

# Arthroscopic Hip Capsular Reconstruction: A Step-by-Step Guide With Rectus Overlay



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**Abstract:** The hip capsule is the primary stabilizer of the hip joint. At the time of hip arthroscopy, the capsule is disrupted to obtain intra-articular access and proper joint visualization. With the number of patients undergoing primary and revision hip arthroscopy continuing to increase, it is not uncommon for surgeons to encounter patients with iatrogenic capsular deficiency from prior hip arthroscopy. In cases where substantial capsular defects beyond the scope of capsular repair are visualized, reconstruction may be required to obtain satisfactory closure and restore hip stability. We present a step-by-step workflow for efficient hip capsular reconstruction with rectus overlay while allowing for facile incorporation of other revision procedures such as labral repair and femoral osteochondroplasty.

Hip preservation procedures have become increasingly common over the past decade to treat intra-articular conditions such as labral tears and femoroacetabular impingement.<sup>1</sup> During hip arthroscopy, a capsulotomy must be performed to obtain intra-articular access and ensure proper joint visualization. Although the capsule is a prominent stabilizer of the hip joint, historically it was not routinely repaired during hip arthroscopy. Contemporary literature, however, demonstrates that lack of closure for substantial capsulotomies can result in postoperative instability and pain.<sup>2,3</sup> A study by Duplantier et al.<sup>4</sup> found that of 11 patients with either hip dislocation or subluxation after hip arthroscopy, only 2 had undergone previous capsular closure. Additionally, this instability may lead to increased micromotion of the hip joint, resulting in accelerated degeneration of the articular cartilage and labrum.<sup>5,6</sup> Over the past decade, there has been a marked shift toward prioritizing capsular repair, leading to improved stability and better patient outcomes.<sup>7,8</sup>

With an increasing number of hip arthroscopies being performed, there is also an increase in the number of revision hip arthroscopies. Multiple hip surgeries can result in anatomic defects of the capsule through incremental capsulectomies performed for visualization as well as the lysis of postoperative adhesions.<sup>9</sup> These adhesions can develop between the labrum and capsule, causing repetitive stress on the capsule during hip motion and ultimately leading to capsular tearing.<sup>10</sup> In cases where substantial capsular defects remain due to inadequate tissue or limited excursion of capsular leaflets, a reconstruction may be required to obtain closure and restore hip stability in revision settings (Fig 1). The technique described herein allows for a step-by-step workflow for efficient hip capsular reconstruction with rectus overlay while allowing for facile incorporation of other revision procedures such as labral repair and femoral osteochondroplasty. The technique is demonstrated in a video (Video 1) along with a list of pearls and pitfalls that the authors have found to be helpful (Table 1).

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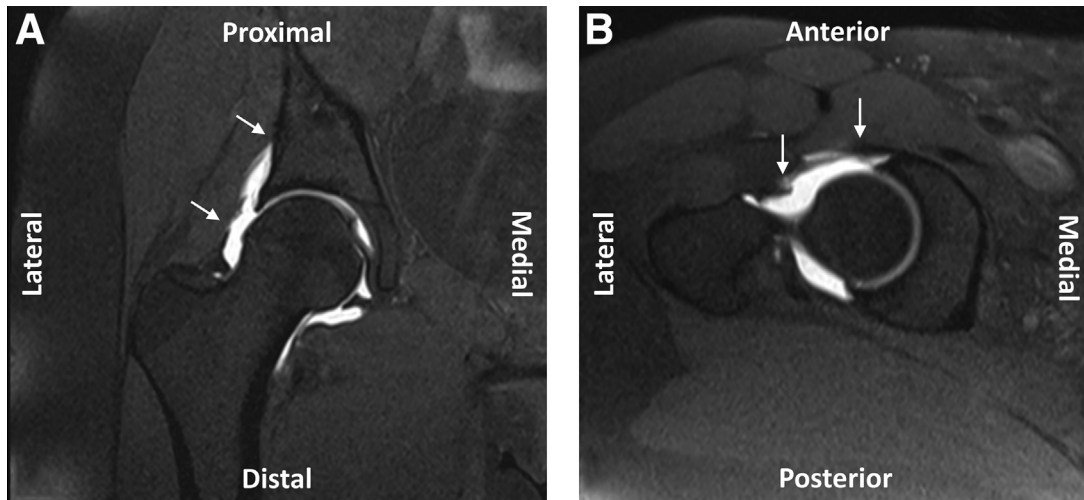
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## Surgical Technique

### Patient Positioning and Preparation

The patient is positioned supine on a hip distraction table with a padded perineal post and the feet placed into padded traction boots. The field is then draped in standard fashion with fluoroscopy positioned on the contralateral side of the patient. The hip is distracted 10 to 12 mm under fluoroscopy.

