Washington State Health Care Authority

Hip Surgery Procedures for Treatment of Femoroacetabular Impingement Syndrome – Rereview

Draft Evidence Report

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Health Technology Assessment Program (HTA)
Washington State Health Care Authority
PO Box 42712
Olympia, WA 98504-2712
(360) 725-5126
www.hca.wa.gov/health-technology-assessment
shtap@hca.wa.gov

Hip Surgery Procedures for Treatment of Femoroacetabular Impingement Syndrome – Rereview

Provided by:

Aggregate Analytics, Inc.

Prepared by:
Andrea C. Skelly, PhD, MPH
Erika D. Brodt, BS
Rongwei (Rochelle) Fu, PhD
Yun Yu, MS
Shay Stabler-Morris, MSc
Dakota Riopelle, MPH

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This technology assessment report is based on research conducted by a contracted technology assessment center, with updates as contracted by the Washington State Health Care Authority. This report is an independent assessment of the technology question(s) described based on accepted methodological principles. The findings and conclusions contained herein are those of the investigators and authors who are responsible for the content. These findings and conclusions may not necessarily represent the views of the HCA/Agency and thus, no statement in this report shall be construed as an official position or policy of the HCA/Agency.

The information in this assessment is intended to assist health care decision makers, clinicians, patients and policy makers in making sound evidence-based decisions that may improve the quality and cost-effectiveness of health care services. Information in this report is not a substitute for sound clinical judgment. Those making decisions regarding the provision of health care services should consider this report in a manner similar to any other medical reference, integrating the information with all other pertinent information to make decisions within the context of individual patient circumstances and resource availability.

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TABLES

FIGURES

Abbreviations

ADL = activities of daily living
AE = adverse event
AHQR = Agency for Healthcare Research and Quality
AMSTAR-2 = A measurement Tool to Assess Systematic Reviews 2
AVN = avascular necrosis
CAD = Canadian dollars
CI = confidence intervals
CT = computed tomography
CTA = computed tomography arthrography
CUA = cost-utility analysis
DVT = deep vein thrombosis
ED = emergency department
EQ-5D = EuroQol 5-Dimension
EQ-5D-5L = EuroQol 5-Dimension, 5-level
FABER = Flexion, Abduction, External Rotation
FADIR = Flexion, Adduction, Internal Rotation
FAI = femoroacetabular impingement
FAIS = femoroacetabular impingement syndrome
FDA = US Food and Drug Administration
FIRST = Femoroacetabular Impingement Randomized Controlled Trial
F/U = follow-up
GRADE = Grading of Recommendations Assessment, Development and Evaluation
HADS = Hospital Anxiety and Depression Scale
HAGOS = Copenhagen Hip and Groin Outcome Score
HO = heterotopic ossification
HOOS = Hip Disability and Osteoarthritis Outcome Score
HOS = Hip Outcome Score
HTA = health technology assessment
ICC = intraclass correlation coefficient
ICEMAN = Instrument to assess the Credibility of Effect Modification Analyses
ICER = incremental cost-effectiveness ratio
IHOT-12 = 12-item International Hip Outcome Tool
IHOT-33 = 33-item International Hip Outcome Tool
IR = internal rotation
ITT = intention-to-treat
KQ = Key Question
LEFS = Lower Extremity Functional Scale
LR = likelihood ratio
MCID = minimal clinically important difference
MCS = mental component summary
MD = mean difference
MRA = magnetic resonance arthrography
MRI = magnetic resonance imaging
mHHS = modified Harris Hip Score
NAHS = Non-Arthritic Hip Score
NHS = National Health Service

NPV = negative predictive value
NR = not reported
NRS = numerical rating scale
NRSI = nonrandomized study of intervention
NSAIDs = nonsteroid anti-inflammatory drugs
OA = osteoarthritis
OHS = Oxford Hip Score
OR = odds ratio
PA = physical activity
PASS = patient acceptable symptom state
PCS = physical component summary
PD-Q = PainDETECT Questionnaire
PICOTS = populations, interventions, comparators, outcomes, timing, and settings
PL = profile likelihood
PPV = positive predictive value
PT = physical therapy
QALY = quality-adjusted life-year
QHES = Quality of Health Economic Studies
QoL = quality of life
RCT = randomized controlled trial
RoB = risk of bias
ROM = range of motion
RR = risk ratio
SD = standard deviation
SF-12 = 12-item Short Form Health Survey
SHD = surgical hip dislocation
SOE = strength of evidence
SR = systematic review
SSS = Sport-specific Subscale
THA = total hip arthroplasty
UCLA = UCLA Activity Score
USD = United States Dollar
VAS = visual analogue scale
WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index
WTP = willingness-to-pay

Abstract

Background. Femoroacetabular impingement (FAI) results from abnormal morphology of the femoral head/neck and/or acetabulum leading to abnormal contact between these structures during hip motion. When symptomatic, femoroacetabular impingement syndrome (FAIS) may cause hip pain, impaired function, and joint or labral damage. Treatment includes conservative management and surgery, most commonly hip arthroscopy; however, uncertainty remains regarding the comparative effectiveness, safety, and cost-effectiveness of surgery and its impact on longer-term outcomes, including osteoarthritis.

Objective: To evaluate the effectiveness and harms, differential effectiveness and safety, and cost-effectiveness of operative procedures for the treatment of FAI/FAIS compared with non-operative treatments or procedures that do not involve bone alteration to update the 2019 technology assessment on this topic.

Data sources. Electronic databases from 2019 to March 2026; clinical trials.gov; and reference lists.

Review methods. Using predefined criteria and dual review, we selected randomized controlled trials (RCTs) and nonrandomized studies of interventions that evaluated the benefits and harms of operative treatment for FAI/FAIS. Study risk of bias was assessed using predefined criteria. Strength of evidence (SOE) was assessed for the primary outcomes of function, pain, conversion to THA, labral tear or retear, and harms. Random effects meta-analysis using the profile likelihood method was conducted when feasible to enhance estimate precision.

Results. We included five RCTs (2 new) and four formal economic analyses for adults and one NRSI, two systematic reviews (SRs) of case series (1 new), and six new case series for adolescents. For contextual questions, no new high-quality diagnostic accuracy studies specific to FAI/FAIS were identified and no new validated outcomes measures were used in more recent RCTs. There was additional evaluation of MCIDs for various measures, some of which expanded the MCID ranges for some measures. All outcomes were reported over the short term (≤5 years); no trials evaluated longer-term outcomes. In adults, arthroscopic osteochondroplasty may not improve function or pain versus lavage at 12 months but may reduce the risk of hip complications requiring surgery at 24 months, most commonly for hip pain. Compared with supervised physical therapy (PT), arthroscopy may improve function and pain although findings varied by outcome measure and time frames. Estimates were frequently very imprecise, and not all statistically significant improvements met published minimal clinically important difference (MCIDs). SOE was low for many outcomes and time points. Arthroscopy may lead to revision, however there was insufficient data to provide estimates of frequency as authors did not report on as-treated populations. Nerve injury (numbness in the groin, leg, or foot) was the most common complication (SOE: low). Evidence was very uncertain for serious adverse events; trials are likely underpowered to detect rare events. Evidence in adolescents consisted primarily of case series and was insufficient, resulting in substantial uncertainty. Younger age was identified as a potential treatment-effect modifier in one trial in adults; no other variables modified treatment effects across studies. However, confidence in subgroup findings was very low. In one economic analysis, arthroscopic osteochondroplasty was cost-effective compared with arthroscopic lavage for young adults with FAIS.

Evidence regarding the cost-effectiveness of arthroscopy versus PT across three cost-utility analyses was inconsistent.

Limitations: Many limitations of this review are tied to those of the available evidence. Across trials, there was no evidence beyond 3 years and harms were variably reported. General study limitations included unclear randomization and treatment concealment methods and inability to blind patients and providers; some trials also had high loss-to-follow-up and crossover rates. Strength of evidence for many outcomes was low usually due to these study limitations and imprecision.

Conclusions. Findings are generally consistent with the 2019 report. While the updated evidence synthesis in this re-review suggests that hip arthroscopy may improve function and pain in the short-term (<5 years) versus PT, the durability of these effects beyond 38 months is unclear. Similarly, the long-term impact of hip arthroscopy on OA progression and need for THA versus lavage or PT remains unclear. In adolescent populations, evidence for the benefits and harms of hip arthroscopy for FAIS continues to be sparse, primarily from case series, and considered insufficient.

Executive Summary

Introduction

Femoroacetabular impingement (FAI) results from abnormal morphology of one or both of the bones that form the hip joint – the femoral head/neck and the acetabulum – resulting in abnormal contact between these structures at the end range of hip motion, particularly during flexion and internal rotation. There are two types of FAI described in the literature: cam impingement (non-spherical femoral head or abnormality at the head-neck junction) and pincer impingement (deep or retroverted acetabulum resulting in over coverage of the femoral head). Clinically, patients frequently present with a combination of both types. This abnormal contact between the femur and acetabulum may result in impingement and pain and/or reduced function depending on activity level. Repetitive motion, particularly vigorous motion may result in joint and labral damage. The 2016 Warwick Agreement, an international consensus document, suggests that the term femoroacetabular impingement syndrome (FAIS) be used for symptomatic presentation of FAI.[21] This agreement and related 2019 consensus-based best practice guideline[45] remain the primary basis for assessment and treatment of FAI/FAIS. Accurate determination of FAI prevalence is challenging due to differences in populations and diagnostic criteria as well as variability in symptoms and patient presentation across publications.[12] One systematic review reported that FAI may be suspected in 47% to 74% of patients with hip pain but without arthritis.[30] A geographic database study reported an overall incidence of FAI diagnosis of 54.4 per 100,000 person years, noting a consistent increase in diagnosis between 2000 and 2016 together with an increase in the use of surgical management of FAI.[26] Increases in clinician education during this time may partially explain the increases in diagnosis and surgical management.

Diagnosis of FAIS is based on a triad of symptoms, clinical signs and imaging findings described in the 2016 Warwick agreement.[21] The agreement notes, however, that there are not any agreed upon thresholds for imaging diagnosis and that symptoms and clinical tests may not be specific to FAI. None are pathognomonic for FAIS. Hip or groin pain that occurs with specific movements or positions is the most common FAIS symptom however patients may have pain in the lateral hip, thigh, buttock or low back. Hip range of motion may be restricted.

Labral tear and chondral injury are frequently seen in patients with FAI.[11] Labral tears are also commonly reported in asymptomatic adults with FAI as well as in symptomatic adults,[71] although labral tear patterns differ by FAI type.[11] Labral defects may also frequently be seen on imaging in asymptomatic individuals without FAI.[4,70] Chondral defects are similarly common in patients with FAI.[71] Although these abnormalities may occur in the absence of symptoms, labral tears and chondral defects may contribute to the symptoms experienced by patients with FAIS.

The overarching goal of treatment for FAIS, whether conservative or operative, is to reduce symptoms (e.g., pain) and improve function, allowing patients to return to normal activity.

Nonoperative management is generally considered first-line treatment, including in the Lynch consensus document,[45] although there is no current consensus on optimal nonoperative management. Conservative treatment may include activity modification, nonsteroidal anti-inflammatory drugs (NSAIDs), core strengthening, physical therapy (PT), manual therapy, steroid injections, activity modification and pelvic postural retraining.[5,17,29,37,42,53,72] One recent trial suggests that FAIS-specific PT may improve hip pain and function.[33,36] However, the impact of conservative therapy on arthritis development is unclear.[8,9]

Surgical treatment aims to correct the impinging deformity and address associated intraarticular pathology. Surgery may be performed using an open or arthroscopic approach, with arthroscopy being more common. Surgical procedures may include resection of abnormal bone, removal of damaged

cartilage, and reshaping of the femoral head-neck junction to improve clearance between the femur and acetabular rim. Concurrent labral tears and chondral injuries are also usually addressed as part of surgical treatment. Trials of arthroscopy have generally shown improved function compared to nonoperative management.[22,27,49,60] However, the 2016 Warwick Agreement[21] acknowledged that there is no high-level evidence to support the definitive treatment of FAIS, and that conservative care, rehabilitation, and surgery may each play a role in different patients.

While the understanding of the etiology, natural history and clinical presentation of FAI/FAIS has evolved, the causes of hip pain, the natural history of FAI and its relationship to osteoarthritis (OA) remain unclear.

Proponents for operative intervention believe that surgical correction of the impinging deformities will alleviate the symptoms and retard the progression of OA degeneration. However, published evidence for progression of OA is mixed. Some studies report that arthroscopy is associated with lower rates of OA progression[62] while others report no differences in OA progression between arthroscopy and conservative treatment.[39,40] FAI type may also influence the development of OA.[2,16,64,69] There is a need to better understand the relationship between FAI, its treatment and the impact of type and treatment on hip OA development. Therefore, the relationships between FAI, its treatment, FAI type, and subsequent OA development remain uncertain. Given that labral tears are common among patients with FAI/FAIS, proponents of surgical intervention also suggest that correction of the underlying bony deformity may reduce the risk of labral retear. Questions remain about the efficacy and effectiveness, safety and cost effectiveness of hip surgery for FAIS.

Policy Context/Reason for Selection

This topic was originally reviewed in 2011 and a full re-review, titled Hip Surgery Procedures for Treatment of Femoroacetabular Impingement Syndrome-Update Report was performed in October, 2019. The most recent signal update report (2023) identified two new randomized controlled trials (RCTs) and a review of economic studies. Public comment resulting from the topic selection announcement suggests that an additional RCT may be available.

Objectives

The aim of this report is to update the 2019 health technology assessment (HTA) on Hip Surgery Procedures for the Treatment of Femoroacetabular Impingement Syndrome (FAIS) by systematically reviewing, critically appraising and analyzing new research evidence comparing the safety and efficacy of operative procedures for the treatment of FAI/FAIS with non-operative treatments or procedures that do not involve bone alteration with a focus on RCT evidence. Information on validation for new outcomes measures used in new RCTs and updated information on clinically meaningful improvement for validated measures used in the evidence base will be presented.

Contextual Questions

1. Is there updated information published subsequent to the 2019 report regarding a consistent or agreed upon case definition or diagnostic criteria for FAI/FAIS?
2. Are new validated outcomes measurement instruments used for evaluation of function or pain in FAIS patients in new RCTs?
3. Is there new information on clinically meaningful improvement for validated measures used in the evidence base?

Research Key Questions (KQ)

The focus of this report is on the comparison of surgical intervention for FAI/FAIS versus non-operative treatments.

When used in patients with FAI/FAIS:

1. What is the evidence of effectiveness of hip surgery compared with non-operative for FAI/FAIS or procedures not involving alteration of bone? Including consideration of short-term (≤5 years) intermediate-term (>5 years to <10 years) and long-term (≥10 years) outcomes.
2. What is the evidence of the safety of hip surgery for FAI/FAIS compared with non-operative treatment or procedures not involving alteration of bone?
3. What is the evidence that hip surgery for FAI/FAIS compared with non-operative treatment or procedures not involving alteration of bone has differential efficacy or safety in subpopulations (e.g. age, sex, psychological or psychosocial comorbidities, baseline characteristics, deformity type, degree of osteoarthritis or cartilage damage, provider type, and payer type)?
4. What is the cost-effectiveness of hip surgery for FAI/FAIS compared with non-operative treatments or procedures not involving alteration of bone in the short and long term?

PICOTS Scope for Research Key Questions:

PICOTS (populations, interventions, comparators, outcomes, timing, and settings) inclusion and exclusion criteria below (Error! Reference source not found.) were finalized following consultation with the agency and after review of public comment on Key Questions and clinical expert input.

Focus: RCTs comparing surgical treatment with non-operative treatments for FAIS or procedures not involving alteration of bone.

Table A. Inclusion and exclusion criteria for research Key Questions 1-4

Study Component	Inclusion	Exclusion
Population	• Patients undergoing primary/initial treatment for symptomatic FAI or FAIS (any age) Special populations: age, comorbidities, presence (or not) of labral tear, type of FAIS, baseline presence and degree of arthritis, degree of cartilage damage, provider type, payer type	• Congenital hip dysplasia, slipped capital femoral epiphysis, Legg-Calve-Perthes • Studies including <80% FAI/FAIS patients • Patients presenting for revision surgery • Extra-articular impingement • Asymptomatic individuals
Intervention	• Surgical treatment for FAI/FAIS	• Matrix-induced autologous chondrocyte implant (MACI) • Autologous matrix-induced chondrogenesis (AMIC)

Study Component	Inclusion	Exclusion

Comparator	• Focus:
	  ○ Non-operative care (may include, but not limited to, exercise, rehabilitation and manual therapies, activity modification, NSAIDs, injections, etc.)
	  ○ Surgical procedures not involving alteration of bone
	  ○ Simulated or sham surgery
	• Others: Comparison of labral repair/debridement with or without bone alteration
		• Matrix-induced autologous chondrocyte implant (MACI)
		• Autologous matrix-induced chondrogenesis (AMIC)
		• Direct or indirect comparisons of surgical approaches (e.g., arthroscopic vs. open)
		• Comparisons of surgical methods (i.e., for labral repair, rim repair, capsule closure, etc.)

Outcomes	**Primary (SOE assessed)** • Functional outcome (validated patient- and clinician-reported hip scores, validated activities of daily living) • Pain (validated measures) • Conversion to THA (“continuing” or “subsequent intervention” that is not THA will be reported in the safety section) • Labral tear or retear **Secondary (SOE not assessed)** • Progression to arthritis • Quality of life • Return to work or activity • Range of motion **Harms/Safety: (SOE assessed)** • Complications/adverse events (peri-operative or longer-term) • Revision surgery • Heterotopic ossification • Trochanteric nonunion • Failure of labral re-fixation, debridement or repair • Nerve damage • Mortality	• Non-clinical outcomes • Non-validated measures • Intermediate outcomes (e.g., laboratory or radiographic measurements)
Timing	• Short- (≤5 years), intermediate- (>5 years to <10 years) and long-term (≥10 years)	--

Study Component	Inclusion	Exclusion
Study Design	• KQs 1 and 2 (efficacy/effectiveness and safety): ○ **Adults**: RCTs will be the primary focus. High-quality comparative, NRSI (e.g., low risk of bias, prospective observational studies) that adjust for confounding on key prognostic factors will be considered primarily for safety (KQ 2) or if no RCTs are available. ○ **Children/Adolescent**s: Comparative NRSI will be the primary focus. Case series may be considered if no comparative studies are available. Systematic reviews of comparative NRSI or case series may be used. • KQ 3 (differential effectiveness and safety): Only RCTs will be considered (adults and children/adolescents). • KQ 4 (cost-effectiveness): Full economic studies (adults and children/adolescents).	• Non-clinical studies • NRS (observational studies) that do not control for confounding • NRSIs with <20 per treatment arm in adults • Case reports • Case series or single arm studies in adults • Imaging studies • Studies comparing simultaneous vs. staged bilateral surgery, differences in suture techniques, iliopsoas lengthening vs. not, traditional vs. extra-articular techniques • Indirect comparisons of treatments
Publication	• Studies published in English in peer reviewed journals, technology assessments or publicly available FDA reports • Studies published after the 2019 report • For KQ 4 full, formal economic analyses (e.g., cost-effectiveness, cost-utility studies) published in English in a peer reviewed journal	• Abstracts, editorials, letters • Duplicate publications of the same study that do not report different outcomes or follow-up times • Single reports from multicenter trials • White papers • Narrative reviews • Articles identified as preliminary reports when full results are published in later versions • Incomplete economic evaluations such as costing studies

FAIS = femoroacetabular impingement syndrome; FDA = US Food and Drug Administration; HO = heterotopic ossification; NRS = nonrandomized study; NRSI = nonrandomized study of intervention; NSAIDs = non-steroidal anti-inflammatory drugs; RCT = randomized controlled trial; SOE = strength of evidence; THA = total hip arthroplasty.

Methods

The draft Key Questions (KQs) and PICOTS scope for the comparison of hip surgery with non-operative care are based on the 2019 report. A comparison between surgical treatment of FAI with surgical procedures not involving alteration of bone was added for this update review. In contrast to the 2019 report, this update does not compare other types of hip surgery, nor does it compare methods of treating labral tear or chondral damage. The draft KQs and PICOTS were available for public comment. Comments related to policy concerns or considerations were brought to the attention of the Health Technology Assessment Program. Comments related to evidence review and synthesis were considered in the finalization of the key questions. Responses to all public comments will be posted on the Health Technology Assessment Program's website with the final report.

A formal, structured systematic search of the peer-reviewed literature across multiple databases was conducted to identify publications (including clinical guidelines) published subsequent to the 2019 report, i.e., January 1, 2019 to March 27, 2026. The search process is detailed in the main report and

Appendix A. Reference lists of relevant studies, and the bibliographies of systematic reviews were searched.

Primary outcomes for this report were function (validated patient- and clinician-reported hip scores), pain (validated measures), conversion to total hip arthroplasty (THA), labral tear or retear, and adverse events (AEs). Strength of evidence (SOE) was assessed for these primary outcomes only. Additional outcomes are described in the full report.

Methods for quantitative analysis are described in the full report. Briefly, meta-analyses were conducted using profile likelihood methods and focused on the primary outcomes. To determine the appropriateness of meta-analysis, we considered clinical and methodological diversity and assessed statistical heterogeneity. Data from RCTs included in the 2019 review were added to new RCT data to update meta-analyses where possible. Sensitivity analyses excluding poor-quality trials, outlying data and related to clinical heterogeneity were considered. Where possible, we reported on the proportion of patients meeting thresholds for clinically important differences (e.g., >30% pain relief). Consistent with the 2019 report, we report on whether continuous outcomes that were statistically significant did or did not meet minimal clinically important differences based on published psychometric evaluations. Where standardized mean differences, risk ratios or odds ratios were reported or calculated, we followed guidance from the GRADE working group for small, moderate and large effect sizes as described in the full report and Appendix C. We did not conduct analyses to evaluate potential markers for publication bias given the small number of trials available for some analyses.[1]

Included studies reporting on primary outcomes of interest were critically appraised independently by two reviewers evaluating the methodological quality, study limitations and potential for bias based on study design as well as factors which may bias studies. Methods for assessing study quality are detailed in the full report and Appendix C. An overall SOE combined the appraisal of study limitations with consideration of the number of studies and the consistency across them, directness and precision of the findings to describe an overall confidence regarding the stability of estimates as further research is available. The SOE for all primary health outcomes was assessed by two researchers following the principles for adapting GRADE (Grading of Recommendation Assessment, Development, and Evaluation) as outlined by the Agency for Healthcare Research and Quality (AHRQ).[1,7,24,25] The SOE was based on the highest quality evidence available from comparative studies for a given outcome. SOE was determined based on the following domains:

- **Risk of bias**: the extent to which the included studies have protection against bias
- **Consistency:** the degree to which the included studies report results that are similar in terms of effect sizes, range and variability. Consistency in unknown in single studies.
- **Directness**: describes whether the evidence is directly related to patient health outcomes or comparisons of interventions are direct (head-to-head).
- **Precision:** describes the level of certainty surrounding the effect estimates.
- **Publication or reporting bias:** is considered when there is concern of selective publishing or selective reporting. This is difficult to assess particularly for nonrandomized studies.

