Outcomes After Hip Labral Reconstruction Using Peroneus Longus Graft: A Novel Graft Experience

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Abstract

Currently, there is no consensus on the ideal graft for hip labral reconstruction. The purpose of this study was to describe the surgical technique and report the short-term outcomes after hip labral reconstruction using a peroneal longus allograft. Eleven patients diagnosed with femoracetabular impingement and irreparable damage to the acetabular labrum underwent labral reconstruction with a peroneus longus allograft. The average follow-up time was 227 days (range: 26-457 days). Pre-operative radiographic measurements included an average pre-operative center edge angle of 29.0° (range: 19° to 37°) and an average alpha angle of 62.9° (range: 55° to 71°). All patients underwent femoroplasty, with additional procedures including 7 acetabuloplasties and 6 microfractures. The average visual analogue score for pain improved from 4.91±2.17 preoperatively to 3.85±2.0 postoperatively but this was not significant (P=.26). No patients sustained post-operative complications or allograft failures during follow up. Compared to other acetabular labral reconstruction options, the strength and shape of thedcd peroneus tendon may best replicate the native hip labrum. The current findings of no immediate post-operative complications or early failures suggests the peroneus longus allograft may be a viable option for hip labrum reconstruction.

Keywords

peroneus longus graft; hip labrum reconstruction; labrum allograft; arthroscopy; hip labrum; arthroscopic hip

Acronyms and Abbreviations

FADIR: flexion, adduction, and internal rotation
PL: peroneus longus
VAS: Visual Analog Scale

Introduction

Currently, hip labral reconstruction is reserved as a primary surgery for irreparable labral tears or as a salvage, revision surgery for failed labral repairs. Ideally, labral reconstruction is performed on nonarthritic hips in non-obese patients with irreparable labral tears who have failed conservative treatment including nonsteroidal anti-inflammatory treatment and physical therapy.[1] Cadaveric studies have shown intraarticular pressure of the hip can be restored within normal physiologic parameters with labral reconstruction.[2] Restoration of the physiologic intra-articular pressure is clinically relevant as it helps maintain articular space and reduce surface contact pressures, potentially slowing the progression of osteoarthritis.[3] Compared to patients undergoing simple debridement, patients undergoing reconstruction have reported higher satisfaction and improved modified Harris hip scores.[4,5] With improved patient outcomes and expanding surgical indications, hip labral reconstruction is likely to become more popular in the near future.[6]

Although previous research favors an arthroscopic surgical approach to labral reconstruction, the graft choice remains controversial.[6] Previous studies have evaluated the use of autograft harvested from the indirect head of the rectus, the iliotibial band, and the gracilis tendon, as well as allografts from the iliotibial band or tensor fascia lata; however, none have been shown to be superior.[7] Furthermore, there is a lack of literature examining specific biomechanical and physical properties of various grafts and the possible limitations associated with them.

Peroneus longus (PL) allograft has not been previously described for hip labral reconstruction, however, it has been used for knee cruciate ligament and meniscus reconstruction. Because the labrum is a meniscal analogue and hamstrings are commonly used in ACL reconstructions, the PL is a possible alternative for hip labral reconstruction.[8-10] Theoretically, the peroneus longus graft might be biomechanically superior to other graft options due to its size and durability, which may translate to improved clinical outcomes. This study will briefly describe the surgical technique and report the short-term outcomes on a small patient cohort undergoing hip labral reconstruction using PL allograft.

Methods

This institutional approved (HPHRI# 2020-092) retrospective chart review included a consecutive cohort of patients who underwent hip labral reconstructions from December 2015 to January 2021. Clinical evaluations and surgical procedures were performed by a single, fellowship-trained orthopedic surgeon. During the study period, patients presenting with hip pain and clinical signs of hip labral pathology underwent a radiograph assessment, including weight-bearing anteroposterior radiographs, lateral frog leg radiographs, and a magnetic resonance image (preferably an arthrogram) of the hip. All patients met the standard indications for labral reconstruction, including failed symptomatic management with conservative treatment, clinical appearance, and/or intraoperatively confirmed findings of labral derangement.

