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Technical Note

Arthroscopic Shoelace Capsular Closure Technique in the Hip Using Ultratape

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Abstract: Hip arthroscopy is promising tool for assessing and treating intra-articular pathologies including labral tears, cartilage injuries, and ligamentum teres tears of the hip. Interportal capsulotomy allows for better visualization and accessibility of the arthroscope and working instruments. The hip capsule has been defined as a crucial stabilizer of the hip joint. Thus, capsular closure is recognized as an important procedure to prevent postoperative instability after hip arthroscopic surgery. Despite the routine capsular closure during hip arthroscopy, there is a small subset of patients who complain of hip pain and dysfunction after surgery most likely because of disruption of hip closure site after routine complete capsular closure with strong suture for treating hip instability. This technical note describes the arthroscopic shoelace capsular suture technique using Ultratape for treating femoroacetabular impingement with capsular laxity and borderline hip dysplasia.

Hip arthroscopy has exponentially evolved during the last decades, and it is currently the gold standard for treating femoroacetabular impingement (FAI). Contrary to knee and shoulder arthroscopic surgeries, capsulotomy can provide better accessibility and visualization, especially in the treatment of FAI. Routine capsular closure might diminish the adverse effects of microinstability, by restoring native capsular stabilization properties.¹ Nho and colleagues showed that the routine complete capsular closure with strong sutures can provide better results and lower revision rates compared with partial capsular closure in the treatment of FAI.²

Borderline developmental dysplasia of the hip (BDDH) is frequently diagnosed concurrently with cam impingement. In this regard, recent studies have shown favorable and moderate clinical outcomes in treating BDDH with arthroscopic labral preservation and capsular plication.^{3,4} It has been recognized that BDDH is still a challenging condition because capsular laxity problems might exist besides the bony abnormalities (undercoverage).

Chandrasekaran and Domb proposed that capsular plication should be advocated when treating patients with hip instability.⁵ In our practice, we have experienced cases of disruption of the suture site after a routine capsular closure with strong suture for treating hip instability. Thus, we devised a surgical technique for capsular closure or plication using smooth suture tape (Ultratape; Smith & Nephew, Andover, MA) (the shoelace technique). The purpose of this technical note was to describe an arthroscopic shoelace capsular suture technique after capsulotomy for treating BDDH.

Surgical Technique

The patient is placed on a traction table in well-padded boots and a well-padded perineal post adjacent to the involved medial thigh, under general anesthesia. An anterolateral portal and a midanterior portal (MAP) are established (Video 1). Interportal capsulotomy is performed using a beaver blade and a

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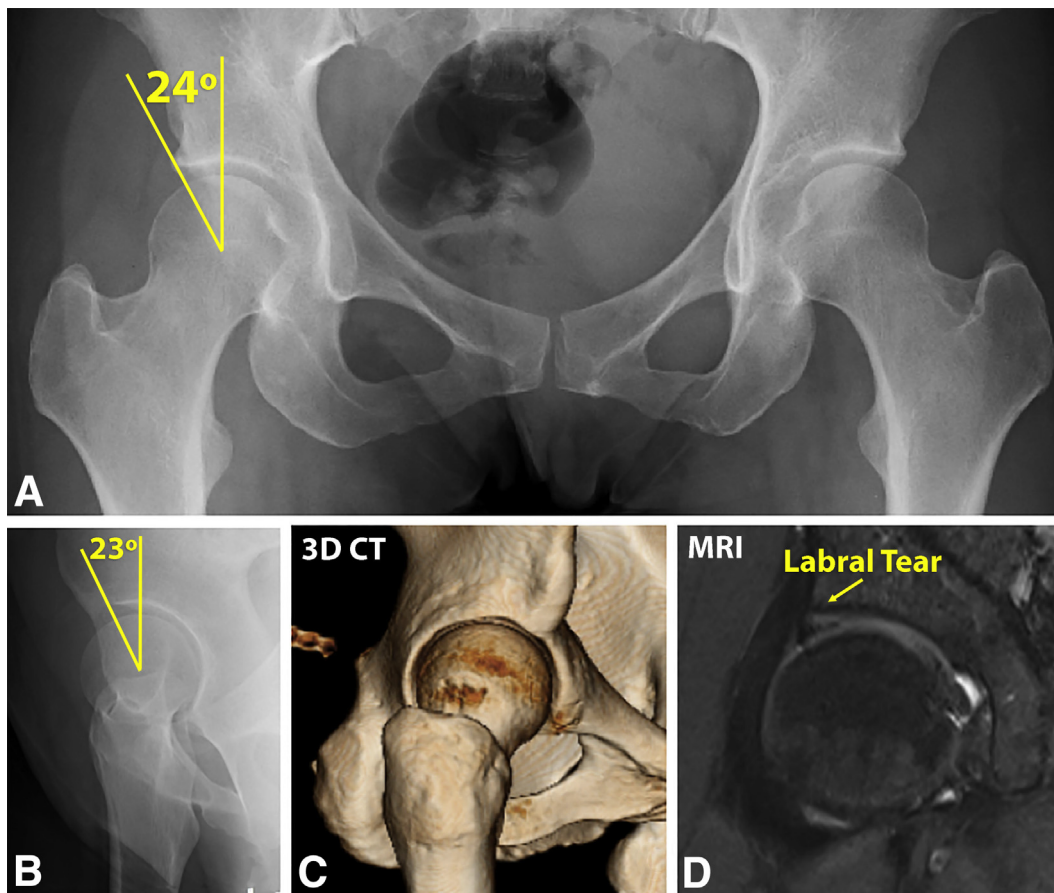


