

Suture-on-Screw Technique for Os Acetabuli Fixation and Labral Repair



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Abstract: The os acetabuli is thought to arise from unfused secondary ossification centers or as rim fractures in the setting of dysplastic hips or hips with femoroacetabular impingement. Resection of a large os acetabuli can lead to structural instability of the joint, and in these cases, osteoplasty of the impingement, reduction and internal fixation of the osseous fragment, and labral repair have been described in the literature. Anchor fixation for labral repair in the surrounding zone of the osteosynthesis might bring some technical problems. We aim to describe a technical modification improving labral lesion treatment while addressing the rim fracture. The addition of a suture to the screw addresses both lesions because it simultaneously has the function of a screw and an anchor. A suture-on-screw technique for os acetabuli fixation helps surgeons to gain versatility and is more cost-effective for the patients and health services.

The term “os acetabuli,” usually used to refer to an anterolateral acetabular osseous fragment, was first used by Krause¹ in 1876, and despite the number of years from its description, this entity is not yet fully understood and is still a cause of discussion. Authors of early reports believed that these fragments were the remnants of secondary ossification centers and would usually disappear before the age of 20 years; a form of nonspecific osteochondritis comparable with Perthes disease; or the consequence of different pathologies such as trauma, osteomyelitis, tuberculosis, and osteochondritis.^{1,2} However, with the growing interest in femoroacetabular impingement (FAI), insights were brought to os acetabuli knowledge,³⁻⁵ and nowadays, it is believed that in young adults, an os acetabuli may be the result of repetitive overloading of the acetabular rim in patients with FAI that leads to a stress fracture and, consequently, to a bony detachment of the acetabular rim. Usually, the fragments may be removed to correct hip morphology.⁴⁻⁶ However, there

are cases in which complete removal of these fragments would lead to instability or hip dysplasia.^{5,7} In these situations, correcting the aggressor mechanism (i.e., FAI) and at the same time maintaining good acetabular coverage by fixating the osseous fragment may re-establish a well-functioning hip.^{5,8,9}

We describe a technical modification improving labral lesion treatment while addressing the rim fracture. The addition of a suture to the screw, that is, “suture on screw,” addresses both lesions as it simultaneously has the function of a screw and an anchor, improving labral fixation. The surgical technique was performed in a case with combined-type FAI (cam and pincer) in a well-maintained hip space with an os acetabuli that split the acetabular roof. The lateral center-edge angle of Wiberg was 57°. The lateral center-edge angle of Wiberg without the rim fracture measured 20°. Arthro-magnetic resonance imaging showed an os acetabuli in the anterolateral zone with a labral rupture between the 11- and 3-o’clock positions (Fig 1).

Surgical Technique

Patient Positioning and Portal Placement

We perform supine hip arthroscopy using standard anterolateral, anteromedial, and distal anterolateral portals (Video 1). The patient lies supine on a traction table with the feet well padded and placed into traction boots. After placement of an extra-wide post (perineal post) to protect the perineum, the hip is placed in a

