Technical Note

Concomitant Arthroscopy With Labral Reconstruction and Periacetabular Osteotomy for Hip Dysplasia

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Abstract: In the setting of true hip dysplasia, the high prevalence of intra-articular pathology may lead to recurrent symptoms and failure after periacetabular osteotomy (PAO). Femoral neck osteochondroplasty, microfracture, removal of loose bodies, and labral repair are examples of procedures that are performed with concomitant arthroscopy. When damage to the labrum is too severe to repair, reconstruction instead of extensive debridement before PAO can be more effective in restoring the labral seal to maintain joint lubrication and chondral protection. This Technical Note describes a method for concomitant hip arthroscopy with circumferential labral reconstruction with allograft and PAO.

The addition of hip arthroscopy in conjunction with periacetabular osteotomy (PAO) has expanded the treatment options for dysplasia in the young active adult patient.[1] There is increasing recognition of previously under-reported intra-articular hip pathologies associated with dysplasia[2,3] and the possibility to treat them through a modern and minimally invasive manner.[4-6] Previous authors have described residual femoroacetabular impingement,[7] untreated labral tears, and chondral lesions as potential causes of recurrent symptoms and risk factors for revision surgery after PAO procedures.[8,9] Bony correction with PAO is the fundamental base for the treatment of true hip dysplasia.[10-12] However, the authors have also advocated concomitant arthroscopy for the treatment of intra-articular derangements.[2,6,13,14]

This Technical Note presents a method for concomitant hip arthroscopy with a circumferential labral reconstruction technique[15] and PAO for the treatment of an irreparable labral tear in the setting of true hip dysplasia (Fig 1).

Surgical Technique

Patient Preparation and Portal Placement

A combination of general anesthesia for skeletal relaxation and epidural analgesia for postoperative pain control is administered. The patient is placed in the modified supine position on a traction table (Supine Hip Positioning System; Smith & Nephew, Andover, MA) with a well-padded perineal post (Fig 2A). Under fluoroscopy, the joint seal is broken and traction is applied (Fig 2B). Anterolateral, midanterior (MA), distal anterolateral accessory, and posterolateral portals are created[15] (Fig 3A).

Diagnostic Arthroscopy and Labral Assessment

A systematic diagnostic arthroscopy is performed. The ligamentum teres, acetabular notch, iliopsoas impingement sign, labral and chondrolabral junction conditions, and acetabular and femoral head cartilage are assessed. Labral reconstruction is indicated if the labrum is too severely torn or diminutive for repair or is significantly calcified[16] (Fig 4). Indications for reconstruction are listed in Table 1.

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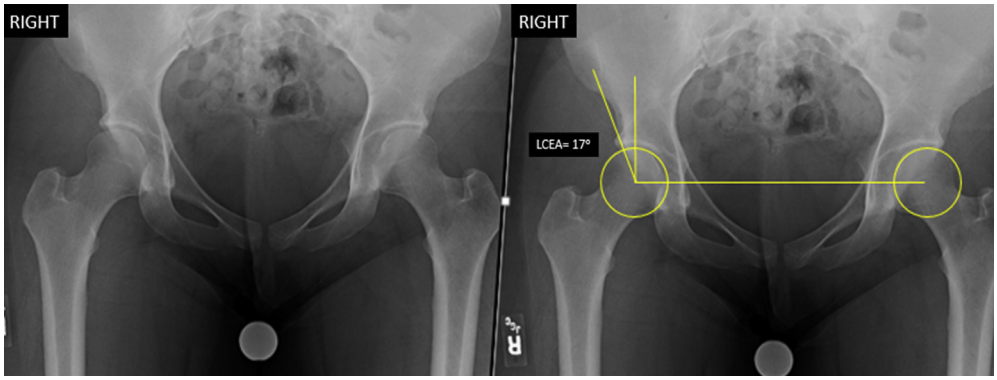

Fig 1. Anteroposterior pelvis x-ray projection of a 17-year-old female patient with previous failed right (R) hip arthroscopy. The lateral center-edge angle (LCEA) is measured and shows evidence of frank hip dysplasia.

