

## **Medical Policy Manual**

**Topic:** Femoroacetabular Impingement Surgery

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### **IMPORTANT REMINDER**

Medical Policies are developed to provide guidance for members and providers regarding coverage in accordance with contract terms. Benefit determinations are based in all cases on the applicable contract language. To the extent there may be any conflict between the Medical Policy and contract language, the contract language takes precedence.

PLEASE NOTE: Contracts exclude from coverage, among other things, services or procedures that are considered investigational or cosmetic. Providers may bill members for services or procedures that are considered investigational or cosmetic. Providers are encouraged to inform members before rendering such services that the members are likely to be financially responsible for the cost of these services.

### **DESCRIPTION<sup>[1]</sup>**

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.

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 overcoverage) 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, known as cam impingement and pincer impingement 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. It has been proposed that impingement with damage to the labrum and/or acetabulum is a causative factor in the development of hip osteoarthritis, and that as many as half of cases currently categorized as primary osteoarthritis may have an etiology of FAI.

Other terms that may be used for FAI include the following:

- Acetabular rim syndrome
- Acetabular retroversion
- Pistol grip deformity of the proximal femur
- Bone spurs of the hip

Nonsurgical treatments include modification of activities and avoidance of specific movements that elicit symptoms and non-steroidal anti-inflammatory drugs. Intra-articular steroid injections and physical therapy with hip strengthening exercises may reduce symptoms. Hip stretching exercises such as yoga usually make symptoms worse.

Various open surgical and/or arthroscopic techniques have been described. Previously, access to the joint space was limited and treatment consisted primarily of debridement and/or labral reattachment. A technique for hip dislocation with open osteochondroplasty that preserved the femoral blood supply was reported by Ganz and colleagues in 2001. Visualization of the entire joint with this procedure led to the identification and acceptance of FAI as an etiology of cartilage damage (the association between abnormal femoral head/neck morphology and early age onset of osteoarthritis had been described earlier by others) and the possibility of correcting the abnormal femoroacetabular morphology. Open osteochondroplasty of bony abnormalities and treatment of the symptomatic cartilage defect is considered the gold 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 adapted from the open approach 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 (CT) and fluoroscopy, have been utilized to improve visualization of the 3-dimensional head/neck morphology during arthroscopy.

The following terms may also be used for FAI surgery (though these operative terms apply as well to other orthopedic procedures):

- Hip decompression
- Joint preserving surgery
- Resection osteoplasty
- Osteotomy (periacetabular for reorientation of a retroverted acetabulum, trochanteric or intertrochanteric)

- Hip debridement

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. It is believed that if FAI presents with limitations in hip range of motion, compensatory patterns during athletic activity may lead to increased stresses involving the abdominal obliques, distal rectus abdominis, pubic symphysis, and adductor musculature. The condition is more common in men than in women and is associated with sports in which high speed twisting of the hip and pelvis occur (e.g., football and hockey). Under surgical exploration, a variety of musculotendinous defects, nerve entrapments, and inflammatory conditions have been observed. These defects are often discovered and repaired during open or minimally invasive exploratory laparoscopy. Surgery for athletic pubalgia has been performed concurrently with treatment of FAI or might be performed following FAI surgery if symptoms do not resolve. However, there is little definitive evidence to determine if surgical repair improves health outcomes in patients with athletic pubalgia.

The recognition and treatment of FAI has also brought attention to the possibility of cam-type FAI after slipped capital femoral epiphysis (SCFE). The standard treatment for SCFE is stabilization across the physis by in-situ pinning, although it is not uncommon for patients with SCFE to develop premature osteoarthritis requiring total hip arthroplasty within 20 years. Treatments being evaluated 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. Therefore, early treatment to decrease impingement must be weighed against increased risk for adverse events including avascular necrosis in patients with SCFE.

It is known that surgical treatment of FAI pathology is less effective for pain reduction in patients with late stage osteoarthritis. In addition, delay in the surgical correction of bony abnormalities may lead to disease progression to the point where joint preservation is no longer appropriate. It is believed that osteoplasty of the impinging bone is needed to protect the cartilage from further damage and preserve the natural joint. Therefore, if FAI morphology is shown to be an etiology of osteoarthritis, a future strategy to reduce the occurrence of idiopathic hip osteoarthritis could be early recognition and treatment of FAI before cartilage damage occurs.

**Note:** The surgical procedure may be done arthroscopically or as an open procedure based on the evaluation and recommendation of the treating surgeon. It is preferable that any surgeon performing a surgical procedure have current, appropriate experience applicable to that procedure. Surgical treatment of FAI should be performed only in centers experienced in treating this condition and staffed by surgeons who have attended courses in FAI surgery, particularly for arthroscopic surgery, who perform at least ten FAI surgeries per year, and who are able to perform other hip surgeries that may be necessary during FAI surgery (e.g., labral debridement and repair, osteoplasty, synovectomy). Because of the differing benefits and risks of open and arthroscopic approaches, patients should make an informed choice between the procedures.

