An Intact Ligamentum Teres Predicts a Superior Prognosis in Patients With Borderline Dysplasia

A Matched-Pair Controlled Study With Minimum 5-Year Outcomes After Hip Arthroscopic Surgery

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Background: Hip arthroscopic surgery in patients with borderline dysplasia continues to be controversial. In addition, it has been suggested that ligamentum teres (LT) tears may lead to inferior short-term patient-reported outcomes (PROs) when compared with a match-controlled group.

Purposes: (1) To report minimum 5-year PROs in patients with borderline dysplasia and LT tears who underwent hip arthroscopic surgery and (2) to compare these PROs to those of a matched-pair control group of patients with borderline dysplastic hips without LT tears.

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

Methods: Data were prospectively collected for patients who underwent hip arthroscopic surgery between September 2008 and August 2013. Patients were included if they had a preoperative diagnosis of borderline dysplasia (lateral center-edge angle [LCEA], 18°-25°) and had preoperative and minimum 5-year postoperative modified Harris Hip Score (mHHS), Nonarthritic Hip Score (NAHS), and visual analog scale (VAS) for pain scores. Exclusion criteria were osteoarthritis of Tönnis grade >1, previous hip conditions, any previous ipsilateral hip surgery, or workers' compensation status. There were 2 borderline dysplastic groups created. An LT tear group was matched 1:1 to a control group (no LT tear) with similar age, sex, body mass index (BMI), and laterality via propensity score matching. Significance was set at $P < .05$.

Results: A total of 24 patients with an LT tear (24 hips) were matched to 24 patients without an LT tear (24 hips). There was no significant difference in age, sex, BMI, or laterality between groups. The mean age was 36.2 ± 17.2 and 34.9 ± 15.9 years for the control and LT tear groups, respectively ($P = .783$). There were 17 (70.8%) and 16 (66.7%) female patients in the control and LT tear groups, respectively, and the mean preoperative LCEA was 23.3° and 22.2° in the control and LT tear groups, respectively. No differences were observed between groups in baseline PROs, intraoperative findings, or surgical procedures. LT debridement was performed in 17 (70.8%) patients in the LT tear group compared with 0 (0.0%) in the control group. Also, 5-year postoperative PROs were comparable in both groups, with the control group exhibiting superior Veterans RAND 12-Item Health Survey (VR-12) mental ($P = .041$) and Short Form–12 (SF-12) mental ($P = .042$) scores. Finally, hips with an intact LT were significantly more likely ($P = .022$) to achieve the patient acceptable symptomatic state (PASS) for the mHHS (100.0% and 75.0%, respectively). No significant differences were present between the groups for the minimal clinically important difference (MCID) of the mHHS ($P = .140$), MCID of the Hip Outcome Score–Sport-Specific Subscale (HOS-SSS) ($P = .550$), or PASS of the HOS-SSS ($P = .390$).

Conclusion: After hip arthroscopic surgery, patients with borderline dysplasia and LT tears demonstrated favorable PROs at a minimum 5-year follow-up. Outcomes were similar to a matched-pair control group without LT tears, with the group with intact LTs showing higher VR-12 mental and SF-12 mental scores. Furthermore, patients with borderline dysplasia and intact LTs were significantly more likely to achieve the PASS for the mHHS.

Keywords: hip arthroscopic surgery; ligamentum teres; dysplasia; femoroacetabular impingement; patient-reported outcomes

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Periacetabular osteotomy is an effective treatment option for patients with dysplasia, with data also showing favorable results in those with borderline dysplasia.[50,68] Further,

periacetabular osteotomy with concomitant hip arthroscopic surgery has been shown to be safe and reproducible.[45,46,65] Isolated arthroscopic management of borderline hip dysplasia remains controversial and a matter of ongoing debate.[31,51] Several authors have reported good to excellent short-term and midterm outcomes in patients with borderline dysplasia after an arthroscopic approach that includes labral function restoration and capsular plication.[40,48]

