

Arthroscopic Fixation of Os Acetabuli and Labral Repair: Suture-on-Screw Technique



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Abstract: Os acetabuli is thought to be the result of an unfused ossification center or an acetabular rim fracture in the setting of femoral-sided femoroacetabular impingement syndrome. Historically, patients with symptomatic hips have been treated with resection alone; however, in patients with large bone fragments or with reduced acetabular coverage prior to surgical intervention, iatrogenic dysplasia and structural instability may develop after resection. Therefore, for patients with an acetabular os, labral tearing, and cam-type femoroacetabular impingement, internal fixation of the os acetabuli, femoral osteochondroplasty, and labral repair have been described. We propose a “suture-on-screw” arthroscopic technique to simultaneously address both the labral tear and os acetabuli, thereby reducing the number of suture anchors required for labral fixation, leading to an efficient and cost-effective approach for the treatment of these patients.

Os acetabuli, or acetabular rim fracture, arises from formation and division of an anterolateral acetabular rim osseous fragment. Authors have debated the cause and pathogenesis of this condition for the past century. Some have argued that this fragment is the result of a secondary ossification center remnant and will disappear with skeletal maturity. Others have described various traumatic and infectious causes.^{1,2} With the growing interest in, and understanding of, femoroacetabular impingement syndrome (FAIS) and its

role in chondrolabral injury, this lesion is now thought to result from repetitive impingement of an irregularly shaped femoral neck on the acetabular rim, resulting in a stress fracture of the acetabular rim.³ Some lesions may be treated successfully with resection alone, but resection can result in iatrogenic dysplasia and resultant mechanical instability in select cases depending on a patient’s degree of acetabular coverage.⁴ Therefore, internal fixation combined with treatment of FAIS has been performed with maintenance of acetabular coverage and correction of causative pathology.⁴ We present a “suture-on-screw” technique to address both FAIS and os acetabuli arthroscopically without the use of suture anchors, leading to a more efficient and cost-effective approach while preserving the native hip structure and function.

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Patient Evaluation, Imaging, and Indications

The clinical diagnosis of os acetabuli requires consideration of patient history, physical examination findings, and imaging. Patients typically express complaints of anterior hip and groin pain that increases with activity. On passive range-of-motion testing, patients may have limitations in flexion and internal range of motion. On provocative examination, patients may have positive results on the flexion–adduction–internal rotation impingement test and/or flexion–abduction–external rotation test.

Radiographic imaging is used to evaluate concomitant intra-articular pathology and to identify the presence of the os (Fig 1). Radiographic imaging should include

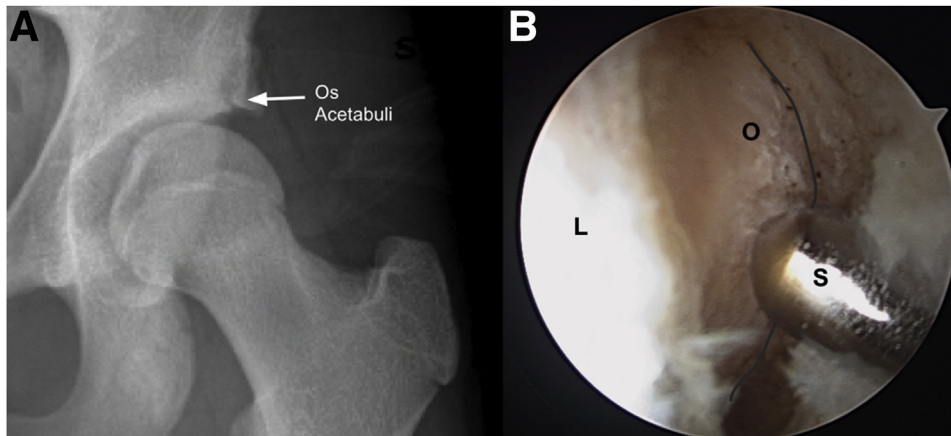


Fig 1. (A) Anteroposterior radiograph representing os acetabuli fragment. (B) Seventy-degree arthroscopic view of left hip from modified midanterior portal with patient in supine position. The arthroscopic shaver (S) is probing the unstable os acetabuli (O); the labrum (L) is visualized adjacent to the os.

