# Management of Incarcerating Pincer-Type Femoroacetabular Impingement With Hip Arthroscopy

Amir A. Jamali, M.D., Andrea Palestro, B.F.A., John P. Meehan, M.D., and Meghan Sampson, B.S.

**Abstract:** This report describes the arthroscopic management of a case of incarcerating pincer-type femoroacetabular impingement. The hip joint had a marked restriction of range of motion and secondary pain as a result of osteophytes wrapping around the femoral head down the femoral neck. The patient was treated with staged bilateral hip arthroscopy. The procedures were initially performed through the peripheral compartment to remove the incarcerating acetabular rim, followed by arthroscopy of the central compartment with acetabuloplasty and femoral head osteochondroplasty. The patient's treatment has led to an excellent clinical and radiographic result at 24 months' follow-up despite an unrelated pelvic fracture sustained in the postoperative period. This technique emphasizes the capabilities of hip arthroscopy in advanced cases of femoroacetabular impingement as an alternative to arthroplasty for patients with healthy articular cartilage.

Pincer-type femoroacetabular impingement (FAI) is a source of significant pain in the hip in up to 8% of the population.[1-4] It is usually associated with acetabular retroversion but can also be a result of global overcoverage. Impingement between the rim of the acetabulum and the proximal femur has been recognized since the early part of the 20th century. Smith-Petersen[5] recommended open acetabuloplasty for the treatment of coxa protrusio in isolation or in combination with femoral deformities. This philosophy has gained new momentum in the past decade based on the work of Ganz and colleagues[6-9] and the development of a safe approach to surgical dislocation of the hip. Arthroscopic approaches have subsequently been developed that seek to achieve the same goals in a minimally invasive fashion, either with or without repair or reconstruction of the acetabular labrum.[10-15] However, in the case of severe global pincer-type FAI, arthroscopy has had a limited role and has not been widely used. Matsuda[16] recently published a case report on the staged arthroscopic management of bilateral pincer-type FAI in the setting of coxa protrusio. The patient had a satisfactory outcome at a minimum follow-up of 1 year.

In the case presented in this report, a patient with severe pincer-type FAI in the absence of coxa protrusio was treated arthroscopically. He had concurrent loss of femoral head/neck offset. He presented with pain and a marked restriction of range of motion with little evidence of articular cartilage degeneration.

## Technical Note With Report of 2 Cases in a Single Patient

The patient was a 54-year-old man with a history of post-traumatic stress disorder, diet-controlled hyperglycemia, and several surgeries as a result of a motorcycle accident. He reported that for many years, he had had bilateral hip pain and decreased range of motion that limited his activities. His pain was severe, self-assessed as being constantly 8 to 9 of 10 bilaterally and worsened with activity. He used a cane occasionally and had received a few hip injections with limited, short-term benefit. He had taken nonsteroidal antiinflammatory medications and oral narcotics.

On physical examination, the patient's hips were not tender to palpation and had normal alignment. He had no tenderness along the greater trochanteric region. Examination of both hips showed a range of motion

*From the Joint Preservation Institute (A.A.J., A.P., M.S.); and Sacramento Knee and Sports Medicine (J.P.M.), Sacramento, California, U.S.A.*

*The authors report the following potential conflict of interest or source of funding: A.A.J. receives support from California Orthopaedic Association, Zimmer, Biomet, and Synvasive.*

*Received December 22, 2011; accepted September 20, 2013.*

*Address correspondence to Amir A. Jamali, M.D., Joint Preservation Institute, 2825 J St, Ste 440, Sacramento, CA 95682, U.S.A. E-mail: contactus@jointpreservationinstitute.com*