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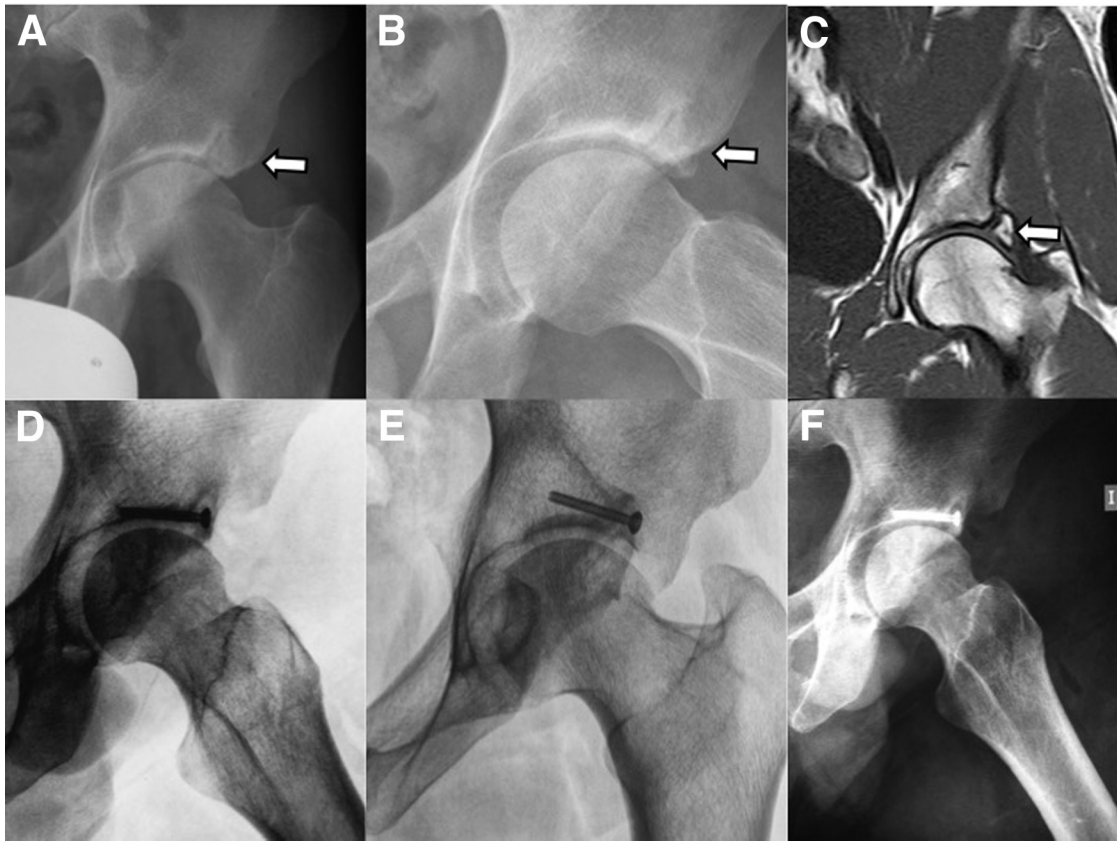


Fig 1. Preoperative and postoperative imaging studies in a left hip. (A, B) Preoperative radiographs showing the os acetabuli (arrows). (C) Magnetic resonance imaging, coronal view. The arrow indicates the os acetabuli. (D-F) Postoperative plain radiographs after partial excision and fixation. Anteroposterior views (A, E) and frog-leg lateral images (B, D, F) are shown.

position of 10° of flexion, 15° of internal rotation, and neutral abduction. Traction force is applied gradually in the operative limb, with gentle counter-traction applied to the contralateral limb. After traction, the leg is placed in slight adduction over the post, which forces the femoral head laterally. Traction is controlled using fluoroscopy. After routine preparation and draping of the hip, the procedure is begun by establishing standard anterolateral, anteromedial, and distal anterolateral portals to allow access to the central compartment.

Capsulotomy and Addressing of Intra-articular Pathology

After access is obtained, an interportal capsulotomy is performed and a standard diagnostic arthroscopy is performed using a 70° arthroscope to evaluate any concomitant pathology. The labral tear is assessed regarding its location and size, as well as overall labral tissue quality. At this point, the surgeon must separate the adhesions between the capsule and labrum to access the recess with the help of a shaver and a radiofrequency device to clearly identify the os acetabuli. Besides the labral rupture previously diagnosed, the diagnostic arthroscopy shows a pseudo-articulation

attached to the native acetabulum, caused by the nonunion of the os acetabuli, promoting osseous and labral instability when stressed with the probe. Despite this, the articular cartilage of the os acetabuli was intact and contiguous with the rest of the cartilage, so we decide to fix and compress the nonunion site without removing the fibrous tissue.

