Technical Note

Arthroscopic Anchor-Based Hip Capsular Reconstruction Without Graft Augmentation

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Abstract: The hip capsule is one of the most important static stabilizers of the hip joint. Routine capsulotomy without closure during hip arthroscopy increases instability of the hip joint, leading to pain and dysfunction. Capsular repair is now part of routine practice for most hip arthroscopists with restoration of normal hip biomechanics. In patients requiring revision surgery due to ongoing pain and instability as a result of deficient capsule, capsular reconstruction often is necessary to restore hip stability. Although there are many techniques available both with and without the use of allograft tissue, the purpose of this report is to describe a novel technique for capsular reconstruction without the use of graft augmentation using suture anchors at the acetabular rim.

The hip capsule is one of the most important static stabilizers of the hip joint,[1] and restoration of normal hip biomechanics through capsular closure has been a primary goal of hip surgeons since the concept of femoroacetabular impingement syndrome (FAIS) was first recognized.[2] Over the last 2 decades, hip arthroscopy has become an increasingly popular method for treatment of FAIS,[3] with improvement in patient-reported outcomes.[4] Despite excellent results following hip arthroscopy for the treatment of FAIS, a subset of patients require revision surgery. Of those, up to 35% are found to have unaddressed capsular insufficiency,[5] leading to hip pain and instability.[6] Therefore, as the incidence of hip arthroscopy continues to increase, it is imperative for hip arthroscopists to be diligent in capsular management. Most surgeons have now advocated for routine capsular closure or plication to prevent symptoms of instability[7] and progressive chondrolabral injury.[8] In patients with

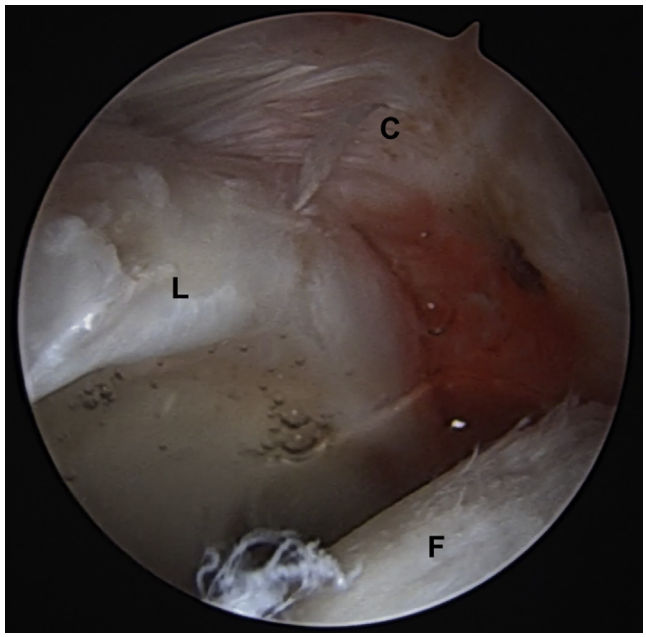

Fig 1. View of a right hip from the anterolateral portal with 70° arthroscope. Note the erythematous nature of the deficient capsule (C), consistent with scar tissue as opposed to normal capsule. (F, femoral head; L, labrum.)

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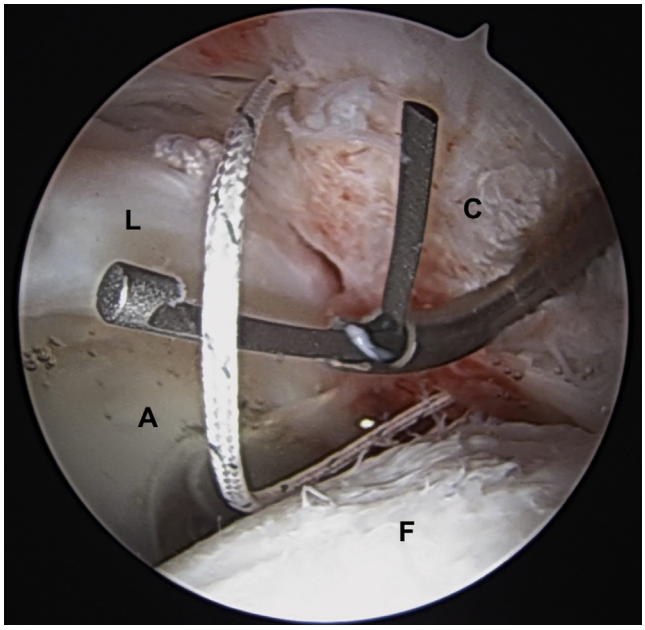