*2212-6287/11861/$36.00*

*http://dx.doi.org/10.1016/j.eats.2013.09.015*

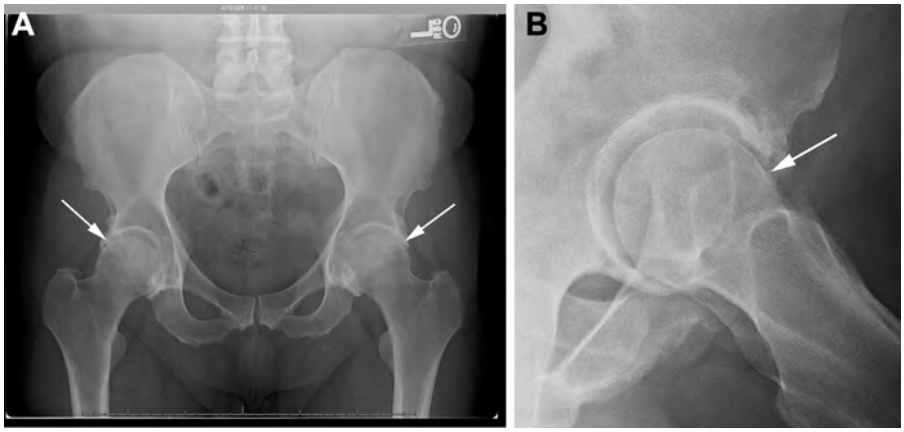


**Fig 1.** (A) A preoperative anteroposterior pelvis radiograph showed substantial acetabular overhang (arrows) with the appearance of lateral joint space narrowing, which was due to circumferential labral ossification. (B) A preoperative frog-lateral radiograph of the left hip showed extensive acetabular osteophytosis, a decreased femoral head/neck offset, and an aspherical femoral head anteriorly (arrow).

(right/left) of 100°/90° for flexion, 50°/35° for external rotation, 10°/−5° for internal rotation, and 15°/15° for abduction. The anterior impingement sign was positive bilaterally with a sharp, pinching pain with flexion, adduction, and internal rotation of the hip.[17] Findings of the motor, sensory, and vascular examinations were normal for both lower extremities.

**Table 1.** Steps Involved in Treatment of Incarcerating Pincer-Type FAI With Hip Arthroscopy

| |
|---|
| 1. Obtain full pharmacologic muscle relaxation. |
| 2. Attempt joint distraction. In these cases, distraction is typically impossible. |
| 3. Flex the hip to 30° to 40° of flexion. |
| 4. Perform a limited capsulotomy/capsulectomy to establish a working space in the anterior hip. |
| 5. Determine the interface between the femoral neck and the acetabulum. |
| 6. Use a motorized arthroscopic burr to remove and thin the acetabular osteophytes until contact is achieved with the neck. |
| 7. Extend the acetabuloplasty proximally until appropriate contour is achieved based on arthroscopic appearance and fluoroscopy. |
| 8. Bring the fluoroscopy unit to a 45° to 50° rainbow position to provide a profile view of the acetabulum and femoral head. |
| 9. Switch portals and perform removal of the acetabular overhang while viewing from the direct anterior portal and using the burr from the anterior paratrochanteric portal. |
| 10. Use the anteroposterior fluoroscopy projection to determine the adequacy of the initial rim recontouring. |
| 11. Bring the leg into the fully extended position. |
| 12. Attempt to apply traction while confirming ongoing full muscle relaxation. |
| 13. Use a burr or bone cutter to puncture the acetabular rim while visualizing the position of the femoral head to avoid iatrogenic injury to the femoral head cartilage. |
| 14. Finalize the rim recontouring, taking great care to avoid sharp bony edges in contact with the femoral head. A 5.5-mm burr is very helpful in creating a rounded surface at the rim. |
| 15. Perform labral reconstruction if desired. |
| 16. Perform femoral head osteochondroplasty if indicated. |
| 17. Flex the hip to 100° to 110° to confirm the achieved range of motion. |
| 18. Depending on patient age, consider reconstruction of the labrum with autogenous fascia lata or allograft tissue. |

Radiographic examination showed bilateral joint space narrowing predominating peripherally, with maintenance of a healthy joint space superiorly (Fig 1A). There was extensive labral ossification and an aspherical femoral morphology characteristic of cam-type FAI. Extensive anterior overhanging osteophytosis and a decreased head/neck offset could be seen on the lateral hip radiograph (Fig 1B). The patient had seen several surgeons who had recommended total hip arthroplasty as the only feasible treatment option. On the basis of his clinical and radiographic findings, he was offered left hip arthroscopy with debridement, acetabuloplasty, and femoral head osteochondroplasty. He ultimately underwent the identical procedure on the right side 5 months after the left hip arthroscopy.

## Surgical Procedure (Identical for Left and Right Sides)

The arthroscopic procedure (Video 1 shows additional details) was performed in a staged fashion; the left side was treated 5 months before the right side. The patient was placed in the supine position under general endotracheal anesthesia with full muscle relaxation (Table 1). Both legs were padded with gel and cast padding and placed in the traction boots of a portable traction table (Supine Hip Positioning System; Smith & Nephew, Andover, MA). Axial traction was applied to the operative leg with comparable countertraction to the contralateral side. Absolutely no distraction of the joint was achieved because of the incarceration of the femoral head by the acetabular bone spurs.