**Note:** Femoroacetabular impingement (FAI) should not be confused with acetabular dysplasia, considered a part of developmental dysplasia of the hip (DDH), formerly described as congenital hip dislocation.

## MEDICAL POLICY CRITERIA

- I. Open or arthroscopic treatment of femoroacetabular impingement (FAI) may be **medically necessary** in skeletally mature patients when all of the following criteria are met:
  - A. Symptoms
    1. Moderate-to-severe hip pain that is worsened by flexion activities (e.g., squatting or prolonged sitting) that significantly limits activities
    2. Unresponsive to conservative therapy for at least three months or conservative therapy is contraindicated (e.g., history of falls due to mechanical instability of hip joint). Conservative therapy for FAI should include:
      - a. Activity modification including avoidance of hip stretching activities (e.g., yoga)
      - b. Restriction of athletic pursuits
      - c. Avoidance of symptomatic motion.
    3. Positive impingement sign on clinical examination (i.e., pain elicited with 90 degrees of flexion and internal rotation and adduction of the femur)
  - B. Imaging as read by a radiologist
    1. Morphology indicative of cam-type 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 (overcoverage with crossover sign), coxa profunda or protrusion, or damage of the acetabular rim
    2. 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
    3. No evidence of advanced osteoarthritis, defined as Tonnis grade II or III, or joint space of less than 2 mm, except when there is mechanical instability
    4. No evidence of severe (Outerbridge grade IV) chondral damage.
- II. Open or arthroscopic treatment of FAI is considered **not medically necessary** when the criteria in I.A.-C. above are not met.

## SCIENTIFIC EVIDENCE<sup>[1]</sup>

The key issue for this policy is whether correction of femoroacetabular impingement (FAI) morphology with open or arthroscopic osteoplasty alters the development of symptomatic cartilage damage and hip osteoarthritis. Given the relatively recent recognition of FAI and development of interventional procedures, neither the natural history of FAI nor the effect of osteochondroplasty on the development of osteoarthritis is known. No prospective randomized controlled trials were identified. Therefore, to

evaluate the potential benefit of FAI with the evidence available at this time, studies were reviewed for the following:

- Evidence that FAI is an etiology of cartilage damage and hip osteoarthritis.
- Evidence for benefit of open or arthroscopic osteoplasty on pain and function in patients with FAI pathology. If there is benefit, what are the specific indications and the appropriate timing for surgical intervention?

## **Natural History**

The most recent study of the development and progression of osteoarthritis (OA) in hips with FAI was a retrospective review of 96 asymptomatic patients with radiological evidence of cam (n=17), pincer (n=34), or mixed (n=45) FAI.<sup>[2]</sup> Over a mean period of 18.5 years (range 10 to 40 years), 79 hips (82%) remained free of OA. Seventeen (18%) developed OA at a mean of 12 years (range 2 to 28 years). The authors concluded that many hips with FAI may not develop OA in the long term and, therefore, prophylactic surgical treatment in asymptomatic patients is not warranted.

A frequently cited paper describing the relationship between hip morphology and acetabular damage is from the group of Ganz and Leunig, who had previously reported the open procedure with dislocation in 2001.<sup>[3]</sup> In this study, a total of 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. Only hips with minor radiological changes, with narrowing or osteophytes equivalent to an osteoarthrosis grade less than 1 according to the classification of Tonnis, were included. Excluded were hips with traumatic or post-traumatic conditions (n=37), avascular necrosis (n=14), and hips that had undergone previous surgery (n=7). Patients with incomplete or inadequate preoperative radiographs were also excluded. For the 26 hips that met the inclusion/exclusion criteria and showed 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 osteoarthritis and well-defined hip configurations, a strong association existed between specific hip morphology and the pattern of cartilage damage. The intent of the study was “to obtain unequivocal data” on the starting point of joint degeneration with FAI; damage in patients with more complex morphology was not described.

To address the gap in current knowledge, Ganz and colleagues began a population-based natural history study in 2005 with a cohort of 1,100 young men to determine whether morphologic alterations are associated with an increased rate of early osteoarthritis. As of 2011, 1,080 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 questionnaire.<sup>[4]</sup> 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 asymptomatic men (27%). The primary outcome of labral lesions was found in a large proportion of subjects both with and without cam-type deformities; labral lesions were found 57 of 67 participants (85%) with a cam-type deformity and 118 of 177 participants (67%) without a deformity. Logistic regression models adjusted for age and body mass index (BMI) found an odds ratio [OR] 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 compared to those without in this cross-sectional study. As noted by the authors,

longitudinal studies are needed to determine whether cam-type deformity is a risk factor for symptomatic hip osteoarthritis.