Abbreviated Surgical Technique

Each hip arthroscopy was completed using standard equipment, with the patient supine on a specialized fracture table (Hana®, Mizuho OSI, Union City, CA, USA). A standard anterolateral viewing portal was created slightly anterior to the greater trochanter using fluoroscopic guidance. Through this portal, the feasibility and appropriateness of labral repair or reconstruction was evaluated based on the condition of labral tissue and acetabular cartilage. Next, a mid-anterior portal was created at the apex of an equilateral triangle referencing the greater trochanter and a line drawn parallel to the anterior superior iliac spine (Figure 1). Utilizing these 2 portals for viewing or instrumentation, hip labral tissue and acetabular cartilage were again evaluated and debrided of free flaps, nonviable tissue and delaminated cartilage (Figure 2).

Measuring with the shaver head as a reference, the size of the labral deficit and graft size needed were estimated. An additional 1 cm was added to the measured length and the PL allograft tendon was truncated to size. A thorough acetabular rim chondroplasty and labral debridement were performed with primary goals of achieving a stable remnant labral end and a bony surface with high healing potential. Osseus work (acetabuloplasty/femoroplasty) was done to correct the cause of impingement (pincer/cam) before any tendon work was performed and ensure a viable recipient graft bed.

Single-loaded suture anchors were placed along the length of the debrided acetabular edge. The peroneus longus graft was inserted through the mid-anterior portal and manipulated into its final position. One limb of the previously placed suture anchor was then passed around the graft. The graft was manipulated into position according to the primary surgeon's preference, with the goal of filling the labral defect and reconstituting the anatomic geometry of a native hip labrum. Sutures were then tied to create a stable healing construct (Figure 3). The reconstruction was evaluated by taking the limb off traction, reassessing the position of the graft, and evaluating the establishment of an intra-articular seal.

Post-Operative Care

Following surgery, patients were limited to touch down weight-bearing for 4 weeks. Range of motion was limited to 90° flexion, 0° of hip extension, and neutral rotation with external rotation only allowed during resting positions. Subsequently, the patients were progressed incrementally to weight-bearing as tolerated. Patients were permitted to start bicycling immediately after surgery and they were progressed to more demanding activities such as elliptical training and running on a case-by-case basis.

Data Analysis

Data collected included patient demographics and historical treatment of hip pain, including narcotic use and previous surgeries. Pre-operative clinical variables were collected from the office visit immediately preceding surgery including visual analogue scoring for pain (VAS), and positive physical exam findings. Pre-operative radiographs were reviewed by the senior surgeon, and the center edge angle,[11] Tonnis angle,[12] and alpha angle were calculated.[13] Peri-operative variables included location and length of labral tear, graft size, Outerbridge graded articular cartilage, and surgical procedures performed.[14,15] Postoperative VAS scores and narcotic use were also collected.

Figure 1. A photograph of the lateral hip demonstrating various portal sites. Orientation: superior to the left and anterior up. The black curved line on the left of the photo represents the iliac crest and the smaller black curved line represents the greater trochanter. 1: anterior-superior iliac spine. 2: Traditional anterior portal. 3: Anterolateral portal. 4: Mid-anterior portal.

