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Arthroscopic acetabular labral reconstruction with rectus femoris tendon autograft: Our experiences and early results

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ABSTRACT

Background: The native labrum has been shown to play a critical role in the maintenance of overall health of the cartilage of the hip. Disruption of the labral seal could be detrimental to the overall nutrition of the cartilage, leading to its premature degeneration.
Purpose: This study sought to investigate patients undergoing labral reconstruction with indirect head of rectus femoris autograft, to determine the subjective improvement in pain they experienced, the complications and reoperation rates including conversion to Total hip replacement(THR).
Method: We retrospectively reviewed all 7 patients who underwent labral reconstruction using indirect head of the rectus femoris tendon autograft between January 2013 to October 2015. We assessed improvement in pain and function, complications, and subsequent surgery. The minimum follow-up was 12 months (average, 15 months; range, 12–18 months).
Results: All patients reported subjective improvement in preoperative pain and function. The mean modified Harris Hip Score (mHHS) improved significantly from 56 (54–60) preoperatively to 93 (90–97)) at mean latest follow-up. The mean change of mHHS was 36 (30–43) and mean postoperative patient satisfaction score was 9.1. We observed no radiological progression of arthritis as well as no patient had revision procedure including total hip replacement.
Conclusion: Acetabular labrum reconstruction for irreparable labral tears in young patients with no significant arthritis, using indirect head of the rectus femoris tendon autograft is a new technique that shows improvement in pain and function post-operatively. Long-term follow-up results with higher quality studies will be necessary to further define the role of labral reconstruction in hip preservation surgery.

1. Introduction

The native labrum has been shown to play a critical role in the maintenance of overall health of the cartilage of the hip. The intact acetabular labrum play a direct role on the stability of the hip via its structural extension of the bony acetabulum, but it plays a crucial role in stability through its effect on the fluid dynamics of the central and peripheral compartments.[1,2]

The labrum provides a seal against fluid flow in and out of the intra-articular space. This sealing function of the labrum improves the stability of the joint through a vacuum effect and enhances lubrication mechanisms in the hip joint.[3,4]

The ability of the labrum to contain a pressurised fluid layer within the hip joint under loading conditions prevents direct contact of the joint surfaces and distributed the applied load more evenly across the cartilage surfaces.[1,2]

With a relatively low permeability, the labrum limit the rate of fluid expression from the cartilage layers during loading. By slowing fluid expression from the cartilage layers, loads applied to the joint are carried by fluid pressure within the cartilage, limiting the magnitude of stresses within the collagenous solid matrix of the cartilage.[5–7]

Failure of this mechanism could lead to increased friction and higher loading in the solid matrix of the cartilage surfaces, and eventually to the degenerative changes associated with Osteoarthritis (OA).[8–10]

The available literature emphasizes the importance of restoring normal hip anatomy when possible, with an intact labrum independently leading to better outcomes with intra-articular hip pathology.[11]

Labral debridement can lead to an immediate pain relief on a short-term period, but will likely compromise the physiologic function of the labrum, thus resulting in an increased joint degeneration. Preservation

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of labral tissue by repairing it when damaged is increasingly being reported with successful outcomes.[12,13]

However, clinical situations do exist where primary labral repair may not be possible. Labral reconstruction, therefore, has recently emerged as a technique to address the issue of an irreparable labrum, with reconstruction serving to alleviate pain and improve hip biomechanics.

This study sought to investigate patients undergoing labral reconstruction with indirect head of rectus femoris autograft, to determine the subjective improvement in pain they experienced, the complications and reoperation rates including conversion to THR.

2. Method

A Retrospective review of the 19 patients with irreparable labral tear who underwent arthroscopic acetabular labral reconstruction from January 2013 to October 2015 is carried out.

Inclusion criteria were adult patients having undergone arthroscopic labral reconstruction with indirect head of rectus femoris tendon autograft during the study period for symptomatic labral tear without advanced radiographic osteoarthritis with minimum follow-up of one year. Informed consent has been obtained from all the study subjects to participate in the study.

For this study, we excluded 11 patients who underwent labral reconstruction with tensor fascia lata allograft and are part of another report. One patient in labral reconstruction with indirect head of rectus femoris tendon autograft group has less than one-year follow-up, is also excluded from the study.

Clinical and radiographic examinations were done preoperatively, at 6 weeks and 1 year postoperatively.

2.1. Clinical assessments

At initial evaluation, the patient underwent physical examination that included bony and soft tissue palpation, range of motion testing, and special diagnostic tests. The special tests included the impingement test and FABER (flex- ion, abduction, and external rotation) test.

All the patients completed detailed subjective questionnaire-modified Harris Hip Score (mHHS) at each clinical visits and Patient satisfaction outcome score postoperatively once only.