Bodies of evidence consisting of RCTs are initially considered as High SOE. In general, the GRADE and AHRQ methodologies initially consider nonrandomized studies as Low SOE as such studies typically are at higher risk of bias due to lack of randomization and inability of investigators to control for critical confounding factors. If only high risk of bias studies were available for a primary outcome, evidence was considered insufficient. Evidence consisting of case series alone was considered insufficient evidence. Additional methods details are available in the full report, including assessment of differential

effectiveness and harms. The final SOE was assigned an overall grade of high, moderate, low, or insufficient described as follows:

- High – Very confident that effect size estimates lie close to the true effect for this outcome; there are few or no deficiencies in the body of evidence; we believe the findings are stable.
- Moderate – Moderately confident that effect size estimates lie close to the true effect for this outcome; some deficiencies in the body of evidence; we believe the findings are likely to be stable, but some doubt remains.
- Low – Limited confidence that effect size estimates lie close to the true effect for this outcome; major or numerous deficiencies in the body of evidence; we believe that additional evidence is needed before concluding that findings are stable or that the estimate is close to the true effect.
- Insufficient – We are uncertain about the effect; we are unable to estimate an effect or have no confidence in the effect estimate for this outcome; OR the body of evidence has unacceptable deficiencies precluding judgment.

Results

Contextual Questions 1-3

For contextual questions, no new high-quality diagnostic accuracy studies specific to FAI/FAIS were identified and no new validated outcomes measures were used in more recent RCTs. There was additional evaluation of minimal clinically important difference (MCIDs) for various measures, some of which expanded the MCID ranges for some measures. New MCIDs have been added to tables in the full report and are reflected in **Table B** below.

Primary functional outcomes reported across studies in adults for which SOE was done and their MCIDs are summarized below. Not all published MCIDs were derived specifically from patients with FAIS or who had arthroscopy. Summary tables below indicated whether MCID was met for the measures if results were statistically significant; if the effect size was below the MCID, we have indicated that the clinical importance is unknown, however individual patients may value small improvements. Additional details and information on other outcomes are in the full report.

Table B. Overview of primary outcomes measures and published minimum clinically important differences

PROM	Scale	MCID Unit or Range in Adolescents	MCID Unit or Range in Adults
iHOT-33	0-100	10.7[56]	6.1[54] to 12.1[58*]
iHOT-12	0-100	NR	13[48,57]
HOS-ADL	0-100	9.8[56]	8.3[58]
HOOS-ADL	0-100	NR	6[34†]
HOS-sport	0-100	12.1[56]	14.5[58]
HOOS-Sport	0-100	NR	10[34†]
NAHS	0-100	NR	8.5[10‡]
HAGOS-Pain	0-100	NR	6[34†]
HOOS-Pain	0-100	NR	9[34†]
VAS	0-100	NR	-15[48§]

ADL = activities of daily living; HADS = Hospital Anxiety and Depression Scale; HAGOS = Hip and Groin Outcome Score; HOS = Hip Outcome Score; HOOS = Hip disability and osteoarthritis outcome score; iHOT-12 = Short-form International Hip Outcome Tool; iHOT-33 = international Hip Outcome Tool; LEFS = Lower Extremity Functional Scale; MCID = minimal clinically important difference; mHHS = modified Harris Hip Score; NAHS = Non-arthritic Hip Score; NR = not reported; NRS = numerical rating scale; OHS = Oxford Hip Score; PD-Q = PainDETECT Questionnaire; QoL = quality of life; SF-12 = 12-item Short Form; VAS = visual analogue scale.
* Using the distribution method. One study (not specific to FAIS patients) reports MCID of 10 points using the anchor method.
† For patients receiving hip arthroscopy for any condition.
‡ In young adult patients with various hip disabilities.
§ Using the distribution method. One study (not specific to FAIS patients) reports MCID of -14.8 points using the anchor method.

Key Questions 1-4

We identified 11 new studies (in 15 publications) for this report: three RCTs (in 7 publications),[6,27,31,32,49,50,55] one systematic review (SR) of case series,[66] six case series,[14,23,43,44,67,73] and one formal economic analysis,[74] We also included five studies from the 2019 report: three RCTs,[22,47,61] one nonrandomized study of intervention (NRSI),[63] one SR of case series,[13] and three formal economic analyses.[22,51,68] Two updates to RCTs included from the 2019 report that provided longer term data were additionally included.[20,60] In total, 18 studies (in 24 publications) were included for this report: six RCTs (in 12 publications),[6,20,22,27,31,32,47,49,50,55,60,61] one NRSI,[63] two SRs of case series,[13,66] six case series,[14,23,43,44,67,73] and four economic analyses.[22,51,68,74]

The primary evidence for this report is from RCTs considered to be moderate risk of bias. The overall strength of evidence for most outcomes across most times was low. Evidence was moderate for some measures of function for the comparison of arthroscopy and PT. No RCTs in pediatric patients were identified. Data on this population was primarily from case series and one comparative NRSI included in the prior report; all were at high risk of bias.

This updated review adds two RCTs[27,49] evaluating the effectiveness and safety of hip arthroscopy in adults published since the 2019 review. No new RCTs in adolescents were identified, one NRSI from the previous report was included, however the evidence base continues to consist of case series.

No RCTs comparing surgical procedures that alter bone in FAIS versus not involving alteration of bone were identified aside from the FIRST. There were no simulated or sham surgery

Table C provides an overview of included studies.

Table C. Overview of included studies

Population: Intervention vs. Comparator	2019 Report	2026 Update (New)	Total Included
Adults: Arthroscopic Surgery vs. Lavage	Comparison not included	RCTs: 1[6,31,32]†	RCTs: 1[6,31,32]
Adults: Arthroscopic Surgery vs. Non-operative Treatment	RCTs: 3[22,47,61] Economic: 3[22,51,68]*	RCTs: 2[27,49,50,55] Additional publications for RCTs included from 2019 Report: 2[20,60] Economic: 1[74]	RCTs: 5[20,22,27,47,49,50,55,60,61] Economic: 4[22,51,68,74]
Adolescents: Arthroscopic Surgery vs. PT	NRSI: 1[63]	No new studies identified	NRSI: 1[63]

Population: Intervention vs. Comparator	2019 Report	2026 Update (New)	Total Included
Adolescents: Arthroscopic (primarily) or Open Surgery only	SRs of case series: 1[13]	SRs of case series: 1[66] Case series: 6[14,23,43,44,67,73]	SRs of case series: 2[13,66] Case series: 6[14,23,43,44,67,73]

NRSI = comparative nonrandomized studies on interventions; RCT = randomized controlled trial; SR = systematic review.

Overview of Findings KQ 1 - 4

In adults with FAIS

- Osteochondroplasty may not improve function or pain versus lavage at 12 months. It may, however, reduce the risk of hip complications requiring surgery at 24 months with persistent hip pain cited as the most common reason.
- Arthroscopy may improve function and pain versus supervised physical therapy, however findings varied somewhat based on measure used and time frames reported. Findings are generally consistent with the 2019 report.
- Not all statistically significant findings for pain and function met published MCIDs. The SOE was low for many outcomes and time frames.
- Consistent with the prior report, we did not identify high-quality, low risk of bias evidence for longer-term outcomes. Follow-up across trials was short-term (up to 38 months).

In adolescents with FAIS

- Evidence consisted primarily of case series and was considered insufficient.
- Data from one poor-quality NRSI suggests that arthroscopy may result in similar improvement in function compared activity modification or injections at 2 years but there is substantial uncertainty regarding these findings.
- Across case series, function and pain generally improved following arthroscopy and/or open surgery. Adverse events and harms were poorly reported but serious events appeared to be rare. Again, there is substantial uncertainty regarding these findings.

Results in Adults by Treatment

Arthroscopic Osteochondroplasty Versus Arthroscopic Lavage

One moderate risk of bias RCT (N=220) (in 4 publications)[3,6,31,32] compared arthroscopic osteochondroplasty versus arthroscopic lavage with or without labral repair. Enrolled patients were young (mean 36 years old) and were required to have failed at least 6 months of nonoperative management that included hip-focused physical therapy. Differences between the operative and lavage groups included baseline Tönnis grade 1 (52% vs. 39%), complete labral tear at surgery (52% vs. 41%), partial tears at surgery (39% vs. 45%) and use of labral repair (73% vs. 47%) and capsular closure (31% vs. 13%). Authors report adjusted estimates and controlled for treatment, baseline score, impingement subtype, and center.

Key Questions 1 and 2: Effectiveness and Safety (Table D)

Effectiveness

- Osteochondroplasty may not improve functional outcomes at 12 months; there was no difference between treatment groups on the iHOT-12 or HOS-Sport. Lavage was favored for the

HOS-ADL measure (adjusted mean difference in change scores, -5.03, 95% confidence interval [CI] -10.04 to -0.03).

- Osteochondroplasty may not improve pain (visual analogue scale [VAS] 0-100) versus lavage at 12 months.
- No evidence beyond 12 months was identified.
- Osteochondroplasty may not reduce the risk of labral-reinjury compared with lavage by 24 months.
    - There were fewer labral re-injuries in the osteochondroplasty group versus lavage over 24 months, but the difference was not statistically significant (N=209, 3.8% vs. 7.7%; relative risk [RR] 0.50, 95% CI 0.15 to 1.59) and the estimate is very imprecise. All but one re-injury which occurred in the lavage group, required revision surgery.
    - It is unclear how differences between groups in the severity of labral tear and use of repair (versus debridement) may impact this finding. Authors note that it is difficult to determine the extent to which differences in labral treatment may have influenced revision rates.
- SOE across outcomes was low due to study limitations, imprecision and unknown consistency.

Safety

- Hip complications *not* requiring surgery were common in both treatment groups with no difference between them noted (21.0% vs. 27.9%, adjusted odds ratio [OR] 0.69, 95% CI 0.36 to 1.30)
- For hip complications requiring surgery
    - Osteochondroplasty may not reduce hip complications requiring surgery at 12 months (N=214, 1.9% vs. 4.7%, RR 0.39, 95% CI 0.08 to 1.98) compared with lavage.
    - Osteochondroplasty may reduce decrease the risk of hip complications require surgery (N=209, 7.6% vs. 18.3%; adjusted OR 0.37, 95% CI 0.15 to 0.89 by 24 months. Persistent hip pain was the most common reason for revision/surgery (2.9% vs. 11.5%; RR 0.25, 95% CI 0.07 to 0.85), followed by re-injury of the labrum described above.
- SOE across outcomes above was low due to study limitations, imprecision and unknown consistency.
- Other safety outcomes: There was insufficient evidence to draw conclusions regarding the impact of osteochondroplasty versus lavage on mortality, nerve injury, heterotopic ossification, or sexual dysfunction and urinary events.

Table D. Summary of evidence for arthroscopic osteochondroplasty vs. lavage in patients with symptomatic FAIS

Effect/Improvement is for osteochondroplasty unless otherwise indicated

Category	Outcomes*	12 Months	24 Months
Efficacy outcomes	iHOT-12 MCID: 13	No difference 1 RCT, N=130 (SOE: LOW)	No evidence
	HOS-ADL MCID: 6-8.3	MCID: No (favored lavage) 1 RCT, N=178 (SOE: LOW)	No evidence
	HOS-Sport MCID: 10-14.5	No difference 1 RCT, N=163 (SOE: LOW)	No evidence

Category	Outcomes*	12 Months	24 Months
	VAS pain MCID: 1.5	No difference 1 RCT, N=187 (SOE: LOW)	No evidence
	Labral re-injury (%)	No evidence	No difference 1 RCT, N=209 (SOE: LOW)
Safety outcomes	Any hip complication and hip complications not requiring surgery (%)	No evidence	No difference 1 RCT, N=209 (SOE: LOW)
	Hip complications requiring surgery (i.e., Revision surgery) (%)	No difference 1 RCT, N=214 (SOE: LOW)	Substantial decrease in risk 1 RCT, N=209 (SOE: LOW)
	Heterotopic Ossification (%)	No evidence	Insufficient evidence
	Nerve injury (%)	No evidence	Insufficient evidence

ADL = activities of daily living; HOS = Hip Outcome Score; iHOT-12 = International Hip Outcome Tool – 12 item questionnaire; MCID = minimal clinically important difference; RCT = randomized controlled trial; SOE = strength of evidence; VAS = visual analog scale.
*All continuous outcomes are on a 0-100 scale except for VAS which is a 0-10 scale.
†MCID: No means that the between-group difference was statistically significant but was below the published MCID(s); therefore, clinical importance is unclear. No difference means that the between-group difference was not statistically significant.

Key Question 3: Differential effectiveness and harms

The FIRST found no interaction by FAI type, baseline impingement severity, sex, cartilage status, labrum treatment and center, and the outcome of VAS pain scores. Our confidence in these findings is very low based on study limitations, inadequate sample size leading to substantial imprecision and failure to specify subanalyses and hypotheses a priori.

Key Question 4: Cost-effectiveness

A moderate quality (Quality of Health Economic Studies (QHES) 78/100) cost-utility analysis based on FIRST was conducted from a Canadian public healthcare payer perspective found that arthroscopic osteochondroplasty dominated arthroscopic lavage based on a lifetime time horizon. Incremental cost-effectiveness ratios (ICERs) ranged from $2,676/quality-adjusted life-year (QALY) to $3,726/QALY from sensitivity analysis. Osteochondroplasty had an 85.3% chance of being cost-effective at a willingness-to-pay (WTP) of $5,000 per QALY, and 90.5% change of being cost-effective when the WTP was increased to $50,000 per QALY gained in probabilistic analyses. The primary limitation of this study was extrapolation of 24-month RCT data to a lifetime. This short-term follow-up precludes evaluation of OA development or conversion to THA. Modeling of AEs is unclear. The applicability to the US health care system is unclear.

Arthroscopy Versus Nonoperative Care

Five moderate risk of bias RCTs (N=859; in 9 publications)[20,22,27,47,49,50,55,60,61] compared arthroscopic surgery with physical therapy. Three of these RCTs were included in the 2019 HTA, two are new. Patients were young (30 to 48 years). Two trials[47,49,50] required failure of conservative treatment ranging from 6 weeks to at least 3 months duration prior to enrollment. The nonoperative groups received supervised physical therapy in all trials.[22,27,47,49,61] Only one trial[47] described conservative treatment, which included NSAIDs, patient education, and handout-based home exercise. Procedural details of

arthroscopic surgery not well-reported across trials. Labral treatment of various types was performed to some extent in all trials. Harms were poorly reported.

Key Question 1: Effectiveness (Table E)

- Arthroscopy may increase the likelihood of achieving clinically important improvement thresholds for HOS-ADL to a moderate extent at 6-8 months (51% vs. 32%, RR 1.6, 95% CI 1.12 to 2.2) and slightly at 38 months (67% vs. 48%, RR 1.40, 95% CI 1.07 to 1.82) based on a single trial. (SOE Low)
- Functional improvement was generally seen following arthroscopy versus PT and MCIDs were frequently met, however results varied somewhat by measure and time frame as did the SOE.
    - For example, at 6-8 months, pooled mean differences did not meet the MCIDs for the HOT-33 or the ADL subscales but did meet it at later times although statistical significance was seen.
    - Arthroscopy likely results in little or no difference in Sport subscales versus PT.
- Arthroscopy probably improves pain versus PT based on pooled estimates at 12-14 months for the Copenhagen Hip and Groin Outcome Score (HAGOS) and Hip Disability and Osteoarthritis Outcome Score (HOOS) pain scales which met MCIDs. Evidence is less certain for improvement at later times. While arthroscopy may improve within 3 months of treatment based on VAS, improvement did not persist to later times up to 26 months; data were from a single trial.
- Arthroscopy may result in little or no difference in conversion to total hip arthroplasty versus PT by 38 months, the longest follow-up reported.

Table E. Summary of *effectiveness* evidence for arthroscopy vs. conservative care (PT) in patients with FAIS

Effect/Improvement is for arthroscopy unless otherwise indicated

Outcomes*	3 Months†	6-8 Months†	12-14 Months†	24-26 Months†	38 Months†
Proportion achieving clinically important improvement in HOS-ADL (≥9 points)	No evidence	Moderately greater likelihood 1 RCT, N=191 (SOE: Low)	No evidence	No evidence	Slightly greater likelihood 1 RCT, N=171 (SOE: Low)
Proportion achieving PASS on HOS-ADL (>87 points)	No evidence	Substantially greater likelihood 1 RCT, N=191 (SOE: Low)	No evidence	No evidence	No evidence
HOT-33 MCID: 6.1-12.1	MCID: Yes 1 RCT, N=97 (SOE: Low)	MCID: No 5 RCTs, N=752 (SOE: Low)	MCID: Yes 5 RCTs, N=735 (SOE: Moderate)	MCID: Yes 3 RCTs, N=261 (SOE: Low)	MCID: Yes 1 RCT, N=136 (SOE: Moderate)
HOS-ADL and HOOS-ADL subscales MCID: 6-8.3	MCID: Yes 1 RCT, N=97 (SOE: Low)	MCID: No 4 RCTs, N=483 (SOE: Low)	Insufficient evidence	No difference 3 RCTs, N=262 (SOE: Low)	MCID: Yes 1 RCT, N=171 (SOE: Moderate)
HOS-Sport and HOOS-Sport subscales MCID: 10-14.5	Insufficient evidence	Insufficient evidence	MCID: No 4 RCTs, N=407 (SOE: Moderate)	No difference 3 RCTs, N=262 (SOE: Low)	MCID: No 1 RCT, N=171 (SOE: Moderate)
NAHS MCID: 8.5	MCID: Yes 1 RCT, N=97 (SOE: Low)	MCID: Yes 2 RCTs, N=266 (SOE: Low)	MCID: Yes 2 RCTs, N=239 (SOE: Low)	MCID: No 2 RCTs, N=178 (SOE: Low)	MCID: No 1 RCTs, N=158 (SOE: Low)

Outcomes*	3 Months†	6-8 Months†	12-14 Months†	24-26 Months†	38 Months†
HAGOS and HOOS pain subscales MCID: 6-9	No evidence	Insufficient evidence	MCID: Yes 2 RCTs, N=233 (SOE: Moderate)	MCID: Yes 1 RCT, N=90 (SOE: Low)	MCID: Yes 1 RCT, N=136 (SOE: Low)
VAS pain MCID: 1.5	MCID: Yes 1 RCT, N=97 (SOE: Low)	MCID: No 1 RCT, N=97 (SOE: Low)	No difference 1 RCT, N=97 (SOE: Low)	No difference 1 RCT, N=97 (SOE: Low)	No evidence
Conversion to THA	No evidence	No evidence	No evidence	No evidence	No difference 4 RCT, N=682 (SOE: Low)

ADL = activities of daily living; AE = adverse event; HAGOS = Copenhagen Hip and Groin Outcome Score; HOS = Hip Outcome Score; HOOS: Hip Disability and Osteoarthritis Outcome Score; iHOT-33 = International Hip Outcome Tool – 33 item questionnaire; MCID = minimal clinically important difference; NAHS = Non-arthritic Hip Score; PT = physical therapy; RCT = randomized controlled trial; SOE = strength of evidence; THA = total hip arthroscopy; VAS = visual analog scale.
*All are on a 0-100 scale except for VAS which is a 0-10 scale.
†MCID: Yes means that the between-group difference met or exceeded the published MCID(s) for that measure and is considered a clinically important improvement. MCID: No means that the between-group difference was statistically significant but was below the published MCID(s); therefore, clinical importance is unclear. No difference means that the between-group difference was not statistically significant.

Key Question 2: Safety (Table F)

- Harms and AEs were poorly and variably reported across trials. Evidence was insufficient for many outcomes due to study limitations, serious imprecision and unknown consistency.
- One RCT[27] reported AEs as "possibly or definitely" related to interventions. These included lump from cannula insertion, superficial infection, hip, quadricep, and knee pain, inguinal ligament repair, and others. The difference between arthroscopy and PT was not statistically significant, but the estimate is imprecise (15.6% vs. 23.4%, RR 0.66, 95% CI 0.28 to 1.56)
- The evidence suggests that there is little or no difference in hip pain or stiffness (14.4% vs. 14.8%) between hip arthroscopy and PT.
- Across studies, 0% to 12.5% of patients randomized to PT crossed-over to receive arthroscopic surgery; all revision surgeries were done in patients who had received hip arthroscopy (i.e., those randomized and those who crossed over.) There were insufficient data to provide estimates of frequency of revision as authors do not report on as-treated populations.
- In patients receiving hip arthroscopy, numbness in groin, leg, or foot was common (2 RCTs pooled, 27.3% range, 25.4% to 33.3%.
- Superficial wound infection requiring antibiotics occurred in 2.8% of patients (2 RCTs, range 1.0% to 6.7%), however hip joint infection and scrotal infection were rare (<1%).
- Evidence was insufficient to draw conclusions for mortality, fracture, avascular necrosis, heterotopic ossification and thromboembolic events; studies were likely underpowered to detect these rare events.

Table F. Summary of *safety* evidence for arthroscopy versus PT in patients with FAIS
Effect/Improvement is for Arthroscopy unless otherwise indicated

Outcomes	Follow-up	Follow-up, Conclusion, SOE
Mortality	12-24 months	Insufficient
Any SAE and any treatment-related SAE	12-38 months	Insufficient

Outcomes	Follow-up	Follow-up, Conclusion, SOE
AEs possibly or definitely related to the interventions	12 months	No difference SOE: Low
Hip Fracture	12-24 months	Insufficient
Hip pain or stiffness	12-38 months	Common, similar 2 RCTs, N=506 (SOE: Low)
Revision surgery (*surgery-specific AE*)	12-38 months	Arthroscopy may lead to revision 5 RCTs, N=774 in arthroscopy arm (SOE: Low)
Nerve injury (*surgery-specific AE*)	8-12 months	Numbness in groin, leg, foot common; others less common 3 RCTs, N=282 in arthroscopy arm (SOE: Low)
Infection (hip joint, scrotal infection) (*surgery-specific AE)*	12 months	Insufficient
Infection (superficial requiring antibiotics) (*surgery-specific AE)*	8-12 months	Infection may not be uncommon 3 RCTs, N=282 in arthroscopy arm (SOE: Low)
Thromboembolic events (*surgery-specific AE*)	12-24 months	Insufficient
Heterotopic ossification (*surgery-specific AE*)	24 months	Insufficient
Avascular necrosis (*surgery-specific AE*)	24 months	Insufficient

AE = adverse event; RCT = randomized controlled trial; SAE = serious adverse event; SOE = strength of evidence

Key Question 3: Differential effectiveness and harms

Three RCTs[22,55,61] evaluated potential modification of treatment. Age modified the treatment effect in one of the trials,[61] with arthroscopy providing greater improvement in HOS-ADL versus physiotherapy in younger patients; this benefit diminished with increasing age.[61] No interactions were found for other patient, clinical, or imaging characteristics assessed, including sex, FAI type, osteoarthritis severity, body mass index (BMI), symptom duration, smoking status, or imaging measures.[22,55,61]

Our confidence in these findings is very low based on study limitations, inadequate sample size leading to substantial imprecision and failure to specify subanalyses and hypotheses a priori.

