

Basic Hip Arthroscopy: Supine Patient Positioning and Dynamic Fluoroscopic Evaluation



Sandeep Mannava, M.D., Ph.D., Elizabeth A. Howse, M.D., Austin V. Stone, M.D., Ph.D.,
and Allston J. Stubbs, M.D., M.B.A.

Abstract: Hip arthroscopy serves as both a diagnostic and therapeutic tool for the management of various conditions that afflict the hip. This article reviews the basics of hip arthroscopy by demonstrating supine patient positioning, fluoroscopic evaluation of the hip under anesthesia, and sterile preparation and draping. Careful attention to detail during the operating theater setup ensures adequate access to the various compartments of the hip to facilitate the diagnosis of disease and treatment with minimally invasive arthroscopy. Furthermore, having a routine method for patient positioning and operative setup improves patient safety, as well as operative efficiency, as the operative team becomes familiar with the surgeon's standard approach to hip arthroscopy cases.

Hip arthroscopy is gaining more popularity as both a diagnostic and therapeutic procedure performed by orthopaedic surgeons.¹⁻³ The number of arthroscopic hip procedures has increased 6-fold based on the number of reported hip arthroscopies performed by American Board of Orthopaedic Surgery Part II examinees over the 5-year period from 2006 through 2010.⁴ Indications for hip arthroscopy have also expanded since Burman's first description of the procedure in 1931.⁵ Modern hip arthroscopy can address focal chondromalacia, labral tears, septic arthritis, synovial chondromatosis, hip instability, osteochondritis dissecans, femoroacetabular impingement, ischiofemoral impingement, removal of loose bodies, ligamentum

teres injuries, and snapping hip syndrome, as well as other hip diseases.⁶⁻¹⁰

This article and [Video 1](#) review the operating theater setup for hip arthroscopy, in particular supine patient positioning, positioning of the arms, application of traction, dynamic fluoroscopic evaluation of the hip under anesthesia, and sterile preparation and draping. Proper positioning of the patient on the operating table allows for efficient access to the deep-seated hip joint and facilitates surgical intervention during arthroscopy.

Surgical Technique

The patient is brought to the operating theater and transferred to the operating table after appropriate patient identification and safety measures, such as marking of the patient in the preoperative holding room by the surgeon ([Table 1](#)). Time-out procedures are performed to ensure patient safety. Typically, general anesthesia with paralysis is induced to facilitate relaxation, and regional methods of anesthesia, such as spinal, epidural, or lumbar plexus blocks, may be used concomitantly for adjuvant postoperative pain control. Hip arthroscopy has been described with the patient in both the lateral position and the supine position; however, at our institution, we prefer supine positioning for hip arthroscopy and will focus on this positioning method in this article and in [Video 1](#). Our anesthesia colleagues also prefer supine patient positioning to facilitate intraoperative anesthetic care during hip arthroscopy. In addition, the anesthesia team is made aware preoperatively of our preference

From the Department of Orthopaedic Surgery, Division of Sports Medicine, Wake Forest University School of Medicine (S.M., A.V.S., A.J.S.), Winston-Salem, North Carolina; and Department of Emergency Medicine, Kaiser Permanente Walnut Creek Medical Center (E.A.H.), Walnut Creek, CA, U.S.A.

The authors report the following potential conflict of interest or source of funding: S.M. receives support from Wake Forest Innovations Spark Award for development of rotator cuff repair device, and Orthopaedic Research and Education Foundation Resident Clinician Scientist Award. A.J.S. receives support from Smith & Nephew Endoscopy, Bauerfeind, and Johnson & Johnson.

Received February 15, 2015; accepted May 18, 2015.

Address correspondence to Allston J. Stubbs, M.D., M.B.A., Department of Orthopaedic Surgery, Wake Forest University School of Medicine, Medical Center Boulevard, Winston Salem, NC 27157, U.S.A. E-mail: astubbs@wakehealth.edu

© 2015 by the Arthroscopy Association of North America

2212-6287/15155/\$36.00

<http://dx.doi.org/10.1016/j.eats.2015.05.005>

Table 1. Potential Pearls and Pitfalls for Supine Positioning for Hip Arthroscopy**Positioning pearls**

- Perform a safety time-out before surgical positioning per institutional protocol.
- Position patients the same way every time to avoid variability.
- Ensure that operating room staff know and understand equipment preferences.
- Place instruments in a similar position to avoid case-to-case variability.

