



# Arthroscopic Treatment of Hip Dislocation After Previous Hip Arthroscopy: Capsular Reconstruction With Labral Augmentation

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**Abstract:** The hip capsule and acetabular labrum are critical structures that function to protect and stabilize the hip joint. As the use of hip arthroscopy increases, there is increasing interest in the integrity of the hip capsule and labrum in optimizing postoperative function and outcomes. In this report, we describe the surgical technique for capsular reconstruction with dermal allograft and labral augmentation with tibialis anterior allograft for the treatment of gross instability after hip arthroscopy. This technique may be applied in situations with large capsular defects and deficient labral tissue.

**B**iomechanical studies have demonstrated the importance of both the capsular and labral tissue in stabilizing the hip joint.<sup>1,2</sup> The hip capsule consists of 3 external ligaments, the iliofemoral ligament, the ischiofemoral ligament, and the pubofemoral ligament, as well as circumferential internal fibers.<sup>3</sup> Access to the hip joint is described via capsulectomy, capsulotomy, and capsulotomy with repair.

Recently, focus has shifted to the importance of capsular management and closure.<sup>4</sup> Difficulty with closure of the hip capsule may be encountered as a result of previous capsulectomy, inadvertent removal of capsular tissue during joint access during primary hip arthroscopy, failure of previous capsular closure in revision hip arthroscopy, gross instability (either traumatic or posthip arthroscopy), and poor-quality tissue due to patient factors (i.e., older age, collagen disorders). A high percentage of patients undergoing revision hip arthroscopy have iatrogenic capsular defects,

up to 78% of patients in one study.<sup>5</sup> Magnetic resonance arthrogram effectively shows soft-tissue pathology in patients postoperative hip arthroscopy and can be used to identify capsular defects (Fig 1).<sup>6,7</sup>

The labrum also plays an essential role in the normal function of the hip. It stabilizes the hip joint, increases the depth of the acetabulum, creates a suction seal that aids with synovial fluid lubrication, and preserves the articular cartilage of the hip.<sup>8,9</sup> Restoring labral integrity has become a key principle in hip arthroscopy. Labral augmentation or reconstruction is an option for patients with deficient labral tissue due to hypoplastic or degenerative native tissue, labral ossification, or revision scenarios. Labral augmentation, with preservation of remaining healthy, native labral tissue has been encouraged when possible. A comparative study showed significantly greater outcome scores (Hip Outcome Score-ADL, Hip Outcome Score-Sport, Modified Harris Hip Score, and Western Ontario and McMaster

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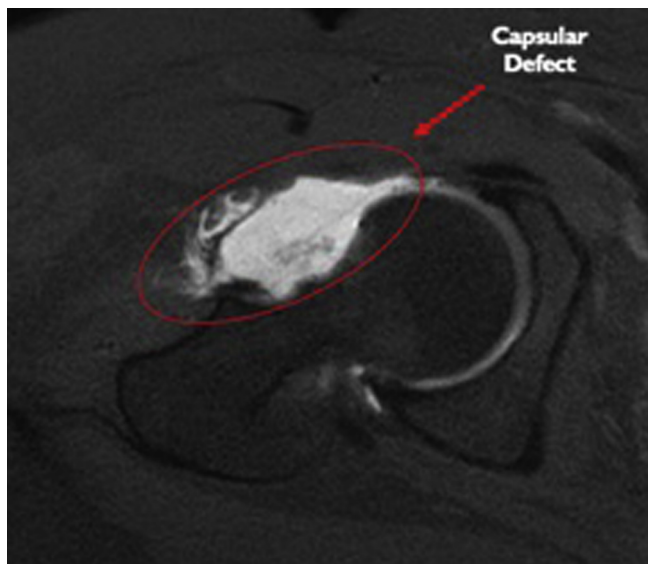
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**Fig 1.** Magnetic resonance arthrography of the neck axial view demonstrating a large anterior capsular defect of the right hip as indicated by extra-articular fluid extravasation.