Fig 1. (A) A pelvic anteroposterior radiograph showing 24° in lateral center-edge and normal Shenton line. (B) A false-profile view showing the anterior center-edge angle (23°). (C) Computed tomographic 3-dimensional reconstruction (3D CT) of the right hip and (D) a T2-star coronal view of 3-Tesla magnetic resonance image (MRI) showing high intensity of the anterior superior acetabular labrum, suggesting acetabular labral tear.

radiofrequency probe, cutting the capsule parallel to the lateral margin of the acetabular labrum from the 11 to the 2:30 o'clock position. A diagnostic arthroscopy is then performed to evaluate intra-articular pathologies, including labral tear, chondral damage, and tear of teres ligament. Intra-articular procedures comprising decompression of the anterior inferior iliac spine, rim trimming, labral refixation, and cam osteoplasty are performed at this time if indicated based on preoperative imaging (Fig 1) and a thorough physical examination. After these pathologies are addressed, capsular closure is performed.

Shoelace Complete Capsular Closure/Plication

Traction is then released and the hip is flexed to 30° to 40°. A proximal midanterior portal (PMAP) is established. Edges of the capsule are then prepared with the aid of a series of shavers and radiofrequency probes (Fig 2). Usually, the reflected head of rectus femoris covers the proximal side of the capsule from the level of the anterior inferior iliac spine to the lateral

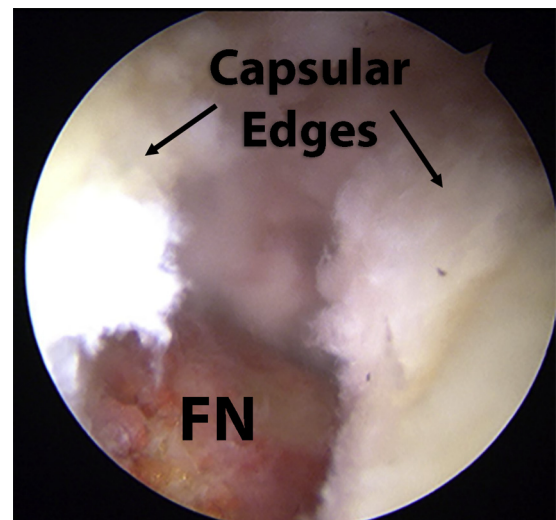


Fig 2. Arthroscopic findings on viewing from the antero-lateral portal on a right hip in the modified supine position without traction where the 2 capsular edges of unrepaired interportal capsulotomy can be identified. The femoral neck (FN) can be visualized at the bottom of the image.

