Technical Note

Capsular Management with Traction-Assisted T-Capsulotomy Technique During Hip Arthroscopy

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Abstract: Capsular management, from the initial capsulotomy to capsule closure is essential to success in hip arthroscopy to achieve optimal outcomes. Although an interportal capsulotomy is typically sufficient for resection of proximal cam lesions and for performing central compartment procedures, T-capsulotomy is usually performed when large cam deformity needs to be addressed because it provides a broader field of view. The purpose of this Technical Note is to summarize each step of capsule management and to define a traction-assisted T-capsulotomy technique that allows for accurate placement of the T-capsulotomy while also avoiding damage to the articular cartilage.

The use of hip arthroscopy has exponentially increased in the past decade.1-3 Because studies continue to report low complication rates, high return to activity,4-6 and excellent outcomes and satisfaction ratings after surgery,7-9 hip arthroscopy techniques continue to evolve. A capsulotomy is commonly performed by hip arthroscopists to provide necessary visualization of pathologies in the head-neck junction and to ensure adequate resection when treating femoroacetabular impingement.10,11 The capsular ligaments of the hip, including the pubofemoral, ischiofemoral, and iliofemoral, contribute to the stability and mobility of the hip joint.12 Among these, the iliofemoral ligament, which provides the greatest contribution for external rotation,13 reveals its effect in preventing anterior hip instability.14,15 As such, it is important to maintain the integrity of these structures and to perform the capsulotomy carefully because the transection of these ligaments may cause gross anterior translation of the hip.16 On the other hand, previous studies have also shown that capsular closure after arthroscopy may prevent instability, yield lower revision rates, and improve postoperative outcomes.16-18 Thus meticulous capsular management is a key to success in hip arthroscopy.

Various capsulotomy techniques have been identified for proper resection of a cam deformity. An interportal capsulotomy is typically sufficient for the resection of a proximal and relative mild cam deformity and for performing central compartment procedures,19 whereas a T-capsulotomy may be used in the resection of a large cam deformity or when the deformity is more lateral because it provides a broader field of view.10 The T-capsulotomy is usually performed with a radio-frequency probe or an arthroscopic blade while viewing the anteromedial aspect of the capsule. When a T-capsulotomy is performed, the lateral aspect of the femoral neck cannot be observed, and therefore an eccentric cut can jeopardize visualization during the case, as well as capsular closure at the conclusion of the procedure.

The purpose of this Technical Note is to summarize each step of capsule management, from the initial capsulotomy to capsule closure, and to define a traction-assisted T-capsulotomy technique (performing...
the cut in line with the midline of the femoral neck axis while viewing the bottom of the capsule after passing traction sutures), which may provide better control than other T-capsulotomy techniques while avoiding damage to hip cartilage.

**Surgical Technique**

The patient is placed supine on a traction table (Smith & Nephew, Andover, MD) after being prepared under general anesthesia for complete muscle relaxation. Traction is ensured with a pink pad positioning device (Xodus Medical Pink Hip Kit; Smith & Nephew) that eliminates the need for a perineal post. Following joint distraction of approximately 1 cm (confirmed with fluoroscopy), the anterolateral (AL) and modified midanterior (mMAP) portals are created. The hip arthroscopy technique of a right hip is shown in Video 1.

### Periportal and Interportal Capsulotomy

Interportal capsulotomy is performed 1 cm distal to the labrum to achieve capsule closure after hip arthroscopy. The AL portal is established under fluoroscopic guidance, which is followed by creation of the mMAP 1 cm distal to the labrum while viewing with a 70° scope through the AL portal. The scope is then switched to the mMAP to first perform a periportal capsulotomy around the AL portal using an arthroscopic blade (CAP-FIX; Smith & Nephew). The scope is switched back to the AL portal, and the interportal capsulotomy is completed with an arthroscopic blade toward the AL periportal capsulotomy line through the mMAP (Fig 1). To avoid disruption of the iliofemoral ligament while allowing adequate room for instrumentation, the capsulotomy should be 2 cm or less in length.

### Passing Traction Sutures

With traction sutures, a working space is created between the labrum and the capsule to improve visualization during acetabuloplasty and any indicated labral procedures during central compartment arthroscopy. Traction sutures are placed at the proximal end of the capsule through the interportal capsulotomy. While the anterior acetabulum is prepared, traction sutures are first placed through the mMAP while viewing through the AL portal. Another traction suture is placed in the superolateral region of the capsule through the AL portal.