Key Question 4: Cost-effectiveness

No new full economic studies comparing hip arthroscopy with conservative care were identified for this update. Three cost-utility analysis (CUA) studies were included in the 2019 report. Conclusions regarding the cost-effectiveness of hip arthroscopy compared with non-operative care were inconsistent across the three studies.

- The only CUA (moderate quality) based on RCT data found that personalized PT was both more effective and less costly that arthroscopy at one year from the U.K. National Health Service perspective. The short-term horizon precluded evaluation of OA development or conversion to THA.
- Two poor-quality CUAs from the United States found that arthroscopy was more cost-effective than non-operative care from a societal perspective over 10 years and more cost-effective than observation from a hospital cost perspective for a lifetime. Primary data sources were case series, expert opinion and retrospective survey of arthroscopy patients. Both used an unvalidated method for determining utility.

Results in Adolescents

Consistent with the 2019 report there was no high-quality evidence on the effectiveness and safety of hip arthroscopy in adolescent or pediatric patients with FAIS. One NRSI was identified, however evidence was primarily from case series and was considered to be insufficient. Primary findings are summarized below.

Key Question 1: Effectiveness

Evidence of the effectiveness of hip arthroscopy was limited to one NRSI[63] and case series (1 SR of 24 case series[66] and six additional case series[14,23,43,44,67,73] not in the SR) There is substantial uncertainty regarding the findings and evidence was considered insufficient for all.

- There were no differences between arthroscopy and activity modification or injections on any outcome measured over a mean of 2 years (n=93 hips in 76 patients): proportion meeting the MCID on the modified Harris Hip Score (mHHS), mean difference in mHHS and Non-Arthritic Hip Score (NAHS) scores, and return to sport. There is substantial uncertainty regarding these findings.
- Across case series, pooled estimates of mean change from baseline on measures of function (all 0-100 scale) suggest improvements with arthroscopy and/or open surgery that met reported MCIDs (range of MDs 21.41 to 44.82, across 2 to 28 studies, N range 72 to 1,726), however there is substantial uncertainty regarding these findings.
- Pain was improved following arthroscopy and/or open surgery. Pooled estimates of mean change from baseline were -4.0 on the VAS (0-10 scale, 9 studies, N=693) and 37.18 on HOOS pain (0-100 scale, 2 studies, N=72) which met reported MCIDs, however there is substantial uncertainty regarding these findings.

Key Question 2: Safety

Adverse events and harms were poorly reported. Evidence of the safety of hip surgery for FAI/FAIS was limited to two SRs[13,66] and four case series.[14,23,43,67] There is substantial uncertainty regarding these findings and evidence was insufficient.

- The NRSI did not report harms.
- Across case series the frequency of heterotopic ossification (HO) ranged from 0% to 5.5% (2 SRs, 2 case series), nerve injury from 0.4% to 8.3% (1 SR, 4 case series), infection from 0% to 2.7% (2 SRs, 3 case series), revision surgery from 0% to 13% (2 SRs, 7 case series). There were no cases of avascular necrosis (1 SR, 4 case series) or femoral fracture (1 SR, 1 case series). Other complications reported by case series were rare.

Key Question 3 and 4: Differential effectiveness and harms and Cost-effectiveness

No studies evaluating the differential effectiveness or safety of hip surgery in adolescent patients were identified for KQ 3 and no formal economic studies in this population were identified for KQ 4.

Strength of Evidence Summaries

Detailed SOE tables, including reasons for downgrading, are found in Section 5 of the full report.

Discussion

An overview of key findings related to the surgical treatment of FAIS from the original 2011 HTA, the 2019 update and this new report are summarized in **Tables G and H below.**

For the contextual questions, we found no new high-quality diagnostic accuracy studies specific to FAI/FAIS. Criteria outlined by the 2016 Warwick Agreement[21] and 2019 Lynch consensus document[45] continue to provide the primary basis for defining cases of FAIS. As noted in this update and the prior report, none of the criteria in the Warwick Agreement are pathognomonic for FAIS. Not all persons with FAI will have symptoms and symptoms be seen in patients who do not have FAI. The limited new information on MCIDs for specific patient-reported outcomes measures was combined with that from the 2019 report and is summarized in the full report.

Regarding surgical treatment of FAIS, this update to the 2019 HTA includes evidence comparing hip arthroscopy with physical therapy in adults from two RCTs published after that report as well as additional follow-up publications from previously included RCTs. This update also includes RCT evidence comparing arthroscopic osteochondroplasty versus arthroscopic lavage. All trials were considered at moderate risk of bias. Common limitations included the inability to blind patients and/or assessors and unacceptable loss to follow-up; two trials had very high crossover (70%).[47,49] For many primary outcomes, the overall SOE was low due to these study limitations in addition to imprecision and in some cases inconsistency or unknown consistency of estimates. Evidence for the effectiveness and safety of hip arthroscopy in adolescents remains sparse and was considered insufficient.

New to this update is a trial of arthroscopic osteochondroplasty versus arthroscopic lavage. Findings from this trial suggest that osteochondroplasty may not result improvement in function or pain versus lavage, however, revision rates were lower in the osteochondroplasty group. Persistent hip pain followed by labral re-injury were the primary reasons for revision.

This update report incorporates new publications for the comparison of hip arthroscopy with PT in adults with those from the 2019 HTA. The findings based on updated syntheses are generally consistent with those from the 2019 HTA (**Table G**). Overall, hip arthroscopy may improve function and pain, however, harms and AEs are poorly reported and trials were likely underpowered to detect rare events. All RCTs comparing hip arthroscopy with PT employed post-operative PT; the impact of this on findings is unclear.

Only short-term (≤5 years) evidence was reported in included trials for all comparisons. Consistent with the 2019 report, high-quality evidence of intermediate term (>5 to 10 years) or long-term (≥ 10 years) effectiveness and safety was not identified. While the updated evidence synthesis in this re-review suggests that hip arthroscopy improved function and pain in the short-term (< 5 years) versus PT, the durability of this effect beyond 38 months is unclear. Similarly, the long-term impact of hip arthroscopy on OA progression and the need for THA versus lavage or PT remains unclear. Limited information from the RCT data included in this update suggests that there may be little or no difference between hip arthroscopy and PT on the development or progression of OA in younger (< 40-years old) adult patients with no or only mild OA prior to FAI treatment. There is mixed evidence from comparative NRSIs on the impact of hip arthroscopy on OA development. Two newer comparative NRSIs[28,65] found lower rates of progression to OA in patients receiving correction of impingement deformities versus no correction at 1 a minimum follow-up of 10 years while a third NRSI[39] conversely reported increased progression to OA in operative versus nonoperative patients at mean 32 months follow-up. These mixed results combined with the methodologic limitations of these NRSI (e.g., selection bias, lack of control for confounding) suggest that the evidence is very uncertain about the impact of hip arthroscopy on OA progression and development. Methodologically rigorous comparative longitudinal studies that control for OA prognostic factors are needed to evaluate the impact of hip arthroscopy on OA progression compared with other treatment or no treatment.

The impact of hip arthroscopy versus conservative care on conversion to THA is also unclear. Included trials suggest little or no difference in conversion to THA between hip arthroscopy and PT up to

38 months. Trial populations are again young (<40 years old) with no or mild OA, which may at least partially account for this finding together with the limited length of follow-up. Information from the NRSI included for context would be considered insufficient to draw conclusions given substantial study limitations, primarily failure to adjust for important prognostic factors, selection bias and imprecision.

Labral tears are common in asymptomatic and symptomatic patients with FAI. They are also commonly seen in patients who do not have FAI/FAIS. The bony deformities of FAI may increase the risk of labral tear. A variety of surgical methods may be used to treat the labrum including repair, debridement or reconstruction depending on the extent of the tear and surgeon preference. Across trials, a high proportion of patients had labral injury and all surgical treatment arms (including lavage) used a variety of methods to address labral tear. None provided subgroup analysis of those who did or did not receive labral tear treatment or by type of treatment. Similarly, the potential impact of inadequate bone resection on labral re-injury could not be assessed. The FIRST was the only trial comparing hip arthroscopy involving bone alteration versus lavage, a procedure that did not alter the bone. There were fewer labral re-injuries in the osteochondroplasty group versus lavage over 24 months, but the difference was not statistically significant (N=209, 3.8% vs. 7.7%; RR 0.50, 95% CI 0.15 to 1.59) and the estimate is very imprecise. It is unclear how differences between the groups in the severity of labral tear at the time of the index surgery and differences in procedures used to address them may impact the results versus other factors such as residual FAI. Four systematic reviews,[38,41,46,59] primarily of case series, report that the most common indications for revision surgery following original hip arthroscopy for a variety of indications are labral re-injury, femoroplasty and acetabuloplasty. One review,[59] which appears to focus on FAI/FAIS, and an initial surgical indication, suggests that inadequate or complete lack of bony resection resulting in continued FAI is the primary reason for revision and that in turn could result in retear of the labrum. Formal analysis of association between adequacy of bone resection and labral reinjury is not presented, the initial treatment for labral tear is not described for included studies and criteria for determining adequacy of bony resection are not defined in any of the reviews making it difficult to draw conclusions. The impact of these factors on the frequency of labral re-injury or need for revision to address additional labral treatment is unclear.

In adolescent populations, evidence for the benefits and harms of hip arthroscopy for FAIS continues to be sparse and primarily from case series. There was substantial heterogeneity across studies with regard to the populations included, procedures performed and follow-up reported. Evidence in this population was considered insufficient. Well-conducted RCTs remain the standard for evaluating the efficacy of an intervention. Comparative NRSI with concurrent controls can be helpful in particularly for “hard” and quantitative outcomes, (e.g., death). Selection bias and confounding that are common to NRSI, and have been shown to overestimate treatment effectiveness, especially for subjective outcomes. Well conducted prospective NRSI that mitigate selection bias and control for important prognostic factors may be helpful to future evaluation of the benefits and harms of hip arthroscopy in adolescents.

Applicability

All trials in adults were in symptomatic patients generally <40 years of age with no or minimal osteoarthritis. Thus, applicability of the findings of this report to older populations with greater degrees of OA is unclear. In some trials patients had to have failed conservative therapy prior to enrollment, however this was not described in many trials. The components and characterization of prior conservative therapy were not well described in the trials. PT interventions across clinical trials varied substantially and were not typically designed to be FAIS-specific.[15,19,36,52] A 2019 editorial article[35] suggested that PT programs utilized by two of the RCTs[22,47] included in this review do not reflect current best practice of PT for FAIS since both protocols were developed prior to 2012. The extent to which PT in

other trials is consistent with more recent guidelines[18] suggesting use of a multimodal approach incorporating strengthening exercises, manual therapy, postural and movement correction, stretching, balance exercises, and possibly other activities where appropriate is unclear. There was heterogeneity across trials in the type of FAI treated and methods used to treat labral tear and chondral injury and use of capsular closure. This presumably would be consistent with clinical practice. All RCTs comparing hip arthroscopy with PT employed post-operative PT, which again presumably is consistent with clinical practice.

Comparison with Prior Reports

The focus of these reports was on the comparative effectiveness and safety of operative versus non-operative treatments; in addition, the 2026 report included comparison of hip surgery with and without alteration of the bone. Across all three reports, there was no evidence available to assess the intermediate (>5 years to <10 years) or long term (≥10 years) comparative effectiveness or safety for either adults (Table G) or adolescents (Table H). All outcomes are short term (≤5 years).

Table G. Summary of evidence in adults across reports (all short term, ≤5 years).

Key Question	2011 Report	2019 Report Update	2026 Report Update
Effectiveness **Short-term (≤5 years)**	No evidence available to assess the short-term effectiveness of FAI surgery compared with no surgery.	• No studies comparing operative and non-operative care in asymptomatic patients were identified. • 3 RCTs of arthroscopy vs. PT for FAI in adults over the short-term (up to 24 months) identified. Labral tear procedures were done in >90% of patients.	• Asymptomatic FAI was excluded • 5 RCTs (2 new) of arthroscopy vs. PT in the short-term (to 38 months) were included. Labral tear procedures were done in >90% of patients. • In general, evidence continues to favor arthroscopy vs. PT for some function and pain outcomes. As in the 2019 report, findings varied by outcome and timepoint and not all statistically significant findings met published MCIDs. • One new RCT comparing surgical treatment involving bone modification versus no bone modification was identified.

Key Question	2011 Report	2019 Report Update	2026 Report Update
Effectiveness **Short-term (≤5 years)**	No evidence available to assess the short-term effectiveness of FAI surgery compared with no surgery.	**<u>Arthroscopy vs. PT</u>** **Function** • More arthroscopy vs.PT patients achieved clinically important improvements in function in 1 RCT: MCID (≥9 points) and PASS (score >87 points) at 8 months (SOE: moderate). • Improvement favoring arthroscopy versus PT was seen for function at 6 to 8 months for the I iHOT-33) (3 RCTs) and the HOS-Sport subscale (2 RCTs) but not the HOS-ADL subscale (2 RCTs); only the difference on the HOS-Sport subscale is likely clinically significant (SOE: moderate for iHOT-33 and HOS-Sport, low for HOS-ADL). • No clear difference between groups was seen for iHOT-33, HOS-ADL or HOS-Sport at 12 or 24 months (SOE: moderate for the i-HOT-33 at 12 months [2 trials]; insufficient for i-HOT-33 at 24 months and HOS-ADL and -Sport subscales[1 trial]).	**<u>Arthroscopy vs. PT</u>** **Function** • The same RCTs from 2019 reported slightly higher likelihood clinically important improvement at 38 weeks (SOE Low) • Arthroscopy was associated with a **clinically important improvement** (i.e., met or exceed MCID) for the following: ○ iHOT-33 scores at 3 months (1 RCT; SOE: Low), 12–14 months (5 RCTs; SOE: Moderate), 24–26 months (3 RCTs; SOE: Low), and 38 months (1 RCT; SOE: Moderate). ○ NAHS scores at 3 months (1 RCT), 6–8 months (2 RCTs), and 12–14 months (2 RCTs) (SOE: Low for all) • HOS/HOOS ADL scores at 3 months (1 RCT; SOE: low) and 38 months (1 RCT; SOE: moderate • Improvement seen with Arthroscopy, but **estimates were below published MCIDs** for the following: • iHOT-33 scores, 6–8 months (5 RCTs; SOE: low). • NAHS scores,24–26 months (2 RCTs; SOE: low) and 38 months (1 RCT; SOE: low) • HOS/HOOS ADL, 6–8 months (4 RCTs; SOE: low). • HOS/HOOS Sport at 12–14 months (4 RCTs; SOE: Moderate) and 38 months (1 RCT; SOE: Moderate). **No Difference:** • HOS-HOOS ADL at 24–26 months (3 RCTs; SOE: Low). • HOS/HOOS Sport at 24–26 months (3 RCTs; SOE: Low). **Insufficient Evidence** • HOS/HOOS ADL at 12–14 months (4 RCTs) • HOS/HOOS Sport at 3 months (1 RCT) and 6–8 months (4 RCTs).

Key Question	2011 Report	2019 Report Update	2026 Report Update

Effectiveness
 	
Short-term (≤5 years)
	No evidence available to assess the short-term effectiveness of FAI surgery compared with no surgery.	**<u>Arthroscopy vs. PT</u>**
		Pain
		• In one RCT, greater improvement in pain (HAGOS) was reported following arthroscopy versus PT at 8 months and; may be clinically important, Fewer arthroscopy patients reported pain on hip flexion, adduction, and the FABER test but there were no differences between groups on other assessments; clinical relevance of differences is unclear (SOE: low).
		
		Conversion to THA
		• Across two RCTs, two arthroscopy patients (1.0%) compared with none who received PT required conversion to THA up to 24 months; sample size and short follow-up may impact the ability to adequately capture this event (SOE: low).
			<u>Arthroscopy vs. PT</u>
			Pain
			• Arthroscopy is associated with a **clinically important improvement** (i.e., met or exceed MCID) for the following:
			  • VAS scores, 3 months (1 RCT; SOE: Low).
			  • HOOS/HAGOS pain, 12–14 months (2 RCTs; SOE: Moderate) and 24–26 months (1 RCT; SOE: low)
			• Improvement with arthroscopy**, but estimates were below published MCIDs:** VAS scores, at 6–8 months (1 RCT; SOE: low).
			• **No Difference:** VAS scores at 12–14 months (1 RCT; SOE: low) or 26 months (1 RCT; SOE: low)
			• **Insufficient Evidence**
			  • HOOS/HAGOS pain at 6-8 months (2 RCTs)
			
			Conversion to THA
			• At 12-38 months, there was no difference between groups across 4 RCTs (SOE: low).

Effectiveness **Short-term (≤5 years)**	Comparison not included.	Comparison not included.	**<u>Arthroscopy vs. Lavage (1 RCT)</u>** **Function (12 months)** • Osteochondroplasty was associated with slightly worse HOS-ADL score, but estimates were below published MCIDs (SOE: low). There was no difference between groups in iHOT-12 or HOS-sport scores (SOE: low). **Pain (12 months)** • There was no difference between groups in VAS pain scores (SOE: low). **Labral Re-Injury** • At 24 months, there was no difference between groups in labral re-injury (SOE: low).

Key Question	2011 Report	2019 Report Update	2026 Report Update
Safety	• **The risk of reoperation** (other than conversion to THA) occurred in 4% (arthroscopy and open dislocation) and 9% of the patients (mini-open). • There was only one reported head-neck **fracture** (0.1%) and no reports of AVN, osteonecrosis or trochanteric nonunion. • **Heterotopic ossification** occurred in 2 to 3% of those receiving arthroscopy or mini-open, and 6% in those receiving open dislocation. • **Neurological complications:** were rare with arthroscopy or open dislocation; but seen in 22% of 258 hips with a mini-open procedure. Most were transient	**Arthroscopy vs. PT** • Across 2 RCTs, there were no deaths; serious and non-serious treatment-related AEs were more common following arthroscopy. (SOE: low) • Across RCTs, SRs of case series, comparative surgery cohorts, and additional case series in adults it appears that the frequency of most serious surgical complications may be low (<3%). • Higher risk surgical complications included transient nerve injury (0% to 25%; 0% to 9% excluding outliers) and revision surgery (0% to 8%).	**Arthroscopy vs. PT** • Hip pain or stiffness was common after arthroscopy with no difference vs. PT (SOE: Low). • Arthroscopy may lead to revision surgery, but frequency estimates could not be calculated because authors did not report as-treated populations (SOE: Low). • Nerve injury, particularly numbness, and infection may be common after arthroscopy (SOE: Low). • Evidence was insufficient for mortality, any SAE, AEs potentially or definitely related to treatment, hip fracture, thromboembolic events, heterotopic ossification, and avascular necrosis. **Arthroscopy vs. Lavage (12 months)** • No difference between groups in revision surgery (SOE: Low). • At 24 months, arthroscopy was associated with a substantial decrease in likelihood of revision (SOE: low). • There was no difference between groups in any hip complication or any hip complication not requiring surgery (SOE: low). • Evidence was insufficient for mortality, heterotopic ossification, and nerve injury.
Differential Efficacy and Safety	• No evidence	• Evidence from two trials evaluating whether age, FAI type, sex, Kellgren Lawrence grade and study center modify the treatment effect following operative versus non-operative treatment was insufficient to draw conclusions.	• Evidence remains insufficient. Evidence from four trials evaluated modification by age, FAI type and severity, sex, Kellgren Lawrence grade, study center, baseline scores, BMI, health care system, smoking, symptom duration, various imaging measures, cartilage status and labrum treatment for operative versus non-operative treatment (3 RCTs) and arthroscopy versus lavage (1 RCT) was insufficient.

Key Question	2011 Report	2019 Report Update	2026 Report Update
Cost-effectiveness	• No evidence	• Conclusions regarding the cost-effectiveness of hip arthroscopy compared with non-operative care were inconsistent across three CUAs. • The only CUA (moderate quality) based on RCT data found that personalized PT was both more effective and less costly that arthroscopy at one year from the U.K. National Health Service perspective. The short-term horizon precluded evaluation of OA development or conversion to THA. • Two poor quality CUAs from the U.S. found that arthroscopy was more cost-effective than non-operative care from a societal perspective over 10 year and more cost-effective than observation from a hospital cost perspective for a lifetime.. Both used an unvalidated method for determining utility.	• One moderate-quality CUA found arthroscopic osteochondroplasty to dominate arthroscopic lavage (with or without labral repair), with lower lifetime costs and greater QALYs from the Canadian public payer perspective. • No new full economic studies for arthroscopy vs. PT were identified.

ADL = activities of daily living; AE = adverse event; AVN = avascular necrosis; CUA= cost-utility analyses; FAI = Femoroacetabular impingement; FABER = flexion abduction and external rotation; HOS = hip outcome score; HAGOS = Copenhagen hip and groin outcome score; HOOS = hip disability and osteoarthritis outcome score; iHOT = international hip outcome tool; MCID = minimum clinically important difference; NAHS = non-arthritic hip score; NSAIDs = non-steroidal anti-inflammatory drugs; PASS = patient acceptable symptom state; PT = physical therapy; RCT = randomized controlled trial; SOE = strength of evidence; THA = total hip arthroplasty; U.K. = United Kingdom; U.S. = United States; VAS = visual analog scale.

Table H. Summary of evidence in adolescents across reports (all short term, ≤5 years).

Outcome	2011 Report	2019 Update	2026 Update
Effectiveness	No comparative evidence.	• Comparative evidence was insufficient (1 poor-quality NRSI) • NRSIs comparing surgery types and case series suggest clinically important improvements in function and pain following surgery	• Comparative evidence was insufficient (1 poor-quality NRSI) • Evidence from case series was insufficient; Case series suggest clinically important improvements in function and pain following surgery but there is substantial uncertainty.
Safety (of surgery)	No evidence.	• Serious complications appeared uncommon; revision and additional surgery were reported, with substantial variability across studies.	• Harms were poorly reported. There is substantial uncertainty. Most reported complications were uncommon, although revision surgery occurred in some patients.

NRSI = nonrandomized study of intervention.

