

Simultaneous Bilateral Hip Arthroscopy



Dean K. Matsuda, M.D., Kaycee Ching, B.S., and Nicole A. Matsuda

Abstract: Many patients are afflicted with painful conditions affecting both hips, most commonly femoroacetabular impingement. Some patients prefer the advantage of undergoing a single surgical procedure and anesthetic followed by a single postoperative rehabilitation program. We present a Technical Note on single-stage bilateral hip arthroscopy. This Technical Note reports on key steps enabling safe and efficient performance of bilateral arthroscopic acetabuloplasty, labral refixation, femoroplasty, and dynamic testing while limiting traction times and facilitating rapid transition to the second hip arthroscopic surgery. Enabling factors include supine positioning with bilateral mobile leg spars, rapid surgical and hip traction times, and postoperative rehabilitation with immediate weight bearing as tolerated. A rationale for deciding which hip should undergo arthroscopy first is also offered. Concurrent bilateral hip arthroscopy is a viable option for select patients and experienced surgical teams, enabling potentially expedited recovery and return to work or sport with inherent cost savings.

Radiographic evidence of cam femoroacetabular impingement (FAI) occurs in 78% of contralateral hips in patients presenting with symptomatic FAI.¹ Emerging evidence has shown 21% to 26% of patients will have bilateral symptomatic FAI.^{1,2} Surgical treatment options for such patients include staged hip arthroscopy or simultaneous bilateral hip arthroscopy.

Our experience with simultaneous hip arthroscopy began when patients afflicted with bilateral symptomatic FAI inquired whether a single-stage surgical procedure could be performed. Our initial 2 patients preferred a single operation and anesthetic and a single postoperative recovery and rehabilitation program with the potential for earlier return to work and sport. Immediate postoperative wheelchair ambulation was used, but both patients abandoned their wheelchairs for crutches and early bilateral weight bearing, precipitating a transition to an immediate weight-bearing

protocol on 2 crutches.³ Emerging evidence has supported this offering as efficacious and safe.^{4,5} We present our current techniques that have evolved in this Technical Note.

The patient is offered single-stage (i.e., simultaneous) versus 2-stage (i.e., sequential) hip arthroscopy with explanations of inherent advantages (Table 1) and disadvantages (Table 2). We describe the advantages of a single surgical procedure and anesthetic followed by a single postoperative rehabilitation program. Emerging studies have supported our experience of simultaneous hip arthroscopy as a safe and efficient alternative to staged hip arthroscopy.^{4,5} We explain to each patient that disadvantages to undergoing single-stage surgery include the inability to “test the waters” to determine if, in their individual experience, the initial hip arthroscopy provides an unacceptable outcome. One cannot undo surgery; if, for example, a right hip arthroscopy yields a real or perceived unsatisfactory outcome, the patient has the option to not proceed with contralateral hip arthroscopy only if he or she opts for 2-stage surgery.

Surgical Technique

Supine hip arthroscopy positioning is performed with the patient under general anesthesia (Fig 1). A Foley catheter is inserted. Both feet and ankles are secured to padded hip distractor boots on a portable hip distractor device (Smith & Nephew, Andover, MA) that has bilateral mobile joint leg spars. A well-padded large-diameter groin post is lateralized toward the first (in this case, right) operative hip. Countertraction is applied to

From the Department of Orthopedics, DISC Sports and Spine (D.K.M.), Marina del Rey; University of California (K.C.), Berkeley; and University of California, Davis (N.A.M.), Davis, California, U.S.A.

The authors report the following potential conflict of interest or source of funding: D.K.M. receives support from Orthopedics Today but receives no money from that source. Editorial board member. Zimmer Biomet. Paid consultant. Smith & Nephew, Zimmer Biomet. Royalties for intellectual property.

Received November 15, 2016; accepted March 2, 2017.