Os Acetabuli Partial Excision and Femoral Osteochondroplasty

We start by performing arthroscopic osteochondroplasty of the acetabular rim with partial os acetabuli excision of about 50% (Fig 2) using a 5.5-mm burr (Smith & Nephew, Andover, MA) and femoral osteochondroplasty to treat the cam impingement until we are satisfied with the congruence and head-neck offset (Video 1). After complete resection of the deformities, the hip is again brought through a dynamic range of motion and impingement is assessed on arthroscopic visualization and fluoroscopy.

Internal Fixation and Labral Repair

After completion of the impingement surgical procedure, we fix the remaining portion of the os acetabuli. First, we prepare the os acetabuli and its

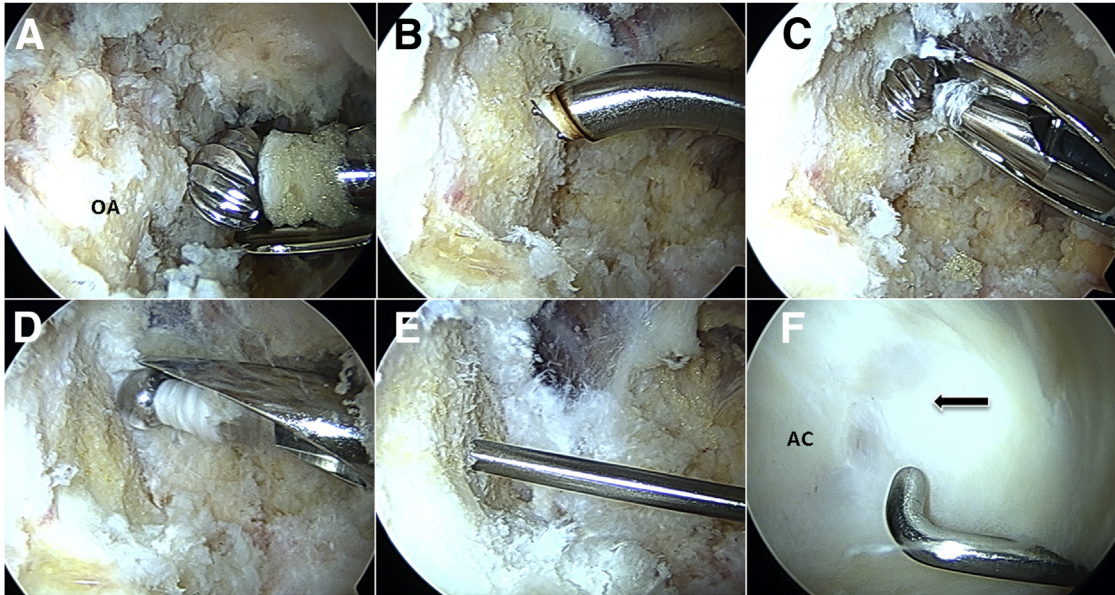


Fig 2. Intraoperative arthroscopic images of suture-on-screw technique in a left hip. The arthroscope is in the medial portal, with drilling and excision performed through the anterolateral portal. (A-C) Acetabuloplasty and fragment excision. (D) Os acetabuli fragment after acetabuloplasty. (E) Drilling of fragment. (F) The articular cartilage of the os acetabuli was intact and contiguous with the rest of the cartilage (arrow). (AC, acetabulum; OA, os acetabuli.)

corresponding side in the acetabulum, drilling both interfaces with a K-wire to improve the healing process (Fig 3, Video 1). At this point, we fix it with a guidewire under arthroscopic and fluoroscopic control. The arthroscope is in the medial portal, and drilling and fixation are performed through the anterolateral portal (Fig 4). The guidance of the guidewire should take into account the inclination of the acetabular roof (Fig 5), and it is also very important to place the guidewire in the center of the fragment to prevent any cracking. Then, we perform a percutaneous osteosynthesis of the rim fragment into the native acetabulum with a 4.0-mm cannulated cancellous screw that is 28 mm in