Fig 2. (A) Anteroposterior radiograph representing adequate trajectory of drill guide on acetabular rim at approximate 1-o'clock position. (B) Seventy-degree arthroscopic view of left hip from modified midanterior portal with patient in supine position. The drill guide (D) is placed in the center of the os (O). It is imperative to maintain a safe trajectory with respect to the labrum (L) and acetabular cartilage.

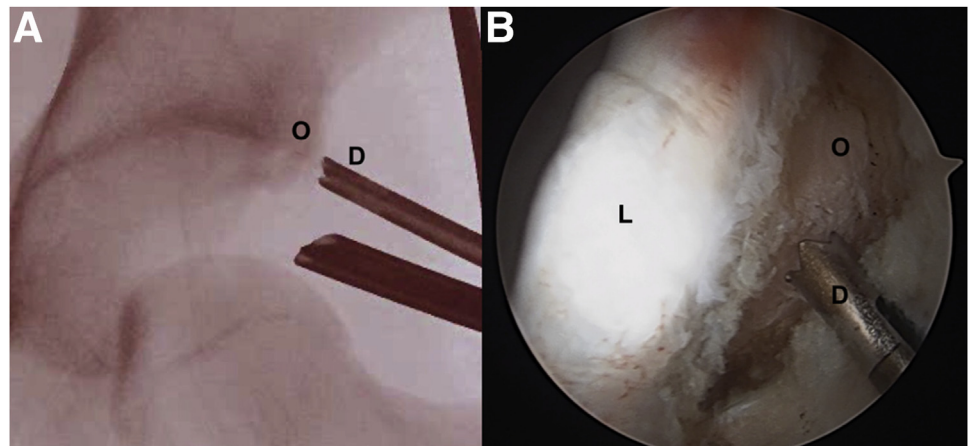


Fig 3. Seventy-degree arthroscopic view of left hip from modified midanterior portal with patient in supine position. The acetabular cartilage (A) and labrum (L) are visualized during drilling to ensure a safe trajectory of the drill bit prior to screw placement.

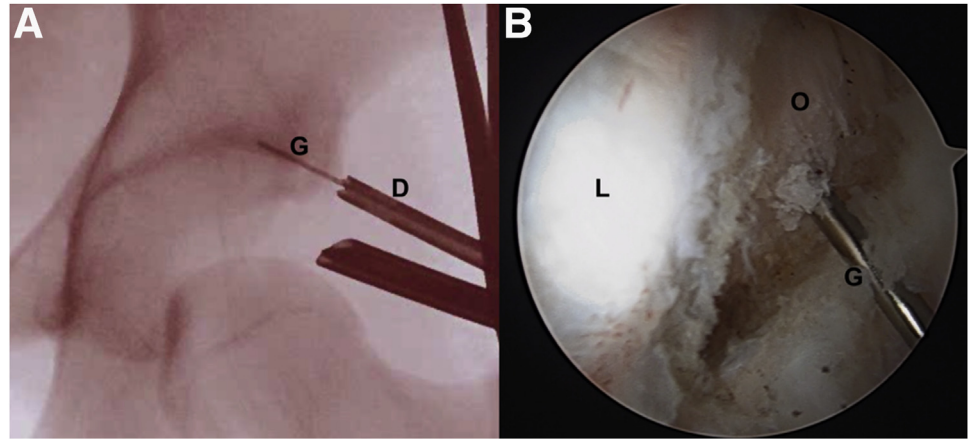
anteroposterior pelvis, 90° Dunn, and false-profile views. Computed tomography and/or magnetic resonance imaging can be used to support radiographic imaging. After identification of the os acetabuli, the lateral center-edge angle (LCEA), anterior center-edge angle, and Tönnis angle are used to evaluate whether fixation of the os acetabuli is indicated. Patients with an LCEA of less than 25° without the os acetabuli are indicated for fixation of the os because excision of the os may result in iatrogenic instability. Contraindications for fixation are cases in which fixation of the os acetabuli will result in acetabular overcoverage.