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1 Background

1.1 History of Femoroacetabular Impingement as a Diagnosis: Epidemiology and Burden of Disease

In the early 1960s, hip damage resulting from femoroacetabular contact was described as a consequence of childhood hip disease, particularly slipped capital femoral epiphysis.[31,90] In 1974, Stulberg et al. reported that subtle anatomic abnormalities of the hip, particularly a decreased head-neck offset of the proximal femur, were associated with early development of osteoarthritis (OA).[232] In the early 1990s, Ganz et al. described six cases of femoral neck-acetabular impingement following femoral neck fracture and malunion.[66] In 2001, Ganz subsequently described a technique for surgical dislocation of the hip that allowed direct observation of the joint.[67] Following this description, Ganz and colleagues proposed femoroacetabular impingement (FAI) as a mechanism for the development of early osteoarthritis for nondysplastic hips based on in situ inspection of the damage pattern of over six hundred surgical hip dislocations.[68] Subsequent research has further characterized FAI and its symptomatic presentation. In 2016, the Warwick Agreement, an international consensus document, established femoroacetabular impingement syndrome (FAIS) as the preferred term for the symptomatic clinical disorder associated with FAI.[75]

The true prevalence of FAI morphologies and FAIS is difficult to assess. Accurate determination of FAI prevalence is challenging due to differences in populations and diagnostic criteria as well as variability in symptoms and patient presentation across publications.[39] One systematic review reported that FAI may be suspected in 47% to 74% of patients with hip pain but without arthritis.[101] A geographic database study reported an overall incidence of FAI diagnosis of 54.4 per 100,000 person years, noting a consistent increase in diagnosis between 2000 and 2016 together with an increase in the use of surgical management of FAI.[82] Increases in clinician education during this time may partially explain the increases in diagnosis and surgical management. Prevalence varies depending on sex, age, symptoms, and athletic status.[158,236] Of particular note is that a large percentage of asymptomatic individuals often show radiographic evidence of cam or pincer deformities.[82,236] The 2019 HTA detailed prevalence across various populations and impingement types (Error! Reference source not found.).[228] Recent literature suggests that the true picture of prevalence is still unclear.[39] It is believed that an increase in incidence may be multifactorial, with the primary reason be due to increased awareness from clinician education on the diagnosis of FAI.[82]

Table 1. Prevalence of FAI/FAIS in various populations

Impingement Type	Study	Athletes*	Asymptomatic – General Population	Symptomatic – General Population
Cam	Mascarenhas 2016[143] (n=60 studies)	66.4% (SD, 23.5%) (across 15 studies)	22.4% (SD, 6.2%) (across 10 studies)	49% (SD, 21.2%) (across 35 studies)
	Frank 2015[62] (n=26 studies)	Mean, 54.80% (across 7 studies)	Mean, 23.10% (across 19 studies)	---
	Dickenson 2016[47] (n=30 studies)	Range, 48% to 75% (across 30 studies)	---	---
	Single Studies†	Range, 9.8% to 69.4% (n=5 studies; 705 hips)[65,104,127,136,162]	Range, 14% to 47% (n=4 studies; 2039 patients)[5,48,153,191]	22.2% of hips (n=1 study; 998 hips)[124]

Impingement Type	Study	Athletes*	Asymptomatic – General Population	Symptomatic – General Population
Pincer	Mascarenhas 2016[143] (n=60 studies)	51.2% (SD, 20.3%) (across 15 studies)	57% (1 study)	28.5% (SD, 19.2%) (across 35 studies)
	Frank 2015[62] (n=26 studies)	50% (across 7 studies)	74% (across 19 studies)	---
	Single Studies†	Range, 1% to 37.9% (n=4 studies; 445 hips)[65,104,136,162]	Range, 10.6% to 25.8% (n=3 studies; 1340 patients)[5,153,191]	18.6% of hips (n=1 study; 998 hips)[124]
Mixed	Mascarenhas 2016 (n=60 studies)[143]	57.1% (6.1%) (across 2 studies)	8.8% (5.1%) (across 10 studies)	40.2% (18%) (across 35 studies)
	Single Studies†	Range, 0% to 61.8% (n=4 studies; 445 hips)[65,104,136,162]	Range: 3.1% to 10.2% (n=2 studies; 1140 patients)[153,191]	48.9% of hips (n=1 study; 998 hips)[124]
Labral Injury	Frank 2015[62] (n=26 studies)	65.40% (across 7 studies)	73% (Number of studies NR)	---
	Single Studies†	33.8% to 51% (n=2 studies; 280 hips)[136,145]	41% (reviewer 1) 43% (reviewer 2) (n= 1 study; 100 patients; 200 hips‡)[51]	97% (reviewer 1) 96% (reviewer 2) (n= 1 study; 100 patients; 200 hips‡)[51]

NR = not reported; SD = standard deviation.

* Authors do not report whether or not athletes were experiencing hip pain, although the majority appear to be asymptomatic.

† Single studies represent those studies identified by our search that were published subsequent to the search dates of the SRs we have included.

‡ Hips are from same patients (i.e. one hip was symptomatic and the contralateral hip was not)

There is mixed evidence for the association between FAI/FAIS and progression to OA. It has been suggested that FAI is a precursor to hip OA,[232] particularly cam morphology.[3,55] With cam impingement, the femoral head "migrates" anteriorly and superiorly to the acetabulum during motion, which has been described in the literature to contribute to OA. [55,112] However, high-quality longitudinal evidence is limited and results are mixed in the available literature. Two RCTs[9,135] report no difference between individuals receiving surgical correction of impingement deformities and no correction of impingement deformities; however, exclusion of individuals with pre-existing osteoarthritis and short follow-up of two years in both studies present challenges in generalizability and determining the long-term risk of OA development as studies suggest OA may be more likely to naturally develop in FAI patients within 8 to 10 years, particularly in men aged 51 to 60.[4,235] Two comparative NRSIs[97,195] found lower rates of progression to OA in patients receiving correction of impingement deformities versus no correction (pooled RR 0.68, 95% CI 0.53 to 0.87) at mean follow up of at least 10 years; This follow-up is more in line with previously stated natural rate of progression to OA in this population and operative and nonoperative groups reported similar osteoarthritis profiles at baseline, but methodological concerns including required minimum follow-up time, lack of other demographic information, and lack of control for confounding limit the interpretability of these results. A third NRSI[117] conversely reported increased progression to OA in operative versus nonoperative patients at mean 32 months follow-up; Osteoarthritis profiles and other demographic data were similar and follow-up was slightly longer than available RCT data, but significant methodological concerns including unexplained missing data, lack of control for confounding, and insufficient follow-up length relative to previously discussed natural course

of OA progression limit the interpretability of this evidence as well. One SR[116] reported a range of progression to OA of 0% to 37.1% at 2 years to less than 5 years in six case series, 11.5% to 23% at 5 years to less than 10 years in two case series, and 26.8% at 10 years or longer in one case series. The lack of comparator, lack of control for confounding, and general poor quality of these studies, however, elicits low confidence in their results. Overall, it is difficult to draw conclusions on the relationship between correction of impingement deformities and progression of OA based on the paucity of high-quality longitudinal evidence in the FAI population. There is a need to better understand the relationship between FAI/FAIS and the impact of FAI type and surgical treatment on hip OA development.

Patients presenting with FAIS frequently have concomitant labral tear. Impingement problems and underlying deformities are thought to cause increased stress on the labrum, leading to labral pathology and articular cartilage damage due to reduced labral capability (i.e. cushioning and sealing the joint and regulating fluid expression from cartilage tissue).[28,77,198] However, the prevalence of both abnormal bony morphology and labral lesions are common among asymptomatic populations as well. A 2019 study reported labral tears in 41% to 43% of asymptomatic hips observed, with only 9% of observed hips developing a symptomatic tear in the following two years.[238] Furthermore, a 2015 systematic review by Frank et al. that included twenty-six studies comprising a total of 2,114 asymptomatic hips (mean age 25.3 years) found the overall prevalence of pincer and cam lesions to be 67% and 37%, respectively (for cam lesions, the prevalence was higher in athletes versus the general population, 55% vs. 23%); additionally, labral injury was found on MRI in 68% of hips.[62] Thus, many individuals present with clinically insignificant bony morphology and "dormant" labral pathology, many of whom may never transition to a symptomatic state. Further, the prevalence of symptomatic hip OA was found to be only 15% in a large osteoarthritis cohort in 2018,[161] indicating that the connection between abnormal hip morphology and labral lesions, and the presence of OA is nebulous. Prophylactic treatment for asymptomatic individuals is not currently recommended as there is no evidence that doing so will decrease their risk of developing symptomatic FAI or osteoarthritis.[75]

1.2 Mechanism of Femoroacetabular Impingement

The proposed mechanism of FAI is one where abnormal contact occurs between the proximal femur and acetabulum during the end range of hip motion, particularly flexion and internal rotation. This abnormal contact is believed to be due to morphologic abnormalities of the acetabulum or proximal femur (or both) increasing risk of labrum tears, chondral lesions, and progressive osteoarthritis[68,99,181]

1.3 Classification of Femoroacetabular Impingement

Two distinct types of FAI have been proposed by Ganz and coworkers[68] depending on where the abnormal morphology occurs; abnormal morphology of the femur is termed "cam impingement" and of the acetabulum, "pincer impingement".

Cam-type impingement is associated with a non-spherical femoral head or an abnormality at the head-neck junction.[68,103,120,128] The misshaped proximal femur has the effect of increasing the radius of the femoral head, leading to abnormal contact with the acetabulum at the end of hip motion. This type of impingement has also been associated with slipped capital femoral epiphysis, Leg-Calvé-Perthes disease, osteonecrosis and post-traumatic deformities of the femur.[103,128,159,229]

Pincer-type FAI is characterized by a functionally deep or retroverted acetabulum resulting in over coverage of the femoral head.[68,103,128,229] This over coverage may be a relative anterior over coverage, as seen in retroverted acetabuli, focal anterior over coverage or a global acetabular over coverage, often the result of coxa profunda or protusio acetabuli.[68,103,159]

While FAI has been classified into these two types, patients commonly present with a mixed-type impingement, with characteristics of both cam and pincer-type FAI.[25,26,86,94,188,190]

Recently, extra-articular causes of hip impingement have been described in the literature[57,98] and are caused by abnormal or excessive contact between the extra-articular regions of the proximal femur and the pelvis. While extra-articular impingement conditions (e.g. central iliopsoas impingement, subspine impingement, ischiofemoral impingement, and greater trochanteric-pelvic impingement) have been associated with and display some similar clinical features as intra-articular FAI, they are a distinct entity with unique characteristics.[37] Extra-articular impingement is beyond the scope of this report.

1.4 Technologies & Interventions

The overarching goal of treatment for FAIS, either conservative or operative, is to reduce symptoms (e.g., pain) and improve function such that the patient can return to normal activity.

1.4.1 Non-operative Treatment

A variety of non-operative approaches have been used to treat FAIS including non-steroidal anti-inflammatory medications, core strengthening, physical therapy (PT), steroid injections, activity modification and pelvic postural retraining.[7,56,99,113,128,148,241] An important distinction must be made between non-operative interventions of passive conservative care (i.e. activity modification and pharmacologic anti-inflammatory interventions) and rehabilitative exercise-based therapies (i.e. PT and exercise), as the later may provide increased clinical benefits compared to the former.[75,108] While there appears to be limited high-quality evidence on various types of non-operative care[75,148,241], some recent prospective randomized controlled trials suggest that an FAIS-specific PT program has the potential for a positive effect on hip pain, function, and hip adductor strength[106,109], and that FAIS may be amenable to conservative treatment strategies as well. It is unknown to what extent these therapies may impact hip degeneration or development of osteoarthritis.[19] A recent clinical guideline[57] recommends a multimodal approach incorporating strengthening exercises, manual therapy, postural and movement correction, stretching, balance exercises, and possibly other activities where appropriate (**Table 2**)

PT interventions across included clinical trials varied substantially and were not typically designed to be FAIS-specific.[46,63,109,146] Some experts have[108] suggested that PT programs utilized by two of the RCTs[76,135] included in this review do not reflect current best practice of PT for FAIS since both protocols were developed prior to 2012.

1.4.2 Operative Treatment of FAI/FAIS

The fundamental goals of surgical intervention in the treatment of FAI/FAIS, regardless of the type of impingement or the surgical technique used, are to correct the underlying morphologic abnormalities of the femur and/or acetabulum and address possible pathologic changes present in the labrum and articular cartilage in order to improve hip range of motion and alleviate areas of abnormal contact.[68,99,103,128,181] In dealing with labral abnormalities, it has been suggested that resecting the labrum should be avoided if at all possible. However, if the acetabular rim needs to be resected the labrum can be taken down as part of the approach and surgically refixed.[68,128]

- *Cam Impingement*
  In cam-type impingement, the goals of surgery are to remove any asphericity of the femoral head and improve the head-neck offset. Debridement of bony abnormalities of the head and femoral osteotomy at the level of the head and neck, base of neck and intertrochanteric level, have all been used to correct underlying morphologic abnormalities and restore the head-neck offset in femoral causes of FAI.[68,103,128,159]
- *Pincer Impingement*

In pincer-type impingement, surgery is aimed at reducing the prominence of the acetabular rim, debriding the degenerative labral tissue and reattaching normal labral tissue. [68,103,128] Periacetabular osteotomy has also been performed in cases of severe acetabular retroversion.[128,159]

Three operative approaches may be used to correct the bony abnormalities: arthroscopy (most commonly), open hip dislocation surgery, or arthroscopy with a limited open approach (mini-open). Anecdotally, arthroscopy is most frequently performed, however there is an important learning curve and there may be instances where there is complex joint morphology and open procedures may be preferred.[114] All studies included in this report used an arthroscopic approach to operative treatment of FAI/FAIS bony deformity. Background on other surgical approaches can be found in the 2019 report.

Hip arthroscopy is a minimally invasive procedure that has gained favor in treating cam, pincer or mixed-type FAI.[103,120,231] Similar to treatment through an open approach, the goals of treating FAI with arthroscopy are correcting underlying structural deformities of the femur in cam-type impingement and reduction of over coverage of the acetabulum in pincer-type FAI. This is accomplished through a minimally invasive approach, utilizing two to three ports and, unlike the open approach, does not involve surgical dislocation of the hip. Although this procedure is less invasive than an open procedure, there are limitations to what can be done arthroscopically. Posterior based lesions can be challenging to treat, difficulty assessing the true depth of bony resection may lead to over or under resection, resecting a retroverted acetabulum is technically difficult, and it is difficult to treat chondral lesions.[103,120] Protrusio acetabuli has also been cited as being difficult to treat arthroscopically given the difficulty in performing dynamic assessment of hip motion intraoperatively.[120] All studies included in this report used an arthroscopic approach to operative treatment of FAI/FAIS.

1.5 Indications and Contraindications

The 2016 Warwick Agreement[75] and the Lynch 2019[132] consensus-based best-practices guideline continue to provide the primary sources for indications and contraindications for arthroscopic treatment of FAIS (**Table 4**).

The 2016 Warwick Agreement[75] acknowledges that there is no high-level evidence to support the definitive treatment of FAIS and that conservative care, rehabilitation and surgery may play a role in different patients. The panel further suggests that decision making should employ a multidisciplinary group that has access to and knowledge about all of the options. No specific criteria or indications for surgery for FAIS are described. Authors do, however, indicate that it is rarely indicated to offer surgery to persons with an asymptomatic cam or pincer morphology.

There appears to be a continued lack of consensus and inconsistency regarding specific indications or criteria for surgical treatment of FAIS across the literature.[61] Recent consensus statements[50,141,142,193,234] suggest use of both imaging (via radiograph, MRI, and CT) and physical tests including FADIR, FABER, and range of motion testing to identify suspected FAIS, however actual diagnostic parameters are not frequently discussed (**Table 2** and **Table 3)**. One older systematic review[10] of indications used by clinicians to address FAI with surgical dislocation (N=15 studies, 12 were case series) reported that pain and the impingement sign were the most common clinical criteria for surgery and that the most common radiologic criteria were derived from MRI/MRA versus plain radiographs and included description of labral tears and cartilage damage. A scoping review[187] of 108 studies reported that only 56% of studies identified followed the Warwick Agreement consensus of using a combination of symptoms, clinical signs and diagnostic imaging for FAIS diagnosis. Across the studies reporting on the triad, the most commonly reported criteria were ≥6 months of hip pain, decreased hip flexion and internal rotation, positive impingement sign, α-angle >50° and a positive

cross-over sign. Only 44% described previous failure of non-operative or physiotherapist led rehabilitation as part of surgical decision making. The most common criterion for FAIS surgery was related to imaging evidence (92%) and only 12% of studies reported use of diagnostic intra-articular injection as a FAIS diagnostic criterion. Across RCTs included in the current report, three of seven (43%) reported on the Warwick specified criteria; Six (86%) trials required symptoms, four (57%) required clinical signs, and all seven trials required diagnostic imaging. Additionally, two (29%) trials required successful diagnostic intra-articular injection and four (57%) required previously failed conservative care. Positive FADIR and FABER tests were the most common clinical signs reported and alpha angle of at least fifty to fifty-five degrees, LCEA of at least forty degrees, and positive crossover sign were the most common imaging signs (**Appendix Table E-1**).

The Lynch 2019[132] consensus-based best-practices guideline recommends that a standard minimum 3-month duration of conservative care is recommended and alludes to general selection criteria for surgical candidates. Their recommendations list the following contraindications to arthroscopy: Joint space narrowing (<2mm anywhere along the lateral and/or medial source or OA, Tönnis grade ≤2, and pain not localized to the hip or out of proportion due to psychological issue. Obesity and severe femoral retro or anteversion with gait abnormality are also listed as contraindications but hypermobility and skeletal immaturity are not. Additional detail is found in **Table 10**, section 3.1 below and with the contextual questions.

Several authors have cited patient selection as an important factor in outcomes of surgery for FAI, particularly the difficulty of achieving a successful outcome in patients with advanced osteoarthritis prior to surgery.[94,125,166,203] One author found that patients with greater than 50% joint space narrowing, predominance of aching pain at rest and bipolar grade 4 lesions on MRI had universally poor outcomes following surgery for FAI.[122] Thus, hip arthroscopy is not a procedure for osteoarthritis and should not be performed in patients with greater than Tönnis grade 2 or joint space less than 2mm.[132]

1.6 Potential Complications/Harms of FAI surgery

It has been suggested that complications/harms for FAI surgery can be grouped into major, moderate and minor categories.[54,225,227,249] Potential major complications include avascular necrosis, femoral head-neck fracture, revision surgery, deep infection, symptomatic or significant limitation of hip motion due to heterotopic ossification, neurovascular injury, and symptomatic venous thromboembolism. Potential moderate complications include symptomatic hardware, with or without removal. Potential minor complications include asymptomatic heterotopic ossification, superficial infection, and urinary tract infection.

1.7 Clinical Guidelines

ECRI Guideline Trust (formerly, National Guideline Clearinghouse), PubMed, Google and Google Scholar, and references of included studies were searched for guidelines related to treatment of FAIS. Additionally, several professional societies were searched for clinical practice guidelines including, but not limited to, the American Association of Orthopaedic Surgeons, American Orthopaedic Association, and American Board of Orthopaedic Surgery. Updated versions of all guidelines included in the previous report were looked for.

One new revised clinical guideline for physical therapy for FAI was identified, but does not include guidance on surgical treatments.[57] (**Table 2**) The Warwick Agreement[75] and Lynch consensus document [132] continue to provide the basis for FAI/FAIS assessment and surgical treatment. (**Table 2**) New consensus statements were limited and overall similar to or based upon the these (**Table 3**) New literature placed a diagnostic focus on increasing use of advanced imaging (MRI or CT), specified the

utility of anteroposterior (AP) pelvic and Dunn 45 degree radiographs, and the importance of cam and pincer morphology as well as center edge angle as diagnostic criteria; Physical examination recommendations included FADIR and FABER testing as well as ROM tests. Recommendations for outcome measures were similar to the previously published literature. There was no new guidance or consensus on reliability of diagnostic criteria.

Table 2. Revised Clinical Guideline on Physical Therapy for FAIS

Author, Year Organization Method	Statement(s)
Enseki, 2023[57] AOPT/AASPT Clinical Practice Guideline for Hip Pain and Movement Dysfunction Associated with Nonarthritic Hip Joint Pain – A Revision	• Clinicians should continue to use the iHOT, HAGOS, HOS-ADL, and/or HOS-SS at baseline and at least 1 other follow-up point, which includes discharge to assess the impact of impairments of body function and structure on activity limitations and participation restrictions in those with nonarthritic hip joint pain. (Strong evidence) • Clinicians may use a PROM to assess for depression, anxiety, low self-efficacy, and kinesiophobia at baseline and at least 1 other follow-up point that includes discharge in those with nonarthritic hip joint pain. (Weak evidence) • Clinicians should continue to assess impairments of body function, including objective and reproducible measures of hip pain, mobility, muscle strength, and movement coordination and specifically perform measures of ROM and strength for hip internal rotation, external rotation, flexion, extension, abduction, and adduction, at baseline and at least 1 other follow-up point that includes discharge for individuals with nonarthritic hip joint pain. (Moderate evidence) • Clinicians should include measures of function and postural control, with performance tests such as single leg squat test, star excursion balance test, hop distance, single-leg sit to stand, and timed measures of function at baseline and at least 1 other follow-up point that includes discharge for individuals with nonarthritic hip joint pain. (Moderate evidence) • Clinicians should utilize multimodal interventions consisting of activity modification and exercises for strengthening specific hip muscles (iliopsoas, gluteus medius, gluteus maximus, and the internal and external rotators), trunk musculature (abdominals and paraspinals) and general lower extremity musculature (lunges, squats, step-ups), combined with additional interventions such as manual therapy, postural and movement correction, stretching, and balance exercises, when treating individuals with nonarthritic hip joint pain, particularly FAI and labral injuries. (Moderate evidence) • Clinicians may provide movement pattern training to optimize lower extremity movement patterns associated with pain during ADL for patients with nonarthritic hip joint pain and associated movement dysfunction. (Weak evidence) • Clinicians may use therapeutic exercises and activities to address joint mobility, muscle flexibility, and muscle strength deficits identified during the physical examination of patients with nonarthritic hip joint pain. (Weak evidence) • Clinicians may use patient education and counseling for modifying aggravating factors and managing pain associated with nonarthritic hip joint pain related to FAI. (Weak evidence) • Based on conflicting evidence, a recommendation cannot be made for the use of bracing as a standalone intervention. (Conflicting evidence) • Joint mobilization procedures may be used when pain or capsular restrictions are suspected to impair hip mobility. Soft tissue mobilization procedures may be used when muscles and their related fascia are suspected to impair hip mobility in patients with FAI. (Expert opinion) • Clinicians may utilize progressive neuromuscular re-education procedures to diminish movement coordination impairments identified in patients with nonarthritic hip joint pain. (Expert opinion)

ADL = activities of daily life; FAI = femoroacetabular impingement; HAGOS = Copenhagen hip and groin outcome score; HOS-ADL = hip outcome score – activities of daily life subscale; HOS-SS = hip outcome score – sport subscale; iHOT = international hip outcome tool; PROM = patient-reported outcome measure; ROM = range of motion.

