Anchor Arthropathy Caused by Cartilage Penetration: An Approach to Revision Hip Arthroscopy With Removal of Problematic Anchors

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Abstract: Hip arthroscopy has been proven to effectively treat labral tears in the setting of femoroacetabular impingement. Anchors used for this treatment have constantly evolved and improved to ensure safety and minimal invasion. However, acetabular drilling and anchor placement are technically challenging due to the concavity of the acetabular articular surface, limited angles for anchor insertion, and finite bone availability in the anterior and posterior column. Inadequate technique can result in protruding anchors, which may lead to full-thickness articular cartilage damage, manifesting in pain, mechanical symptoms, and impaired function. This Technical Note demonstrates arthroscopic removal of protruding anchors and management of the iatrogenic grade IV cartilage damage. In this description, the technical pearls and pitfalls of acetabular anchor placement to treat labral pathology are presented along with the aforementioned technique.

The importance of the hip labrum in creating a suction seal effect in the hip joint has been demonstrated in previous studies. Arthroscopic restoration of labral function has been shown to lead to significantly improved short- to long-term patient-reported outcomes, as well as pain reduction and decreased likelihood of conversion to total hip arthroplasty. However, hip arthroscopy remains a challenging procedure with a steep learning curve; iatrogenic damage to articular surfaces may be caused during many different steps of the procedure, which may lead to a low survivorship rate.

Suture anchors, consisting of a metal, polyether-ether ketone, bioabsorbable (poly-L-lactic acid), or all-suture anchors, have vastly evolved over the past 2 decades as a method of fixation of the labrum to the acetabular bone. Careful placement of the anchor should be directed in such a way that the anchors remain close to the acetabular rim without penetrating the articular cartilage. However, suture anchors should not be placed...
too far from the cartilage in such a way that it causes
eversion of the labrum. While considered safe, there
have been reports of complications associated with the
use of suture anchors.
A mechanical condition caused by a protruding an-
chor, known as anchor arthropathy, may lead to me-
chanical erosion of the acetabular and femoral head
articular cartilage, or to anchor fragmentation, leading
to loose bodies that may potentially cause further
chondral injury. Ultimately, this condition may lead
to progressively worsening pain and limited range of
motion and activity for the patient, who is typically
unresponsive to nonsurgical treatment and will require
a revision arthroscopy. This Technical Note presents
arthroscopic treatment to remove protruding anchors
and manage chondral injury resulting from anchor
arthropathy. This study was performed in accordance
with the ethical standards in the 1964 Declaration of
Helsinki. This study was carried out in accordance with
relevant regulations of the US Health Insurance Porta-
bility and Accountability Act (HIPAA). Details that
might disclose the identity of the subjects under study
have been omitted. This study was approved by the
institutional review board (IRB ID: 5276).

Fig 1. (A) Coronal T2 image of a fat-saturated magnetic resonance arthrogram (MRA) of the right hip, where a labral tear can be visualized (white arrow). (B) Axial T2 image of a fat-saturated MRA of the right hip. Hyperintense images produced by the protruding anchors can be seen in both views, disrupting articular cartilage of the acetabulum (blue arrow). (A, acetabulum; FH, femoral head.)

Fig 2. (A) The patient is placed in the modified supine position and the anterior inferior iliac spine is marked (*). (B) The right hip is shown, with patient’s head to the left and feet to the right. The 4 portals used are identified: anterolateral (AL), mid-
anterior (MA), distal anterolateral accessory (DALA), and posterolateral (PL). (This figure was previously published by Sabetian et al. under the terms of https://creativecommons.org/licenses/by-nc-nd/4.0/.)
Surgical Technique (With Video Illustration)

Indication

Physical examination includes assessment of femoroacetabular impingement syndrome using the lateral, anterior, and posterior impingement tests.10 Views for radiographic evaluation include the supine and upright anteroposterior pelvic, false profile, and modified Dunn 45°11. Preoperative magnetic resonance arthrogram is performed to determine detachment of the chondral surface at the chondrolabral junction, as well as full- and partial-thickness tears in articular cartilage (Fig 3). Outerbridge and acetabular labrum articular disruption classifications are used to grade chondral defects,15,16 which can be caused by protruding anchors in the acetabulum.