Technique

Patient Setup and Diagnostic Arthroscopy

The patient is placed in the supine position with a well-padded perineal post, and balanced suspension is applied to achieve adequate joint distraction, which is confirmed by fluoroscopic imaging.⁵ The standard anterolateral portal (ALP) is then created with

Fig 4. (A) A safe trajectory is once again verified radiographically with an anteroposterior radiograph. (D, drill guide.) (B) Seventy-degree arthroscopic view of left hip from modified midanterior portal with patient in supine position. After drilling, a guidewire (G) is placed through the drill guide to aid in eventual screw placement, and the drill guide is removed. (L, labrum; O, os.)



fluoroscopic assistance, with care taken to enter the joint parallel to the acetabular sourcil. A 70° arthroscope is inserted into the joint, and the modified midanterior portal (MMAP) is similarly created under direct visualization. The camera is then moved to the MMAP, verifying accurate placement of the ALP, as well as atraumatic entry with respect to the labrum. Diagnostic arthroscopy is performed to evaluate the labrum, ligamentum teres, and acetabular and femoral hard cartilage, as well as the stage of the capsular tissue (hyperemic, deficient, synovitis, and so on).

Capsulotomy and Identification of Pathology

Once the ALP is deemed adequate, a Samurai blade (Stryker, Kalamazoo, MI) is brought through the ALP and the interportal capsulotomy is started. The camera is moved back to the ALP, and the Samurai is used via the MMAP to complete the interportal capsulotomy for ease of instrumentation throughout the procedure. A tagging stitch can then be used via the MMAP to tag the

acetabular leaflet of the capsulotomy and apply traction to enhance identification of the capsulolabral recess. At this point, a 4.0-mm full-radius arthroscopic shaver (Stryker) is used to demarcate the plane between the capsule and the labrum and to identify the labral tear and os acetabuli (Fig 1A). Once debridement is adequate, a radiofrequency ablation device can further define the borders of the fragment. The fragment should be probed to assess mobility (Fig 1B). A 5.5-mm round arthroscopic burr (Stryker) is used as necessary in the event of pincer impingement of the os acetabuli prior to fixation.

Internal Fixation of Os Acetabuli

Once the fragment is clearly identified, fixation can occur (Video 1). With the camera in the MMAP, a soft-tissue cannula (Clear-Trac Complete; Smith & Nephew, Andover, MA) is placed in the ALP. The guide for the Stryker CinchLock is placed through the cannula and perpendicular to the os fragment. Fluoroscopy is used to confirm the trajectory of the guide for subsequent

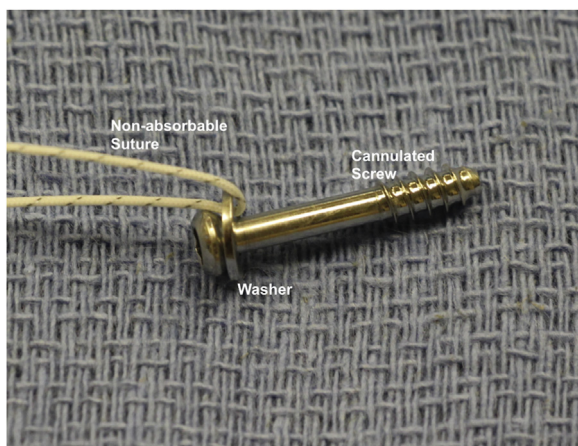


Fig 5. A 3.5-mm partially threaded cannulated screw with an absorbable suture is passed through a washer. This will allow the screw to both fixate the os acetabuli and serve as a suture anchor for labral repair at the 1-o'clock position.

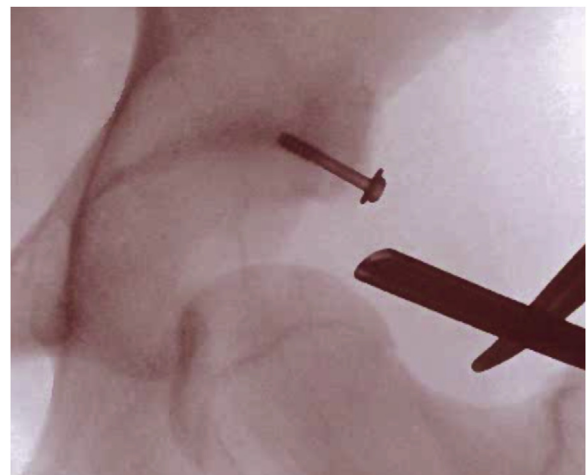


Fig 6. Anteroposterior radiograph showing final fixation of os with screw threads bypassing fracture site.

