Technical Note

Modified Loop Suture Technique in Arthroscopic Labral Repair of the Hip

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Abstract: Hip arthroscopy is rapidly increasing in case volume annually in the United States. However, it remains a challenging surgery with a steep learning curve. Labral repair is commonly performed to preserve the labrum rather than labral debridement or reconstruction. Many techniques have been described for labral repair. In this technical note, we describe our technique for a modified loop suture technique for arthroscopic labral repair of the hip.

Hip arthroscopy is a rapidly growing surgery in the United States. Similarly, labral repair is increasing in the number of cases being performed because of broadening indications, increase in surgeon education, and positive outcomes with labral repair compared to labral debridement or labral resection.[1] Labral repair has been shown to have good patient-reported outcomes and lower rates of conversion to total hip arthroplasty.[2,3] The labrum plays an important role in maintaining a nonpainful hip joint.[4] The goals of labral repair have previously been defined by Fry and Domb[5] with emphasis on securely reattaching the base of the labrum to the acetabular rim, restoring continuity of the transitional zone between the labrum and adjacent cartilage, and restoring the suction seal by achieving contact between the labrum and femoral head.

Previous repair techniques have been described, including such techniques as the simple loop, base refixation, luggage tag, and the Iberian loop.[6] However, no significant differences are consistently demonstrated in the literature. The objective of this article is to describe a modified looping suture technique for arthroscopic labral repair of the hip.

Patient Evaluation

When evaluating patients in the clinic for labral pathology, it is imperative to obtain a detailed history, perform a thorough physical examination, and carefully check all available imaging. Common historical factors for labral pathology include hip pain, specifically groin pain, decreased athletic performance, and limitations in daily activities.[7] On physical examination, it is important to determine whether the cause of the patient's symptoms are intra-articular in nature or from other common causes of hip-like pain such as lumbar spine, trochanteric bursitis, and more. If the patient's symptoms are stemming from labral pathology, patients will often have pain with hip flexion, adduction, and internal rotation and other positive provocative physical examination findings.

Standard radiographs should be obtained. Our standard hip radiographs include anteroposterior pelvis, anteroposterior symptomatic hip, 45° Dunn, and false-profile views. Using this imaging, we evaluate for the degree of osteoarthritis as evidenced by the joint space and Tönnis grade. We also evaluate the radiographs for signs of femoroacetabular impingement including the crossover sign and measure the lateral and anterior center edge angle and alpha angle as indicated. If there is enough suspicion for labral pathology based on history, physical examination, and standard imaging, we will obtain a magnetic resonance imaging scanof the hip to further evaluate the labrum, cartilage, and surrounding soft tissues.

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Initial management is focused on nonoperative treatments. Typically, a course of formal physical therapy for at least 6 weeks and supervised home exercise program, activity modification, and anti-inflammatory medications are prescribed. Ultrasound-guided intra-articular hip corticosteroid injections can also be considered, providing diagnostic and therapeutic benefits. However, if a patient remains symptomatic, they may be indicated for hip arthroscopy and labral repair.

Indications for Surgery

Surgical indications and contraindications for arthroscopic hip labral repair are detailed in Table 1. When patients have exhausted nonoperative treatments with persistent symptoms, we recommend labral repair to restore the biomechanical properties of the labrum and prevent advancement in degenerative changes of the hip. Contraindications include patients who are poor surgical candidates or have advanced hip osteoarthritis. If a patient has had prior ultrasound-guided intra-articular hip corticosteroid injections with relief of symptoms, it can provide a reference point for pain relief after surgery. We feel it is important to discuss risks associated with hip arthroscopy including nerve palsy, heterotopic ossification, and possible femoral neck fracture. We also thoroughly discuss postoperative restrictions, including partial weightbearing (20%) for 2 to 3 weeks and crutch use for approximately 4 weeks.

It is standard practice at our institution to obtain a computerized tomography scan with 3-dimensional reconstruction, which we believe provides the most detailed bony anatomy if planning to perform a femoroplasty at the time of labral repair.

