Regence

Medical Policy Manual Surgery, Policy No. 160

Femoroacetabular Impingement Surgery

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IMPORTANT REMINDER

DESCRIPTION

Surgery for femoroacetabular impingement surgery reshapes the misshapen head of the femur and/or the acetabulum as an alternative to total hip replacement or hip resurfacing. It can be done as an open or arthroscopic procedure.

MEDICAL POLICY CRITERIA

Note: This policy addresses femoroacetabular impingement (FAI) and does not address acetabular dysplasia, considered a part of developmental dysplasia of the hip (DDH), formerly described as congenital hip dislocation.

I. Open or arthroscopic surgical treatment of femoroacetabular impingement (FAI) may be **medically necessary** in skeletally mature patients when all of the following criteria (A-E) are met:

   A. Moderate-to-severe hip pain that is worsened by flexion activities (e.g., squatting or prolonged sitting) that significantly limits activities

   B. Unresponsive to conservative therapy for at least 3 months or clinical documentation that conservative therapy is contraindicated (e.g., history of falls due to mechanical instability of hip joint).

C. Positive impingement sign on clinical examination (i.e., pain elicited with 90 degrees of flexion and internal rotation and adduction of the femur)

D. All of the following criteria must be met:

1. Imaging (conventional x-rays, MRI, MRI arthrogram) documents morphology indicative of cam-type or pincer-type FAI (See List of Information Needed for Review); and

2. 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.

E. Requested procedures must be consistent with the anatomical abnormalities documented.

II. Open or arthroscopic treatment of FAI is considered **not medically necessary** when Criterion I. is not met. Note that capsular plication, capsular repair, acetabular or femoral chondroplasty, acetabular or femoral microfracture, labral reconstruction, iliotibial band windowing, trochanteric bursectomy, abductor muscle repair, and/or iliopsoas tenotomy, when performed at the time of any FAI surgery, would be considered **a component of and incidental to** the FAI procedure.

NOTE: A summary of the supporting rationale for the policy criteria is at the end of the policy.

LIST OF INFORMATION NEEDED FOR REVIEW

It is critical that the list of information below is submitted for review to determine if the policy criteria are met. If any of these items are not submitted, it could impact our review and decision outcome.

- History and Physical
- Documented symptoms and conservative treatments attempted specific to policy criteria 1. B.
- Physical exam findings
- Imaging (conventional x-rays, MRI, MRI arthrogram) that documents morphology indicative of cam-type or pincer-type FAI such as one or more of the following:

    i. pistol-grip deformity
    ii. femoral head-neck offset with an alpha angle greater than 50 degrees
    iii. positive wall sign
    iv. acetabular retroversion (overcoverage with crossover sign)
    v. coxa profunda or protrusion
    vi. damage of the acetabular rim

CROSS REFERENCES

None

BACKGROUND

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.

The anatomical 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 arthroscopic techniques have been described. Previously, access to the joint space was limited and treatment consisted primarily of debridement or labral reattachment. A technique for hip dislocation with open osteochondroplasty that preserved the femoral blood supply was reported by Ganz (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 three-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 (THA) 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.

EVIDENCE SUMMARY

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 (OA). 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 OA is known. 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

A systematic review was published by Kowalczuk (2016), evaluating the contribution of FAI to the development of hip OA.[1] The authors included 35 studies that linked the pathophysiology of hip osteoarthritis to FAI, published between 2003 and 2014. Of these studies, eight were longitudinal, with a mean follow-up time of 11.3 years, and the others were cross-sectional. Six of the cross-sectional studies found high rates of radiographic FAI in patients initially diagnosed with “idiopathic” arthritis. The results of nine of the cross-sectional studies and six of the longitudinal studies indicated that some morphological features of cam-type FAI, in particular an elevated alpha angle, seem to be associated with radiological progression of OA. The relationship between pincer-type impingement and the development of OA was less clear.

Thomas (2014) published results from a study that found subclinical deformities of the hip, including cam-type FAI, were significant predictors of radiographic OA and joint replacement in women.[2] This was a population-based longitudinal cohort of 1003 women who underwent pelvis radiographs at years two and 20. Baseline morphology was available for 1466 hips (734 participants). At 20 years, blinded radiographic analysis was available for 670 hips (46%), of which 70 (11%) showed OA. Data on total hip replacement (see Policy No. 7.01.80) at the 20-year assessment was available for 1455 hips (99%), of which 40 (3%) had undergone replacement. Pincer-type FAI at year two was not significantly associated with radiographic OA. Cam-type FAI at year two of the study, determined by alpha angle and Gosvig Triangular Index Height, was significantly associated with development of radiographic OA and THR.

