Arthroscopic Labral Reconstruction of the Hip Using Semitendinosus Allograft

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Abstract: The labrum of the hip is recognized as being important to the stability of the hip and a major cause of hip pain. Damage to the labrum may result in increased joint stress and articular damage. Labral damage is often treated through various methods, among them simple stitch repair, base refixation, and debridement. Labral reconstruction becomes necessary when the labrum is too damaged to salvage, which renders labral repair improbable and labral debridement ineffective. In contrast to other methods that have been described for this treatment, our technique uses a semitendinosus allograft as a graft source, allowing for arthroscopic hip labral reconstruction. This technique has many advantages and is easily reproducible. It has shown promising results in patients with labral damage. The purpose of this article is to detail the step-by-step surgical technique of labral reconstruction using a semitendinosus allograft, in addition to the indications, pearls, and pitfalls of the technique.

The acetabular labrum appears to have an important role in maintaining normal physiology within the hip joint. The labrum provides stability by both creating a suction seal[1,2] and deepening the acetabulum.[3-5] By increasing the acetabular surface area and maintaining adequate fluid pressure, direct contact stress on the articular surface can be distributed and therefore decreased.[2-6]

There are instances in which the labral seal can become disrupted (i.e., labral tear), resulting in abnormal physiology and possibly pain.[7-9] Labral tears alter the normal physiological environment of the hip joint, leading to joint destabilization with increased joint stress and subsequent articular damage.[3-5,10-14] Contact stress between the acetabular and femoral cartilage increases by as much as 92% in the absence of a labrum.[6] The treatment of these lesions in young patients is especially important because there is a strong association between labral tears and the premature onset of degenerative changes.[3,5-7,15]

Until recently, surgical treatment options were limited to debridement and labral repair. Clinically, the results of labral repair have been superior to debridement for the treatment of labral tears.[16,17] This may be because of loss of labral function in groups undergoing labral debridement. Labral repair likely maintains labral function, and it has the potential to decrease the risk of degenerative changes.[18] However, there are occasions in which the labrum is unsalvageable, and in such patients, labral reconstruction is a viable treatment modality.

To our knowledge, 5 types of labral repair techniques have been described. Philippon et al.[19] described an arthroscopic technique using iliotibial band autografts. Sierra and Trousdale[18] described an open approach using the ligamentum teres. Both groups of authors showed promising early results. Matsuda[20] described an arthroscopic technique using gracilis autografts, and Park and Ko[21] reported an arthroscopic reconstruction using quadriceps tendon. Recently, Domb et al.[22] documented an arthroscopic technique using capsular autografts. In this technical note, we introduce arthroscopic hip labral reconstruction using semitendinosus allograft as a graft source (Video 1). Indications for this technique are listed in Table 1. Our technique is similar to that described by Matsuda; however, several

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Table 1. Indications for Labral Reconstruction Using Semitendinosus as Graft Source

Indications for labral reconstruction
Unsalvageable labrum (i.e., damaged or surgically debrided tissue)
Evidence of labral hypoplasia
Complete labral calcification
Indications against labral reconstruction
Joint space measurement <2 mm
Tönnis grade >1
Repairable native labrum

differences are apparent. We believe that the described technique has the potential to restore labral function in patients with otherwise unsalvageable labrums.

Surgical Technique

Operating Room Preparation

We perform hip arthroscopy using a standard traction table with the patient in the supine position, as previously described by Kelly et al.[23] The patient is typically placed under general anesthesia. Hypotensive anesthesia allows a lower pump pressure and improves visualization arthroscopically and endoscopically.[24] The patient is placed on a fracture table or on a traction extension table, with a well-padded perineal post.[25] The patient is placed in the slight Trendelenburg position to decrease perineal pressure on the post. The operative extremity is positioned in adduction, with the hip flexed to 10° and the femur internally rotated.[26]

Portal Placement

A 20-gauge spinal needle is used to vent the hip during gentle distraction as previously described by Domb and Botser.[27] With the bevel of the needle positioned facing the femoral head while being advanced toward the superior aspect of the joint space, damage to the femoral cartilage is minimized. The needle is passed through the anterosuperior joint capsule until a "pop" is felt, whereby the stylet of the needle is then removed to vent the joint and create an air arthrogram. Traction can be applied to the hip. A 14-gauge needle and nitinol wire (Arthrex, Naples, FL) are then used to create an anterolateral portal,[26] with subsequent introduction of a 70° arthroscope through the portal. A midanterior portal is created approximately at a 30° angle anterior to the anterolateral portal using an outside-in technique, and a distal midanterior portal (DMAP) is then created approximately 3 to 4 cm distal to the midanterior portal. Diagnostic arthroscopy is carried out, and the quality of the labral tissue is characterized. If the labrum is believed to be unsalvageable, a decision to proceed with labral reconstruction is considered.