Address correspondence to Dean K. Matsuda, M.D., Department of Orthopedics, DISC Sports and Spine, 13160 Mindanao Way, Suite 300, Marina del Rey, CA 90292, U.S.A. E-mail: saltandlight777@hotmail.com

© 2017 by the Arthroscopy Association of North America

2212-6287/161134/\$36.00

<http://dx.doi.org/10.1016/j.eats.2017.03.002>

Table 1. Advantages of Single-stage Bilateral Hip Arthroscopy

Single surgery and anesthesia
Single recovery
Single postoperative rehabilitation
Potential for sooner return to work and/or sport
Potential cost savings (e.g., reuse of some disposable instruments for second hip procedure)

the nonoperative lower extremity in 40° of abduction, neutral rotation, and neutral extension followed by titrated application of traction to the operative lower extremity with the hip in 10° of flexion, 20° of abduction, and maximal internal rotation (about 30° in this case). Sufficient hip distraction to safely access the hip joint is fluoroscopically confirmed. Fluoroscopic templating is performed as per routine without hip distraction and has been described previously.⁶ The patient is then prepared and draped in the usual sterile manner, and a sterile protective bag is placed over the C-arm head. The patient receives an intravenous antibiotic immediately before initiation of incisions. Traction is carefully reapplied, and fluoroscopic guidance is used for initial central compartment access into the hip by use of a 17-gauge needle from the anterolateral portal site. With initial fluoroscopic and dry arthroscopic guidance with a 70° arthroscope, the modified midanterior working portal is established.⁷

Interportal capsulotomy is performed with an arthroscopic knife under dry arthroscopic guidance. Arthroscopic fluid flow is initiated at a pump pressure of 50 mm Hg, and fluid outflow is confirmed. Diagnostic right hip arthroscopy is performed with inspection of the central compartment with attention to any areas of intra-articular pathology. Arthroscopic acetabuloplasty is performed with a 5.5-mm burr (Flat-top; Smith & Nephew) through an 8.25-mm plastic cannula in the modified midanterior portal under arthroscopic visualization and fluoroscopic guidance by use of the fluoroscopic templating technique⁶ without hip distraction (Fig 2). Removal of pincer FAI and adjacent subtle delamination to a stable rim construct are achieved, followed by arthroscopic anterosuperior acetabular rim preparation (Fig 3). Drilling in preparation for superior rim suture anchor placement is confirmed by fluoroscopic imaging, whereas anterior rim drilling is performed with the drill bit parallel to the floor to avoid inadvertent joint violation. Hip distraction is reapplied to pass sutures for labral refixation (Fig 4). Traction and

Table 2. Disadvantages of Single-stage Bilateral Hip Arthroscopy

Higher chance of temporary wheelchair ambulation
Limited to experienced surgeons and surgical teams with limited traction times
Potential decreased reimbursement for second hip procedure

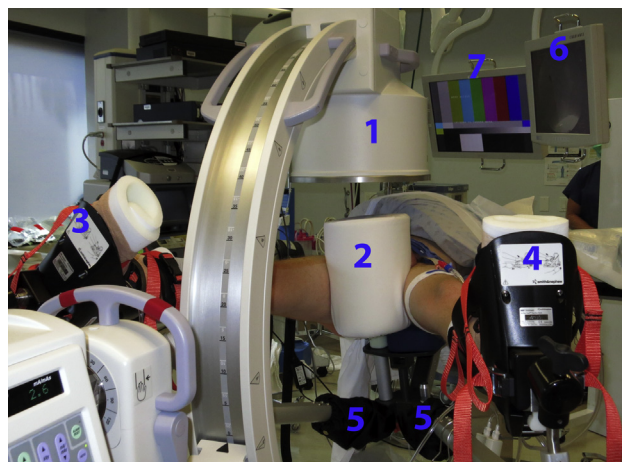


Fig 1. External photograph showing the setup for supine bilateral hip arthroscopy beginning, in this instance, with the right operative hip. One should note the raised vertical C-arm monitor (1) positioned between the legs; the padded central post (2) positioned toward the operative hip; the operative lower extremity in 10° of hip flexion, neutral abduction, and 30° of internal rotation (3); and the nonoperative lower extremity in abduction, neutral extension, and rotation (4). A table or portable hip distractor with universal joints (5) for each leg spar facilitates rapid transitioning from first to second hip arthroscopy, as does the centralized C-arm device. For this right hip, the fluoroscopic monitor (6) is positioned adjacent to the arthroscopic monitor (7) and both monitors are facing the surgeon's position to optimize fluoroscopic templating with intermittent fluoroscopic spot imaging in real time during acetabuloplasty.

countertraction are then carefully released, and a stable labral construct with a restored fluid seal against the femoral head is confirmed (Fig 5).