Each degree increase in alpha angle above 65º was associated with an increase in 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

Development and progression of osteoarthritis (OA) in hips with FAI was studied in a 2011 retrospective study of 96 asymptomatic patients with radiological evidence of cam (n=17), pincer (n=34), or mixed (n=45) FAI.[3] 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.

Gosvig (2010) 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.[4] 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 two 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 two 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).

Sink (2010) reported a retrospective review from two 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.[5] The degree of slip was considered to be mild in eight, 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 or 39 hips (five grade I, 10 Grade II, four Grade III, 10 Grade IV, and four Grade V); the average depth of cartilage damage was five mm (range: 2–10 mm). There was no correlation between slip severity or duration of symptoms and the type of cartilage injury.

Baradakos2009) 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 I or II) at baseline.[6] 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.

Takeyama (2009) reviewed records of 843 consecutive Asian patients (978 hips) who underwent primary surgery for osteoarthritis or other diseases of the hip to determine the prevalence of FAI in this population.[7] 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). 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, six 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.

Dodds (2009) examined the prevalence of FAI in 36 patients (49 hips) who returned for clinical evaluation at an average six years after SCFE.[8] 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 I slips, 25% of the eight hips with grade II slips, and 0% of the four hips with grade III 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.

Kim (2007) reviewed outcomes of 43 patients (mean age: 40 years; range: 18–68 years) who had labral tears and early osteoarthritis (Tonnis grade 0 to I, average Japanese Orthopedic Association [JOA] scores of less than 1) and symptoms lasting three months or more who had been treated with debridement.[9] 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.

Tanzer and Noiseaux (2004) 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.[10] These authors also reported that in 200 consecutive patients (200 hips) having primary THA, 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 frequently cited article 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.[11] 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 I 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 underdone 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 knowledge, Ganz 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.[12] 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.

Section 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

A 2014 Cochrane systematic review noted the following reason for studying surgical treatment of FAI:[13]

> "FAI surgery has evolved rapidly and at a pace far quicker than our understanding about the natural history and epidemiological characteristics of the condition. Although some evidence exists to suggest that abnormal hip shape morphology is associated with both pain and osteoarthritis, a true causal effect relationship has yet to be proven. In light of this, it is not clear whether surgically correcting shape will have any true beneficial effect on symptoms such as pain or reduce the risk of osteoarthritis."

Authors therefore conducted a systematic review of randomized or quasi-randomized studies comparing surgical treatment of FAI with placebo, no treatment, or nonoperative treatment. No studies were identified that were of sufficient quality to determine the benefits and safety of surgery for FAI. The authors did mention four ongoing trials that may be adequate for analysis when completed.

Comparisons of Arthroscopic and Open Approaches

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

In 2016, a systematic review of management options for FAI was published by Fairley.[14] The authors identified 18 studies comparing FAI management strategies, most of which had a high risk of bias. There were no studies that compared surgical and non-surgical treatment. There was evidence that arthroscopy provided improved symptom outcomes compared to open surgery with labral preservation, and that surgical interventions could effectively reduce the alpha angle. However, there is no data on how the alpha angle reduction affects long-term outcomes. There was also weak evidence that surgery was associated with structural progression of hip OA. According to the authors, the review "highlights the lack of evidence for use of surgery in FAI. Given that hip geometry may be modified by non-surgical factors, clarifying the role of non-surgical approaches vs surgery for the management of FAI is warranted."

A meta-analysis by Zhang (2016), and included five controlled clinical trials and a total of 352 hip treatments.[15] The primary outcomes were alpha angle improvement in patients with cam FAI, Nonarthritic Hip Score (NAHS) at three months follow-up, NAHS improvement at three months follow-up, and NAHS, modified Harris Hip Score (MHHS), Hip Outcome Score-Activities of Daily Living (HOS-ADL), and Hip Outcome Score-Sport-Specific Subscale (HOS-SSS) at 12 months follow-up. Other outcomes evaluated were reoperation rate and complications. Meta-analysis of the three studies with 103 hips with alpha angle data demonstrated an association between open surgical dislocation and significant improvement in alpha angle compared with arthroscopy (−4.45°, 95% CI: −8.22 to −0.67, $P = 0.02$). According to the two studies with a total of 53 hips that reported on NAHS at three months follow-up, hip arthroscopy resulted in higher NAHS (16.58, 95% CI: 9.54–23.61, $P < 0.00001$) and significant improvement from baseline (18.30, 95% CI: 11.10–25.50, $P < 0.00001$) compared with open surgical dislocation. At 12 months follow-up in these two studies, hip arthroscopy was also associated with a significantly higher NAHS than open dislocation (8.07, 95% CI: 1.09–15.06, $P = 0.02$), but there was no difference between the two treatments for MHHS, HOS-ADL, or HOS-SSS. The reoperation rate from four studies (292 hips) was lower after arthroscopy compared to open surgical dislocation (relative risk [RR]: 0.40, 95% CI: 0.17–0.95, $P = 0.04$).