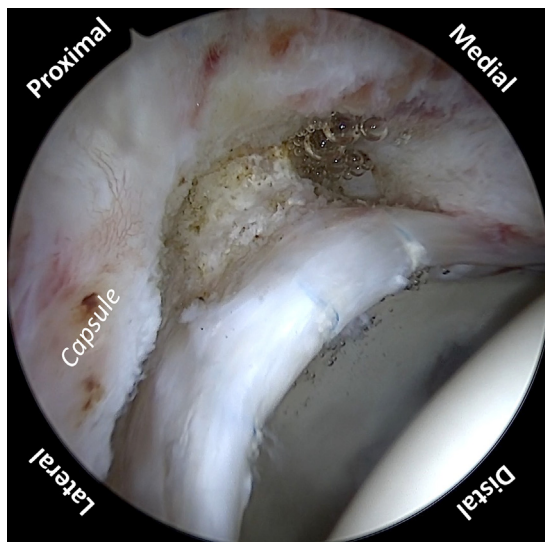


**Fig 1.** Magnetic resonance imaging (MRI) T2-weighted images demonstrating the margins of a superior and anterior capsular defect (white arrows) on coronal (A) and axial (B) series for a right hip.

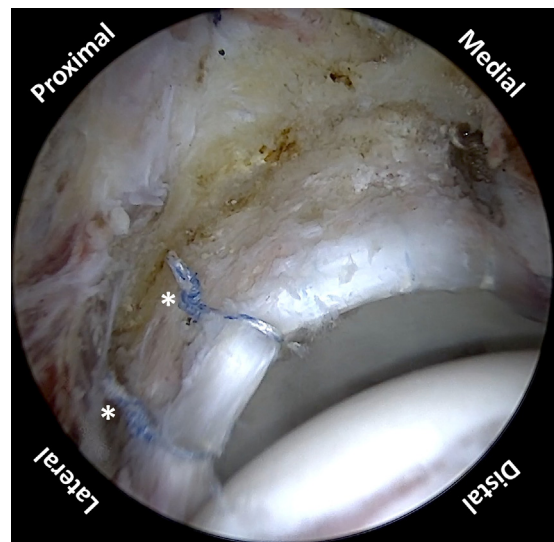
**Table 1.** Pearls and Pitfalls of Capsular Reconstruction With Rectus Overlay

Pearls	Pitfalls
Complete all-labral repair and associated anchors prior to placing acetabular rim anchors for acetabular capsular fixation.	Starting with capsular fixation anchors may lead to loss of rim real estate for labral fixation.
Cut the capsular graft as 1 cm larger than the measured length and width of the capsular defect.	“Line-to-line” graft sizing will prevent the ability to overlap the graft and remaining native capsule for a watertight seal.
Ensure all graft passage sutures exit together through the DALA portal.	Suture bridges from sutures exiting through different planes or bands of tissue in the DALA portal will hold up graft and make passage difficult.
Verify all graft passage sutures are tangle free by independently running along each suture pair with a suture passer, from suture base (i.e., anchor or capsule) to suture tails outside the body.	Any suture tangles will make it more likely that the graft flips or twists during passage, making it difficult to shuttle down the graft appropriately.

