BlueCross BlueShield of Alabama

Name of Policy:
Surgical Treatment of Femoroacetabular Impingement

Policy #: 421
Category: Surgery

Latest Review Date: May 2018
Policy Grade: B

Background/Definitions:

As a general rule, benefits are payable under Blue Cross and Blue Shield of Alabama health plans only in cases of medical necessity and only if services or supplies are not investigational, provided the customer group contracts have such coverage.

The following Association Technology Evaluation Criteria must be met for a service/supply to be considered for coverage:

1. *The technology must have final approval from the appropriate government regulatory bodies;*
2. *The scientific evidence must permit conclusions concerning the effect of the technology on health outcomes;*
3. *The technology must improve the net health outcome;*
4. *The technology must be as beneficial as any established alternatives;*
5. *The improvement must be attainable outside the investigational setting.*

Medical Necessity means that health care services (e.g., procedures, treatments, supplies, devices, equipment, facilities or drugs) that a physician, exercising prudent clinical judgment, would provide to a patient for the purpose of preventing, evaluating, diagnosing or treating an illness, injury or disease or its symptoms, and that are:

1. *In accordance with generally accepted standards of medical practice; and*
2. *Clinically appropriate in terms of type, frequency, extent, site and duration and considered effective for the patient's illness, injury or disease; and*
3. *Not primarily for the convenience of the patient, physician or other health care provider; and*
4. *Not more costly than an alternative service or sequence of services at least as likely to produce equivalent therapeutic or diagnostic results as to the diagnosis or treatment of that patient's illness, injury or disease.*

Description of Procedure or Service:

Femoroacetabular impingement (FAI) results from localized compression in the joint due to an anatomical mismatch between the head of the femur and the acetabulum. Symptoms of impingement typically occur in young to middle-aged adults prior to the onset of osteoarthritis, but may be present in younger patients with developmental hip disorders. The objective of surgical treatment of FAI is to improve symptoms and reduce further damage to the joint.

Femoroacetabular Impingement

FAI arises from an anatomical mismatch between the head of the femur and the acetabulum, causing compression of the labrum or articular cartilage during flexion. The mismatch can arise from subtle morphologic alterations in the anatomy or orientation of the ball-and-socket components (for example, a bony prominence at the head-neck junction or acetabular over-coverage) with articular cartilage damage initially occurring from abutment of the femoral neck against the acetabular rim, typically at the anterosuperior aspect of the acetabulum. Although hip joints can possess the morphologic features of FAI without symptoms, FAI may become pathologic with repetitive movement and/or increased force on the hip joint. High-demand activities may also result in pathologic impingement in hips with normal morphology.

Two types of impingement, cam and pincer, may occur alone or, more frequently, together. Cam impingement is associated with an asymmetric or nonspherical contour of the head or neck of the femur jamming against the acetabulum, resulting in cartilage damage and delamination (detachment from the subchondral bone). Deformity of the head/neck junction that looks like a pistol grip on radiographs is associated with damage to the anterosuperior area of the acetabulum. Symptomatic cam impingement is found most frequently in young male athletes. Pincer impingement is associated with overcoverage of the acetabulum and pinching of the labrum, with pain more typically beginning in women of middle age. In cases of isolated pincer impingement, the damage may be limited to a narrow strip of the acetabular cartilage.

Epidemiologic and radiographic studies have found correlations between hip osteoarthritis (OA) and FAI lesions, supporting the theory that prolonged contact between the anatomically mismatched acetabulum and femur may lead not only to cam and pincer lesions, but eventually to further cartilage damage and subsequent joint deterioration. Surgical treatment of FAI is less effective for pain reduction in patients who have already progressed to late-stage OA. It is believed that osteoplasty of the impinging bone is needed to protect the cartilage from further damage and to preserve the natural joint. Therefore, if FAI morphology is shown to be an etiology of OA, a strategy to reduce the occurrence of idiopathic hip OA could be early recognition and treatment of FAI before cartilage damage and joint deterioration occurs.

An association between FAI and athletic pubalgia, sometimes called sports hernia, has been proposed. Athletic pubalgia is an umbrella term for a large variety of musculoskeletal injuries involving attachments and/or soft tissue support structures of the pubis.

Surgical Techniques for Treating FAI

A technique for hip dislocation with open osteochondroplasty that preserved the femoral blood supply was reported by Ganz et al in 2001. Visualization of the entire joint with this procedure led to the identification and acceptance of FAI as an etiology of cartilage damage and the possibility

of correcting the abnormal femoroacetabular morphology. Open osteochondroplasty of bony abnormalities and treatment of the symptomatic cartilage defect is considered the criterion standard for complex bony abnormalities. However, open osteochondroplasty is invasive, requiring transection of the greater trochanter (separation of the femoral head from the femoral shaft) and dislocation of the hip joint to provide full access to the femoral head and acetabulum. In addition to the general adverse effects of open surgical procedures, open osteochondroplasty with dislocation has been associated with nonunion and neurologic and soft tissue lesions.

Less invasive hip arthroscopy and an arthroscopy-assisted mini-approach were developed by 2004. Arthroscopy requires specially designed instruments and is considered to be more technically difficult due to reduced visibility and limited access to the joint space. Advanced imaging techniques, including computed tomography and fluoroscopy, have been used to improve visualization of the 3-dimensional head/neck morphology during arthroscopy.

FAI can also be a source of hip pain and decreased hip internal rotation in the pediatric population. When nonoperative management of FAI in children and adolescents is ineffective, operative procedures may be indicated. Surgical techniques include arthroscopy, open hip dislocation, limited open with arthroscopy, and osteotomy.

FAI in Association with SCFE

Patients with slipped capital femoral epiphysis (SCFE) have a displaced femoral head in relation to the femoral neck within the confines of the acetabulum, which can result in hip pain, thigh pain, knee pain, and onset of a limp. SCFE occurs most frequently in children between the ages of 10 to 16. In a study of patients reaching skeletal maturity after being diagnosed with SCFE, 32% were found to have clinical signs of impingement. It is not uncommon for patients with SCFE to develop premature OA requiring total hip arthroplasty within 20 years. The standard treatment for SCFE is stabilization across the physis by in situ pinning. Alternative treatments proposed for pediatric patients with SCFE-related FAI include osteoplasty without dislocation, or with the open dislocation technique described by Ganz. The Ganz technique (capital realignment with open dislocation) is technically demanding with a steep learning curve and a high risk of complications, including avascular necrosis. Therefore, early treatment to decrease impingement must be weighed against increased risk of adverse events.

Policy:

Open or arthroscopic treatment of femoroacetabular impingement meets Blue Cross and Blue Shield of Alabama's medical criteria for coverage when **all** of the following conditions have been met:

Age

- Patients should be skeletally mature with documented closure of growth plates (e.g., 15 years or older).
- Symptoms
    - Moderate-to-severe hip pain worsened by flexion activities (e.g., squatting or prolonged sitting) that significantly limits activities; AND

- Unresponsive to conservative therapy for at least 3 months (including activity modifications, restriction of athletic pursuits and avoidance of symptomatic motion); AND
- Positive impingement sign on clinical examination (pain elicited with 90 degrees of flexion and internal rotation and adduction of the femur)

Imaging

- Morphology indicative of cam or pincer-type FAI, e.g., pistol-grip deformity, femoral head-neck offset with an alpha angle greater than 50 degrees, a positive wall sign, acetabular retroversion (over-coverage with crossover sign), coxa profunda or protrusion, or damage of the acetabular rim; AND
- High probability of a causal association between the FAI morphology and damage, e.g., a pistol-grip deformity with a tear of the acetabular labrum and articular cartilage damage in the anterosuperior quadrant; AND
- No evidence of advanced osteoarthritis, defined as Tonnis Grade II or III, or joint space of less than 2mm; AND
- No evidence of severe (Outerbridge Grade IV) chondral damage

Treatment of FAI in all other situations does not meet Blue Cross and Blue Shield of Alabama's medical criteria for coverage and is considered **investigational.**

Blue Cross and Blue Shield of Alabama does not approve or deny procedures, services, testing, or equipment for our members. Our decisions concern coverage only. The decision of whether or not to have a certain test, treatment or procedure is one made between the physician and his/her patient. Blue Cross and Blue Shield of Alabama administers benefits based on the member's contract and corporate medical policies. Physicians should always exercise their best medical judgment in providing the care they feel is most appropriate for their patients. Needed care should not be delayed or refused because of a coverage determination.