Table 3. New Consensus Statements on Arthroscopic Treatment of FAI

Author, Year Organization Method	Statement(s)
Radha, 2024[193] International Hip Preservation Society (ISHA)	• Gait analysis, hypermobility testing, anterior apprehension testing, FADIR/FABER testing, and labral stress testing should be performed during physical examination for suspected FAI. • CT or MRI should be obtained for imaging evaluation of suspected FAI; Dynamic 3D motion analysis may also be beneficial
Dijkstra, 2022[50] Young Athlete's Hip Research (YAHiR) Collaborative	• Supine radiographs are the current imaging practice standard, but standing radiographs may be preferable for evaluation of hip pain • Imaging is usually performed when FAI is suspected. AP pelvic radiographs and Dunn 45 degree view are the best choice for viewing features and measuring joint space. • MRI arthrography with minimum strength of 1.5T is recommended for imaging. • Radial imaging should be obtained when FAI is suspected.
Mascarenhas, 2020[141,142] Lisbon Agreement on Femoroacetabular Imaging – Part 1	• Radiographs should be used in first-line assessment of patients with suspected FAI • Initial diagnostic imaging should include AP pelvis and lateral radiographs • Dunn 45 degree radiographs may be helpful in identifying abnormalities of the femoral head • MRI and CT imaging may be helpful in evaluation of potential FAI • Cam morphology criteria were recommended: Osseus convexity of femoral head-neck junction, alpha angle >=60 degrees, or head-neck offset <8mm with head-neck offset ratio <=0.15 degrees • Recommends including presence of protusio acetabuli as a red flag and removal of coxa profunda as a red flag for acetabular overcoverage • Recommended center-edge angle criteria: < 20° for undercoverage, 20–25° for borderline undercoverage, 25–39° for normal coverage and ≥ 40° for overcoverage. An acetabular index of < 0° on an AP pelvic radiograph is classically accepted as overcoverage, while a value > 13° represents undercoverage. Based on Wilberg, 1939 • Recommended global pincer criteria: Protrusio acetabuli, Wiberg center edge angle >=40 degrees, or Wiberg center edge angle >=35 degrees with acetabular index <0 degrees; Positive crossover sign, posterior wall sign, and ischial spine sign (global retroversion) • Recommended focal pincer criteria: Positive crossover sign or cranial acetabular version <0 degrees • No labral criteria are recommended • Cartilage descriptive language are suggested but authors indicate evidence is limited
Takla, 2019[234] ISHA Consensus Statement	• Lumbosacral pathology should be ruled out prior to assessing individuals for suspected FAI. • FABER, FADIR, internal ROM with over-pressure, 90 degree flexion with external rotation, and scour tests should be performed to confirm any suspicion of FAIS or other intra-articular pathology.

AP = anteroposterior; CT = computed tomography; FAI = femoroacetabular impingement; FABER = flexion abduction and external rotation; FADIR = flexion adduction and internal rotation; MRI = magnetic resonance imaging; ROM = range of motion

Table 4. Warwick and Lynch Consensus Statements from 2019 Report

Guideline	Recommendation
The Warwick Agreement[75]	FAI definition: FAI is a motion-related clinical disorder of the hip with a triad of symptoms, clinical signs, and imaging findings. It represents a symptomatic premature contact between the proximal femur and the acetabulum.
The Warwick Agreement[75]	FAI diagnosis: Symptoms, clinical signs and imaging findings must be present in order to diagnose FAI syndrome.
The Warwick Agreement[75]	Treatment of FAI: FAI syndrome can be treated by conservative care, rehabilitation or surgery. Conservative care may involve education, watchful waiting, and 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. No specific criteria or indications for surgery for FAI are described.
The Warwick Agreement[75]	Management of asymptomatic FAI patients: It is not known which individuals with cam or pincer morphologies will develop symptoms, and therefore FAI syndrome. Preventive measures may have a role in higher risk populations, but it is rarely indicated to offer surgery to these individuals.
Lynch 2020[132]	Preoperative 1. Patients should receive education regarding FAI 2. Conservative treatment should include a standard minimum duration of 3 months, including: a. Trial of rest b. Trial of NSAIDs c. Activity modification or restriction d. Physical therapy e. No opioids 3. Permit less than the full duration of conservative treatment with the following clinical history: a. Professional athletes or out-of-season athletes b. Patients who are undergoing PT with no or marginal improvement as deemed by the surgeon and physical therapist c. High baseline mental health d. Successful surgery on the contralateral side 4. Assess joint parameters for proceeding with surgery before completing the full duration of conservative treatment: a. High Alpha angle b. Low Tönnis grade c. Large cam-type deformity in the absence of osteoarthritic changes d. Large combined deformity in the absence of osteoarthritic changes e. Large ROM limitations with pain 5. Obtain an MRI in the setting of a previous hip scope with intra-articular pain

Guideline	Recommendation
Lynch 2020[132]	Contraindications to hip arthroscopy • Joint space narrowing (<2 mm anywhere along the lateral and/or middle sourcil) or OA • Tönnis grade ≥2 • Severe femoral retro or anteversion with gait abnormality • Pain not localizing to the hip, or out of proportion due to psychosocial issue • Obesity to where access cannot be obtained • Broken Shenton's line
Lynch 2020[132]	Not considered to be contraindications to surgery • Hypermobility (Beighton hypermobility score ≥5) • Skeletal immaturity are not contraindications
Lynch 2020[132]	Surgical recommendations Guide bone resection by: • Plain preoperative radiographs • Visualization of the femoral head-neck contour & re-establishing the slope/junction • Conducting a dynamic exam assessing areas of impingement • Intraoperative fluoroscopy • Including any hard, sclerotic bone • In patients with labral tears, perform a labral repair, rather than debridement only • Labral reconstruction (vs. repair) should be done in a revision surgery with a labral deficiency • Surgery for bilateral FAI should generally be completed via a staged approach • A nonprofessional athlete or young patient is not an indication for a concomitant procedure • Perform capsular plication in ligamentous laxity (Beighton Score ≥5, Ehlers–Danlos) • Perform capsular plication during hip arthroscopy in the setting of a patient with borderline dysplasia • Address both femoral and acetabular pathology in combined lesions

FAI = femoroacetabular impingement; MRI = magnetic resonance imaging; NSAID = non-steroid anti-inflammatory drug; OA = osteoarthritis; ROM = range of motion

1.8 Previous Systematic Reviews & Health Technology Assessments

Eight systematic reviews (SRs) evaluating the effectiveness and/or safety of operative treatment for FAIS were identified via search strategy and hand searching (**Table 5**). Five SRs included mixed, but primarily adult, populations;[116,118,152,180,194] three SRs focused on pediatric populations.[95,152,196] One SR in pediatric populations was used as evidence in this report.[196] Of note, all SRs except two[118,194] in adults included primarily low-level evidence (i.e., retrospective cohorts and case series) and there is some overlap between SRs in included studies. Additionally, some SRs included studies with comparisons outside the scope of the current HTA, but primarily focused on operative treatments for FAIS. In particular, four SRs in adults focused on operative versus nonoperative or conservative management[116,118,180,194], and one focused on arthroscopy and open/mini-open surgeries[152] Amongst the pediatric SRs, all three[95,152,196] primarily included case series data on operative management, with one[196] including NRSI and case-control studies, but only reporting data on pediatric patients receiving operative care. Amongst the SRs focused on adults, one was considered high quality[194] on the AMSTAR-2, one SR was low quality,[118] and three were critically-low quality.[116,152,180] All three SRs in pediatrics were rated as critically-low quality.[95,152,196]

1.8.1 SRs in Adults

1.8.1.1 Function

In adults, three SRs reported on functional outcomes. One critically-low quality SR reported significant improvements in operative management patients on the mHHS, HOS, and NAHS[116], but data was poorly reported and pooled estimates were not provided. One high-quality SR reported an association between arthroscopy and improvements on the iHOT (pooled MD 10.98, 95% CI 6.62 to 15.34, I^2=0%), but not HOS-ADL at 8 to 12 months compared to conservative management.[194] A third low-quality SR reported no difference between arthroscopy and conservative (i.e., physiotherapy or lavage) therapy at 6 months for iHOT-33 or HOS-ADL, but did report an association between arthroscopy and an improvement in iHOT-33 (pooled MD 10.65, 95%. CI 6.54 to 14.76, I^2=0%) as well as HOS-ADL (pooled MD 8.06, 95% CI 1.05 to 15.07, I^2=35%) at 12 months. However, this third SR reported that arthroscopy did not exceed the MCID for any outcome at any time point.[118]

1.8.1.2 Pain

One critically-low quality SR poorly reported pain using the VAS, with 31% of studies (5/16) reporting a significant improvement using operative management. However, data was not reported and specifics were unclear.[116]

1.8.1.3 Conversion to THA

One critically-low quality SR found no difference in risk of conversion to THA between arthroscopy and nonoperative management.[116] Another critically-low quality SR found that five studies (mix of RCTs and NRSI) reported on conversion to THA in arthroscopy (range 0.9% to 7%) and nonoperative management (range 0% to 10.5%), with only one study reporting a lower risk of conversion to THA (p=0.35) amongst arthroscopy patients.[180] A third critically-low quality SR did not provide comparative data, but did report that the overall rate of conversion to THA was 3.9%.[152]

1.8.1.4 Progression to OA

One critically-low quality SR found a significant reduction in the risk for progression to OA in adult patients receiving arthroscopy compared to nonoperative management (pooled RR 0.68, 95% CI 0.53 to 0.87, I^2=9%).[116] Another critically-low quality SR found that four studies (mix of RCTs and NRSI) reported a significantly lower risk of progression to OA in arthroscopy (range 10.8% to 28%) compared to nonoperative patients (range 7.1% to 48%).[180]

1.8.1.5 Revision/additional surgery

Three studies reported on revision surgery within adult patients.[116] One critically-low quality SR reported that arthroscopy patients received revision surgery at a rate of 5.6% to 9.1% in the short term (timing unclear), 8.1% to 20% in the mid-term, and 5.6% to 10.9% in the long-term.[116] A second critically-low quality SR reported that the overall rate of revision surgery amongst patients receiving arthroscopy and open/mini-open surgeries was 5.3%[152] one low-quality SR reporting on operative treatment versus conservative treatment (i.e., physiotherapy or lavage) found that conservative treatment was associated with a need for additional surgery (pooled OR 8.91, 95% CI 1.04 to 76.63, I^2=0%).[118]

1.8.1.6 Harms/Safety

Harms were generally not reported amongst recent SRs. One low-quality study reported no difference between arthroscopy and conservative (i.e., physiotherapy or lavage) and infections, nerve injury, or osteoarthritis, but did report an association between arthroscopy and numbness (pooled OR 67.97, 95% CI 9.22 to 501.27, I^2=0%).[118] However, meta-analyses were questionable as very few arthroscopy patients experienced adverse events other than numbness, and no conservative treatment patients experienced any adverse event.

1.8.2 SRs in Pediatrics

1.8.2.1 Function

All three SRs (all rated critically-low quality on AMSTAR-2) reported similarly significant differences between pre-operative and post-operative function scores in pediatric patients receiving operative treatment, with similar pooled estimates reported for mHHS, NAHS, HOS-ADL, HOS-SS, and iHOT.[95,152,196]

1.8.2.2 Pain

All three SRs (all rated critically-low quality on AMSTAR) reported similarly significant differences between pre-operative and post-operative VAS pain scores in pediatric patients receiving operative treatment, with similar pooled estimates.[95,152,196]

1.8.2.3 Return to sport

One critically-low quality SR in pediatric patients found that 94% of patients returned to their chosen sport by the end of follow-up.[152]

1.8.2.4 Revision/additional surgery

One SR reported that revision surgery ranged from 0% to 10% amongst 13 studies.[196] The other two SRs reported the need for revision ranged from 3.4%[95] to 4.7%[152] of patients.

1.8.2.5 Harms/Safety

One SR reported that cam recurrence and heterotopic ossification occurred in 2% to 6% of patients respectively.[196] All three SRs reported that complications were otherwise rare, ranging from <1% to 1% of patients;[95,152,196] importantly, there was likely significant overlap in the studies reporting complications amongst all three studies.

Table 5. Summary of selected previous systematic reviews of surgery for FAIS

SR Search dates Database	Purpose	Population Interventions	Primary Outcomes	Evidence Base	Risk of Bias Assessed (Tool)	Quantitative Synthesis	Primary Conclusions
Lameire, 2025[116] Inception to March 2024 Embase, Medline, ClinicalTrials.org	To determine whether hip arthroscopy for FAI may reduce the progression of OA and the risk of conversion to THA	Adults Operative vs. Nonoperative management	<u>Function</u> mHHS HOS NAHS <u>Pain</u> Vas Conversion to THA Progression to OA <u>Harms/Safety</u> Revision	1 RCT 5 NRSI 10 case series	Yes (MINORS)	Yes	<u>Function</u> Function outcomes were poorly reported. Nine studies reported post-operative **mHHS** scores ranging from 78.5 to 95.8. Six studies reported **HOS** acts of daily living, with four studies reporting significant improvements. Five studies reported **NAHS** with four finding significant improvements. Data NR. <u>Pain</u> VAS was poorly reported (8 studies), with five reporting significant improvements (data NR). <u>Conversion to THA</u> Pooled analysis found no difference between arthroscopy and nonoperative management (2 studies, RR 0.77, 95% CI 0.44 to 1.34, I^2=0%). Amongst all studies, conversion to THA ranged from 0% to 13.2% (5 studies) in the short-term, 2.4% to 29.7% (number of studies NR) in the mid-term, and 7% to 21.7% (4 studies) in the long-term for hip arthroscopy.

SR Search dates Database	Purpose	Population Interventions	Primary Outcomes	Evidence Base	Risk of Bias Assessed (Tool)	Quantitative Synthesis	Primary Conclusions
Lameire, 2025[116] Inception to March 2024 Embase, Medline, ClinicalTrials.org **(Continued)**	--	--	--	--	--	--	Progression to OA Pooled analysis found a significant reduction in the risk for hip OA progression with hip arthroscopy compared to nonoperative management (2 NRSI, RR 0.68, 95% CI 0.53 to 0.87, I^2=9%) Amongst all studies (16 studies), the reported rate of OA progression ranged from 0% to 37.1% in the short term, 11.5% to 23% in the mid-term, and 4.3% to 28% in the long term compared to 35.2% to 48% for nonoperative management in the long-term. **Revision arthroscopy**: Revision rates were 5.6% to 9.1% in the short-term, 8.1% to 20.0% in the mid-term, and 5.6% to 10.9% in the long-term (6 studies).

SR Search dates Database	Purpose	Population Interventions	Primary Outcomes	Evidence Base	Risk of Bias Assessed (Tool)	Quantitative Synthesis	Primary Conclusions
Ramadanov, 2025[194] Inception to March 2025 PubMed, Cochrane, Epistemonikos, Embase	To assess the outcomes of FAI patients treated conservatively compared to those treated with hip arthroscopy	Adults Arthroscopy vs. conservative management	Function Post-intervention functional MCID iHOT HOS-ADL	7 RCTs	Yes (Cochrane)	Yes	Function **Post-intervention functional MCID**: Pooled analysis found that patients in the arthroscopy group had a 0.85 significantly higher post-intervention functional MCID than the conservative group. **iHOT**: Pooled analysis found an association between arthroscopic surgery and an improvement in function at ≤12 months compared to conservative treatment (6 RCTs, MD 10.98, 95% CI 6.62 to 15.34, I^2=0%) **HOS-ADL**: Pooled analysis found no difference between arthroscopy and conservative management at <8 months (3 RCTs, MD 4.10, 95% CI -12.31 to 20.50, I^2=69%).

SR Search dates Database	Purpose	Population Interventions	Primary Outcomes	Evidence Base	Risk of Bias Assessed (Tool)	Quantitative Synthesis	Primary Conclusions
Parry, 2025[180] Inception to January 2025 PubMed, Cochrane, Embase	To directly compare hip arthroscopy and nonoperative treatment for FAI with outcomes including the risk for developing hip OA or undergoing total hip arthroplasty later in life	Adults Arthroscopy vs. nonoperative management	Conversion to THA Progression to OA	3 RCTs 3 NRSI	Yes (Cochrane and ROBINS)	No	<u>Conversion to THA</u> Five studies reported on THA in arthroscopy (range 0.9% to 7%) and nonoperative management (range 0% to 10.5%) patients, with only one study reporting a significantly lower rate of THA in arthroscopy patients compared to nonoperative management patients (p=0.35) <u>Progression to OA</u> Four studies (2 RCTs, 2 NRSI) reported a significantly lower rate of OA progression in arthroscopy patients (range 10.8% to 28%) compared to nonoperative management patients (range 7.1% to 48%).

SR Search dates Database	Purpose	Population Interventions	Primary Outcomes	Evidence Base	Risk of Bias Assessed (Tool)	Quantitative Synthesis	Primary Conclusions
Migliorini, 2021[152] Inception to October 2020	To investigate the possible association between rate of revision and progression to THA and patient characteristics, type of lesion, family history of hip disease, type of intervention, radiographic parameters, physical examination, and pre- and post-operative scores	Mixed (mean age 33 ± 9, 47.5% female) Arthroscopy, open/mini-open surgery	Conversion to THA Revision	3 RCTs 18 NRSI 78 case series	Yes (CMS)	No	<u>Conversion to THA</u> The overall rate of conversion to THA was 3.87% (263/6966) Labral debridement (p=0.0001), higher preoperative acetabular index (p=0.01), and BMI at baseline (p=0.03) were associated with an increased rate of conversion to THA <u>Revision</u> The overall rate of revision surgery was 5.29% (351/6641)

SR Search dates Database	Purpose	Population Interventions	Primary Outcomes	Evidence Base	Risk of Bias Assessed (Tool)	Quantitative Synthesis	Primary Conclusions
Lamo-Espinosa, 2025[118] No date limit specified PubMed, Embase, Scopus, Cochrane Library	To compare the efficacy and safety of arthroscopy with physiotherapy or joint lavage in patients with FAI	Adults Arthroscopy vs. conservative care (physiotherapy or lavage)	<u>Function</u> iHot-33 HOS-ADL Additional Surgery <u>Harms/Safety</u> Infections Nerve injury Osteoarthritis Numbness	6 RCTs	Yes (Cochrane)	Yes	<u>Function</u> **iHot-33**: Pooled analysis found no difference between arthroscopy and conservative therapy at 6 months (4 RCTs, MD 4.68, 95% CI -0.07 to 9.44, I^2=26%), but did find an association between arthroscopy and improvement in function at 12 months (4 RCTs, MD 10.65, 95% CI 6.54 to 14.76, I^2=0%). **HOS-ADL**: Pooled analysis found no difference between arthroscopy and conservative therapy at 6 months (3 RCTs, MD 5.09, 95% CI -0.07 to 10.24, I^2=25%), but did find an association between arthroscopy and improvement in function at 12 months (3 RCTs, MD 8.06, 95% CI 1.05 to 15.07, I^2=35%). Arthroscopy did not exceed the MCID in any case at either 6 or 12 months. **HOS-SS**: Arthroscopy did not exceed the MCID in any case at either 6 or 12 months. <u>Additional Surgery</u> Pooled analysis found an association between conservative treatment and the need for additional surgery (2 RCTs, OR 8.91, 95% CI 1.04 to 76.63, I^2=0%).

SR Search dates Database	Purpose	Population Interventions	Primary Outcomes	Evidence Base	Risk of Bias Assessed (Tool)	Quantitative Synthesis	Primary Conclusions
Lamo-Espinosa, 2025[118] No date limit specified PubMed, Embase, Scopus, Cochrane Library **(Continued)**	--	--	--	--	--	--	Harms/Safety **Infections**: Pooled analysis found no difference between groups (3 RCTs, OR 3.94, 95% CI 0.81 to 19.02, I^2=0%). **Nerve injury**: Pooled analysis found no difference between groups (2 RCT, OR 2.07, 95% CI 0.26 to 16.17, I^2=0%). **Osteoarthritis**: Pooled analysis found no difference between groups (2 RCTs, OR 1.92, 95% CI 0.32 to 11.69, I^2=0%). **Numbness**: Pooled analysis found an association between arthroscopy and the need for additional surgery (2 RCTs, OR 67.97, 95% CI 9.22 to 501.27, I^2=0%).