The hip was prepared and draped in the standard fashion. Standard arthroscopic portals were marked on the skin and confirmed with the image intensifier. The anterior paratrochanteric portal was established at approximately the level of the greater trochanteric tip in the coronal plane and 1 cm anterior to the tip in the sagittal plane. The hip was then flexed up to 30° with

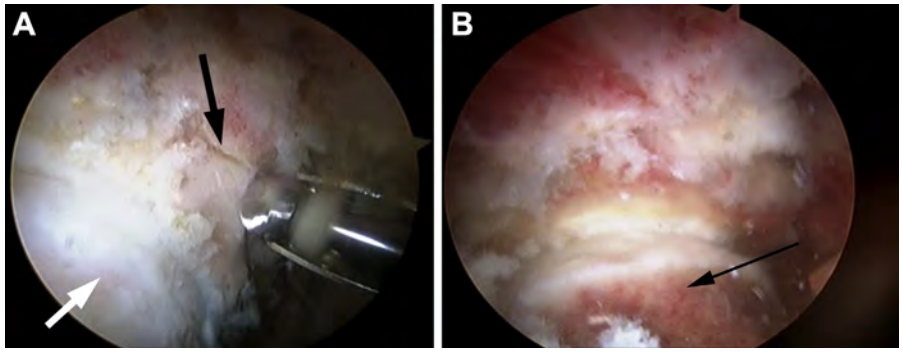


**Fig 2.** (A) The left hip acetabular rim was trimmed with a 5.5-mm round burr brought in from the anterior paratrochanteric portal, viewing from the direct anterior portal. The leg was off traction with the hip flexed 45°. The femoral head is shown (white arrow), and the interface between the normal rim and the ossified labrum can be seen (black arrow). (B) At the end of the acetabular rim recontouring and the femoral head osteochondroplasty (arrow), the hip was flexed to 90°, showing impingement-free range of motion. The arthroscope is viewing from the direct anterior portal.

the traction table by release of the ankle range of motion and flexion of the knee.

The peripheral compartment was entered. An extensive capsulotomy was performed with the assistance of a long arthroscopic shaver (Dyonics 4.5-mm-long full-radius shaver; Smith & Nephew) to eliminate any constraint of the joint range of motion. This also facilitated the view of the proximal femur and acetabular osteophytes. Acetabular osteophytes were apparent completely enclosing the femoral head and extending down onto the femoral neck. A 5.5-mm motorized burr (Smith & Nephew) was then used to carefully perform an anterior acetabuloplasty until the acetabular tissue was noted to be adequately thin to be removed with an arthroscopic biter (Fig 2A). This was continued from the 3-o'clock (anteromedial) position to the 1-o'clock (anterosuperior) position. A span of the acetabular bone of approximately 2 cm was resected in the proximal-to-distal dimension with a thickness of approximately 1 cm at the re-established acetabular rim. Next, the leg was brought back into full extension, and another attempt was made to apply traction. Traction could then be established to distract the hip by approximately 1 cm. However, a clear view of the central compartment was still not possible because of the lateral acetabular osteophytes. A 4.0-mm burr (Dyonics Full Radius Bone Cutter; Smith & Nephew) was used to create a transosseous approach into the acetabulum using the image intensifier. This opening was then expanded anteriorly and posteriorly to approximately the 10- to 11-o'clock (posterosuperior) position. Examination of the central compartment showed mild diffuse chondromalacia but no focal defects. The acetabuloplasty was then completed from the 10-o'clock (posterosuperior) to 4-o'clock (anteroinferior) position. The hip was again flexed, and an osteochondroplasty was performed on the femoral head/neck extending from the medial synovial fold to the lateral synovial fold to re-establish normal offset and morphology to this region. The hip was then flexed to 90° with no evidence of contact between the femoral neck and the acetabular rim (Fig 2B).

The instruments were removed, and the portals were closed in the standard fashion with nylon sutures. Immediate postoperative radiographs showed marked improvement in hip morphology on both the femoral and acetabular sides (Fig 3).

**Fig 3.** A frog-lateral radiograph of the hip at 2 months postoperatively showed marked improvement in the morphology of the femoral head (arrowhead) and anterior acetabular rim (arrow).

