Technical Note

The Pie-Crusting Technique for Capsular Management During Hip Arthroscopy

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Abstract: Hip arthroscopy is commonly performed for the treatment of femoroacetabular impingement and labral pathology. When arthroscopy for femoroacetabular impingement is performed, a capsulotomy is often utilized to maximize access and allow for improved visualization. When an extended interportal or T capsulotomy is performed, the iliofemoral ligament is transected, which can lead to micro or gross instability. The purpose of this Technical Note is to describe an alternative approach to the standard T capsulotomy using a pie crusting technique, which provides improved visualization of the femoral head–neck junction during the femoroplasty without the need for an extended capsulotomy and can also serve to create venting holes that prevent hematoma formation within the capsule.

Hip arthroscopy is commonly performed for the treatment of femoroacetabular impingement and labral pathology. Cross-sectional analysis of national patient databases has demonstrated an increase in hip arthroscopy surgeries of approximately 250% from 2007 to 2011.[1] As the popularity of this field grows, there is an expanding interest in surgical techniques to optimize patient outcomes. When arthroscopy for femoroacetabular impingement is performed, a capsulotomy is often utilized to maximize access to the head–neck junction to perform osteoplasty. The hip capsule consists of 3 ligaments: the pubofemoral, iliofemoral, and ischiofemoral ligaments, which provide hip stability in rotation and translation.[2-4] The iliofemoral ligament is located anterolaterally and is particularly important for stability when the hip is placed in extension and external rotation.[5] When an interportal or T capsulotomy is performed, the iliofemoral ligament is transected, which can lead to micro or gross instability.[2,6,7]

Capsular repair after arthroscopy may mitigate the destabilizing effect of transection of the iliofemoral ligament, and compared with no capsular repair, has demonstrated improved sport-specific outcome scores and lower revision rates.[6]

Adding a perpendicular arm to the interportal capsulotomy (T capsulotomy) can increase the risk of morbidity if not correctly addressed at the conclusion of the case and can add surgical time to an already challenging procedure. Therefore, the purpose of this Technical Note is to describe an alternative approach to the standard T capsulotomy using a pie crusting technique, which provides improved visualization of the femoral head–neck junction during the femoroplasty without the need for an extended capsulotomy and can also serve to create venting holes that prevent hematoma formation within the capsule.

Surgical Technique

Indications

Patients undergoing hip arthroscopy requiring capsulotomy for improved visualization of peripheral compartment pathology are candidates for this procedure (Video 1). Advantages and disadvantages and pearls and pitfalls of this technique are summarized in Tables 1 and 2, respectively.

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Table 1. Advantages and Disadvantages of the Pie-Crusting Technique

Advantages	Disadvantages
No closure required	Less extensive visualization than T capsulotomy
Improve fluid management	
Postoperative venting	
Reduced surgical time	

Preoperative Preparation and Positioning

General anesthesia is induced, and patients are placed in stirrups utilizing a distractor system table (Smith & Nephew, Andover, MD). A wide peroneal post is used to minimize neurologic damage to the pudendal nerve and provides lateral translation to the femoral head. Traction is placed with the hip in 10° of flexion and lateral tilt, slight internal rotation, and neutral abduction. Approximately 1 cm of joint distraction is adequate and is confirmed with fluoroscopy.

Portal and Cannula Placement

Surface anatomy is marked, including the superior border of the pubis, the anterior superior iliac spine, and the greater trochanter. A 70° arthroscope (Arthrex, Naples, FL) is used to perform a diagnostic evaluation of the labrum and to assess for associated pathologies such as bony impingement, cartilage lesions, loose bodies, synovitis, and adhesions.

Accessing the Peripheral Compartment

Traction is released to relax the capsule and allow for improved maneuverability. The hip is placed in flexion, slight external rotation, and abduction at first and brought into extension to allow for a comprehensive review of the cam impingement and allow for a more accurate visualization of the bony deformity.