Positioning pitfalls

- Excessive continuous traction can lead to lateral femoral cutaneous nerve neurapraxia, as can inappropriate portal placement.
- A known risk, due to inadequate perineal post padding, is pudendal nerve neurapraxia.
- Hip flexion $>20^\circ$ may result in sciatic nerve injury.

to keep the mean arterial pressure lower than or equal to about 65 mm Hg, when this can be safely accomplished based on various patient factors. Keeping the mean arterial pressure lower than the arthroscopic pump pressure and using epinephrine in the arthroscopic irrigation solution aid in intraoperative arthroscopic visualization. The anesthesia team maintains normothermia throughout the case using warmed intravenous saline solution and the Bair Hugger warming system (3M, St Paul, MN).^{11,12} Warmed arthroscopic solution may also be protective against intraoperative hypothermia, but this option is not used at our institution.¹³

The operating theater setup is shown in [Figure 1](#). The arthroscopic monitors, fluid management system, fluoroscopy/C-arm (OEC Fluoro Scanner; GE Healthcare, Salt Lake City, UT), operating device units such as radiofrequency, and arthroscopic shaver stations should be positioned on the contralateral side, or opposite the surgical side. The surgeon, surgical assistant, and surgical technologist, along with the back primary instrument table and Mayo stand, are positioned on the ipsilateral, operative side. There should be sufficient room for the circulating nurse to access the foot of the fracture table. Intraoperative manipulation of the operative extremity with the addition or subtraction of traction, limb abduction and adduction, and flexion and extension of the hip is necessary for gaining access to the various portions of the intra-articular and extra-articular hip joint.

After general anesthesia is induced, a Foley catheter is placed to decompress and relax the bladder during traction and hip manipulation. The Foley catheter is secured to the patient's abdomen and taken off the head of the operative table so that the anesthesiologist may monitor urine output. Ocular lubrication, additional intravenous access, and placement of additional monitors, as well as other protective anesthesia measures, can be undertaken at this time. A radiofrequency

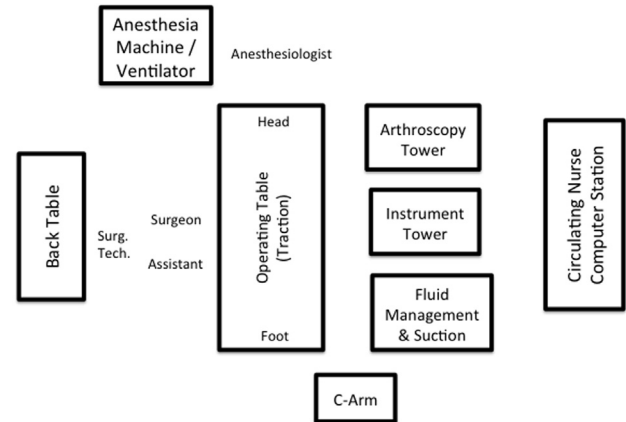
**Layout of Operating Theater for Right Hip Arthroscopy**

Fig 1. Operative theater setup for right-sided hip arthroscopy. The locations of various instruments and equipment in the operating theater are shown. The surgeon, assistants, and instrumentation are located on the operative (right) side of the patient. The arthroscopy tower and associated equipment are located on the contralateral (left) side of the patient. (Surg Tech, surgical technologist.)

grounding pad is also placed at this time on the operative side of the abdomen. A compression stocking is placed on the contralateral lower extremity to prevent deep vein thrombosis.

Next, the patient's bilateral feet and ankles are placed into commercially available foam-padded boots (Philippon Hip; Bledsoe, Grand Prairie, TX) ([Fig 2](#), [Table 2](#)). After the foam-padded boots are secured, with care taken to ensure that no wrinkles are present, the patient is brought down on the standard fracture table (Amsco Orthovision; Steris, Le Haillan, France) or standard operating table with traction attachment and

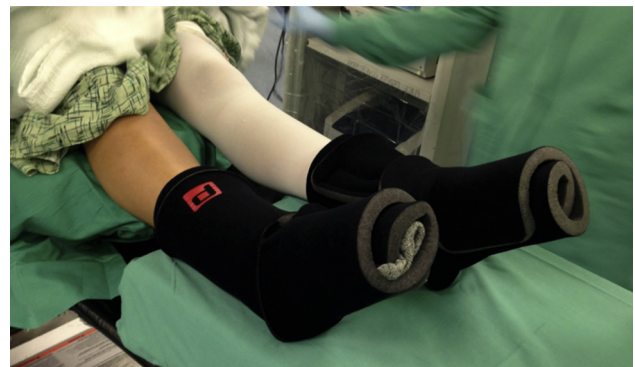


Fig 2. Bilateral feet after placement of commercially available foam-padded boots for right hip arthroscopy. The contralateral (left) leg is depicted with a compression hose to prevent deep vein thrombosis. The ipsilateral, operative (right) leg does not have a compression hose. Care is taken to avoid wrinkles while applying the foam-padded boots to prevent decubitus ulcers.