Arthroscopic femoroplasty is performed through the small interportal capsulotomy without extension or



Fig 2. External photograph of first (right) hip during acetabuloplasty (arrow) with burr (Flat-top) without traction. One should note the raised vertical C-arm device (asterisk) between both lower extremities enabling the fluoroscopic templating technique on the adjacent fluoroscopic monitor for precision rim trimming.



Fig 3. External photograph of first (right) hip showing safe drilling of anterior rim anchor site (asterisk) without hip distraction by keeping drill parallel to floor (arrow).

enlargement to minimize compromise of capsular integrity. Peripheral compartment diagnostic arthroscopy shows a cam deformity with bony prominence at the anterior and lateral femoral head-neck junction. Arthroscopic femoroplasty begins near the lateral aspect of the deformity with the hip in 10° of flexion and maximal internal rotation, with care taken to avoid the posterolateral retinacular vessels from the medial circumflex artery. Arthroscopic femoroplasty advances toward the anterior aspect of the cam deformity with progressive hip flexion and external rotation, progressively bringing the cam deformity into the field of view of the capsular window. Intentional gentle contouring

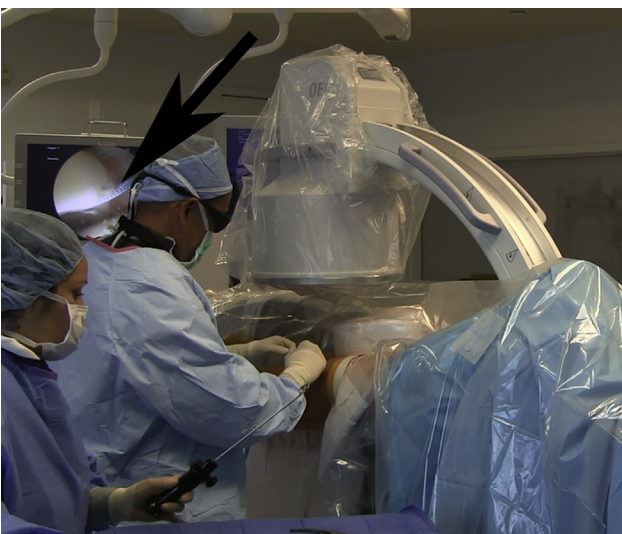


Fig 4. External photograph of first (right) hip showing applied hip distraction to pass labral repair sutures (arrow). Traction times are minimized by using traction only for initial joint access and/or diagnostics and for labral suture passage.



Fig 5. External photograph of first (right) hip during arthroscopic femoroplasty (arrow). One should note that traction is released and the labral fluid seal is confirmed (asterisk).

of the femoral head-neck region is performed to eradicate cam impingement while retaining a functional labral fluid seal. Incremental femoroplasty is performed with intermittent fluoroscopic guidance. Subsequent arthroscopic dynamic examination is performed after caudal repositioning of the C-arm to avoid encroachment to show sufficient but not excessive femoroplasty and eradication of impingement with hip flexion to 130° and flexed hip internal rotation to 30°, without any visible abutment or impingement against the rim or labrum (Fig 6). The vertically oriented C-arm is quickly repositioned, and a fluoroscopic modified Dunn projection confirms cam decompression with restoration of anterior offset. No repair of the small vertical oblique capsulotomy is performed. The hip is injected with 20 mL of 0.5% ropivacaine plus 10 mg of morphine

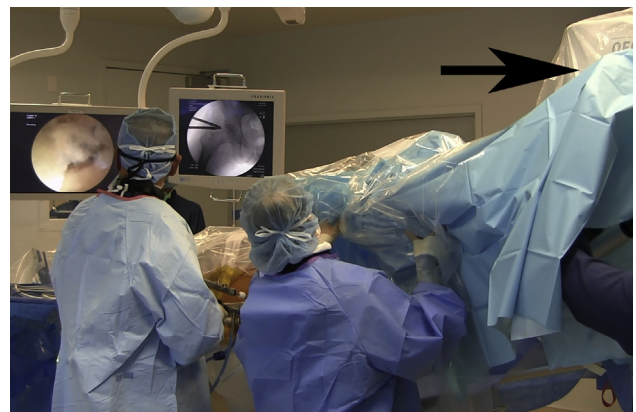


Fig 6. External photograph of first (right) hip during arthroscopic dynamic testing to confirm eradication of any ongoing femoroacetabular impingement. One should note that the C-arm (arrow) has simply been retracted to facilitate full range-of-motion testing but the C-arm base remains between both lower extremities for rapid redeployment.



