Acetabular Labral Base Repair Versus Circumferential Suture Repair: A Matched-Paired Comparison of Clinical Outcomes

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Purpose: To determine whether an acetabular labral repair technique would be superior to another repair technique based on clinical outcomes measured by patient-reported outcome (PRO) scores. **Methods:** We identified 465 patients who underwent labral base repair or circumferential suture repair from February 2008 to February 2012. The type of repair performed was based on labral size and tear type. The 2 groups were pair matched for age within 5 years, sex, crossover sign within 15%, coxa profunda, Workers' Compensation status, and microfracture (femur, acetabulum, or none). Data were prospectively collected and retrospectively reviewed. PROs included a visual analog scale score and the modified Harris Hip Score, Non-Arthritic Hip Score, Hip Outcome Score—Activities of Daily Living, and Hip Outcome Score—Sports-Specific Subscale. **Results:** One hundred ten patients met the inclusion criteria for labral base repair and were pair matched on a 1:1 basis with 110 patients who underwent circumferential suture repair. The mean follow-up period was 30 months for both groups, with a range of 19.2 to 60 months for the labral base repair group and 19.2 to 67 months for the circumferential suture repair group. Radiographic data were similar between groups with respect to the lateral center-edge angle ($P = .906$), acetabular inclination ($P = .329$), anterior center-edge angle ($P = .208$), alpha angle ($P = .387$), and joint space width ($P = .388$). All preoperative PRO scores were statistically similar. Both groups showed significant improvements in all PROs. There were no statistical differences in postoperative PRO scores at latest follow-up (modified Harris Hip Score, $P = .215$; Hip Outcome Score—Activities of Daily Living, $P = .839$; Hip Outcome Score—Sports-Specific Subscale, $P = .561$; Non-Arthritic Hip Score, $P = .333$; visual analog scale score, $P = .373$; and satisfaction, $P = .483$). There were similar rates of revision ($n = 10$ for both groups) and conversion to arthroplasty ($n = 2$ for both groups). **Conclusions:** On the basis of PRO scores at 2 years' follow-up, there is no difference in outcomes based on the type of labral repair performed. **Level of Evidence:** Level III, retrospective comparative study.

The goal of acetabular labral repair is to stabilize the labrum to restore the function of the suction-seal effect as the labrum makes contact with the femoral head. The function of the labrum and the clinical benefit of labral repair have been shown in numerous studies.[1-6]

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Early hip arthroscopy was limited to simple procedures such as loose body removal and labral debridement. With advancements in equipment and techniques, labral repair became possible, with early repair techniques using circumferential suture (CS) configurations. Most clinical studies showing the benefit of arthroscopic labral repair have not separated repair techniques or more commonly used circumferential techniques.[7-10]

Fry and Domb[11] proposed an anatomic rationale for a labral base repair (LBR) technique. This was met with some controversy at the time.[12] A study by Jackson et al.[13] showed good outcomes using the LBR technique in a cohort of patients. The benefits of the LBR technique lie in the ability to restore the suction seal of the acetabular labrum.[1-3] In cases in which the labrum may be small in width, a CS pattern may elevate the labrum off of the femoral head, thus negating its

Table 1. Patient Demographic Data

Demographic Characteristic/Variable	LBR Group	CS Group	*P* Value
Patients, n	110	110	NA
Sex, n			
Male	34	34	
Female	76	76	
Side, n			
Right	53	55	
Left	57	55	
Mean age, yr	27.30	27.43	.925
Mean follow-up, yr	2.53	2.45	.413
Follow-up %	95	88	
Conversion/revision, n			
THR	1	2	
BHR	1	0	
Revision	10	10	
Preoperative PRO score, mean			
mHHS	64	64	.858
HOS-ADL	66	67	.530
HOS-SSS	46	45	.609
NAHS	61	63	.552
VAS	6.1	6.0	.664

BHR, Birmingham Hip Resurfacing; CS, circumferential suture; HOS-ADL, Hip Outcome Score—Activities of Daily Living; HOS-SSS, Hip Outcome Score—Sports-Specific Subscale; LBR, labral base repair; mHHS, modified Harris Hip Score; NA, not applicable; NAHS, Non-Arthritic Hip Score; PRO, patient-reported outcome; THR, total hip replacement; VAS, visual analog scale.