Circumferential Labral Reconstruction Technique

A single-strand anterior tibialis tendon allograft is used for the reconstruction (Fig 4 A and B). The following implants are needed: Knotless SutureTak 3.0-mm anchors (Arthrex, Naples, FL) and 1 PushLock 2.9-mm anchor (Arthrex). As previously described and published by the senior author (B.G.D.), an advantage of this technique is that it does not require measurement of the size of the labral defect.[15]

The labrum to be replaced is debrided, and the acetabular rim is decorticated to ensure healing[17] (Video 1). Knotless SutureTak anchors are placed through the distal anterolateral accessory portal with 6 to 8 mm of spacing, which generally amounts to 4 to 6 anchors (Video 1, Fig 3B). Meanwhile, an assistant prepares the allograft by placing a FiberLoop suture (Arthrex) at each end of the graft (Fig 5 A and B). One side is prepared with the PushLock anchor, and the other remains free (Fig 5 C and D).

The free end of the graft is passed into the joint through the MA portal (Fig 3C) and retrieved by pulling the free limb of the FiberLoop from the posterolateral portal (Fig 3D). The graft is fixed to the most anteromedial part of the defect with the PushLock anchor through the modified MA portal, and the sutures of the previously positioned Knotless SutureTak anchors are passed and cinched sequentially (Video 1). Finally, the graft is fixed in the most posteromedial part of the defect also with a Knotless SutureTak anchor, and any excess graft is removed. This allows appropriate

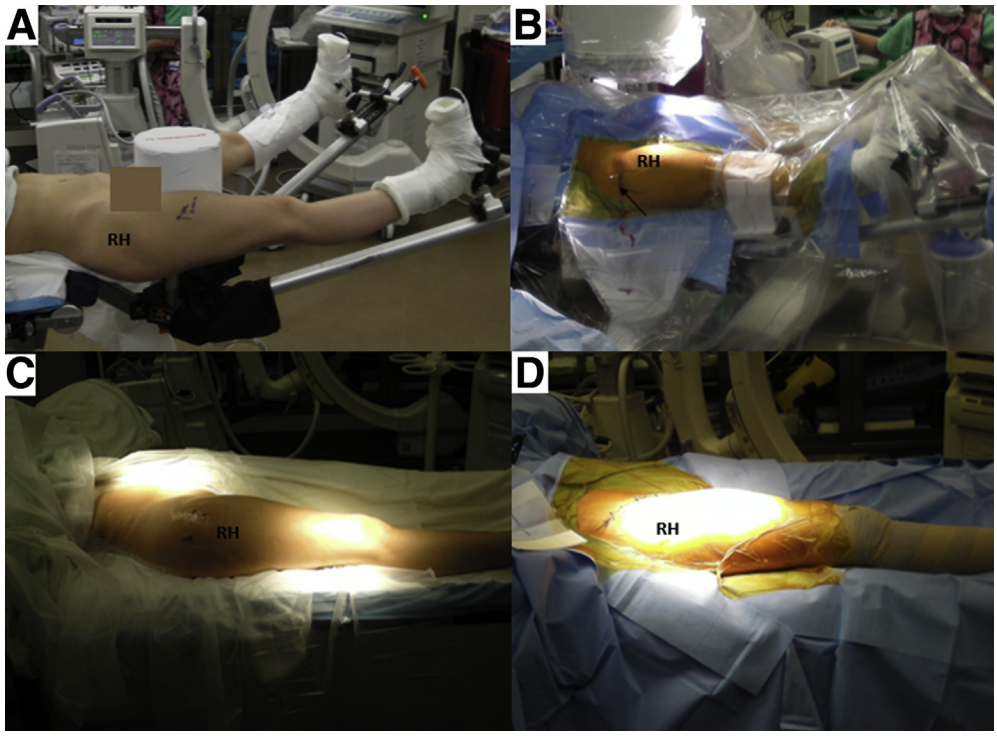

Fig 2. Right hip (RH) in a patient in the supine position with the head of the patient to the right, feet to the left. (A) In the arthroscopic phase, the patient is already positioned with the Supine Hip Positioning System with Trendelenburg positioning with 8°. No draping is shown; the operative leg (right leg) is in neutral rotation and adduction, and the nonoperative leg is in neutral rotation and 30° of abduction. (B) The patient is now draped with no modification of the previous position, except that gross traction is applied and the RH is vented with a spinal needle (arrow). (C) After completion of the arthroscopic phase, periacetabular osteotomy is next. (D) The patient is transferred to a radiolucent table, and draping is performed.