Fig 2. View of a right hip from the anterolateral portal with 70° arthroscope. Slingshot device being used to tag and retract the deficient acetabular sided capsular tissue (C). (A, acetabulum; F, femoral head; L, labrum.)

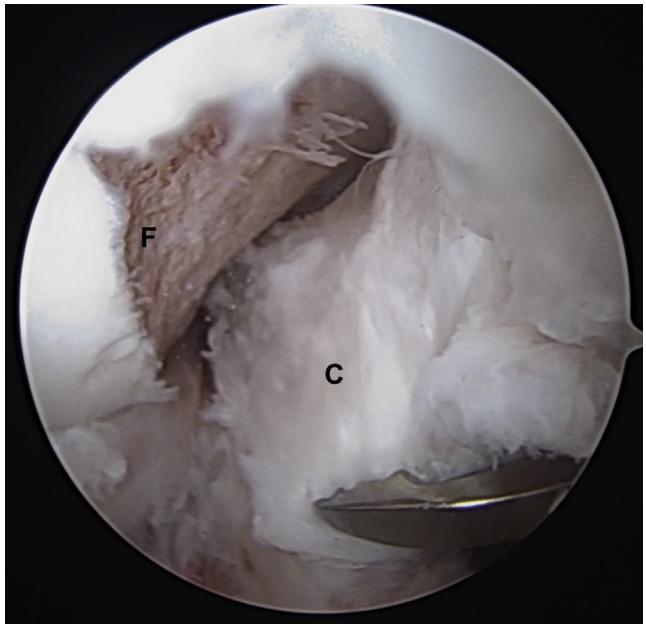

Fig 3. View of a right hip from the modified mid-anterior portal with 70° arthroscope. Arthroscopic grasper is used to assess the mobility of the femoral-sided capsular leaflet (C). (F, femoral head.)

deficient capsular tissue not amenable to primary closure, reconstruction techniques with dermal and iliotibial band allografts have been described. Although studies have shown promising early results, these procedures are associated with a 20% failure rate, are costly, and may be considered technically challenging.[9] The purpose of this paper is to describe a novel technique for arthroscopic anchor-based capsular reconstruction without graft augmentation for patients with deficient hip capsule.

Surgical Technique (With Video Illustration)

Patient Set-up and Diagnostic Arthroscopy

Full demonstration of our technique is seen in Video 1. The patient is placed in the supine position with a well-padded perineal post. Balanced suspension is applied to achieve adequate joint distraction which is confirmed by fluoroscopic imaging. A standard anterolateral portal (ALP) is then created with fluoroscopic assistance, with care taken to enter the joint parallel to the acetabular sourcil. The 70° arthroscope is then inserted into the joint and the modified mid-anterior portal (MMAP) is similarly created under direct visualization. The camera is then moved to the MMAP, verifying accurate placement of the ALP, as well as atraumatic entry with respect to the labrum. Diagnostic arthroscopy is performed to evaluate the labrum, ligamentum teres, acetabular and femoral hard cartilage, and the state of the capsular tissue (hyperemic, deficient, synovitis, etc.) (Fig 1).