It has been reported that hips with less lateral acetabular coverage are more likely to have ligamentum teres (LT) tears.[27] The LT was previously thought of as a vestigial structure; however, there has been a recent shift in opinions. There is an increased awareness of the LT as an important hip stabilizer, which may be particularly relevant in patients with borderline dysplasia.[56] Nevertheless, there is a paucity of literature regarding the effect of LT tears in patients with borderline dysplasia, with only one study investigating outcomes in patients with borderline dysplasia and LT tears.[15]

The purposes of this study were (1) to report minimum 5-year patient-reported outcomes (PROs) in patients with borderline dysplasia and LT tears who underwent hip arthroscopic surgery for femoroacetabular impingement (FAI) and labral tears and (2) to compare these PROs to those of a match-controlled borderline dysplastic group with no LT tears. It was hypothesized that (1) patients with borderline dysplasia and LT tears would experience favorable PROs at a minimum 5-year follow-up and (2) 5-year PROs in this group would be comparable with those of a matched-pair control borderline dysplastic group with no LT tears.

METHODS

Patient Selection

This analysis was a 5-year follow-up to a study previously published by this institution (American Hip Institute).[15] Data were prospectively collected for patients who underwent hip arthroscopic surgery at our institution between September 2008 and August 2013. Patients were included if they (1) had a preoperative diagnosis of borderline dysplasia (lateral center-edge angle [LCEA] of 18°-25°)[48] and (2) had preoperative and minimum 5-year modified Harris Hip Score (mHHS), Nonarthritic Hip Score (NAHS), and visual analog scale (VAS) for pain scores.[2,14] Patients who met any of the following criteria were excluded from this analysis: osteoarthritis Tönnis grade >1; previous hip conditions, such as Legg-Calvé-Perthes, inflammatory, or connective tissue disease (Ehlers-Danlos syndrome); neoplastic conditions (pigmented villonodular synovitis); previous ipsilateral hip surgery; or workers' compensation status.

This study was performed in accordance with the ethical standards of the 1964 Declaration of Helsinki. This study was carried out in accordance with relevant regulations of the United States Health Insurance Portability and Accountability Act (HIPAA). Details that might disclose the identity of the participants under study have been omitted. This study was approved by an institutional review board (No. 5276).

Matching Process

Patients with borderline dysplasia and an LT tear of ≥50% (LT percentile class ≥2)[9] were group matched 1:1 to patients with borderline dysplasia without LT tears (LT percentile class 0) via propensity score matching. Patients were matched with similar age, sex, body mass index (BMI), and laterality. Patients without an LT tear composed the control group, and patients with an LT tear of ≥50% composed the LT tear group. The patient selection process is illustrated in Figure 1.

Participation in the American Hip Institute Hip Preservation Registry

All patients participated in the American Hip Institute Hip Preservation Registry. Although the present study represents a unique analysis, data on some patients in this study may have been reported in other studies. All data collection received institutional review board approval.

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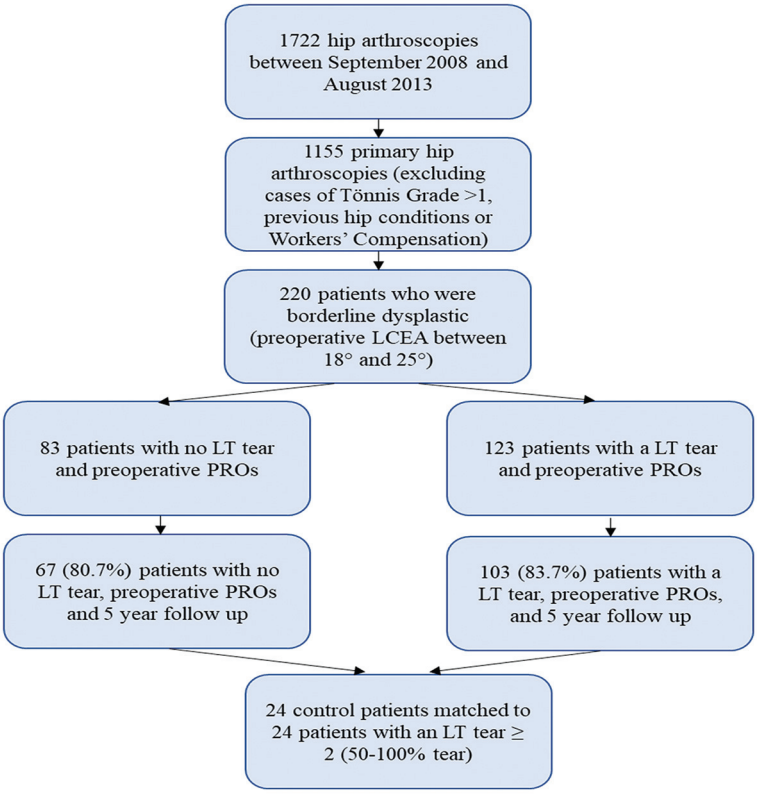