2.2. Radiological assessments

Patients also underwent radiographic evaluation that included anteroposterior (AP) pelvis view for the examination of joint space and center edge angle, cross-table lateral view to measure alpha angle, and false profile view to determine over coverage.

Acetabular over coverage was also determined by a crossover sign or posterior wall sign on AP view. Radiological progression of osteoarthritis was recorded according to Tönnis scale.[14] A magnetic resonance imaging (MRI) was completed in all patients for chondral and labral assessment.

In addition, the subjective improvement in pain, complications, revision surgeries, or conversion arthroplasties after labral reconstruction were also recorded.

2.3. Surgical technique

Surgical technique for Arthroscopic labral reconstruction with indirect head of rectus femoris tendon is described in literature.[15]

A dual portal arthroscopic technique with the patient in the supine position is undertaken. Systematic diagnostic arthroscopy is performed to confirm the suspected labral pathology and identify concomitant injuries. Following confirmation of the presence of irreparable labral tissue, debridement of the labral tear is performed and an estimate of the amount of labral deficiency is made. The acetabular rim is prepared to expose a bleeding cancellous bed and poor quality labral tissue is debrided back to stable margins.

The capsule between the reflected head of the rectus femoris and the labrum was carefully debrided to expose the tendon. The reflected head of the rectus femoris tendon is split to achieve the graft of desired width and length.

A suture is place around the graft at the most anterolateral portion of the acetabulum that underlies the tear and fixed using knotless suture anchor (PEEK, Parcus Medical™). Knotless anchors are then sequentially placed along the length of the graft, separated by 1–1.5 cm, to fix the graft to the acetabular rim in the same manner utilized for routine labral repairs. The muscular attachment of the reflected head of the rectus femoris tendon is completely released in order to perform a side-toside anastomosis with the remaining labrum.

Traction was released, and a bird's-eye view was taken of the reconstructed labrum, demonstrating a visually appropriate initial fluid seal effect

2.4. Post-op rehabilitation

Postoperatively, patients are allowed 20 pounds of foot-flat weight bearing for 21 days, followed by 1 week of weaning off crutches. A continuous passive motion machine is used for 4 weeks for 6–8 hours per day. Physical therapy is used to first restore passive motion, followed by active motion and, lastly, strength.

3. Results

There were 7 patients (five men, two women) with a mean age of 35 years (25–41 years) and with mean follow-up of 15 months (12–18 months). All the procedures were undertaken by senior author (JM). Demographics details are shown in Table 1.

All the procedures were primary hip arthroscopies. Femoroplasty as well as resection of the acetabular rim was carried out in all hips with reconstruction of the labrum. A detailed overview of the intraoperative findings is given in Table 2. All seven patients had some degree of acetabular cartilage changes while femoral head cartilage was normal. Five patients had grade II (Outerbridge classification) changes, four of them required micro fractures while one patient has debridement of the lesion. One patient has grade III changes repaired with collagen gel.

All 7 patients reported improvement of their symptoms. Post-operative details are shown in Table 3. The mean mHHS was significantly better from 56 (54–60), preoperatively to 93 (90-97) at mean latest follow-up. The mean change of mHHS was 36 (30–43). All the patients are very satisfied with the outcome of the surgery with mean post-operative patient satisfaction score is 9.1.

No intraoperative or postoperative complications were observed in any of the hips.

None of the patients had undergone or scheduled for revision surgery or arthroplasty. We have not observed progression of osteoarthritis on plain radiographs on latest follow-up.

Table 1
Patient Demographics.

Patient number	Gender	Age in years	Duration of Follow-up in months
1	M	25	15
2	M	37	14
3	M	34	18
4	M	40	16
5	M	33	14
6	F	35	12
7	F	41	14

Table 2
Intra-operative findings.

Patient number	Acetabular cartilage	Femoral head cartilage	Location of labral damage	Reason for labral reconstruction	Additional surgical procedure
1	Zone 2-3, Grade 3	Normal	10 to 12 o'clock	Multidirectional damage	CAM resection, Rim trimming Cartilage repair using collagen gel
2	Zone 2-3, Grade 2	Normal	12 to 2 o'clock	Multidirectional damage	CAM resection, Rim trimming, micro fractures
3	Zone 2-3, Grade 2	Normal	12 to 2 o'clock	Degenerative damage	CAM resection, Rim trimming, micro fractures
4	Zone 2-3, Grade 2	Normal	12 to 2 o'clock	Degenerative damage	CAM resection, Rim trimming, micro fractures
5	Zone 2, Grade 1	Normal	10 to 12 o'clock	Multidirectional damage	CAM resection, Rim trimming
6	Zone 2, Grade 2	Normal	12 to 2 o'clock	Multidirectional damage	CAM resection, Rim trimming, micro fractures
7	Zone 2-3, Grade 2	Normal	12 to 2 o'clock	Degenerative damage	CAM resection, Rim trimming Debridement

Table 3
Post-operative findings.