Capsulotomy and Identification of Pathology

Once the ALP is deemed adequate, the Samurai blade (Stryker, Kalamazoo, MI) is brought through the ALP and the interportal capsulotomy is started. The camera is moved back to the ALP and the Samurai is used via

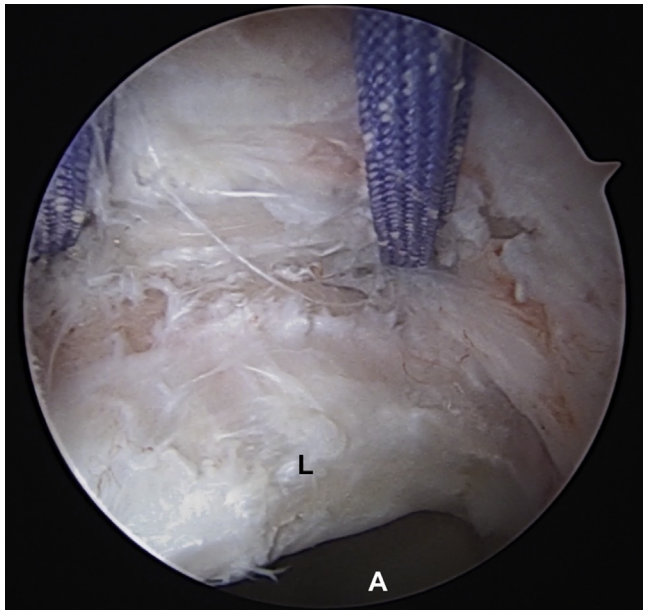

Fig 4. View of a right hip from the modified mid-anterior portal with 70° arthroscope. Note the anchors placed along the acetabular rim. (A, acetabulum; L, labrum.)

Fig 5. View of a right hip from the modified mid-anterior portal with 70° arthroscope demonstrating the final construct following capsular closure with the combination of sutures from the anchors (purple) and free nonabsorbable suture (white).

the MMAP to complete the interportal capsulotomy for ease of instrumentation throughout the procedure. A tagging stitch is then used via the MMAP to tag the acetabular leaflet of the capsulotomy and apply traction to enhance identification of the capsulolabral recess and assess the quality of the labrum as well as the capsule (Fig 2). At this point, a 4.0-mm full radius arthroscopic shaver (Stryker) is used to demarcate the plain between the capsule and the labrum, followed by radiofrequency ablation as needed to further develop this interval. In this instance the labrum is deemed healed, and the negative suction seal is found to be intact. The capsule is noted to be thin, and deficient in areas, as indicated by hyperemic scar tissue, particularly on the acetabular side. It is common for the femoral capsular leaflet to be in a retracted position. An arthroscopic grasper can be used to tension the femoral leaflet to release any adhesions, and assess the mobilization of the tissue to determine if the capsule is repairable without graft augmentation (Fig 3). Once the capsule has been sufficiently mobilized and definitive surgical treatment without need for augmentation has been determined, we proceed with management of the peripheral compartment prior to capsular reconstruction with acetabular-sided anchors.

Femoral Osteochondroplasty and Capsular Closure

To address the peripheral compartment the camera is moved back to the MMAP, traction is released, and the limb is flexed to approximately 45°, allowing for improved visualization within the peripheral compartment of the hip. Often in cases of capsular deficiency, the horizontal capsulotomy with the aid of traction stitches is sufficient to gain adequate visualization of the femoral neck; however, a T-capsulotomy can be added if necessary. Once the capsule is retracted, a balanced cam resection is performed with the aid of fluoroscopy. A dynamic evaluation in then performed to confirm no residual deformity is present.

Capsular Reconstruction

Following assessment of the labrum and treatment of any residual cam lesion, the capsular reconstruction is performed. An arthroscopic grasper is used once more

Table 1. Pearls and Pitfalls

Pearls	Pitfalls
Instrumentation and suture passage is typically easiest if performed via the ALP.	Technically demanding for inexperienced hip surgeons.
Grasper is used to assess adequate release of any capsular adhesions and to ensure the femoral-sided capsule is fully reducible.	Failure to perform this step may result in undue tension on the construct or capsular residual defect.
The remnant acetabular leaflet of tissue should be incorporated into the repair.	Failure to do so can result in residual capsular defect.
Anchors should be evenly spaced along the acetabular rim.	The capsule will be tensioned unequally if anchors are misplaced.
Free sutures can be used as needed to supplement the repair and decrease tension.	Watertight closure may not be accomplished with suture from the anchors alone.
In high-tension situations, sutures can be passed, clamped, and sequentially tied at the end of the case.	Suture management can become very difficult in this setting.
Obtaining the appropriate "perspective" when viewing from the MMAP may require the surgeon to "invert their hand" to obtain the proper view for instrumentation of the capsule.	