Key Points:

This policy has been updated regularly with searches of the MEDLINE database. The most recent literature update was performed through March 8, 2018.

Evidence reviews assess the clinical evidence to determine whether the use of a technology improves the net health outcome. Broadly defined, health outcomes are length of life, quality of life, and ability to function- including benefits and harms. Every clinical condition has specific outcomes that are important to patients and to managing the course of that condition. Validated outcome measures are necessary to ascertain whether a condition improves or worsens; and whether the magnitude of that change is clinically significant. The net health outcome is a balance of benefits and harms.

To assess whether the evidence is sufficient to draw conclusions about the net health outcome of a technology, 2 domains are examined: the relevance and the quality and credibility. To be relevant, studies must represent one or more intended clinical use of the technology in the intended population and compare an effective and appropriate alternative at a comparable intensity. For

some conditions, the alternative will be supportive care or surveillance. The quality and credibility of the evidence depend on study design and conduct, minimizing bias and confounding that can generate incorrect findings. The randomized controlled trial (RCT) is preferred to assess efficacy; however, in some circumstances, nonrandomized studies may be adequate. RCTs are rarely large enough or long enough to capture less common adverse events and long-term effects. Other types of studies can be used for these purposes and to assess generalizability to broader clinical populations and settings of clinical practice.

Adults with Asymptomatic Femoroacetabular Impingement

Currently, there are no studies providing evidence on the effect of femoroacetabular impingement (FAI) surgery on asymptomatic adults with FAI morphology for the prevention of osteoarthritis (OA). Indirect evidence consists of observational studies that demonstrate a relationship between FAI and OA.

Observational Studies

In 2016, Oner et al conducted a retrospective study to determine the prevalence of FAI as an etiologic factor for OA in the hip joint among patients who had undergone THA. Radiographs of 1004 patients who had undergone THA between 2005 and 2010 were reviewed by 3 authors. Intra- and interobserver consistencies were calculated. The predisposing etiologic factor leading to end-stage degenerative hip disease was undetermined in 26 of the radiographs. Among the remaining 978 patients, 99 patients were diagnosed with FAI by all 3 reviewers, 83 with a cam-type FAI and 16 with pincer-type FAI. Interobserver agreement was high, with a contingency coefficient of 0.71 for the diagnosis of FAI.

A frequently cited paper by Ganz and Leunig (2001) has described the potential relation between hip morphology and acetabular damage. In this report, 26 patients with pure pistol-grip deformity and 16 patients with isolated coxa profunda were identified from 302 hips treated for intra-articular pathology between 1996 and 2001. Among the 26 hips with isolated cam impingement on preoperative radiographs, all showed acetabular cartilage damage in the anterosuperior area of the acetabulum with separation between the acetabular cartilage and the labrum. In the 16 hips with isolated pincer impingement, the damage was located more circumferentially, usually including only a narrow strip of the acetabular cartilage. The report illustrated that in carefully selected patients with early stage OA and well-defined hip configurations, a strong association exists between specific hip morphology and the pattern of cartilage damage.

Ganz et al began a cross-sectional population-based natural history cohort in 2005 of over 1000 young men to determine whether morphologic alterations are associated with an increased rate of early OA. As of 2011, Reichenbach, Ganz, et al report that 1080 asymptomatic young men in the Sumiswald Cohort had undergone clinical examination and completed the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and the EuroQoL health-related quality-of-life (QOL) questionnaire. Of these, 244 randomly selected subjects with a mean age of 19.9 years underwent magnetic resonance imaging (MRI) to evaluate cam-type deformities, labral lesions, cartilage thickness, and impingement pits. Definite cam-type deformities were detected in 67 (27%) asymptomatic men. Logistic regression models, adjusted for age and body mass index (BMI), found for patients with cam-type deformities, odds ratio of 2.77 for labral lesions, 2.91 for

impingement pits, and 2.45 for labral deformities. Cartilage thickness was -0.19 mm lower in subjects with cam-type deformities.

A 2014 population-based cohort study by Thomas et al found that subclinical deformities of the hip, including cam-type FAI, were significant predictors of radiographic OA and total hip replacement (THR) in women. The cohort of 1003 women underwent pelvis radiographs at years 2 and 20. At 20 years, blinded radiographic analysis was available for 670 (46%) hips, of which 70 (11%) showed OA. Data on total hip replacement (see evidence review 7.01.80) at the 20-year assessment was available for 1455 (99%) hips, of which 40 (3%) had undergone replacement. Pincer-type FAI at year 2 was not significantly associated with radiographic OA. Cam-type FAI at year 2 of the study was significantly associated with development of radiographic OA and THR. Each degree increase in alpha angle above 65° was associated with an increased risk of 5% for radiographic OA and 4% for THR. This finding is limited by the low rate of participants having both baseline and follow-up radiographs.

In 2010, Gosvig et al published findings from a cross-sectional radiographic and questionnaire database of 4151 individuals from the Copenhagen Osteoarthritis study. The study group consisted of 1332 men, mean age 60.0 years (range, 22-90 years), and 2288 women, mean age 60.8 years (range, 21-90 years). The hips were categorized as being without malformations or as having an abnormality consisting of a deep acetabular socket, a pistol-grip deformity, or a combination of the 2 based on radiographic criteria. Male and female prevalence of hip-joint malformations was 71% and 36.6%, respectively. The prevalence of hip OA, radiographically defined, was 9.5% in men and 11.2% in women. A deep acetabular socket or pistol-grip deformity was a significant risk factor in the development of hip OA (relative risk, 2.4 and 2.2, respectively).

A 2009 study from Asia reviewed records of 817 patients (946 hips) who underwent primary surgery for osteoarthritis or other diseases of the hip to determine the prevalence of FA. Most (73%) patients were diagnosed with OA secondary to developmental dysplasia of the hip. Only 17 (1.8%) patients were considered to have had primary OA. Of these, 6 patients (average age, 63 years; range, 32-79) were determined to have FAI from preoperative radiographs, resulting in a possible etiology of FAI for 0.6% of the total population undergoing surgery for OA and 35% in the population with primary OA.

Bardakos and Villar (2009) retrospectively examined 43 patients (43 hips) <55 years of age with a history of symptomatic idiopathic arthritis, who exhibited pistol-grip deformity of the femur and mild-to-moderate OA (Tonnis Grade 1 or 2). Radiographs showed progression of OA in two-thirds of the patients, with 12 receiving hip replacement or resurfacing after more than 10 years. Logistic regression analysis showed the medial proximal femoral angle and the posterior wall sign as significant independent predictors for progression of OA. A reduction of 1 in the medial proximal angle increased the odds of the OA progressing by 21 times, while OA in a hip with a positive posterior wall sign was 10 times more likely to progress than a hip that had a negative posterior wall sign. Of note, one-third of the patients with a pistol-grip deformity did not progress rapidly within the assessment period.

Tanzer and Noiseaux (2004) reported on 3 separate populations to investigate anterior hip impingement as a common etiology of hip disorders. The 3 populations of interest were patients who had undergone hip arthroscopy for labral tears (n=38), patients who had undergone cheilectomy for anterior FAI (n=10), and patients who had THA due to idiopathic arthritis (n=200). Radiographic findings showed a pistol grip deformity in 97% of the patients with labral tears and 100% of the patients in the idiopathic arthritis.

Kim et al reviewed outcomes of 43 patients (mean age, 40 years; range, 18-68) who had labral tears and early osteoarthritis (Tonnis Grade 0 to 1, average Japanese Orthopedic association [JOA] scores of <1) and symptoms lasting three months or more who had been treated with debridement. At an average 50 months' follow-up (12-96 months), 74% of patients reported symptom improvement. Blinded evaluation of preoperative radiographs and magnetic resonance arthrograms indicated 42% of patients had FAI. The JOA scale ranges from 0=severe pain to 3=no pain. Patients treated only with débridement were less likely to improve if early stage OA or FAI was present at the time of surgery (JOA=1.67). Patients without either FAI or OA scored 2.6 while patients with FAI scored 1.83.