Figure 1. Patient selection flow diagram. LCEA, lateral center-edge angle; LT, ligamentum teres; PROs, patient-reported outcomes.

Clinical Evaluation

All patients underwent a comprehensive preoperative physical examination by the senior surgeon (B.G.D.) to assess range of motion, strength, and instability. During their preoperative visit, patients underwent a standard radiographic evaluation, which included an anteroposterior pelvic view, a Dunn view, a cross-table lateral view, and a false profile view.[22] The degree of osteoarthritis was assessed using the Tönnis classification,[37,39] and the LCEA was measured according to the method described by Wiberg[70] and modified by Ogata et al.[58] The anterior center-edge angle was measured on the false profile view according to the method described by Lequesne and de Seze,[41] and the alpha angle was measured on the Dunn view according to the method described by Nötzli et al.[7,55] All radiographic measurements were made using a picture archiving and communication system (GE Healthcare). The institution's radiographic measurements have demonstrated good interobserver reliability in previously published studies.[27,28,64]

Surgical Technique

All patients underwent nonoperative treatment, which included rest, physical therapy, activity modification, and nonsteroidal anti-inflammatory medication. Patients whose hip did not improve after nonoperative management for a minimum of 3 months were recommended for surgery.

All surgical procedures were performed by the senior surgeon (B.G.D.) while the patient was in the modified supine position. Diagnostic arthroscopic surgery was performed in all cases, and the joint was accessed using the anterolateral and midanterior portals.[11] Intraoperatively, cartilage damage was assessed using the Outerbridge and acetabular labrum articular disruption (ALAD) classification systems.[12,59] The condition of the labrum was classified according to Seldes et al,[66] and the LT was assessed using both the Villar and Domb classification systems.[9,32] Labral tear treatment was decided by the senior surgeon (B.G.D.) intraoperatively. This treatment algorithm has been published, and the labrum is either repaired, reconstructed, or debrided, with the goal of preserving its function as a static stabilizer.[26] LT tears were treated with selective debridement using a radiofrequency ablation probe and shaver.[15,36]

Minimal acetabular rim decortication was performed only in cases when labral repair or reconstruction was required. Femoroplasty was performed to correct cam-type impingement, which was defined as an alpha angle $\geq 55°$.[49] Patients with Outerbridge grade 4 damage underwent acetabular or femoral microfracture. Capsular treatment (repair or plication) was dependent on the patient's range of motion and generalized ligamentous laxity.[18] Patients who had painful internal snapping at their preoperative visit or had a positive iliopsoas impingement sign underwent iliopsoas fractional lengthening.[30,43,44] Trochanteric bursitis was treated using endoscopic bursectomy, and gluteus medius tears were repaired.[19,25,29,34]

Rehabilitation Protocol

Patients used a fitted hip X-Act ROM brace (DJO Global) after surgery to limit adduction, extension, and flexion and were limited to a 20-lb flat-foot weightbearing restriction on the operative extremity for 2 to 8 weeks, tailored to the procedures performed. On postoperative day 1, patients began physical therapy, which included using a continuous passive motion machine or recumbent bicycle daily for 8 weeks. Patients were also prescribed 4 weeks of oral anti-inflammatory medication to be taken twice daily.