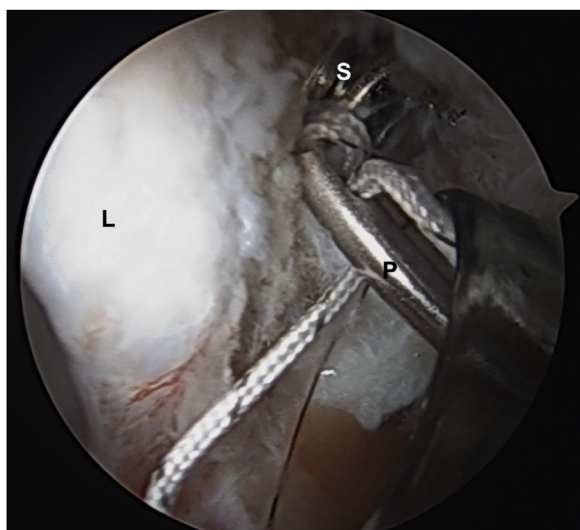


Fig 7. Seventy-degree arthroscopic view of left hip from modified midanterior portal with patient in supine position. The nonabsorbable suture from the cannulated screw (S) can be passed through the labrum (L) with a penetrator (P) in the surgeon's preferred configuration (simple vs horizontal) and tied like a typical suture anchor.

drilling (Fig 2). The drill guide for the CinchLock is then used for predrilling, prior to fixation. The drill is 2.4 mm in diameter with a depth of 20 mm. The joint is directly visualized to ensure that the articular cartilage is not penetrated during drilling (Fig 3). The drill is removed, and a 0.067-mm guidewire from the Stryker anterior cruciate ligament system is then placed in the drill guide and across the fracture site. Correct placement of the guidewire is confirmed via fluoroscopy, and the drill guide is removed (Fig 4). On the back table, a 3.5-mm × 20-mm-long partially threaded cannulated screw with a washer from the Synthes small fragment set (West Chester, PA) is prepared for implantation. Additionally, a nonabsorbable suture is passed through the washer so that the screw will also serve as a labral anchor at the 12-o'clock position (Fig 5). A long-handle cannulated screwdriver from the Smith & Nephew anterior cruciate ligament set is then used to seat the screw under direct arthroscopic visualization. It is imperative to stay co-linear with the guidewire during implantation, as well as to have an assistant hold the sutures taut so that they do not become tangled as the screw is advanced. Final fluoroscopic images can verify correct, impingement-free placement of the screw, with the screw threads spanning the os acetabuli (Fig 6).

Labral Repair

Labral repair then proceeds in the standard fashion. An arthroscopic penetrator device can be brought in via the ALP to pass the suture from the screw and washer through the labrum at the approximate 12-o'clock position, allowing for fixation (Fig 7). The camera is moved

to the ALP, and the arthroscopic cannula is moved to the MMAP while a percutaneous direct anterolateral portal is created under arthroscopic visualization. The surgeon can then place additional labral anchors from the 1- to 4-o'clock position via the direct anterolateral portal as indicated based on tear pattern (Fig 8). The sutures are retrieved and tied via the MMAP.

Femoral Osteochondroplasty and Capsular Closure

Once labral repair has been performed, the camera is moved back to the MMAP, traction is released, and the limb is flexed to approximately 45°, allowing for access to the peripheral compartment of the hip. A T-capsulotomy can be performed as needed for adequate visualization of any cam deformity, and a balanced cam resection should be performed with the aid of fluoroscopy. Once adequate resection has taken place, a dynamic evaluation can be performed to confirm no residual deformity is present. Capsular closure should then be performed as has been previously described to avoid any potential microinstability.⁶ Pearls and pitfalls of the procedure are described in Table 1, and advantages and disadvantages are presented in Table 2.

Rehabilitation

Rehabilitation for acetabular os aligns with the protocol after surgical intervention for FAIS.⁷ In brief, the patient is instructed to remain foot-flat weight bearing for a minimum of 2 weeks. A full week of 50% weight bearing with crutches, followed by a full week of 100% weight bearing with crutches, is recommended before the patient progresses to full weight bearing. Weight