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**Fig 1.** Interportal Capsulotomy. In right-sided hip arthroscopy, the anterolateral (AL) portal is created under fluoroscopic guidance, followed by (A) creation of the modified mid-anterior portal (mMAP) 1 cm distal to the labrum after determining its location with an 18-gauge spinal needle (*). (B) The scope is then switched to the mMAP, and the location of the AL portal (*) is confirmed. (C) Periportal capsulotomy is then performed around the AL portal, parallel to the labrum using an arthroscopic blade (*). (D) The scope is switched back to the AL portal, and the interportal capsulotomy is completed with an arthroscopic blade (*) toward the periportal capsulotomy direction through the mMAP. (A1) Interportal capsulotomy is demonstrated in left-sided cadaveric dissection. (FH, femoral head; IHRF, indirect head of the rectus femoris; DHRF, direct head of the rectus femoris)
portal while viewing through the mMAP (Fig 2). A distal anterolateral accessory (DALA) portal is created within the interportal capsulotomy for anchor placement that may be required for the anterior acetabulum. After the capsule has been protected and retracted, an acetabuloplasty and a labral repair can be performed if indicated (Fig 3).

**Traction-Assisted T-Capsulotomy Technique**

Following traction release after completion of central compartment arthroscopy, arthroscopy of the peripheral compartment is initiated. During viewing through the AL portal, a radiofrequency probe (Dyonics RF System; Smith & Nephew Endoscopy, Andover, MA) is used to perform fat pad debridement. The iliofemoral
ligament, which the T-capsulotomy will be performed parallel to, is dissected and identified. The scope is switched to the mMAP. Traction sutures, 1 medially and 1 laterally, are then passed into the distal limb of the capsule from the interportal capsulotomy, through the DALA and AL portals, respectively, with a suture passer (Pivot Injector II; Stryker, Kalamazoo, MI), and suspension is applied on the skin with a hemostat (Fig 4). Then, the scope is moved toward the interportal capsulotomy line, as shown in Fig 5, allowing for achievement of a proximal-to-distal view. The T-capsulotomy is performed in the proximal-to-distal direction in a controlled manner centered on the interportal capsulotomy, parallel to the femoral neck using an arthroscopic blade (CAP-FIX; Smith & Nephew). In a right hip arthroscopy, a capsulotomy is performed with 30° to 40° of hip abduction through the DALA portal, whereas the AL portal is used in left-sided hip arthroscopies. The femoral head-neck appearance obtained by half T-capsulotomy is assessed for adequate visualization to perform the desired cam resection (Fig 6). If inadequate, the T-capsulotomy can be extended distally, depending on the size of cam deformity (Fig 7). The view is improved by suspension sutures passed through the medial and lateral ends of the capsule using a suture passer (Pivot Injector II; Stryker). In a right-sided hip arthroscopy, a 5.5-mm arthroscopic burr (Arthrex, Naples, FL) is placed through the DALA portal to perform the cam resection, while the cam deformity is viewed at the femoral head-neck junction through the mMAP.

**Capsule Closure**

After confirmation of an adequate cam resection, primary closure of the T-capsulotomy is performed. T-capsulotomy closure is initiated from the area that is parallel to the femoral neck. Closure of the said area is achieved by tying No. 2 Ultrabraid sutures (Smith & Nephew) passed through the medial and lateral ends of the capsule with a suture passer (Pivot SlingShot; Stryker). This is followed by closure of the horizontal component of capsulotomy, which may be performed with a different suture passer (Pivot Injector II; Stryker) depending on the surgeon’s choice. The sutures that are passed during closure of the horizontal capsule component are tied at 0° of hip flexion (Fig 8). During the capsule closure procedure, all sutures are passed through the AL and DALA portals while viewing from the mMAP.

**Rehabilitation**

The described traction-assisted T-capsulotomy technique does not require a modification in the standard rehabilitation regimen. The patient is initially restricted to 20-pound flatfoot weightbearing with the use of crutches and uses a de-rotational boot for the first 3
postoperative weeks. At postoperative week 3, the patient should be weaned from crutches and advance weightbearing. The goal is symmetric range of motion by 6 to 8 weeks. Return to sport may occur 4 to 6 months after surgery beginning with activities such as golf and swimming and then transitioning to impact-loading activities and exercises.