Surgical Technique

Patient Positioning and Diagnostic Arthroscopy

A list of equipment required to perform our surgical technique for the modified loop suture arthroscopic labral repair is listed in Table 2. The key steps of the technique are summarized in Table 3. The patient is placed supine on the Stryker Pivot Guardian hip system (Stryker, Kalamazoo, MI), a postless traction setup that also allows for controlled hip positioning. Under fluoroscopic guidance, the hip is carefully distracted to obtain a minimal appropriate amount of hip distraction for arthroscopy entry with a goal of at least 1 cm of distraction. Standard arthroscopy access is then localized and established using a spinal needle for the anterolateral and midanterior and percutaneously established distal anterolateral accessory portals. Standard diagnostic hip arthroscopy is performed after creation of an intraportal capsulotomy with a specific capsular blade.

Table 1. Indications and Contraindications for Arthroscopic Labral Repair

Indications
Labral tear that remains symptomatic after attempting nonoperative management (physical therapy, nonsteroidal anti-inflammatory drugs, activity modification)
Contraindications
Patient is a poor surgical candidate
Advanced hip osteoarthritis
Physical examination is not consistent with labral pathology
Minimal relief with ultrasound-guided corticosteroid injection

Table 2. Equipment Required for Modified Loop Suture Technique

General
Standard arthroscopy equipment with 70° arthroscope
ConMed Ergo shaver handle and angled shaver
Smith & Nephew HipVac 50°
Stryker Pivot table
Beaver blade
Stryker Pivot Slingshot
Modified Loop Suture Technique
Stryker TransPort Cannula
Anchor
Stryker NanoPass
Knot Pusher

Labral Preparation

Once the diagnostic arthroscopy has been completed, attention is turned to evaluation of the labrum. A probe is used to evaluate for the chondrolabral junction. If labral pathology is present, a tear maybe be obvious or wave sign is commonly encountered, which is indicative of labral destabilization. Once the labral pathology has been confirmed, we then prepare the labrum for repair. First, a Smith & Nephew HipVac 50° (Smith & Nephew, London, UK), a radiofrequency coblation device, is used to define and dissect the chondrolabral interval. A ConMed Ergo shaver (ConMed, Utica, NY) handpiece and shaver to debride degenerative labral tissue. This angled shaver allows for easier use within

Table 3. Key Steps of Arthroscopic Labral Repair Using Modified Loop Suture Technique

1. Establish standard anterolateral, midanterior, and distal anterolateral accessory portals per routine.
2. Complete standard diagnostic hip arthroscopy.
3. Probe the chondrolabral junction and determine whether there is labral destabilization.
4. Dissect and debride the chondrolabral junction with coblation device and shaver.
5. Prepare the acetabular rim with burr until bony bleeding surface is achieved.
6. Place anchor at the appropriate location along the acetabular rim.
7. Create slack in one limb of the suture and pass through chondrolabral junction/base of labrum.
8. Pass the suture passer though loop and into the central compartment.
9. Retrieve the labral suture through loop out through the cannula.
10. Place a locking loop stitch on acetabular side of the labrum.

the constrained hip joint. Using a burr attachment, the acetabular rim is trimmed back to bare bone surface to prepare the surface for repair.

Labral Repair Technique

Once the labral and acetabular surface has been adequately prepared, we then start the labral repair. A Stryker TransPort cannula, most commonly 4 to 6 mm, is placed into the modified anterior (MA) to allow for anchor placement and suture passing. The size of the labral destabilization determines the number of anchors used in the repair. Using the MA portal and percutaneous distal anterolateral accessory portal, anchors are placed in the acetabular bone at the appropriate distance from the chondrolabral junction (Video 1, Fig 1). A mallet is used to gently tap the guide into the bone to stabilize the guide's placement, and the drill is used until the appropriate depth is met. While drilling, we visualize the chondral surface to ensure there is no intra-articular penetration. Then we place a nitinol wire through the guide to sound the drill hole to confirm that there is a firm endpoint. The anchor is then placed within the guide and gently malleted into place. Once the anchor has been placed and set, the guide is removed. The suture is then pulled out the cannula within the MA portal. With a Stryker NanoPass suture passing device, one limb of suture is grasped. Next, slack is created in the suture by past-pointing with the suture passer by placing it into the central compartment or withdrawn into the cannula (Fig 2). The suture passing device then grasps the suture with the created slack and is passed through the chondrolabral junction and released in the central compartment (Fig 3). The suture passer is withdrawn. Next, the loop that was