SR Search dates Database	Purpose	Population Interventions	Primary Outcomes	Evidence Base	Risk of Bias Assessed (Tool)	Quantitative Synthesis	Primary Conclusions
Rathore, 2025[196] Inception to January 2024 PubMed, Embase, Google Scholar	To update the SR and MA of recently published studies and a comprehensive review of the arthroscopic approach for FAI in adolescents	Adolescents Arthroscopy, acetabuloplasty, femoroplasty, labral	Function mHHS HOS-ADL HOS-SSS NAHS i-HOT Pain VAS Harms/Safety Any AE Cam recurrence HO Revision	19 case series 2 NRSI 3 Case-controls	Yes (NOS)	Yes	Function **mHHS**: Pooled analysis found an association between arthroscopic surgery and an increase in function post-operatively compared to preoperatively at 2 to 3 years follow-up (15 studies, MD 27.09, 95% CI 23.82 to 30.37, I^2=83%) **HOS-ADL**: Pooled analysis found an association between arthroscopic surgery and an increase in function post-operatively compared to preoperatively at 2 to 3 years follow-up (8 studies, MD 24.80, 95% CI 23.22 to 26.38, I^2=13%) **HOS-SSS**: Pooled analysis found an association between arthroscopic surgery and an increase in function post-operatively compared to preoperatively at 2 to 3 years follow-up (12 studies, MD 38.68, 95% CI 35.72 to 41.65, I^2=60%) **NAHS:** Pooled analysis found an association between arthroscopic surgery and an increase in function post-operatively compared to preoperatively at 2 to 3 years follow-up (6 studies, MD 23.26, 95% CI 21.47 to 25.06, I^2=0%)

SR Search dates Database	Purpose	Population Interventions	Primary Outcomes	Evidence Base	Risk of Bias Assessed (Tool)	Quantitative Synthesis	Primary Conclusions
Rathore, 2025[196] Inception to January 2024 PubMed, Embase, Google Scholar **(Continued)**	--	--	--	--	--	--	**i-HOT**: Pooled analysis found an association between arthroscopic surgery and an increase in function post-operatively compared to preoperatively (4 studies, MD 29.81, 95% CI 16.17 to 43.45, I^2=95%) Pain **VAS:** Pooled analysis found an association between arthroscopic surgery and a decrease in pain post-operatively compared to preoperatively (6 studies, MD -3.87, 95% CI -4.16 to -3.59, I^2=0%) Revision Revision varied from 0% to 10% (n=90, 13 studies) Harms/Safety **Any AE**: Numbness, neuropraxia, and infections were seen in <1% (12/1619) of patients (number of studies NR). There was one case each of erectile dysfunction and lateral thigh impairment. **Cam recurrence**: Incidence of cam recurrence was 1.7% (n=NR, 1 study) **HO**: Incidence of HO was 5.5% (n=NR, 1 study)

SR Search dates Database	Purpose	Population Interventions	Primary Outcomes	Evidence Base	Risk of Bias Assessed (Tool)	Quantitative Synthesis	Primary Conclusions
Huang, 2022[95] Inception to May 2021 PubMed, Scopus, Cochrane, Embase, Medline	To establish more conclusive results regarding the effect of arthroscopic surgery for FAI in adolescents, and future complications in the follow-up	Adolescents Arthroscopy	<u>Functions</u> mHHS HOS-SS HOS-ADL NAHS <u>Pain</u> VAS <u>Harms/Safety</u> Complications Revision	14 case series	Yes (Assessing quality o case series studies)[248]	Yes	<u>Functions</u> **mHHS**: Pooled analysis found a significant difference between pre-operative and post-operative scores in adolescents receiving arthroscopy (7 studies, MD 24.9, 95% CI 22.9 to 27.1, I^2=19.9%) **HOS-SS**: Pooled analysis found a significant difference between pre-operative and post-operative scores in adolescents receiving arthroscopy (6 studies, MD 35.88, 95% CI 33.1 to 38.7, I^2=0%) **HOS-ADL**: Pooled analysis found a significant difference between pre-operative and post-operative scores in adolescents receiving arthroscopy (5 studies, MD 23.5, 95% CI 21.2 to 25.9, I^2=0%) **NAHS**: Pooled analysis found a significant difference between pre-operative and post-operative scores in adolescents receiving arthroscopy (3 studies, MD 22.3, 95% CI 18.4 to 26.3, I^2=40.9%) <u>Pain</u> **VAS**: Pooled analysis found a significant difference between pre-operative and post-operative scores in adolescents receiving arthroscopy (3 studies, MD -4.0, 95% CI -4.4 to -3.6, I^2=0%)

SR Search dates Database	Purpose	Population Interventions	Primary Outcomes	Evidence Base	Risk of Bias Assessed (Tool)	Quantitative Synthesis	Primary Conclusions
Huang, 2022[95] Inception to May 2021 PubMed, Scopus, Cochrane, Embase, Medline **(Continued)**	--	--	--	--	--	--	Harms/Safety **Complications**: Complications were rare (1.2%, 10/832), including four cases of numbness, three cases of pudendal nerve neuropraxias, two minor infections, and one portal site wound dehiscence (number of studies NR) **Revision**: Twelve studies reported that revisions rates ranged from 0% to 10%. Seven studies reported the need for revision surgery in 3.4% of patients.

SR Search dates Database	Purpose	Population Interventions	Primary Outcomes	Evidence Base	Risk of Bias Assessed (Tool)	Quantitative Synthesis	Primary Conclusions
Migliorini, 2021[152] Inception to August 2021 PubMed, Scopus, Google Scholar, Embase	To investigate the role of arthroscopic management for FAI in adolescents	Adolescents Arthroscopy	<u>Function</u> mHHS NAHS HOS-ADL HOS-SS <u>Pain</u> VAS Return to Sport <u>Harms/Safety</u> Complications Revision	10 case series	Yes (Cochrane)	Yes (limited)	<u>Function</u> **mHHS**: Pooled analysis found a significant difference between pre-operative and post-operative scores in adolescents receiving arthroscopy (number of studies NR, MD 25.3, p<0.001) **NAHS**: Pooled analysis found a significant difference between pre-operative and post-operative scores in adolescents receiving arthroscopy (number of studies NR, MD 25.9, p=0.03) **HOS-ADL**: Pooled analysis found a significant difference between pre-operative and post-operative scores in adolescents receiving arthroscopy (number of studies NR, MD 15.9, p=-0.01) **HOS-SS**: Pooled analysis found a significant difference between pre-operative and post-operative scores in adolescents receiving arthroscopy (number of studies NR, MD 39.5, p<0.001) <u>Pain</u> **VAS**: Pooled analysis found a significant difference between pre-operative and post-operative scores in adolescents receiving arthroscopy (number of studies NR, MD -5.5, p=0.01)

SR Search dates Database	Purpose	Population Interventions	Primary Outcomes	Evidence Base	Risk of Bias Assessed (Tool)	Quantitative Synthesis	Primary Conclusions
Migliorini, 2021[152] Inception to August 2021 PubMed, Scopus, Google Scholar, Embase **(Continued)**	--	--	--	--	--	--	Return to Sport Four studies report that the rate of return to sport was 94% (128/136). Harms/Safety **Complications**: Complications were rare (1.1%), including 2 cases of temporary paresthesia of the lateral femoral cutaneous nerve, two cases of transient perineal nerve paresthesia, and one case of unspecified transient neurapraxia **Revision**: Revision arthroscopies were performed in 4.7% (22/470) of patients.

ADL = activities of daily living; AE = adverse event; CI = confidence interval; CMS = Coleman Methodology Score; HO = heterotopic ossification; HOS = Hip Outcome Score; iHOT-12 = 12-item International Hip Outcome Tool; MH-OR = Mantel-Haenszel odds ratio; mHHS = modified Harris Hip Score; NAHS = Nonarthritic Hip Score; NR = not reported; NRSI = non-randomized study of interventions; OA = osteoarthritis; QoL = quality of life; RCT = randomized control trial; RR = risk ratio; SMD = standardized mean difference; SS = sport-specific; VAS = visual analogue scale; VR-12 = Veterans Rand.

1.9 Medicare and Representative Private Insurer Coverage Policies

For the purposes of this report, we obtained and summarized payer policies from four bellwether payers. National coverage determinations (NCDs) are not currently available for arthroscopic or surgical treatment of FAI. Coverage determinations would, therefore, be at the discretion of regional Medicare part B contractors via local coverage determinations (LCDs). There is not currently an LCD available for the region covering Washington state for arthroscopic or surgical treatment of FAI. Coverage decisions from four bellwether payers are briefly summarized below (**Table 6**). Briefly, all payers consider arthroscopic surgery for FAI medically necessary with conditions often including symptoms, low osteoarthritis grade, positive imaging and physical exam tests, and previously failed conservative treatment. A summary of Payer Policies regarding Surgical Treatments for FAIS is in **Table 6**.

Table 6. Summary of Payer policies regarding surgical treatments for FAI/FAIS

Payer	Decision
Aetna Policy Number 0736 Last Reviewed: 1/14/2026 Next Review: 8/27/2026	Open or arthroscopic femoroacetabular surgery for FAI is considered **medically necessary** for individuals fulfilling *all* of the following criteria: • Imaging-based diagnosis of FAI showing labral tear/damage with cam impingement (alpha angle >50 degrees), pincer impingement (acetabular retroversion or coxa profunda, center edge angle ≥40 degrees), and/or pistol grip deformity (non-spherical femoral head shape) • Moderate to severe FAI symptoms (hip/groin pain worsened by flexion activities) significantly limiting activity for ≥6 months with imaging diagnosis made • Positive impingement sign with sudden pain on 90 degree hip flexion with adduction and internal rotation or extension and external rotation • Failure of conservative treatments including activity modification, pharmacological intervention, and physiotherapy (at least 12 weeks with 6 weeks formal in-person physiotherapy) • Absence of advanced OA (Tönnis grade ≥2) on x-ray or severe cartilage injury (Outerbridge grade II or IV) • Absence of joint space narrowing (not less than 2mm wide along sourcil) on plain radiograph • No generalized joint laxity including diseases causing joint hypermobility such as Marfan and Ehlers-Danlos syndromes • No osteogenesis imperfecta Hip arthroscopy to repair labral tear is considered **medically necessary** for traumatic labral tears causing mechanical symptoms or as an adjunct to FAI surgery All other procedures or indications for surgery are considered experimental, investigational, or unproven

Payer	Decision
Cigna Policy Number CMM-314 Last Reviewed: 3/7/2026 Next Review: NR	Arthroscopic or open hip surgery for FAI is considered **medically necessary** when *all* of the following criteria are met: • Imaging-confirmed FAI (x-ray, CT, MRI) with any of: alpha angle >50 degrees, pistol grip deformity, decrease of femoral head-neck offset, acetabular retroversion, coxa profunda; and confirmed Tonnis grade 0-1 OA • Physical exam confirming positive anterior impingement sign (groin-dominant hip pain with hip flexion, adduction, and internal rotation) and limited passive hip internal rotation • Failed conservative management ≥3 months including intra-articular hip injection with anesthetic yielding positive pain response in following 2 weeks (unless contraindicated) • Groin-dominant hip pain worsened by flexion (squatting, prolonged sitting) that significantly limits activities The following radiographic findings are contraindications to arthroscopic or open hip surgery for FAI: joint space <2mm along sourcil, Tonnis grade 2-3 OA, severe femoral retroversion/anteversion with gait abnormality, broken Shenton line, inclination Tonnis angle >13-15 degrees All other indications or conditions are considered not medically necessary for arthroscopic or open hip surgery for FAI
United Healthcare Policy Number 2026T0503JJ Last Reviewed: 3/1/2026 Next Review: NR	Hip and other surgical treatment for FAI is proven and **medically necessary** in certain circumstances • Covered procedures (of the affected hip) include: diagnostic arthroscopy, arthroscopy, arthrotomy, hemiarthroplasty, total joint replacement Surgical treatment of FAI is unproven and not medically necessary where advanced OA (Tannis grade 2 or 3) and/or severe cartilage damage (Outerbridge grade III or IV) are present

Payer	Decision
Premera Blue Cross Policy Number 7.01.592 Last Reviewed: 6/23/2025 Next Review: NR	Arthroscopic treatment of FAI may be **medically necessary** when all of the following conditions are met: • Patient is skeletally mature with documented closure of growth plates (≥15 years old) • Moderate to severe hip pain worsened by flexion (squatting, sitting) that significantly limits activities • Unresponsive to conservative therapy including activity modification, restriction of athletic activity, and avoidance of symptomatic motion for 3 months • Positive impingement signs on physical exam (pain with 90 degree flexion and internal rotation and adduction of femur or FADIR test) or FABER test • Imaging (x-ray, CT, MRI) confirming partial/full labral tearing and/or articular cartilage damage AND one or more of: acetabular retroversion, cox profunda or protrusion, acetabular rim damage, femoral head-neck offset with alpha angle >50 degrees, pistol grip deformity, and/or positive wall sign • No evidence of advanced OA (Tönnis grade 2 or 3 or joint space <2mm) or severe cartilage damage (Outerbridge grade III or IV) Hip arthroscopic repair of labral tear is medically necessary either alone or adjunct to FAI surgery All other uses of arthroscopic treatment of FAI are considered investigational

CT = computed tomography; FABER = flexion abduction and external rotation; FADIR = flexion adduction and internal rotation; FAI = femoroacetabular impingement syndrome; mm = millimeter; MRI = magnetic resonance imaging; NR = not reported; OA = osteoarthritis

1.10 Washington State Utilization Data

2 The Evidence

2.1 Methods of the Systematic Literature Review

2.1.1 Objectives

The aim of this report was to update the 2019 HTA on Hip Surgery Procedures for the Treatment of Femoroacetabular Impingement Syndrome (FAIS) by systematically reviewing, critically appraising, analyzing and synthesizing new research evidence comparing the safety and effectiveness of operative procedures for the treatment of FAI/FAIS with non-operative treatments or procedures that do not involve bone alteration. The differential effectiveness and safety of these therapies in relevant subpopulations were evaluated, as well as their cost effectiveness. Information on validation for new outcomes measures used in new randomized controlled trials (RCTs) and updated information on clinically meaningful improvement for validated measures used across the evidence base are presented.

2.1.2 Policy Context/Reason for Selection

This topic was originally reviewed in 2011 and a full re-review, titled Hip Surgery Procedures for Treatment of Femoroacetabular Impingement Syndrome-Update Report was performed in October 2019. The most recent signal update report (2023) identified two new RCTs and a review of economic studies. Public comment resulting from the topic selection announcement suggested that an additional RCT was available.

2.1.3 Contextual Questions

1. Is there updated information published subsequent to the 2019 report regarding a consistent or agreed upon case definition or diagnostic criteria for FAI/FAIS?
2. Are new validated outcomes measurement instruments used for evaluation of function or pain in FAIS patients in new RCTs?
3. Is there new information on clinically meaningful improvement for validated measures used in the evidence base?

2.1.4 Key Questions (KQs)

1. What is the evidence of effectiveness of hip surgery compared with non-operative treatment for FAI/FAIS or procedures not involving alteration of bone? Including consideration of short-term (≤5 years) intermediate-term (>5 years to <10 years) and long-term (≥10 years) outcomes.
2. What is the evidence of the safety of hip surgery for FAI/FAIS compared with non-operative treatment or procedures not involving alteration of bone?
3. What is the evidence that hip surgery for FAI/FAIS compared with non-operative treatment or procedures not involving alteration of bone has differential effectiveness or safety in subpopulations (e.g., age, sex, psychological or psychosocial comorbidities, baseline characteristics, deformity type, degree of osteoarthritis or cartilage damage, provider type, and payer type)?
4. What is the cost-effectiveness of hip surgery for FAI/FAIS compared with non-operative treatments or procedures not involving alteration of bone in the short and long term?

2.1.5 Inclusion/Exclusion Criteria

The scope of this report and final Key Questions (KQs) were refined based on input from clinical experts. Clinical expert input was sought to confirm critical outcomes on which to focus. Draft KQs and PICOTS scope were published on the HCA website for public comment. Four were received. Public

comments as well as those from clinical experts and peer-reviewers were considered for finalization of this report. See **Table 7** below for inclusion and exclusion criteria.

Table 7. Summary of inclusion and exclusion criteria

Study Component	Inclusion	Exclusion
Population	• Patients undergoing primary/initial treatment for symptomatic FAI or FAIS (any age) Special populations: age, comorbidities, presence (or not) of labral tear, type of FAIS, baseline presence and degree of arthritis, degree of cartilage damage, provider type, payer type	• Congenital hip dysplasia, slipped capital femoral epiphysis, Legg-Calve-Perthes • Studies including <80% FAI/FAIS patients • Patients presenting for revision surgery • Extra-articular impingement • Asymptomatic individuals
Intervention	• Surgical treatment for FAI/FAIS	• Matrix-induced autologous chondrocyte implant (MACI) • Autologous matrix-induced chondrogenesis (AMIC)
Comparator	• Focus: ○ Non-operative care (may include, but not limited to, exercise, rehabilitation and manual therapies, activity modification, NSAIDs, injections, etc.) ○ Surgical procedures not involving alteration of bone ○ Simulated or sham surgery • Others: Comparison of labral repair/debridement with or without bone alteration	• Matrix-induced autologous chondrocyte implant (MACI) • Autologous matrix-induced chondrogenesis (AMIC) • Direct or indirect comparisons of surgical approaches (e.g., arthroscopic vs. open) • Comparisons of surgical methods (i.e., for labral repair, rim repair, capsule closure, etc.)
Outcomes	**Primary (SOE assessed)** • Functional outcome (validated patient- and clinician-reported hip scores, validated activities of daily living) • Pain (validated measures) • Conversion to THA (“continuing” or “subsequent intervention” that is not THA will be reported in the safety section) • Labral tear or retear **Secondary (SOE not assessed)** • Progression to arthritis • Quality of life • Return to work or activity • Range of motion **Harms/Safety: (SOE assessed)** • Complications/adverse events (peri-operative or longer-term) • Revision surgery • Heterotopic ossification • Trochanteric nonunion • Failure of labral re-fixation, debridement or repair • Nerve damage • Mortality	• Non-clinical outcomes • Non-validated measures • Intermediate outcomes (e.g., laboratory or radiographic measurements)

Study Component	Inclusion	Exclusion
Timing	• Short- (≤5 years), intermediate- (>5 years to <10 years) and long-term (≥10 years)	
Study Design	• KQs 1 and 2 (effectiveness and safety): ○ **Adults**: RCTs will be the primary focus. High-quality comparative, NRSI (e.g., low risk of bias, prospective observational studies) that adjust for confounding on key prognostic factors will be considered primarily for safety (KQ 2) or if no RCTs are available. ○ **Children/Adolescent**s: Comparative NRSI will be the primary focus. Case series may be considered if no comparative studies are available. Systematic reviews of comparative NRSI or case series may be used. • KQ 3 (differential effectiveness and safety): Only RCTs will be considered (adults and children/adolescents). • KQ 4 (cost-effectiveness): Full economic studies (adults and children/adolescents).	• Non-clinical studies • NRS (observational studies) that do not control for confounding • NRSIs with <20 per treatment arm in adults • Case reports • Case series or single arm studies in adults • Imaging studies • Studies comparing simultaneous vs. staged bilateral surgery, differences in suture techniques, iliopsoas lengthening vs. not, traditional vs. extra-articular techniques • Indirect comparisons of treatments
Publication	• Studies published in English in peer reviewed journals, technology assessments or publicly available FDA reports • Studies published after the 2019 report • For KQ 4 full, formal economic analyses (e.g., cost-effectiveness, cost-utility studies) published in English in a peer reviewed journal	• Abstracts, editorials, letters • Duplicate publications of the same study that do not report different outcomes or follow-up times • Single reports from multicenter trials • White papers • Narrative reviews • Articles identified as preliminary reports when full results are published in later versions • Incomplete economic evaluations such as costing studies

FAI = femoroacetabular impingement; FAIS = femoroacetabular impingement syndrome; KQ = Key Question; NRSI = nonrandomized study of intervention; NRS = nonrandomized study; NSAIDs = non-steroidal anti-inflammatory drugs; RCT = randomized controlled trial; THA = total hip arthroplasty.

2.1.6 Outcomes Assessed

This review focused on the following primary effectiveness outcomes: validated measures of function and pain, conversion to THA, and labral tear or retear. Secondary effectiveness outcomes included progression to arthritis, quality of life (based on validated measures), return to work or activity, and range of motion. We focused on serious harms, including procedure-related harms, revision surgery, all-cause mortality, heterotopic ossification, and embolic complications. Clinical input on prioritization of harms and adverse events (AEs) was obtained and reflected in the reporting of these. We also report on cost-effectiveness measures from full economic analyses. **Table 12** under Contextual Question 3 below provides a list of outcomes measures used in this review.

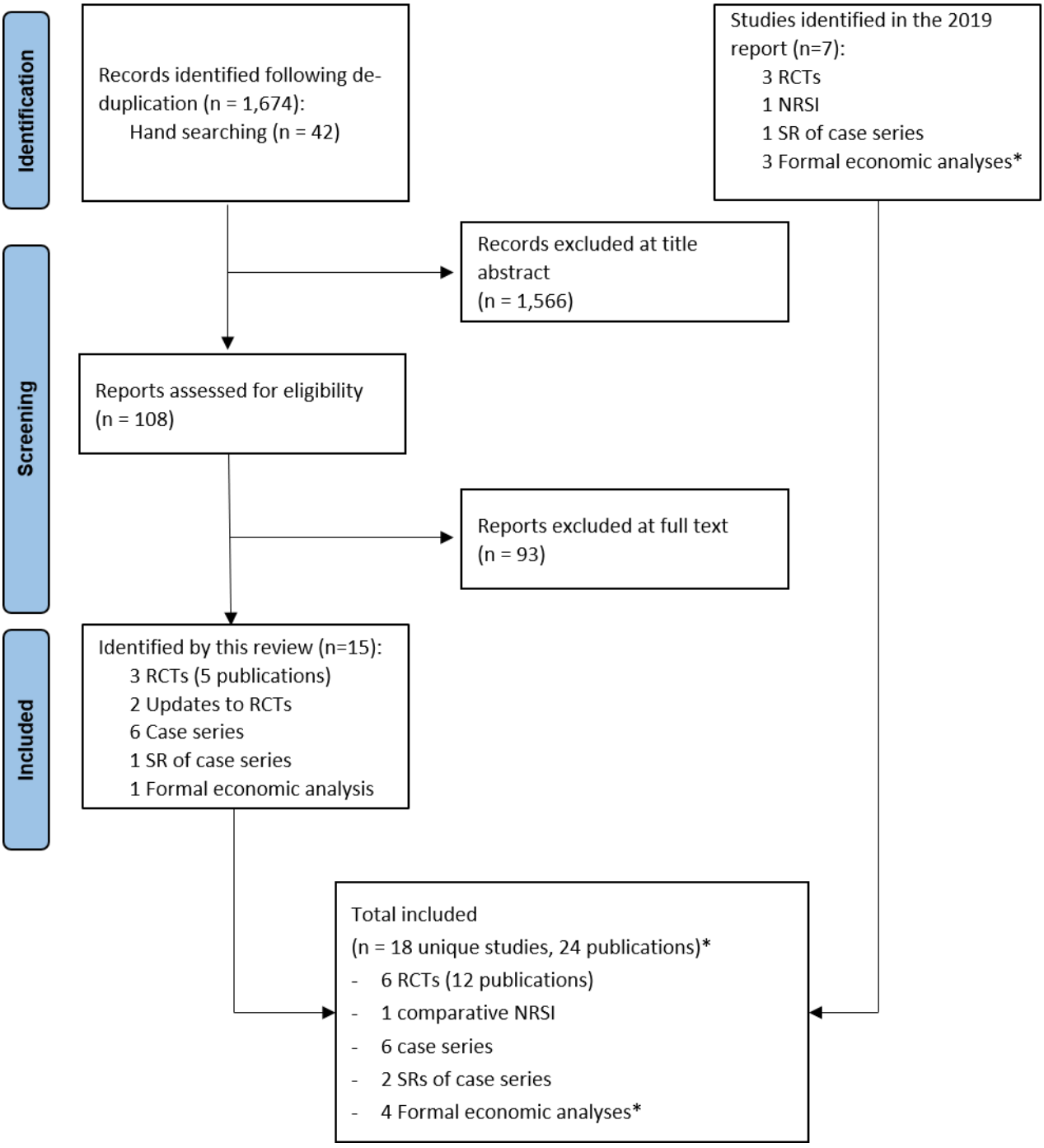
2.1.7 Data Sources and Search Strategy

We searched electronic databases from January 1, 2019 to March 27, 2026 to identify publications assessing operative and non-operative treatments for FAIS that had been published since the 2019 report. A formal, structured systematic search of the peer-reviewed literature was performed across a number of databases including PubMed, EMBASE, the Cochrane Central Register of Controlled Trials, and the Cochrane Database of Systematic Reviews (see **Appendix A** for full search strategy) to identify relevant peer reviewed literature as well as other sources (ClinicalTrials.gov, ECRI Guidelines Trust, Center for Reviews and Dissemination Database) to identify pertinent clinical guidelines and previously performed assessments. We conducted a comprehensive search on ClinicalTrials.gov to identify relevant ongoing research trials (**Appendix Table I-1**). We also hand-searched the reference lists of relevant studies and the bibliographies of systematic reviews.