There was no difference in complications between the procedures, according to a meta-analysis of the data from the two studies that reported this information.

In 2016, Nwachukwu published results from a systematic review to determine if there is a significant difference in clinical outcomes and progression to THA between hip arthroscopy and open surgical hip dislocation treatment for FAI at medium to long-term follow-up.[16] The review included 16 studies; nine were open surgical hip dislocation studies, and seven were hip arthroscopy studies. The open studies included 600 hips at a mean follow-up of 57.6 months (4.8 years; range, 6-144 months), and the arthroscopic studies included 1,484 hips at a mean follow-up of 50.8 months (4.2 years; range, 12-97 months). With THA was an outcome endpoint, there was an overall survival rate of 93% for open and 90.5% for arthroscopic procedures. Advanced age and preexisting chondral injury were risk factors for progression to THA after both treatments. Direct comparison among disease-specific outcome instruments between the two procedures was limited by outcome measure heterogeneity; however, both treatments demonstrated good outcomes in their respective scoring systems. Notably, hip arthroscopy was associated with a higher general health-related quality of life (HRQoL) score on the 12-Item Short-Form Survey physical component score ($P < .001$).

A direct comparison of arthroscopic and open treatment of FAI was reported by Zingg in 2013.[17] 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 and 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 over-corrections at the head-neck junction.

Also in 2013, Domb reported a matched-pair comparison of open vs arthroscopic treatment of FAI.[18] 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 2 groups had similar preoperative scores and both groups showed significant improvements postoperatively. At 2-year follow-up, the improvements in 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.

In 2011, Matsuda included 18 level III or IV studies (controlled cohort or case series) with a minimum one-year follow-up.[19] There were six papers on open surgical dislocation, four on mini-open procedures, and right 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.

In 2011, Botser included 26 level II to IV articles totaling 1,462 hips in 1,409 patients.[20] 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.

In 2011, Papalia included 31 studies that reported clinical, functional, and imaging outcomes following FAI surgery via arthroscopy, open surgery, or arthroscopy followed by mini open surgery.[21] 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 to 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 THA.

Arthroscopic Approach

Zhu (2022) published a systematic review of six observational studies comparing conservative therapy (CT) to arthroscopic FAI surgery.[22] The methodological quality of the trials indicated five of six studies had a low risk of bias and one article had a high risk of bias. The differences were statistically significant between FAI and CT for HOS at six months, iHOT-33 for six months, iHOT-33 at 12 months, iHOT-33 (follow-up for 12 months), EQ-5D-5L index score at 12 months, and FAI showed higher benefits than CT.

Mahmoud (2022) published a meta-analysis of studies comparing conservative therapy with FAI surgery.[23] Four trials were identified including 749 patients. The mean ages of the cohorts ranged between 30.1 and 36.2 years old. Three hundred thirty-five patients underwent FAI by 46 surgeons among all trials. Fifty-two patients crossed over from the CT to the FAI group. One of the trials was found to have a high risk of bias, while the other three were between low risk and some concerns. The iHOT-33 was the most commonly used patient-reported outcome measure followed by the HOS ADL and EQ-5D-5L. Scores from two trials could be pooled together for meta-analysis. Apart from SF-12 and GRC, all other scores have shown significantly better outcomes with FAI in comparison to CT at 8- and 12-months follow-up points. FAI offers better patient-reported outcomes than CT for management of FAIS at 8- and 12-months follow-up.

Dwyer (2020) published a systematic review and meta-analysis comparing efficacy and outcomes of patients with FAI treated with hip arthroscopy vs physical therapy alone.[24] Three RCTs that included 650 patients (323 randomized to surgery; 327 randomized to physical therapy) with a follow-up rate of 90% and mean duration of 11.5 months. Patients treated with arthroscopic surgery had improved scores on the International Hip Outcome Tool 33 compared with the nonoperative group (standardized mean difference, 3.46; 95% CI, 0.07 to 6.86). The degree of statistical heterogeneity for this result was low.