Baradakos and Villar retrospectively examined progression of osteoarthritis of 43 patients (43 hips) under 55 years of age with a history of symptomatic idiopathic arthritis, first seen no later than 1997, who exhibited pistol-grip deformity of the femur and mild to moderate osteoarthritis (Tonnis grade 1 or 2) at baseline.<sup>[5]</sup> Radiographs taken at least 10 years apart showed progression of osteoarthritis 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 the only significant independent predictors for progression of osteoarthritis in this small sample. A reduction of one degree in the medial proximal angle increased the odds of the osteoarthritis progressing by 21 times, while osteoarthritis in a hip with a positive posterior wall sign (the center of the femoral head located lateral to the outline of the of the posterior acetabular rim) 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.

In another study, Tanzer and Noisieux reported that of 38 consecutive patients who were treated arthroscopically and who had a labral tear, 97% were found to have a pistol-grip deformity on preoperative radiographs.<sup>[6]</sup> These authors also reported that in 200 consecutive patients (200 hips) having primary total hip arthroplasty, the underlying etiology of patients' arthritis was determined by their history and radiographic findings. Anteroposterior pelvis, lateral, and frog lateral hip radiographs were evaluated for abnormalities of the femur and/or acetabulum. All patients without a history or radiographic evidence of underlying hip disease were given the diagnosis of idiopathic hip arthritis. From the 125 cases diagnosed as idiopathic arthritis, 100% exhibited a pistol-grip deformity. Radiographs of the contralateral limb showed that 31% of patients had a healthy hip without a deformity or evidence of osteoarthritis, 14% had a deformity without evidence of arthritis, and 55% had a pistol-grip deformity and radiographic evidence of arthritis. A pistol-grip deformity was associated with arthritis later in life.

A 2009 study from Asia reviewed records of 843 consecutive patients (978 hips) who underwent primary surgery for osteoarthritis or other diseases of the hip to determine the prevalence of FAI in this population.<sup>[7]</sup> Twenty-six patients (32 hips) were excluded due to insufficient radiographs or records, resulting in a study population of 817 patients (946 hips). The average age at the time of surgery was 54.8 years (range: 12–92 years). All of the patients were Asian. The majority of patients (73%) were diagnosed with osteoarthritis secondary to developmental dysplasia of the hip, another 12% had idiopathic osteonecrosis, and 1.7% had Legg-Calve-Perthes disease. Only 17 patients (1.8%) were considered to have had primary osteoarthritis. 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 osteoarthritis and 35% in the population with primary osteoarthritis.

In 2010, Gosvig et al. published findings from a cross-sectional radiographic and questionnaire database of 4,151 individuals from the Copenhagen Osteoarthritis study. Subjects in this population-based cohort were selected according to a random Social Security number algorithm between 1991 and 1994.<sup>[8]</sup> Excluding subjects with hip replacement surgery, Perthes disease, childhood hip disease, rheumatoid arthritis, radiographs with excessive rotation, or unreadable radiographs resulted in 3,620 subjects who met the study criteria. The study group consisted of 1,332 men with a mean age of 60.0 years (range 22 to 90 years) and 2,288 women with a mean age of 60.8 years (range 21 to 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 on the basis of radiographic criteria. The male and female prevalence of hip-joint malformations was 71% and 36.6%, respectively. The prevalence of hip osteoarthritis, defined radiographically as a minimum joint-space width of equal to or less than 2 mm, was 9.5% in men and 11.2% in women. Although there was no significant increase in the reporting of deep groin pain in subjects with hip-joint malformations ( $p>0.13$ ), a deep acetabular socket or pistol-grip deformity were significant risk factors in the development of hip osteoarthritis (risk ratio of 2.4 and 2.2, respectively).

Kim et al. reviewed outcomes of 43 patients (mean age: 40 years; range: 18–68 years) who had labral tears and early osteoarthritis (Tonnis grade 0 to 1, average Japanese Orthopedic Association [JOA] scores of less than 1) and symptoms lasting 3 months or more who had been treated with debridement.<sup>[9]</sup> At an average 50 months' follow-up (12–96 months), 74% of patients had improved, with 11 showing no improvement. Blinded evaluation of preoperative radiographs and MR arthrograms indicated that 42% of patients had FAI. When treated only with debridement, patients were less likely to improve if early stage osteoarthritis or FAI was present at the time of surgery. For example, on the JOA scale where 0=severe pain to 3=no pain, patients without either FAI or osteoarthritis scored 2.6 at follow-up, while patients with FAI scored 1.83 and those with both FAI and osteoarthritis scored 1.67.