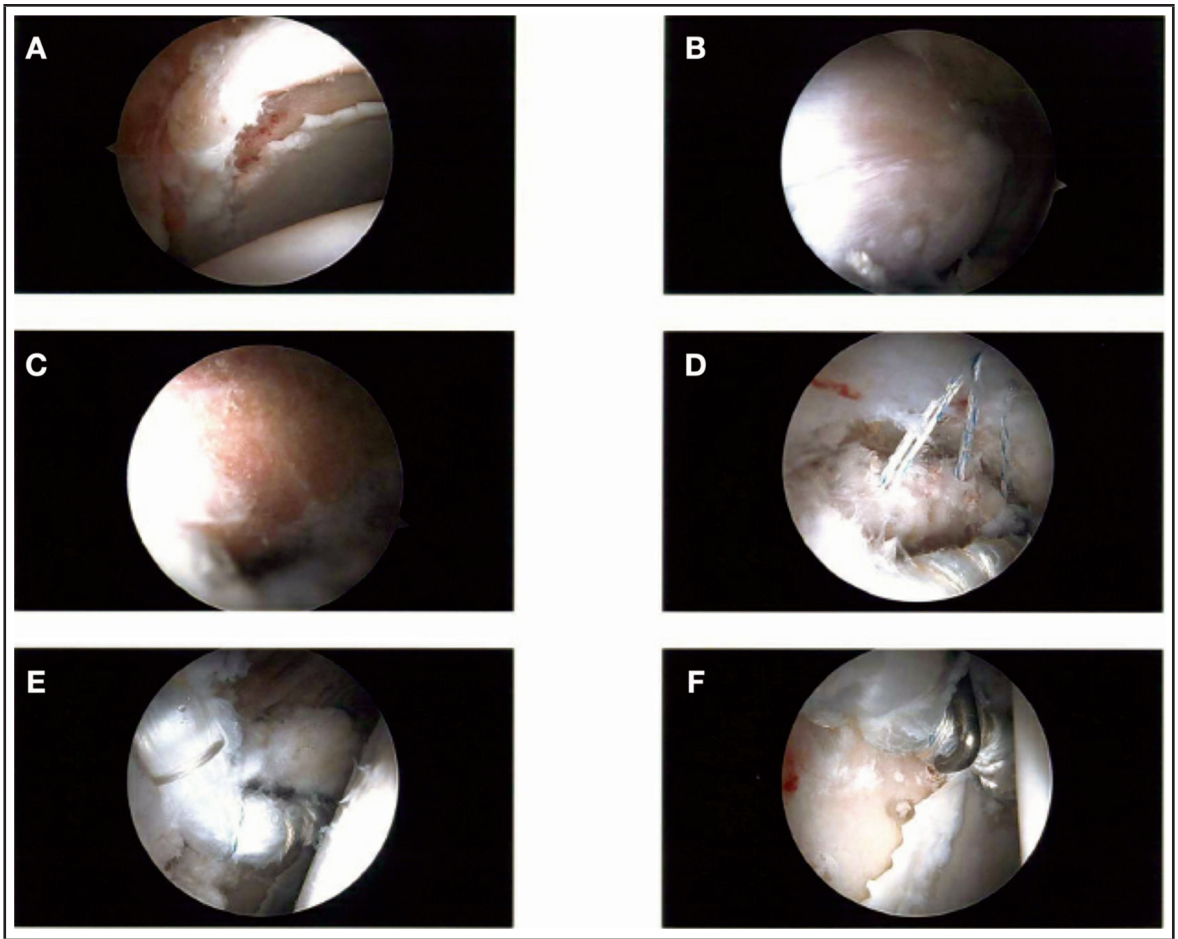

Figure 2. Various arthroscopic images of the procedure. A: The labrum is detached from approximately 12 o'clock to 3 o'clock with a chondral rim injury. Otherwise, the cartilage of the acetabulum and femoral head is preserved. B: A cam lesion is identified at the anterior femoral neck. C: A view of the femoral neck after the cam lesion was removed. D: Suture anchors were placed along the chondrolabral junction after the labral and acetabular debridements were performed. E/F: The peroneus longus graft is shuttled from the midanterior portal with manipulation into its appropriate position.

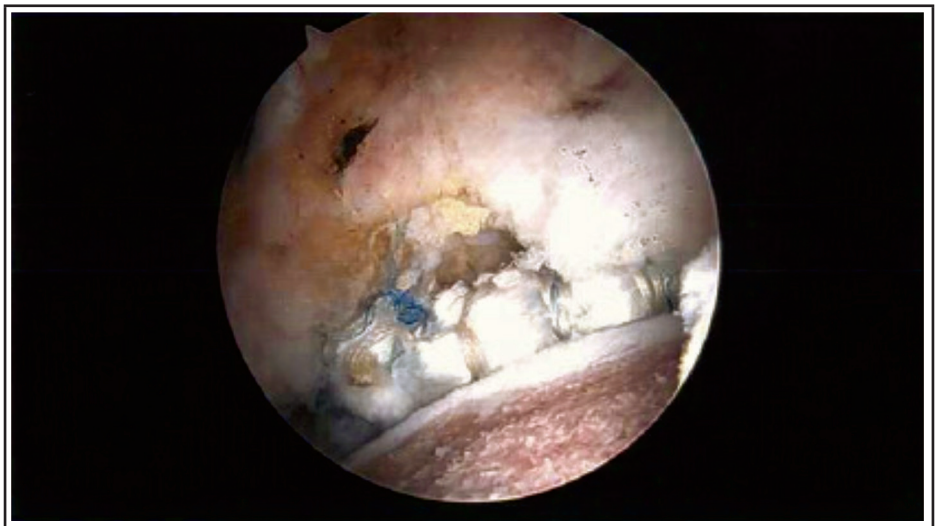

Figure 3. Final construct with a stable acetabular chondrolabral junction and newly reconstructed superolateral acetabular labrum.