Table 2. Quick Reference for Hip Arthroscopy Procedure Setup

	Recommendations
Padding of bony prominences	Foam padding, feet and ankles in traction boots, and blankets placed on ipsilateral arm
Ipsilateral upper extremity	Placement across patient's body (flexion <90°), with pulse oximetry, papoose wrapping, and safety belt
Contralateral upper extremity	Arm board (shoulder abducted <60°, elbow flexion <20°) and IV access
Perineal post	Lateralized to operative side—contact with medial thigh (check for genital compression)
Foot and ankle	Traction boots
Fluoroscopy	45° lateral Dunn view, ROM, and vacuum crescent sign
Operative hip	15° of flexion and 0° of adduction before application of traction
Ipsilateral foot	Internal rotation of 10°-15°
Contralateral lower extremity	Delicate countertraction (10-20 lb [4.5-9 kg])

IV, intravenous; ROM, range of motion.

lateralized to the ipsilateral, operative side to facilitate full access to the operative hip. Movement of the patient is coordinated with the anesthesia staff to ensure that the endotracheal tube is secure and with the nursing and operative room staff, as well as the surgeon, to ensure the safety of the patient and the surgical operating room team. The patient's buttocks will need to be positioned at the edge of the table to facilitate application of traction against a well-padded commercially available post (Bledsoe [padding] and Amsco Orthovision [post]) that is positioned toward the operative side, which is placed after initial positioning is performed (Fig 3). More details regarding the post and application of traction will be reviewed later in this article.

The upper extremity ipsilateral to the operative side is positioned away from the operative field by bringing it across the patient's body. We allow for our anesthesia colleagues to ensure that placement of their monitors and intravenous access are adequate throughout the positioning of the upper extremities. The ipsilateral arm is brought over folded blankets and foam padding. The ipsilateral upper extremity is not flexed past 90° at the elbow to prevent ischemia and to facilitate circulation. A pulse oximeter is placed on the ipsilateral upper extremity to monitor oxygen saturation to the upper extremity. Then, a draw sheet is folded, with care taken to ensure that there are no wrinkles in the papoose wrapping, and the arm and patient are secured with a safety belt to fix the upper extremity and patient to the operative table. The contralateral upper extremity is positioned on an arm board with padding of the bony prominences and peripheral nerves. In addition, we

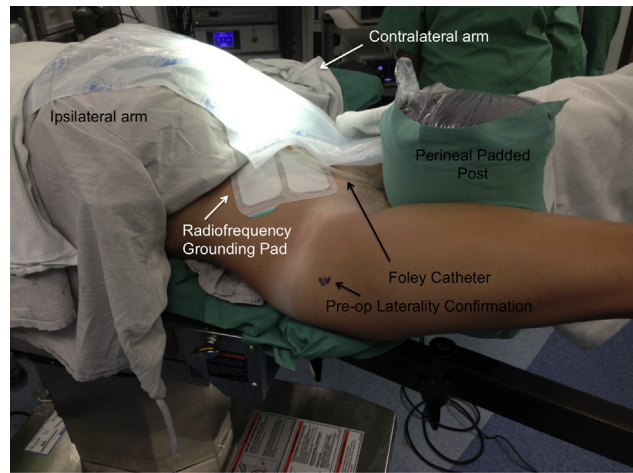


Fig 3. Positioning of operative right hip after placement into traction boots and positioning of perineal padded post for right hip arthroscopy. The arms have been positioned so that the ipsilateral (right) arm is placed over the patient and is well padded, and a papoose wrapping has been applied. The contralateral (left) arm is placed on a standard arm board. The perfusion of both upper extremities is confirmed after positioning. The positioning of the Foley catheter and the radiofrequency grounding pad is also shown.

recommend abduction of the contralateral shoulder of no more than 60° and contralateral elbow flexion of 20°. By allowing the contralateral arm to be free, the anesthesia team is able to gain access to the extremity during the operative procedure throughout the case (Fig 3). Before further positioning is performed, we confirm adequate intravenous flow into the upper extremities.

