The Pie-Crusting Technique for Capsular Management during Hip Arthroscopy

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Level 1: Hip

Level 2: Capsule

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Abstract

Hip arthroscopy is commonly performed for the treatment of femoroacetabular impingement (FAI) and labral pathology. While performing arthroscopy for FAI, a capsulotomy is often utilized to maximize access and allow for improved visualization. In performing an extended interportal or T capsulotomy, the iliofemoral ligament is transected, which can lead to micro or gross instability. The purpose of this technique article 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.

Introduction

Hip arthroscopy is commonly performed for the treatment of femoroacetabular impingement (FAI) and labral pathology. Cross-sectional analysis of national patient databases have demonstrated a growth 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. While performing arthroscopy for FAI a capsulotomy is often utilized to maximize access to the head-neck junction to perform osteoplasty. The hip capsule consists of three 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 particular important for stability when the hip is placed into extension and external rotation.[2] In performing an interportal or T capsulotomy, the iliofemoral ligament is transected, which can lead to micro or gross instability.[5-7]

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 add further morbidity if not correctly addressed at the conclusion of the case and/or add surgical time to an already challenging procedure. Therefore, the purpose of this technique article 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. Video 1. Advantages/disadvantages, pearls and pitfalls of this technique are summarized in table 1 and 2, respectively.

Preoperative Preparation and Positioning:

Patients are induced under general anesthesia and placed into stirrups utilizing a distractor system table (Smith and 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 degrees 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 out including the superior border of the pubis, the anterior superior iliac spine (ASIS) and the greater trochanter. A 70° arthroscope (Arthrex, Naples, FL) is used to perform a diagnostic arthroscopy to evaluate the status of the labrum and assess for associated pathologies such as bony impingement, cartilage lesions, loose bodies, synovitis, or adhesions.

Accessing the peripheral compartment:

Traction is released to relax the capsule and allow for improved maneuverability. The hip is placed into 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 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 (RF) probe. Capsular excursion is

then re-tested and if visualization is still not optimal, a second perforation is made just lateral to the first one and 1 cm distal to the original capsulotomy. A third perforation can also be performed more laterally and adjacent to the second perforation. The arrangement of the perforations is demonstrated in figure 1.

Osteoplasty

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

Capsular Repair

To repair the interportal a suture shuttling device (Pivot Injector, Stryker) was utilized to place three #1 vicryl sutures from anterior to posterior (figure 4). Once this was completed, all instruments were removed from the joint. The wounds were closed using 4-0 nylon sutures.

Postoperative Management

For the first two 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 include range of motion, stretching and core/hip strengthening. After two weeks the patients are allowed to progressively weight bear. After approximately four weeks, the patient's rehabilitation progresses to balance and strength training with cycling and advanced based on patient progress. Plyometric and sport specific exercises are allowed at four months post-operatively and patients may return to sport after four to six months post-operatively.

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, 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 using only an interportal capsulotomy.[10] The less aggressive addition of the pie crusting technique to the surgeons arsenal gives an alternative technique to the T capsulotomy. This technique provides adequate visualization of distal and large cam lesions without several of the draw backs to the larger T capsulotomy.

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 post-operatively may allow for venting of fluid and blood to decompress the joint.

Video 1 Legend

This video demonstrates the creation of perforations in the anterolateral hip capsule after a standard inter-portal capsulotomy has been performed, to maximize capsular excursion. The patient is supine on the traction table with the arthroscope in the anterolateral viewing portal. Capsular excursion is checked with the radiofrequency ablator and found insufficient to adequately view the pathology in the head-neck junction. An anterolateral full-thickness capsular perforation was made 1 cm distal to the original capsulotomy (most anteromedial aspect of the capsulotomy) with the use of a radiofrequency (RF) probe. Capsular excursion was then re-tested, and visualization found to be still not optimal. A second perforation was made lateral to the first one and distal to the original capsulotomy. Capsular excursion was then re-tested, and visualization found to be still not optimal. A third perforation was made further lateral and again distal to the inter-portal capsulotomy. Capsular excursion was then found to be adequate for proper visualization of the pathology.