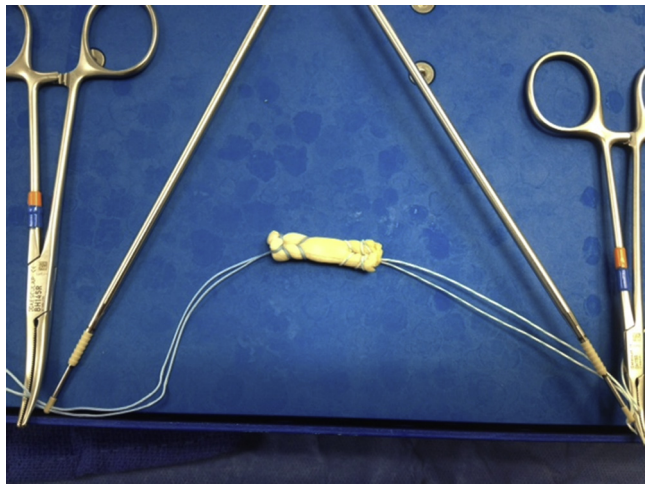

Fig 1. View of a prepared graft with accompanying instruments. The length between the end sutures matches the length of the labral defect.

Graft Preparation

Our preference for most patients undergoing labral reconstruction is semitendinosus allograft. In younger patients and in athletes, we have also used semitendinosus autograft. In our experience, harvesting hamstring tendons is associated with postoperative knee pain and may hinder postoperative recovery. The semitendinosus is placed on a back table and folded over once. In most patients the length of the acetabular defect is between 20 and 70 mm; therefore the length of tendon necessary is 40 to 140 mm. Once the surgeon confirms the length of graft necessary, an assistant may begin suturing the graft. We prepare the terminal 5 to 10 mm of each end with a looped FiberLoop stitch (Arthrex). We begin with the apex of the folded-over graft (Fig 1). The looped suture is passed 3 to 4 times through the graft. The last pass should be just proximal to the previous pass for stability of the terminal suture ends. The graft is then placed under tension on a graft preparation board (Arthrex). A second looped suture is used to prepare the opposite end of the graft in an identical manner. The graft length measured by the surgeon should be identical to the distance between the 2 terminal suture ends (Fig 1). Any remaining tendon from the tail end of the graft is then sharply truncated. A knotless anchor is placed over the looped suture on each end of the graft. A clamp is placed on each end of the looped suture to prevent the anchors from falling off (Fig 1).

Labral Reconstruction

Once a decision has been made to proceed with labral reconstruction, the surgeon should identify the segment of unsalvageable labrum to be resected (Fig 2). By use of a suction shaver and electrocautery, the

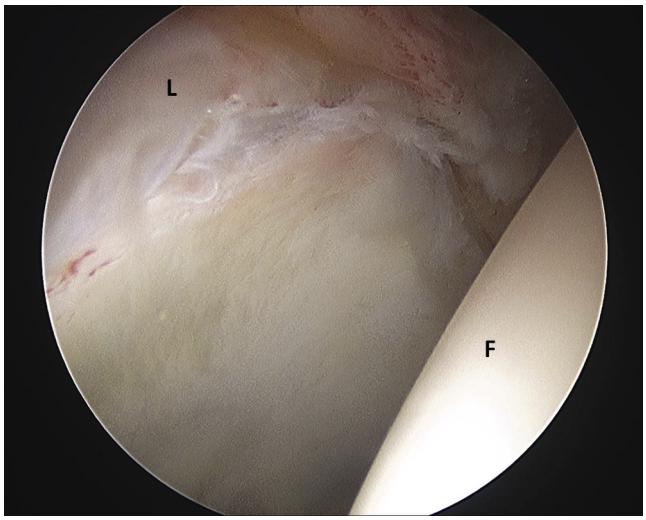

Fig 2. Arthroscopic view of a left hip through the anterolateral portal showing an example of an unsalvageable labrum (L). (F, femoral head.)