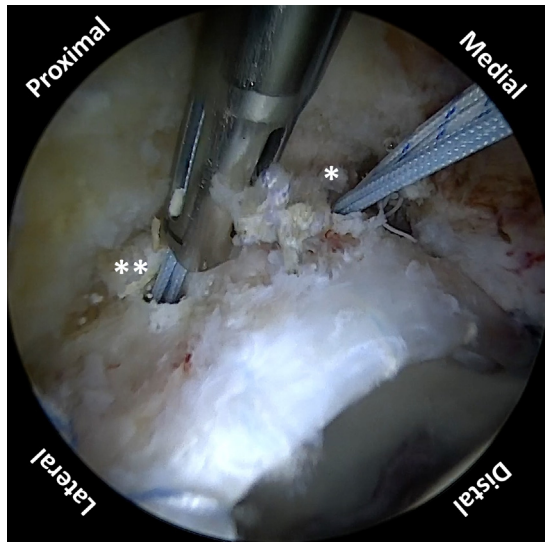
DALA, distal anterolateral accessory.



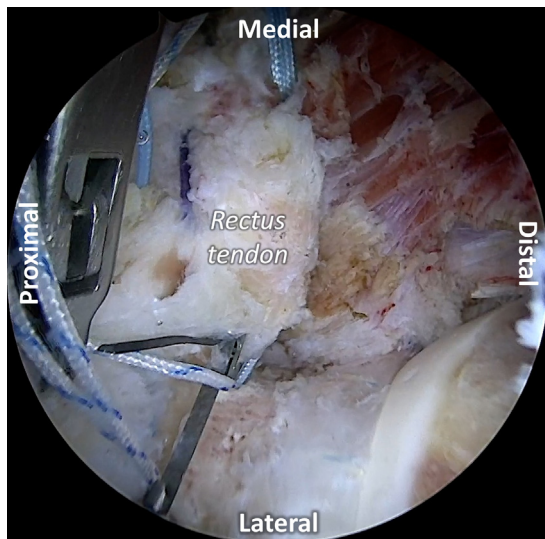
**Fig 2.** The capsule and associated capsular defect are defined to re-establish native tissue planes. Right hip viewed from anterolateral portal.



**Fig 3.** The labrum and central compartment are inspected and any planned procedures such as labral repair (\*) or reconstruction are performed. Right hip viewed from anterolateral portal.



**Fig 4.** Anchors are placed along the proximal aspect of the capsular defect, proceeding from medial (\*) to central (\*\*) and further laterally, ensuring anchors are placed at 3 mm proximal to previous anchors employed for labral repair. Right hip viewed from anterolateral portal.



**Fig 5.** One pair of sutures from each anchor with proximity to the overlying indirect head of the rectus tendon is passed in a horizontal mattress configuration through the tendon. Right hip viewed from anterolateral portal.

### Define Capsule, Lysis of Adhesions

Under fluoroscopic visualization, a standard anterolateral (AL) portal is established with needle localization. Direct visualization from the AL portal is used to establish a modified mid-anterior portal (MAP). The capsule and associated capsular defect are subsequently defined, employing a radiofrequency ablator (50-S Sweep; Stryker Sports Medicine) and 4.2-mm straight shaver (CoolCut; Arthrex) to re-establish native tissue planes and perform a lysis of adhesions (Fig 2). It is important to

define the medial and lateral extent of the capsular defect and clear the associated rim in the area of the previous native capsulolabral recess.

### Address Intra-articular (Labral) Pathology

The labrum and central compartments are then inspected and any planned procedures such as labral repair or reconstruction are performed (Fig 3). It is key to place labral anchors prior to proceeding with capsular reconstruction as labral anchors will define the distal aspect of the acetabular rim to be avoided at the time of capsular reconstruction anchor drilling.