Capsule Pie Crusting

A standard interportal capsulotomy is made, and excursion is tested. If capsular excursion is not sufficient, an anterolateral full-thickness capsular perforation is made 1 cm distal to the original capsulotomy (most anteriomedial aspect of the capsulotomy) with the use of a radiofrequency probe. Capsular excursion is then retested, and if visualization is still not optimal, a second perforation is made just lateral to the first and 1 cm distal to the original capsulotomy. A third perforation can also be made more laterally and adjacent to the second perforation. The arrangement of the perforations is demonstrated in Figures 1-3.

Table 2. Surgical Pearls and Pitfalls of Performing the Pie- Crusting Technique

Pearls	Pitfalls
The first 2 perforations should be approximately 1 cm distal to the capsulotomy	Perforations placed too closely may propagate a tear between the holes
Check excursion after each perforation to minimize the number required	The interportal capsulotomy should be closed to prevent instability

Osteoplasty

Once an optimal exposure has been achieved, a 5.5-mm arthroscopic burr (Arthrex) is used to gently recontour the femoral neck until a dynamic examination of the hip demonstrates no residual impingement.

Capsular Repair

To repair the interportal, a suture shuttling device (Pivot Injector; Stryker, Kalamazoo, MI) is utilized to place 3 No. 1 vicryl sutures from anterior to posterior (Fig 4). Once this is completed, all instruments are removed from the joint. The wounds are closed with 4-0 nylon sutures.

Postoperative Management

For the first 2 weeks after surgery, the patients are allowed to ambulate with crutches and may place up to 20 pounds of weight on their operative extremity with the foot flat. Early range of motion is performed using a continuous passive motion machine. The patients initiate physical therapy early on, and it includes range of motion, stretching, and core/hip strengthening. After 2 weeks, the patients are allowed to progressively weight bear. After approximately 4 weeks, the patient rehabilitation progresses to balance and strength

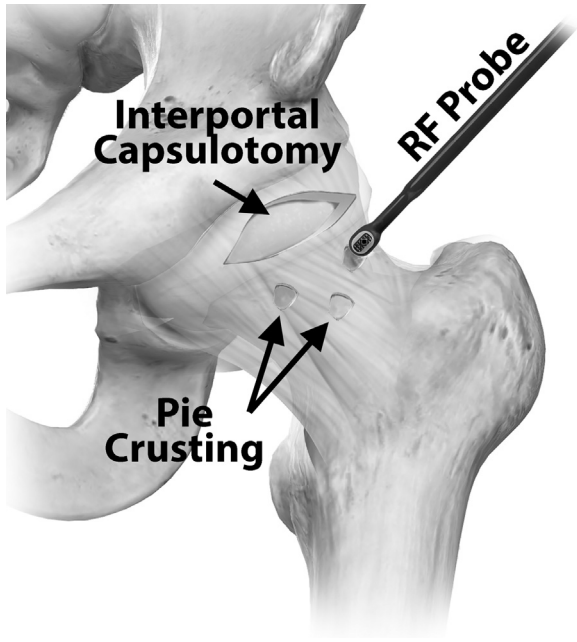

Fig 1. Illustration of the pie-crusting technique as viewed from anterior of the left hip. A standard interportal capsulotomy is performed, and the radiofrequency ablator is used to create small perforations in the capsule. (RF, radiofrequency.)