Section Summary: Adults with Asymptomatic Femoroacetabular Impingement
There is no direct evidence that performing FAI surgery on asymptomatic adults with FAI morphology will prevent OA from developing. There is indirect evidence from retrospective studies indicating that patients with cam-type impingement related to a pistol-grip deformity will experience labral damage, which can lead to the subsequent development of OA.

Adults with Symptomatic FAI
Surgical options for the treatment of adults with symptomatic FAI are: open, arthroscopic, mini-open, and mixed open/arthroscopic. Evidence for surgical treatment of FAI consists of systematic reviews of nonrandomized comparative studies and observational studies.

A Cochrane review by Wall et al (2014) evaluated surgery for the treatment of FAI, conducting a literature search for randomized and quasi-randomized trials assessing surgical intervention compared with placebo treatment, nonoperative treatment, or no treatment in adults with FAI. No studies met these inclusion criteria. Four ongoing studies were identified at the time of publication.

A 2013 systematic review by Harris et al evaluating the treatment of FAI included literature through April 2013, identifying 29 studies (total N=2369 patients): 83% level IV evidence (case series), 14% level III (cohort), and 3.4% level I (RCT). An arthroscopic approach was used in 59% of studies. The study interventions included nonoperative treatment, arthroscopy, surgical open dislocation, mixed open/arthroscopic, and mini-open. Non-arthritic hip scores (NAHS) and modified Harris Hip Scores (MHHS) were improved significantly, regardless of surgical procedure compared with nonsurgical management. Differences between surgical techniques could not be compared due to heterogeneity across surgical groups and inconsistent outcome measures.

Open Surgery

In a 2008 systematic review, Bedi et al evaluated the management of labral tears and FAI. Seven of the 19 studies assessed were case series of patients with FAI treated with open hip dislocation. Several of these studies are briefly described next.

In 2004, Beck et al reported on 19 of 22 patients (average age, 36 years; range, 21-52 years) with confirmed clinical, radiographic, and magnetic resonance arthrographic diagnosis of FAI, treated with surgical dislocation of the hip. Follow-up duration was at least 4 years. All had labral damage, and 18 had acetabular damage. Using the Merle d'Aubigné hip score, 13 of the hips were rated excellent to good and pain scores improved from 2.9 to 5.1. By 4- to 5-year follow-up, 5 (26%) patients had undergone THA, due to cartilage damage.

In 2006, Espinosa et al compared the effect of reattaching (n=35) or removing (n=25) the labrum during treatment for FAI. Patients were 20 to 40 years of age and had no prior surgery; all had preoperative evidence of acetabular damage. Independent evaluations at 2-year follow-up indicated improved Merle d'Aubigné scores for both groups. The study also reported a reduction in OA progression.

Also in 2006, Peters and Erickson reported on 29 patients (30 hips) in a prospective study with minimum 2-year follow-up. The specific diagnoses were primary FAI in 25 patients (26 hips), Legg-Calve-Perthes disease (n=3), and slipped capital femoral epiphysis (SCFE; n=1). The average age of the patients was 31 years (range, 16-51 years). Twenty-nine of the 30 hips had cam-type impingement (n=14) or mixed cam and pincer-type impingement (n=15). The Harris Hip Score (HSS) improved from 70 at baseline to 87 at an average 32-month follow-up. No progression to OA was observed in 68% of patients. There was nonunion in 8 (27%) hips; 5 (17%) hips were expected to convert to THA due to progressive pain, and 4 (13%) had progressed to OA. Radiographic signs of progression of OA and clinical failure requiring conversion to THA were seen only in patients with severe damage to the acetabular articular cartilage.

Arthroscopic Surgery

The evidence consists of a systematic review of observational studies and 1 small RCT, and stand-alone observational studies.

Systematic Reviews

In 2017, Kierkegaard et al published a systematic review and meta-analysis on patients with FAI who had undergone hip arthroscopy. Outcomes were pain, activities of daily living (ADLs), and sports function. Databases were searched through September 2015. Nineteen studies were included in the meta-analysis: 15 case series, 3 cohort, and 1 RCT. The RCT by Krych et al (2013) is described below in the next section. The total number of patients included in the 19 studies was 2322 (mean age, 36 years; range, 18-57 years) and 42% were women. Weighted mean differences between pre- and postoperative outcomes were used in the meta-analysis. Detectable pain reduction was achieved in less than 3 months and maintained through 5 years. Improved ADLs were evident between 3 and 6 months, and maintained through at least 3 years of follow-up. Sports function improvements were detected between 6 and 12 months after arthroscopy and were maintained through follow-up over several years. Patients who received FAI report continued to have some pain post-surgery.

Minkara et al (2018) published a systematic review and meta-analysis analyzing risk factors and outcomes after patients with FAI had undergone hip arthroscopy. Reviewers identified 29 relevant articles that included 1911 patients (1981 hips). Reviewers conducted a meta-analysis assessing return to play, revision rate, surgical and nonsurgical complications, change in α-angle, intraoperative bone resection, and patient-reported outcome measures after hip arthroscopy in FAI. However, all but 2 studies (1 RCT, 1 prospective cohort) in the meta-analysis were case series. Reviewers also sought to identify risk factors associated with intervention success and/or failure. The data on reoperation and complication rates are most relevant. The cumulative risk of reoperation after hip arthroscopy, including revision surgery or subsequent THA, was 5.5% (95% CI, 3.6% to 7.5%). For patients requiring a secondary procedure, 77% underwent THA, and 13% required revision arthroscopy. A single study was the source for 19% of patients requiring a second procedure, which assessed hip arthroscopy exclusively among patients who were 50 years of age and older (mean, 57 years; range, 50-77 years). The risk of clinically reported complications was 1.7% (95% CI, 0.9% to 2.5%) The most frequent complication was heterotopic ossification, followed by transient neurapraxia, typically of the lateral femoral cutaneous nerve and sciatic nerve.

Randomized Controlled Trials

The single RCT of arthroscopic labral repair versus labral débridement was reported by Krych et al in 2013. This nonblinded RCT included 36 female patients with pincer-type or combined-type FAI. At a mean 32-month follow-up (range, 12-48 months), both groups showed significant improvement in the HOS compared with baseline. Compared with the débridement group, the arthroscopic repair group had better outcomes on ADLs HOS (91.2 vs 80.9) and sports HOS (88.7 vs 76.3). A greater number of patients in the arthroscopic repair group rated their hip function as normal or nearly normal (94% vs 78%).

Observational Studies

Lund et al (2017) used data from the Danish Hip Arthroscopy Registry to report on outcomes for 1835 patients treated with 2054 FAI procedures between 2012 and 2015. At 1- and 2-year follow-ups, patient-related outcome measures (PROM) were: the European Quality of Life assessment, the Copenhagen Hip and Groin Outcome Score; the Hip Sports Activity Scale; and a numeric rating scale for pain. Although statistically significant improvements in all PROM scores were reported at one-year follow-up, there were no improvements in these measures between 1 and 2 years, with the exception of mean numeric rating scale pain scores for walking (preoperative, 49; 1 year, 27; 2 year, 22; $p<0.05$; 95% CI not reported). The authors concluded that patients with FAI could generally expect to see reductions in pain and improvements in QOL postsurgery.

The largest prospective series is by Malviya et al (2012), who reported on changes in QOL for 612 patients who were treated by a single surgeon. Patients ranged in age from 14 to 75 years (mean, 36.7). At 1 year follow-up, QOL scores on the Rosser Index improved by at least 1 grade in 76.6% of patients were unchanged in 14.4%, and decreased in 9%.

Philippon et al evaluated outcomes following arthroscopic treatment of FAI in 153 consecutive patients aged 50 years or older. The mean age of the patients was 57 years (range, 50 to 77 years). The prospective database included range of motion, MHHS, Hip Outcome Score (HOS) for activities of daily living, HOS for sports, and SF-12 score preoperatively and at six months after

surgery. Questionnaires were then mailed annually. THA was required after arthroscopy for FAI in 20% of patients at a mean of 1.6 years (range, three months to four years). In the patients who did not require THA, the MHHS improved from 58 to 84, the HOS for activities of daily living improved from 66 to 87, and the HOS for sports improved from 42 to 72. The physical component of the SF-12 improved from 38 to 49, with no change in the mental component. Survivorship, defined as not requiring hip replacement, was 92% at one year, 84% at two years, and 80% at three years. For the 64 patients who had data available at three years, patients with greater than 2mm of joint space preoperatively had survivorship of 90% whereas those with two mm or less of joint space had survivorship of 57%. Logistic regression modeling adjusted for age and days from injury to surgery identified joint space of 2mm or less and preoperative MHHS of less than 50 as risk factors for hip replacement.