Fig 7. External photograph of first (right) hip during intra-articular injection through modified midanterior portal with ropivacaine and morphine (10 mg of Duramorph) prior to portal closure and application of sterile dressing.

sulfate injection (Duramorph, West-Ward Pharmaceuticals Corp., Eatontown, New Jersey) after routine portal closures (Fig 7). Sterile dressings are applied.

With the feet and ankles being retained in their respective boots, setup transition commences with positioning of the second (left) operative hip into a frog-leg position (hip flexion, abduction, external rotation) without traction to facilitate repositioning of the padded post toward that hip (Fig 8). The lower extremities and the floating monitors (adjacent arthroscopic and fluoroscopic) are efficiently repositioned to create a mirror image of the first (right) hip arthroscopy setup (Fig 9). The C-arm, still positioned between the legs, is rapidly repositioned over the left hip. Moderate countertraction is applied to the right lower extremity, and traction is briefly applied to the left operative hip to confirm appropriate hip distractibility followed by fluoroscopic templating⁶ without distraction. The patient is then prepared and draped in the usual sterile manner, and a sterile protective bag is placed over the C-arm head. Further intravenous antibiotics have not been necessary because both hips are typically completed within 3 hours. Arthroscopic left hip surgery including chondrolabral surgery, acetabuloplasty, femoroplasty, and dynamic testing is performed without incident, with care taken to limit traction to initial central compartment access and diagnostic and/or therapeutic work and to labral suture passage before labral refixation (Fig 10). Once arthroscopic dynamic testing and a fluoroscopic modified Dunn view confirm eradication of ongoing impingement, the second (left) hip is injected with ropivacaine and Duramorph. Sterile dressings are applied. There are no intraoperative complications. The Foley catheter is removed. The patient is extubated without incident after reversal of

general anesthesia and taken to the recovery room in stable condition. Video 1 shows our techniques for the performance of simultaneous bilateral hip arthroscopy.

In the presented patient, right hip arthroscopy was performed in 77 minutes including a cumulative traction time of 20 minutes. The transition time was 19 minutes. Left hip arthroscopy was completed in 88 minutes, with a cumulative traction time of 23 minutes. The patient was able to bear weight to tolerance on both lower extremities using dual crutches in the recovery room before discharge home.

Discussion

Enabling factors to the performance of safe and efficacious single-stage bilateral hip arthroscopy^{4,5} include the following: proper patient selection, setup with supine arthroscopy with bilateral mobile leg spars, rapid traction and surgical times, C-arm positioned between legs, and postoperative rehabilitation with immediate weight bearing. Each of these topics will be discussed in turn.

Patient selection is important, and in general, younger healthier patients who can tolerate early bilateral weight bearing are good candidates for single-stage bilateral hip arthroscopy. Patient considerations that might preclude or discourage single-stage bilateral hip arthroscopy are listed in Table 3. Although our experience has been that most patients with bilateral symptomatic FAI are good candidates, there may be



Fig 8. External photograph showing rapid transition technique of repositioning central padded post (black asterisk) toward second (left) operative hip without having to move patient torso. Both lower extremities are abducted on mobile leg spars, and the second operative lower extremity (left) is placed in the figure-of-4 position (hip and knee flexion and hip abduction and external rotation) (arrow) while still engaged on the mobile leg spar without any applied traction. One should note that the C-arm device (red asterisk) remains between both lower extremities but has not yet been repositioned over the second (left) operative hip.