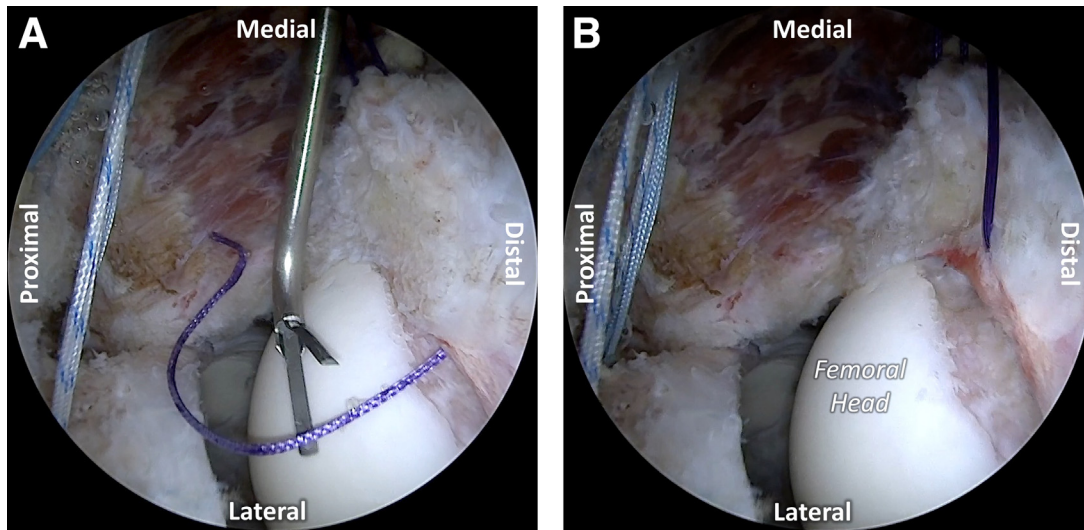
### Acetabular Preparation and Anchor Placement

The acetabular rim is prepared proximal to any labral instrumentation with a 5.5-mm straight arthroscopic diamond burr (Stryker Sports Medicine). A 17-gauge access needle (Portal Entry Kit; Stryker Sports Medicine) is used to establish a distal anterolateral accessory (DALA) portal. The inner stylet of the needle is removed and carefully exchanged for a 1.2-mm nitinol wire. A straight 2.3-mm drill guide is introduced over the wire and placed at the medial aspect of the capsular defect, approximately 3 mm proximal to any labral anchors. The drill is advanced, ensuring no intra-articular penetration under direct arthroscopic visualization, and a 2.3-mm all-suture anchor double loaded with No. 2 ultra-high molecular weight polyethylene suture (ICONIX 2; Stryker Sports Medicine) is seated and deployed in the guide (Fig 4). It is the senior author's (M.H.) preference to place an acetabular anchor for every 10 to 15 mm of capsular defect, measured in a medial to lateral direction. Subsequently, the process is repeated, drilling through the DALA portal for a central anchor and then viewing from the MAP and drilling from the AL portal under arthroscopic visualization for the lateral-most anchor.

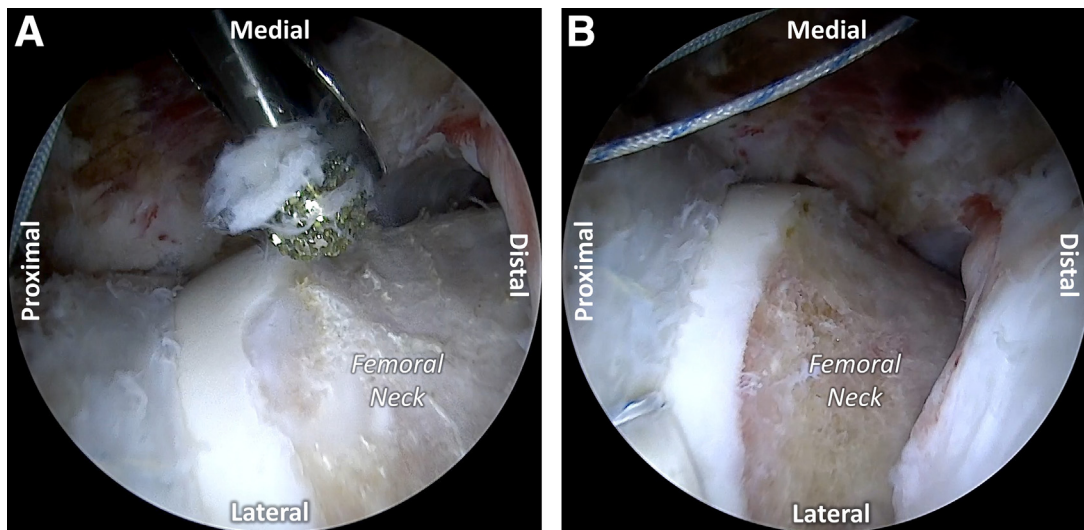
One pair of sutures from each anchor with proximity to the overlying indirect head of the rectus tendon, when present and visualized (i.e., not previously excised), is then passed in a horizontal mattress configuration through the tendon (Fig 5). This is most readily accomplished by passage through the tendon with a 70° curved suture passer (SlingShot; Stryker Sports Medicine) in the MAP with the assistance of an arthroscopic 10° up suture retriever (Arthrex) employed through the DALA portal while visualizing from the AL portal. This is generally anatomically optimal for the medially and centrally based anchors as the indirect head insertion is limited in its lateral extension. No cannula is employed.