Patient number	Pre-op mHHS	Post-op mHHS	Patient satisfaction score (1–10)	Tonnis Grade (Pre-op)	Tonnis grade (Post-op)
1	55	90	10/10	0	0
2	56	90	9/10	1	1
3	56	92	9/10	1	1
4	59	94	10/10	1	1
5	60	90	10/10	0	0
6	55	96	8/10	1	1
7	54	97	8/10	1	1

4. Discussion

The present study confirms that the described technique for labral reconstruction is safe, reproducible and leads to excellent objective patient outcomes.

The native labrum has been shown to play a critical role in the maintenance of overall health of the cartilage of the hip. An in vitro analysis, compared the intact labral state to labral deficiency and the reconstructed labrum in biomechanical model to examine contact area, contact pressure, and peak forces. The study has demonstrated that labral reconstruction is likely to improve the properties of pressure dissipation compared with a resected state; however, labral reconstructions may be unable to completely restore normal joint biomechanics.[16]

The effect of labral tears on the fluid seal of the hip has been studied by several investigators. Philippon et al have described the effect of labral tears, labral repairs, labral resections and labral reconstructions on intra-articular fluid pressurization and hip stability to distraction. Partial labral resection caused significant decreases in intra-articular fluid pressurization while reconstructions re-established pressurization to the intact state.[17] With regard to stability secondary to the fluid seal, reconstructions were found to improve the resistance to distraction to 66% of the intact state, compared with 27% with complete resection, 29% with partial resection, 76% with partial tears, and 84% with repairs.[18] These data demonstrate the relative importance of the labral tissue to both uniform fluid pressurizations within the central compartment and prevention of unwanted distraction.

Cadet et al.[19] reported that labral reconstruction does not recreate the suction seal mechanism of the hip when compared to an intact labrum in a laboratory

setting.

The current gold standard of treatment of labral tears is labral preservation, primarily in the form of labral repair. However, in the cases where labral tears are nonrepairable, labral reconstruction should be considered.

Recent systematic review of the available literature has demonstrated that labral reconstruction of the hip predictably improves pain and function. Short-term results show that patient-reported outcomes and functional scores consistently improved.[20] The most common indication for reconstruction is a deficient labrum due to previous surgical excision or irreparable tears in young patients without significant arthrosis.

Philippon and colleagues have presented their short- term results of arthroscopic labral reconstructions utilizing ITB autografts in both elite athletes as well as a population of non-elite athletes. At a minimum of 3 years of follow-up in non-athletic population of 49 patients (86%), they demonstrated an improvement in modified Harris Hip Scores (MHHS) from 59 to 83 and high satisfaction in those patients that did not go on to require THR.[21] Similar to the results of Walker and colleagues,[22] approximately 25% of their patients progressed to THA at an average of 28 months from their labral reconstruction. They also found that a joint space of < 2 mm was prognostic of a poor outcome and eventual failure.

Boykin et al.[23] published the results of labral reconstruction in elite athletes. (professional and Olympic athletes) The study demonstrates short-term results that are promising with return to sport was high (approximately 85%), with 81% returning to a similar level of competition. Overall median satisfaction was found to be 8.2/10 and MHHS improved from 67 to 84.

A recently published biomechanical study of different graft choices including acetabular labrum, iliotibial band, semitendinosus, gracilis, indirect head of the rectus femoris, and anterior tibialis tendons displayed similar cyclic elongation behaviour in response to simulated physiologic forces.[24]

Using the indirect head of the rectus femoris tendon has the added benefit of reducing the number of incisions as well as eliminating a need for back table work. There is no donor site morbidity as the harvesting and fixation are completed through the same portals. Retaining blood supply to the graft is another added benefit, although further studies will be required to fully understand its impact.

This study has some limitations. First, we report on a limited patient population with short follow up. Second, although our patient-reported outcome scores seem similar to those described in the literature they are not compared with control group.

Despite these limitations, to our knowledge, there isn't a study describing the result of labral reconstruction with rectus femoris tendon autograft. Reporting of short-term data for new procedures is prudent to publicly evaluate and discuss the role of such procedures in clinical practice and to refine their technique to maximize the benefits conferred to the patient.

As the labrum reconstruction procedure is relatively new and still in evolution, many other controversies exist and will require further investigation with long-term follow-up and prospective comparative studies.

5. Conclusion

Acetabular labrum reconstruction using indirect head of the rectus femoris tendon autograft is a new technique that shows improvement in pain and function postoperatively. The main indication for reconstruction was a deficient labrum due to previous surgical excision or

irreparable tears in young patients with no significant arthritis. Long-term follow-up results with higher quality studies will be necessary to further define the role of labral reconstruction in hip preservation surgery.

Conflicts of interest

None.

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