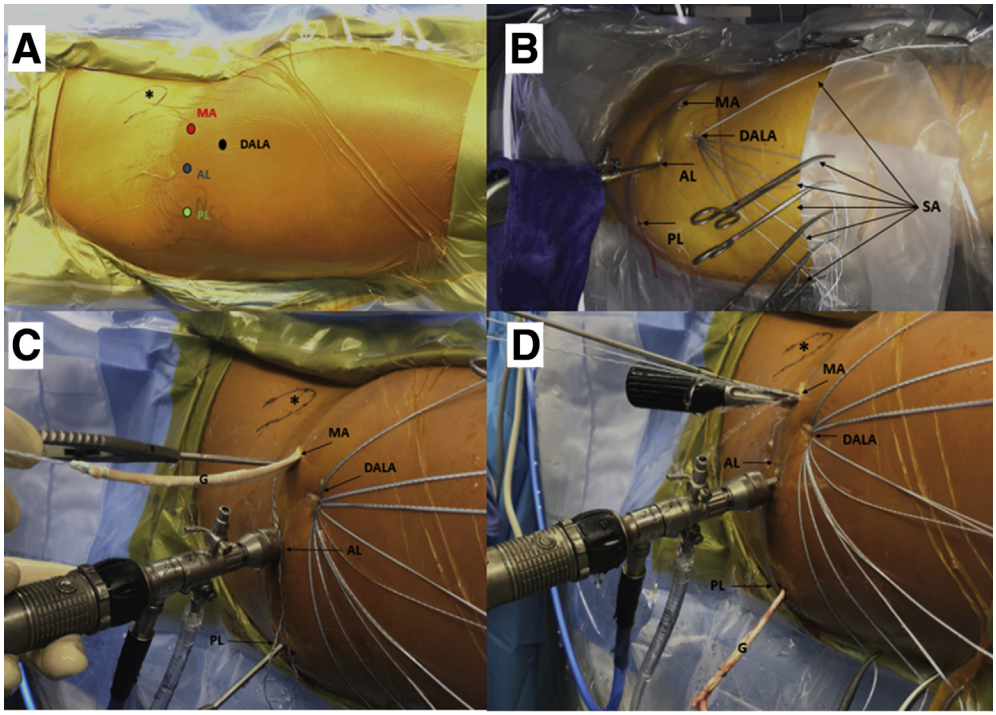

Fig 3. Right hip in a patient in the supine position, with the patient's head to the left. (A) Portals used for arthroscopic phase: anterolateral (AL), midanterior (MA), distal anterolateral accessory (DALA), and posterolateral (PL). (B-D) The AL portal serves as the viewing portal with a 70° arthroscope. All knotless SutureTak anchors (SA) are placed sequentially through the DALA portal from medial to lateral on the acetabular rim, with care taken to secure each limb in the same order of placement to the surgical drapes from inferior to superior to avoid confusion during graft fixation. The asterisks indicate the anterior inferior iliac spine. (G, graft.)

matching to the size and location of the original defect and essentially circumferential reconstruction (Fig 6). Additional arthroscopic procedures for the treatment of other intra-articular pathologies may then proceed.