In 2012, Palmer et al reported prospective three-year follow-up on 201 procedures for cam-type FAI with a Tonnis Grade of one or less. The mean duration of symptoms before surgery was 59 months. At follow-up, the Nonarthritic Hip Score (NAHS) improved from a mean of 56.1 to 78.2 and VAS for pain improved from 6.8 to 2.7. There was a higher incidence of Grade 4 acetabular chondral defect in the 12 patients who required hip arthroplasty during the follow-up period compared with patients who did not undergo arthroplasty, and patients with pincer resection had poorer results (NAHS improvement of 16.1) compared to patients with only cam-type FAI (NAHS improvement of 23.9). Of the 93 patients who were able to return for a final postoperative radiograph, 91 (97.8%) had no change in the Tonnis grade. Subgroup analyses of patients who were 20 or younger and 60 or older showed no significant effect of age. Among the 48 patients who were excluded from this study due to acetabular chondral defects greater than 1.5 cm2, 60% underwent hip replacement at a mean of 21.7 months (range, 2-29 months).

Javed and O'Donnell reported arthroscopic treatment of cam-type FAI in 40 patients over 60 years of age (mean 65 years, range 60 to 82). The MHHS and the non-arthritic hip score were collected pre-operatively and at 2, 6, 26, and 52 weeks post-operatively, and then on an annual basis. Follow-up was performed for a mean of 30 months (range, 12 to 54 months). The mean MHHS improved by 19.2 points (from 60.5 to 79.7) and the mean non-arthritic hip score improved by 15 points (from 62.1 to 77.2). Out of this selected group of 40 patients with unilateral cam impingement, Tonnis Grade 1 or osteoarthritis, and a mean age of 63 years (range 60 to 70), seven (17.5%), underwent total hip replacement at a mean interval of 12 months.

Larson et al (2011) conducted a retrospective comparison of outcomes from arthroscopic treatment of 154 patients (169 hips) without joint space narrowing (Tonnis Grade 0 to 1) and 56 patients (58 hips) with preoperative radiographic evidence of joint space narrowing (Tonnis Grade 2 or 3). Although both groups had improved scores throughout 12-month follow-up, outcomes were better for patients without OA than for patients with OA. Patients with advanced preoperative joint space narrowing (n=22) showed no improvement after surgery. At 3-year follow-up, mean HHS score was 88 for the group without OA and 67 for the group with OA. The failure rate at the last follow-up, defined as MHHS of less than 70 or conversion to THA, was 12% for patients without OA, 33% for hips with mild-to-moderate preoperative joint space narrowing (<50% joint space narrowing or >2 mm joint space), and 82% failure rate for hips with advanced preoperative joint space narrowing (>50% joint space narrowing or ≤2 mm joint space). Multiple linear regression analysis revealed that increasing radiographic joint space narrowing,

chondral grade on MRI, and greater duration of symptoms preoperatively were independent predictors for lower HHS.

A 2010 study by Horisberger et al reported on outcomes from 20 patients who showed generalized severe cartilage lesions during intraoperative arthroscopic assessment for FAI. Nine hips had Tonnis Grade I OA, 6 had Grade II, and 5 had Grade III OA. At a mean follow-up of 3 years, 10 patients (50%) had undergone, or planned to undergo, THA. Preoperatively, 5 of the 10 hips had Tonnis Grade III OA. Another 2 patients had a poor result at latest follow-up but were not yet willing to undergo THA. Mean time between index surgery and THA was 1.4 years (range, 0.4-2.2 years). The authors concluded that in patients with generalized chondral lesions, arthroscopic treatment of FAI does not have any effect beyond the short-term pain relief resulting from débridement.

Philippon et al (2009) reported 2.3 year follow-up (range, 2-2.9 years) on 100 of 209 prospectively enrolled consecutive patients who underwent hip arthroscopy for disabling pain. Of the 100 patients available for follow-up, 90 (90%) improved from an average score of 58 to 84 on the MHHS, and 10 (10%) required THA at a mean of 16 months. Patients with a joint space of less than 2 mm were 39 times more likely to progress to THA.

Byrd and Jones provided a brief report on 200 patients (207 hips) from a consecutive group of 220 patients (227 hips) who had been treated with arthroscopy for FAI. The average age of the patients was 33 (range not reported), with symptoms averaging 32 months and no sign of advance osteoarthritis. At an average of 16 months (range: 12-24 months) after treatment, patients showed an average 20-point improvement (-17 to 60) on the 91-point modified Harris Hip Score (MHHS). Eighty-three percent of patients were considered to be improved by the procedure.

Larson and Giveans (2008) reported 10-month follow-up (3 months to 3 years) on 96 patients (100 hips) who presented with FAI and underwent arthroscopy. The average age was 35 (range, 16-64 years). Following FAI treatment, the impingement test was reported to be better in 86% of patients, with good-to-excellent results in 75% of patients. Three (3%) patients required THA, and 6 had heterotopic bone formation. VAS for pain improved from 6.7 at baseline to 1.9 at follow-up. Scores on the SF-12 improved from 60 to 78.

Open Surgery vs Arthroscopic Surgery

Systematic Reviews

In 2016, Zhang et al published a systematic review of studies that compared the efficacy and safety of hip arthroscopy versus open surgical dislocation for the treatment of FAI. Five comparative studies published through August 2016 were included, evaluating a total of 352 hips. All studies were considered good or high quality based on the Newcastle-Ottawa scale. Length of follow-up among the studies ranged from 12 to 25 months. At the 3-month follow-up, patients undergoing open dislocation experienced significant improvements in alpha angle (-4.45; 95% CI, -8.22 to -0.67) compared with patients undergoing arthroscopy, while patients undergoing arthroscopy reported significantly better Nonarthritic Hip Scores (NAHS) (16.58; 95% CI, 9.54 to 23.61]) compared with patients undergoing open dislocation. At 12 months follow-up, NAHS remained significantly better in the group undergoing arthroscopy, though the modified Harris Hip Score and measures of ADLs and sports-specific scales were equivalent between the groups.

Complications were also equivalent between the two groups, though reoperation rates were significantly lower in the patients undergoing arthroscopy (RR=0.4; 95% CI, 0.17 to 0.95).

In 2016, Nwachukwu et al published a systematic review and meta-analysis comparing open with arthroscopic surgical techniques for the treatment of FAI. The literature search included studies published through October 2014, which had a mean follow-up of at least 3 years. Sixteen studies met inclusion criteria: 9 open surgical hip dislocation studies and 7 hip arthroscopy studies. Pooled cohort analyses were conducted on data from 600 hips and mean follow-up of 58 months from the open surgery studies and 1484 hips and a mean follow-up of 51 months from the arthroscopy studies. Conversion to total hip arthroplasty (THA) was the outcome endpoint, with an overall survival rate of 93% for patients undergoing open surgery and 90.5% for patients undergoing arthroscopy (p=0.06). The 12-Item Short Form, an instrument for measuring general health-related quality of life, showed significantly better scores among patients undergoing arthroscopy. Direct comparison of other outcomes was limited by outcome instrument heterogeneity. Both surgical techniques demonstrated favorable outcomes in their respective measuring systems.

Several systematic reviews comparing open and arthroscopic surgery for FAI have been identified. Matsudo et al included 18 level III or IV studies (controlled cohort or case series) with a minimum one-year follow-up. There were six papers on open surgical dislocation, four on mini-open procedures, and eight arthroscopic studies. All three approaches were found to be effective in improving pain and function in short-term to midterm studies. Open dislocation surgery had a comparatively high major complication rate primarily because of trochanteric osteotomy-related issues. The mini-open method showed comparable efficacy but a significant incidence of iatrogenic injury to the lateral femoral cutaneous nerve. Botser et al included 26 level II to IV articles totaling 1,462 hips in 1,409 patients. Of these, 900 hips were treated arthroscopically, 304 with the open dislocation method, and 258 by the mini-open method. The mean time from onset of symptoms to surgery was 28 months. Overall complication rates were found to be 1.7% for the arthroscopic group, 9.2% for the open surgical dislocation group, and 16% for the combined approach group.