Sink et al. reported a retrospective review from 2 U.S. centers on 36 patients (39 hips) with stable slipped capital femoral epiphysis (SCFE) who were treated with open surgical hip dislocation for chronic symptoms.<sup>[10]</sup> The degree of slip was considered to be mild in 8, moderate in 19, and severe in 11 patients, and the average time between in situ pinning and surgical hip dislocation was 20 months (range: 6–48 months). The majority of 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 one patient had either labral or cartilage injury, with labral injury observed in 34 of 39 hips and cartilage injury in 33 of 39 hips (5 grade 1, 10 Grade 2, 4 Grade 3, 10 Grade 4, and 4 Grade 5); 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.

Dodds et al. examined the prevalence of FAI in 36 patients (49 hips) who returned for clinical evaluation at an average 6 years after SCFE.<sup>[11]</sup> There was no difference in the grade of slip between those patients who were available for follow-up and the total cohort treated for SCFE. The average age at presentation was 12.2 years, and at the time of evaluation all patients had reached skeletal maturity. Postoperative radiographs were reviewed for the grade of slip, Southwick slip angle, Loder's classification of physeal stability, and the anterior head-neck offset (alpha) angle. Pain and impingement were found in 30% of the 30 hips with Grade 1 slips, 25% of the 8 hips with Grade 2 slips, and 0% of the 4 hips with Grade 3 slips. None of the radiographic factors including the grade of slip was predictive of subsequent impingement; the alpha angle was the most influential variable in regression analysis ( $p=0.63$ ). Together, these results indicate that it is difficult to predict which patients with SCFE will develop FAI, but that all children should be followed into adulthood and monitored for impingement.

In summary, evidence on the natural history and long-term effect of treatment is limited due to the relatively recent recognition of this condition. Overall, the retrospective evidence available indicates a relatively strong association between cam-type impingement related to a pistol-grip deformity, labral damage, and the subsequent development of osteoarthritis. The identification of patients with FAI morphology who will progress to osteoarthritis (and perhaps more importantly those who are unlikely to progress) is limited at this time, although some evidence from retrospective studies is beginning to emerge.

## Treatment of FAI with Arthroscopic or Open Approaches

### Comparisons of Arthroscopic and Open Approaches

The following three 2011 systematic reviews compared open and arthroscopic surgery for FAI.

- Matsuda et al. included 18 level III or IV studies (controlled cohort or case series) with a minimum 1-year follow-up.<sup>[12]</sup> There were 6 papers on open surgical dislocation, 4 on mini-open procedures, and 8 arthroscopic studies. All 3 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 and colleagues included 26 level II to IV articles totaling 1,462 hips in 1,409 patients.<sup>[13]</sup> 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.
- Papalia et al included 31 studies that reported clinical, functional, and imaging outcomes following FAI surgery via arthroscopy, open surgery, or arthroscopy followed by mini open surgery.<sup>[14]</sup> The assessment of methodological quality of published studies found generally low methodological quality, and great heterogeneity in study designs and outcome measures. The surgical techniques were found to have comparable functional results, biomechanics, and return to sports. Preoperative cartilage status and osteoarthritis (OA) were prognostic for postoperative progression to osteoarthritis and conversion to hip arthroplasty.

### Arthroscopic Approach

Short- to mid-term studies of arthroscopic techniques in patients of various demographics (e.g., age), and hip joint pathology (e.g., FAI with or without labral tears, osteoarthritis) continue to be published. The following studies are representative of the currently available published evidence.

- The largest prospective series is by Malviya et al., who reported on changes in quality of life (QoL) for 612 patients who were treated by a single surgeon.<sup>[15]</sup> Patients ranged in age from 14 to 75 years (mean of 36.7). At 1 year after surgery, 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%.
- Byrd and colleagues 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 impingement in 2004-2007.<sup>[16]</sup> The average age of the patients was 33 (range not reported), with symptoms averaging 32 months and no sign of advanced osteoarthritis. There was 100% follow-up of the 207 hips at a minimum of 12 months. 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.
- In 2012, Palmer et al. reported prospective 3-year follow-up on 201 procedures for cam-type FAI with a Tonnis grade of 1 or less.<sup>[17]</sup> 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 with 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 cm<sup>2</sup>, 60% underwent hip replacement at a mean of 21.7 months (range, 2-29 months).