Table 2. Intraoperative Procedures

Procedure	LBR Group, n	CS Group, n	*P* Value
Acetabuloplasty—arthroscopic	92	97	.332
Femoral osteoplasty—arthroscopic	64	66	.784
Iliopsoas release—arthroscopic	48	58	.177
Trochanteric bursectomy—arthroscopic	3	3	> .99
Gluteus medius repair—arthroscopic	0	1	.316
Synovectomy—arthroscopic	14	10	.387
LT debridement—arthroscopic	34	50	.026
Removal of loose body—arthroscopic	9	9	> .99
Excision of bone cyst of acetabulum—arthroscopic	1	0	.316
Excision of bone cyst of femur—arthroscopic	1	0	.316
Excision of heterotopic ossification	1	0	.316
Iliotibial band release	1	1	> .99
Removal of os acetabulum—arthroscopic	1	1	> .99
Capsule			
Repair/plication	71	70	.731
Release	33	36	

CS, circumferential suture; LBR, labral base repair; LT, ligamentum teres.

suction-seal function. There is no clear advantage as to which repair technique is superior. To date, there is no direct comparison of clinical outcomes between LBR and CS repair.

The purpose of this study is to determine whether there was any difference between the LBR technique and the CS technique based on clinical outcomes measured by patient-reported outcome (PRO) scores. Our hypothesis was that both acetabular labral repair techniques would result in improved postoperative outcomes with no difference between the 2 techniques when the suction-seal function was restored.

Methods

This study included patients who were identified as having had either the LBR or CS pattern by the senior surgeon (B.G.D.) during the period from February 2008 to February 2012. This time frame was used because it captured all patients who underwent surgery greater than 2 years before commencement of the study so that 2-year follow-up could be reached. Repair type (LBR or CS) was documented on a research data collection form at the time of surgery and was recorded in a prospectively collected database for patients undergoing hip arthroscopy. Patients were excluded if they had any pre-existing conditions such as fracture, Legg-Calvé-Perthes disease, or avascular necrosis; underwent concomitant procedures such as periacetabular osteotomy, femoral osteotomy, or labral debridement; or underwent previous hip surgery. Surgical technique with both repair types focused on restoration of the suction seal by maintaining contact between the labrum and femoral head. Patients who underwent LBR were matched with those who underwent CS repair. The matching criteria were age within 5 years, sex, crossover sign within 15%, coxa profunda, Workers' Compensation status, and microfracture (femur, acetabulum, or none). The crossover sign is measured as the percent of the posterior rim that the anterior rim is covering. A crossover sign only at the cranial-most portion of the acetabulum may measure 10%, whereas a large crossover sign may be as high as 50%. The matching criterion of 15% ensured that we did not have patients with large crossover signs matched with patients with small crossover signs. Patient demographic data (Table 1), intraoperative procedures (Table 2), and radiographic findings were compared to ensure that there were no statistically significant differences between the 2 groups. Data were prospectively collected and retrospectively reviewed. The study was approved by the institutional review board.

Outcomes compared included survivorship, revision rate, patient satisfaction, and PRO scores. The PROs included a visual analog scale (VAS) score and the modified Harris Hip Score (mHHS),[14] Non-Arthritic Hip Score (NAHS),[15] Hip Outcome Score—Activities of Daily Living (HOS-ADL), and Hip Outcome Score—Sports-Specific Subscale (HOS-SSS).[16] These were collected preoperatively at preoperative visits and postoperatively during clinic visits at regular intervals of 1 year, 2 years, and 3 years. For patients who do not present for a scheduled clinic follow-up visit, a phone call is made or an email is sent to collect the postoperative questionnaire. As a routine in our clinical practice, PRO scores are obtained at each of the aforementioned time points; however, this study reports data from the latest follow-up visit.

Surgical Technique

The decision to perform each repair type was based on the status of the labrum. CS repair was performed for labra that had significant intrasubstance damage and in cases in which we considered the labrum large and unstable and for which a CS suture would not risk lifting the labrum from the femoral head. The LBR technique was used for labra that were smaller in width and were torn at the chondrolabral junction.

Hip arthroscopy was performed with the patient in the supine position on a traction table. Anterolateral and anterior portals were created, and a capsulotomy was performed parallel to the labrum. For patients who had pincer impingement, an acetabuloplasty was performed with a 5.5-mm round burr. For patients with labral tears without pincer impingement, the acetabular rim was decorticated with the burr but no significant amount of bone was removed. After the rim was prepared, a distal lateral accessory portal was created for placement of anchors and suture passage. Pilot holes were drilled into the rim under direct visualization of the rim and the articular cartilage to ensure that no cartilage penetration occurred. All pilot holes were drilled before any suture passage.