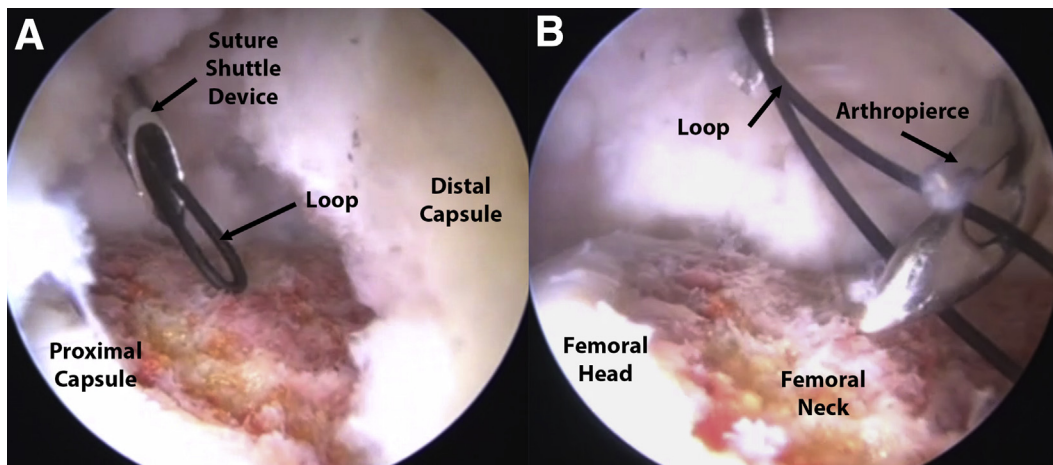


Fig 3. Arthroscopic view from the anterolateral portal in a right hip showing (A) a suture-shuttling device passing a suture loop through the capsule at the proximal side of the capsulotomy superficially to deep into the capsule. (B) A 35° Arthropiercer penetrator is seen retrieving the lasso through the capsule on the distal side of the capsulotomy.

side of the capsule. A suture passer (Acupass; Smith & Nephew) is then introduced through the PMAP (Fig 3) and is used to pass a suture loop through the capsule at the proximal side of the capsulotomy superficially to deep into the capsule (Fig 4). A 35° Arthro-piercer penetrator (Smith & Nephew) is then used to retrieve the lasso through the capsule on the distal side of the capsulotomy, near the zona orbicularis through the MAP. An Ultratape is then passed through the suture lasso and retrieved with suture loop through both the ends of capsulotomy from the MAP to the PMAP (Fig 4). Next, a suture passer is used to pass a suture loop through the proximal end of the capsule 6 to 7 mm posteriorly from the first suture limb at the proximal side of the capsulotomy (Fig 5). A suture lasso

is then retrieved outside of the capsule, and the distal limb of the Ultratape is grasped and passed through the suture lasso. The suture lasso is then retrieved with Ultratape and passed through the proximal side of the capsulotomy. Similarly, a suture passer is passed through the distal side of the capsule 6 to 7 mm posteriorly from the distal limb of the Ultratape. A suture lasso is then retrieved outside of the capsule, and the first proximal limb of the Ultratape is grasped and passed through the suture lasso. Next, the suture lasso is retrieved with the Ultratape and passed through the distal side of the capsule. This procedure is repeated at least 3 times depending on the distance of capsulotomy (Figs 6 and 7). Finally, both limbs of the Ultratape are retrieved through a Clear Trac Cannula (DePuy Mitek,

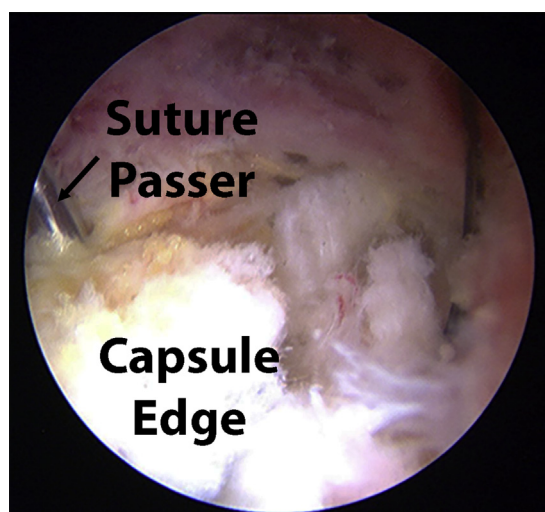


Fig 4. Arthroscopic image (as viewed from the anterolateral portal in a right hip) showing a suture passer being introduced through the proximal midanterior portal and used to pass a suture loop through the capsule at the proximal side of the capsulotomy.