173 **Table 1.** Advantages and disadvantages of the pie crusting technique

Advantages	**Disadvantages**
No closure required	Less extensive visualization than T capsulotomy
Improve fluid management	
Post-operative venting	
Reduced surgical time	

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176 **Table 2.** Surgical pearls and pitfalls for 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 still should be closed to prevent instability

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Figure Legends:

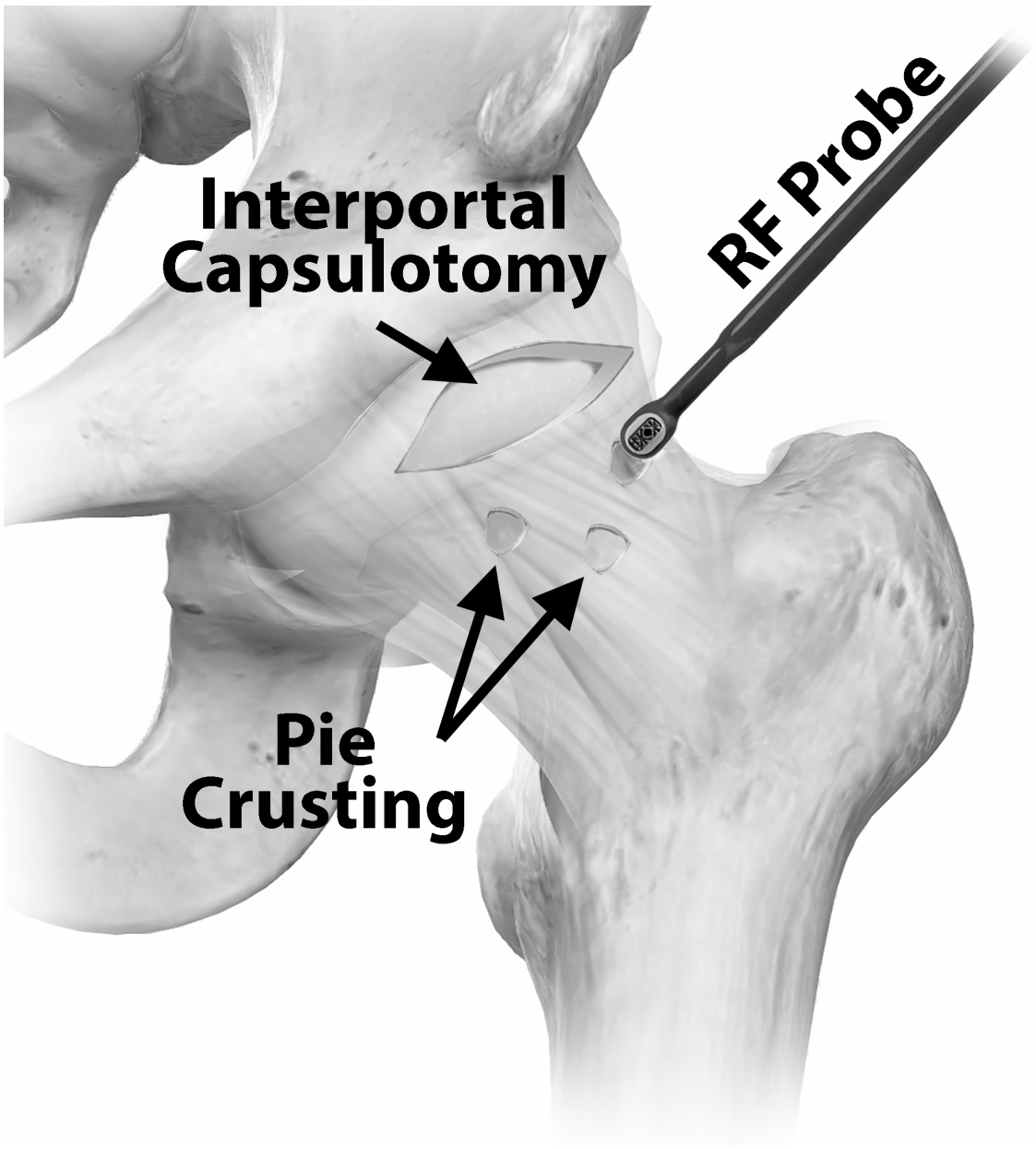

Figure 1. Illustration of the pie crusting technique. A standard interportal capsulotomy is performed, and the radiofrequency ablator is used to create small perforations in the capsule.