ALP, anterolateral portal; MMAP, modified mid-anterior portal.

Table 2. Advantages and Disadvantages

Advantages	Disadvantages
Cost-effective compared with allograft	Suture management can be challenging
Removes the need for graft passage and shuttling	Technically difficult
When done properly, can save time vs allograft use	If closure is inadequate despite free suture augmentation, graft may still be required
Anchors are typically more readily available at most facilities than grafts in the event the case was not booked for graft use	

to confirm that the femoral capsular leaflet can be reduced to any remnant acetabular tissue and the acetabular rim, ensuring graft augmentation is not needed. Two double-loaded 2.3-mm Iconix all-suture anchors (Stryker) are inserted along the acetabular rim at approximately 1 and 2 o'clock (Fig 4). For this aspect of the procedure, the camera is in the MMAP and instrumentation occurs via the ALP. A slingshot device (Stryker) is used via the ALP to pass the suture from the anchor through both the remnant acetabular capsular leaflet as well as the femoral sided leaflet. Free nonabsorbable suture is used as needed to reinforce, and augment the repair. Once passed, suture can be sequentially tied; however, the penultimate suture is not tied until the final suture has been passed, to allow continued visualization of the capsular tissue for suture passage. Once all the suture within the construct has been tied, final inspection and probing of the repair is performed with a switching stick to ensure watertight repair (Fig 5). Pearls and pitfalls and advantages/disadvantages of the procedure are described in Table 1 and Table 2, respectively.

Postoperative Protocol

Patients follow our standard postoperative protocol. A brace is worn to limit flexion to less than 90° and abduction to less than 30° for the first 3 weeks after surgery. Patients are allowed to be weight-bearing up to 20 pounds on the surgical extremity with crutches for the first 3 to 4 weeks postoperatively. Patients complete physical therapy twice a week for the first 3 months of their recovery and are progressed through core, balance, and strengthening exercises. Patients are cleared with no restriction at approximately 6 months.

Discussion

The hip capsule, comprising the iliofemoral, ilioischial, and pubofemoral ligaments as well as the zona orbicularis, is one of the most important static stabilizers of the hip and consists of the strongest ligaments in the body.[7] The iliofemoral ligament, which provides stability in extension and external rotation, is most commonly involved in arthroscopic capsulotomy, as it is located between the 12- and 3-o'clock position.[10] With increasing release of iliofemoral ligament, the force required to distract the hip decreases in a linear fashion while capsular repair restores normal hip biomechanics in cadaveric models.[10] Although the hip capsule can be closed in most cases, larger capsular defects, particularly in revision surgery, may require reconstruction techniques to re-establish hip biomechanics.[11] While reconstruction techniques using different allografts have been described, each graft has reported complications and failures[12] and adds significant cost to the procedure.

In a biomechanical study of 8 paired hemi-pelvises (16 hips), Pasic et al.[13] evaluated the hip joint range of motion in the intact state, after capsulectomy, and in the reconstructed state. Pairs were randomly allocated to either iliotibial band or Achilles reconstruction groups. The authors found increased internal—external rotation range of motion after capsulectomy compared with the intact state, which was restored after either reconstruction technique. The authors found no difference in range of motion based on graft type.[13] Although early results of our capsular reconstruction technique have been promising in our clinical practice, studies reporting medium- to long-term patient-reported outcomes and biomechanical studies are necessary to support capsular reconstruction without the use of a graft. Given our encouraging early results, we will continue to perform anchor-based reconstruction without allograft augmentation in select patients with capsular deficiency in those who have adequate femoral sided capsular tissue for complete, watertight closure.

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