Technical Note

Arthroscopic Hip Labral Augmentation Technique With Iliotibial Band Graft

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Abstract: The importance of the acetabular labrum has been well documented for the function and overall health of the hip joint. Several biomechanical studies have shown the sealing effect of the acetabular labrum. In the past decade, labral repair procedures have gained increased attention, with the literature suggesting that the outcomes after hip arthroscopy are directly related to labral preservation. However, a primary labral repair can be challenging in cases of hypoplastic, ossified, or complex and irreparable labral tears in which there is insufficient tissue to perform a primary repair. For these cases, labral reconstruction becomes a viable option with good outcomes at short-term and midterm follow-up. A subset of these patients may show viable remnants of the labral circumferential fibers but, because of the low tissue volume, these remnant fibers are unable to maintain the suction seal. In this situation, a labral augmentation may be a viable alternative to labral reconstruction while preserving as much native labral tissue as possible. The purpose of this technical note is to describe an arthroscopic hip labral augmentation technique using iliotibial band autograft or allograft.

The labrum plays an integral role in preserving hip joint stability and preserving the articular cartilage.[1] The labrum deepens the acetabulum while extending coverage of the femoral head and is responsible for the hip fluid seal, which ensures adequate joint lubrication.[1] Furthermore, it distributes load and pressure within the acetabulum and enhances stability by providing negative intra-articular pressure within the hip joint.[2] A previous cadaveric study evaluated the effect of an acetabular labral tear, repair, resection, and reconstruction on hip fluid pressurization and reported that partial labral resection caused a significant decrease in intra-articular fluid pressurization.[3] In the past decade, labral repair procedures have gained increased attention, with recent evidence suggesting that the outcome after hip arthroscopy is directly related to preservation of the labrum.[4]

Although most surgeons prefer to repair a torn labrum, primary labral repair can be challenging. A hypoplastic, ossified, or complex and irreparable labral tear may be encountered, leaving insufficient tissue to perform a primary repair. Previous studies have discussed labral reconstruction in these cases and have suggested the use of a variety of tissue grafts suitable for reconstructing the labrum.[5-8] Promising early and midterm results have been reported with an arthroscopic labral reconstruction technique using iliotibial band (ITB) autograft.[9,10]

A subset of these patients may show viable remnants of the labral circumferential fibers but, because of the low tissue volume, these remnant fibers are unable to maintain the suction seal. In this situation, a labral augmentation may be a viable alternative to labral reconstruction (Table 1). The purpose of this technical note is to describe an arthroscopic hip labral augmentation technique using ITB graft.

Technique

Patient Positioning

The patient is placed in a modified supine position on a traction table (Steris/Amsco, Mentor, OH). After induction of general anesthesia, a bilateral lower extremity examination is performed to assess for hip

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Table 1. Indications and Contraindications

Indications
Degenerative or complex labral tear pattern precluding repair
Hypoplastic labrum and incapability of keeping suction seal
Contraindications
Advanced intra-articular degenerative joint disease
Developmental dysplasia of hip (lateral center-edge angle <20°)
Severe acetabular retroversion

range of motion. Traction is gently applied to the leg with 15° of internal rotation, 10° of lateral tilt, 10° of flexion, and neutral abduction. To prevent neurologic complications, an extra-wide perineal post is used and lateralized toward the ipsilateral side in the perineal space to minimize pressure on the pudendal nerve and to force the femoral head laterally.

Arthroscopic Technique

Standard anterolateral and midanterior portals are created as previously described.[5] A diagnostic arthroscopy is performed with the aid of a 70° arthroscope (Smith & Nephew, Andover, MA) to evaluate the status of the labrum and concomitant intra-articular pathology (Video 1). Bony impingement such as a cam or pincer lesion is addressed at this point (Table 2).

The labral tissue is debrided until healthy tissue is observed while the surgeon attempts to keep the augmentation area as small as possible (Fig 1). After this, the remaining intact tissue volume is assessed to ensure adequacy for maintaining the suction seal. A healthy bleeding bony bed is created with an arthroscopic burr in preparation for graft placement to aid in graft-to-bone healing.