## Postoperative Course

Postoperatively, the patient had an uneventful recovery on both sides. He was extremely happy with the results of the procedure until he was involved in a

motorcycle accident 12 months after the procedure on the left hip and 7 months after the procedure on the right hip. This accident led to a pelvic ring injury. As part of the workup for this injury, he underwent computed tomography scanning with 3-dimensional reconstructions (Fig 4). The scan showed the absence of any further acetabular osteophytosis and relatively normal morphology. His pelvic injury was associated with an incisional hernia and a prolonged recovery. He underwent percutaneous fixation of his posterior pelvic ring injury as well as anterior plating. The hardware was removed 1 year later. Much of his pubic pain has since resolved. At 24 months after the second hip arthroscopy, the patient had no hip pain. He had 130° of flexion of both hips (left hip flexion is shown in Fig 5), 50° of external rotation, 10° of internal rotation, and a 15° flexion contracture bilaterally. Impingement signs were negative bilaterally both anteriorly and posteriorly. An anteroposterior pelvis radiograph showed some recurrent osteophyte formation on the acetabular side posteriorly on the right side but a well-maintained joint space bilaterally.

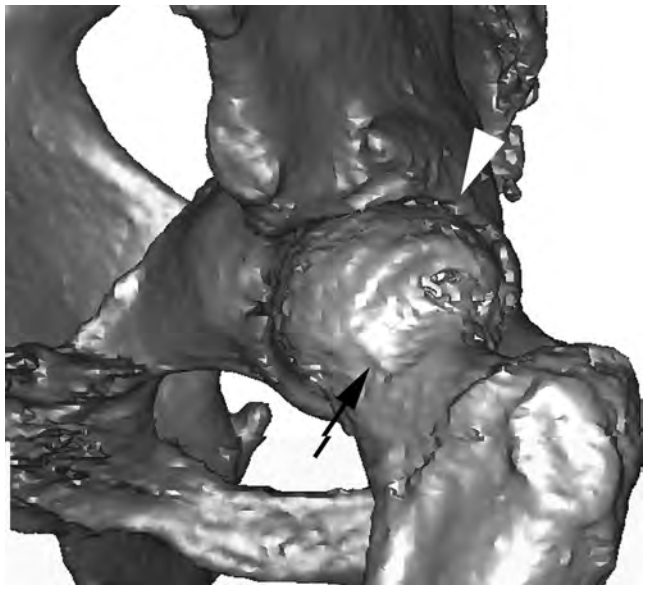

**Fig 4.** A 3-dimensional computed tomography reconstruction image of the left hip taken during the treatment of the patient's subsequent pelvic injury, 12 months after left hip arthroscopy, indicated improved morphology of both the femoral head/neck (arrow) and the acetabular rim (arrowhead).

## Discussion

This case demonstrates a clinically successful outcome after arthroscopic acetabular rim resection in the face of a femoral head incarcerated by the acetabulum. In the presence of healthy articular cartilage on both the femoral head and acetabulum, this strategy has proven successful in this case. Most patients with severe protrusio and/or acetabular rim overgrowth have advanced articular cartilage loss and osteoarthritis. In our patient the articular cartilage of the femoral head and acetabulum was relatively spared of osteoarthritis. The manifestation of arthritis in this patient was global acetabular rim overgrowth without femoral head protrusio. A transosseous approach to the central compartment was used to access the acetabulum, and this opening was expanded anteriorly and posteriorly to achieve adequate bony resection.

Despite the benefits of the procedure in this case, the procedure includes a number of limitations. These include the lack of reconstruction of the acetabular labrum. It was believed that such a reconstruction with allograft or autograft tissue would be at risk of heterotopic ossification, leading to a recurrence of the original problem. Furthermore, the resection on the posterior aspect of the hip (below the 10:30 position referencing a right hip) was limited by the operative access to this region and based on the patient's main complaints of limitation of hip flexion rather than any issues with hip extension.

Removal of bone spurs to improve range of motion has multiple analogs in other areas of orthopaedics, including elbow surgery, hand surgery, and foot surgery. In the hip, Smith-Petersen[5] reported on the use of acetabuloplasty in the case of protrusio, termed "intrapelvic protrusion of the acetabulum." His technique was performed through the classic Smith-Petersen approach, which requires an extensile anterior approach to the hip. More recently, FAI has been implicated as a risk factor for osteoarthritis of the hip. This condition has been classified into cam and pincer types.[7,8] The cam type is associated with an aspherical femoral head, which leads to a high risk of articular cartilage damage on the acetabular side because of

**Fig 5.** Clinical photograph of patient taken 24 months after second surgery. He showed pain-free hip flexion to approximately 120° on the left side but continued to have a 15° flexion contracture bilaterally.