Fig 9. External photograph of second (left) hip prior to sterile skin preparation and draping with lateralized central padded post, repositioned adjacent arthroscopic and fluoroscopic monitors (arrow), lower extremities repositioned into mirror image of initial (right) hip supine setup, redeployed vertical C-arm (red asterisk), and Foley catheter tubing exchanged to contralateral thigh (black asterisk).

notable exceptions. Patients with preoperative evidence of significant chondral wear may be better served by staged hip arthroscopy because microfracture can further complicate rehabilitation, as identified by Meidan et al.⁵ However, our experience is that microfracture chondroplasty is not often required because the typical anterosuperior acetabular rim region may commonly be treated with controlled acetabuloplasty, thereby eliminating or at least significantly decreasing this focal chondral high-grade pathology when present. If microfracture is performed in one hip, postoperative weight bearing is still permitted on the contralateral leg until such time that both lower extremities may be fully loaded, thereby enabling single-stage bilateral hip arthroscopy sans wheelchair use. Conditions at risk of hip instability (e.g., dysplasia, focal or generalized hyperlaxity, and increased femoral anteversion) may be relative contraindications because arthroscopic capsular repair or plication may limit implementation if bilateral hip braces or prolonged limited weight bearing is required. By using a small, vertical oblique interportal capsulotomy (from anterolateral to modified mid-anterior portal⁷) minimizing violation of the iliofemoral ligament and using femoroplasty techniques that obviate enlarging this capsular window,⁸ we do not perform routine capsular closure unless the aforementioned risk factors or postoperative instability (based on the shuck test or excessive external rotation) is shown. Moreover, as with microfracture, if only one hip requires postoperative bracing or prolonged restricted weight bearing, single-stage bilateral hip arthroscopy may still be feasible.

Although we often perform single-stage bilateral hip arthroscopy for global pincer FAI, we acknowledge that

these procedures often entail more traction time and force and may be a relative contraindication, perhaps best undertaken only by very experienced surgeons and surgical teams. Bilateral borderline dysplasia also may be a relative contraindication because capsular closures with bilateral protective bracing and prolonged weight-bearing restrictions may dictate initial wheelchair use. Moreover, we have performed arthroscopic labral reconstructions in the setting of simultaneous bilateral hip arthroscopy, and because our postoperative rehabilitation protocol remains unaltered, this is not a contraindication.

As with any bilateral surgery, we believe it is important to establish with the patient which hip's treatment must be completed should an unforeseen medical, surgical, or anesthetic event arise that prompts aborting the case before the second hip operation. Through experience, we consider prioritizing the more symptomatic hip; however, we also consider other factors. Even if the more symptomatic hip has more osteoarthritic change based on preoperative imaging studies (e.g., Tönnis grade 1), we might give higher priority to the hip that has a higher potential for ultimate hip preservation (e.g., Tönnis grade 0). Recent evidence has suggested similar short-term to midterm outcomes in either subset, but all things being equal, we would advise addressing the hip with no arthritis first. One could reasonably argue that a hip with Tönnis grade 1 osteoarthritis is at higher risk of progression to Tönnis grade 2 or 3 osteoarthritis and hence should be treated first. The first author (D.K.M.) then initials both hips prior to surgery and makes a small "2" after his initials as a reminder of which hip will be surgically addressed second. Fortunately, we have had no cases in which we have had to abort surgery prior to successful completion of bilateral hip arthroscopy. Furthermore, we currently

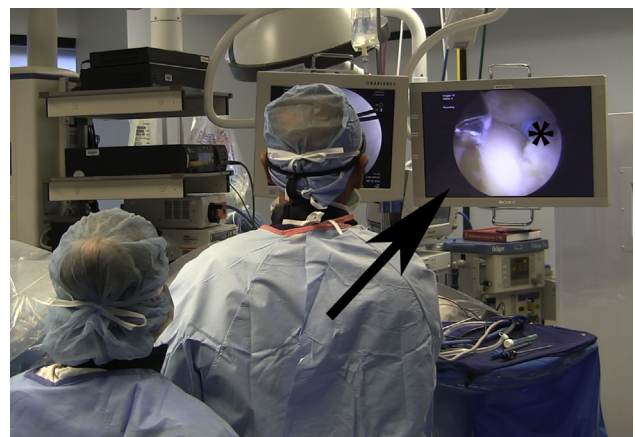


Fig 10. External photograph of second (left) hip after acetabuloplasty and labral refixation and during femoroplasty (arrow). One should note the absence of hip distraction and presence of a labral fluid seal (asterisk).