Attention is then turned toward final positioning adjustment and traction application (Table 3). The perineal post is placed in a lateralized position toward the operative side with the perineum against the padded post, with contact of the medial thigh of the operative hip allowing for controlled lateralization of the femur. The use of a commercially available oversized perineal post that ranges in diameter from 9 to 12 cm is preferred because such posts have been associated with a lower risk of pudendal neurapraxia (Figs 3 and 4).^{14,15} After the post is placed and the patient is moved into position against the post, the

Table 3. Traction Tips

Place the operative hip in 15° of flexion and 0° of adduction before application of traction.
Monitor the amount of total traction time.
Grossly apply manual traction.
Typically, use 25-50 lb (11-23 kg) to achieve adequate joint distraction.
Apply gentle countertraction on the contralateral extremity.

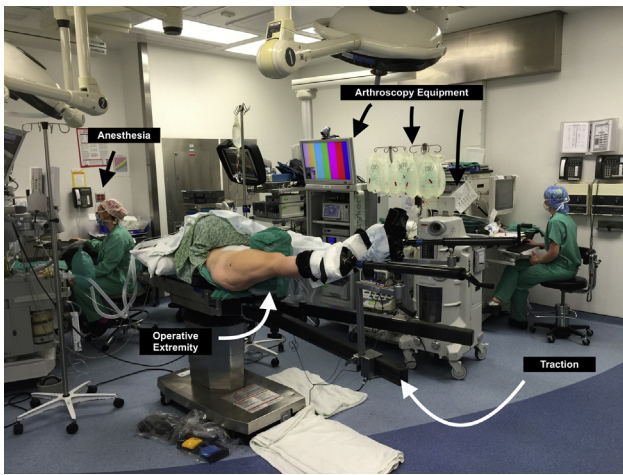


Fig 4. Positioning of patient in traction before sterile preparation and draping for right hip arthroscopy. The operative hip is positioned at 15° of flexion and 0° of adduction before the application of traction. Internal rotation of the foot to 10° to 15° positions the femoral neck more parallel to the operative horizon.

genitalia and scrotum should be checked to ensure that they are not compressed. The bilateral padded feet and ankles can then be placed in the traction boots and secured with Velcro straps and tape. The pelvis and torso are stabilized by application of gentle countertraction of about 10 to 20 lb (4.5 to 9 kg) on the contralateral lower extremity. Then, the operative extremity is tested in the traction boot by bringing it into full flexion, extension, abduction, and adduction.

The C-arm fluoroscopic machine is brought into the operative field, and a 45° lateral Dunn view is obtained. The operative leg is taken through a range of motion under fluoroscopy. These dynamic hip assessments aid

in the surgical planning for femoroacetabular impingement resection and osteoplasty during arthroscopic surgery. The operative hip is positioned at 15° of flexion and 0° of adduction before the application of traction. Internal rotation of the foot to 10° to 15° positions the femoral neck more parallel to the operative horizon (Fig 4). We avoid excessive hip flexion during positioning and application of traction to relieve pressure on the sciatic nerve.

With adequate muscle paralysis, traction should be gently applied under fluoroscopic guidance. Carefully monitoring the amount of total traction time is critical to avoid adverse events related to excessive and lengthy traction times. The amount of traction force required is patient specific and dependent on the patient's pathologic condition—typically, arthritic joints require more traction—but most patients require from 25 to 50 lb (11 to 23 kg) to achieve adequate joint distraction to gain access to the central hip compartment. Manual traction is grossly applied by locking the boot into the sliding rail, followed by fine traction through the rotating handle attached to the boot. Providing gross traction first ensures that the amount of distraction does not exceed the limitations of the traction device. The appearance of a vacuum crescent sign under fluoroscopy confirms that traction is adequate (Fig 5). If the surgeon is unable to attain the vacuum crescent sign and bony distraction, 2 options are available. The patient can be prepared and draped sterilely, and the joint can then be vented with a spinal needle to break the suction seal of the femoroacetabular joint. Alternatively, the surgeon can continue to add gentle traction until the crescent sign appears by relaxation through physiological creep and ligamentotaxis. Of note, we have found that bony distraction of the hip joint without a vacuum crescent sign is indicative of 3