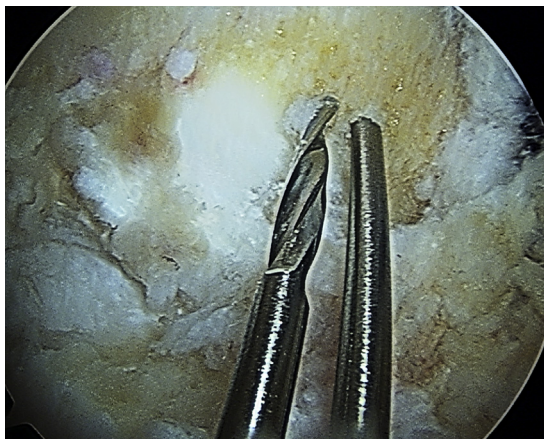


Fig 3. Intraoperative arthroscopic image showing the drilling of the os acetabuli and its corresponding side in the acetabulum with a K-wire to improve the healing process.

length (Zimmer-Biomet, Warsaw, IN) (Fig 6). Once again, the position of the screw is controlled by fluoroscopy, and direct visualization of the acetabulum is used to ensure that there is no intra-articular damage while placing the screw. The screw that we use has been previously prepared and has a suture thread with No. 2 Ultrabraid suture (Smith & Nephew) attached to its proximal part (suture on screw), and it is used for the labral repair in the region of the screw (Fig 7). Two additional 1.4-mm suture anchors (Iconix; Stryker, Mahwah, NJ) next to the screw complete the labral repair. Complete capsular closure is performed using the SlingShot suture passer (Stryker) with No. 2 Ultrabraid sutures (Smith & Nephew). Table 1 details the steps of our technique.

Postoperative Recovery and Rehabilitation

The postoperative period progressed uneventfully in our patient. He used crutches with partial weight bearing of the left limb for 6 weeks. Just after that, he started to progress to full weight bearing. Hip rehabilitation used the same protocol as standard FAI treatment and was started right after the operation. Four months after surgery, plain radiographs showed that the rim fracture healed, with the remaining acetabulum maintaining its joint space, without heterotopic calcifications. At the 6-month follow-up appointment, the patient had no pain during sports activities. The findings of impingement tests were also negative, with improvement in range of motion: 110° in flexion and 25° in internal rotation.