Graft Preparation

An autogenous or allogenous ITB graft can be used for this technique. When autograft is being harvested,

Table 2. Pearls and Pitfalls

The surgeon should be sure to address concomitant bony pathology, including cam and pincer lesions.
The native labrum should be debrided until healthy tissue is observed with stable margins to aid in labrum-graft healing.
A burr should be used to create a bleeding bone surface on the acetabulum for graft healing and fixation.
If using ITB autograft, the surgeon should release traction, extend the hip and knee ipsilateral to the graft harvest, and internally rotate the foot to maximize ITB visualization.
The graft should be 30%-40% longer than the measured native labral defect size.
Cerclage sutures should be used on the graft ends to avoid loosening of the tubular graft shape.
The surgeon should use a suture loop on the lateral end of the graft to allow for manipulation during graft passage.
A shaver or radiofrequency probe device should be used to carefully remove any frayed edges of the native labrum and/or the graft to decrease the risk of tissue impingement.

ITB, iliotibial band.

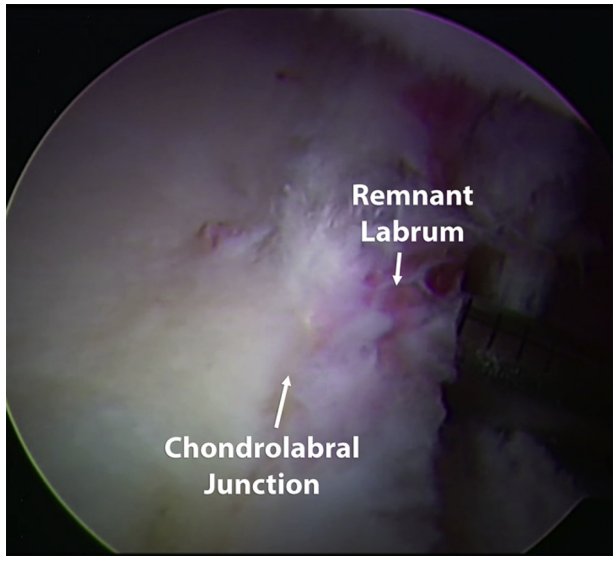

Fig 1. Arthroscopic view from the midanterior portal in a right hip, showing insufficient but functional remnant labral tissue, which is incapable of providing an adequate suction seal. This constitutes an indication for labral augmentation.

traction should be released and the lower extremity straightened into full extension with the foot placed in internal rotation to better expose the ITB. A longitudinal incision is made just distal to the anterolateral portal directly in line with the long axis of the proximal femur (Fig 2). A rectangular graft is harvested along the ITB at the junction of the anterior two-thirds and posterior one-third. The harvested graft should be approximately 30% to 40% longer than the labral defect and measure approximately 1 cm in width. When ITB allograft is used, the width should suffice to fold the graft 4 times (Fig 3). A bursectomy at the harvest site can be performed if indicated. Once the autograft is harvested, it is then cleared of any muscular or fatty soft-tissue remnants. Hanging stitches

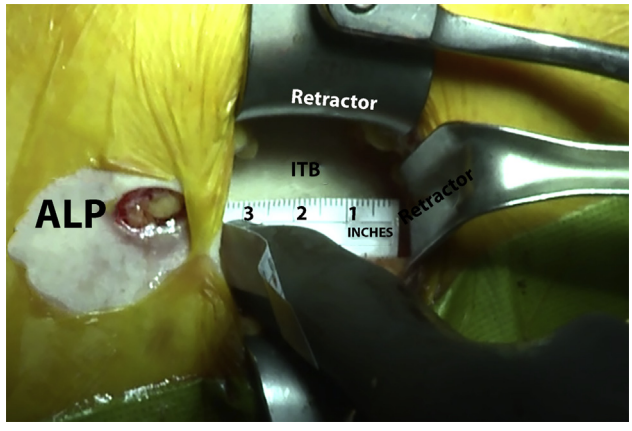

Fig 2. Iliotibial band (ITB) autograft harvesting in a right hip. A small incision is performed in line with and slightly distal to the anterolateral portal (ALP).