Surgical Outcome Measurement

The following PROs were collected postoperatively for our patient population: mHHS, NAHS, Hip Outcome Score–Sport-Specific Subscale (HOS-SSS), International Hip Outcome Tool (iHOT-12), and physical and mental components of the Veterans RAND 12-Item Health Survey (VR-12) and Short Form–12 (SF-12). In addition, the proportion of patients who achieved the minimal clinically important difference (MCID) and patient acceptable symptomatic state (PASS) for the mHHS and HOS-SSS was also calculated.[13,42,61] Pain was measured on a VAS in which 0 was defined as having no pain at all and 10 was defined as extreme pain.[20] Satisfaction with surgery results was measured on a scale of 0 to 10, with 10 being the most satisfied.[20,63]

Statistical Analysis

Based on an assumed mean difference on the mHHS of 10 and a standard deviation of 10 (Cohen $d = 1.0$), as in Chaharbakhshi et al,[15] an a priori power analysis determined that 16 patients in each group would be needed to attain 80% power at a 1:1 matching ratio. Propensity score matching was performed using RStudio.[4,5,17,38] Continuous variables were assessed for normality using the Shapiro-Wilk test and assessed for equal variance using the F test. Normally distributed data were compared using the Student t test, and nonnormally distributed data with equal variances were compared using the Mann-Whitney U test. Categorical variables were assessed using the Fisher exact test or chi-square test. Statistical analysis was performed using Excel (Microsoft Corp) and the Real Statistics add-in. The threshold for statistical significance was set at $P < .05$.

RESULTS

Patient Demographics

After the matching process, 24 patients (24 hips) with an LT tear were successfully matched to 24 patients (24 hips) without an LT tear (Figure 2). There was no significant difference in age, sex, BMI, laterality, or preoperative LCEA between the 2 groups (Tables 1 and 2).

Intraoperative Findings and Procedures Performed

A summary of intraoperative findings and procedures performed in the patient population is provided in Tables 3 and 4. Both groups had a similar distribution of Seldes, ALAD, and Outerbridge grades.

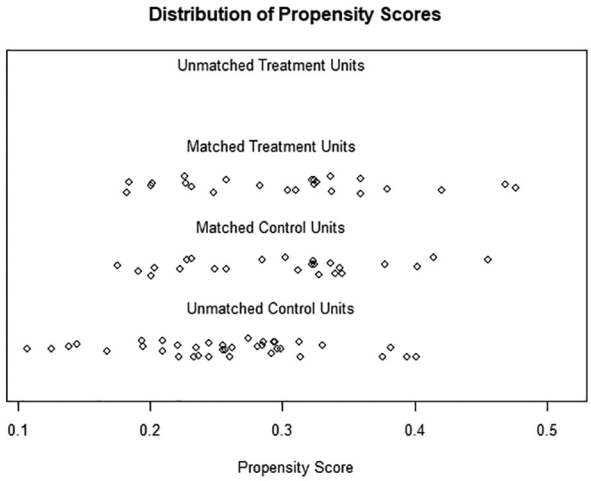


Figure 2. Jitter plot illustrating the propensity scores of the matched and unmatched control and treatment groups. The treatment group is the ligamentum teres tear group. The propensity score was based on age, sex, body mass index, and laterality.

In both groups, the most common labral treatment was labral repair. LT debridement was performed in 17 (70.8%) patients in the LT tear group.

Patient-Reported Outcomes

There was no significant difference in preoperative mHHS, NAHS, and HOS-SSS scores between the control and LT tear groups. Preoperative and postoperative scores, as well as delta values, for both groups are provided in Table 5. The mHHS scores were excellent for the control group (90.5 ± 8.9; $P < .0001$) and good for the LT tear group (84.0 ± 20.0; $P = .0016$) at latest follow-up. In the LT tear group, the mean NAHS score improved from 58.8 ± 18.9 to 88.8 ± 12.0 ($P < .0001$), and in the control group, the mean NAHS score improved from 62.6 ± 17.2 to 90.1 ± 9.9 ($P < .0001$). Patients in the LT tear group had significantly lower VR-12 mental and SF-12 mental scores than patients in the control group ($P = .041$ and $P = .042$, respectively).

In addition, patients in the LT tear group were significantly less likely to achieve the PASS for the mHHS ($P = .022$) (Figure 3). A similar proportion of patients in the control and LT tear groups demonstrated improvement that surpassed literature values for the MCID of the mHHS and HOS-SSS ($P > .05$).