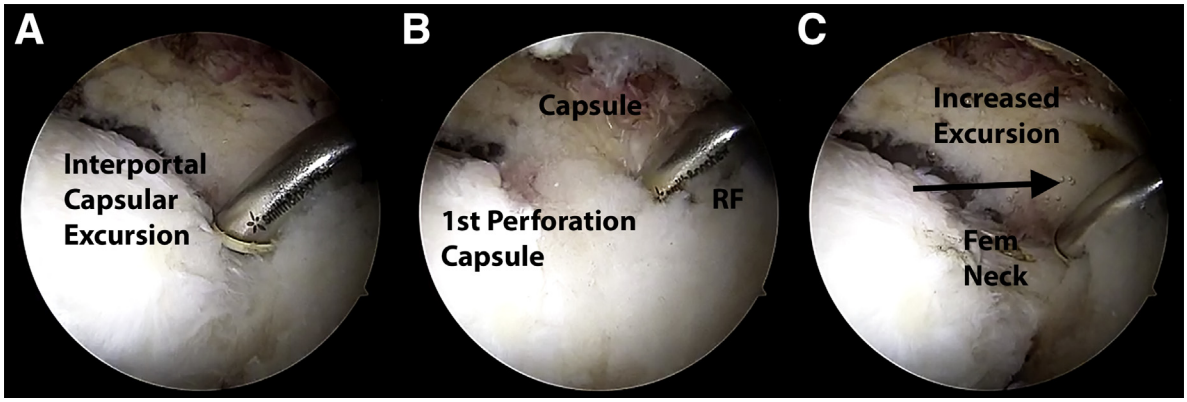

Fig 2. View of the femoral neck and capsule as seen from the anterolateral portal of the right hip using a 70° arthroscope. (A) An interportal capsulotomy has been made, and the radiofrequency ablator is seen pulling traction to test excursion of the capsule. (B) Demonstration of the first full-thickness capsule perforation using the ablator approximately 1 cm distal to the interportal capsulotomy. (C) Demonstration of the increase in capsular excursion after the first capsular perforation.

training with cycling and advances based on patient progress. Plyometric and sport-specific exercises are allowed at 4 months after the operation, and patients may return to sport at 4 to 6 months after the operation.

Discussion

The hip capsule provides significant stability to the hip joint. Performing a capsulotomy during hip arthroscopy sacrifices the integrity of the iliofemoral ligament, which provides stability in hip extension and external rotation. If the capsule is not repaired, there is potential for anterior hip pain and instability.[8]

Abrams et al.[9] have demonstrated, in a biomechanical cadaver study, that repair of the capsulotomy restores the native rotational resistance and stability.[9] The use of a T capsulotomy has been advocated for increased arthroscopic visualization of cam lesions too distal or large to be viewed by using only an interportal capsulotomy.[10] The less aggressive addition of the pie-crusting technique to the surgeon's arsenal provides an alternative to the T capsulotomy. This technique provides adequate visualization of distal and large cam lesions without several of the drawbacks of the larger T capsulotomy.

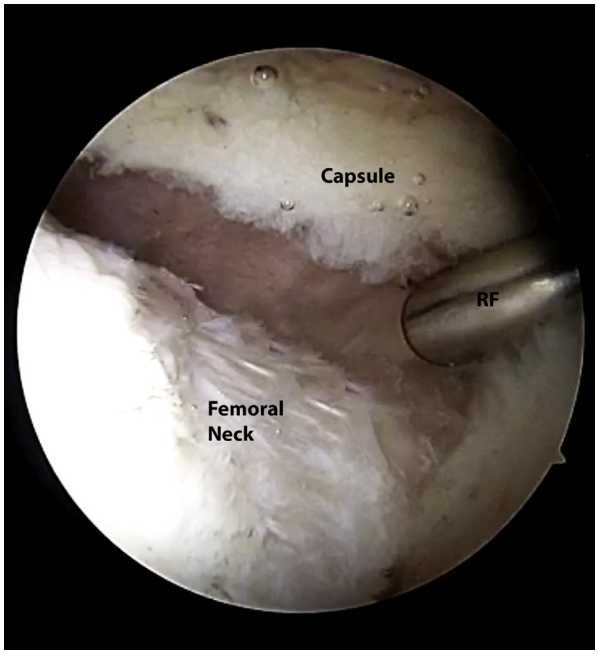

Fig 3. View of the femoral neck and capsule as seen from the anterolateral portal of the right hip using a 70° arthroscope. The radiofrequency ablator (RF) is seen pulling traction on the anterior hip capsule to check for adequate excursion.