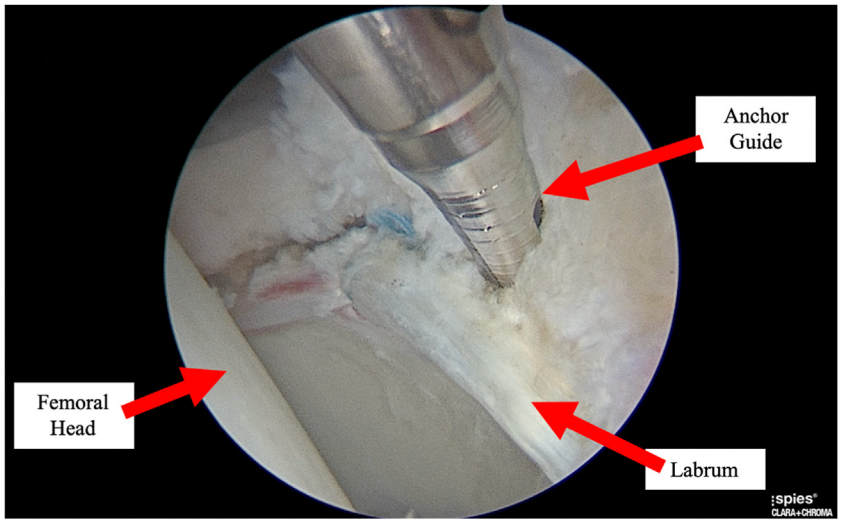

Fig 1. Arthroscopic image of a left hip while the patient is in the supine position with the arthroscope in the anterolateral portal and the anchor guide placed from the midanterior portal. The anchor guide is placed along the acetabular rim to prepare for placement of an anchor for labral repair.

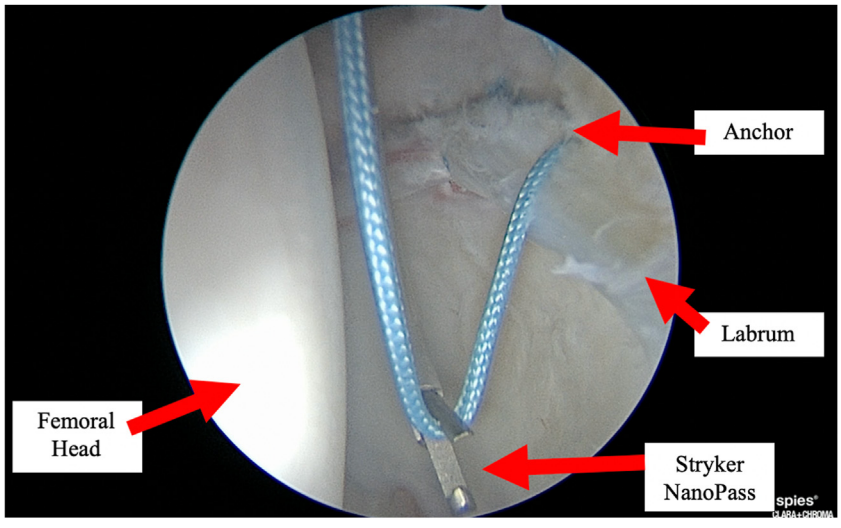

Fig 2. Arthroscopic image of a left hip while the patient is in the supine position with the arthroscope in the anterolateral portal, and the Stryker NanoPass is placed from the midanterior portal. The anchor has been placed at the acetabular rim. A Stryker NanoPass suture passing device grasps one limb of the suture from the anchor and creates slack in the suture by past-pointing with the suture passer by placing it into the central compartment or withdrawn into the cannula.