Discussion

An accurate and complete management of the capsule is essential for successful hip arthroscopy. Capsulotomies that are performed during hip arthroscopy enhance visibility, thereby providing the opportunity to complete the procedure thoroughly and efficiently. Moreover, capsule closure is necessary in preventing instability and in achieving the desired clinical outcomes. This technical note underlined the pearls of interportal and T-capsulotomies, traction sutures use, and capsule closure methods while defining a traction-assisted T-capsulotomy technique.

The method defined in this technical note allows for a reliable and efficient T-capsulotomy to be performed parallel to the femoral neck at the midline. Before the capsulotomy, traction sutures are placed at the distal end of interportal capsulotomy to aide in evaluation of the extent of cam deformity and the femoral head-neck junction. With this view, the T-capsulotomy can be performed without causing damage to the cartilage at the femoral head. As such, this field of view enables the visual analysis and resection of large cam deformities.

Fig 6. Further steps of the T-capsulotomy in a right-sided patient. (A) T-capsulotomy is performed in the proximal-to-distal direction with an arthroscopic blade (star). (B) The view is improved by passing traction sutures with a suture passer (*) into the medial and lateral limbs of T-capsulotomy. (C) Half T-capsulotomy can be extended distally with a radiofrequency probe (+), depending on the size of the cam deformity.
Although this method improves visualization, passing traction sutures may prolong the operative time compared to directly cutting the capsule from above. In addition, the proximal-inferior visualization of the capsule requires additional orientation as compared to using the top view of the capsule.

Fig 7. Side-to-side comparisons of capsulotomy types. (A, B, C) Arthroscopic views after interportal, half T- and full T-capsulotomies, respectively. The bottom row provides the corresponding demonstration of (A1) interportal, (B1) half T- and (C1) full-T capsulotomies, respectively in cadaveric dissection.

Fig 8. Capsule Closure. (A1) The view after capsule closure is demonstrated in the left-sided cadaveric dissection. T-capsulotomy closure is initiated from the area parallel to the femoral neck. (A) The suture passed through the medial limb with a suture passer (star) (B) is retrieved with a suture passer (star) through the lateral limb, (C) allowing the suture (red arrow) to pass through both limbs of the capsule. In the closure of the horizontal capsulotomy component, sutures that are passed through the (D) distal and (E) proximal ends of the capsulotomy using a different suture passer (*) (F) are tied using a suture passer (+). (IHRF, indirect head of the rectus femoris; DHRF, direct head of the rectus femoris)
Table 1. Pearls and Pitfalls

Pearls
- Before T-capsulotomy, placement of the traction sutures separately at the medial and lateral aspects through the AL and DALA portals, respectively, provides balanced capsule traction and better visualization.
- Performing T-capsulotomy at 30° to 40° of hip abduction brings the portal used and femoral neck closer, allowing for better control of the arthroscopic blade.
- During T-capsulotomy, distal traction of the capsule with an arthroscopic blade, followed by anterior-posterior movement of the blade for cutting enables a full-layer cut of the capsule in one movement.

Pitfalls
- The remaining capsule may not be suitable for closure if an interportal capsulotomy is performed too close to the labrum and or if the capsule is excessively debrided.
- Knotting the sutures that are used for closure of the interportal capsule in flexion may lead to an increased risk of postoperative flexion contracture.

Capsulotomies that are performed to enhance surgical visualization should allow for easy reclosure of the capsule. However, when the interportal capsulotomy is performed too close to the labrum or when the capsule is excessively debrided, the remaining capsular tissue may not be suitable for closure. Moreover, knotting the sutures, which are used for closure of interportal capsulotomy, in flexion may lead to an increased risk of postoperative flexion contracture. The pearls and pitfalls, as well as the advantages and limitations, are described in Tables 1 and 2.

Table 2. Advantages and Limitations

Advantages
- Placement of traction sutures at the distal aspect of interportal capsulotomy provides better visualization for performing T-capsulotomy parallel to the femoral neck at the midline.
- The use of additional traction sutures provides better visualization of the femoral head-neck junction during capsulotomy, thereby preventing damage to articular cartilage.
- Performing T-capsulotomy precisely at the midline using the defined traction-assisted technique enables complete visualization of the anterior and superolateral extensions of a cam deformity.

Limitations
- Passing traction sutures before T-capsulotomy may lead to a prolonged operative time.
- The proximal-inferior visualization of the capsule requires additional orientation in T-capsulotomy.
- The use of an arthroscopic blade with the defined technique requires surgical experience compared to a capsulotomy performed with Radion frequency probe by using a top view of the capsule.
- Passing suspension sutures into the distal limb of the capsule from the interportal capsulotomy without damaging the femoral head cartilage may require specially developed suture passer surgical devices for the capsular management in hip arthroscopy.