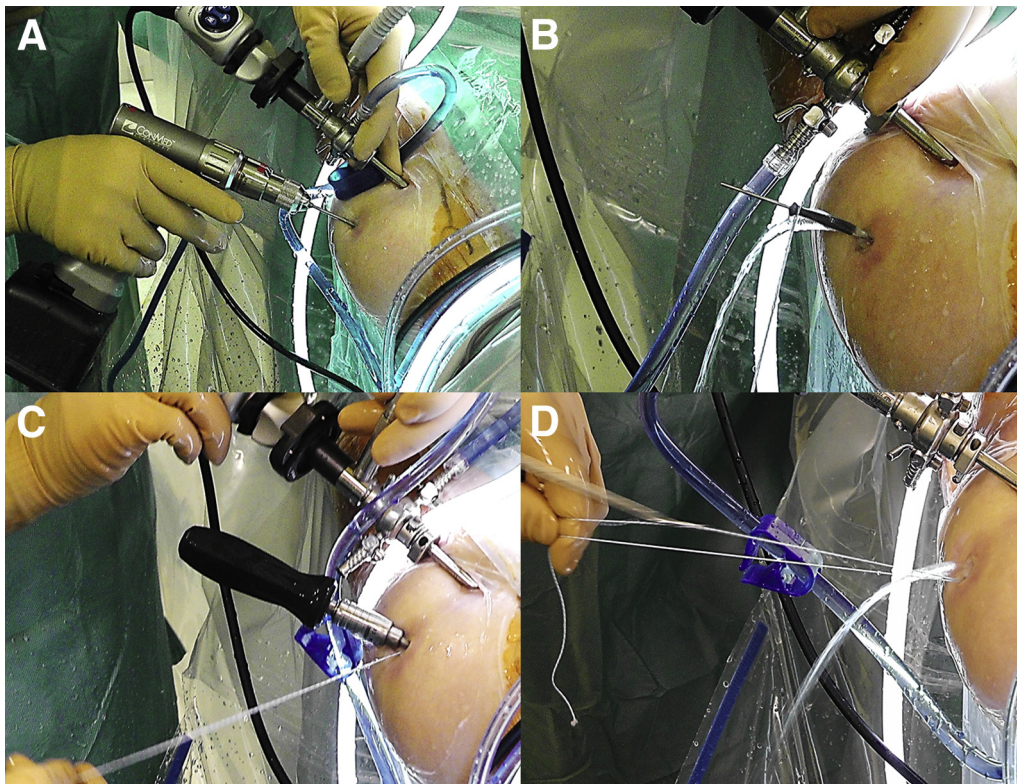


Fig 4. External views in a left hip showing the portals used for the suture-on-screw technique. The arthroscope is in the medial portal, and drilling, fixation (A-C), and labral repair (D) are performed through the anterolateral portal.

Discussion

The past decade brought additional concepts related to FAI, improving and complementing our understanding about it. It is well established that FAI develops from abnormal contact between the proximal femur and acetabular rim, which can lead to a variety of lesions of the surrounding soft-tissue structures such as the cartilage and labrum.^{2,4,10} Nowadays, it is believed that the onset of os acetabuli in young adults may be the result of repeating shear forces over the acetabular rim that lead to a stress fracture and that

os acetabuli has a prevalence of between 3.6% and 6.4% in the FAI population.^{4,5,8} Thus, despite having a variable presentation, the presence of FAI and os acetabuli in a patient presenting with a painful hip should raise concern among orthopaedic surgeons because it is usually a sign of a decompensated hip that probably will progress to having significant articular cartilage damage.^{6,8}

It is established that in these cases, surgical treatment should address not only the consequence but also the cause, meaning resecting or debriding the acetabular

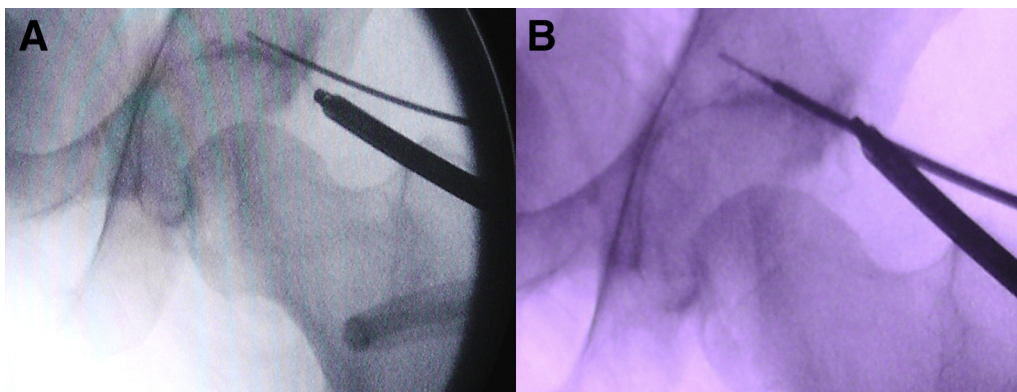


Fig 5. Intraoperative anteroposterior fluoroscopic images of a left hip in traction. The guidance of the guidewire should take into account the inclination of the acetabular roof to avoid intra-articular penetration. (A) Guidewire. (B) Drilling.