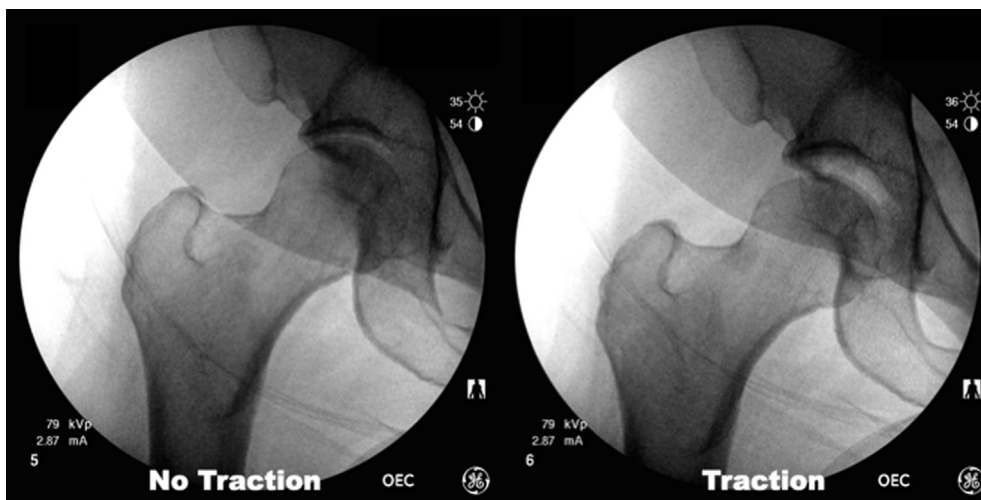


Fig 5. Fluoroscopic views of the right hip before and after application of traction, confirming adequate distraction of the hip joint through the appearance of the crescent sign. If the surgeon is unable to attain the vacuum crescent sign, the joint can be vented with a spinal needle to break the suction seal or the surgeon can continue to add gentle traction until the crescent sign appears.

specific pathologic conditions: hemarthrosis, synovial chondromatosis, and pigmented villonodular synovitis. Traction is then maintained during sterile preparation and draping of the operative field.

We prefer the use of prepackaged stick sterile preparation (DuraPrep Surgical Solution; 3M). Then, the sterile field is isolated and draped with adhesive sterile rectangular sheets. If the patient is allergic to iodine, a sticky, clear, adhesive sheet is first applied to the operative field (Steri-Drape Incise Drape; 3M). A sterile "shower-curtain" clear drape with an arthroscopic fluid collection pocket and associated drain is then used (Steri-Drape with Isolation Drape and Incise Film and Pouch; 3M). A final sterile drape is placed on the patient's upper body and used as a curtain isolating the anesthesia staff from the surgical field.

Discussion

Hip arthroscopy is valuable for the diagnosis of various hip disorders and allows for operative therapeutic intervention. Several steps are critical in patient positioning. The upper extremities should be positioned away from the surgical field but still permit adequate perfusion and intravenous access. The surgeon should be comfortable with fracture table operation and aware of potential pressure injuries that result from improper positioning. One of the most significant injuries is pudendal nerve palsy from excessive pressure from the perineal post. Preoperative fluoroscopic evaluation ensures that adequate distraction is possible before preparation and draping of the extremity. During final surgical sterile preparation and draping, care should be taken to isolate the surgical field while maintaining a sufficient field for access to all joint compartments.

The vacuum force between the femoral head and acetabulum related to the labral seal has been described as between 120 and 200 N, with distraction forces of 200 lb (90 kg) necessary for initial distraction.^{16,17} Venting the joint or injecting normal saline solution with joint distention can aid in breaking the suction seal and facilitate distraction across the hip joint; in some instances these forces are reduced to 50 lb (23 kg).^{18,19} The complications related to excessive traction force or the duration of the applied traction are well documented and include, but are not limited to, pudendal neurapraxia, sciatic nerve injury, lower-extremity skin compromise, and genital injury.^{9,10,20-23}

Optimal surgical outcomes after hip arthroscopy hinge on many factors, including safe, reproducible positioning of the patient on the operating table for optimal surgical intervention. Proper patient positioning requires the assistance and skilled expertise of the entire operating room team, including the surgeon, surgical assistants, nursing staff, surgical technologists, and anesthesia staff. A surgical team that is acquainted with the positioning and sterile preparation for hip

arthroscopy will aid in the efficiency of the operative procedure and minimize risk to the patient.