- Philippon et al. 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.<sup>[18]</sup> Patients were included in the study report (n=122) if they underwent arthroscopic treatment for FAI and chondrolabral dysfunction, and did not have bilateral hip arthroscopy, avascular necrosis, or previous surgery. 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 total hip arthroplasty at a mean of 16 months. Patients with a joint space of less than 2 mm were 39 times more likely to progress to total hip arthroplasty.
- Larson and Giveans reported 10-month follow-up (3 months to 3 years) from a consecutive series of 96 patients (100 hips) who presented with FAI.<sup>[19]</sup> 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 patients (3%) required total hip arthroplasty, and 6 had heterotopic bone formation. Visual analog scale (VAS) scores for pain improved from 6.7 at baseline to 1.9 at the 3-month to 3-year follow-up. Scores on the SF-12 improved from 60 to 78.

#### Mixed Open/Arthroscopic Approach

- A mixed open/arthroscopic approach for treatment of FAI was reported by Laude et al in 97 patients (100 hips).<sup>[20]</sup> This technique allows direct visualization of the anterior femoral head-neck junction without dislocation. All patients had a positive impingement test (pain reproduced in flexion, adduction, and internal rotation). All patients had MR arthrography or CT arthrography to analyze the labrum for tears. Nine patients had prior surgery and 3 patients had Tonnis grade 2 osteoarthritis. Thirty patients had grade 1 osteoarthritis. The average age of the patients was 33 (range: 16–56 years). Ninety-one (94%) were available for follow-up at an average 58 months (range: 29–104 months). Scores on the nonarthritic hip score (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. In 8 of these patients, the damaged part of the labrum was removed and in 6 patients, osteochondroplasty of the head was performed to improve the groove at the head-neck junction. Another patient had heterotopic ossification. Eleven hips (12%) required total hip arthroplasty at a mean of 40 months (range: 5–75 months). In the total hip arthroplasty group, the acetabular lesions were deeper (10.9 mm vs. 6 mm) and a higher percentage of Beck grade 5 was found (54% vs. 7%). The best results were observed in patients younger than 40 years with a Tonnis grade of 0.

#### Labral Repair

- In 2013, Krych et al. reported a non-blinded RCT of labral repair versus labral debridement in 36 female patients with pincer-type or combined-type FAI.<sup>[21]</sup> At a mean 32-month follow-up (range 12 to 48 months), both groups showed significant improvement in the Hip Outcome Score (HOS) compared to baseline. Compared to the debridement group, the repair group had better outcomes on activities of daily living HOS (91.2 vs. 80.9) and sports HOS (88.7 vs. 76.3). A greater number of

patients in the repair group rated their hip function as normal or nearly normal (94% vs. 78%).

- Bardakos and colleagues compared results from 24 patients treated with osteochondroplasty for cam impingement (after 2004) with 47 patients who showed cam impingement but had only the labrum repaired (between 2000 and 2004).<sup>[22]</sup> The cohorts were matched for age (27–46 years) and for follow-up of 1 year. The number of patients who did not meet the selection criteria was not reported. There was a trend ( $p=0.11$ ) for improved MHHS outcomes (excellent, good, fair, poor) in patients who were treated for impingement in addition to labral repair in this small study. Post hoc analysis of the percentage of patients in the excellent/good category showed significant improvement for the FAI-treated patients over historical controls (83% vs. 60%,  $p=0.043$ ). Results of this study should be interpreted cautiously due to multiple potential sources of bias, including selection bias, limited follow-up, and the small sample size.

### Revision Surgery

- Philippon and colleagues reported on 37 revisions of previous hip arthroscopies by the senior author (51%) or referred from other centers.<sup>[23]</sup> Radiographic evaluation showed evidence of impingement in 36 of 37 patients that was either not addressed (60%) or inadequately addressed (32%) at the time of the index procedure. Five of the revisions (14%) required repeat revision or total hip replacement and were considered failures. Average 1-year follow-up on 27 of 32 hips that did not fail revision showed improvement (mean of 77; range: 36–100) on the MHHS.
- Heyworth et al. identified 24 revisions (23 patients) out of a total of 450 patients who underwent a hip arthroscopy at their institution.<sup>[24]</sup> The mean interval between the primary hip arthroscopy and recurrence of symptoms was 6 months (range: 0 to 39 months). Radiographic evaluation showed evidence of bony impingement in 19 cases (79%). Of these, 10 had only soft-tissue repair during the primary procedure and 9 had debridement of bone; 7 of the 9 were considered to be inadequate. Although the revision rate for arthroscopic FAI cannot be determined from the data provided, the authors commented that even when bony lesions are fully recognized, there may be a tendency to insufficiently address them surgically. Revision arthroscopy was also reported in 16 patients for the treatment of adhesions following open surgical hip dislocation for FAI.<sup>[25]</sup>

Poor outcomes following arthroscopic treatment of FAI in patients with arthritis have been reported.