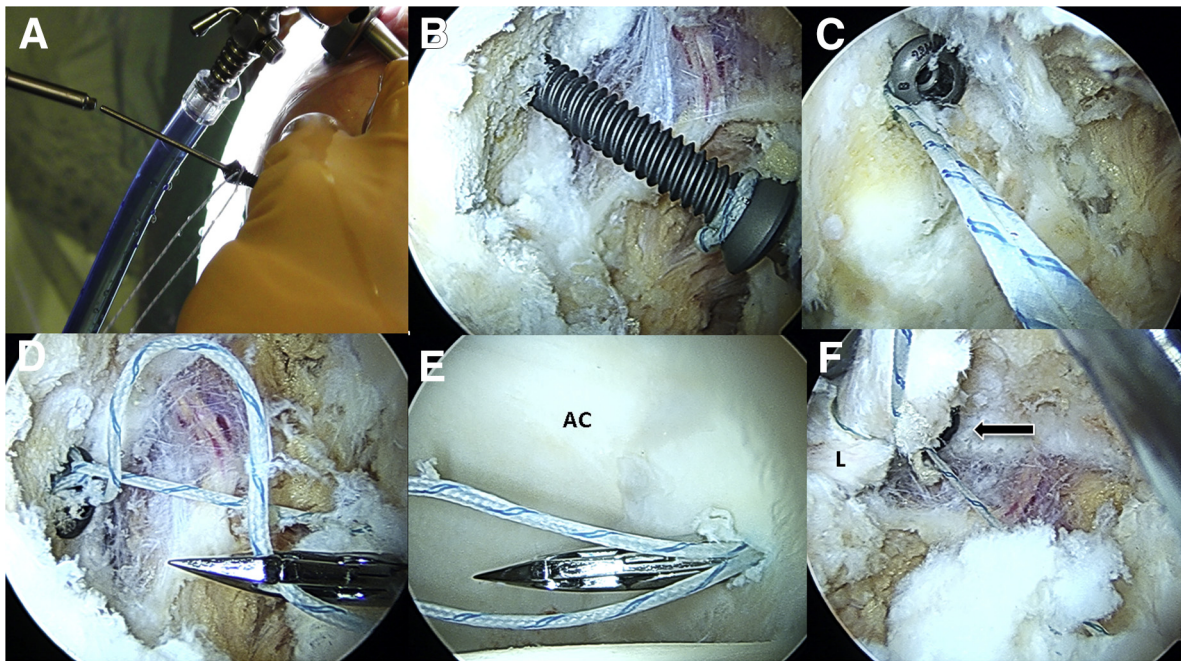


Fig 6. Osteosynthesis of os acetabuli and labral repair with suture-on-screw technique in a left hip. The arthroscope is in the medial portal, and the anterolateral portal is used as the working portal. (A-C) External and endoscopic views of the screw previously prepared with a suture thread attached to its proximal part (suture on screw). (D-F) The suture around the screw is used for the labral repair. The arrow points to the screw. (AC, acetabulum; L, labrum.)

fragment but, moreover, treating FAI.⁴ Similar to other authors, we believe that arthroscopic management has shown good results in FAI management, and it might be the best approach for os acetabuli treatment with the purpose of stopping the progression of the lesion, leading to pain relief and restoration of physical activities.^{11,12} Although an os acetabuli can be completely excised, there are cases in which its full removal would lead to hip instability. In our case, although the patient had acetabular overcoverage as shown by the

center-edge angle of Wiberg of 57°, the total removal of the os acetabuli would have led to a center-edge angle of Wiberg of only 20°, leading to iatrogenic

Table 1. Technical Pearls and Pitfalls for Suture-on-Screw Technique

Pearls	
The surgeon should separate the adhesions between the capsule and labrum to access the recess with the help of a shaver and a radiofrequency device to clearly identify the os acetabuli.	
A thorough acetabuloplasty should be undertaken including the fragment of the os acetabuli to resolve the excess acetabular coverage.	
The surgeon should place the guidewire in the center of the fragment to prevent any cracking.	
The guidance of the guidewire should take into account the inclination of the acetabular roof.	
Using direct visualization, the surgeon should confirm the integrity of the cartilage of the acetabulum along with the screw placement process to ensure that it is not violating the intra-articular space.	
The suture on the screw should be used first to achieve labrum fixation and then the other anchor sutures should be used to make sure that the attachment of the labrum will be well tensioned in the most fragile zone (around the screw).	
The knot to be applied to the labral suture using the screw thread must not be slippery.	
Pitfalls	
Failure to obtain adequate visualization of the joint, as well as poor angles and portal placement during screw fixation, can lead to iatrogenic intra-articular penetration.	
Leaving the screw proud can lead to irritation of the soft tissues.	
Preservation of bony fragments that contribute to structural impingement may lead to continued impingement.	