Table 3. Contraindications to Single-stage Bilateral Hip Arthroscopy

The procedure is contraindicated if there is a high degree of chondral damage in one or both hips based on preoperative imaging studies (which may then require prolonged protected weight bearing for microfracture chondroplasty or variant).
Global pincer femoroacetabular impingement in one or both hips may increase the cumulative traction time and/or force and increase the risk of traction-related complications (e.g., pudendal neurapraxia).
Bilateral borderline or mild dysplasia may require bilateral capsular closures, bilateral hip bracing, and prolonged limited weight-bearing restrictions.
High medical morbidity may increase the risk of the need to abort surgery prior to the second hip operation.

do not operate on contralateral hips with asymptomatic FAI.

Regarding setup, supine positioning facilitates the performance of single-stage bilateral hip arthroscopy. Supine rather than lateral hip arthroscopy enables a relatively rapid transition between hips without major repositioning of the torso or disengagement of the feet or ankles from their respective boots. Our transition technique retains the feet and ankles in their respective holders with simple figure-of-4 (hip flexion, abduction, external rotation) or frog-leg positioning, facilitating rapid lateralization of the padded groin post toward the second hip, followed by rapid reapplication of standard lower extremity positioning for the second operative hip. Care is taken to avoid over-distraction of the first hip when applying supine countertraction. If the lateral hip arthroscopy setup is being used, the patient would require torso repositioning, lower extremity padding and reattachment to the foot holder, and a longer transition time between operative hip procedures. This does not preclude the performance of simultaneous bilateral hip arthroscopy using the lateral setup but detracts from the aforementioned relative ease and rapidity of the supine technique. We opt to re-drape and re-prepare the operative field. Although we have performed this procedure using one initial skin preparation and draping for both hips, we do not believe a potential small decrement in transition time outweighs the potential for compromise of sterility. We do not advise putting the groin post in a centralized position when performing bilateral cases because this can theoretically increase the risk of traction-related pudendal neurapraxia. The beneficial lateralization vector of the lateralized groin post is also decreased.

A traction table or portable distractor that enables multiplane mobility of both leg spars optimizes the efficiency of simultaneous bilateral hip arthroscopy by obviating switching spars if one spar is immobile. If one is considering incorporating simultaneous bilateral hip arthroscopy, he or she should consider using a table or portable distractor with bilateral mobile leg spars. Although not typically used for unilateral hip arthroscopy, we use a Foley catheter for simultaneous bilateral

hip arthroscopy because of the longer anesthesia and surgical times. The catheter is typically removed prior to reversal of general anesthesia.

Although the C-arm fluoroscopy device may be placed on the contralateral side of each operative hip, we have found that a centralized position between the patient's legs facilitates simultaneous bilateral hip arthroscopy. We use intermittent spot images during joint access, acetabuloplasty using the fluoroscopic templating technique,⁶ and femoroplasty. The operative hip is not distracted during acetabuloplasty or femoroplasty, enabling low cumulative traction times in the 15- to 30-minute range per hip. The former represents a modification from our earlier published Technical Note describing fluoroscopic templating⁶; in that description, traction was applied during acetabuloplasty whereas currently the hip is not distracted, but the same setup for a horizontal pelvic alignment on the fluoroscopic monitor applies to ensure precision rim reduction. We reapply hip distraction during labral suture passage and any intra-articular chondroplasty. We believe the relatively quick traction times contribute to our low incidence of traction-related complications from unilateral and bilateral hip arthroscopy. The C-arm is kept motionless in a vertical orientation with the operative hip in a horizontal anterior-posterior pelvis orientation for the acetabuloplasty without distraction. After femoroplasty, it is moved away from the operative field in a caudad direction so as not to impede arthroscopic dynamic testing of the operative hip, enabling confirmation of impingement-free hip range of motion. We desire at least 130° of flexion and 30° of flexed hip internal rotation as our endpoints. The C-arm is then repositioned to obtain a final modified Dunn lateral image with radiographic anterior offset confirmation.