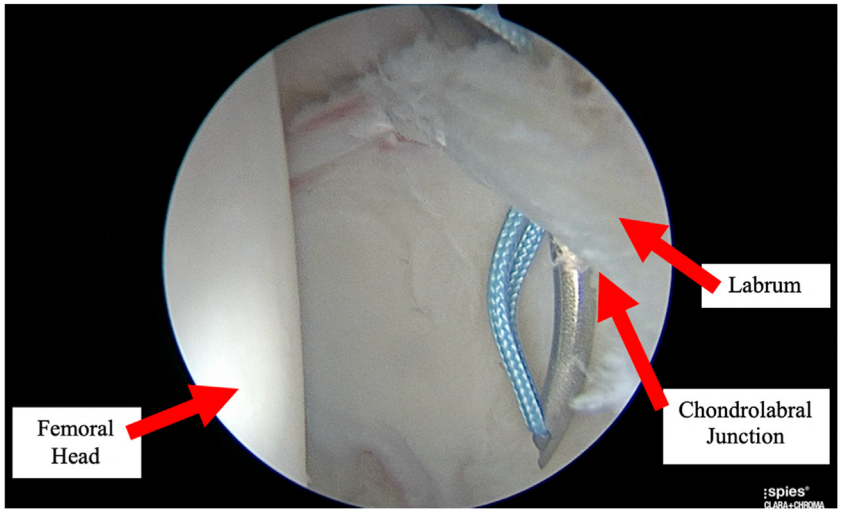

Fig 3. Arthroscopic image of a left hip while the patient is in the supine position with the arthroscope in the anterolateral portal and the Stryker NanoPass is placed from the midanterior portal. The suture passing device is taking the previously grasped suture and has passed through the chondrolabral junction into the central compartment.

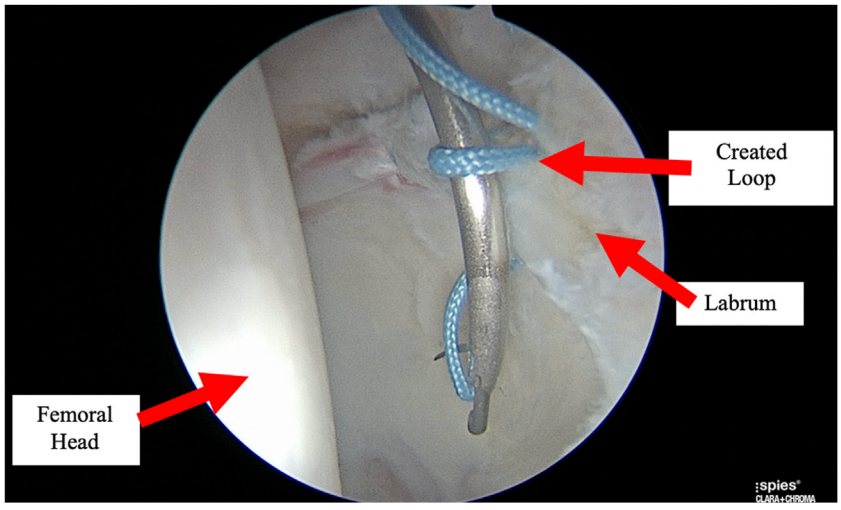

Fig 4. Arthroscopic image of a left hip while the patient is in the supine position with the arthroscope in the anterolateral portal and the Stryker NanoPass is placed from the midanterior portal. The Stryker NanoPass suture passer previously released the suture into the central compartment. The suture passer then passes through the created loop and retrieves the previously released suture in the central compartment.