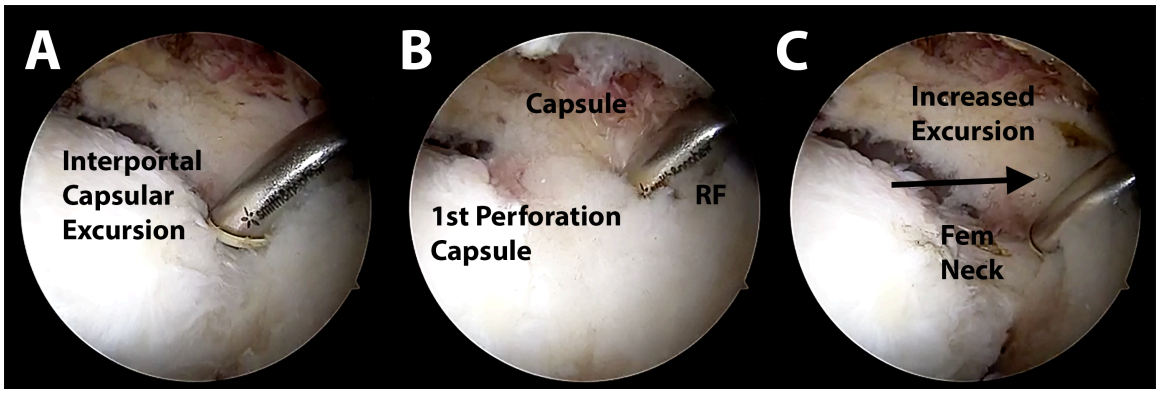

Figure 2. View of the femoral neck and capsule as seen from the anterolateral portal using a 70-degree arthroscope. In figure 2A, an interportal capsulotomy has been made and the radiofrequency ablator is seen pulling traction to test excursion of the capsule. Figure 2B demonstrates the first full-thickness capsule perforation using the ablator approximately 1 cm distal to the interportal capsulotomy. Figure 2C demonstrates the increase in capsular excursion after the first capsular perforation.