### Distal Capsular Exposure

A combination of the arthroscopic shaver and radiofrequency ablator is employed to free the distal capsule from the overlying pericapsular adipose tissue



**Fig 6.** Traction sutures are (A) placed into the distal capsular leaflet employing the 70° curved suture passer and then retrieved and (B) tensioned to gain better control of the distal leaflet, more complete visualization of any residual cam morphology, and countertraction for the passage of sutures for capsular reconstruction. Right hip viewed from anterolateral portal.



**Fig 7.** Lower-extremity traction is let down and revision femoral osteochondroplasty is performed, as indicated, with arthroscopic views shown before (A) and after (B) osteochondroplasty completion. Right hip viewed from anterolateral portal.

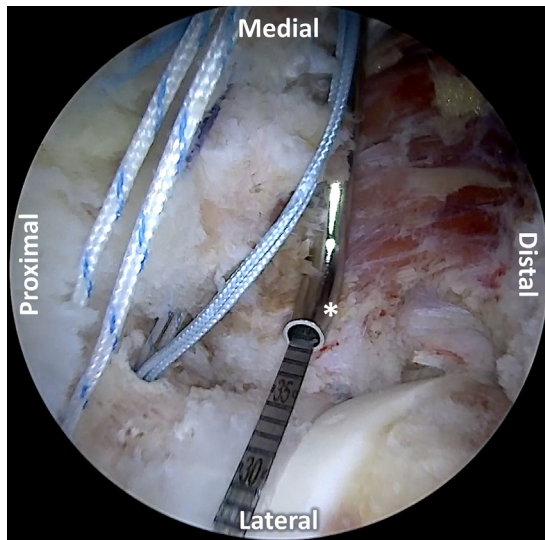
and scar anteriorly and to mobilize capsular adhesions to the gluteus minimus laterally. It is our preference to place traction sutures into the distal capsular leaflet employing a 70° curved suture passer to gain better control of the distal leaflet, more complete visualization of any residual cam morphology, and countertraction for the passage of sutures for capsular reconstruction (Fig 6). Lower-extremity traction is let down, and any necessary revision femoral osteochondroplasty is completed (Fig 7). The distal capsular leaflet is examined for excursion using an arthroscopic grasper, and the residual capsular defect is then measured with a 60° arthroscopic measurement probe (Arthrex). Measurements are taken of the medial to lateral and proximal to distal dimensions of the defect (Fig 8).

#### Placement of Capsular Shuttle Suture

A No. 2 ultra-high molecular weight polyethylene suture is placed in a horizontal mattress fashion through the central aspect of the distal capsular cuff employing the 70° suture passer (Fig 9 A and B). Suspension sutures are removed to limit the potential for future suture tangling (Fig 9C).

#### Establishing a Tangle-Free Suture Corridor

The skin incision for the DALA portal is enlarged to 2 cm to allow for unimpeded graft passage. A Wissinger rod is placed into the DALA portal and exchanged for an open, blunt-tip low-profile cannula (Arthrex). Subsequently, sutures from the 3 proximally based anchors as well as the distal capsular leaflet are sequentially retrieved from the DALA portal, ensuring



**Fig 8.** The residual capsular defect is then measured with a 60° arthroscopic measurement probe (\*). Measurements are taken of the medial to lateral (as shown) and proximal to distal dimensions of the defect. Right hip viewed from anterolateral portal.

no tissue bridge exists between sutures and reverifying that each suture is free of the others by running along them individually with the 10° up suture retriever.

### Graft Preparation and Initial Suturing

On the back table, a 1.5-mm-thick decellularized dermal allograft (ArthroFlex; LifeNet Health) is cut to size based on the previously measured defect size, adding 1 cm in both medial-lateral and proximal-distal dimensions (Fig 10A). This will allow for a perimeter of tissue for which the sutures will pass through. Subsequently, sutures from each anchor and the distal capsular leaflet are passed through the graft in a horizontal mattress fashion employing a free needle and ensuring suture pairs do not cross during handling (Fig 10B).