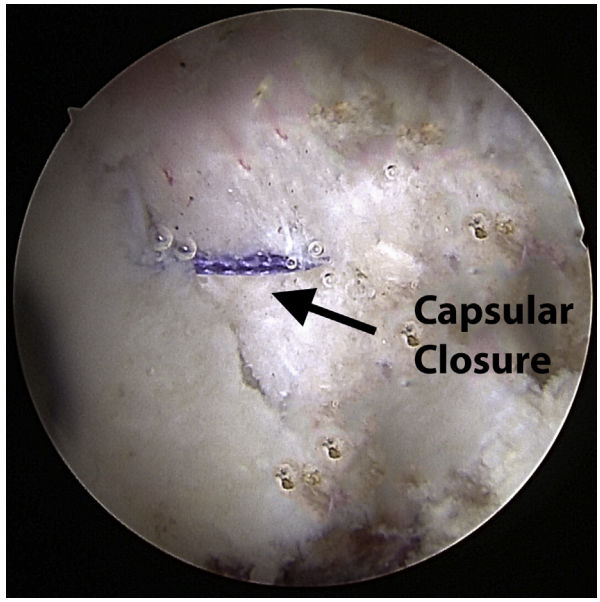

Fig 4. View of the right hip from the anterolateral portal. Repair of the interportal capsulotomy is performed using a suture shuttling device (Pivot Injector; Stryker) to place 3 No. 1 vicryl sutures from anterior to posterior.

One advantage is that the small perforations in the anterolateral capsule do not destabilize the hip and do not require closure.[11] The perforations allow improved visualization during surgery and may allow for venting of fluid and blood to decompress the joint during the immediate postoperative period.

References

1. Sing DC, Feeley BT, Tay B, Vail TP, Zhang AL. Age-related trends in hip arthroscopy: A large cross-sectional analysis. *Arthroscopy* 2015;31:2307-2313 e2302.
2. Hewitt JD, Glisson RR, Guilak F, Vail TP. The mechanical properties of the human hip capsule ligaments. *J Arthroplasty* 2002;17:82-89.
3. Domb BG, Philippon MJ, Giordano BD. Arthroscopic capsulotomy, capsular repair, and capsular plication of the hip: Relation to atraumatic instability. *Arthroscopy* 2013;29:162-173.
4. Torry MR, Schenker ML, Martin HD, Hogoboom D, Philippon MJ. Neuromuscular hip biomechanics and pathology in the athlete. *Clin Sports Med* 2006;25:179-197. vii.
5. Gerhardt MB, Logishetty K, Meftah M, Ranawat AS. Arthroscopic and open anatomy of the hip. In: Sekiya JK, Safran MR, Ranawat AS, Leunig M, eds. *Techniques in hip arthroscopy and joint preservation surgery*. 1st edn. Philadelphia: Saunders, 2011;9-22.
6. 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.
7. Conaway WK, Martin SD. Puncture capsulotomy during hip arthroscopy for femoroacetabular impingement: Preserving anatomy and biomechanics. *Arthrosc Tech* 2017;6:e2265-e2269.
8. Shu B, Safran MR. Hip instability: Anatomic and clinical considerations of traumatic and atraumatic instability. *Clin Sports Med* 2011;30:349-367.
9. Abrams GD, Hart MA, Takami K, et al. Biomechanical evaluation of capsulotomy, capsulectomy, and capsular repair on hip rotation. *Arthroscopy* 2015;31:1511-1517.
10. Camp CL, Reardon PJ, Levy BA, Krych AJ. Creating and closing the T-capsulotomy for improved visualization during arthroscopic treatment of femoroacetabular impingement. *Arthrosc Tech* 2015;4:e731-e735.
11. Glick JM. Complications of hip arthroscopy by the lateral approach. In: Sherman OH, Minkoff J, eds. *Current management of orthopaedics: Arthroscopic surgery*. Baltimore: Williams & Wilkins, 1990;1-9.