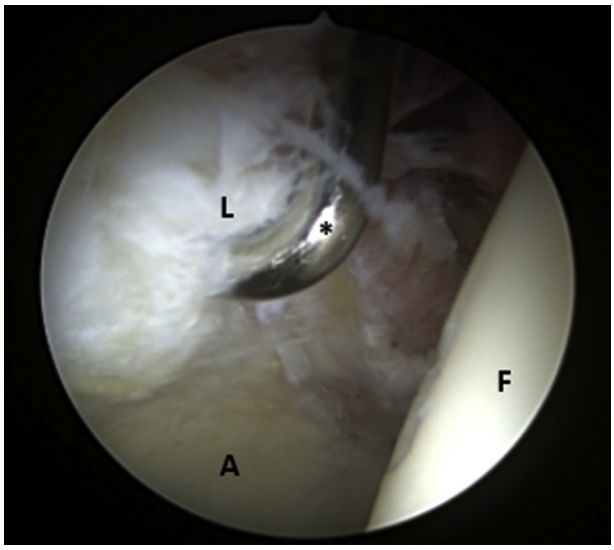

Fig 4. Right hip in a 17-year-old female patient with previous failed right hip arthroscopy. The patient is in the supine position. Routinely, systematic diagnostic arthroscopy is performed viewing from the anterolateral portal with a 70° arthroscope and a 3-mm probe (asterisk) coming through the midanterior portal with intraoperative evidence of an irreparable labral tear (L). (A, acetabulum; F, femoral head.)

Periacetabular Osteotomy

After completion of the arthroscopic phase, the patient is transferred to a radiolucent table (Fig 2 C and D). A PAO technique as described by Ganz et al.[18] and modified by Murphy and Millis[19] with a modified iliofemoral incision is used (Video 1). Superficial dissection is performed with identification of the anterior superior iliac spine (ASIS). The interval between the medial joint capsule and iliopsoas is developed, and ischial osteotomy is performed before pubis osteotomy. The ilium is exposed, with care taken regarding the abductors attached to the lateral iliac wing, and with a sagittal saw, an osteotomy from the ASIS to the pelvic ring is created. The final posterior column osteotomy is connected to the ischial osteotomy, allowing fragment mobilization and correction under fluoroscopy, which

Table 1. Surgical Indications and Contraindications for Labral Reconstruction With Concomitant PAO

Indications	Contraindications
Intraoperative findings of nonviable and/or irreparable labral tear*	Reparable tear*
Frank dysplasia with LCEA < 18°	Advanced osteoarthritis
No evidence of severe chondral damage on dGEMRIC MRA	Active infection
Tönnis grade ≤ 1	Skeletally immature patient (age < 12 yr)
	Bipolar and severe chondral damage

dGEMRIC, delayed contrast-enhanced magnetic resonance imaging of cartilage; LCEA, lateral center-edge angle; MRA, magnetic resonance arthrography; PAO, periacetabular osteotomy.

*Only for labral reconstruction.

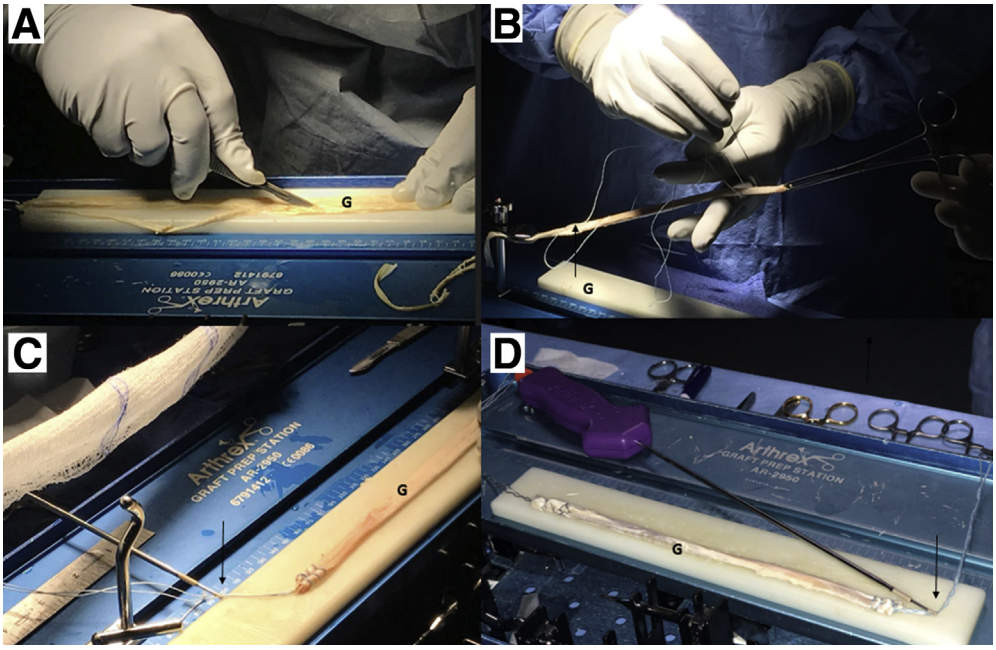

Fig 5. (A, B) Preparation of anterior tibialis allograft (G). The anterior tibialis allograft should be at least 7 mm wide and 220 mm long to ensure appropriate filling of the circumferential defect and restoration of the suction seal. (C, D) Final product after anterior tibialis allograft (G) preparation. The arrows indicate the free FiberLoop endings that go through a 2.9-mm PushLock anchor and will correspond to the most medial (3-o'clock position) part of the construct.