The clinical studies included in this report were identified using the algorithm shown in **Appendix A**. The process involves four stages. The first stage of the study selection process consisted of a comprehensive electronic search and bibliography review. We then screened all possible relevant articles using titles and abstracts in stage two. This was done by two individuals independently. Those articles that met a set of *a priori* retrieval criteria were included for full-text review. We excluded conference abstracts, non-English-language articles, duplicate publications that did not report different data or follow-up times, white papers, narrative reviews, preliminary reports, and incomplete economic evaluations. Any disagreement between screeners that were unresolved resulted in the article being included for the next stage. Stage three involved retrieval of the full text articles remaining. The final stage of the study selection algorithm consisted of the review and selection of those studies using a set of *a priori* inclusion criteria, again, by two independent investigators. Discrepancies were resolved through discussion and if necessary adjudicated by a third investigator. A list of excluded articles along with the reason for exclusion is available in **Appendix B.**

Consistent with the prior reports, we focused on comparative studies evaluating operative versus non-operative treatments. Comparative studies that directly compared treatments in the same underlying patient population were considered. Indirect comparisons of adult case series were not considered; however, indirect comparisons of adolescent case series were included because of the lack of comparative evidence in adolescents. Studies comparing different surgical approaches or techniques for the treatment of FAIS were not included in this update. However, safety findings from the prior report were carried forward to provide contextual information on procedure-related harms.

Figure 1. CONSORT diagram – flow of studies



NRSI = non-randomized studies of interventions; RCT = randomized controlled trial; SR = systematic review.
*One formal economic analysis is included as part of an included RCT and, therefore, is not counted as a unique study.

2.1.8 Data Extraction

Reviewers extracted the following data from the clinical studies: study design, country, sample size, inclusion and exclusion criteria, intervention/comparator, additional treatments (e.g., postoperative physical therapy, conservative care), rate of crossover, study population characteristics, follow-up time, treatment characteristics (e.g., surgical approach and pathologies addressed, components of non-operative care), type of FAI (e.g., cam, pincer, or mixed), effectiveness outcomes, adverse events and funding source. Data from figures were estimated using Web Plot Digitizer v5.[206] For economic studies, data related to sources used, economic parameters and perspectives, results, and sensitivity analyses were abstracted. An attempt was made to reconcile conflicting information among multiple reports presenting the same data. Detailed study and patient characteristics and results are available in **Appendix E**.

2.1.9 Quality Assessment: Risk of Bias, QHES evaluation & Overall Strength of Evidence,

The methods used by Aggregate Analytics, Inc. (AAI) for assessing the quality of evidence of individual studies as well as the overall strength of evidence (SOE) are based on established methods for systematic reviews. Included studies reporting on primary outcomes of interest were critically appraised independently by two reviewers evaluating the methodological quality, study limitations and potential for bias based on study design as well as factors which may bias studies using defined templates and pre-specified criteria. Assessment of RCTs followed appropriate criteria[239,240] based on methods described in the Cochrane Handbook for Systematic Reviews of Interventions[91] and guidance from the Agency for Healthcare Research and Quality (AHRQ) Methods Guide for Effectiveness and Comparative Effectiveness Reviews.[2] In keeping with the AHRQ methods, each study was given a final rating of "low", "moderate", or "high" risk of bias as described below (**Table 8**). Discrepancies in ratings between reviewers were resolved through discussion and consensus. Criteria are detailed in **Appendix C**.

Table 8. Criteria for grading the quality of individual studies

Rating	Description and Criteria
Low	• Good quality study; study results generally considered valid • Employed valid methods for selection, inclusion, and allocation of patients to treatment; report similar baseline characteristics/key risk factors for testing groups being compared; clearly describe attrition and have low attrition; use appropriate means for preventing bias (e.g., blinded outcomes assessment); and use appropriate analytic methods (e.g., intention-to-treat analysis); full reporting on pre-specified outcomes. • For studies of testing, pre-specification of thresholds for a positive test,
Moderate	• Fair quality study; study is susceptible to some bias but not enough to necessarily invalidate results • May not meet all criteria for good quality, but no flaw is likely to cause major bias; the study may be missing information making it difficult to assess limitations and potential problems • This category is broad; studies with this rating will vary in strengths and weaknesses; some fair-quality studies are likely to be valid, while others may be only possibly valid
High	• Poor quality study; significant flaws that imply biases of various kinds that may invalidate results; the study contains "fatal flaws" in design, analysis, or reporting; large amounts of missing information; discrepancies in reporting or serious problems with intervention or test delivery • Study results are at least as likely to reflect flaws in the study design or execution as the true difference between the compared interventions • Considered to be less reliable than higher quality studies when synthesizing the evidence, particularly if discrepancies between studies are present

Risk of bias was not assessed for case series (single arm studies); all case series were considered to be at high risk of bias. Economic studies were evaluated according to The Quality of Health Economic Studies (QHES) instrument developed by Ofman et al. in conjunction with consideration of epidemiologic principles that may impact findings.[173] Systematic reviews included as primary evidence were assessed using the AMSTAR-2 tool.[220,221]

Based on these quality criteria, each comparative study chosen for inclusion for a Key Question was given a risk of bias (or QHES) rating; details of each rating are available in **Appendix D**.

SOE was assessed by two researchers following the principles for adapting GRADE (Grading of Recommendation Assessment, Development and Evaluation) as outlined by the AHRQ.[2,8,79,80] The SOE was based on the highest quality evidence available for the primary outcomes only (see section 2.1.6).

In determining the strength of the body of evidence regarding a given outcome, the following domains were considered:

- **Risk of bias**: the extent to which the included studies have protection against bias
- **Consistency:** the degree to which the included studies report results that are similar in terms of effect sizes, range, and variability.
- **Directness**: describes whether the evidence is directly related to patient health outcomes or comparisons of interventions are direct (head-to-head).
- **Precision:** describes the level of certainty surrounding the effect estimates.
- **Publication or reporting bias:** is considered when there is concern of selective publishing or selective reporting. Concordance between trial protocols and published results and review of trial registries may provide information to evaluate reporting/publication bias. This may be challenging. It is difficult to assess small sample effects when there are <10 RCTS.

Bodies of evidence consisting of RCTs are initially considered High SOE. In general, the GRADE and AHRQ methodologies initially consider nonrandomized studies as Low SOE as such studies typically are at higher risk of bias due to lack of randomization and inability of investigators to control for critical confounding factors. The SOE could be downgraded based on the limitations described above. There are also situations where studies (particularly observational studies) could be upgraded if the study had large magnitude of effect (strength of association) or if a dose-response relationship is identified and there are no downgrades for the primary domains listed above and confounding is not a concern. Publication and reporting bias are difficult to assess, particularly with fewer than 10 RCTs and for observational studies.[20,215] Publication bias was unknown in all studies and thus this domain was eliminated from the strength of evidence tables. The final SOE was assigned an overall grade of high, moderate, low, or insufficient, which are defined as follows:

- **High** - Very confident that effect size estimates lie close to the true effect for this outcome; there are few or no deficiencies in the body of evidence; we believe the findings are stable.
- **Moderate** – Moderately confident that effect size estimates lie close to the true effect for this outcome; some deficiencies in the body of evidence; we believe the findings are likely to be stable, but some doubt remains.
- **Low** – Limited confidence that effect size estimates lie close to the true effect for this outcome; major or numerous deficiencies in the body of evidence; we believe that additional evidence is needed before concluding that findings are stable or that the estimate is close to the true effect.

- **Insufficient** – We have no evidence, are unable to estimate an effect or have no confidence in the effect estimate for this outcome; OR no available evidence or the body of evidence has unacceptable efficiencies precluding judgment.

Assessing the SOE for studies performing subgroup analysis for evaluation of differential effectiveness or safety requires additional considerations discussed below. Methods for determining the overall quality (strength) of evidence related to economic studies have not been reported, thus the overall strength of evidence for outcomes reported in **Key Question 4** was not assessed.

Evidence for effectiveness outcomes consisting of case series alone was considered insufficient as conclusions regarding comparative effectiveness are not possible in the absence of a comparison with alternative treatments in groups of patients from the same underlying patient populations. Therefore, evidence for adolescent patients was considered insufficient.

We compared overall conclusions and findings as reported in the previous report with findings in this update to the extent possible based on general qualitative concepts of AHRQ guidance on signal updates for systematic reviews,[164] primarily based on the Ottawa Method.[223,224] Individual studies included in the prior report were not extensively evaluated by AAI. Considerations included:

- Comparison of the general quality of evidence of included comparative effectiveness studies on primary outcomes.
- Comparison of comparators used.
- Assessment of whether new evidence constitutes a major change in the evidence based on existence of opposing findings or major changes in effectiveness short of opposing findings based on the highest quality of evidence available (preferably from high quality systematic reviews or pivotal RCTs). Substantial changes in effect size (e.g., ≥50%) or changes in statistical significance beyond "borderline" changes (e.g., borderline p-values of 0.4 to 0.06) across studies of comparable quality were considered.
- Assessment of whether new evidence suggests substantial harm wherein risk of harms outweighs benefits.
- Assessment of whether new evidence provides high quality data on clinically important expansion of treatment (e.g., to new subgroups of patients) or clinically important caveat.

2.1.10 Analysis

Evidence was summarized qualitatively and quantitatively. Pair-wise meta-analyses were conducted to synthesize the quantitative evidence. To determine the appropriateness of meta-analysis, we considered clinical and methodological diversity (e.g., homogeneity of populations, the consistency of research designs) and assessed statistical heterogeneity (similarity of outcome measures across studies).

For the RCTs, mean difference was used as the effect measure for continuous outcomes, including pain, function and QoL. All studies within an outcome were reported using the same scale. Adjusted mean difference (MD) from the analysis of covariance or other appropriate regression models was used if available, followed by difference in follow-up scores. Pooled risk ratios (RRs) were estimated for binary outcomes, including conversion to total hip arthroplasty, any adverse event (AE), hip pain or stiffness, and other AEs related to intervention. Adjusted RR was used in the meta-analysis if reported. Where possible, we reported on the proportion of patients meeting thresholds for clinically important differences (e.g., >30% pain relief).

For case series studies, meta-analyses were conducted only on continuous outcomes, including mHHS, SF-12 PCS, SF-12 MCS, HOS-ADL, HOS-SSS, HOOS symptoms, HOOS Pain, HOOS ADL, HOOS sports, HOOS QoL, NAHS, VAS, iHOT-12 and iHOT-33. Reported MD and SD between pre- and post-

operation scores were used if available. Otherwise, mean difference was calculated from pre- and post-operation scores. The standard deviation (SD) of mean difference was calculated using the formula: $\sqrt{SD_{pre}{}^2 + SD_{post}{}^2 - 2 \times correlation \times SD_{pre} \times SD_{post}}$, where correlation was imputed using the average calculated correlation from the studies reporting the same outcome and providing SDs of pre-, post-operation scores and preoperative versus postoperative MDs. If no calculated correlation was available for an outcome, we assumed the correlation was 0.3, given that the calculated correlations were close to 0.3. Sensitivity analysis was conducted using different correlations values: 0.3, 0.5 and 0.7 and results were similar. When the SD of pre- and post-operation scores was not reported, or could not be calculated from the reported data, it was imputed using the average coefficient of variation from the other included studies reporting the same outcome.

A random effects meta-analysis using the profile likelihood method[83] was performed to combine the included studies. For randomized studies, analyses of continuous outcomes were stratified by the pre-specified follow-up duration categories (e.g., 6-8 months, 12-14 months, 24-26 months, and 38 months). For case series, analyses were stratified by intervention types (e.g., arthroscopy, surgical hip dislocation [SHD], and arthroscopy or SHD). Additionally, sensitivity analyses were conducted by excluding outlying studies or studies rated as high risk of bias.

Statistical heterogeneity among the studies was assessed using Cochran's $\chi 2$ test and the I^2 statistic.[91] For analyses with at least 10 trials that were sufficiently homogeneous regarding populations, interventions, and outcomes, small study effects were evaluated using funnel plots and the Egger test.[230] Only three meta-analyses – all of adolescent case series – were amenable to assessment for small-study effects. No significant small study effects were detected for the mHHS, HOS-ADL, and HOS-SSS.

All meta-analyses were conducted using Stata/SE 16.1 (StataCorp, College Station, TX), and all results were provided with 95% confidence intervals (CI). Descriptive Cleveland dot plots were generated to visualize revision surgery rates in adolescent case series using R version 4.5.1[192] in RStudio using the ggplot2[243] and tidyverse[244] packages.

Consistent with the 2019 report, we reported on whether continuous outcomes that were statistically significant did or did not meet minimal clinically important differences (MCIDs) based on published psychometric evaluations.

To evaluate differential effectiveness and safety (heterogeneity of effect, interaction), we focused on RCTs as they have the least potential for bias and confounding thus allowing for causal inference. Further, only RCTs that formally tested for interaction between subgroups were considered for Key Questions 3. SOE for these studies is based on consideration of the overall study risk of bias (study quality) as well as whether subgroup variables and analyses were specified a priori, the hypothesized impact of a subgroup on the outcome/effect and sample size as evaluation of interaction requires greater sample size and are based on recommendations from Oxman and Guyatt and the Instrument to assess the Credibility of Effect Modification (ICEMAN) criteria.[214] Such analyses should be interpreted cautiously and consider the biologic plausibility of differential effectiveness or safety. Such analyses are generally considered hypothesis generating, and additional confirmatory evidence should be sought.[174,233]

Outcomes are detailed in the evidence tables in the appendices and/or the body of the report. Summary tables for case series are also found in the appendices.

3 Results

3.1 Contextual Questions

3.1.1 Contextual Question 1

Is there updated information published subsequent to the 2019 report regarding a consistent or agreed upon case definition or diagnostic criteria for FAI/FAIS

We did not identify high-quality prospective new evidence for this update that would counter the information presented in the 2019 report regarding case definition and diagnostic criteria. Information related to case definition and diagnostic accuracy across the 2011, 2019, and 2026 reports are summarized below and in Error! Reference source not found..

Table 9. Summary comparison of findings from 2011, 2019, and 2026 reports regarding case definition and diagnostic criteria, accuracy and reliability

2011 Report SOE: VERY LOW (Insufficient)	2019 Report (SOE: not formally assessed for contextual questions)	2026 Report (SOE not assessed)
Case definition • The most consistent case definition of FAI (cam or mixed) as defined by inclusion/exclusion criteria in prospective studies of treatment effectiveness includes hip/groin pain, positive clinical impingement test, and an α-angle >50-55º	• Compared with the 2011 report, no new prospective evidence was identified to support a specific case definition of FAI. • **2016 Warwick Agreement** (expert consensus) defines FAI syndrome (FAIS) as a triad of symptoms, clinical signs and imaging findings. This emphasizes that symptoms, clinical signs and relevant imaging findings must all be present for diagnosis to distinguish it from "asymptomatic FAI" or "radiological FAI" that may be more descriptive of hip morphology versus a clinical disorder. The agreement does not specify thresholds for radiographic parameters. • **Inclusion/exclusion criteria:** Across 4 included RCTs most consistently define FAIS (regardless of morphologic type) based on inclusion/exclusion criteria across the RCTs to include hip or groin pain (assuming that "symptomatic" means pain was present) and positive imaging signs; one RCT noted the absence of agreed upon diagnostic thresholds • **Surgical criteria/indications:** Systematic reviews (SR) suggest a lack of consensus and substantial inconsistency regarding specific indications or criteria for surgical treatment of FAIS. A 2019 consensus-based best practice guideline alludes to general selection criteria for surgical candidates and list contraindications to surgery	• No new high-quality prospective studies were identified to support a specific case definition of FAI • Surgical **criteria/indications:** New systematic reviews (SR) do not give information on surgical criteria or indications.

2011 Report SOE: VERY LOW (Insufficient)	2019 Report (SOE: not formally assessed for contextual questions)	2026 Report (SOE not assessed)
Diagnostic accuracy and reliability • There is no evidence that the diagnosis of FAI can be obtained from clinical exam in one small study. One clinical test, the impingement sign, had a positive and negative predictive value of 86% and 79% in one study where the prevalence of FAI was 50%; however, in another study, the reliability of the impingement sign was only moderate. • Even though the α-angle showed moderate to high inter-observer reliability in several studies, it had poor diagnostic value in identifying FAI. Other imaging tests assessing abnormalities of the femur and acetabulum had variable degrees of reliability, but no others were tested for diagnostic validity.	**Diagnostic criteria** • High-quality prospective studies on the accuracy of diagnostic criteria described in the agreement for FAIS compared with surgical findings were not identified. The evidence base cited in studies identified is of poor quality. None of the criteria described are pathognomonic for FAI or FAIS. There continues to be insufficient evidence for FAI/FAIS diagnostic accuracy or reliability. • **2016 Warwick Agreement** specifies that the triad of symptoms, clinical signs and imaging findings must **all** be present to diagnose FAIS, but acknowledges that criteria are imprecise and their utility unclear. Consensus recommendations regarding criteria include: ○ **Symptoms:** Pain is the primary symptom, usually in hip or groin, but may be reported in lateral hip, anterior thigh, buttock, knee, and lower back, lateral and posterior thigh; typically motion-related or position-related. ○ **Clinical Tests:** FADIR impingement test and impingement testing to reproduce patient's pain, ROM evaluation (including internal rotation in flexion), FABER distance; should also assess gait, single leg control, muscle tenderness. Image-guided anesthetic injection may help distinguish sources of hip pain. ○ **Imaging:** Morphologic assessment with plain radiographs and to rule out other painful conditions. Cross-sectional imaging (CT, MR, MRA) to further assess morphology and associated labral or chondral pathology (particularly if surgery is considered). The panel did not recommend precise diagnostic values for any common measures to define morphologies in routine clinical practice indicating FAIS is a complex interaction, during motion, between the acetabulum and femoral neck.	**Diagnostic criteria** • High-quality prospective studies on the accuracy of diagnostic criteria described in the agreement for FAIS compared with surgical findings were not identified.

2011 Report SOE: VERY LOW (Insufficient)	2019 Report (SOE: not formally assessed for contextual questions)	2026 Report (SOE not assessed)
Diagnostic accuracy and reliability • There is no evidence that the diagnosis of FAI can be obtained from clinical exam in one small study. One clinical test, the impingement sign, had a positive and negative predictive value of 86% and 79% in one study where the prevalence of FAI was 50%; however, in another study, the reliability of the impingement sign was only moderate.	• **Accuracy (surgery referent) and reliability of symptoms and clinical tests**: ○ One systematic review and one retrospective study suggest that impingement tests may be sensitive but not specific for FAIS. ○ The retrospective study found that groin pain was the most sensitive (87%) and specific symptom (100%); most combinations of groin pain, impingement tests and FABER distance were sensitive (>90%), but specificity was 0% ○ Overall raw agreement for most clinical tests in one institution was substantial (58% to 99%). ○ No prospective studies comparing the accuracy of diagnostic hip injection with surgical findings in patients with FAIS were identified	**Systematic reviews of diagnostic accuracy since 2019** • **Clinical and imaging**: Two reviews of various physical tests and/or imaging did not contain updated evidence on diagnostic accuracy. They conclude that some tests may have acceptable sensitivity but overall tests have poor specificity. • **Intra-articular injection**: A good-quality systematic review (4 high risk of bias studies) concluded that that the diagnostic capability of intra-articular injections for FAI could not be supported and that it remains unclear which pain relief thresholds were related to higher diagnostic capability. SOE was very low (insufficient) for diagnostic accuracy measures and or differences in pain relief between groups based on reported pain thresholds

2011 Report SOE: VERY LOW (Insufficient)	2019 Report (SOE: not formally assessed for contextual questions)	2026 Report (SOE not assessed)
Diagnostic accuracy and reliability • Even though the α-angle showed moderate to high inter-observer reliability in several studies, it had poor diagnostic value in identifying FAI. Other imaging tests assessing abnormalities of the femur and acetabulum had variable degrees of reliability, but no others were tested for diagnostic validity.	• **Accuracy of imaging (surgery referent)** ○ Specific to FAI diagnosis, one SR reports sensitivities ranging from 71% to 91% for MRI/MRA and CT across 3 individual studies with specificities ranging from 60% to 89% using various criteria. Sensitivity (66%) and specificity (65%) of ultrasound were low. Pre-test FAIS prevalence was high; all tests impacted posttest probabilities to varying degrees; all but one study was retrospective. Another SR reported that most poor-quality studies supported the use of various radiographic parameters for diagnosis of pincer-type FAI, higher quality studies were inconclusive. o Two SRs suggest that MRI, MRA and CTA are useful for diagnosing labral and chondral pathology in FAIS patients. (See report) • **Reliability of imaging** ○ Across four studies, inter-rater reliability varied by radiographic parameter, reader specialty and patient population, ranging from slight agreement (κ =0.06) to substantial agreement (κ or ICC >0.61); agreement was most frequently fair to moderate across most parameters and diagnostic determination of FAI suggesting that interpretation is subjective.	**Systematic reviews of diagnostic accuracy since 2019** • **Clinical and imaging**: Two reviews of various physical tests and/or imaging did not contain updated evidence on diagnostic accuracy. They conclude that some tests may have acceptable sensitivity but overall tests have poor specificity. **Consensus statements since 2019** • **Reliability of imaging;** Updated information was not sought.

CT = computed tomography; CTA = computed tomography arthrography; FABER = flexion adduction external rotation test; FADDIR = flexion-adduction-internal rotation impingement test; FAI = femoroacetabular Impingement; IR = internal rotation; LR = Likelihood ratio; MRA = magnetic resonance arthrogram; MRI = magnetic resonance imaging; NPV = negative predictive value; NR = not reported; SR = systematic review; US = ultrasound.

3.1.1.1 Case definition

No new prospective evidence was identified to support specific a specific case definition of FAI in the 2019 report or this update. The 2016 Warwick agreement has served as the basis for determination of FAIS (**Table 10**). Various consensus documents have added additional context around these components.

Case definitions of FAI/FAIS as defined by the inclusion/exclusion criteria across included RCTs of HAS treatment effectiveness from the 2019 report and this update include hip/groin pain, positive clinical impingement test (i.e., FADIR, FABER), an α-angle >50-55º, lateral center edge angle >40º, and positive crossover sign. There was heterogeneity across trials in use of clinical impingement testing and diagnostic injection; Only half of the included RCTs required positive clinical impingement test with FADIR being more common than FABER and only two of six trials required positive diagnostic injection. See **Appendix Table E-1** and **Appendix Table E-2** for more information on diagnostic criteria and overall inclusion and exclusion criteria.