Patient Preparation and Positioning

Under general anesthesia, the patient is placed in the supine position on a post-less traction.12 The feet are protected with extra-padding, and the patient is adequately positioned and secured. The operative leg is positioned in neutral rotation and adduction, whereas the contralateral leg is placed at 30° of abduction. The operative table is then fixed at 10 to 15° of Trendelenburg inclination.

Portal Placement

The anterolateral portal is created using fluoroscopic guidance as previously described at the 12-o’clock position.13 The remaining 3 portals, mid-anterior, distal anterolateral accessory, and posterolateral are created under direct visualization.14 Routine portal placement is shown in Figure 2.

Diagnostic Arthroscopy and Articular Cartilage Assessment

A systematic assessment is performed through a diagnostic arthroscopy to assess the intra-articular cartilage, labrum, and ligamentum teres. Notable procedures performed during the previous surgery are assessed, including the placement and function of suture anchors for labral repair. Acetabular cartilage is assessed with an arthroscopic probe to determine detachment of the chondral surface at the chondrolabral junction, as well as full- and partial-thickness tears in articular cartilage (Fig 3). Outerbridge and acetabular labrum articular disruption classifications are used to grade chondral defects,15,16 which can be caused by protruding anchors in the acetabulum.

Other pathologic conditions, such as retearing of the labrum, residual acetabular overcoverage and femoral cam morphology, intra-articular loose bodies, subspine impingement, acetabular notch osteophytes, and instability, also are treated arthroscopically during the procedure.

Identification and Removal of Protruding Anchors

All unviable and unstable cartilage around the edges of the lesion is removed with the use of an arthroscopic shaver. This exposes the protruding anchors and the resulting iatrogenic cartilage injury (Fig 4 A-D). Treatment options for removal of anchor-induced arthropathy are shown on Table 1. In the presented case, the anchors were mobilized and completely exposed through the defect with the use of an arthroscopic probe, and an alligator grasper was then used to perform an en bloc removal (Fig 5 A and B). A ring curette was used to scrape the loose edges of the cartilage and to create perpendicular borders around the lesion (Video 1). Arthroscopic lavage of the hip to remove debris that could cause synovitis or third body wear is then performed.

Micro-Drilling

Typically, Outerbridge type III and IV lesions are treated with a micro-drilling procedure.17 Indications and contraindications for this procedure are found in Table 2. To perform this, a micro-drilling pick or a 70°
A curved drill guide with a flexible drill (Arthrex, Naples, FL) is introduced into the joint from the portal offering a perpendicular trajectory to the lesion (mid-anterior or distal anterolateral accessory portal). The drill bit is assembled to reach the desired depth and set on forward speed to reduce the risk of breakage. It is recommended to begin from the periphery of the defect and work towards the center, placing holes 3 to 4 mm apart to avoid subchondral plate fractures. After drilling, the shaver is used to remove debris that may have accumulated in the joint during drilling. Fluid irrigation is ceased to ensure bleeding from each micro-drilled hole.

Rehabilitation
Following surgery, rehabilitation includes 2 weeks of bracing with limiting flexion range of motion to 90°. In addition, patients are limited to 20 lbs of weight-bearing on the operative extremity for 6 weeks. Patients begin physical therapy the day after surgery and started with passive range of motion using a stationary bike. They
then progress to full strength activity over a 3- to 4-month period.

**Discussion**

Acetabular anchor placement can lead to iatrogenic complications when repairing or reconstructing the labrum. A misdirected anchor can cause damage by penetrating the articular cartilage during drilling or anchor placement. It may also internally detach a segment of the articular cartilage without piercing entirely through the articular cartilage (bubbling). Furthermore, if the anchor is exposed and becomes free, it may act as a loose body that potentially could cause chondral injury throughout the articular surface. Acetabular cartilage lesions may lead to femoral head lesions, leading to advanced stages of osteoarthritis.