### Graft Passage and Fixation

While viewing from the AL portal and employing the suture tails from the medial-most acetabular anchor, a simple sliding knot is tied and then tensioned, introducing the proximal medial corner of the graft into the joint under arthroscopic visualization (Fig 10C). An arthroscopic knot pusher is then used to push the graft down the proximal and lateral sutures, thus docking the graft proximally at its both medial and lateral corners. A Wissinger rod is placed in the MAP portal and exchanged for an 8.5 × 110-mm cannula (CLEAR-TRAC; Smith & Nephew). The sutures from the proximal, lateral anchor are retrieved, cut, and tied. This is repeated for the proximal, central anchor and then the proximal, medial anchor. Finally, the sutures from the distal capsular leaflet are retrieved and tied. Employing

a combination of the 70° suture passer and self-retrieving suture passage devices (Hip Labral Scorpion; Arthrex), the graft is further secured to the surrounding capsule along its medial, distal, and lateral borders.

### Rectus Overlay

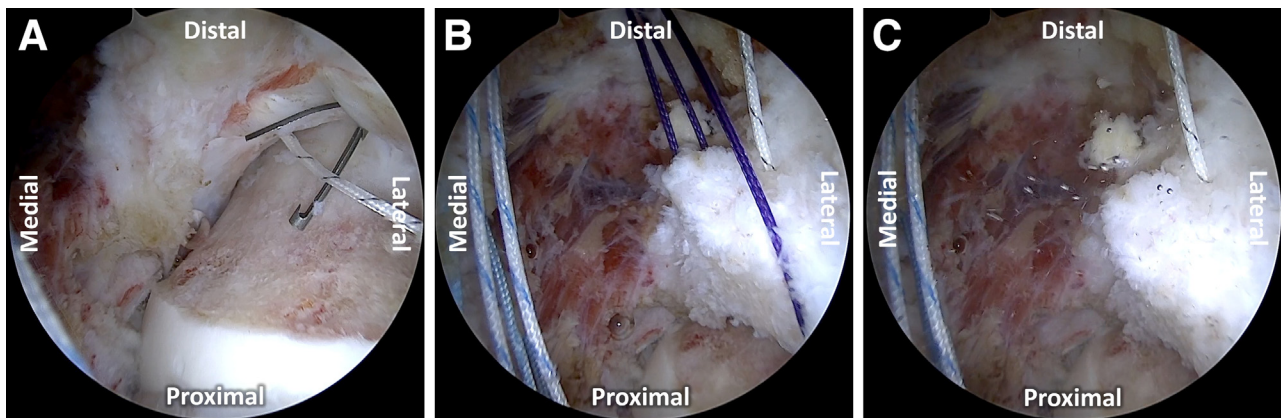
Sutures previously passed through the indirect head of the rectus tendon are sequentially retrieved through the MAP cannula, tied, and cut, thus bringing the overlying rectus tendon over the proximal aspect of the capsular reconstruction in a “pants-over-vest” fashion (Figs 11 and 12). This extra layer of tissue incorporation is one of many advantages to this capsular reconstruction technique, as it provides further coverage to any remaining capsular defects (Table 2).

### Closure and Postoperative Rehabilitation

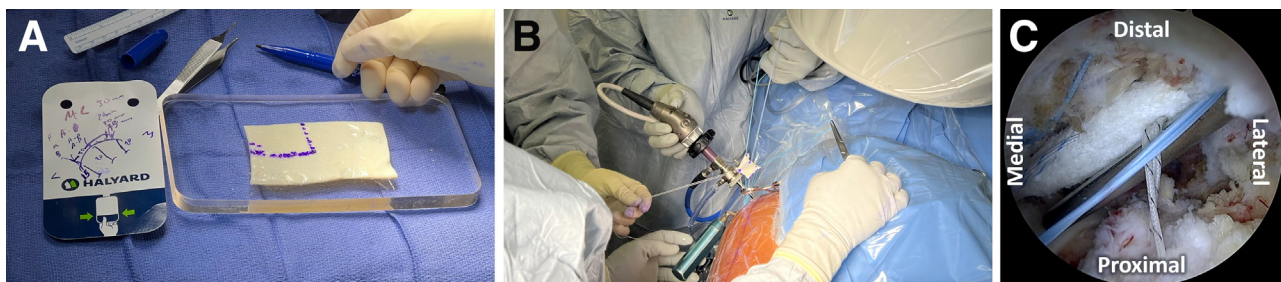
Incisions are closed with a 3-0 Monocryl suture placed in subcuticular fashion and 3-0 Nylon sutures placed superficially in a horizontal mattress fashion. A sterile dressing is applied. Patients are placed in a brace with flexion limited to 30° to 90° and abduction limited to 0° to 20°. Patients are made foot flat partial (25%) weightbearing for the first 6 weeks postoperatively. Patients are seen and evaluated by physical therapy following their 2-week suture removal appointment.