References

1. Colvin AC, Harrast J, Harner C. Trends in hip arthroscopy. *J Bone Joint Surg Am* 2012;94:e23.
2. Larson CM, Stone RM. Current concepts and trends for operative treatment of FAI: Hip arthroscopy. *Curr Rev Musculoskelet Med* 2013;6:242-249.
3. Montgomery SR, Ngo SS, Hobson T, et al. Trends and demographics in hip arthroscopy in the United States. *Arthroscopy* 2013;29:661-665.
4. Bozic KJ, Chan V, Valone FH III, Feeley BT, Vail TP. Trends in hip arthroscopy utilization in the United States. *J Arthroplasty* 2013;28:140-143 (suppl).
5. Burman MS. Arthroscopy or the direct visualization of joints: An experimental cadaver study. 1931. *Clin Orthop Relat Res* 2001;(390):5-9.
6. Howse EA, Wooster BM, Mannava S, Perry B, Stubbs AJ. Arthroscopic treatment of slipped capital femoral epiphysis screw impingement and concomitant hip pathology. *Arthrosc Tech* 2014;3:e515-e517.
7. Stabile KJ, Neumann JA, Mannava S, Howse EA, Stubbs AJ. Arthroscopic treatment of bucket-handle labral tear and acetabular fracture. *Arthrosc Tech* 2014;3:e283-e287.
8. Stubbs AJ, Andersen JS, Mannava S, et al. Arthroscopic hip labral repair: The Iberian suture technique. *Arthrosc Tech* 2014;3:e351-e354.
9. Shetty VD, Villar RN. Hip arthroscopy: Current concepts and review of literature. *Br J Sports Med* 2007;41:64-68 (discussion 68).
10. Kowalczyk M, Bhandari M, Farrokhyar F, et al. Complications following hip arthroscopy: A systematic review and meta-analysis. *Knee Surg Sports Traumatol Arthrosc* 2013;21:1669-1675.
11. Sardesai A, Hujazi I, Khanduja V. Surgical access warming blanket to prevent hypothermia after hip arthroscopy. *Arthroscopy* 2012;28:1045-1046.
12. Parodi D, Tobar C, Valderrama J, et al. Hip arthroscopy and hypothermia. *Arthroscopy* 2012;28:924-928.
13. Parodi D, Valderrama J, Tobar C, et al. Effect of warmed irrigation solution on core body temperature during hip arthroscopy for femoroacetabular impingement. *Arthroscopy* 2014;30:36-41.
14. Kong KF, Chien P, Wong JW, Yip DK. Peroneal padding: An alternative to a peroneal post in hip arthroscopy. *Arthroscopy* 2003;19:1027-1029.
15. Byrd JW. Hip arthroscopy utilizing the supine position. *Arthroscopy* 1994;10:275-280.
16. Dienst M, Seil R, Godde S, et al. Effects of traction, distension, and joint position on distraction of the hip joint: An experimental study in cadavers. *Arthroscopy* 2002;18:865-871.
17. Byrd JW, Chern KY. Traction versus distension for distraction of the joint during hip arthroscopy. *Arthroscopy* 1997;13:346-349.
18. McCarthy JC. Hip arthroscopy: Applications and technique. *J Am Acad Orthop Surg* 1995;3:115-122.

19. Eriksson E, Arvidsson I, Arvidsson H. Diagnostic and operative arthroscopy of the hip. *Orthopedics* 1986;9:169-176.
20. Gupta A, Redmond JM, Hammarstedt JE, Schwindel L, Domb BG. Safety measures in hip arthroscopy and their efficacy in minimizing complications: A systematic review of the evidence. *Arthroscopy* 2014;30:1342-1348.
21. Harris JD, McCormick FM, Abrams GD, et al. Complications and reoperations during and after hip arthroscopy: A systematic review of 92 studies and more than 6,000 patients. *Arthroscopy* 2013;29:589-595.
22. Dippmann C, Thorborg K, Kraemer O, Winge S, Hölmich P. Symptoms of nerve dysfunction after hip arthroscopy: An under-reported complication? *Arthroscopy* 2014;30:202-207.
23. Telleria JJ, Safran MR, Harris AH, Gardi JN, Glick JM. Risk of sciatic nerve traction injury during hip arthroscopy—Is it the amount or duration? An intraoperative nerve monitoring study. *J Bone Joint Surg Am* 2012;94:2025-2032.