is held in place with four 4.5-mm fully threaded screws. Capsular repair or plication is performed, and the ASIS is repaired. Preoperative and postoperative radiographs show the final construct in Figure 7.

Postoperative Course

An epidural catheter is used for 48 hours for pain control. A continuous passive motion machine is used for 4 weeks beginning on postoperative day 1.

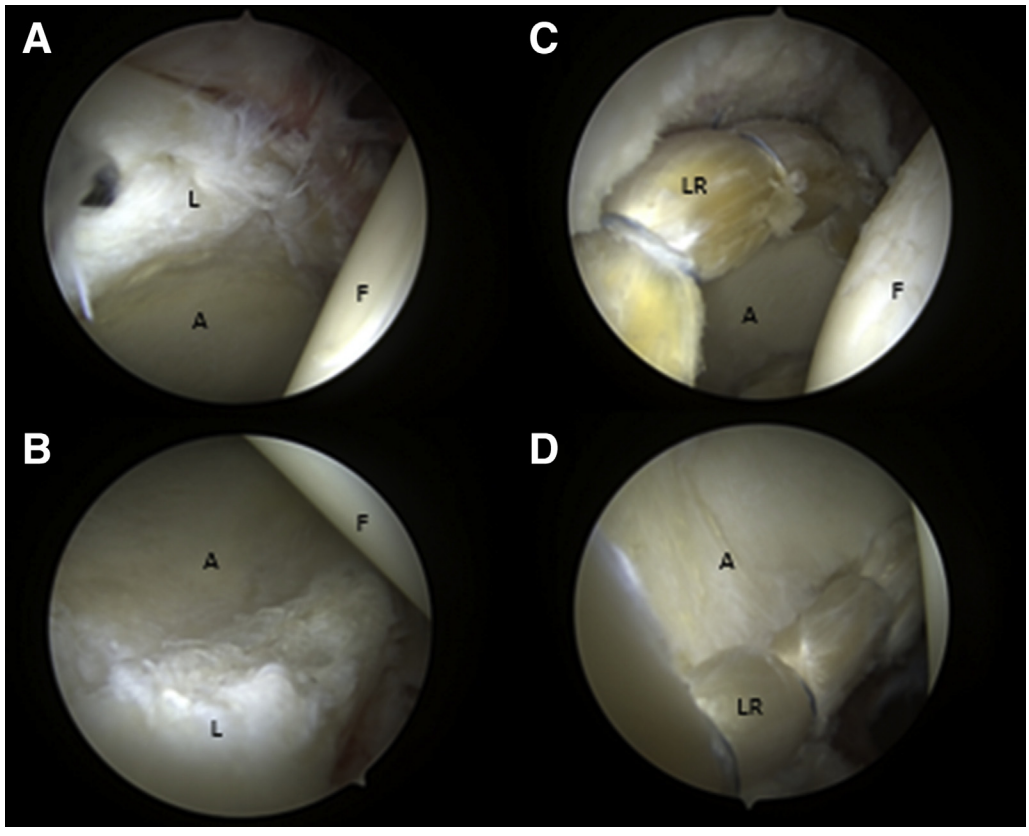

Fig 6. Right hip in a 17-year-old female patient with previous failed right hip arthroscopy. The patient is in the supine position. (A-D) The "before and after" sequence during circumferential labral reconstruction (LR) is shown in the setting of an irreparable labral tear (L) and frank hip dysplasia; the anterolateral portal is used as the viewing portal with a 70° arthroscope, with the acetabulum (A) located to the left and femoral head (F) located to the right: perspective of irreparable labral tear (L) from 12- to 3-o'clock position (A) and continuity of irreparable labral tear (L) from 11- to 7-o'clock position (B) before reconstruction and perspective from 12- to 3-o'clock position (C) and from 11- to 7-o'clock position (D) after circumferential LR.