### Discussion

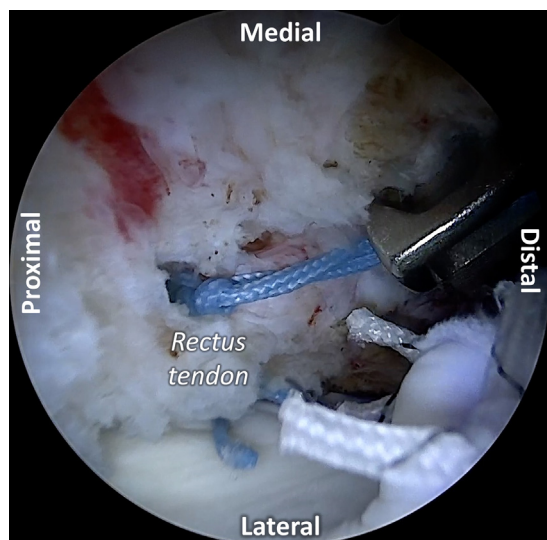
Capsular insufficiency is becoming more recognized as an underlying reason for failure of hip arthroscopy. In a series of revision hip arthroscopy patients, all were found to have capsular irregularity once patients with residual osseous impingement were excluded.<sup>11</sup> When there is capsular insufficiency of the proximal limb, the intact distal limb can be reattached to its native acetabular insertion with suture anchors or can be reapproximated to the indirect head of the rectus femoris near the acetabulum, thus avoiding more extensive reconstruction. However, capsular reconstruction with allograft can prove to be necessary in revision settings where there is inadequate capsular tissue to reapproximate tissue edges and close the visualized defect. In these scenarios, iliotibial (IT) band allograft or dermal allograft has been used to reconstruct the capsule. Both graft options have been reported to have similar failure rates, clinically.<sup>10</sup> The IT band requires more preparation as the tissue needs to be folded to create adequate thickness, whereas the dermal allograft requires less preparation and has been shown to restore biomechanical strength at time zero after reconstruction.<sup>12</sup> Due to its relative ease of use, dermal allograft is preferred by the senior author. An incorporation of the rectus femoris into the proximal aspect of the reconstruction is employed due its anatomic proximity, native blending of the rectus and capsular tissues, and pants-over-vest augmentation of



**Fig 9.** (A) A No. 2 ultra-high molecular weight polyethylene suture is placed, retrieved, and then (B) tensioned in a horizontal mattress fashion through the central aspect of the distal capsular cuff employing the 70° suture passer. (C) Suspension sutures are removed to limit the potential for future suture tangling. Right hip viewed from anterolateral portal.



**Fig 10.** (A) A 1.5-mm-thick decellularized dermal allograft is cut to size based on the previously measured defect size, adding 1 cm in both medial-lateral and proximal-distal dimensions. (B) Sutures from each anchor and the distal capsular leaflet are passed through the graft in a horizontal mattress fashion employing a free needle and ensuring suture pairs do not cross during handling. (C) While viewing a right hip from the anterolateral portal and employing the suture tails from the medial-most acetabular anchor, a simple sliding knot is tied and then tensioned, and the proximal medial corner of the graft is introduced into the joint under arthroscopic visualization.