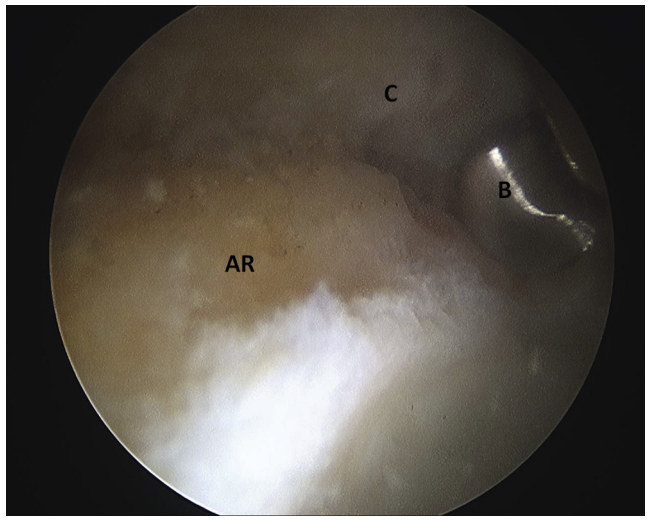

Fig 4. Arthroscopic birds-eye view of a left hip through the anterolateral portal. The capsule (C) has been elevated. The acetabular rim (AR) has been burred to remove a pincer lesion. (B, burr.)

unsalvageable labrum is completely debrided to the acetabular rim (Fig 3). Because the graft is generally slightly larger than the native labrum, the capsule should be elevated approximately 5 mm from the acetabular rim. At this point, a 5.5-mm burr (Smith & Nephew, London, England) is used to perform an acetabuloplasty if necessary. If an acetabuloplasty is not necessary, the burr is used to decorticate the acetabular rim and create a bleeding bony surface (Fig 4). A ruler designed for measuring the acetabular rim (Arthrex) is then inserted through the anterior portal. The labral defect distance is measured (Fig 5); this distance is used to prepare the semitendinosus graft as described earlier.

A 2.9-mm drill is used to prepare the acetabular rim to accept a series of 2.9-mm knotless suture anchors. In most cases drill holes can be placed through the DMAP. The drill holes are placed 1 to 2 mm away from the chondral surface (Fig 6). This is slightly farther away from the chondral surface than the distance used for labral repair. If the holes are placed too close to the chondral surface, the graft can involute into the hip joint. If the holes are placed too far away from the chondral surface, the graft may not seal against the femoral head as desired. Once the holes are drilled, we generally release traction and move to the peripheral compartment if a femoral osteoplasty is necessary. The

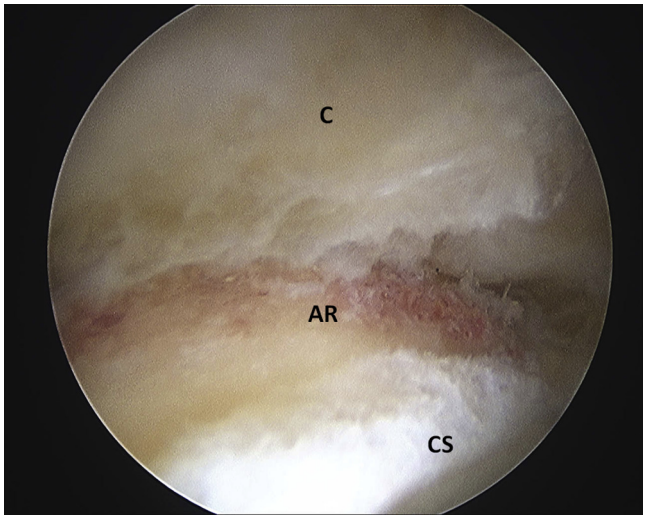

Fig 3. Arthroscopic view of a left hip through the anterolateral portal showing the acetabular rim (AR), capsule (C), and chondral surface (CS) after debridement of the unsalvageable labrum.