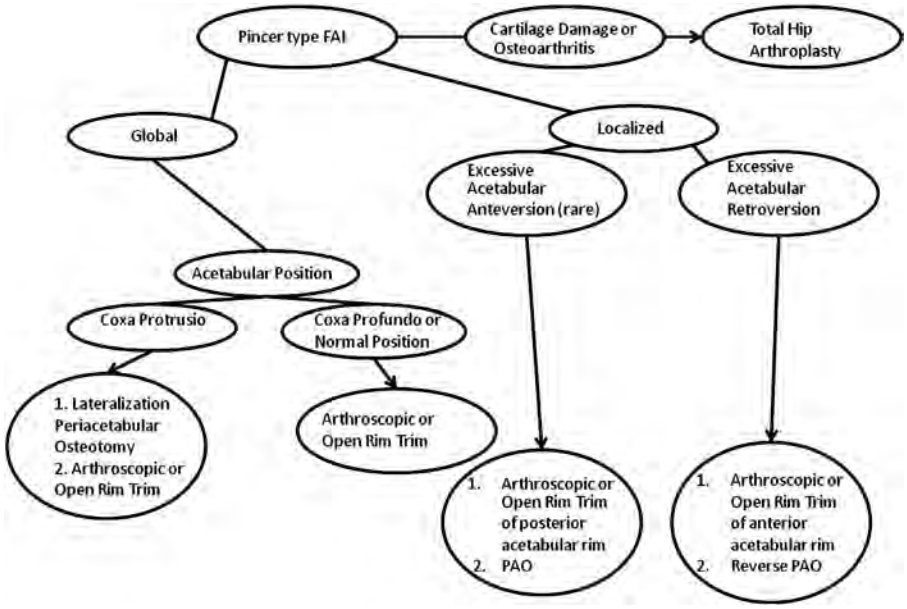


**Fig 6.** General treatment algorithm of senior author in treating pincer-type FAI in patients in whom nonsurgical treatment has failed. (PAO, periacetabular osteotomy.)

shearing forces from the femoral head. The pincer type can be due to acetabular retroversion or due to ossification of the acetabular labrum. Various treatment options have been proposed for FAI including periacetabular osteotomy[18] and acetabular and femoral head recontouring through open surgical dislocation, a limited open direct anterior approach,[19] or an all-arthroscopic approach (Fig 6).[15]

The arthroscopic technique has several advantages over open techniques such as surgical dislocation. It avoids the need for a large open incision with trochanteric osteotomy and the subsequent complications associated with that procedure. Despite these benefits, the technique has a number of critical limitations. First, the arthroscopic technique requires a substantial capsulotomy. In most cases such capsulotomies are of no clinical consequence. However, iatrogenic hip instability has been reported in some cases.[20] Patients with generalized laxity and hip dysplasia should be considered at risk of such instability and progression to osteoarthritis.[21] Fortunately, it is rare to encounter patients with generalized laxity in combination with the acetabular rim overgrowth as seen in this case. A second limitation of arthroscopic treatment is the preferential access to the anterior acetabulum compared with the posterior acetabulum. Although arthroscopic approaches can access the posterior acetabulum, the position of the sciatic nerve and the greater trochanter limit the angles for instrument placement. As shown in the case report by Matsuda,[16] anterior and posterior access to the acetabulum can be achieved arthroscopically.

Because the procedure starts with no traction, there is some protection from traction neurapraxia. However, it is critical to avoid excessive traction during central-compartment arthroscopy. Excessive traction could lead to sciatic nerve injury as well as compression neurapraxia of the pudendal nerve and superficial peroneal nerve on the dorsum of the foot.

In summary, this case provides an alternative treatment for patients who have a healthy intra-articular joint space but extensive acetabular osteophytes combined with a decreased femoral head/neck offset leading to incarceration of the femoral head within the acetabulum.