Palmer (2019) compared arthroscopic hip surgery with physiotherapy and activity modification for improving patient reported outcome measures in patients with symptomatic femoroacetabular impingement (FAI).[25] In this study, 222 participants aged 18 to 60 years with symptomatic FAI confirmed clinically and with imaging (radiography or magnetic resonance imaging) were randomized (1:1) to receive arthroscopic hip surgery (n=112) or a program of physiotherapy and activity modification (n=110). Exclusion criteria included previous surgery, completion of a physiotherapy targeting FAI within the preceding 12 months, established osteoarthritis (Kellgren-Lawrence grade greater than or equal to II), and hip dysplasia (center-edge angle <20 degrees). The primary outcome measure was the hip outcome score activities of daily living subscale (HOS ADL) at eight months post-randomization, with a minimum clinically important difference (MCID) between groups of nine points. At eight months post-randomization, data were available for 100 patients in the arthroscopic hip surgery group (89%) and 88 patients in the physiotherapy program group (80%). Mean HOS ADL was 78.4 for patients randomized to arthroscopic hip surgery and 69.2 for patients randomized to the physiotherapy group. After adjusting for baseline HOS ADL, age, sex, and study site, the mean HOS ADL was 10.0 points higher in the arthroscopic hip surgery group compared with the physiotherapy group ($p<0.001$). No serious adverse events were reported in either group.

In 2018, Griffin published a multi-center randomized controlled trial enrolling patients ages 16 and over with FAI.[26] A total of 348 patients were randomized to receive the intervention (171) or control (177) treatments. Follow-up at the primary outcome assessment was 92% and at 12 months after randomization, mean iHOT-33 scores improved in the intervention group from 39.2 to 58.8 and scores improved from 35.6 to 49.7 in the personalized hip therapy group. The mean difference in the primary analysis in iHOT-33 scores was 6.8 in favor of the intervention. In terms of adverse events, seven serious adverse events were reported and five of these were in the intervention group. The intervention led to a statistically significant improvement for the intervention group compared to the control group.

In 2017, Kierkegaard published a systematic review and meta-analysis on patients with FAI who have undergone hip arthroscopy[27]. Outcomes were pain, activities of daily living (ADLs), and sport function. Databases were searched through September 2015. Nineteen studies were included in the meta-analysis: 15 case series, three cohort, and 1 RCT. Total number of patients was 2322 (mean age, 36 years; range, 18-57 years) and 42% women. Weighted mean differences between pre- and postoperative outcomes were used in the meta-analysis. Detectable pain reduction was achieved in less than three months, and maintained through 5 years. Improved ADLs were evident between three and six months, and maintained through at least three years of follow-up. Sport function improvements were detected between six and 12 months after arthroscopy and maintained through several years of follow-up. Average outcome scores indicated mild residual pain among patients when compared to healthy counterparts.

Larson published a paper in 2016 on postoperative complications in a series of 1487 consecutive patients (1615 hips) that underwent hip arthroscopy at four institutions.[28] The mean age of the patients was 30.4 years; 93.2% had FAI correction and 78.8% underwent a labral repair procedure. The most common complication was postoperative lateral femoral cutaneous nerve disturbance (16.5%), which only persisted beyond 6 months in 1.6%. Other complications ranged from 1.4% (perineal numbness) to 0.01% (deep vein thrombosis, pulmonary embolism, and femoral neck stress fracture). Excluding temporary lateral femoral cutaneous nerve disturbance and thigh numbness, the overall complication rate was 8.3% (134 hips). Longer surgical time and traction time were associated with greater complications ($P < 0.01$), and complications were higher for females than for males ($P = 0.017$).

In 2016, Sansone reported outcomes after arthroscopic surgery for FAI in 289 patients with at least 2 years of follow-up.[29] The mean age of the patients was 37 years and approximately 67% were male. The mean follow-up time was 25.4 months. The outcome measures were web-based, patient-reported measurements, including the International Hip Outcome Tool (iHOT-12), the Copenhagen Hip and Groin Outcome Score (HAGOS), a health-related quality of live measure (EQ-5D), the Hip Sports Activity Scale (HSAS), and visual analog scale (VAS) for overall hip function, and overall satisfaction. Compared with baseline, there were significant improvements in all outcomes at 2 years follow-up, and 82% of patients reported satisfaction with the outcome of the surgery.