Observational Studies

A direct comparison of arthroscopic and open treatment of FAI was reported by Zingg et al in 2013. Of 200 patients with FAI who were invited to participate in this prospective study, 10 patients agreed to be randomly allocated to arthroscopy or open surgical hip dislocation, and 28 patients agreed to participate in the study but selected their preferred treatment. The open and arthroscopic groups were generally comparable at baseline. Arthroscopic treatment of FAI resulted in a shorter hospital stay (3 vs 5 days) and less time off work. The Harris Hip Score (HHS) was improved compared with open treatment at 6 weeks, 3 months, and 12 months. Overall, pain scores (WOMAC, visual analog scale [VAS]) were lower with arthroscopy, reaching statistical significance on about half of the time points. Compared with the open surgical approach, arthroscopy resulted in morphologic overcorrections at the head-neck-junction.

Domb et al (2013) reported a matched-pair comparison of open vs arthroscopic treatment of FAI. Patients chose the procedure after discussion of the advantages and disadvantages of each approach. Ten patients who chose the open procedure were matched with 20 patients from a

larger cohort of 785 patients who underwent arthroscopic treatment of FAI during the same period. Patients were matched for age, gender, diagnosis of FAI, and Worker's Compensation status. The two groups had similar preoperative scores and both groups showed significant improvements postoperatively. At two-year follow-up, the improvements in the Hip Outcome Score (HOS)-Sport-Specific Subscale (42.8 vs 23.5) and Non-Arthritic Hip Score (94.2 vs 85.7) were significantly higher in the arthroscopic group. There was no significant difference between the groups in the modified HHS, HOS-activities of daily living, or VAS for pain.

Mini-Open and Mixed Open/Arthroscopic Approaches

The evidence for mixed-open and open/arthroscopic approaches for the treatment of FAI consists of observational studies. This technique permits direct visualization of the anterior femoral head-neck junction without dislocation.

Observational Studies

A study of the mini-open surgical technique performed on 118 patients with FAI was described by Chiron et al (2012). Fifty-eight percent had cam-type impingement and 42% had mixed type impingement. Average follow-up was 2.2 years. NAHS scores, internal rotation, and alpha angles significantly improved following surgery. Eight revisions were performed, 2 patients experienced residual pain and eventually underwent TKA, and 2 progressed rapidly to OA.

A mixed open/arthroscopic approach for treatment of FAI was reported by Laude et al (2009) in 97 patients (100 hips). This technique allows direct visualization of the anterior femoral head-neck junction without dislocation. The average age of the patients was 33 years (range, 16-56 years). Ninety-one (94%) were available for follow-up at an average 58 months (range, 29-104 months). Scores on the NAHS increased from 55 at baseline to 84 at the last follow-up. One patient had a femoral neck fracture 3 weeks postoperatively, and 13 (14%) required revision due to persistent pain. Eleven (12%) hips required THA at a mean of 40 months (range, 5-75 months). The best results were observed in patients younger than 40 years with a Tonnis grade of 0.

Section Summary: Adults with Symptomatic FAI

The evidence for the use of open dislocation for the treatment of adults with FAI consists of systematic reviews of observational studies. Evidence for the use of arthroscopy for the treatment of adults with FAI consists of systematic reviews of observational studies and 1 small nonblinded RCT. Comparisons of open dislocation and arthroscopy have shown that both procedures are successful in improving pain and functional outcomes, with arthroscopy showing more favorable satisfaction ratings. Although the evidence is mostly observational, cumulatively, the observational studies have reported on thousands of patients and outcomes have been positive.

Adolescents and Children with Symptomatic FAI

The evidence for the surgical management of children with FAI consists of a systematic review of observational studies and one case series published after the systematic review. The systematic review, one of the case series in the systematic review, and the case series published after the systematic review are described below.

Systematic Review

Oduwole et al (2017) reviewed 15 case series identified in a literature search from 2005 to 2016 that reported on the efficacy of surgical management in patients with FAI secondary to slipped capital femoral epiphysis.38 A total of 261 patients (266 hips) underwent both arthroscopic and open procedures (arthroscopic osteochondroplasty, 85 patients [88 hips]; surgical hip dislocation, 131 patients [133 hips; open osteotomy, 45 patients [45 hips]). Mean alpha angle corrections observed for arthroscopy were 32.14°; for surgical hip dislocation, 41.45°; and for open osteotomy, 6.0° ($p<0.05$). Surgical hip dislocation resulted in the most improved correction of the alpha angle.

A systematic review by de Sa et al (2015) conducted a literature search through April 2014 and identified 6 case series and 2 conference abstracts with a total of 388 children and adolescents who had been surgically treated for FAI. The mean number of hips per study was 54 (range, 17-108). Meta-analysis could not be performed due to the inconsistency of outcome measures across the studies. Ages of the patients ranged from 11 to 19.9 years. The main indication for surgery was confirmed diagnosis of FAI, with persistent pain despite nonoperative interventions. Most patients were treated with hip arthroscopy (81% arthroscopic, 19% open). Mean follow-up was 23.4 months. All studies reported significant improvements in pain and function. Satisfaction rates were 84% to 100% for arthroscopy and 79% for open dislocation. There were no reports of iatrogenic femoral neck fracture, instability/dislocation, acute SCFE, avascular necrosis, or premature physeal closure and proximal femoral growth arrest.

Observational Studies

Included in the systematic review was a 2013 multicenter prospective study on arthroscopic treatment for cam type FAI in skeletally immature adolescents with open growth plates (N=34, 41 hips). At a mean follow-up of 14 months (range, 1-2 years), the MHHS improved from 77.39 to 94.15 and on the NAHS improved from 76.34 to 93.18. Return to full sporting activity was reported by 78% of the patients. No complications (e.g, avascular necrosis, SCFE, fracture, growth plate arrest) were observed.

In 2017, Guindani et al published results from patients less than 18 years of age who were retrospectively identified as having undergone surgical dislocation for several different indications at a single instituion. Among the 51 patients (53 hips) in the study, 18 (34%) hips had the diagnosis of FAI. Patients with FAI reported significant improvements in the following pre- and postmeasurements: MHHS, NAHS, and SF-12. No significant improvements were found in: sphericity deviation score, or on α angles (both anteroposterior and Lauenstein views).

Nwachukwu et al (2017) reviewed an institutional hip preservation registry of patients with FAI who underwent hip arthroscopy. The authors sought to define the minimal clinically important difference) and the substantial clinical benefit for adolescents undergoing hip arthroscopy. Data from 47 adolescents (68.1% female; mean age, 16.5 years) were obtained on the patients' modified HHS, the HOS, and the international Hip Outcome Tool. Overall adolescent patients reported a minimal clinically important difference for the various patient-related outcomes but not substantial clinical benefit. The authors discussed the potential limitations of patient-related outcomes for adolescents compared with adults. They noted that adolescents might have higher expectations and greater physical activity demands that influence their scores.

Section Summary: Adolescents and Children with Symptomatic FAI
The evidence consists of a systematic review of observational studies and another of case series as well as 2 case series. All studies reported favorable outcomes in pain reduction and functional improvements, but all studies had relatively small sample sizes, and sufficiently long follow-up is lacking. No serious adverse events were reported.

Children with Slipped Capital Femoral Epiphysis Associated FAI
Evidence for the use of FAI surgery for the treatment of children with slipped capital femoral epiphysis (SCFE) associated FAI consists of observational studies.

Observational Studies
In 2017, Guindani et al published results from patients less than 18 years of age undergoing surgical dislocation for several different indications. Among the 51 patients (53 hips) in the study, 13 (24%) hips had the diagnosis of SCFE. Mean age at surgery for the whole population was 14 years and mean follow-up was 3 years. Outcomes following surgery differed by indication. SCFE patients reported significant improvements in the following pre- and postmeasurements: NAHS, and on α angles (both anteroposterior and Lauenstein views). No significant improvements were found in: MHHS, SF-12, or sphericity deviation score.