## References

1. Jamali AA, Mladenov K, Meyer DC, et al. Anteroposterior pelvic radiographs to assess acetabular retroversion: High validity of the "cross-over-sign." *J Orthop Res* 2007;25:758-765.
2. Ezoe M, Naito M, Inoue T. The prevalence of acetabular retroversion among various disorders of the hip. *J Bone Joint Surg Am* 2006;88:372-379.
3. Giori NJ, Trousdale RT. Acetabular retroversion is associated with osteoarthritis of the hip. *Clin Orthop Relat Res* 2003:263-269.
4. Perreira AC, Hunter JC, Laird T, Jamali AA. Multilevel measurement of acetabular version using 3-D CT-generated models: Implications for hip preservation surgery. *Clin Orthop Relat Res* 2011;469:552-561.
5. Smith-Petersen MN. Treatment of malum coxae senilis, old slipped upper femoral epiphysis, intrapelvic protrusion of the acetabulum, and coxa plana by means of acetabuloplasty. *J Bone Joint Surg* 1936;18:869-880.
6. Beck M, Kalhor M, Leunig M, Ganz R. Hip morphology influences the pattern of damage to the acetabular cartilage: Femoroacetabular impingement as a cause of early osteoarthritis of the hip. *J Bone Joint Surg Br* 2005;87:1012-1018.

7. Ganz R, Leunig M, Leunig-Ganz K, Harris WH. The etiology of osteoarthritis of the hip: An integrated mechanical concept. *Clin Orthop Relat Res* 2008;466:264-272.
8. Ganz R, Parvizi J, Beck M, Leunig M, Notzli H, Siebenrock KA. Femoroacetabular impingement: A cause for osteoarthritis of the hip. *Clin Orthop Relat Res* 2003: 112-120.
9. Lavigne M, Parvizi J, Beck M, Siebenrock KA, Ganz R, Leunig M. Anterior femoroacetabular impingement: Part I. Techniques of joint preserving surgery. *Clin Orthop Relat Res* 2004:61-66.
10. Ayeni OR, Wong I, Chien T, Musahl V, Kelly BT, Bhandari M. Surgical indications for arthroscopic management of femoroacetabular impingement. *Arthroscopy* 2012;28:1170-1179.
11. Matsuda DK, Carlisle JC, Arthurs SC, Wierks CH, Philippon MJ. Comparative systematic review of the open dislocation, mini-open, and arthroscopic surgeries for femoroacetabular impingement. *Arthroscopy* 2011;27: 252-269.
12. Leunig M, Mast NH, Impellizerri FM, Ganz R, Panaro C. Arthroscopic appearance and treatment of impingement cysts at femoral head-neck junction. *Arthroscopy* 2012;28: 66-73.
13. Larson CM, Giveans MR. Arthroscopic management of femoroacetabular impingement: Early outcomes measures. *Arthroscopy* 2008;24:540-546.
14. Jamali AA, Fritz AT, Reddy D, Meehan JP. Minimally invasive bone grafting of cysts of the femoral head and acetabulum in femoroacetabular impingement: Arthroscopic technique and case presentation. *Arthroscopy* 2010;26:279-285.
15. Philippon MJ, Schenker ML. A new method for acetabular rim trimming and labral repair. *Clin Sports Med* 2006;25:293-297,ix.
16. Matsuda DK. Protrusio acetabuli: Contraindication or indication for hip arthroscopy? And the case for arthroscopic treatment of global pincer impingement. *Arthroscopy* 2012;28:882-888.
17. Tijssen M, van Cingel R, Willemsen L, de Visser E. Diagnostics of femoroacetabular impingement and labral pathology of the hip: A systematic review of the accuracy and validity of physical tests. *Arthroscopy* 2012;28: 860-871.
18. Siebenrock KA, Schoeniger R, Ganz R. Anterior femoroacetabular impingement due to acetabular retroversion. Treatment with periacetabular osteotomy. *J Bone Joint Surg Am* 2003;85:278-286.
19. Laude F, Sariali E, Nogier A. Femoroacetabular impingement treatment using arthroscopy and anterior approach. *Clin Orthop Relat Res* 2009;467:747-752.
20. Matsuda DK. Acute iatrogenic dislocation following hip impingement arthroscopic surgery. *Arthroscopy* 2009;25: 400-404.
21. Mei-Dan O, McConkey MO, Brick M. Catastrophic failure of hip arthroscopy due to iatrogenic instability: Can partial division of the ligamentum teres and iliofemoral ligament cause subluxation? *Arthroscopy* 2012;28:440-445.