Table 1. Treatment Options of Anchor-Induced Arthropathy

| No visible cartilage penetration | Retrograde removal |
|----------------------------------|--------------------|
|   - Unscrew hard threaded anchor  |                    |
|   - Remove barbed anchor with grasper. |            |
|   - Drill through anchor.        |                    |
|   - Drill adjacent to anchor, then remove anchor with grasper. | |

| Visible cartilage penetration with exposed anchors |
|----------------------------------------------------|
|   - Antegrade removal |
|   - Remove threaded anchor by screwing toward articular surface to expose completely. |
|   - Remove barbed anchor with arthroscopic grasper |
|     - Use probe to expose completely by engaging suture hole |
|   - Remove soft anchor (suture) with arthroscopic grasper, use open suture cutter if needed. |

| Loose bodies (anchor fragments) |
|---------------------------------|
|   - Remove with a suture grasper if large.size |
|   - Suction through arthroscopic shaver |
|   - Lavage |

Fig 5. Intraoperative images during removal of protruding anchors visualized with a 70° arthroscope from the anterolateral (AL) portal. (B) An arthroscopic probe (P) is introduced through the midanterior portal and used to expose and mobilize anchors used for labral repair in a previous procedure, which have protruded through articular cartilage (black star). (B) An arthroscopic grasper (G) is used to complete the en bloc removal of the anchors. (A, acetabulum; FH, femoral head.)

Table 2. Surgical Indications for Micro-drilling

| Indications                        | Contraindications                                  |
|-----------------------------------|----------------------------------------------------|
| Focal and full-thickness cartilage lesion | Diffuse cartilage damage |
| Diffuse cartilage damage          | Patients unwilling to commit to the required and specific postoperative management |
Drill through the DALA portal
Adequate rim preparation using wand and burr
Use flexible drill bit
Visualize articular surface during drilling and anchor placement
Sound the drilled hole with a flexible wire to palpate distal cortex

Use small-diameter, suture anchors

It may be removed en bloc with the use of an arthroscopic grasper; however, this may generate a large inflammation or provoke an intra-articular loose implant. Finally, if the anchor is protruding completely, it may be removed en bloc with the use of an arthroscopic grasper; however, this may generate a large chondral defect. _anchor may be removed through their insertion point using an arthroscopic grasper. If the anchors may not be removed retrogradely, they may be removed through anterograde advancement for its removal in the central compartment. If difficult to remove in either direction, one option is to burr down the exposed surface of the anchor, which carries the risk of compromising the labral fixation or provoking an intra-articular loose implant. Finally, if the anchor is protruding completely, it may be removed en bloc with the use of an arthroscopic grasper; however, this may generate a large articulard defec

Anchor arthropathy may have devastating effects in the post-operative recovery, as well as the short- to long-term survivorship of the hip joint. While the learning curve in hip arthroscopy may be steep, a careful surgical technique should avoid penetrating anchors at all costs, in the pursuit of the best possible outcome in the patients’ treatment.

| Table 3. Pearls to Avoid Cartilage Damage During Anchor Placement |
|-------------------|-------------------|
| Drill through the DALA portal |
| Adequate rim preparation using wand and burr |
| Use flexible drill bit |
| Visualize articular surface during drilling and anchor placement |
| Sound the drilled hole with a flexible wire to palpate distal cortex |
| Use small-diameter, suture anchors |

DALA, distal anterolateral accessory.

Pearls to avoid cartilage damage during anchor placement are found in Table 3.

There are different treatment options to remove anchors, which depend on the type of anchor—hard (threaded or barbed) or soft—and the amount of protrusion. In any case, the goal of the removal is to preserve as much cartilage as possible. Hard, threaded anchors may be removed by a reverse screwing motion in the opposite direction of its insertion. Hard, barbed anchors may be removed through their insertion point using an arthroscopic grasper. If the anchors may not be removed retrogradely, they may be removed through anterograde advancement for its removal in the central compartment. If difficult to remove in either direction, one option is to burr down the exposed surface of the anchor, which carries the risk of compromising the labral fixation or provoking an intra-articular loose implant. Finally, if the anchor is protruding completely, it may be removed en bloc with the use of an arthroscopic grasper; however, this may generate a large chondral defect.  

Anchor arthropathy may have devastating effects in the post-operative recovery, as well as the short- to long-term survivorship of the hip joint. While the learning curve in hip arthroscopy may be steep, a careful surgical technique should avoid penetrating anchors at all costs, in the pursuit of the best possible outcome in the patients’ treatment.

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