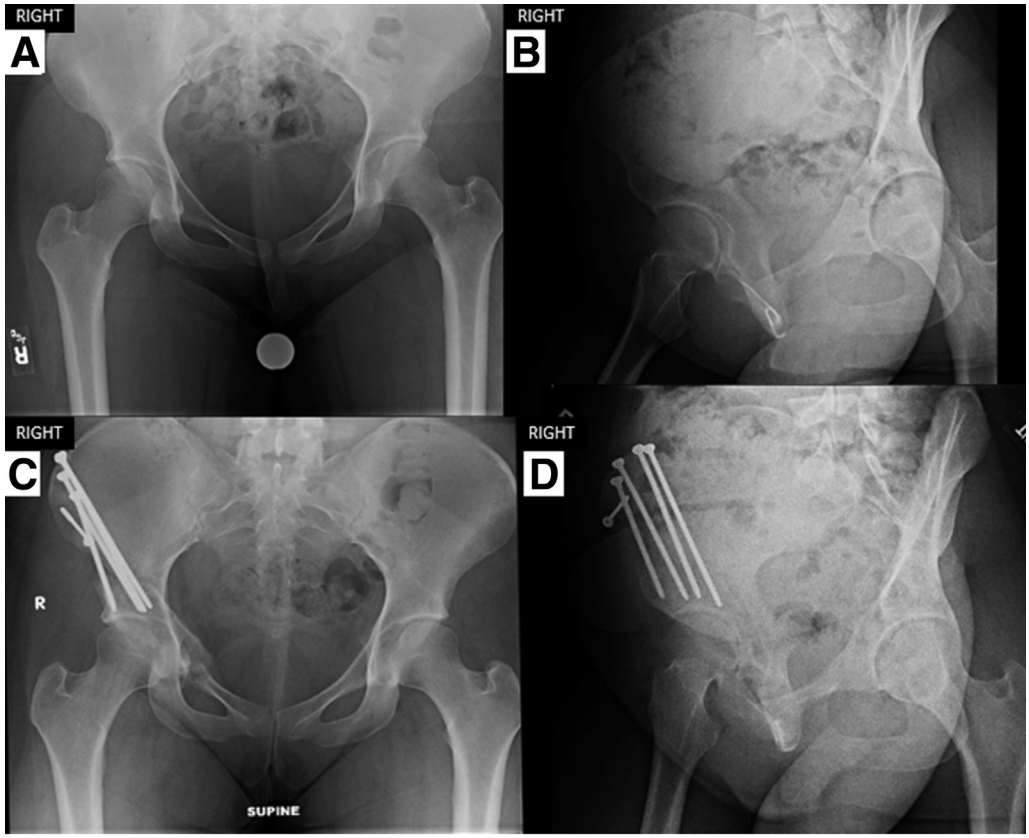

Fig 7. (A, B) Anteroposterior pelvis and false-profile right (R) hip projections before periacetabular osteotomy in a 17-year-old female patient with previous failed right hip arthroscopy with evidence of frank hip dysplasia. (C, D) After periacetabular osteotomy, appropriate acetabular femoral coverage has been achieved.

Postoperative Rehabilitation

The patient is placed in a brace (Donjoy X-Act ROM Hip Brace; DJO Global, Vista, CA) for 6 weeks to protect the hip and limit abduction and rotation. Use of crutches is encouraged for 8 weeks with weight-bearing restriction of up to 20% of body weight. Gentle passive range-of-motion exercise is initiated during the first week, under the supervision of a physiotherapist. Active hip flexion is not allowed until week 8.

