictor of clinical symptoms of hip

OA,[11,21] the interobserver reliability in the classification system may limit its use. In addition, postoperative imaging was not reviewed to ensure complete resection of acetabular and femoral bony impingement. Last, this sample of patients comes from a single high-volume hip arthroscopic surgeon (>500 per year) at a major quaternary referral academic center, which may limit our ability to provide generalizable conclusions.

CONCLUSION

Patients with Tönnis grade 0 and grade 1 OA were able to reach statistically significant improvements in PROs at a minimum 5 years of follow-up. HOS-ADL and HOS-SS scores at 5 years were significantly lower for the Tönnis grade 1 cohort than the Tönnis grade 0 group. Patients with Tönnis grade 1 OA also had significantly lower rates of achievement of the MCID and PASS, with a significantly higher THA conversion rate at a minimum 5 years postoperatively. Our study highlights the limitations of elective hip arthroscopy for the treatment of FAIS in the setting of OA.

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