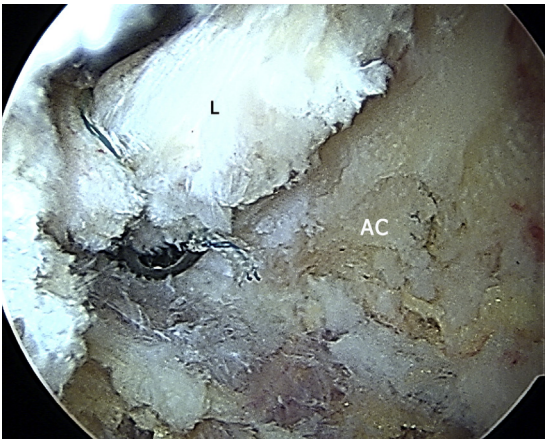


Fig 7. Intraoperative arthroscopic image of a left hip at the end of the labral repair around the screw that fixes the remaining portion of the os acetabuli. (AC, acetabulum; L, labrum.)

Table 2. Advantages and Limitations of Suture-on-Screw Technique

Advantages	
	The rim fracture and labral lesion are addressed at the same time.
	The likelihood of damaging the fixed fragment is reduced.
	The excessive expense of overuse of anchors is avoided.
Limitations	
	The technique is highly technically demanding and has a steep learning curve.
	Os acetabuli fixation still requires long-term studies with large patient populations.

dysplasia and all its consequences. With this being taken into account, it is easy to understand that although acetabular overcoverage must be addressed, the total removal of the os acetabuli in these cases is not an option.

To our knowledge, there are only 4 cases regarding os acetabuli osteosynthesis in the literature. Epstein and Safran⁵ reported the first case, with fixation being performed with two 4.5-mm cannulated screws and the labrum being repaired with a radiofrequency device. In the other 3 published cases, acetabuloplasty was performed because of overcoverage and fixation with 1 or 2 screws was performed.^{8,9} In those cases, as expected, it was also necessary to perform a labral repair with anchors (4 anchors in 2 cases and 3 anchors in 1 case). In all cases good results were achieved without complications reported.

We present a technique modification improving labral lesion treatment while addressing the rim fracture. Indeed, labral reattachment has a crucial role; however, it implies anchor fixation in the surrounding zone of the osteosynthesis, which might bring some technical issues. If we leave a safe distance between the screw and the anchors, we might not have good labral fixation, and so, we will fail to restore the labral seal. On the other hand, if anchor placements are performed near the screw, this might compromise the osteosynthesis and weaken or fracture a fragment that is already small. With the suture-on-screw technique, we address both lesions, avoiding unnecessary complications, because it simultaneously has the function of a screw and an anchor. It is simple to execute because it just needs a thread to be attached with simple knots to the screw that would be used for fixation. Moreover, it is less time-consuming, which is always a favorable point when performing hip arthroscopy, and avoids excessive expense from the overuse of anchors. The good results obtained in our case with the suture-on-screw technique lead us to believe that this small technical note should be taken into consideration when performing this procedure because it enhances the treatment of the labral repair. The approach to this case with percutaneous drilling across the nonunion site performed with a K-wire to stimulate bone growth and percutaneous fixation to compress the nonunion

site without removing the fibrous tissue was performed because the articular cartilage was entirely intact. In cases in which the articular cartilage is damaged, we can consider removing the fibrous tissue prior to fixating the fragment.

The suture-on-screw technique is a promising technique to address the problem of a rim fracture and labral lesion because it allows good fixation of both the fragment and labrum while reducing the likelihood of damaging the fixed fragment. This could be an inexpensive and practical method for management of a rim fracture that contributes to both FAI and hip instability. Advantages and risks or limitations of our technique are detailed in Table 2.

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