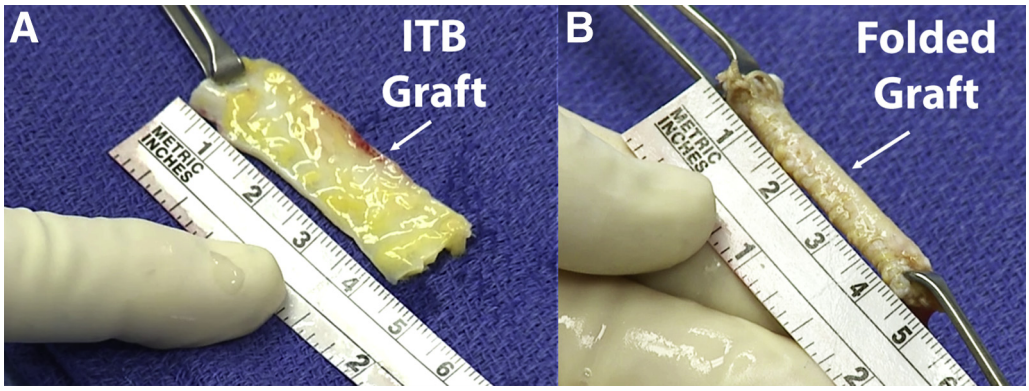

Fig 3. (A) Inner part of the iliotibial band (ITB) autograft harvest from a right hip. (B) Final aspect of the graft with a loop suture in one of the extremities to facilitate arthroscopic maneuverability.

are placed on the ends of the graft to help with tubularization. Hanging stitches help secure the ends and prevent the anastomosis sutures from pulling out while being fixed. Tubularization of the graft is accomplished with Krackow sutures performed in a longitudinal fashion in one direction and a nonlocked continuous suture in the reverse direction, by use of No. 2-0 Vicryl (Ethicon, Somerville, NJ). Cerclage of both graft ends is then performed to avoid inadvertent loosening of the tubular shape. It is important that all of the knots are placed on the superior portion of the graft to preserve a smooth interface at the inferior aspect for soft tissue—to—bone healing. Additional reinforcing sutures should be placed at both ends to avoid graft tearing that can occur with suture passage. Finally, a suture loop is made at one end of the graft to allow for manipulation during passage of the graft into the hip joint. This loop should obey the 3 L's rule (loop, lateral, and large), which means that the loop has to be placed in the lateral margin and it has to protrude beyond the edge of the graft. Of note, the loop is typically made at the thicker end of the graft to help with natural labral contour and size progression.

Arthroscopic Labral Augmentation

A 1.5-mm JuggerKnot suture anchor (Biomet, Warsaw, IN) is placed at the most medial edge of the labral deficiency (Fig 1). The graft is pierced with a free needle holding one suture arm from the previously placed anchor. The graft is inserted through a clear plastic 7-mm × 11-cm cannula (Arthrex, Naples, FL) in the midanterior portal with an arthroscopic knot pusher. The graft is then secured against the acetabulum with racking half-hitch knots, thus anchoring one end of the graft anteromedially along the acetabular rim. An additional anchor is placed laterally with the suture loop in the graft being used to fix the other end of the graft to the acetabulum and labrum. Additional anchors are placed at 1.0- to 1.5-cm intervals to affix the graft to the native labrum and acetabular rim in a loop fashion (Figs 4 and 5). If coexisting chondral injury must be addressed,

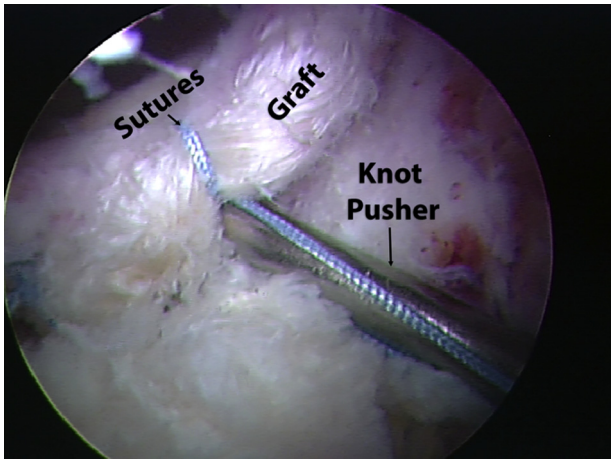

Fig 4. Arthroscopic view from the midanterior portal in a right hip, showing graft fixation through a loop suture passed around the native labrum and the graft.