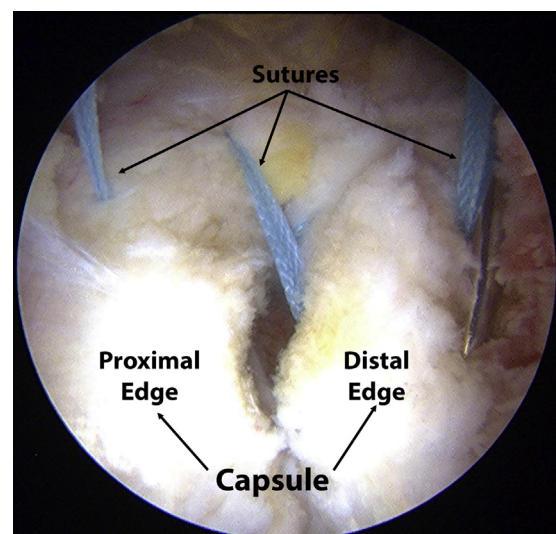


Fig 5. Arthroscopic image (as viewed from the anterolateral portal in a right hip) showing the first passages of the Ultratape securing both (the proximal and distal) edges of the capsule. Note the anatomic approximation of the capsule.

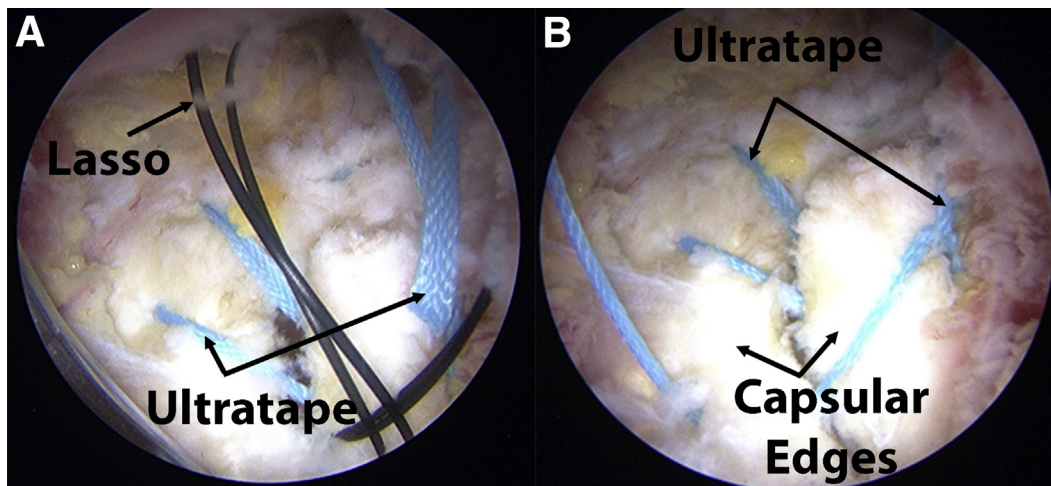


Fig 6. (A, B) Arthroscopic image (as viewed from the anterolateral portal in a right hip) showing a suture loop passed through the capsule at the proximal side of the capsulotomy superficially to the deep layer of the capsule. After retrieving the lasso, the Ultratape was passed through the suture lasso and retrieved with the suture loop through the other end of the capsulotomy.

Raynham, MA). Both limbs of the Ultratape are gradually pulled and tightened in the cannula, confirming adequate tension in the capsule. Finally, 4 knots are tied to secure the construction (Figs 6 and 7). Indications and contraindications as well as the pearls and pitfalls of this surgical technique are summarized in Tables 1 and 2, respectively.