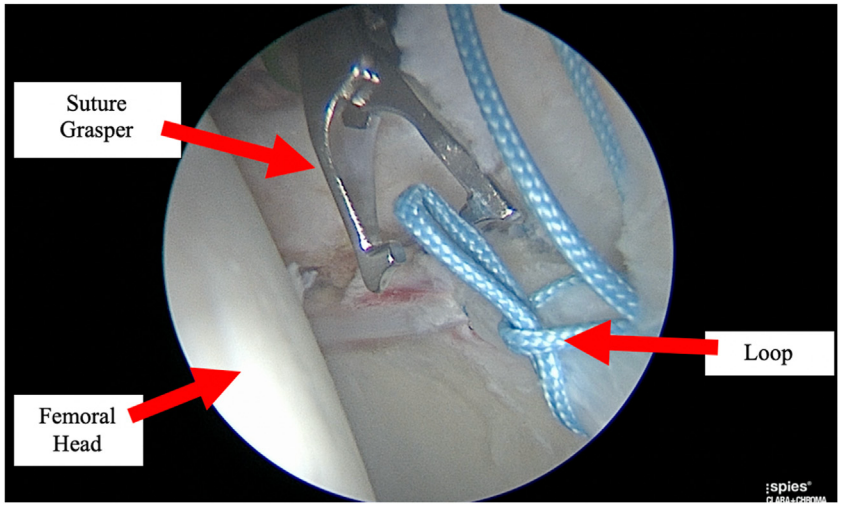

Fig 5. Arthroscopic image of a left hip while the patient is in the supine position with the arthroscope in the anterolateral portal and a suture is placed from the midanterior portal. A suture grasper grasps the suture that was pulled through the loop and is pulled out of the midanterior portal.

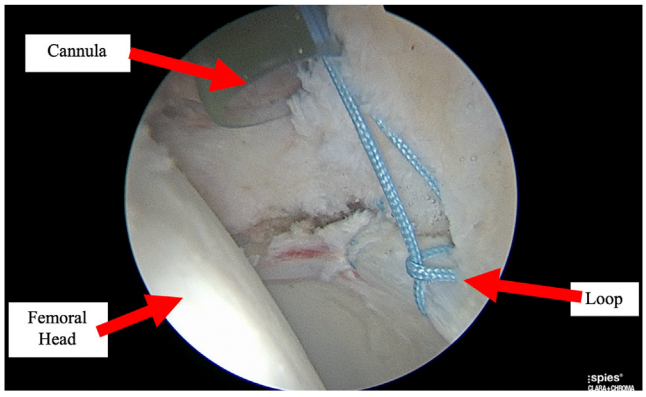

Fig 6. Arthroscopic image of a left hip while the patient is in the supine position with the arthroscope in the anterolateral portal and a cannula is placed in the midanterior portal. Both limbs of suture from the suture anchor have been pulled out through the cannula in the midanterior portal. This creates a locking loop stitch on the acetabular side of the labral for repair.

created is identified, and the suture passer is placed through the loop into the central compartment (Fig 4). With a suture grasper, the suture is then retrieved through the loop (Fig 5). That suture is then pulled out through the cannula (Fig 6). This creates a locking loop stitch on the acetabular side of the labral for repair. By gently pulling on the sliding suture or post, the loop will be cinched toward the anchor entry point and tighten the labral repair (Fig 7). Using standard alternating half-hitches, the sutures are then arthroscopically tied using a knot pusher using the sliding suture, nonlabral loop stitch as the post (Fig 8). The process is repeated until the labral repair has been completed. Once all central compartment work has been completed, the joint distraction is removed. The suction seal of the labrum on the femoral head is evaluated and ensured to have appropriate suction. On completion of all other indicated procedures, the capsulotomy is closed with a Stryker Pivot Slingshot device and 3 sets of OrthoCord (Johnson & Johnson, New Brunswick, NJ), a high-strength, nonabsorbable suture. The fluid is removed from the hip, and all arthroscopic equipment is carefully removed. We inject a local anesthetic comprised of 0.5% ropivacaine, 15 mg Toradol, and 10 mg morphine to the level of the capsule and at all portal sites. The subcutaneous tissue is closed with 2-0 Vicryl suture, followed by 3-0 nylon suture in the skin in interrupted fashion. Xeroform (McKesson Corporation, Richmond, VA) is applied to the incision, and a sterile, dry dressing of 4 × 4s, ABD pad, Tegaderm (3M Corp, St. Paul, MN), and ace wrap is placed. A DonJoy IceMan (DJO Global, Lewisville, TX) is applied to the hip. Depending on concomitant procedures performed, a hip abduction brace may be applied after surgery.