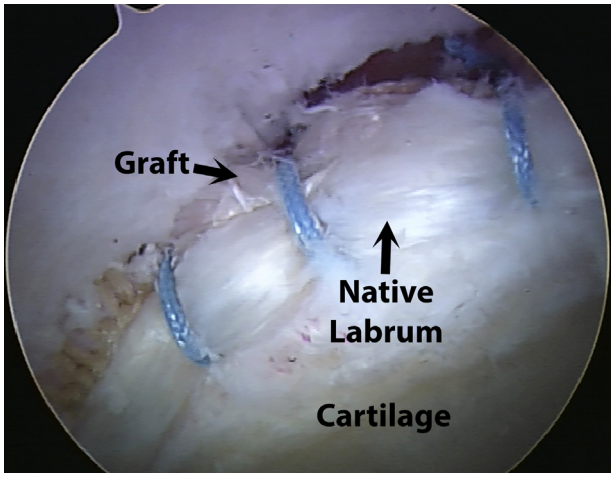

Fig 5. Arthroscopic view from the midanterior portal in a right hip, showing a distracted hip and the final aspect of the labral augmentation procedure with an iliotibial band graft in a labrum considered to have insufficient tissue to keep the suction seal.

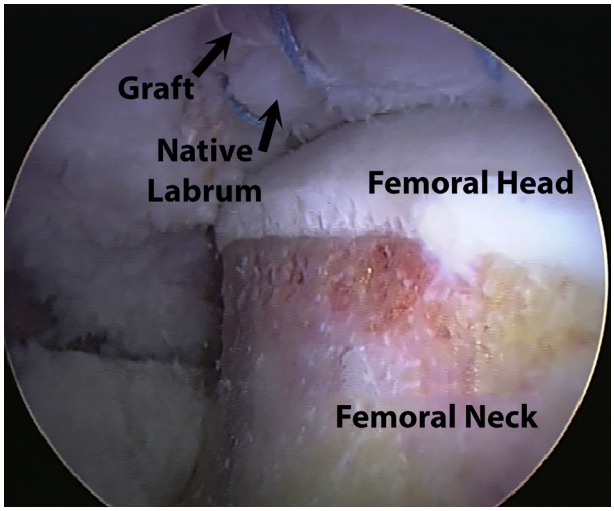

Fig 6. Arthroscopic view from the midanterior portal in a right hip after traction has been released and femoral neck osteoplasty has been performed, showing the re-establishment of the hip joint suction seal.

microfracture should be performed on completion of labral augmentation to ensure continued good visualization. Traction is released, and the augmentation is evaluated dynamically in all planes of motion to assess the fixation and position of the graft. An additional femoral osteoplasty and suture anchor fixation may be necessary (Fig 6). A flexible radiofrequency probe (E-Flex; Smith & Nephew) is used to remove any frayed edges of the native labrum and/or the graft to ensure decreased risk of tissue impingement.

Once intra-articular and extra-articular pathologies have been addressed, the hip is brought into flexion to relax the anterior capsule and facilitate capsular closure. An intra-articular cannula (Arthrex) is inserted through the anterolateral portal. A suture-shuttling device (SutureLasso; Arthrex) is passed through the proximal capsular leaflet, and a soft-tissue penetrator (Arthropierce; Smith & Nephew) is then used to retrieve the lasso through the distal capsular leaflet. A No. 2 Vicryl suture is passed through both leaflets in a double-limb fashion. This is secured with racking half-hitch knots. A total of 2 to 4 side-to-side sutures are placed to complete the capsular closure.

Postoperative Rehabilitation Protocol

Patients are allowed 20 lb 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 to 8 hours per day. This period increases to 8 hours per day for 8 weeks if microfracture is performed. An anti-rotation bolster to prevent hip external rotation is used for 21 days after surgery. A hip brace is used to restrict extension and external rotation for 21 days postoperatively. Physical therapy is used to restore passive motion first, followed by active motion and lastly strength. Passive hip circumduction is performed 4 times daily to prevent adhesions.[8] Endurance strengthening is commenced after motion is maximized and good stability in gait and movement is shown.