Sink et al (2010) reported a retrospective review from 2 U.S. centers on 36 patients (39 hips) with stable SCFE who were treated with open surgical hip dislocation for chronic symptoms. The average time between in situ pinning and surgical hip dislocation was 20 months (range, 6-48 months). Most patients had partial or complete relief of symptoms immediately after initial pinning followed by a recurrence of symptoms that were consistent with impingement. All but 1 patient had either a labral or a cartilage injury, with labral injury observed in 34 of 39 hips and cartilage injury in 33 or 39 hips; the average depth of cartilage damage was 5 mm (range, 2-10 mm). There was no correlation between slip severity or duration of symptoms and the type of cartilage injury.

Ziebarth et al (2009) with Ganz as coauthor conducted a joint 2-center retrospective review that assessed data from their Swiss institution (n=30) and a children hospital in Boston (n=10). Follow-up was 1 to 8 years for patients between 9 and 18 years of age with moderate-to-severe SCFE who were treated with surgical dislocation. No patients from either institution developed osteonecrosis, infection, deep venous thrombosis, or nerve palsies. Three patients developed delayed unions; none developed nonunions. Five patients required additional surgery for heterotopic ossification (n=1), residual impingement (n=1), or breakage of screw or wire fixation (n=3). The short-term postoperative clinical outcomes were found to be near normal, with similar scores between the operative and nonoperative hips.

As reported by Spencer et al (2006, the same U.S. institution evaluated 19 patients (age range, 12-43 years) who underwent femoral neck osteoplasty (n=13) or osteoplasty with intertrochanteric osteotomy (n=6) via Ganz-type surgical dislocation. Of 12 patients with a history of SCFE (age range, 12-38 years), 9 were reported improved symptom control at 8- to 25-month follow-up. Of the 7 patients (age range, 17-43 years) without SCFE who underwent open surgical dislocation for pistol-grip deformities, 5 reported worse symptoms or minimal relief. Outcomes for patients with a chondral flap were worse than for patients without a chondral flap.

Section Summary: Children with Slipped Capital Femoral Epiphysis Associated FAI
The evidence for the use of FAI surgical management for children with SCFE-associated FAI consists of observational studies. Currently, there is no method to determine which children with SCFE will develop FAI. While most patients experienced symptom relief following FAI surgery, the surgery is invasive, and complications (eg, delayed union) have been reported.

Revision Arthrocopic Surgery
Evidence for revision arthroscopic surgery for the treatment of patients with residual FAI consists of two systematic reviews published in 2015. The reviews, as well as an observational study on patients 18 years of age or younger that was published after the systematic reviews.

Systematic Reviews
In 2015, Sardana et al published a systematic review on revision hip arthroscopy, searching for articles through July 2014. Three prospective case control studies and 3 retrospective chart reviews, providing information on 448 hips, were included in the review. The most common indications for revision surgery were residual FAI, labral tears, and chondral lesions. The mean time interval between index and revision procedures was 25.6 months (range, 20.5-36 months). Patients most often requiring revision surgery were women (60%) and younger patients (mean age, 33.4 years). Revision hip arthroscopy resulted in improved functional outcomes (33.6% improvement in HHS) and pain relief. The authors noted that the studies were low quality (level III and IV).

The 2015 systematic review, by Cvetanovich et al, evaluated revision hip arthroscopy. The review included 5 studies, with a total of 348 revision hip arthroscopies. Mean age of patients was 31.4 years and 60% were female. The mean time interval between index and revision procedures was 27.8 months. The most common indication for revision surgery was residual FAI (81%). Revision hip arthroscopy resulted in improved functional outcomes, measured by the HHS (WMD=56.8 (3.6) preoperative vs 72.0 (8.3) at a mean follow-up of 22.4 months; p=0.01), NAHS, Hip Outcome Score, and the SF-12.

Observational Study
A 2016 case-control study by Newman et al compared outcomes after revision hip arthroscopy with outcomes after primary hip arthroscopy among patients 18 years of age and younger. Each patient in the revision hip arthroscopic surgery group (n=42) was matched with 2 patients undergoing primary hip arthroscopic surgery (n=84). Outcomes included the HOS-ADLs, HOS-Sport Score, HSS, and SF-12 Physical Component Summary (PCS) score. Follow-up was conducted for a minimum of 2 years. There were no significant differences between the groups in HOS-ADL and SF-12 PCS. However, the primary arthroscopic surgery group had significantly higher scores in HOS-Sport Score, HHS, and patient satisfaction.

Gwathmey et al (2017) reported on outcomes for 186 patients (190 hips) who underwent revision hip arthroscopy. All patients (mean age, 32.7 years; range 14-64 years) had undergone at least 1 prior hip arthroscopy (range, 1-6) and were prospectively assessed using the modified HHS at both baseline and 3, 12, 24 and 60 months postsurgery. FAI was treated in 79 revision cases. The mean improvement in the modified HHS for the FAI correction as the primary procedure was

27.4 months (mean follow-up, 44.7 months). The overall improvement for FAI correction revision was 21.9 points (mean follow-up, 43.5 months).

Section Summary: Revision Arthroscopic Surgery
The evidence for revision arthroscopic surgery for patients with residual FAI symptoms consists of 2 systematic reviews of observational studies. The observational studies, although low-quality, showed consistent favorable functional outcomes following revision surgery. Evidence for revision arthroscopic surgery for children consists of 1 observational study. Results show that children receiving revision surgery have comparable functional outcomes compared with children receiving primary arthroscopic surgery.

Summary of Evidence
Femoroacetabular impingement (FAI) results from localized compression in the joint due to an anatomic mismatch between the head of the femur and the acetabulum. Symptoms of impingement typically occur in young to middle-aged adults before the onset of osteoarthritis (OA) but may be present in younger patients with developmental hip disorders. The objective of surgical treatment of FAI is to provide symptom relief and reduce further damage to the joint.

For individuals who are asymptomatic adults with FAI who receive FAI surgery, there is no direct evidence that the surgical treatment will prevent the development of OA. Relevant outcomes are symptoms, functional outcomes, health status measures, quality of life, and change in disease status. Indirect evidence consists of observational studies. In retrospective studies of patients with OA, the relevant outcomes were radiographic evidence of hip joint malformations. In prospective studies of patients with FAI, the relevant outcome is progression to OA. Several large observational studies (>1000 patients) as well as smaller studies have shown radiographic evidence of relationships between abnormal hip morphology and the development of OA. There have been no studies in which FAI surgery was performed on patients with FAI morphology but no symptoms. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals who are symptomatic adults with FAI who receive FAI surgery, the evidence includes systematic reviews of large and small observational studies and 1 small RCT. Relevant outcomes are symptoms, functional outcomes, health status measures, quality of life, and change in disease status. Open hip dislocation surgery and arthroscopic surgery are the most common surgical techniques performed on patients with FAI. Systematic reviews have evaluated open hip dislocation surgery and arthroscopic surgery, compared with no comparator, nonsurgical management, and other surgical techniques. Compared with nonsurgical management, all types of surgical techniques have resulted in significant improvements in functional outcomes, pain, and radiographic measurements. The reviews were limited when comparing surgical techniques to each other, because patient characteristics and outcome measurements were heterogeneous among studies. The evidence is sufficient to determine the technology results in a meaningful improvement in the net health outcome.

For individuals who children 15 years of age or younger with symptomatic FAI who receive FAI surgery, the evidence includes systematic reviews of small observational studies. Relevant outcomes are symptoms, functional outcomes, health status measures, quality of life, and change

in disease status. While the studies reported improvements in pain and functional outcomes, the sample sizes were relatively small, with an average of 54 patients per study. The evidence is insufficient to determine the effects of the technology on health outcomes.

For patients 15 years of age or younger with slipped capital femoral epiphysis associated FAI who receive surgical treatment, the evidence includes small observational studies (19 to 51 patients). Relevant outcomes include functional outcomes (modified Harris Hip Score, Non-arthritic Hip Score), symptom relief, radiographic measurements (α angle), and need for additional surgery. While most patients experienced symptom relief following FAI surgery, the surgery is invasive and complications such as nonunion were reported. Evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals who have residual FAI symptoms following a primary surgery who receive revision arthroscopic surgery, the evidence includes systematic reviews of observational studies (>400 patients). Relevant outcomes are symptoms, functional outcomes, health status measures, quality of life, and change in disease status. Though the studies were low quality, consistent improvements in functional outcomes, pain relief, and patient satisfaction were reported. The evidence is sufficient to determine the technology results in a meaningful improvement in the net health outcome.