In 2014 Park assessed complications related to arthroscopic FAI surgery. The outcomes of 200 hips in 197 patients were reviewed. Mean follow-up was 28.2 months. Complications were divided into three groups: Group one related to traction, group two related to surgical technique or implant failure, and group three related to outcomes. The overall complication rate was 15% (30/200 hips) Group one included four patients with pudendal neurapraxia and two with ankle joint pain. Group two consisted of two patients with lateral femoral cutaneous neurapraxia, two with iatrogenic labral perforations, one with instrument labral tear, and four with femoral head scuffs. Group three included one patient with a snapping sound and heterotopic ossification. All complications in groups one and two were related to the learning curve.

The largest prospective series was published Malviya in 2012, who reported on changes in quality of life (QoL) for 612 patients who were treated by a single surgeon.[30] Patients ranged in age from 14 to 75 years (mean of 36.7). At one-year after surgery, QoL scores on the Rosser Index improved by at least one grade in 76.6% of patients, were unchanged in 14.4%, and decreased in 9%.

In 2012, Palmer reported prospective three-year follow-up on 201 procedures for cam-type FAI with a Tonnis grade I or less.[31] The mean duration of symptoms before surgery was 59 months. At follow-up, the 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 IV 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 cm2, 60% underwent hip replacement at a mean of 21.7 months (range, 2-29 months).

In 2009, Byrd published 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.[32] 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 MHHS. Eighty-three percent of patients were considered to be improved by the procedure.

In 2009, Philipon published results from a 2.3 year follow-up study (range: 2–2.9 years) on 100 of 209 prospectively enrolled consecutive patients who underwent hip arthroscopy for disabling pain.[33] 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 THA at a mean of 16 months. Patients with a joint space of less than two mm were 39 times more likely to progress to THA.

In 2008, Larson and Giveans reported 10-month follow-up (three-months to three-years) from a consecutive series of 96 patients (100 hips) who presented with FAI.[34] 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 THA, 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 three-year follow-up. Scores on the SF-12 improved from 60 to 78.

Section Summary

There is enough research to show that arthroscopic surgical treatment of femoroacetabular impingement can improve pain and function in some patients. Additional systematic reviews demonstrate that the arthroscopic approach is safe and effective for the treatment of FAI.[35-38]

Mixed Open/Arthroscopic Approach

A mixed open/arthroscopic approach for treatment of FAI was published by Laude et al in 2009 and included 97 patients (100 hips).[39] 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 three patients had Tonnis grade II osteoarthritis. Thirty patients had grade I 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 NAHS increased from 55 at baseline to 84 at the last follow-up. One patient had a femoral neck fracture three-weeks postoperatively, and 13 (14%) required revision due to persistent pain. In eight of these patients, the damaged part of the labrum was removed and in six 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 THA at a mean of 40 months (range: 5–75 months). In the THA group, the acetabular lesions were deeper (10.9 mm vs. 6 mm) and a higher percentage of Beck grade V was found (54% vs. 7%). The best results were observed in patients younger than 40 years with a Tonnis grade of 0.

Labral Repair

Systematic reviews have found low-quality evidence in favor of labral repair over labral debridement.[40-42] For example, a 2014 systematic review identified one RCT (described next) and five observational studies with a total of 490 patients that met the review inclusion criteria.[41] Five studies used an arthroscopic approach and two used an open approach. None of the studies included in the review were of high quality. With follow-up to three-years, four of the six studies reported that labral repair resulted in significantly greater postoperative improvements in functional scores (MHHS, NAHS, hip outcome, and Merle d'Aubigne scores) compared with labral débridement. Pooled data from three studies that reported the MHHS showed a clinically important difference of 7.4 points favoring labral repair.

A study by Anwander published in 2016 compared long-term outcomes of labral reattachment during FAI surgery with those of resection in a series of consecutive patients.[43] For the first 20 patients (25 hips), a torn or detached labrum in the area of acetabular resection was resected, and for the next 32 patients (35 hips) the labrum was reattached. There were 19 out of the 20 patients in the resection group and 29 of the 32 patients in the reattachment group that had clinical and/or radiographic follow-up for at least 10 years. At follow-up, labral attachment was associated with a slight improvement in the Merle d'Aubigné-Postel pain subscore (5.0 ± 1.0 [3-6] versus 3.9 ± 1.7 [0-6]; p = 0.017), but there was no significant difference between groups for pain assessed by anterior impingement test. Function (Merle d'Aubigné-Postel score) and hip abduction were also slightly improved for hips with labral reattachment compared to hips with resection. There was no significant difference between the groups for progression to OA or conversion to THA.