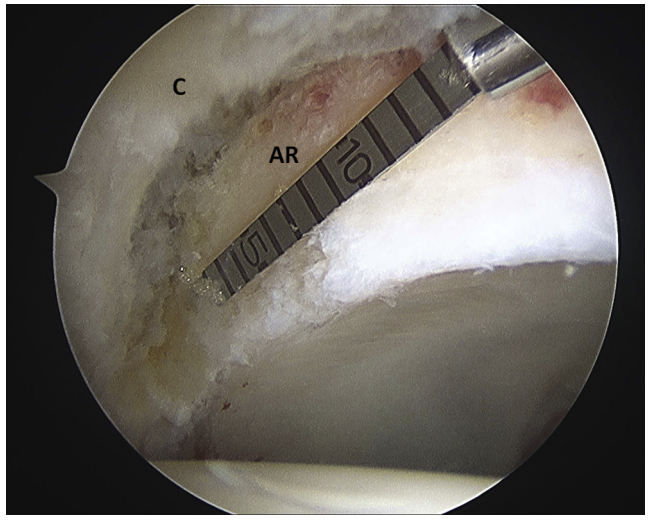

Fig 5. Arthroscopic birds-eye view of a left hip through the anterolateral portal showing measurement of the defect size on the acetabular rim (AR). (C, capsule.)

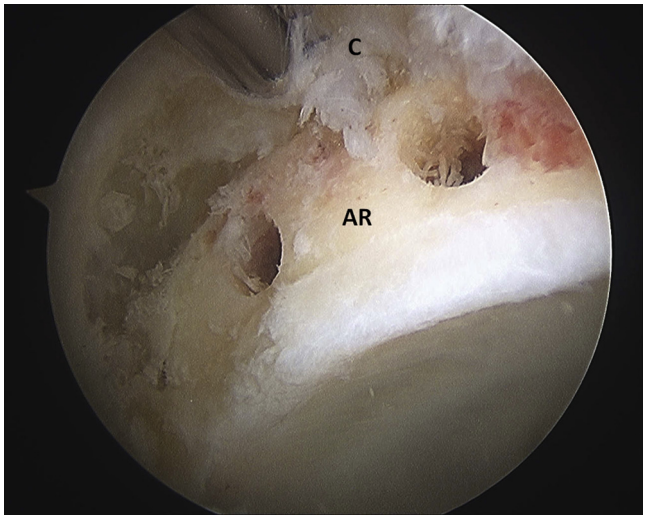

Fig 6. Arthroscopic birds-eye view of a left hip through the anterolateral portal showing holes in the acetabular rim (AR) for suture and graft insertion. (C, capsule.)

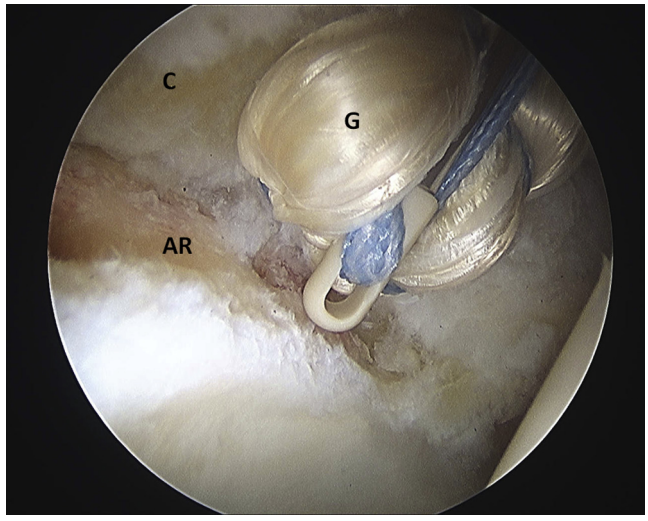

Fig 8. Arthroscopic view of a left hip through the anterolateral portal. The loaded graft (G) is inserted into the anterior hole in the acetabular rim (AR). (C, capsule.)

reconstructed labrum is typically slightly larger than the native labrum and will block access to the central femoral head once inserted. This makes appropriate cam resection difficult because the graft will be adjacent to the burr. When the femoral osteoplasty is performed before graft insertion, access to the central aspect of the femoral head is improved.

After the femoroplasty has been performed, the leg is placed in traction again to visualize the central compartment. An 8-mm threaded cannula is placed through the DMAP to facilitate graft passage (Fig 7). The insertion device for a knotless suture anchor is used to lead the graft through the cannula and into the central compartment. The anchor is provisionally placed in the most anterior drill hole, and the leading edge of the graft is tensioned to the drill hole by pulling on the clamp attached to the looped suture. The anchor is then inserted to anchor the leading edge of the graft to the anterior acetabulum (Fig 8). The second anchor is placed in the most superior/posterior drill hole to anchor the opposite edge of the graft. Tension is then applied to the second anchor to tension the graft along the acetabular rim. After appropriate tension has been achieved, the second anchor is inserted (Fig 9).