Discussion

The purpose of this technique is to restore normal hip biomechanics to a patient with an irreparable labral tear in the setting of true dysplasia by correcting bony abnormalities through PAO, reconstructing a functional labrum, and addressing other associated intra-articular pathologies. Hip dysplasia is well recognized as a leading cause of secondary osteoarthritis in the active young adult. In fact, 20% to 40% of patients with osteoarthritic hips have a history of dysplasia.[11,12] Female sex and familial antecedents are known risk factors. The necessity for total hip arthroplasty at a relatively young age is a concern in terms of implant durability and stability,[20] and the likelihood of a more difficult and unpredictable revision surgical procedure may be as much as 25% higher compared with the general population.[21,22] Bony correction and reorientation in dysplastic sockets through rotational osteotomies have proved to be a good hip-preservation option.[12,23] The Bernese PAO has been shown to be an efficacious procedure in experienced hands,[23] yielding good results even in the long term,[24-26] with survivorship of over 60% at 20 years.[27] Tables 2 and 3 review the advantages and disadvantages of arthroscopic procedures concomitant with PAO, and Table 4 presents pearls and pitfalls.

The use of isolated hip arthroscopy in the setting of hip dysplasia remains controversial.[11,28] Results and outcomes vary greatly between true hip dysplasia and "borderline dysplasia," as well as capsular

Table 2. Advantages and Disadvantages of Concomitant Arthroscopy With PAO

Advantages	Disadvantages
Intra-articular arthroscopic visualization	Steep learning curve
	Meticulous technique
Arthroscopic treatment of concomitant pathologies such labral tears, FAI, SSI, and IPI	Hip traction
	Fluid extravasation, which may make open approach more difficult
	Lack of long-term follow-up

FAI, femoroacetabular impingement; IPI, iliopsoas impingement; PAO, periacetabular osteotomy; SSI, subspine impingement.

Table 3. Advantages and Disadvantages of Concomitant Arthroscopic Labral Reconstruction With PAO

Advantages	Disadvantages
Restoration of labral suction-seal effect	Technically demanding procedure
Restoration of labral function	Longer OR time
	Possible increase in inherent potential arthroscopic complications

OR, operating room; PAO, periacetabular osteotomy.

management.[29-32] Authors have published good results in patients with borderline hip dysplasia with appropriate patient selection criteria and appropriate capsular and labral management.[32,33] Lodhia et al.[10] pointed out in a systematic review that arthroscopy alone with capsular plication improved outcomes at short-term and midterm follow-up in borderline hip dysplastic cases. Discouraging results with isolated hip arthroscopy for true dysplasia have been reported.[34-36] Uchida et al.[30] concluded that patients with a lateral center-edge angle below 19° were at risk of failure after hip arthroscopic surgery even with adequate capsular management. In a recent systematic review, Yeung et al.[37] concluded that hip arthroscopy alone leads to a high rate of reoperation and conversion to total hip arthroplasty in true hip dysplasia cases.

Arthroscopy may be more effective than arthrotomy in the recognition of associated intra-articular hip pathologies in patients with hip dysplasia undergoing PAO.[5] Redmond et al.[13] established this difference between hip arthrotomy and hip arthroscopy in patients who underwent PAO. They found statistically significant differences: Labral tears were found in 21% of arthrotomy cases versus 84% of arthroscopy cases. It is interesting that only arthroscopic evaluation studies reported acetabular and femoral chondral damage, with rates of 73% and 27%, respectively.[13]

Risk factors that accompany arthroscopic labral reconstruction and PAO along with limitations of the procedure are listed in Table 5. Concomitant hip arthroscopy with labral reconstruction and PAO offers a feasible alternative for the management of young active adult patients with true acetabular dysplasia and irreparable labral tears; however, midterm and long-term follow-up is still needed.[38]

Table 4. Pearls and Pitfalls

Pearls	Pitfalls
Minimal to no acetabular trimming	Not addressing associated intra-articular pathologies such as FAI, SSI, loose bodies, and IPI
Use knotless anchor technology to decrease surgical time	Minimal experience in advanced arthroscopic techniques may result in nonreproducible procedure
Use allograft to reduce donor-site morbidity and complications	
Preservation of capsule for further capsular plication	
Ideally, 2 different lead surgeons, one for each surgical phase (arthroscopy and open)	

FAI, femoroacetabular impingement; IPI, iliopsoas impingement; PAO, periacetabular osteotomy; SSI, subspine impingement.

Table 5. Risks and Limitations

Risks	Limitations
Abdominal extravasation	Trained surgical team and staff
Abdominal compartment syndrome	2 surgical teams
	Available allograft
Tight compartment syndrome	Challenging and demanding procedures
Increased neurologic lesion risk	

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