For the CS repair technique, a No. 2 FiberStick suture (Arthrex, Naples, FL) was passed through the chondrolabral junction with a curved Suture Lasso (Arthrex). This was retrieved on the other side of the labrum to wrap the stitch around the labrum. The sutures were then threaded through a 2.9-mm PushLock anchor (Arthrex) and placed into the previously drilled pilot hole. This was repeated for all pilot holes. To achieve appropriate tensioning while using the knotless anchors, we applied variable traction to either suture end to ensure that the labrum was not everted.

For the LBR technique, a FiberStick suture was passed through the Suture Lasso going through the chondrolabral junction. The Suture Lasso was then withdrawn from the labrum while the suture was left in the labrum. The Suture Lasso was passed back through the substance of the labrum, and the suture was passed through the lasso in a shuttle fashion, by use of the anterior portal. The suture tails were placed through the anchor, and the anchor was placed into the pilot hole. The final suture configurations are detailed in Figure 1. In all cases the labrum was visualized opposed to the femoral head after the hip was taken off traction and reduced into the acetabulum.

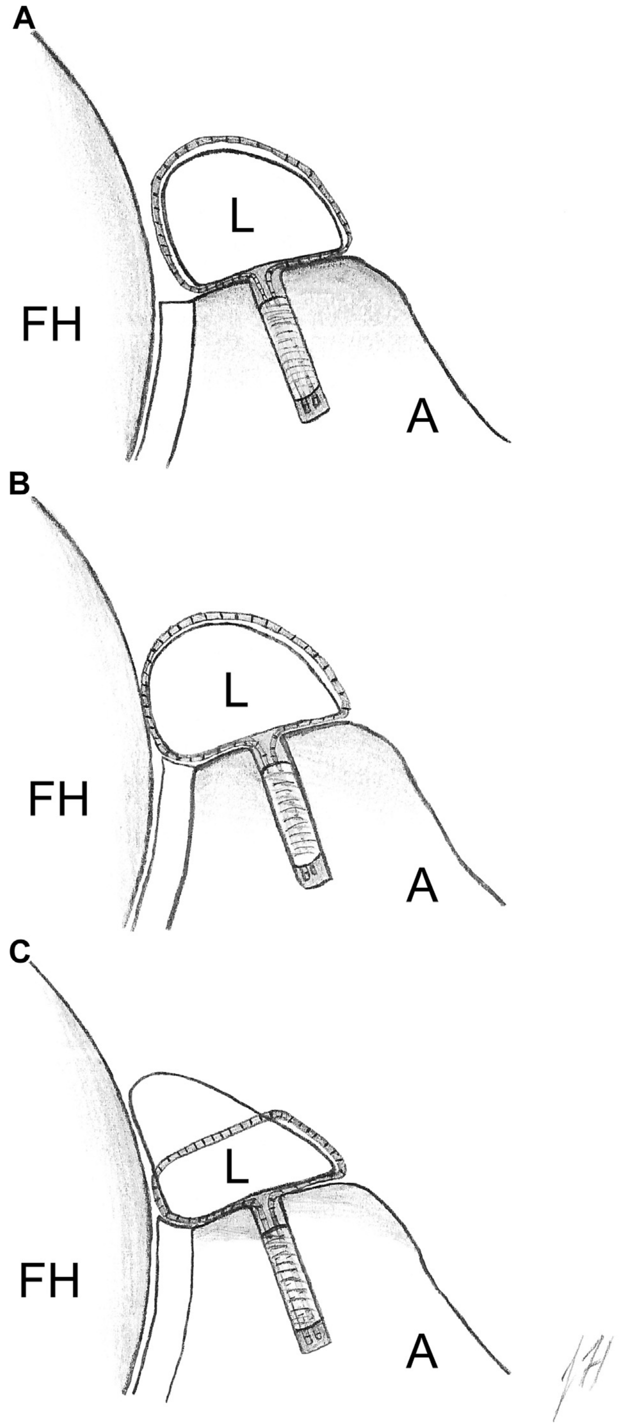

Fig 1. Different repair techniques. (A) The circumferential suture configuration has suture placed around the labrum. In cases of small labra or inappropriate tensioning, this can evert the labrum off of the edge of the rim and femoral head, negating its suction-seal function. (B) Circumferential suture configuration with proper suction-seal function. (C) The labral base repair passes suture through the labrum. (A, acetabulum; FH, femoral head; L, labrum)