Revision Surgery

In the LT tear group, there was 1 patient who underwent revision arthroscopic surgery at 49 months after the index arthroscopic procedure. This patient demonstrated a gradual onset of symptoms consistent with a retorn labrum and underwent labral debridement, femoral head microfracture,

TABLE 1
Patient Characteristics[a]

	Control	LT Tear	*P* Value
Laterality, n (%)			.771
Left	11 (45.8)	10 (41.7)	
Right	13 (54.2)	14 (58.3)	
Sex, n (%)			.756
Female	17 (70.8)	16 (66.7)	
Male	7 (29.2)	8 (33.3)	
Age at surgery, y	36.2 ± 17.2 (16.1-70.0)	34.9 ± 15.9 (15.5-74.8)	.783
BMI, kg/m^2	25.2 ± 5.2 (17.7-41.4)	24.8 ± 6.0 (18.1-39.2)	.493
Follow-up, mo	74.7 ± 13.3 (60.5-113.1)	74.3 ± 12.5 (62.0-111.2)	.992

[a]Data are reported as mean ± SD (range) unless otherwise specified. BMI, body mass index; LT, ligamentum teres.

TABLE 2
Preoperative Radiographic Measurements[a]

	Control	LT Tear	*P* Value
LCEA	23.3 ± 2.0	22.2 ± 1.9	.053
Anterior center-edge angle	26.0 ± 5.7	25.9 ± 6.6	.963
Alpha angle	60.0 ± 12.7	60.4 ± 8.4	.451

[a]Data are reported as mean ± SD. LCEA, lateral center-edge angle; LT, ligamentum teres.

and iliopsoas release during revision arthroscopic surgery. In the control group, there were no patients who underwent revision arthroscopic surgery ($P > .999$).

DISCUSSION

This study demonstrated that hip arthroscopic surgery in the context of borderline dysplasia with or without LT tears resulted in durable and improved PROs at a minimum 5-year follow-up. The 2 borderline dysplastic groups (with and without LT tears) exhibited similar 5-year postoperative PROs, with the control group showing superior SF-12 mental ($P = .042$) and VR-12 mental ($P = .041$) scores. Interestingly, from a clinical standpoint, the control group was significantly more likely to achieve the PASS for the mHHS (100.0% vs 75.0%, respectively; $P = .022$). There was a similar trend favoring the control group with regard to the MCID for the mHHS and HOS-SSS and the PASS for the HOS-SSS.

In general, the management of borderline dysplasia with hip arthroscopic surgery alone remains controversial.[3,31,67,71] Nevertheless, the literature has shown favorable short-term and midterm outcomes after an arthroscopic approach in patients with borderline dysplasia.[23] Restoring labral function and capsular plication with minimal acetabular rim trimming (if required) are key elements for success in this high-risk population.[40,48] In addition, understanding of the LT has evolved from a vestigial structure to an important structure that may play a role in hip stability and pain generation.[16,27,56,57] Recently, Maldonado et al[47] found that patients without dysplasia with a complete LT tear who underwent hip arthroscopic surgery for FAI and labral tears were 3 times more likely to require subsequent total hip arthroplasty than a match-controlled group with no LT tears at a minimum 2-year follow-up. Although a causal relationship has not yet been proven,[24] the authors concluded that patients with LT tears should be considered an at-risk

TABLE 3
Intraoperative Findings[a]

	Control	LT Tear	*P* Value
Seldes			.660
0	2 (8.3)	0 (0)	
1	10 (41.7)	10 (41.7)	
2	5 (20.8)	7 (29.2)	
1 and 2	7 (29.2)	7 (29.2)	
ALAD			.356
0	4 (16.7)	1 (4.2)	
1	6 (25.0)	8 (33.3)	
2	11 (45.8)	8 (33.3)	
3	3 (12.5)	6 (20.8)	
4	0 (0)	1 (4.2)	
Outerbridge (acetabulum)			.447
0	4 (16.7)	1 (4.2)	
1	7 (29.2)	8 (33.3)	
2	10 (41.7)	8 (33.3)	
3	2 (8.3)	5 (20.8)	
4	1 (4.2)	2 (8.3)	
Outerbridge (femoral head)			>.999
0	20 (83.3)	20 (83.3)	
1	0 (0)	0 (0)	
2	1 (4.2)	1 (4.2)	
3	2 (8.3)	1 (4.2)	
4	1 (4.2)	2 (8.3)	
LT percentile class (Domb)			**<.001**
0 (0%)	24 (100.0)	0 (0)	
1 (0%-<50%)	0 (0)	0 (0)	
2 (50%-<100%)	0 (0)	23 (95.8)	
3 (100%)	0 (0)	1 (4.2)	
Villar			**<.001**
0 (no tear)	24 (100.0)	0 (0)	
1 (complete tear)	0 (0)	0 (0)	
2 (partial tear)	0 (0)	18 (75.0)	
3 (degenerative tear)	0 (0)	6 (25.0)	