Universities Osteoarthritis Index) after labral augmentation compared with labral reconstruction.<sup>10</sup>

## Surgical Technique (With Video Illustration)

### Diagnostic Arthroscopy

The patient is positioned supine under general anesthesia on the hip distraction table (Smith & Nephew, Andover, MA) with the operative extremity in traction. The perineum and all bony prominences are well padded. The anterolateral (AL) portal is established under fluoroscopic guidance at the 12-o'clock position. The modified mid-anterior portal (MMAP) is then established under direct visualization at the 2-o'clock position. At this point, an interportal capsulotomy is typically created to connect the AL and the MMAP portals; however, in this case, there was a large capsular

defect due to the patient's previous dislocation (Fig 2). The remaining labrum appeared insufficient and had a large complex tear; thus, the decision was made to perform labral augmentation. The distal anterior lateral accessory portal (DALA) is created 3 to 4 cm distal and 1 to 2 cm anterior to the AL portal. An additional proximal anterior accessory portal also is used for suture management.

### Acetabuloplasty

The residual labral tissue is left in place. Traction sutures are placed in the proximal capsular leaflet through the AL and MMAP portals to better visualize the labrum and capsulolabral junction. The acetabulum is prepared from the 10- to 4-o'clock position, using an arthroscopic shaver (3.5-mm shaver; Stryker, Kalamazoo, MI) to develop the space between the capsule and labrum, followed in the same region by a radiofrequency wand (SERFAS; Stryker), then a standard 5.5-mm burr to create a bleeding bed of bone for anchor placement.

### Labral Augmentation

While viewing from the MMAP, the first anchor (PEEK NanoTack 1.4-mm suture anchor; Stryker) is placed at the 10-o'clock position through the AL portal cannula (CLEAR-TRAC 90-mm cannula; Smith & Nephew). It is important to visualize the acetabular chondral surface while placing the anchors to ensure that the articular surface is not penetrated. One of the sutures from the first anchor is used to measure the distance across the acetabular rim to the 4-o'clock position to determine the length of the tibialis anterior allograft. Our preferred device is the superior capsule reconstruction measuring device (Arthrex, Naples, FL) for this step.

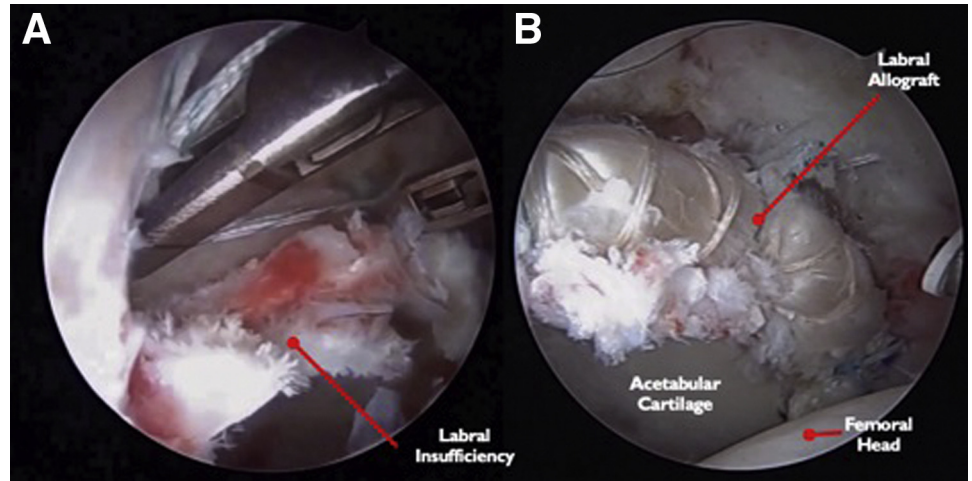
### Tibialis Anterior Graft Preparation

Once the distance between the 10- and 4-o'clock anchors is determined, an assistant begins preparation of the thawed tibialis anterior allograft (AlloSource, Centennial, CO) on the back table. The total length in