In 2013, Krych reported a non-blinded RCT of labral repair versus labral debridement in 36 female patients with pincer-type or combined-type FAI.[44] 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%).

In 2006, Bardakos 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).[45] 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

O'Connor (2019) published a systematic review and meta-analysis on revision hip arthroscopy, which included 15 studies for review identifying 4765 hips in 4316 patients.[46] The most common indication for revision surgery was inadequate bony resection during the index procedure. Meta-analysis indicated significant improvements of patient-reported outcomes (PROs) from baseline to final follow-up after revision surgery based on the modified Harris Hip Score (increase of 17.20 points), the Hip Outcome Score - Activities of Daily Living (improvement by 13.98 points), and the VAS (decrease of 3.16 points).

In 2016, Newman published results from a study comparing outcomes after revision arthroscopic surgery in adolescent patients compared to patients undergoing primary arthroscopic surgery.[47] In this matched cohort study, the primary outcomes were functional outcomes assessed through several scales including the Hip Outcome Scale for activities of daily living, modified Harris Hip Score, and the Short Form Health Survey. There were 42 patients in the revision surgery group matched with 84 patients in the primary surgery group. The results indicated that there were improved outcomes in the revision group, although final outcomes scores in that group were lower than those in the primary surgery group. Also, patients that underwent more than one revision surgery had worse outcomes than those who underwent only one revision surgery.

In 2007, Philippon reported on 37 revisions of previous hip arthroscopies by the senior author (51%) or referred from other centers.[48] 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.

In 2007, Heyworth identified 24 revisions (23 patients) out of a total of 450 patients who underwent a hip arthroscopy at their institution.[49] The mean interval between the primary hip arthroscopy and recurrence of symptoms was six-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 nine had debridement of bone; seven of the nine 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.[50]

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

Philippon (2012) reported significantly better outcomes at 3-year follow-up for patients with preoperative joint space greater than two mm compared with those with joint space narrowing to two mm or less.[51]

Larson (2011) published results from a retrospective comparison of outcomes from arthroscopic treatment of 154 patients (169 hips) without joint space narrowing (Tonnis grade 0 to I) and 56 patients (58 hips) with preoperative radiographic evidence of joint space narrowing (Tonnis grade II or III).[52] 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 HHS 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 THA, was 12% for patients without osteoarthritis, 33% for hips with mild to moderate preoperative joint space narrowing (<50% joint space narrowing or >two mm joint space), and 82% failure rate for hips with advanced preoperative joint space narrowing (>50% joint space narrowing or <two 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 HHS values.

Another study published by Horisberger (2010) reported outcomes from 20 patients (out of a series of 150) who showed generalized severe cartilage lesions during intraoperative arthroscopic assessment for FAI.[53] Nine hips had Tonnis grade I osteoarthritis, six had grade II, and five had grade III osteoarthritis. At a mean follow-up of three-years, 10 patients (50%) had undergone, or planned to undergo, total hip replacement. Preoperatively, five of the 10 hips had Tonnis grade III osteoarthritis. Another two 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.

Selection for Age

Guindani (2017) 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 institution.[54] 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 post-measurements: MHHS, NAHS, and SF-12. No significant improvements were found in: sphericity deviation score, or on α angles (both anteroposterior and Lauenstein views).

Degen (2017) published results from a comparison in functional outcomes after arthroscopic treatment of FAI in adolescent and non-adolescent patients.[55] Along with functional outcomes, the authors also reported on the rate of cam recurrence within two years post-surgery. There were 34 adolescents treated compared to 296 non-adolescents with the same inclusion criteria. There was significant improvement in functional outcomes noted in both groups with no significant difference between the two. There was also no significant difference in follow-up survey scores between the groups. There was a low risk of recurrence reported in the adolescent group. The authors report that improved clinical outcomes can be anticipated after arthroscopic treatment of FAI in adolescents.

A systematic review from 2015 identified six case series and two conference abstracts with a total of 388 children and adolescents who had been surgically treated for FAI.[56] Ages of the patients ranged from 11 to 19.9 years. Although it was not reported how many of the patients had open growth plates, the authors noted that closure of the growth plates is initiated at ages 16 to 18 years, with 88% fusion at age 17 to 18 years and 100% fusion at 20 years of age. Most of the patients were treated with hip arthroscopy (315 arthroscopic, 73 open). The review indicated that surgical treatment of FAI was performed in 81% of patients, and all but 7 of 388 (1.8%) treated surgically were able to return to activity/sport. There were no reports of iatrogenic femoral neck fracture, instability/dislocation, acute SCFE, avascular necrosis, or premature physeal closure and proximal femoral growth arrest. Additional study is needed to evaluate the long-term effects on bone morphology following surgery for FAI in skeletally immature children.