Postoperative Management and Rehabilitation

Patients follow a standardized postoperative and rehabilitation protocol. Patients are partial weight-bearing (20%) with crutches for 2 to 3 weeks and start to wean off crutches at that time. Early range of motion is encouraged immediately after surgery, although hip flexion, external rotation, and hip extension is limited for 4 to 6 weeks after surgery. Return to sport is dependent on return of strength >90% compared to the nonoperative hip with straight leg press. Typically, return to running occurs 3 months after surgery and return to sport is 6 months after surgery.

Discussion

Outcomes of labral repair have been documented to be successful in the literature. Although labral repair in some studies have shown similar outcomes when compared to labral reconstruction, it is a less technically demanding surgery and thus is increasing.[8] This

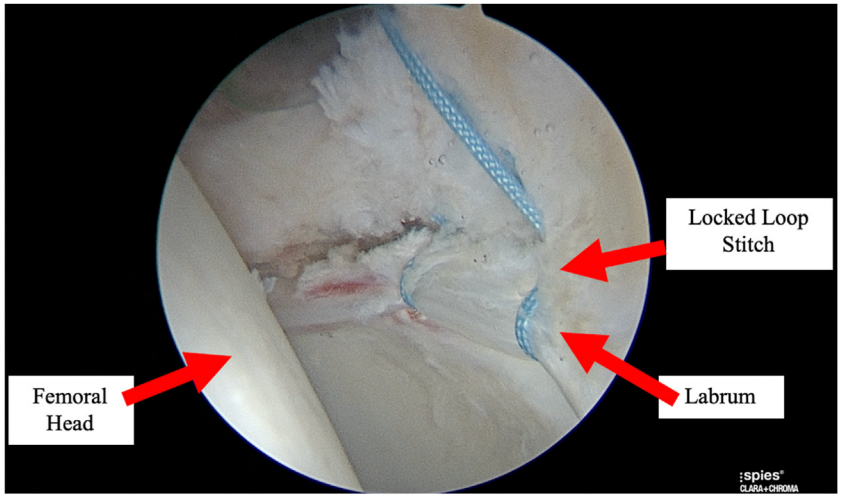

Fig 7. Arthroscopic image of a left hip while the patient is in the supine position with the arthroscope in the anterolateral portal and a cannula is placed in the midanterior portal. By gently pulling on the sliding suture or post, the loop will be cinched toward the anchor entry point and tighten the labral repair.

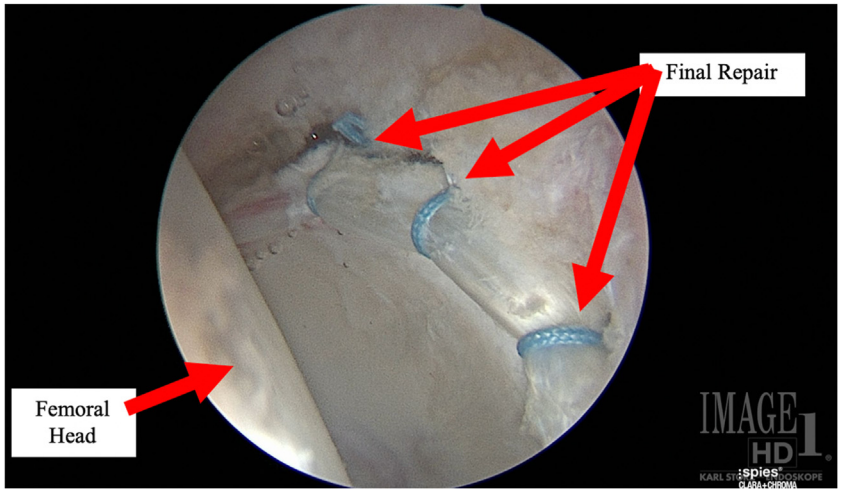

Fig 8. Arthroscopic image of a left hip while the patient is in the supine position with the arthroscope in the anterolateral portal. Using standard alternating half-hitches, the sutures are then arthroscopically tied using a knot pusher using the sliding suture, non-labral loop stitch as the post. The suture limbs have been cut with arthroscopic scissors. This image demonstrates our final labral repair.