In 2007 we placed our first 2 patients undergoing single-stage bilateral hip arthroscopy in a wheelchair,

Table 4. Key Steps and Technical Pearls

A preoperative agreement with the patient should be made regarding which hip should be treated first in case of the need to abort surgery prior to completion of the second hip procedure.
A supine setup should be used with bilateral mobile leg spars. The C-arm should be positioned between the lower extremities.
Foley catheterization is used because of longer surgery times than with unilateral surgery.
The surgeon should consider using the fluoroscopic templating technique to decrease surgery and traction times.
Intra-articular anesthetic injection, portal closure, and application of sterile dressing complete the first hip surgical procedure prior to transitioning and re-draping for the second hip surgical procedure.
During the transition to the second hip, one or both lower extremities should be placed in the figure-of-4 position to facilitate prompt repositioning of the padded groin post to the operative side. Then, the leg positioning setup of the right and left hips should be reversed, and contralateral hip arthroscopy should proceed.
Immediate postoperative ambulation with full weight bearing is allowed as tolerated using dual crutches.

anticipating inability to immediately ambulate using dual crutches or even a walker. Both patients returned at their 1-week postoperative visit sans wheelchair, ambulating with full weight bearing on both lower extremities with crutches. Perhaps analogous to the evolution of anterior cruciate ligament reconstruction rehabilitation, our patients showed that they could, in fact, progress along an “accelerated” pathway. We quickly evolved to using a protocol of immediate weight bearing as tolerated with dual crutches (which we used for our unilateral procedures) and have not required wheelchair use. This early weight-bearing protocol has been documented as safe and effective.³ The postoperative protocol (exercise cycling commencing on postoperative day 1, swimming and pool jogging at 10 to 14 days, elliptical trainer at 4 weeks, and running at 12 weeks) is identical regardless of whether unilateral, staged bilateral, or simultaneous bilateral hip arthroscopy is performed, and no brace or continuous passive motion is typically required. [Table 4](#) highlights key steps and technical pearls for safe and efficient simultaneous bilateral hip arthroscopy.

Single-stage or simultaneous bilateral hip arthroscopy is a feasible surgical procedure with emerging evidence supporting its consideration in select patients.^{4,5} Each patient should decide whether the potential advantages outweigh the potential disadvantages. In addition to economic advantages of potentially earlier return to work, there are other tangible cost savings with simultaneous rather than staged bilateral hip arthroscopy. One set rather than two sets of disposable instruments (e.g., arthroscopic burrs and shavers, radiofrequency ablator wands, disposable cannulas, and/or suture passers) and pads (e.g., groin post pads and foot and/or ankle pads) may be used for both hip operations. Moreover, only one preoperative workup including medical clearance with laboratory studies, rather than two, is required, with inherent cost savings and convenience. Potential disadvantages include

surgeon and facility considerations such as the experience of the surgeon and surgical team to perform single-stage hip arthroscopy efficiently with relatively low traction times, as well as potentially decreased reimbursement from insurers.

Simultaneous bilateral hip arthroscopy is a viable option for select patients and experienced surgical teams, enabling potentially expedited recovery and return to work or sport with inherent cost savings. The described setup and surgical techniques facilitate rapid transition between operative hips and minimization of individual and cumulative traction and surgical times, with rapid postoperative brace-free early weight-bearing rehabilitation.

References

1. Allen D, Beaulé PE, Ramadan O, Doucette S. Prevalence of associated deformities and hip pain in patients with cam-type femoroacetabular impingement. *J Bone Joint Surg Br* 2009;91:589-594.
2. Klingenstein GG, Zbeda RM, Bedi A, Magennis E, Kelly BT. Prevalence and preoperative demographic and radiographic predictors of bilateral femoroacetabular impingement. *Am J Sports Med* 2013;41:762-768.
3. Jayasekera N, Aprato A, Villar RN. Are crutches required after hip arthroscopy? A case-control study. *Hip Int* 2013;23:269-273.
4. Degen RM, Nawabi DH, Fields KG, Wentzel CS, Kelly BT, Coleman SH. Simultaneous versus staged bilateral hip arthroscopy in the treatment of femoroacetabular impingement. *Arthroscopy* 2016;32:1300-1307.
5. Mei-Dan O, McConkey MO, Knudsen JS, Brick MJ. Bilateral hip arthroscopy under the same anesthetic for patients with symptomatic bilateral femoroacetabular impingement: 1-Year outcomes. *Arthroscopy* 2014;30:47-54.
6. Matsuda DK. Fluoroscopic templating technique for precision arthroscopic rim trimming. *Arthroscopy* 2009;25:1175-1182.
7. Matsuda DK, Villamor A. The modified mid-anterior portal for hip arthroscopy. *Arthrosc Tech* 2014;3:e469-e474.
8. Matsuda DK. *Editorial Commentary*: Hip capsule: To repair or not? *Arthroscopy* 2017;33:116-117.