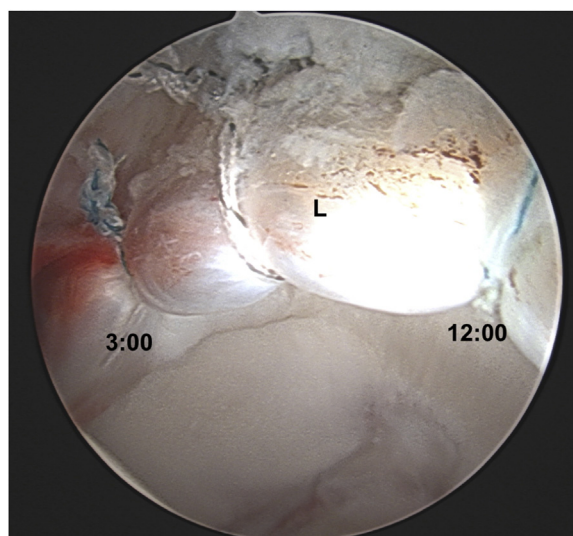


Fig 8. Seventy-degree arthroscopic view of left hip from modified midanterior portal with patient in supine position. A 3-“anchor” labral repair (L) from the 12- to 3-o'clock position is shown. It should be noted that for this construct, in addition to the screw with nonabsorbable suture, 2 additional suture anchors were used.

Table 1. Pearls and Pitfalls

Pearls	Pitfalls
Avoid excessive intra-articular debridement before identification of the location, borders, and character of the os acetabuli.	Excessive intra-articular soft-tissue resection can lead to displacement and possibly removal of the os acetabuli, leading to undercoverage.
Perform cam resection to improve hip function and prevent accelerated osteoarthritis.	Failure to correct impingement may be associated with worsened patient-reported outcomes.
Drill the acetabular surface of the os acetabuli to improve bone healing.	Excessive drilling could modify the anatomic surface and impair fixation.
Use a long K-wire (at least 250 mm in length).	A regular-length K-wire will not be long enough to enter the hip joint.
Secure the screw with suture prior to use while holding the suture limbs outside of the skin.	Tangling of the suture limbs should be avoided.
Use the longest cannulated screwdriver available (often available in the ACL set or as a peel pack).	A short screwdriver will not be long enough to obtain screw engagement within the hip joint.
Ensure the screwdriver is co-linear to the screw, and do not over-tighten.	Failure to do so could strip the screw.

ACL, anterior cruciate ligament.

Table 2. Advantages and Disadvantages

Advantages	Disadvantages
The described arthroscopic technique allows for total visualization of the fragment without the need for large, open exposure.	Arthroscopic fixation is technically challenging and should be performed by a skilled arthroscopist trained in hip arthroscopy.
Arthroscopic fixation limits soft-tissue dissection and blood loss created by open techniques.	Arthroscopic fixation should not be performed in cases of severe hip dysplasia (LCEA < 10°) or advanced osteoarthritis.
Fixation preserves the os acetabuli, preventing hip instability, in comparison to os removal.	The technique is challenging and has a longer operative time.
Using the screw as a suture anchor improves efficiency and decreases cost.	If the screw is not inserted correctly, it may make concomitant labral repair difficult.

LCEA, lateral center-edge angle.

bearing can progress to 100% without crutches at approximately 5 to 6 weeks postoperatively.

Discussion

Hip arthroscopy has been widely accepted as a successful treatment option for patients with FAIS and has shown promising results at medium- to long-term follow-up.⁸ Arthroscopic management of os acetabuli in combination with FAIS is now commonly performed, but techniques differ between surgeons.^{9,10} Because instability and accelerated osteoarthritis have developed after resection alone in some patients,¹¹ it is imperative for clinicians to carefully assess preoperative radiographs to ensure maintenance of acetabular coverage postoperatively. Fragments should not be excised if the resultant LCEA is 20° to 25° and anterior center-edge angle is less than 20°.¹² Because patients with femoral-sided FAIS and acetabular dysplasia have been shown to be at the highest risk of the osteoarthritis development,¹³ internal fixation of the acetabular rim along with femoral osteochondroplasty and labral repair may decrease the risk of accelerated osteoarthritis while improving hip structure and function.⁹ This article describes the senior author's (S.J.N.) preferred technique for internal fixation of an os acetabuli with a partially threaded cannulated screw and nonabsorbable suture. As the cost of an individual

suture anchor ranges from \$75 to \$1,775¹⁴ and as an increasing awareness of the need for cost reduction among surgeons develops, the suture-on-screw technique becomes an increasingly appealing option for the treatment of patients with FAIS and os acetabuli.

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