The remaining drill holes between the terminal drill holes are used to secure the graft to the acetabular rim. A BirdBeak instrument (Arthrex) is then used to shuttle suture around the graft. Knotless suture anchors (Arthrex) are used to secure the suture and graft to the acetabular rim (Fig 10). The process is repeated for each

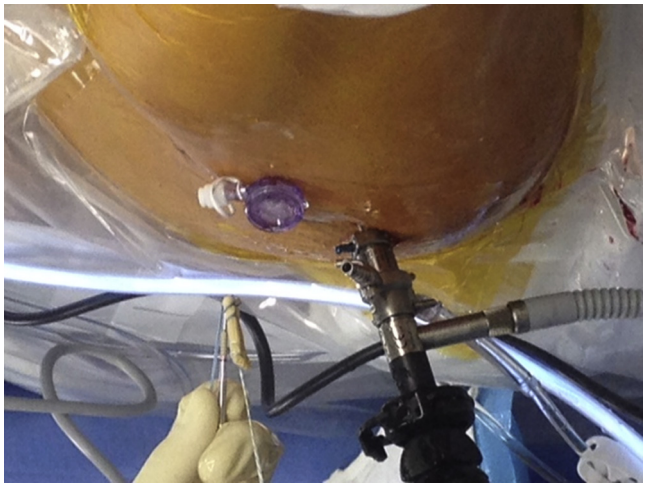

Fig 7. External view of the hip showing preparation of the graft for insertion through the distal midanterior portal.

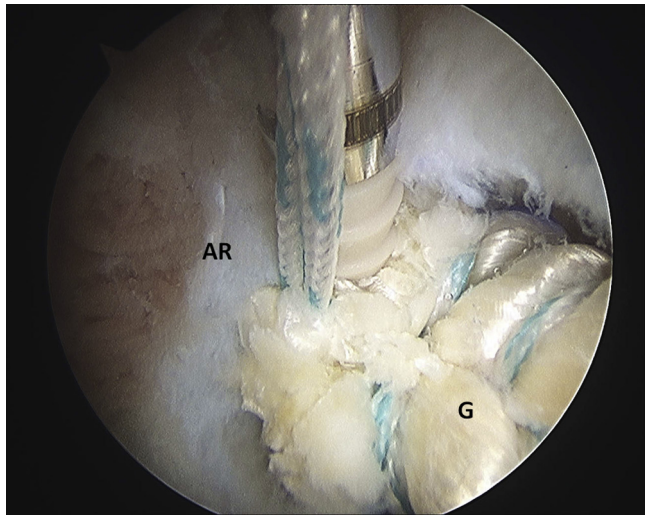

Fig 9. Arthroscopic view of a left hip through the anterolateral portal. The loaded graft (G) is inserted into the posterior hole in the acetabular rim (AR).

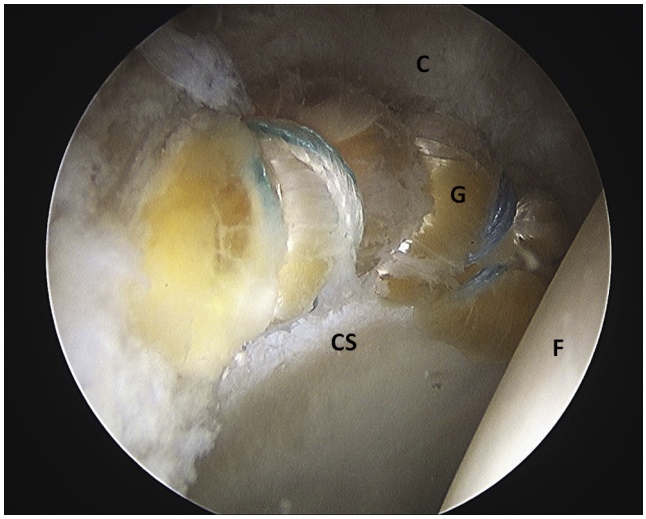

Fig 10. Arthroscopic birds-eye view of a left hip through the anterolateral portal. Sutures have been tied in horizontal mattress fashion. The capsular reconstruction (C) covers the labral defect and restores graft (G) to the area. (CS, chondral surface; F, femoral head.)

remaining hole. After all anchors have been placed, the graft should be securely anchored to the acetabular rim. Ideally, the graft will have 1 to 2 mm of overlap with the native labrum on each of the terminal ends (Fig 11).