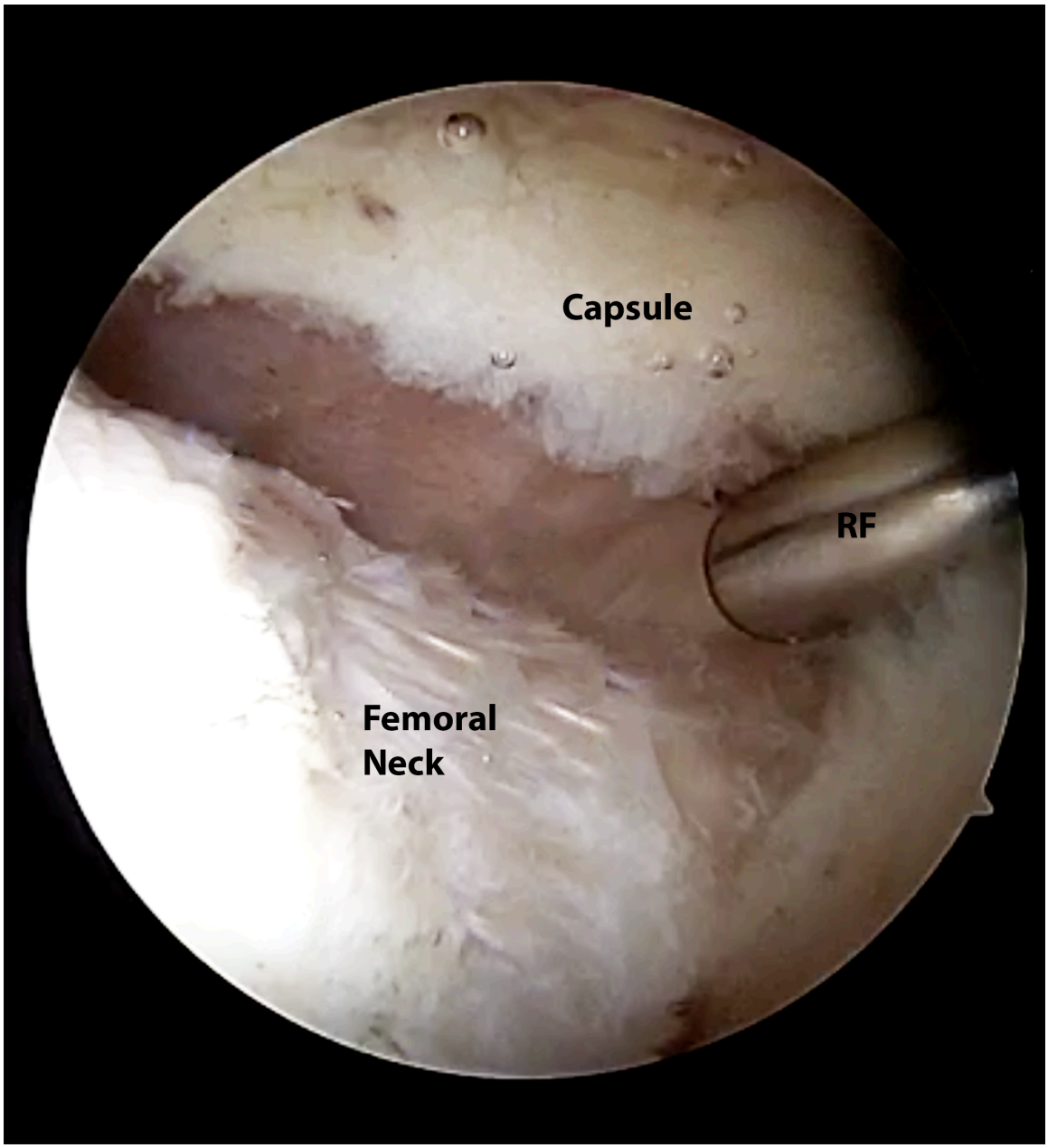

Figure 3. View of the femoral neck and capsule as seen from the anterolateral portal using a 70-degree arthroscope. The radiofrequency ablator (RF) is seen pulling traction on the anterior hip capsule to check for adequate excursion.

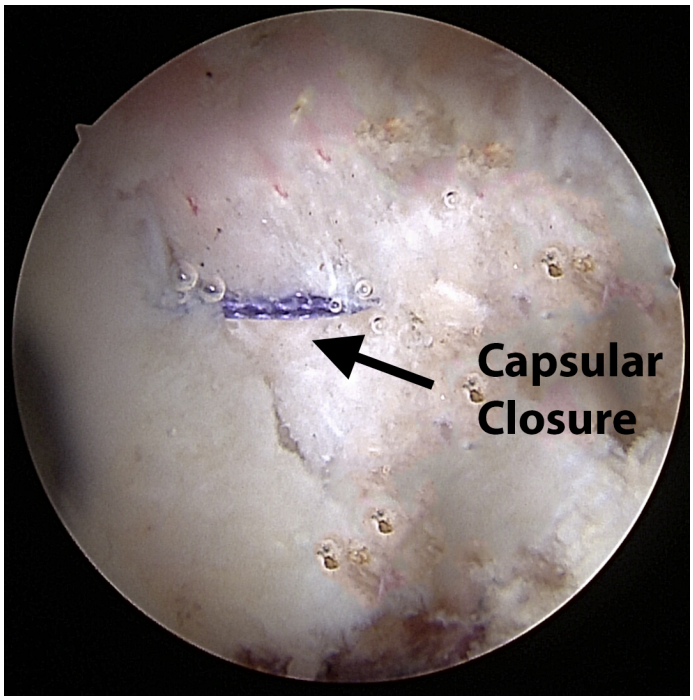

Figure 4. Repair of the interportal capsulotomy is performed using a suture shuttling device (Pivot Injector, Stryker) to place three #1 vicryl sutures from anterior to posterior.

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. Gerhardt MB, Logishetty K, Meftah M, Ranawat AS. Arthroscopic and Open Anatomy of the Hip. In: Sekiya JK SM, Leunig M, Ranawat AS, ed. *Techniques in Hip Arthroscopy and Joint Preservation Surgery*. 1st ed. Philadelphia: Saunders, an imprint of Elsevier Inc; 2011:9-22.
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. Hewitt JD, Glisson RR, Guilak F, Vail TP. The mechanical properties of the human hip capsule ligaments. *J Arthroplasty.* 2002;17:82-89.
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. *The American journal of sports medicine.* 2014;42:2634-2642.
7. Conaway WK, Martin SD. Puncture Capsulotomy During Hip Arthroscopy for Femoroacetabular Impingement: Preserving Anatomy and Biomechanics. *Arthroscopy Techniques.* 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:e731-735.
11. Glick JM. Hip arthroscopy by the lateral approach. *Instr Course Lect.* 2006;55:317-323.