References
1. Heerey J, Risberg MA, Magnus J, et al. Impairment-based rehabilitation following hip arthroscopy: Postoperative protocol for the HIP ARThroscopy International Randomized Controlled Trial. J Orthop Sports Phys Ther 2018;48:336-342.
2. Cvetanovich GL, Chalmers PN, Levy DM, et al. Hip arthroscopy surgical volume trends and 30-day postoperative complications. Arthroscopy 2016;32:1286-1292.
3. Zusmanovich M, Haselman W, Serrano B, Banflly M. The incidence of hip arthroscopy in patients with femoroacetabular impingement syndrome and labral pathology increased by 85% between 2011 and 2018 in the United States. Arthroscopy 2021.
4. Boykin RE, Patterson D, Briggs KK, Dee A, Philippon MJ. Results of arthroscopic labral reconstruction of the hip in elite athletes. Am J Sports Med 2013;41:2296-2301.
5. Alradwan H, Philippon MJ, Farrokhyar F, et al. Return to preinjury activity levels after surgical management of femoroacetabular impingement in athletes. Arthroscopy 2012;28:1567-1576.
6. Harris JD, McCormick FM, Abrams GD, et al. Complications and reoperations during and after hip arthroscopy: A systematic review of 92 studies and more than 6,000 patients. Arthroscopy 2013;29:589-595.
7. Reiman MP, Peters S, Sylvain J, Hagymasi S, Mather RC, Goode AP. Femoroacetabular impingement surgery allows 74% of athletes to return to the same competitive level of sports participation but their level of performance remains unreported: A systematic review with meta-analysis. Br J Sports Med 2018;52:972-981.
8. Nwachukwu BU, Chang B, Adjei J, et al. Time required to achieve minimal clinically important difference and substantial clinical benefit after arthroscopic treatment of femoroacetabular impingement. Am J Sports Med 2018;46:2601-2606.
9. Browning RB, Clapp IM, Krivicich LM, Nwachukwu BU, Chahla J, Nho SJ. Repeat revision hip arthroscopy outcomes match that of initial revision but not that of primary surgery for femoroacetabular impingement syndrome. Arthroscopy 2021.
10. Cvetanovich GL, Levy DM, Beck EC, et al. A T-capsulotomy provides increased hip joint visualization compared with an extended interportal capsulotomy. J Hip Preserv Surg 2019;6:157-163.
11. Monroe EJ, Chambers CC, Zhang AL. Periporal capsulotomy: A technique for limited violation of the hip capsule during arthroscopy for femoroacetabular impingement. Arthrosc Tech 2019;8:e205-e208.
12. Wagner FV, Negroa JR, Campos J, et al. Capsular ligaments of the hip: anatomic, histologic, and positional study in cadaveric specimens with MR arthrography. Radiology 2012;263:189-198.
13. Martin HD, Savage A, Braly BA, Palmer LJ, Beall DP, Kelly B. The function of the hip capsular ligaments: a quantitative report. Arthroscopy 2008;24:188-195.
14. Hewitt JD, Glisson RR, Guilak F, Vail TP. The mechanical properties of the human hip capsule ligaments. J Arthroplasty 2002;17:82-89.
15. Hewitt J, Guilak F, Glisson R, Vail TP. Regional material properties of the human hip joint capsule ligaments. *J Orthop Res* 2001;19:359-364.

16. Bakshi NK, Bayer JL, Bigelow EMR, Jameel OF, Sekiya JK. The effect of capsulectomy on hip joint biomechanics. *Orthop J Sports Med* 2017;5:2325967117733433.

17. Frank RM, Lee S, Bush-Joseph CA, Kelly BT, Salata MJ, Nho SJ. Improved outcomes after hip arthroscopic surgery in patients undergoing T-capsulotomy with complete repair versus partial repair for femoroacetabular impingement: a comparative matched-pair analysis. *Am J Sports Med* 2014;42:2634-2642.

18. Jimenez AE, Owens JS, Shapira J, et al. Hip capsular management in patients with femoroacetabular impingement or microinstability: A systematic review of biomechanical studies. *Arthroscopy* 2021.

19. Bedi A, Galano G, Walsh C, Kelly BT. Capsular management during hip arthroscopy: from femoroacetabular impingement to instability. *Arthroscopy* 2011;27:1720-1731.