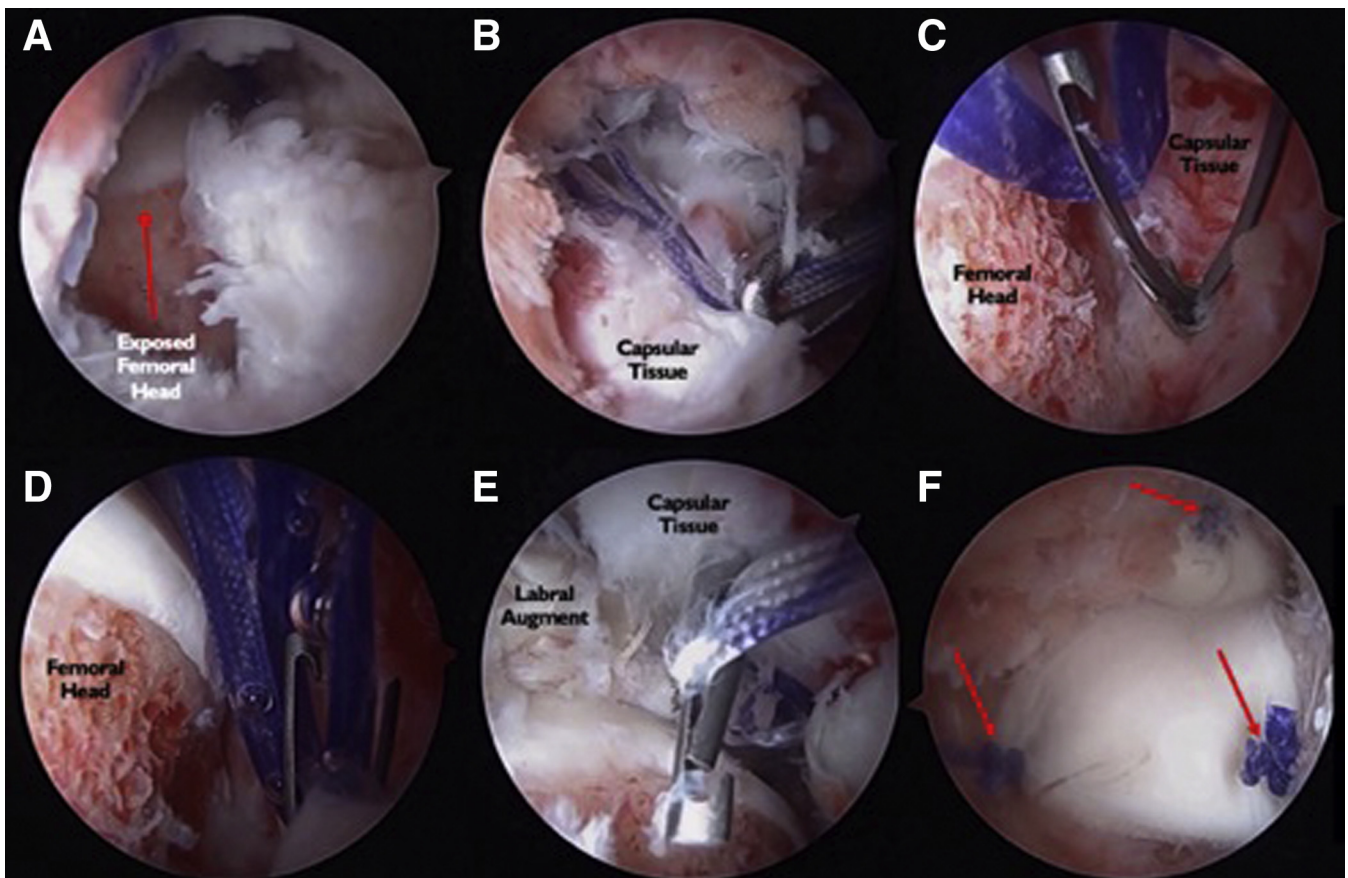
**Fig 2.** Radiography of (A) the anterosuperior right hip dislocation at the time of subluxation, (B) the standard anteroposterior demonstrating adequate acetabular coverage, and (C) the Dunn lateral view showing minimal residual cam-type impingement at the time of the orthopaedic visit.

**Fig 3.** Arthroscopic images of the right hip demonstrating the (A) measurement of the length of labral insufficiency and the (B) the final construct of the labral reconstruction after shuttling the graft through the DALA portal. (DALA, distal anterior lateral accessory.)



this case was 4.2 cm. The tibialis anterior allograft is placed on a graft preparation station (ACUFEX GRAFT-MASTER; Smith & Nephew) and tubularized to 5 to 6 mm in diameter using a running whipstitch with 2-0

VICRYL (Ethicon, Edinburgh, UK) down one side of the graft, then back on other side of the graft. The sutures are tied and cut. The graft is then trimmed to 4.2 cm in length with the ends tapered.



**Fig 4.** Arthroscopic images of the right hip demonstrating (A) capsular tissue defect and (B) subsequent measurement of the defect. (C-D) Sutures from each double loaded anchor were passed through each T-capsulotomy leaflet in a mattress fashion with (E) another suture from the anchor passed through the proximal portion along the acetabulum and shuttled out of the hip via the DALA portal. (F) The final construct demonstrates the capsule allograft sitting over top of the defect. (DALA, distal anterior lateral accessory.)