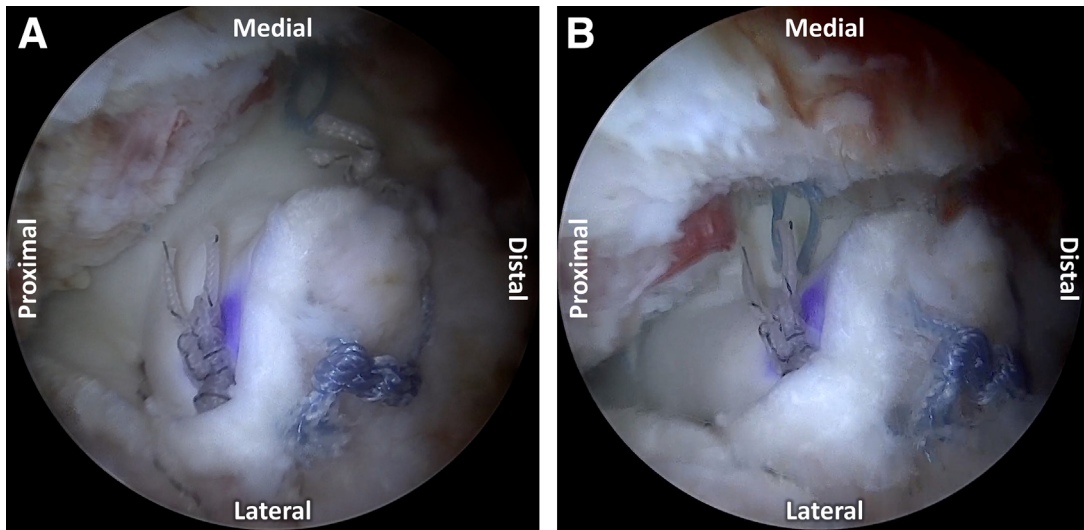


**Fig 11.** Sutures previously passed through the indirect head of the rectus tendon are sequentially retrieved through the mid-anterior portal cannula, tied, and cut, thus bringing the overlying rectus tendon over the proximal aspect of the capsular reconstruction in a “pants-over-vest” fashion. Right hip viewed from anterolateral portal.

the construct’s proximal edge. The presented technique allows for a step-by-step workflow for efficient hip capsular reconstruction with rectus overlay while allowing for facile incorporation of other revision procedures such as labral repair and femoral osteochondroplasty.

### Disclosures

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Support from the Foderaro-Quattrone Musculoskeletal-Orthopaedic Surgery Research Innovation Fund. A.J.K. reports a relationship with Arthrex that includes consulting or advisory, is a board or committee member for the Arthroscopy Association of North America, has received research support from Aesculap/B.Braun, and has a patent with royalties paid from Arthrex. M.H. reports a relationship with DJO-Enovis, Moximed, and Vericel that includes consulting or advisory; is a board member for the Journal of Cartilage and Joint Preservation; and has received funding grants from Elsevier. All other authors (F.M., S.C.C.) declare that



**Fig 12.** Range of motion under arthroscopic visualization through (A) external rotation and (B) internal rotation demonstrates a stable capsular reconstruction with a closed capsular defect. Right hip viewed from anterolateral portal.

**Table 2.** Advantages and Disadvantages, Including Risks and Limitations, of Capsular Reconstruction With Rectus Overlay

Advantages	Disadvantages, Risks, and Limitations
<p>The provided step-by-step workflow allows for facile incorporation of other revision procedures such as labral repair and femoral osteochondroplasty.</p> <p>The described suture management techniques in preparation of and at the time of graft passage make suture tangles and flipped grafts unlikely.</p> <p>Rectus overlay provides an additional layer of capsular defect closure proximally, in a pants-over-vest fashion.</p>	<p>Careful attention should still be taken to hip distraction time in particular, given that all central compartment work and anchor placement, including proximal capsular and labral anchors, should be completed in 2 hours or less of traction to avoid neurovascular injury.</p> <p>Surgeons should be diligent in ensuring clear, untangled suture configuration and be facile with advanced hip arthroscopy given potential technical challenges of graft passage as well as suture retrieval and tying in limited spaces.</p> <p>The indirect head of the rectus tendon may have previously been excised. For intact tendons, this is most useful for reinforcing defects anteriorly and anteromedially, as the tendon thins out at its lateral-most extent.</p>

they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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