Discussion

This study presents our preferred method for augmentation of the acetabular labrum using ITB autograft in selected cases in which functional remnant

Table 3. Advantages and Disadvantages Comparing Labral Reconstruction and Augmentation

Advantages		Disadvantages	
Labral Reconstruction	Labral Augmentation	Labral Reconstruction	Labral Augmentation
The technique can help to restore the anatomy and function of the hip in patients with a complex labral tear with tissue degeneration, severely hypotrophic labrum, ossified labrum, or segmental deficiency.	The technique can help to restore the anatomy and function of the hip in cases of a hypotrophic labrum and when, after a labral tear, the labrum is considered insufficient to keep the suction seal.	The technique is technically demanding and requires advanced hip arthroscopy skill and experience.	The use of autograft necessitates a separate incision and harvesting of the iliotibial band. This increases the potential of inducing soft-tissue complications in the harvest area.
The technique re-establishes the hip suction seal and the contact areas of the joint and allows for improved hip stability.	The remnant circumferential labral fibers work as a guide for correct graft placement.	There are no previous long-term follow-up studies; therefore, there is the possibility of long-term complications that have not yet been identified.	There are no previous outcome studies at short- and medium-term follow-up.
The technique yields good outcomes at short- and medium-term follow-up.	The technique preserves the native chondrolabral junction and, consequently, the native labrum innervation and vascularization.	The technique does not preserve the native vascularization and innervation of the labrum.	The technique cannot be indicated in cases of segmental and circumferential labral defects.
Several autografts and allografts have been reported to produce good outcomes.			

fibers can be preserved. This technique allows the surgeon to augment and repair a deficient labrum and re-create the hip joint suction seal. There is strong evidence in the literature that the acetabular labrum plays an important role in hip joint stability and articular cartilage preservation.[3,11] The tight fit of the acetabular labrum around the femoral head creates a vacuum seal between the 2, keeping them together to resist distraction forces. By use of a human cadaveric model, a simulated chondrolabral tear was shown to reduce the force required to distract the hip. Subsequent labral repair restored hip stability close to the intact state. Partial or complete resection was detrimental, reducing mean distractive force by approximately 70%.[12]

The labrum, which is triangular in cross section, is composed of articular and nonarticular surfaces. The inferior region of the labrum is widest, measuring up to 6.4 mm, and the superior region is thickest, measuring up to 5.5 mm. Posteriorly, the collagen fibers attach perpendicularly, whereas anteriorly, the collagen fibers are parallel to the rim, making the labrum particularly vulnerable to shear forces. On the nonarticular surface, where the labrum is composed of dense connective tissue, it is attached directly to the bone, allowing nerves and blood vessels to traverse the tissue.[13] The possibility of preservation of the original chondrolabral junction anatomy and, consequently, the innervation and vascularization of the labrum is a possible advantage of this technique. Another advantage of this technique is that the remnant circumferential labral fibers work as a guide for correct graft placement. Moreover, by reinforcing the already existing labral part with a graft (iliotibial autograft), we are creating a "spacer" effect between the labrum and the joint capsule. This may help to prevent the formation of capsulolabral adhesions, which may be the cause of a secondary labral tear in the future, as well as the need for additional surgical procedures.[14]

Different graft types (both autografts and allografts) have been successfully used to reconstruct the labrum.[15] In a previous study, ITB, gracilis, anterior tibialis, and semitendinosus autografts were found to have similar biomechanical properties to the native labrum.[16] However, there is a lack of literature on the intrinsic biomechanical characteristics of commonly used allografts[17] or the surrounding soft tissues (indirect head of rectus femoris and capsule) when used for labral restoration techniques. At our institution, ITB autografts have been used for labral reconstruction with good results at short-term and midterm follow-up.[9] However, the use of autograft necessitates a separate incision and harvesting of the ITB.[18] This could potentially induce soft-tissue complications in the harvest area described for labral reconstruction that can also occur in cases of labral augmentation. Labral augmentation cannot be indicated in cases of segmental and circumferential labral defects, in which a labral reconstruction is the most appropriate choice (Table 3).

This article describes a technique for labral augmentation using ITB autograft or allograft, allowing the preservation of the circumferential fibers of the labrum and the native chondrolabral junction. This technique is a reliable example of an anatomic and less invasive technique to deal with labral deficiencies. Further studies are needed to evaluate its longevity, as well as to compare outcomes with those of labral reconstruction.

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