- Larson et al. 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).<sup>[26]</sup> Although both groups had improved scores throughout 12-month follow-up, outcomes were better for patients without osteoarthritis than for patients with osteoarthritis. Patients with advanced preoperative joint space narrowing ( $n=22$ ) showed no improvement after treatment for FAI. At 3-year follow-up, the mean Harris Hip score was 88 for the group without osteoarthritis and 67 for the group with osteoarthritis. The failure rate at the last follow-up, defined as a MHHS less than 70 or conversion to hip arthroplasty, was 12% for patients without osteoarthritis, 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 magnetic resonance imaging (MRI), and greater duration

of symptoms preoperatively were independent predictors for lower Harris Hip scores.

- Another study reported outcomes from 20 patients (out of a series of 150) who showed generalized severe cartilage lesions during intraoperative arthroscopic assessment for FAI.<sup>[27]</sup> Nine hips had Tonnis grade I osteoarthritis, 6 had grade II, and 5 had grade III osteoarthritis. At a mean follow-up of 3 years, 10 patients (50%) had undergone, or planned to undergo, total hip replacement. Preoperatively, 5 of the 10 hips had Tonnis grade III osteoarthritis. Another 2 patients had a poor result at latest follow-up but were not yet willing to undergo THA. The mean time between the index surgery and THA was 1.4 years (range, 0.4 to 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 debridement.
- Similarly, Philippon et al reported significantly better outcomes at 3-year follow-up for patients with preoperative joint space greater than 2 mm compared with those with joint space narrowing to 2 mm or less.<sup>[28]</sup>

### Selection for Age

- Philippon et al. evaluated outcomes following arthroscopic treatment of FAI in 153 consecutive patients aged 50 years or older.<sup>[28]</sup> 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 6-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, 3 months to 4 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 1 year, 84% at 2 years, and 80% at 3 years. For the 64 patients who had data available at 3 years, patients with greater than 2 mm of joint space preoperatively had survivorship of 90% whereas those with 2 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 2 mm or less and preoperative MHHS of less than 50 as risk factors for hip replacement.
- Javed and O'Donnell reported arthroscopic treatment of cam-type FAI in 40 patients older than 60 years of age (mean 65 years; range 60 to 82).<sup>[29]</sup> Patients were excluded from this retrospective study if they had Tonnis grade 2 or 3 osteoarthritis, pincer FAI, bilateral cam FAI, inflammatory or metabolic hip disease, hip dysplasia, Perthes disease, a history of fracture of the hip or previous surgery on the hip. Forty patients fulfilled the inclusion/exclusion criteria out of a total of 1,693 hip arthroscopies (2.4%) performed at their institution. In 17 patients there was no arthroscopic evidence of osteoarthritis in the hip; 23 had a variable degree of chondral loss from the acetabulum and/or femoral head. 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, equal to or less than Tonnis grade 1 osteoarthritis and a mean age of 63 years (range 60 to 70), 7 (17.5%), underwent total hip replacement at a mean interval of 12 months. All but one had evidence of severe synovitis, 4 of the 7 patients had grade 3 chondral loss from both the acetabulum and femoral head, while 3 had a grade 3 lesion of the acetabular cartilage. No fractures of the femoral neck occurred during the follow-up

period.

- Arthroscopic treatment for cam type FAI in adolescents with open growth plates was reported in 2012/2013.<sup>[30]</sup> At a mean follow-up of 14 months (range, 1-2 years), prospectively collected data showed improvement on the MHHS from 77.39 to 94.15 and on the nonarthritic hip score (NAHS) from 76.34 to 93.18. Of the 34 consecutive patients included in the study, 78.1% returned to full sporting activity. No complications (e.g., avascular necrosis, SCFE, fracture, or growth plate arrest) were observed.

### Open Approach

Seven case series of patients with FAI treated with the open approach and dislocation were identified in the systematic review by Bedi et al.<sup>[31]</sup> Two studies reported on 5 patients and 5 studies reported results from 19 to 52 patients, with follow-up ranging from 24 to 60 months. The 5 studies are briefly described here.

Beck et al. reported outcomes from 19 patients (average age: 36 years; range: 21–52) of 22 who had been selected from their database with confirmed clinical, radiographic, and MR arthrography diagnosis of FAI, had been treated with surgical dislocation of the hip, and had at least 4 years of follow-up.<sup>[32]</sup> Three patients were excluded based on a history of prior intra-articular surgery of the involved hip. Of the remaining 19, all had labral damage and 18 had acetabular damage. By 4 to 5 years' follow-up, 5 patients (26%) had undergone total hip arthroplasty, with the failures associated with cartilage damage. Thirteen patients (68%) were reported to have had good to excellent outcomes.