**Table 1.** A Guide for Capsular Reconstruction with Labral Augmentation

Preoperative planning	1. Be prepared for the possibility of using allografts for any revision hip arthroscopy. 2. Preoperative discussion with patient regarding possible allograft.
Labral augmentation	3. Assess remaining labral tissue and its ability to provide adequate suction seal. 4. Ensure proper measurement of the convex acetabular rim. 5. Experienced assistants are useful to prepare grafts and help with suture management. 6. Cannula must be large enough to allow graft passage with Kite technique. 7. Incorporate native labral tissue with central 2 anchors to graft.
Capsular reconstruction	8. Place acetabular anchors early, before augmenting labrum, if reconstruction anticipated. 9. Close as much native capsule as possible, then size capsular defect. 10. Suture management essential while passing sutures through graft outside body. 11. Cannula must be large enough to allow graft passage with Kite technique. 12. Perform dynamic examination and ensure no femoral head cartilage is visible.

While the graft is prepared, the remaining 3 single-loaded anchors are placed on the acetabular rim, evenly spaced, for a total of 4 total anchors for the labral augmentation. Typically, the anchors from 10 to 11 o'clock are placed through the AL portal and the anchors from 12 to 4 o'clock are placed through the DALA portal. It is important to keep the sutures from each anchor separated and in order of placement on the acetabular rim. Two double-loaded all-suture anchors (Stryker Iconix) with suture tape are then placed proximal to the labral anchors, adjacent to the reflected head of the rectus femoris tendon, for later capsule reconstruction. These sutures are passed out the proximal anterior accessory portal while the labral augmentation is completed.

The tibialis anterior allograft is then brought to the surgical field. A cannula is placed in the DALA portal (CLEAR-TRAC 110-mm cannula; Smith & Nephew). An assistant stabilizes the graft while the surgeon passes one suture from the first anchor up through the graft through the DALA portal, which is then secured to the graft using a mulberry knot. This step is repeated for the fourth anchor. The graft is then passed through the DALA portal using the previously described Kite technique.<sup>11</sup> We find it helpful to cut the edges of the cannula's plastic cover to ease graft passage. A grasper is used to guide the graft into the joint as an assistant pulls on the other ends of the first and fourth suture pair to pull tension on the mulberry knots. The anteromedial

side of the graft is brought down first then the posterolateral side.

Each end of the graft is then secured. Our preferred technique is to pull the mulberry knot back out of the cannula using a grasper then tie to the other suture in a simple suture configuration (Fig 3). Then the sutures from second and third anchors are tied to the graft by passing one limb circumferentially around the remaining native labral tissue then around the allograft (NanoPass; Stryker). Hip traction is then released, demonstrating excellent restoration of the suction seal.

### Femoroplasty

The hip is then flexed to 20° and the arthroscope placed in the extra-articular space. The arthroscopic scalpel is placed through the DALA portal and used to perform the vertical portion of the T-capsulotomy from the existing interportal capsulotomy. The vertical limb cut should be perpendicular to the iliofemoral ligament along the center of the femoral neck. Traction sutures are placed in the vertical capsular leaflets to better visualize the cam deformity. Fluoroscopy is used to visualize the cam deformity and localize the proximal extent. The femoral osteochondroplasty is then performed using the arthroscopic burr, from the lateral synovial fold at 12 o'clock to the medial synovial fold at 6 o'clock. Dynamic examination under fluoroscopy is used to confirm cam resection and restoration of head-neck offset.

### Capsular Plication and Reconstruction

Attention is then turned to the capsule. Capsular plication is performed for the vertical limb of the T-capsulotomy. While viewing from the MMAP, the suture shuttling device (Stryker SlingShot) is inserted through the AL portal and retrieved through the DALA portal and a total of 3 ultra-high-molecular-weight polyethylene sutures (Stryker Force Fiber #2 suture) are placed to plicate the vertical limb.

There was a 2- × 2.5-cm capsular defect remaining between the iliofemoral ligament and the acetabulum (Fig 4). Thus, the decision was made to perform a capsular reconstruction. From the previously placed double-loaded anchors, one pair of sutures is passed through the distal lateral leaflets in mattress fashion with a suture passing device (Stryker NanoPass). This is repeated for the distal medial leaflet with the sutures from the other anchor (Fig 4). These sutures are tied with the goal of reapproximating as much of the iliofemoral ligament as possible. The remaining defect in the interportal area is measured and an acellular dermal allograft (AlloMend 3 mm; AlloSource, San Diego, CA) is then cut to the size on the back table (2.5 × 3 cm). The proximal sutures are first passed through the acetabular sided leaflet of the remaining native capsule, then one suture from each anchor is shuttled out through the DALA portal (Fig 4).