Results

Overall, 11 patients underwent hip reconstruction with the PL allograft during the study period, with an average post-operative follow-up time of 227 days (range: 26-457). Patient demographics included an average age of 32±5.9 years old, average body mass index of 26.5±2.9 kg/m^2, and 8 males (73%). All patients had a positive FADIR test. Previous treatment history included 1 patient taking narcotics for pain and 1 patient with a previous labral repair. Radiographically, the average center edge-angle was 29.0°±5.3° (range: 19°-37°) and the average alpha angle was 62.9°±5.4° (range: 55°-71°). Three patients had advanced disease with Tonnis scores of 2, and 5 patients (45.5%) had a positive crossover sign.

Intra-operative findings were consistent with labral derangement requiring hip labral reconstruction such as poor labral tissue quality (N=5) and irreparable labral tears (N=6). For patients with irreparable labral tears, the average tear length was 3.38 ±0.67cm. Five were located at the 12-to-3'oclock position, and 1 was a complete radial tear. Intra-operative assessment of the articular cartilage revealed 7 patients with Outerbridge Grade IV damage. All patients underwent femoroplasty, and 7 patients (63.6%) underwent acetabuloplasty. Microfracture was performed on 6 of the 7 patients with Grade IV articular cartilage damage.

At the most recent clinic post-operative clinic visit, mean pain score was 3.87±2.05, which was improved from preoperative pain score of 4.91±2.17 (*P*=.26). One patient required chronic narcotic medication preoperatively. No post-operative complications or failures were noted during follow-up.

Discussion

Arthroscopic hip procedures have become increasingly popular, and the number of hip labral reconstructions is likely to continue to grow.[16] Many unknowns currently exist, and there is no consensus for the most effective graft for optimal surgical and clinical goals. A recent systematic review evaluated and compared various grafts and found no significant differences among grafts in terms of outcomes, however, nearly all included studies were of low-level evidence with small sample sizes, demonstrating the need for more data in the literature.[17]

Previous biomechanical and clinical studies propose an ideal labral graft diameter of 8 mm diameter to adequately achieve the best suction-seal.[2,4] Labral heights <6 mm (as found in gracilis grafts) were suggested to be too small, lowering the threshold to suction-seal failure and creation of hip instability.[2,18] Labral graft diameters significantly larger than 8 mm (eg, tibialis anterior grafts) can create a mechanical block to adequate intra-articular compression when the limb is off traction.[17] In comparison, the PL graft has been reported to have a mean diameter of 8.3 mm,[8] making it fractions of a millimeter away from an ideal graft diameter postulated to meet surgical and clinical goals.[9] Furthermore, having an optimally sized graft diminishes the need for additional intraoperative modifications (eg, tubulerization) that are often required when using the iliotibial graft, thereby decreasing intraoperative time.[9]

In addition to proper graft shape and size, the chosen graft must possess significant tensile strength to support the cyclic stress cycles seen in the hip. Previous studies have suggested that hamstring allografts have similar biomechanical tensile properties as native acetabular labrum with semitendinosus hamstring graft even demonstrating better resistance to elongation behavior then the native hip labrum.[19] Studies have reported the PL tendon has tensile strengths equivalent or superior to hamstring graft, which might infer superior mechanical strength and toughness ideal for hip labrums.[10,18,20] This strength has not been shown to be influenced by graft donor age, indicating age screening for this graft may be unnecessary.[11] This potentially creates a widened donor pool of an easily obtainable, available, and durable graft.

The current early results indicate peroneus longus is a viable graft alternative for hip labral reconstruction with no catastrophic failures or infections at an average follow-up of 227 days (Range: 26-457). Of the 11 patients undergoing hip labral reconstructing with peroneus longus tendon allograft, pain improved from mean VAS scores of 4.91 to 3.85, but this improvement was not statistically significant (*P*=.26). Although pain did persist in some patients, this was not unexpected as up to 25% of patients have been shown to require conversion to a total hip arthroplasty after a failed acetabular labral reconstruction.[21] These patients will continue to be followed closely. Currently, there are plans to collect specific clinical data and ROM measurements to allow for direct graft comparison in the future. Further long-term and higher-level studies are needed in this new field of orthopedic sports surgery.

Conflict of Interest

None of the authors identify a conflict of interest.

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