Another study selected 52 of 141 consecutive patients to compare the effect of reattaching or removing the labrum during treatment for FAI.<sup>[33]</sup> Patients were selected for age (20–40 years) and no prior surgery; all had preoperative evidence of acetabular damage. Patients were excluded from the study because of incomplete clinical or radiographic documentation (n=48), open growth plates (n=4), age of greater than 40 years (n=29), previous hip surgery (n=7), or participation in professional athletic activity (n=1). Independent evaluations of 2-year follow-up indicated improved Merle d'Aubigne scores for both groups, from a baseline of 12 to 15 in the group in which the labrum was resected and from 12 to 17 in the group where the labrum was reattached. The study also found a reduction in progression to osteoarthritis if the labrum was reattached.

Peters et al. reported on 29 patients (30 hips) in a prospective protocol with minimum 2-years' follow-up.<sup>[34]</sup> The specific diagnoses were primary femoroacetabular impingement in 25 patients (26 hips), Legg-Calve-Perthes disease (n=3), and slipped capital femoral epiphysis (n=1). The average age of the patients was 31 years (range: 16–51 years). Twenty-nine of the 30 hips had either cam-type impingement (n=14), or mixed cam and pincer-type impingement (n=15). Eighteen hips were reported to have had severe cartilage damage that was not seen on MR arthrography. The Harris Hip score improved from 70 at baseline to 87 at an average 32-months' follow-up. No progression to osteoarthritis was observed in 68% of patients. There was non-union in 8 hips (27%), 5 hips (17%) were expected to convert to total hip arthroplasty due to progressive pain, and 4 (13%) had progression to osteoarthritis. Radiographic signs of progression of osteoarthritis and clinical failure requiring conversion to total hip arthroplasty were seen only in patients with severe damage to the acetabular-articular cartilage. Two additional retrospective studies (n=23 and 34) that included patients with severe cartilage damage reported that 50% to 70% of patients improved and 30% to 50% failed (either no improvement or underwent subsequent THA) following open osteochondroplasty with dislocation.<sup>[35,36]</sup>

Chiron et al described a new minimally invasive technique without dislocation via an anterolateral approach.<sup>[37]</sup> This technique, in which the central cartilaginous compartment was not explored and the labrum was not sutured, was performed in 120 hips in 108 patients. Average follow-up was 2.2 years (range 12 to 54 months), and 2 cases were lost to follow-up. Significant improvement in function, and range of motion were reported. Surgical revision included 4 for hematoma, 2 for capsular debridement, and 2 for additional procedures on the acetabulum.

Several articles from specialized centers reported on the treatment of symptomatic FAI in children with developmental hip disorders. The largest series on SCFE was a joint retrospective review from the Swiss group of Ganz and Leunig (n=30), together with the Children's Hospital Boston (n=10), with 1- to 8-year follow-up on 40 patients (between 9 and 18 years of age) with moderate to severe SCFE who were treated by capital realignment with surgical dislocation.<sup>[38]</sup> The primary aim of the article was to determine whether this capital realignment technique was feasible and repeatable, and would restore hip anatomy and function while avoiding osteonecrosis. Dislocation was not performed in SCFE with a slip angle of less than 30 degrees, in which trimming of the anterior metaphysis was considered sufficient to restore the anterior offset without weakening the femoral neck. 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. Stability and the duration of symptoms of SCFE (1 day to 3 years) were associated with the severity of acetabular cartilage damage observed at the time of surgery.

From the same U.S. institution was a 2006 report of 19 patients (12–43 years of age) who underwent either femoral neck osteoplasty (n=13) or osteoplasty with intertrochanteric osteotomy (n=6) via Ganz-type surgical dislocation.<sup>[39]</sup> Out of 12 patients with a history of SCFE (12–38 years of age), 9 were found to be improved at 8–25 months' follow-up. Out of the 7 patients (17–43 years of age) without SCFE who underwent open surgical dislocation for pistol grip deformities, 5 had worse symptoms or minimal relief. Outcomes for patients with a chondral flap were worse than for patients without a chondral flap. For example, function scores on the WOMAC improved from a baseline of 26 to 10 in patients without a chondral flap, but did not improve (25 to 24) in patients with chondral flap damage.