Practice Guidelines and Position Statements

National Institute for Health and Care Excellence

In 2011, the U.K.'s National Institute for Health and Clinical Excellence (NICE) issued revised guidance on arthroscopic femoroacetabular surgery for hip impingement syndrome. NICE considers current evidence on the efficacy of arthroscopic femoroacetabular surgery for hip impingement syndrome to be adequate in terms of symptom relief in the short and medium term.

NICE's 2011 guidance on open femoroacetabular surgery for hip impingement syndrome indicated that evidence for this procedure was adequate for symptom relief in the short and medium term.46 This guidance replaced IPG203.

U.S. Preventive Services Task Force Recommendations

Not applicable.

Key Words:

Femoroacetabular impingement, FAI, Cam-type impingement, pincer-type impingement, femoral osteoplasty, osteochondral osteoplasty, hip arthroscopy, osteoarthritis

Approved by Governing Bodies:

Surgery for treatment of femoroacetabular impingement is a surgical procedure and as such, is not subject to regulation by the U.S. Food and Drug Administration.

Benefit Application:

Coverage is subject to member's specific benefits. Group specific policy will supersede this policy when applicable.
ITS: Home Policy provisions apply
FEP: Special benefit consideration may apply. Refer to member's benefit plan. FEP does not consider investigational if FDA approved and will be reviewed for medical necessity.

Current Coding:

CPT Codes:

29914	Arthroscopy, hip, surgical; with Femoroplasty (i.e., treatment of Cam Lesion)
29915	Arthroscopy, hip, surgical; with acetabuloplasty (i.e., treatment of pincer lesion)
29916	Arthroscopy, hip, surgical; with labral repair

There are no specific CPT codes for the open treatment of FAI. The procedure might be coded using code 27299 (unlisted procedure, pelvis or hip joint).

References:

1. Ayeni OR, Adamich J, Farrokhyar F et al. Surgical management of labral tears during femoroacetabular impingement surgery: a systematic review. Knee Surg Sports Traumatol Arthrosc 2014; 22(4):756-762.
2. Bardakos NV and Villar RN. Predictors of progression of osteoarthritis in femoroacetabular impingement: A radiological study with a minimum of ten years follow-up. Br J Bone Joint Surg, February 2009; 91(2): 162-169.
3. Bardakos NV, Vasconcelos JC and Villar RN. Early outcome of hip arthroscopy for femoroacetabular impingement: The role of femoral osteoplasty in symptomatic improvement. Br J Bone Joint Surg, December 2008; 90(12): 1570-1575.
4. Beaule PE, Le Duff MJ and Zaragoza E. Quality of life following femoral head-neck osteochondroplasty for femoroacetabular impingement. Am J Bone Joint Surg, April 2007; 89(4): 773-779.
5. Beck M, Kalhor M, Leunig M and Ganz R. Hip morphology influences the pattern of damage to the acetabular cartilage: Femoroacetabular impingement as a cause of early osteoarthritis of the hip. Br J Bone Joint Surg, July 2005; 87(7): 1012-1018.
6. Beck M, Leunig M, Parvizi J, et al. Anterior femoroacetabular impingement: Part II. Midterm results of surgical treatment. Clin Orthop Relat Res, January 2004; (418): 67-73.
7. Bedi A, Chen N, Robertson W and Kelly BT. The management of labral tears and femoroacetabular impingement of the hip in the young, active patient. Arthroscopy, October 2008; 24(10): 1135-1145.
8. Botser IB, Smith TW, Jr., Nasser R et al. Open surgical dislocation versus arthroscopy for femoroacetabular impingement: a comparison of clinical outcomes. Arthroscopy 2011; 27(2):270-278.

9. Byrd JW Thomas and Jones Kay S. Arthroscopic femoroplasty in the management of cam-type femoroacetabular impingement. Clin Orthop Relat Res 2009; 467: 739-746.
10. Chiron P, Espie A, Reina N, et al. Surgery for femoroacetabular impingement using a minimally invasive anterolateral approach: analysis of 118 cases at 2.2-year follow-up. Orthop Traumatol Surg Res. Feb 2012; 98(1):30-38.
11. de Sa D, Cargnelli S, Catapano M, et al. Femoroacetabular impingement in skeletally immature patients: a systematic review examining indications, outcomes, and complications of open and arthroscopic treatment. Arthroscopy. Feb 2015; 31(2):373-384.
12. Dodds MK, McCormack D and Mulhall KJ. Femoroacetabular impingement after slipped capital femoral epiphysis: Does slip severity predict clinical symptoms? J Pediatr Orthop, September 2009; 29(6): 535-539.
13. Domb BG, Stake CE, Botser IB et al. Surgical dislocation of the hip versus arthroscopic treatment of femoroacetabular impingement: a prospective matched-pair study with average 2-year follow-up. Arthroscopy 2013; 29(9):1506-1513.
14. Espinosa N, Rothenfluh DA, Beck M, et al. Treatment of femoro-acetabular impingement: Preliminary results of labral refixation. Am J Bone Joint Surg, May 2006; 88(5): 925-935.
15. Ghovle PA, Cameron DB and Millis MB. Slipped capital femoral epiphysis update. Curr Opin Pediatr, February 2009; 21(1): 39-45.
16. Gosvig KK, Jacobsen S, Sonne-Holm S et al. Prevalence of malformations of the hip joint and their relationship to sex, groin pain, and risk of osteoarthritis: a population-based survey. J Bone Joint Surg Am 2010; 92(5):1162-1169.
17. Guindani N, Eberhardt O, Wirth T, et al. Surgical dislocation for pediatric and adolescent hip deformity: clinical and radiographical results at 3 years follow-up. Arch Orthop Trauma Surg. Apr 2017; 137(4):471-479.
18. Gwathmey FW, Jones KS, Thomas Byrd JW. Revision hip arthroscopy: Findings and outcomes. J Hip Preserv Surg. Dec 2017; 4(4):318-323.
19. Hammoud S, Bedi A, Magennis E et al. High incidence of athletic pubalgia symptoms in professional athletes with symptomatic femoroacetabular impingement. Arthroscopy 2012; 28(10):1388-1395.
20. Harris JD, Erickson BJ, Bush-Joseph CA et al. Treatment of femoroacetabular impingement: a systematic review. Curr Rev Musculoskelet Med 2013; 6(3):207-218.
21. Heyworth BE, Shindle MK, Voos JE et al. Radiologic and intraoperative findings in revision hip arthroscopy. Arthroscopy 2007; 23(12):1295-1302.
22. Horisberger M, Brunner A, Herzog RF. Arthroscopic treatment of femoral acetabular impingement in patients with preoperative generalized degenerative changes. Arthroscopy 2010; 26(5):623-629.
23. Javed A, O'Donnell JM. Arthroscopic femoral osteochondroplasty for cam femoroacetabular impingement in patients over 60 years of age. J Bone Joint Surg Br 2011; 93(3):326-331.
24. Kierkegaard S, Langeskov-Christensen M, Lund B, et al. Pain, activities of daily living and sport function at different time points after hip arthroscopy in patients with femoroacetabular impingement: a systematic review with meta-analysis. Br J Sports Med. Apr 2017; 51(7):572-579.
25. Kim KC, Hwang DS, Lee CH and Kwon ST. Influence of femoroacetabular impingement on results of hip arthroscopy in patients with early osteoarthritis. Clin Orthop Relat Res, March 2007; 456: 128-132.