[a]Data are reported as n (%). Bold values indicate statistical significance ($P < .05$). ALAD, acetabular labrum articular disruption; LT, ligamentum teres.

TABLE 4
Surgical Procedures Performed[a]

	Control	LT Tear	*P* Value
Labral treatment			.655
Selective debridement	10 (41.7)	9 (37.5)	
Repair	12 (50.0)	15 (62.5)	
Reconstruction	1 (4.2)	0 (0)	
None	1 (4.2)	0 (0)	
Capsular treatment			.772
Repair	12 (50.0)	13 (54.2)	
Capsulotomy without plication	12 (50.0)	10 (41.7)	
Partial capsulotomy	0 (0)	1 (4.2)	
Acetabular rim decortication	10 (41.7)	11 (45.8)	.771
Femoroplasty	18 (75.0)	14 (58.3)	.358
Acetabular microfracture	1 (4.2)	2 (8.3)	.551
LT debridement	0 (0)	17 (70.8)	**<.001**
Iliopsoas fractional lengthening	8 (33.3)	11 (45.8)	.550
Trochanteric bursectomy	1 (4.2)	2 (8.3)	.551
Gluteus medius repair	2 (8.3)	3 (12.5)	.637

[a]Data are reported as n (%). Bold value indicates statistical significance ($P < .05$). LT, ligamentum teres.

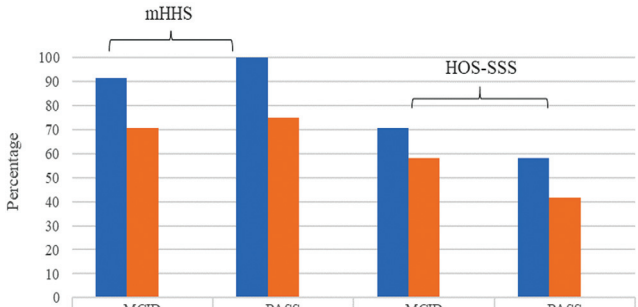
population.[47] Nonetheless, in the present study, only 1 patient with borderline dysplasia and an LT tear required revision surgery at a minimum 5-year follow-up.

The combination of borderline dysplasia and LT tears may constitute the "perfect storm." Domb et al[27] showed that hips with less lateral acetabular coverage were 1.74 times more likely to have LT tears. To our knowledge, only one study has investigated and reported outcomes in patients with borderline dysplasia and LT tears.[15] Matching patients on sex, age, BMI, labral treatment type, and microfracture, Chaharbakhshi et al[15] compared 2 groups of 20 patients with borderline dysplasia (LCEA of 18°-25°). The authors found that both groups demonstrated improvement on the mHHS, NAHS, and HOS-SSS, with the group without LT tears showing greater improvement at 2-year follow-up (mHHS: $P = .09$; NAHS: $P = .09$). In an effort to diminish confounding variables and isolate the effect of an LT tear on functional outcomes, the present study used propensity score matching to compare an LT tear group to a control group. Similar to the results of the previously mentioned study, the present study found favorable results for both groups at 5 years postoperatively. Chaharbakhshi et al[15] included all types of LT tears

TABLE 5
Preoperative and Postoperative Patient-Reported Outcomes[a]