includes multiple repair methods and techniques. Suarez-Ahedo et al.[9] described an anatomic labral repair using a knotless tensional suture anchor. Labral repair has also been described using suture anchors without capsular repair.[10] Maldonado et al.[11] described a knotless controlled-tension anatomic technique that demonstrated significant improvement in multiple patient-reported outcome measures, visual analog scale, and patient satisfaction at a minimum of 2 years' follow-up.

Despite these various repair techniques, various studies have demonstrated no difference in outcomes based on repair type. Jackson et al.[12] compared labral based repair versus circumferential suture repair, finding no difference in outcomes between type of labral repair performed at 2-year follow-up. Sawyer et al.[13] demonstrated equivalent outcomes scores between various labral repair techniques including looped, pierced, and combined repairs with no difference in failure or revision rates. Rhee et al.[14] published similar findings, with no difference between knot-tying or knotless suture anchors but with both repair techniques having significant postoperative improvements at two-year follow-up. Ultimately, the key factor for the surgeon is to use a technique that they are comfortable with to best re-establish the normal labral anatomy, stability, and appropriate suction seal to the hip.

This surgical technique for arthroscopic labral repair of the hip using the modified loop suture technique does include some advantages compared to other repair techniques. Pearls and pitfalls of our technique can be found in Table 4. Advantages of this technique include that it provides complete fixation of potentially degraded circumferential fibers. It also re-establishes the appropriate labral contour, avoids eversion of the labrum and overtensioning the repair by having the ability to modulate and adjust the repair tension as needed. With a single pass through the labrum, this repair technique disrupts fewer fibers. Last, this repair technique allows the surgeon to place the knot stacks well away from the chondral joint surface.

Limitations of this technique include the learning curve associated with labral repair; however, we do feel that there is a relatively short learning curve if familiar with other labral repair techniques (Table 5). Foster et al.[15] described the challenges associated with labral repair, requiring appropriate placement of anchors on

Table 4. Pearls and Pitfalls for Modified Loop Suture Technique for Labral Repair

Pearls
Adequately obtain exposure of the chondrolabral junction by dissecting with a radiofrequency device and shaver
Use a burr to decorticate the bone and to create a bleeding bed
Gently mallet the anchor into the acetabulum to prevent displacement while drilling and subsequently placing the anchor
Create slack in the suture to allow for grabbing the loop from inside the joint
Pitfalls
Have a careful and thorough discussion with patients preoperatively to discuss postoperative limitations
Avoid overcrowding or increased distance between anchors
Avoid overtensioning the suture passage or eversion of the labrum

Table 5. Risks and Limitations for Modified Loop Suture Technique for Labral Repair

Risks
Nerve palsy
Recurrent symptoms
Repair failure
Limitations
Similar to other hip arthroscopy techniques, there can be a learning curve.
No published patient-reported outcomes using this repair technique

the acetabular rim and portal placement and usage during repair. In terms of the number of anchors used, a recent study demonstrates that the number of anchors required varies depending on the tear size, and there is no correlation between anchor density and postoperative outcomes[16,17] There are no published patient-reported outcomes using this repair technique, but our institution is currently gathering prospective data to compare to history patient-reported outcome registry data. It is important to have a thorough discussion with the patient before surgery about the postoperative restrictions, particularly the weightbearing restrictions.

In this Technical Note, we describe our technique for arthroscopic hip labral repair with a modified loop suture technique. We believe that our repair technique provides an anatomic repair and provides a safe, efficient modification of current labral repair techniques. We feel that the modified loop suture technique may have some patient and anatomic specific advantages, and, anecdotally, we have seen good outcomes with our patients treated with this technique.

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