Statistical Analysis

Descriptive statistics were used for patient demographic data. Comparisons of the 2 cohorts were

Table 3. Comparison of Preoperative and Postoperative PRO Scores in LBR Group

	Mean (CI)			
	Preoperative	Postoperative	Δ	*P* Value
mHHS	64 (2.58)	84 (2.95)	20	< .0001
HOS-ADL	66 (3.49)	87 (3.0)	21	< .0001
HOS-SSS	46 (4.37)	76 (4.69)	30	< .0001
NAHS	61 (3.5)	84 (3.27)	23	< .0001
VAS score	6.1 (0.39)	2.77 (0.47)	−3.3	< .0001
Satisfaction	NA	7.98 (0.41)		

CI, confidence interval; HOS-ADL, Hip Outcome Score—Activities of Daily Living; HOS-SSS, Hip Outcome Score—Sports-Specific Subscale; LBR, labral base repair; mHHS, modified Harris Hip Score; NA, not applicable; NAHS, Non-Arthritic Hip Score; PRO, patient-reported outcome; VAS, visual analog scale.

Table 4. Comparison of Preoperative and Postoperative PRO Scores in CS Group

	Mean (CI)			
	Preoperative	Postoperative	Δ	*P* Value
mHHS	64 (3.06)	86 (2.73)	22	< .0001
HOS-ADL	67 (3.45)	88 (2.83)	21	< .0001
HOS-SSS	45 (4.29)	76 (5.21)	31	< .0001
NAHS	63 (3.51)	86 (2.54)	23	< .0001
VAS score	6.0 (0.39)	2.47 (0.47)	−3.5	< .0001
Satisfaction	NA	7.75 (0.51)		

CI, confidence interval; CS, circumferential suture; HOS-ADL, Hip Outcome Score—Activities of Daily Living; HOS-SSS, Hip Outcome Score—Sports-Specific Subscale; mHHS, modified Harris Hip Score; NAHS, Non-Arthritic Hip Score; PRO, patient-reported outcome; VAS, visual analog scale.

made with the unpaired Student *t* test for all PRO scores (mHHS, HOS-ADL, HOS-SSS, NAHS, VAS score), age, radiographic measurements, and length of follow-up. The paired Student *t* test was used to compare preoperative and postoperative PRO scores. The χ^2 test was used for categorical data. $P < .05$ was considered significant.

Results

During the study period, we identified 465 patients who had either the LBR or CS pattern. One hundred ten patients met the inclusion criteria for LBR and were pair matched with 110 patients who underwent CS repair. For reference, 340 patients underwent CS labral repair during the study period. Patient demographic data are listed in Table 1. The mean follow-up period was 30 months for both groups ($P = .41$), with a range of 19.2 to 60 months for the LBR group and 19.2 to 67 months for the CS group. Patient age ($P = .92$) and sex were statistically similar because of the matching criteria. Radiographic data were similar between the groups with respect to the lateral center-edge angle (29.05° in LBR group and 29.15° in CS group, $P = .906$), acetabular inclination (4.18° and 3.51°, respectively; $P = .329$), anterior center-edge angle (30.2° and 32°, respectively; $P = .208$), alpha angle (57° and 58°, respectively; $P = .863$), and joint space width (3.9 mm and 3.8 mm, respectively; $P = .388$). Intraoperative procedures performed aside from labral repair were of a similar frequency with respect to capsule repair/release ($P = .731$), femoroplasty ($P = .784$), and iliopsoas release ($P = .177$). Ligamentum teres debridement was performed more frequently in the CS group (Table 2). An average of 3.07 anchors were used in the LBR group and 3.13 in the CS group ($P = .63$).

All preoperative PRO scores were statistically similar (Table 1). Both groups showed significant improvements in all PROs (Tables 3 and 4). We were unable to show any differences in outcomes based on PRO scores between the LBR group and the CS group (Fig 2) (mHHS, $P = .215$; HOS-ADL, $P = .839$; HOS-SSS, $P = .561$; NAHS, $P = .333$; VAS score, $P = .373$; and satisfaction, $P = .483$). There were similar rates of revision (n = 10, 9%) for both groups and conversion to arthroplasty (n = 2, 0.9%) for both groups.