	Control	LT Tear	*P* Value
mHHS			
Preoperative	65.0 ± 14.0 (59.1 to 71.0)	63.5 ± 13.6 (57.8 to 69.4)	.712
Postoperative	90.5 ± 8.9 (86.8 to 94.3)	84.0 ± 20.0 (75.6 to 92.5)	.156
P value (pre-post)	**<.0001**	**.0016**	
Delta	25.4 ± 15.1 (19.1 to 31.9)	20.4 ± 24.0 (10.3 to 30.6)	.392
NAHS			
Preoperative	62.6 ± 17.2 (55.4 to 69.9)	58.8 ± 18.9 (50.8 to 66.8)	.466
Postoperative	90.1 ± 9.9 (85.9 to 94.2)	88.8 ± 12.0 (83.7 to 93.9)	.891
P value (pre-post)	**<.0001**	**<.0001**	
Delta	27.3 ± 18.4 (19.6 to 35.2)	29.3 ± 21.1 (20.2 to 38.5)	.732
HOS-SSS			
Preoperative	46.6 ± 24.3 (35.8 to 57.4)	38.1 ± 24.2 (27.9 to 48.4)	.243
Postoperative	78.5 ± 19.0 (70.5 to 86.6)	71.5 ± 28.2 (59.6 to 93.4)	.614
P value (pre-post)	**<.0001**	**.0017**	
Delta	33.2 ± 26.6 (20.8 to 45.7)	30.6 ± 34.9 (13.7 to 47.5)	.793
VAS			
Preoperative	5.2 ± 2.4 (4.2 to 6.3)	5.9 ± 2.8 (4.7 to 7.1)	.390
Postoperative	1.3 ± 1.3 (0.8 to 1.9)	2.3 ± 2.3 (1.4 to 3.3)	.085
P value (pre-post)	**<.0001**	**.0005**	
Delta	–3.9 ± 2.6 (–5.0 to –2.8)	–3.6 ± 3.7 (–5.2 to –2.0)	.752
iHOT-12	83.1 ± 15.2 (76.7 to 89.5)	78.3 ± 19.2 (70.2 to 86.4)	.479
SF-12			
Mental	59.0 ± 3.3 (57.6 to 60.4)	56.3 ± 5.2 (54.1 to 58.5)	**.042**
Physical	52.1 ± 5.6 (49.8 to 54.5)	49.3 ± 8.0 (45.9 to 52.6)	.192
VR-12			
Mental	63.7 ± 4.4 (61.8 to 65.5)	60.8 ± 5.3 (58.6 to 63.1)	**.041**
Physical	53.9 ± 4.6 (51.9 to 55.8)	51.0 ± 6.8 (48.2 to 53.9)	.152
Patient satisfaction	8.6 ± 1.4 (8.0 to 9.2)	8.3 ± 2.2 (7.4 to 9.2)	.587

[a]Data are reported as mean ± SD (95% CI). Bold values indicate statistical significance ($P < .05$). HOS-SSS, Hip Outcome Score–Sport-Specific Subscale; iHOT-12, International Hip Outcome Tool; LT, ligamentum teres; mHHS, modified Harris Hip Score; NAHS, Nonarthritic Hip Score; SF-12, Short Form–12; VAS, visual analog scale; VR-12, Veterans RAND 12-Item Health Survey.



	MCID	PASS	MCID	PASS
Control	91.7	100.0	70.8	58.3
LT Tear	70.8	75.0	58.3	41.7
P-Value	0.14	**0.022**	0.55	0.39

Figure 3. Proportion of patients who achieved the minimal clinically important difference (MCID) and patient acceptable symptomatic state (PASS) for the modified Harris Hip Score (mHHS) and Hip Outcome Score–Sport-Specific Subscale (HOS-SSS). Bold values indicate statistical significance ($P < .05$). LT, ligamentum teres.

in their study, whereas our LT tear group consisted of patients with LT tears ≥50%. Further research is needed to confirm if there is a relationship between LT tear severity and outcomes in patients with borderline dysplasia.