**Table 2.** Benefits and Risks of Performing Arthroscopic Capsular Reconstruction With Labral Augmentation

Benefits	Risks
Preserves healthy, native tissue when possible. Restores hip suction seal with labral augmentation.	Technically advanced technique. Potentially long surgical time (increased traction time and potential for fluid extravasation).
Re-establishes hip stability with capsule reconstruction and labral augmentation.	Requires careful attention to suture management and may require additional assistants.

The graft is brought the surgical field and with an assistant stabilizing the graft, one suture from each of the proximal anchors is passed up through the proximal edge of the dermal allograft, and mulberry knots are tied. One suture from each of the distal leaflets (previously tied in mattress fashion through the native tissue) also is shuttled out of the DALA portal and passed through the graft in the distal corners. The graft is then shuttled into the hip using the Kite technique.<sup>11</sup> A grasper on the proximal, leading edge of the graft is helpful to guide the graft into the joint. The proximal sutures are then tied in simple fashion using standard arthroscopic knot-tying technique to secure the proximal edge of the graft to the acetabulum. This is repeated for the distal corners of the graft. A dynamic examination is performed to evaluate the capsular reconstruction and graft placement. When the capsule has been completely reconstructed, the femoral head articular cartilage is no longer visible (Fig 4).

### Rehabilitation

For patients who undergo labral augmentation and hip capsular reconstruction, we use a more conservative rehabilitation program than the typical hip arthroscopy protocol. Following surgery, patients remain in hip abduction orthosis during activity limiting them to 0° extension, 90° flexion, and neutral rotation. They are foot-flat weightbearing (limited to 20 lbs) until 5 to 6 weeks postoperatively. Once fully foot-flat weightbearing, the patient can progress off crutches and the abduction brace. Passive hip circumduction should begin weeks 6 to 8, with emphasis of soft-tissue mobilization to the adductors, rectus femoris, iliopsoas, gluteals, iliotibial band, and hamstring. Normalization of gait with pain free ambulation and reintroduction of double-legged, closed chain strengthening exercises should occur from weeks 8 to 12. Painful activity or movements should be avoided at this time with activity modification as needed. From weeks 12 to 24, advanced lower-extremity strengthening exercises are continued and reintroduction into daily activities can begin. Sport specific rehabilitation can progress after week 24.

### Discussion

Capsular reconstruction with labral augmentation is an effective surgical treatment for those with deficient hip capsule and labral tissue. Technical pearls include preoperative planning for allografts availability, careful

suture management, additional assistants for graft preparation, and efficient use of time to minimize traction time and extraarticular swelling (Table 1).

Restoring the hip capsule and the acetabular labrum are critical to optimizing the function of the hip joint. Cadaveric studies on capsular reconstruction demonstrate increased force required to distract the hip compared to those with capsular defects,<sup>12</sup> and reduction of degrees of rotation following capsular reconstruction.<sup>13</sup> There are few clinical data on the effect of capsular reconstruction. A non-randomized study of 36 patients comparing hip capsular reconstruction with iliotibial band allograft versus dermal allograft tissue found greater improvement in outcome scores (Hip Outcome Score, modified Harris Hip Score, SF-12) in the iliotibial band allograft group and similar failure rates for both graft types.<sup>14</sup> Further research is necessary to follow hip capsular reconstruction clinical outcomes and to determine optimal graft choice.

There are some inherent risks to the discussed technique. The operative procedure is technically advanced and can result in extended surgical duration with potential for lengthened traction time and fluid extravasation. Suture management requires careful attention and additional surgical assistants. The general surgical risks include infection, persistent pain, and the ongoing risk for revision surgery. Despite the described risks, the benefits are preservation of native labral and capsular tissue as needed and restoration of stability to the hip joint (Table 2).

Recognizing the importance of the hip capsule and acetabular labrum is the first step in comprehensive arthroscopic treatment of femoroacetabular impingement syndrome. Capsular reconstruction with labral augmentation can be safely and efficiently performed using this described technique (Video 1).

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