### **FAI Treatment in Pediatric Populations**

Due to the unclear balance of risks and benefits, questions regarding whether, when and how to treat symptomatic FAI in children with slipped capital femoral epiphysis are difficult. Although the impact of not treating FAI is established, there is limited evidence on treatment outcomes in pediatric patients. The open dislocation procedure is technically demanding with a high risk of serious complications and has not been shown to be safe and effective outside of a few highly specialized centers. In addition, questions remain concerning selection criteria and the appropriate timing and approach for FAI treatment in patients with developmental hip disorders. In a 2009 review of SCFE, surgeons from Children's Hospital Boston considered subcapital correction osteotomy with surgical dislocation to be an emerging treatment, stating that, "Currently, we recommend that this type of treatment should be restricted to few select specialized centers until the availability of long-term results and outcome. Also, this type of treatment has a steep learning curve, and it is advised to learn this surgical technique at a specialized center."<sup>[40]</sup>

### **Clinical Practice Guidelines and Position Statements**

No clinical practice guidelines or position statements from U.S. professional societies were found.

## Conclusions

Although there are no randomized controlled trials investigating FAI and long-term follow-up data is limited, the literature is suggestive of the following:

- Not all patients with FAI morphology will have FAI pathology.
- There is a high association between FAI pathology and idiopathic osteoarthritis, but this may represent a small proportion of the total cases of hip osteoarthritis.
- Patients may present with hip pain that can be diagnosed as FAI by a combination of clinical evaluation, radiographs, and MR arthrography.
- In cases in which there is a positive impingement test result, anterosuperior labral or acetabular damage identified on MR arthrography and a pistol-grip morphology identified on imaging, there is a very high probability that the acetabular damage is caused by impingement of the femoral head-neck junction against the acetabular rim. FAI can be verified intraoperatively.
- Repair of the labrum alone can improve symptoms in the short term. It is reasonable to expect that debridement/osteoplasty of the bump or bone spur would reduce continued abrasion in the long term. Some studies, albeit of low quality, support this view.
- Treatment of FAI is most effective in younger patients without osteoarthritis (Tonnis grade 0 or I) or severe cartilage damage. Although osteoarthritis can be identified with plain film radiographs, articular damage is not always identified with current imaging techniques.
- There is a high probability that symptoms in patients with osteoarthritis (Tonnis grade II or III, or joint space of less than 2 mm) or severe cartilage damage (Outerbridge grade IV) will not improve following osteoplasty. These patients may require THA for progressing pain within 5 years.
- In large case series, arthroscopic treatment of FAI in young to middle-age patients without osteoarthritis and showing mild to moderate cartilage damage results in 75% to 85% of patients improved.
- Smaller case series suggest that open treatment of FAI in young to middle-age patients with moderate to severe cartilage damage results in 50% to 70% of patients improved. Non-union has been reported to occur in 27% of patients following the transection of the great trochanter with hip dislocation.

The literature is uncertain with respect to the following:

- It is not known which patients with FAI morphology are most likely to progress to osteoarthritis. The progression of pincer impingement with damage initially restricted to the labrum may follow a different time course than cam-type impingement.
- It is not known whether treatment of FAI will reduce the occurrence of osteoarthritis.

Based on 1) the intraoperatively established relationship between FAI morphology and damage to the acetabulum, 2) the consistent improvement in symptoms reported in large prospective case series, and 3) the potential for continued and irreparable cartilage damage if FAI pathology is not addressed, it may be considered medically necessary to debride the bone when specific criteria are met. Because of the differing benefits and risks of open and arthroscopic approaches, patients who meet the policy criteria should make an informed choice.

## Summary

Current evidence is sufficient to determine that surgical treatment of femoroacetabular impingement may provide symptom relief and improved function in select patients. Therefore, this surgery may be considered medically necessary for patient who meet the policy criteria. For patients who do not meet the policy criteria, surgical treatment of femoroacetabular impingement is considered not medically necessary because the procedure is not considered clinically effective or appropriate in this population.

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## CROSS REFERENCES

None

| CODES   NUMBER   DESCRIPTION   |       |   |
|--|-------|---|
| There is no specific CPT code for open femoroacetabular impingement (FAI) surgery; the appropriate code for reporting this procedure is 27299. CPT codes 29862 and 29863 are for arthroscopic surgery on the articular cartilage, labrum, and/or synovium of the hip joint, not for repair of FAI pathology and, therefore, should <u>not</u> be used to report FAI surgery. |       |   |
| CPT  | 27299 | Unlisted procedure, pelvis or hip joint   |
|  | 29914 | Arthroscopy, hip, surgical; with femoroplasty (ie, treatment of cam lesion)       |
|  | 29915 | Arthroscopy, hip, surgical; with acetabuloplasty (ie, treatment of pincer lesion) |

| CODES | NUMBER | DESCRIPTION                                    |
|-------|--------|--|
|       | 29916  | Arthroscopy, hip, surgical; with labral repair |