26. Krueger A, Leunig M, Siebenrock KA et al. Hip arthroscopy after previous surgical hip dislocation for femoroacetabular impingement. Arthroscopy 2007; 23(12):1285-1289 e1.
27. Krych AJ, Thompson M, Knutson Z et al. Arthroscopic labral repair versus selective labral debridement in female patients with femoroacetabular impingement: a prospective randomized study. Arthroscopy 2013; 29(1):46-53.
28. Laborie LB, Lehmann TG, Engesaeter IO et al. Is a Positive Femoroacetabular Impingement Test a Common Finding in Healthy Young Adults? Clin Orthop Relat Res 2013; 471(7):2267-2277.
29. Larson CM and Giveans MR. Arthroscopic management of femoroacetabular impingement: Early outcomes measures. Arthroscopy, May 2008; 24(5): 540-546.
30. Larson CM, Giveans MR, Taylor M. Does Arthroscopic FAI Correction Improve Function with Radiographic Arthritis? Clin Orthop Relat Res 2011; 469(6):1667-1676.
31. Laude F, Sariali E and Nogier A. Femoroacetabular impingement treatment using arthroscopy and anterior approach. Clin Orthop Relat Res 2009; 467: 747-752.
32. Lund B, Mygind-Klavsen B, Gronbech Nielsen T, et al. Danish Hip Arthroscopy Registry (DHAR): the outcome of patients with femoroacetabular impingement (FAI). J Hip Preserv Surg. Jul 2017; 4(2):170-177.
33. Malviya A, Stafford GH, Villar RN. Impact of arthroscopy of the hip for femoroacetabular impingement on quality of life at a mean follow-up of 3.2 years. J Bone Joint Surg Br 2012; 94(4):466-470.
34. Matsuda DK, Carlisle JC, Arthurs SC et al. Comparative systematic review of the open dislocation, mini-open, and arthroscopic surgeries for femoroacetabular impingement. Arthroscopy 2011; 27(2):252-269.
35. Minkara AA, Westermann RW, Rosneck J, et al. Systematic review and meta-analysis of outcomes after hip arthroscopy in femoroacetabular impingement. Am J Sports Med. Jan 1 2018: 363546517749475.
36. Murphy S, Tannast M, Kim YJ, et al. Debridement of the adult hip for femoroacetabular impingement: Indications and preliminary clinical results. Clin Orthop Relat Res, December 2004; (429): 178-181.
37. National Institute for Health and Clinical Excellence (NICE). Arthroscopic femoro-acetabular surgery for hip impingement syndrome. 2007; www.nice.org.uk/nicemedia/pdf/ip/IPG213Guidance.pdf.
38. National Institute for Health and Clinical Excellence (NICE). Arthroscopic femoro-acetabular surgery for hip impingement syndrome. IPG 408. 2011. www.nice.org.uk/nicemedia/live/11328/56416/56416.pdf.
39. National Institute for Health and Clinical Excellence (NICE). Interventional procedure overview of open femoroacetabular surgery for hip impingement syndrome. 2006; www.nice.org.uk/IP243overview.
40. National Institute for Health and Clinical Excellence (NICE). Open femoro-acetabular surgery for hip impingement syndrome (IPG403). 2011; www.//guidance.nice.org.uk/IPG403.
41. Newman JT, Briggs KK, McNamara SC, et al. Outcomes after revision hip arthroscopic surgery in adolescent patients compared with a matched cohort undergoing primary arthroscopic surgery. Am J Sports Med. Dec 2016; 44(12):3063-3069.

42. Nwachukwu BU, Chang B, Kahlenberg CA, et al. Arthroscopic treatment of femoroacetabular impingement in adolescents provides clinically significant outcome improvement. Arthroscopy. Oct 2017; 33(10):1812-1818.
43. Nwachukwu BU, Rebolledo BJ, McCormick F, et al. Arthroscopic versus open treatment of femoroacetabular impingement: a systematic review of medium- to long-term outcomes. Am J Sports Med. Apr 2016; 44(4):1062-1068.
44. Oner A, Koksal A, Sofu H, et al. The prevalence of femoroacetabular impingement as an aetiologic factor for end-stage degenerative osteoarthritis of the hip joint: analysis of 1,000 cases. Hip Int. Mar-Apr 2016; 26(2):164-168.
45. Palmer DH, Ganesh V, Comfort T et al. Midterm outcomes in patients with cam femoroacetabular impingement treated arthroscopically. Arthroscopy 2012; 28(11):1671-1681.
46. Papalia R, Del Buono A, Franceschi F et al. Femoroacetabular impingement syndrome management: arthroscopy or open surgery? Int Orthop 2012; 36(5):903-914.
47. Peters CL and Erickson JA. Treatment of femoro-acetabular impingement with surgical dislocation and debridement in young adults. Am J Bone Joint Surg, August 2006; 88(8): 1735-1741.
48. Philippon MJ, Briggs KK, et al. Outcomes following hip arthroscopy for femoroacetabular impingement with associated chondrolabral dysfunction: Minimum two-year follow-up. Br J Bone Joint Surg, January 2009; 91(1): 16-23.
49. Philippon MJ, Schenker ML, Briggs KK et al. Revision hip arthroscopy. Am J Sports Med 2007; 35(11):1918-1921.
50. Philippon MJ, Schroder ESBG, Briggs KK. Hip arthroscopy for femoroacetabular impingement in patients aged 50 years or older. Arthroscopy 2012; 28(1):59-65.
51. Reichenbach S, Leunig M, Werlen S et al. Association between cam-type deformities and magnetic resonance imaging-detected structural hip damage: a cross-sectional study in young men. Arthritis rheum 2011; 63(12):4023-4030.
52. Sardana V, Philippon MJ, de Sa D, et al. Revision hip arthroscopy indications and outcomes: a systematic review. Arthroscopy. Oct 2015; 31(10):2047-2055.
53. Sink EL, Zaltz I, Heare T and Dayton M. Acetabular cartilage and labral damage observed during surgical hip dislocation for stable slipped capital femoral epiphysis. J Pediatr Orthop, Jan-Feb 2010; 30(1): 26-30.
54. Spencer S, Millis MB and Kim YJ. Early results of treatment of hip impingement syndrome in slipped capital femoral epiphysis and pistol grip deformity of the femoral head-neck junction using the surgical dislocation technique. J Pediatr Orthop, may-June 2006; 26(3): 281-285.
55. Takeyama A, Naito M, et al. Prevalence of femoroacetabular impingement in Asian patients with osteoarthritis of the hip. Int Orthop, October 2009; 33(5): 1229-1232.
56. Tanzer M and Noiseux N. Osseous abnormalities and early osteoarthritis: The role of hip impingement. Clin Orthop Relat Res, December 2004; (429): 170-177.
57. Tibor LM, Leunig M. Labral resection or preservation during FAI treatment? A systematic review. HSS J 2012; 8(3):225-229.
58. Tran P, Pritchard M, O'Donnell J. Outcome of arthroscopic treatment for cam type femoroacetabular impingement in adolescents. ANZ J Surg 2013; 83(5):382-386.

59. Zhang D, Chen L, Wang G. Hip arthroscopy versus open surgical dislocation for femoroacetabular impingement: A systematic review and meta-analysis. Medicine (Baltimore). Oct 2016; 95(41):e5122.
60. Ziebarth K, Zilkens C, Spencer S, et al. Capital realignment for moderate and severe SCFE using a modified Dunn procedure. Clin Orthop Relat Res 2009; 467: 704-716.
61. Zingg PO, Ulbrich EJ, Buehler TC et al. Surgical hip dislocation versus hip arthroscopy for femoroacetabular impingement: clinical and morphological short-term results. Arch Orthop Trauma Surg 2013; 133(1):69-79.

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Medical Policy Group, April 2010 **(1)**
Medical Policy Administration Committee, May 2010
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Medical Policy Group, December 2010 – 2011 Code updates
Medical Policy Group, May 2011, **(1):** Updated Description, Key Points and References
Medical Policy Group, June 2012 **(1):** Updated Key Points and References
Medical Policy Panel, May 2013
Medical Policy Group, May 2013 **(3):** 2013 Updates to Key Points and References; wording clarification in policy statement – no change in coverage criteria
Medical Policy Panel, May 2014
Medical Policy Group, June 2014 **(3):** 2014 Updates to Key Points & References; no change in policy statement.
Medical Policy Panel, May 2015
Medical Policy Group, June 2015 (**2**): 2015 Updates to Key Points, Approved by Governing Bodies, Current Coding, and References; no change in policy statement.
Medical Policy Panel, April 2017
Medical Policy Group, April 2017 **(7)**: Updates to Description, Key Points and References: no change in policy statement.
Medical Policy Panel, April 2018
Medical Policy Group, May 2018 **(7)**: Updates to Key Points and References: no change in policy statement.