Discussion

Through a matched-pair analysis comparing 2 repair techniques, we were unable to show any differences in outcomes based on PRO scores. Both repair types (LBR and CS) yielded significant clinical improvements in PRO scores from preoperatively to follow-up, with equal rates of conversion to total hip arthroplasty or revision arthroscopy. The clinical outcomes are similar to many studies showing the benefit of labral repair.[4,13]

In addition to correcting bone abnormalities that can predispose to labral damage, the aim of labral repair in any hip arthroscopy procedure is to restore the suction-seal function of the labrum against the femoral head. The senior surgeon (B.G.D.) strives to achieve this in

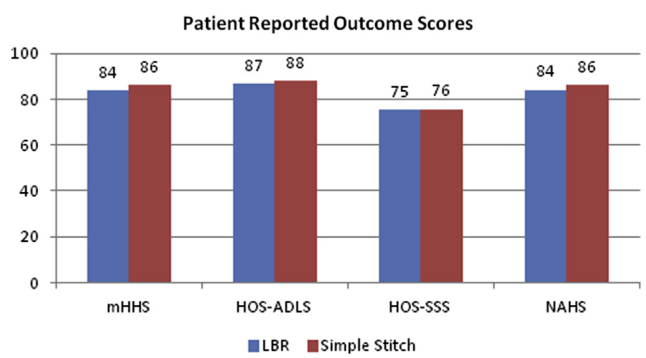

Fig 2. Comparison of patient-reported outcome scores at latest follow-up. (HOS-ADL, Hip Outcome Score—Activity of Daily Living; HOS-SSS, Hip Outcome Score—Sports-Specific Subscale; LBR, labral base repair; mHHS, modified Harris Hip Score; NAHS, Non-Arthritic Hip Score.)

any labral repair and was able to achieve effective labral repair with either labral repair technique. This restoration of the suction seal in either group could account for the success of both groups. Biomechanical evidence supports the role of the suction seal of the labrum by preventing cartilage consolidation and providing stability to the femoroacetabular joint.[1-3]

It is important for surgeons to be familiar with and adept at both suture techniques. The LBR technique is best used in circumstances in which the labrum is small but of good quality. Use of the LBR in this situation allows the surgeon to maintain the suction seal by not lifting the small labrum off the head during suture anchor repair. This can happen more easily with the CS technique because the entire labral substance is incorporated in the suture. Appropriate tensioning can help prevent this from occurring but use of knotless anchors can make optimal tensioning difficult. CS patterns have a role in many capacities. Large labra with intrasubstance damage are perhaps the best use of the CS. Many surgeons use the CS technique for labral reconstruction to stabilize the entire, large graft. As the results of this study show, use of either technique, in the appropriate setting, can lead to clinical improvements after hip arthroscopy.

The main advantage of this study is our use of a matched-pair design with large, well-matched groups. Clinical outcomes are dependent on innumerable variables; thus we sought to control these in this study design. Although it is impossible to eliminate all variables in a clinical outcomes study, our matching criteria were strict and included demographic and radiographic criteria for pincer impingement and microfracture. Statistical analysis of these groups showed similarities in all categories, with no significant differences in any preoperative parameters except, of course, labral repair technique.

Limitations

The main limitation of this study is the length of follow-up. We would hypothesize that true labral function or dysfunction would become evident many years later, with failure from longstanding labral dysfunction. Chronic labral dysfunction will lead to increased cartilage consolidation by loss of the gasket function of the labral suction seal.[1-3] Another limitation lies in the multiple variables that can account for differences in postoperative outcomes after hip arthroscopy. During hip arthroscopy, other procedures performed such as ligamentum teres debridement, chondroplasty, iliopsoas release, and capsular plication are variable among patients. This limitation is inherent to any postoperative clinical outcomes study. Because of this, we sought to minimize these variables with strict matching criteria and were able to show similar groups despite the variety of procedures. Because there is a rationale for when to perform each technique based on labral tissue and tear type, a selection bias is present but is believed to be necessary to optimize the labral function after the repair.

Conclusions

On the basis of PRO scores at 2 years' follow-up, there is no difference in outcomes based on the type of labral repair performed.

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