Several case series, cohort, and case-control studies have evaluated FAI surgery outcomes in adolescents since the 2015 systematic review.[47, 57-59] These have generally demonstrated favorable outcomes, with one study reporting that improvements in postoperative HHS for adolescents are similar to those of an adult control group.[57] One of these studies, by Newman , compared outcomes for 42 adolescents after revision hip arthroscopic surgery to a matched cohort of 84 adolescents that underwent primary arthroscopic surgery.[47] The authors reported that “young patients who required revision hip arthroscopic surgery showed significant improvement in patient-reported outcome scores; however, final outcome scores in the revision group for sport activity, general health, and satisfaction were lower than those in the primary group.” A higher number of revision surgeries was associated with lower outcome scores.

Tran (2013) published results from a study that reported on arthroscopic treatment for cam type FAI in adolescents with open growth plates.[60] 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 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.

Herrmann (2016) published a retrospective case series of 79 middle-aged patients (ages 40-65 years) who underwent arthroscopic treatment for FAI.[61] Outcomes at follow-up were determined during a phone interview, which included questions about further surgery to the hip in question, changes in joint function and patient satisfaction. The HOS and the HOS sports subscale (HOSS) were assessed for all patients who did not have a conversion THA. Other measures, including Alpha angle, Kellgren Lawrence grade (K-L grade), joint space width (JS), lateral center edge (LCE) angle, caput-collum-diaphysis (CCD) angle and acetabular index (AI) were assessed retrospectively. The mean follow-up time was 32 months. During this time, 18 of the patients (22.8%) underwent conversion to THA. Patients with a K-L grade III were significantly likelier to require THA than those with a lower K-L grade (66.7% vs. 16.2 %, $P = 0.003$), as were patients with a JS ≤ 2mm (75% vs. 15.9 % in patients with a JS > 2mm, $P = 0.001$). There was no significant difference in conversion to THA by age, and HOS did not correlate with any of the retrospectively assessed angles.

A study by Bryan compared the short-term outcomes of FAI arthroscopy in 27 patients aged 55 years and above to 174 patients below age 55.[62] The patients in this cohort study did not have radiographic arthritis and were evaluated using the MHHS and HOS (including HOS-ADL), with a minimum follow-up time of two years. Although the younger group was more likely to have full-thickness cartilage defects (22% vs 4%) and labral debridement (78% vs 36%), there were no significant differences in MHHS between the groups at all follow-up points. However, after two years the younger patients did have greater improvement in several HOS subscales, including the HOS-ADL (85.6 vs 75.2; P = .03) and sport score (70.2 vs 55.6; P = .04).

A systematic review by Griffin (2016) focused on hip arthroscopy outcomes in adults over age 40.[63] There were eight studies (401 patients) included in the review, four for which the primary indication for surgery was labral tear, and four which had a primary indication of FAI. The mean age of the patients was 57.3 years, and the average follow-up time was 32.9 months. The study outcomes included patient-reported outcome measures, such as HHS, MHHS, HOS-ADL, NAHS, and WOMAC pain score, as well as complications, and progression to THA. The included studies generally reported significant postoperative improvement of either moderate or large effect size in patient-reported outcome measures, with the exception of one study that reported a poor outcome on the MHHS with a weak effect size. There was an 18.5% rate of conversion to arthroplasty, and a non-arthroplasty reoperation rate of 2.3%. For the five studies that reported complication rates, the minor and major complication rates were 4.5% and 0.63%, which, according to the authors, “compare favorably with the 7.9% and 0.45% rates, respectively, cited in a recent systematic review of hip arthroscopy in all ages.

One of the studies included in the Griffen review evaluated outcomes following arthroscopic treatment of FAI in 153 consecutive patients aged 50 years or older.[51] The mean age of the patients was 57 years (range, 50 to 77 years). The prospective database included range of motion, MHHS, 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 two mm 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 two mm or less and preoperative MHHS of less than 50 as risk factors for hip replacement.