Postoperative Rehabilitation

The postoperative rehabilitation protocol is patient specific and depends on any concomitant procedures that are performed in addition to labral reconstruction. In general, patients who have undergone this procedure are advised to maintain 20-lb heel-touch weight bearing for 6 weeks. A hip brace is used to limit range of motion to 90° of flexion for the first 2 to 6 weeks. Range of motion is then allowed to progress within a pain-free zone.

When patients are fully weight bearing and achieve full range of motion, therapy is advanced. Gentle strengthening exercises begin with a stationary bicycle and isometrics. As strengthening progresses, patients start using an elliptical machine and slide board and performing hip girdle (gluteus medius) strengthening. When range of motion and strength are satisfactory, we begin sport-specific training.

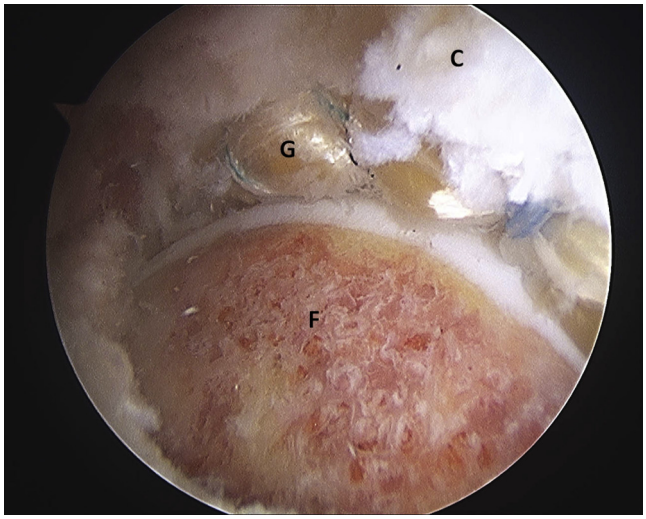

Fig 11. Arthroscopic birds-eye view from the peripheral compartment of a left hip through the anterolateral portal. Traction has been released. The graft (G) functions as labral tissue. (C, capsule; F, femoral head.)

Table 2. Advantages and Disadvantages of Labral Reconstruction Using Semitendinosus Allograft to Treat Unsalvageable Labrum

Advantages
No donor-site morbidity
Minimal graft preparation time
Disadvantages
Possibly longer time to graft incorporation compared with autograft
Possible disease transmission from allograft

Discussion

Evidence suggests that the acetabular labrum serves an important role in the biomechanics of the hip by decreasing intra-articular contact stress and creating a seal effect to promote joint stability.[1-6] Tearing of the labrum can disrupt the native labrum seal, predisposing to degenerative articular damage. Current studies regarding the treatment of labral lesions show a superior outcome with labral repair over labral debridement,[16,17] attesting to the importance of labral preservation. In the setting of the unrepairable labrum, in which the labrum is either nonexistent or unsalvageable, labral reconstruction may be an appealing alternative to debridement. This is especially important in the young, active patient because the premature progression to osteoarthritis may be prevented.[3,5-7,15] We believe that reconstruction of the labrum using a semitendinosus allograft provides a viable arthroscopic approach to restore hip function. The advantages and disadvantages of this technique are presented in Table 2, and pearls are presented in Table 3.

Clinically, labral reconstruction has shown promising early results when matched to currently established treatment options for labral lesions. Specifically,

Table 3. Pearls

Drill holes slightly farther away from the chondral surface than when performing a labral repair.
Perform peripheral compartment work before graft insertion—the graft can prevent access to the femoral head.

Matsuda and Burchette[28] reported results of acetabular labral reconstruction compared with labral refixation. Using the Non-Arthritic Hip Score, they found a mean improvement of 50.5 ± 18.85 in the reconstruction group and 22.5 ± 20.34 in the refixation group. Domb et al.[29] measured outcomes using the Non-Arthritic Hip Score in patients undergoing segmental labral resection versus labral reconstruction for the treatment of unrepairable labral tears in the hip. They found a mean improvement of 24.8 ± 16.0 in the labral reconstruction group and 12.5 ± 16.0 in the labral resection group. Both studies provide evidence for the use of labral reconstruction as a surgical approach to the unrepairable labrum.

Conclusion

The described technique for labral reconstruction has been used numerous times over the past 5 years with a very reproducible appearance. We have been pleased with the restoration of the labral seal using this technique, and we believe this is a better option than debridement for an unsalvageable labrum in the appropriate patient.

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