Discussion

This is a technical note showing arthroscopic complete capsular closure/plication by shoelace suture technique using Ultratape. A recent technical note reported on a complete hip capsular closure or plication by several stitches using no. 2 strong suture.^{1,6,7} Despite the fact

that complete capsular closure was performed,⁶ there is a small subset of patients who complain of hip pain and dysfunction after surgery that is most likely because of disruption or redundancy at the site of repair.⁷ There are reports of other orthopaedic surgery techniques revealing that the shoelace suture technique is a stronger construct than other techniques, for example, for treatment of acute compartment syndrome of the lower leg.^{8,9} The shoelace suture technique could enable more secure and stable complete closure of the hip capsule in routine interportal capsulotomy after an arthroscopic procedure.

In this technique, the scope is placed both outside and inside the capsule for better visualization and understanding of the surrounding structures. The head of the rectus femoris can also be inspected while the scope is placed in the outer part of the capsule. Conversely, standard capsular closure techniques are performed with the scope placed only inside the capsule, which thus has a potentially higher risk of soft tissue bridging within the suture's capsule and can cause persistent pain and/or discomfort after hip arthroscopy.¹⁰ Several surgical techniques showed that viewing from outside the capsule could be helpful in performing secure capsular closures.^{1,11} In agreement with these reports, we believe scope viewing from outside the capsule can provide better visualization.

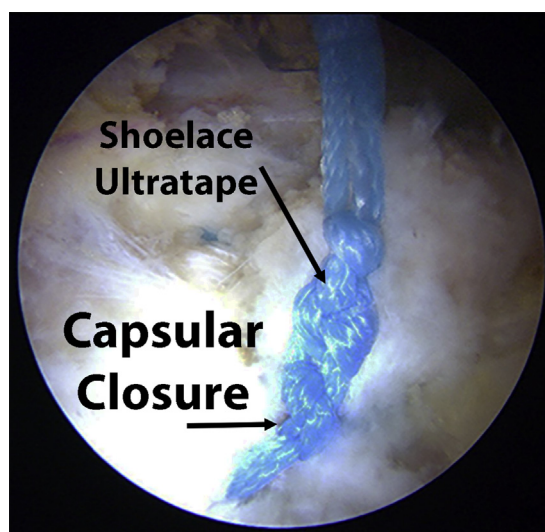


Fig 7. Arthroscopic image showing the final construct of the shoelace sutures after tying the Ultratape as viewed from the anterolateral portal in a right hip. Of note, complete capsular closure can be observed once the procedure is finished.

Table 1. Indications and Contraindications for Shoelace Suture Techniques

Indication	Contraindications
Femoroacetabular impingement	Adhesive capsulitis
Borderline developmental dysplasia of the hip	Joint contracture
Atraumatic instability	
Hyperlaxity	
Developmental dysplasia of the hip	

Table 2. Pearls and Pitfalls of Hip Interportal Capsulotomy and the Shoelace Capsular Closure Technique

Pearls	Pitfalls
Interportal capsular cut	Poor visualization
Avoid aggressive capsulotomy	T-capsulotomy
Optimum visualization outside capsule	Too aggressive capsulotomy
Viewing from the anterolateral portal and working through the midanterior portal and proximal midanterior portal	Do not pass the suture through the straight head of the rectus femoris
Immediate coagulation using a radiofrequency probe	Hold one limb of the suture when pulling the other to prevent the suture from coming out
Begin closure from the medial base to the lateral side	Secure knot tying
Preserve the reflected head of the rectus femoris	Postoperative rehabilitation needed <ul style="list-style-type: none"> Do not extend the hip and avoid external rotation as they might stress the closure site

The indications of a shoelace complete capsular closure technique are BDDH, FAI, and capsular laxity if indicated and DDH undergoing shelf acetabuloplasty as shown in Table 1. The contraindications of this procedure are adhesive capsulitis and hip joint contracture.

An advantage of this technique is the mechanical property of the material of Ultratape that makes it stronger than no. 2 sutures. Shoelace suture techniques permit not only vertical but also horizontal mattress sutures. The disadvantage of this technique is that it is technically demanding and therefore can increase operative time. In conclusion, we believe that the arthroscopic shoelace capsular suture technique can be warranted and provide better stability for hip arthroscopic surgery.

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