Arthroscopic LT debridement has resulted in good outcomes at short-term and midterm follow-up.[1,8,47] In 26 patients (27 hips) with an average age of 24.4 years (range, 12-45 years), Amenabar and O'Donnell[1] reported significant improvement on the mHHS (from 65.2 ± 13.0 [range, 59.5-71.0] to 89.3 ± 11.6 [range, 84.2-94.5]; $P < .05$) and NAHS (from 66.2 ± 13.3 [range, 60.4-72.1] to 86.7 ± 11.0 [range, 81.9-91.5]; $P < .05$) after LT debridement and capsular plication. However, no information regarding acetabular coverage was provided. Maldonado et al[47] reached a similar conclusion in a match-controlled study of patients with complete LT tears. In that study, 18 patients with complete LT tears achieved significant and comparable improvement at 2-year follow-up compared with a group of patients with FAI and intact LTs.[47] The LT tear group included patients outside the borderline dysplasia spectrum, with a mean LCEA of 31.3°. The present study found favorable outcomes in patients with borderline dysplasia and LT tears using LT debridement only; however, LT reconstruction can be a valid option in select patients.[6,10]

There is a growing body of literature showing that LT reconstruction can successfully address LT dysfunction, particularly in patients with hip instability and generalized ligamentous laxity. To date, most of the available literature on LT reconstruction consists of technical articles, cadaveric or biomechanical studies, and small case series with short-term follow-up.[10,21,53,54] Philippon et al[62] published results and early outcomes in 4 patients who underwent LT reconstruction. At a mean follow-up of 31 months, 3 (75%) patients demonstrated improvement on the mHHS, and 1 (25%) patient required subsequent hip resurfacing. Intraoperatively, this patient had severe cartilage damage. The authors concluded that in select patients, LT reconstruction can alleviate hip instability due to LT tearing. In a case series of 4 LT reconstruction procedures, favorable results were also presented by Chandrasekaran et al.[21] Although promising, larger clinical studies are needed to assess the long-term efficacy and ideal indications of LT reconstruction.

Strengths

There are several notable strengths of this study. This is one of the first studies to investigate the effect of LT tears in patients with borderline dysplasia at a minimum 5-year follow-up. In addition, we compared these results to a match-controlled group with similar age, sex, BMI, and laterality to isolate the effect of an LT tear on outcomes. Although this is a narrow and specific patient population, there were adequate numbers of patients in both groups to detect a meaningful difference based on a priori power analysis. Finally, as statistical significance does not equate to clinical significance,[33] the proportion of patients who achieved the MCID and PASS for the mHHS and HOS-SSS was also provided.

Limitations

Limitations of the ongoing study must be acknowledged. First, although a match-controlled design was used, this was a nonrandomized study. As such, additional confounding variables may have influenced our results. Second, the study was also retrospective in nature, which introduces an inherent bias; nevertheless, this bias may be limited by prospective data collection. Third, this analysis was based on the data of patients of a single high-volume surgeon who specializes in hip preservation surgery, which may limit the generalizability of the results.[52] Fourth, although no significant differences were found between groups in regard to arthroscopic findings and procedures, with the exception of LT abnormalities and treatment, these variables were not incorporated into the matching process and could introduce potential confounding bias. Fifth, although our study was powered, the total number of patients was relatively small, and further research including larger case series is required to reinforce our results. Sixth, the present study included a minimum 5-year follow-up; however, a longer follow-up is needed to determine durability in this high-risk group.[35,40,48,69] Seventh, the surgical management of patients with borderline dysplasia has evolved and improved, particularly with the introduction of capsular plication, anatomic labral repair, and labral reconstruction.[48,60] Consequently, whereas the study group comprised patients who underwent labral debridement and capsulotomy without plication, in the present time, patients with the same surgical indications would be treated with labral repair, labral reconstruction, and capsular plication. Eighth, generalized ligamentous laxity was not considered in this analysis. In addition, dysplasia is a complex tridimensional structural abnormality, and an isolated assessment based only on the LCEA may be oversimplistic.[8,51] Lastly, the decision to include LT tears ≥50% was arbitrary.

CONCLUSION

After hip arthroscopic surgery, patients with borderline dysplasia and LT tears demonstrated favorable PROs at a minimum 5-year follow-up. Outcomes were similar to those of a matched-pair control group without LT tears, with the control group showing higher VR-12 mental and SF-12 mental scores. Furthermore, patients with borderline dysplasia and intact LTs were significantly more likely to achieve the PASS for the mHHS.

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