Also included in the systematic review was a study by Javed and O'Donnell that reported arthroscopic treatment of cam-type FAI in 40 patients older than 60 years of age (mean 65 years; range 60 to 82).[64] Patients were excluded from this retrospective study if they had Tonnis grade II or III 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 two, six, 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 I 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, four of the seven patients had grade III chondral loss from both the acetabulum and femoral head, while three had a grade III lesion of the acetabular cartilage. No fractures of the femoral neck occurred during the follow-up period.

Open Approach

Seven case series of patients with FAI treated with the open approach and dislocation were identified in the systematic review by Bedi.[65] An additional two studies reported on five patients, and five studies reported results from 19 to 52 patients, with a follow-up ranging from 24 to 60 months. The five studies are briefly described here.

Chiron (2012) described a new minimally invasive technique without dislocation via an anterolateral approach.[66] 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 two cases were lost to follow-up. Significant improvement in function, and range of motion were reported. Surgical revision included four for hematoma, two for capsular debridement, and two for additional procedures on the acetabulum.

Espinosa (2006) published results from a study that selected 52 of 141 consecutive patients to compare the effect of reattaching or removing the labrum during treatment for FAI.[67] 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 two-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 (2006) reported on 29 patients (30 hips) in a prospective protocol with minimum two-years follow-up.[68] 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 HHS 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 eight hips (27%), five hips (17%) were expected to convert to THA due to progressive pain, and 4 (13%) had progression to osteoarthritis. Radiographic signs of progression of osteoarthritis and clinical failure requiring conversion to THA 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.[69, 70]

Beck (2004) 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 four years of follow-up.[71] 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 four to five years' follow-up, five patients (26%) had undergone THA, with the failures associated with cartilage damage. Thirteen patients (68%) were reported to have had good to excellent outcomes.

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 one to eight-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.[72] 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 (one-day to three-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.[73] Out of 12 patients with a history of SCFE (12–38 years of age), nine were found to be improved at 8–25 months' follow-up. Out of the seven patients (17–43 years of age) without SCFE who underwent open surgical dislocation for pistol grip deformities, five 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 when and how to treat symptomatic FAI in children with slipped capital femoral epiphysis (SCFE) 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. Additional 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."[74]

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 two 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.

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 also 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.

PRACTICE GUIDELINE SUMMARY

There are no clinical practice guidelines that address treatment of FAI, however an international consensus statement called the Warwick Agreement on FAI syndrome was released in 2016.[75] The Warwick Agreement consensus statement included a definition of FAI syndrome; a description of the clinical signs, symptoms, and imaging findings necessary for FAI syndrome diagnosis; a list of appropriate treatment options; an assessment of FAI syndrome prognosis; a statement on the management of asymptomatic patients with cam or pincer morphology; and a list of outcome measures for treatment assessment. According to this agreement:

> "FAI syndrome can be treated by conservative care, rehabilitation or surgery. Conservative care may involve education, watchful waiting, lifestyle and activity modification. Physiotherapy led rehabilitation aims to improve hip stability, neuromuscular control, strength, range of motion and movement patterns. Surgery, either open or arthroscopic, aims to improve the hip morphology and repair damaged tissue. The good management of the variety of patients with FAI syndrome requires the availability of all of these approaches."

And:

> "In patients who are treated for FAI syndrome, symptoms frequently improve, and they return to full activity, including sports. Without treatment, symptoms of FAI syndrome will probably worsen over time. The long term outlook for patients with FAI syndrome is unknown. However, it is likely that cam morphology is associated with hip osteoarthritis. It is currently unknown whether treatment for FAI syndrome prevents hip osteoarthritis."

SUMMARY

There is enough research to show that surgical treatment of femoroacetabular impingement can improve pain and function in some patients. Therefore, this surgery may be considered medically necessary for patients who meet the policy criteria. For patients that 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 for these individuals.

Capsular plication, capsular repair, labral reconstruction, iliotibial band windowing, trochanteric bursectomy, abductor muscle repair, iliopsoas tenotomy, and similar incidental procedures performed during surgical treatment of FAI are considered components of and incidental to the FAI procedure.

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CODES

NOTE: There is no specific CPT code for open femoroacetabular impingement (FAI) surgery; the appropriate code for reporting this procedure is 27299. It is not appropriate to report either code 29862 or 29863 in addition to codes 29914-29916 because the reconstructive procedures described by codes 29914-29916 also involve the articular cartilage and/or labrum.

Codes	Number	Description
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)
	29916	Arthroscopy, hip, surgical; with labral repair
HCPCS	None	

Date of Origin: *July 2008*