At the time of the 2019 review, high-quality prospective studies on the accuracy of diagnostic criteria described in the agreement for FAIS compared with surgical findings were not identified. We did not identify high-quality prospective studies for this update.

The 2019 review reported on two publications on the diagnosis and evaluation of FAI/FAIS considered by experts to be the primary clinical pathway for evaluation and diagnosis of FAI/FAIS: the Warwick International Agreement, on the diagnosis and management of FAI[47,75] and a 2019 consensus-based best-practice guideline by Lynch et al. on arthroscopic treatment of FAI.[132] The Warwick Agreement provides expert consensus on the definition, diagnosis and general treatment options for FAI. The 2019 best-practices guideline provides recommendations for patient evaluation before, during and following hip arthroplasty for FAI to help decrease practice variability through all three stages of care and builds on the Warwick Agreement.

No high-quality prospective accuracy studies specific to the diagnosis of FAI/FAIS as a distinct entity (versus FAI with labral tear) based on recommendations in the Warwick Agreement using surgery as a referent were identified for the 2019 review. The agreement notes that there are not agreed upon thresholds for imaging diagnosis and that symptoms and clinical tests may not be specific to FAI. The Warwick agreement recommends that diagnosis of femoroacetabular impingement syndrome (FAIS) be based on the triad of patient history, clinic tests for impingement and imaging findings. None of the criteria are pathognomonic for FAIS. The consensus definition of FAI *syndrome* (FAIS) reflects the panel's synthesis of previous definitions and descriptions with an emphasis on the importance of patient symptoms to distinguish it from "asymptomatic FAI" or "radiological FAI" that may be more descriptive of hip morphology versus a clinical disorder; individuals with cam or pincer morphology may not be symptomatic.

Table 10. Summary of Warwick Agreement: diagnosis of FAIS

Diagnostic Component	Criterion/Recommendations	Comments
Symptoms	• Motion or position-related hip or groin pain • Possible pain in back, buttocks or thigh • Restricted ROM, clicking, locking, catching, stiffness, giving way may be described by patients	• Such pain may also be seen in a number of other conditions which may or may not arise from the hip joint • In most patients seeking treatment for FAIS, symptoms are often severe and limiting
Clinical signs	• FADIR impingement test should be performed.; Positive test: must reproduce patient's pain/rule out other causes capable of producing similar pain • Restricted ROM (especially internal rotation in flexion) • FABER distance (flexion abduction external rotation) • Abnormal movement patterns around hip, pelvis; examine gait, single leg control	• FADIR impingement test is sensitive, but not very specific (often not positive when FAIS is not the correct diagnosis) • Performance of tests in various environments is unknown • There is substantial variation in how clinicians apply and interpret tests • Abnormal movement patterns may be seen in other conditions • Evidence on ROM is contradictory

Diagnostic Component	Criterion/Recommendations	Comments

Imaging	• AP radiograph of pelvis, lateral (orthogonal) femoral neck view; Identify morphologies, other pain sources
	  • Cam: alpha angle (α-angle)
	  • Pincer: cross-over sign and center edge angle
	• Cross-sectional imaging (CT, MR) appropriate to further assess hip morphology, associated labral and cartilage lesions
	• MRI important if surgery is being considered
		• No specific diagnostic/radiographic measurements or thresholds recommended for morphologies
		• Identification of cam or pincer morphology alone does not constitute diagnosis of FAI; a substantial proportion of the general population may have these morphologies
		• Radiographs moderately sensitive but not specific for identifying typical morphology

Other testing	• Diagnostic injection: Image-guided anesthetic injection may help distinguish sources of hip pain	• Pain relief "supports" diagnosis of FAI if other criteria are met. • Pain relief may also be seen in patients with labral tear and chondral abnormalities in the absence of FAI

CT = computed tomography; FAI = femoroacetabular impingement; FAIS = femoroacetabular impingement syndrome; FADIR = flexion, adduction, and internal rotation; MR = magnetic resonance; ROM = range of motion.

3.1.1.2 Validation and diagnostic accuracy

The 2019 review summarized systematic reviews of studies of diagnostic accuracy/validity providing data on the primary Warwick diagnostic criteria/recommendations, with preferential inclusion of prospective studies if available. The primary reference standard for the diagnosis of FAIS should be arthroscopic or open surgery to verify presence of pathology. Three systematic reviews evaluating and presenting diagnostic accuracy data of clinical tests or imaging compared with surgery were identified and summarized[200,201,211] in the 2019 review; all provided pooled estimates for diagnostic accuracy measures (Appendix H, Tables H-1 and H-2). For completeness, findings related to reliability of tests from the 2019 report are provided in Appendix H, Tables H-3 to H-5.

New publications since the 2019 review report

Clinical tests and imaging

Two recent SRs[45,60] identified for this update do not provide updated evidence on the accuracy of testing specifically for the diagnosis of FAI. Studies or systematic reviews included in these publications either were captured as part of the prior review and/or included studies that did not meet the inclusion criteria established in the prior report. Studies included in the SRs encompass studies published prior to the 2019 review and were consistently rated as being at high risk of bias, consistent with our findings in the 2019 review. Also consistent with the findings of the 2019 review, these publications and a recent narrative review[39] concluded that there substantial variability in diagnostic accuracy for various clinical tests and imaging for FAI/FAIS and that there is a lack of high-quality prospective studies evaluating the diagnostic accuracy of tests specific to FAI/FAIS. Studies of biomarkers and studies not specific to the diagnosis of FAI/FAIS (e.g., those assessing the labrum, capsule or similar structures) were excluded.

One high risk of bias study (N=69 hips)[177] published after the 2019 report from a tertiary referral center evaluated the diagnostic accuracy and reliability of clinical tests (hip impingement tests, passive range of motion tests) using the following criteria for diagnosis of FAIS as a reference standard: 1) symptoms indicating FAIS, 2) radiographic findings of CAM and/or pincer morphology and 3) positive

response to intraarticular block injection. All three criteria for this referent were met by half (51%) of 69 hips evaluated. While all hips were associated with symptoms (100%), positive radiographic results and response to intraarticular injection were less common (67% and 70% respectively). Hip impingement tests were found to have a range of sensitivity (54% to 80%) and poor specificity (ranges 38% to 51%) across the different tests. Passive range of motion tests varied by test and showed poor sensitivity (range 29% to 56%) and somewhat better specificity (range 63% to 94%). Kappa values for interrater reliability ranged from 0.357 to 0.665 for hip impingement tests and from 0.211 to 0.553 for passive range of motion measures. Primary study limitations include the referent used, failure to include a broad spectrum of patients with the expected condition (patients had high disease probability) and unclear independence between test performance and application of the reference standard criteria.

3.1.1.3 Diagnostic injections:

The 2019 review found no prospective studies comparing the accuracy of diagnostic hip injection with surgical findings. One of the imaging systematic reviews [201] described the impact of positive and negative results for diagnostic injection from an older (2004) single study[23] reporting on diagnostic injections. While a positive response to injection did little to shift the post-test probability of pathology (from 80% to 83%), a negative result shifted the post-test probability (from 20% to 41%).

For this update, we identified a good quality 2024 systematic review[59] of four studies that evaluated the diagnostic capability of intra-articular hip injections for the diagnosis of FAIS. The review concluded that that the diagnostic capability of intra-articular injections for FAI could not be supported and that it remained unclear which pain relief thresholds were related to higher diagnostic capability. Strength of evidence (SOE) was very low (insufficient) for the diagnostic accuracy measures (e.g., sensitivity, specificity) and for differences in pain relief between groups based on reported pain thresholds. Two of the studies[69,111] used local anesthetic plus steroid for injection as the index test and a combination of physical tests and arthroscopic findings as a reference standard for FAI diagnosis. Two other studies[89,183] compared local anesthetics to a reference standard which consisted of physical tests together with unspecified radiographic and arthroscopic criteria. All four studies were rated at high risk of bias based on QUADS-2 criteria based on uncertainty of the reference standard to correctly classify FAI and ambiguity related to diagnostic criteria for the reference standard, failure to blind the results for the index and reference standard evaluations, and inappropriate exclusion of patients or partial exclusion of patients.

Consensus statements published since the 2019 report generally adhere to the assessment components outlined in the Warwick agreement and the Lynch consensus document (See guideline section)

3.1.2 Contextual Question 2

Are new validated outcomes measurement instruments used for evaluation of function or pain in FAIS patients in new RCTs?

There were no new outcomes measurement instruments identified. See Section 4.1.2 from the prior report, which identified four new functional outcomes measures (iHOT-33 and iHOT-12, HAGOS, HOOS, and OHS), which are still used in studies reported in the current report. Inter-reliability was not assessed for this report.

3.1.3 Contextual Question 3

Is there new information on clinically meaningful improvement for validated measures used in the evidence base?

We sought new studies evaluating clinically meaningful improvement specifically in patients with FAI or FAIS. Only 3 new studies published since 2019 were identified. None of the studies were specific to patients with FAIS but instead included patients with various hip disabilities[22] (NAHS), adults undergoing THA for OA[42] (HADS), and adults presenting to the ED for acute pain[11] (NRS). Other older citations were included to provide a conservative range of MCIDs for some outcomes, as well as to update MCIDs published in older studies. See **Table 11** and **Table 12** for more details. For completeness, we highlighted and outlined all changes to outcomes in **Table 11** for the 2026 Re-review column.

Values for clinically meaningful improvement for the same outcome measure may differ depending on the method used to derive the MCID (e.g., anchor-based versus distribution-based approaches) and the characteristics of the population in which it was established. MCIDs are population-specific and may vary according to factors such as baseline symptom severity, underlying diagnosis, intervention, and duration of follow-up. Therefore, where available, we prioritized MCIDs derived from populations with FAI or FAIS and otherwise reported the most clinically relevant published estimates.

Table 11. Summary comparison of findings from 2011, 2019, and 2026 reports regarding validated outcome measurement instruments and clinically meaningful improvement

KQ 2, 2011 Report SOE: VERY LOW (Insufficient)	Contextual Questions, 2019 Report*	Contextual Questions, 2026 Re-review*
Assessment of OA • The Tönnis classification is often used to determine the extent of osteoarthritis in the hip. There were no studies found that assessed its validity. Reliability was tested in only one study and intra- and inter-observer reliability in that study was moderate.	Assessment of OA • Two new studies found inter-rater reliability for the Tönnis classification to be slight to fair and intra-rater reliability ranged from fair to moderate. Both conclude that reproducibility is not adequate. No validation studies in FAI patients were identified. • For the Kellgren Lawrence grading system from one general, population-based study reported substantial inter-observer reliability. Construct validity and predictive validity for future THA were considered good.	Assessment of OA • Additional studies were not sought for this update.

KQ 2, 2011 Report SOE: VERY LOW (Insufficient)	Contextual Questions, 2019 Report*	Contextual Questions, 2026 Re-review*
<u>Patient- and clinician reported outcomes</u> • Seven hip outcomes measures were used commonly in FAI patients. Three have undergone psychometric analysis in FAI (HOS-D, M-WOMAC) or young hip-pain (HOS, NAHS) patient populations. • Only one, the NAHS, of the three instruments was adequately tested for validity, and it was performed in a young hip-pain patient population. • Reliability was inadequately tested for all three instruments.	<u>Patient- and clinician reported outcomes</u> • Four additional hip measures were used in RCTs included in the update report: iHOT-33 and iHOT-12, HAGOS, HOOS and OHS. • In FAI patients, OHS demonstrated good construct validity without notable floor or ceiling effects as well as high internal consistency, internal and external responsiveness and ability to discriminate between patients. • A prospective longitudinal study in 50 young adults undergoing arthroscopy for FAI, labral lesion, or chondroplasty (or combination) and 50 healthy age-matched adults evaluated the psychometric properties of the HAGOS, HOOS, HOS, i-HOT-33 and mHHS. Content validity for HOOS, HAGOS, and iHOT-33 and all measures were able to detect differences between the study groups. None demonstrated floor effects. Responsiveness was considered adequate for mHHS, HOOS and iHot-33.	<u>Patient- and clinician reported outcomes</u> • HOS-ADL and HOS-SSS: New publications were not identified, but one citation was published in 2008, so we updated to include only a more up-to-date citation[107] • NRS: The prior report did not report on the NRS. While we did not identify any citations relevant to patients with FAIS, we did identify one new study published in 2020 on adult patients presenting to EDs for acute pain[11] • PD-Q: The previous report did not report on the PD-Q. We did not identify any publications. • HAGOS, HOOS, OHS UCLA, EQ-5D-5L, SF-12: No new publications identified.

KQ 2, 2011 Report SOE: VERY LOW (Insufficient)	Contextual Questions, 2019 Report*	Contextual Questions, 2026 Re-review*
Patient- and clinician reported outcomes • The MCID was defined to be 9 points for the ADL subscale and 6 points for the sports subscale of the HOS-D in FAI patients. • The MCID has not been defined for any other outcome measures in FAI or young hip-pain patients.	Patient- and clinician reported outcomes • OHS: An MCID of 5.22 points was reported by different authors for adults undergoing THA. • Updated MCIDs in patients with hip pain and/or hip related procedures for measures are as follows: (see report for other measures) ▪ iHot-33 for patients undergoing arthroscopy for FAIS: adolescent, 10.7 pts, adults 12.1 pts ▪ mHHS: adolescent patients undergoing arthroscopy for FAIS 9.7pts, adults, any arthroscopy 8 pts ▪ Adult arthroscopy patients: HAGOS-pain: 6 points, HAGOS-symptoms: 10 points, HAGOS-ADL: 9 points, HAGOS-sport: 9 points, HAGOS-physical activity: 1 point, HAGOS- QOL: 9 points ▪ VAS pain (0-100), adult arthroscopy patients: -15 points	Patient- and clinician reported outcomes • iHOT-33: One study was identified in adults that expanded the range from of 6.1 to 10 to include 12.1 using the distribution method.[171] • iHOT-12: This outcome was not included in the prior report for MCIDs; two studies were identified in adults that provided a MCID of 13.0[137,170] using the distribution method. • mHHS: The prior report highlighted MCIDs published in 2013. We identified two studies by the same author group that report MCIDs of 8.2[171] to 9.5 points[170] published in 2017 and 2018 respectively. • NAHS: The previous report did not identify any citations for MCIDs related to the NAHS. While we did not identify any citations relevant to patients with FAIS, we did identify one new study published in 2022 on young adults with various hip disabilities.[22] • HADS: The prior report did not report on the HADS. While we did not identify any citations relevant to patients with FAIS, we did identify one new study published in 2024 on adult patients undergoing THA for OA.[42] • VAS pain (0-10): The prior report cited a publication from 2019 using the distribution method. We identified one other study published in 2019 that reported the same MCID (-1.5) using the anchor method.

ADL = activities of daily living; FAI = femoroacetabular impingement; HADS = Hospital Anxiety and Depression Scale; HAGOS = Hip and Groin Outcome Score; HOS = Hip Outcome Score; HOOS = Hip disability and osteoarthritis outcome score; iHOT-12 = Short-form International Hip Outcome Tool; iHOT-33 = international Hip Outcome Tool; LEFS = Lower Extremity Functional Scale; MCID = minimal clinically important difference; mHHS = Modified Harris Hip Score; NAHS = Non-arthritic Hip Score; NR = not reported; NRS = numerical rating scale; OHS = Oxford Hip Score; PD-Q = PainDETECT Questionnaire; QoL = quality of life; SF-12 = 12-item Short Form; VAS = visual analogue scale; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index.

* SOE: not formally assessed for contextual questions.

Table 12. Outcome measures used in included studies; published minimal clinically important differences

Type of measure	Outcome measure*	Components	Score range	Interpretation	MCID and PASS
Functional Outcome Measures	**International Hip Outcome Tool (iHOT-33)**	33-item survey with questions relating to Symptoms and Functional Limitations, Sports and Recreational Activities, Job-Related Concerns and Lifestyle Concerns.	0-100	Higher scores = increased QOL	For adult patients undergoing hip arthroscopy for any condition: 6.1[155] to 12.1[171] points (distribution method); 10 points[107] (anchor method) For adolescent patients undergoing hip arthroscopy for FAIS: 10.7 points[169] (distribution method)
	Short-form International Hip Outcome Tool (iHOT-12)	12-item survey with questions relating to Symptoms and Functional Limitations, Sports and Recreational Activities, Job-Related Concerns and Lifestyle Concerns. Designed for day-to-day clinical use.	0-100	Higher scores = increased QOL	For adult patients undergoing hip arthroscopy for any condition: 13.0 points[137,170] (distribution method) PASS: 59.5 points[205] (anchor method) For adolescent patients: There are no published references when applied to FAIS or similar patient populations of which we are aware.
	Modified Harris Hip Score (mHHS)	The mHHS score gives a maximum of 100 points. Pain receives 44 points, function 47 points, range of motion 5 points, and deformity 4 points. Function is subdivided into activities of daily living (14 points) and gait (33 points).	0-100	Higher scores = increased function	For adult patients undergoing hip arthroscopy for any condition: 8.2[171] to 9.5 points[170] (distribution method); 8 points[107] (anchor method) PASS threshold: 74 points[34] (anchor method) For adolescent patients undergoing hip arthroscopy for FAIS: 9.5 points[169] (distribution method)

Type of measure	Outcome measure*	Components	Score range	Interpretation	MCID and PASS
	Hip Outcome Score (HOS-ADL & HOS-SSS)	Designed for younger, athletic populations with non-arthritic hip conditions; commonly used for patients dealing with labral tears, FAIR, or undergoing hip arthroscopy. Each item is graded on a 5-point Likert scale. The HOS consists of 2 sub scales, ADL and sports, which are scored separately: the total score is divided by the maximum possible score (based on the number of questions answered), and the result multiplied by 100 to obtain a percentage.	0-100	Higher scores = increased function	For adult patients undergoing hip arthroscopy for FAIS: HOS-ADL: 8.3 points[171] (distribution method) HOS-sport: 14.5 points[171] (distribution method) For adults patients undergoing hip arthroscopy for any condition: HOS-ADL: 8 points[107] (anchor method) HOS-SSS: 6 points[107] (anchor method) PASS threshold HOS-ADL: 87 points[34] (anchor method) HOS-SSS: 75 points [34] (anchor method) For adolescent patients undergoing hip arthroscopy for FAIS: HOS-ADL: 9.8 points [169] (distribution method) HOS-sport: 12.1 points[169] (distribution method)
	Hip and Groin Outcome Score (HAGOS)	Six separate subscales that are scored separately assessing Pain, Symptoms, Physical function in daily living, Physical function in Sport and Recreation, Participation in Physical Activities and hip and/or groin-related Quality of Life	0-100	Higher scores = no hip/groin problems	For adult patients undergoing hip arthroscopy for any condition: HAGOS-pain: 6 points[107] (anchor method) HAGOS-symptoms: 10 points[107] (anchor method) HAGOS-ADL: 9 points[107] (anchor method) HAGOS-sport: 9 points[107] (anchor method) HAGOS-physical activity: 1 point[107] (anchor method)† HAGOS- QOL: 9 points[107] (anchor method) For adolescent patients: There are no published references when applied to FAIS or similar patient populations of which we are aware.

Type of measure	Outcome measure*	Components	Score range	Interpretation	MCID and PASS
	Hip disability and osteoarthritis outcome score (HOOS)	Designed primarily for older or less-active populations suffering from hip osteoarthritis or those undergoing total hip arthroplasty. 26 items scored on a 5-point Likert scale. Subscale scores summed, then transformed to 0–100.	0-100	Higher scores = no hip/groin problems	For adult patients undergoing hip arthroscopy for any condition: HOOS-pain: 9 points[107] (anchor method) HOOS-symptoms: 9 points[107] (anchor method) HOOS-ADL: 6 points[107] (anchor method) HOOS-sport: 10 points[107] (anchor method) HOOS-QOL: 11 points[107] (anchor method) For adolescent patients: There are no published references when applied to FAIS or similar patient populations of which we are aware.
	Lower Extremity Functional Scale (LEFS)	Lists 20 activities ranging from basic mobility to high-demand activities. Each item is scored on a 5-point Likert scale from 0-4.	0-80	Higher scores = better physical function	In adults with lower-extremity musculoskeletal dysfunction: 9 points[21] (distribution method) For adolescent patients: There are no published references when applied to FAIS or similar patient populations of which we are aware.
	Oxford Hip Score (OHS)	12-item survey that assesses pain, and function of the hip in relation to daily activities including walking, dressing, climbing the stairs, and sleeping. Each item has five possible responses.	12-60	Higher scores = increased function	For adults patients: There are no published references when applied to FAIS or similar patient populations of which we are aware. For adult patients undergoing THA for any condition: 5.22 points[15] For adolescent patients: There are no published references when applied to FAIS or similar patient populations of which we are aware.

Type of measure	Outcome measure*	Components	Score range	Interpretation	MCID and PASS
	Non-arthritic Hip Score (NAHS)	NAHS evaluates function with four domains: pain (5 items, 20 points), physical function (5 items, 20 points), mechanical symptoms (4 items, 16 points), and level of activity (6 items, 24 points). The final score is obtained by multiplying the total points by 1.25	0-100	Higher scores = increased hip function	For adult patients: There are no published references when applied to FAIS or similar patient populations of which we are aware. In young adult patients with various hip disabilities: 8.5 points[22] (distribution method) For adolescent patients: There are no published references when applied to FAIS or similar patient populations of which we are aware.
	UCLA Activity Score	A simple scale ranging from 1 to 10 in which the patient indicates their most appropriate activity level	0-10	Higher scores = increased activity level	For adult or adolescent patients: There are no published references when applied to FAIS or similar patient populations of which we are aware.
Quality of Life Outcome Measures	**EQ-5D-5L Index**	5-dimension survey that assesses mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. The test also includes a VAS.	0-1	Higher scores = increased QOL	For adult or adolescent patients: There are no published references when applied to FAIS or similar patient populations of which we are aware.
	12-item Short Form (SF-12)	A shorter version of the SF-36 Health Survey that uses 12 questions to measure functional health and well-being from the patient's point of view. Consists of two component scores; mental and physical.	0-100	Higher scores = increased QOL	For adult or adolescent patients: There are no published references when applied to FAIS or similar patient populations of which we are aware.

Type of measure	Outcome measure*	Components	Score range	Interpretation	MCID and PASS
	Hospital Anxiety and Depression Scale	14-item questionnaire to screen for anxiety and depression. Includes an anxiety subscale, focused on states of worry, tension, and panic; and depression subscale, focused on anhedonia. 0-7: normal/no clinical distress 8-10: mild/borderline abnormal 11-21: moderate to severe/definite case of clinical distress	0-21	Higher scores = worse quality of life	For adult patients undergoing THA for OA HADS-A: range 1.4 to 4.4 (Distribution method)[42] HADS-D: range 1.5 to 4.8 (Distribution method)[42] For adolescent patients: There are no published references when applied to FAIS or similar patient populations of which we are aware.
Pain Outcome Measure	**Visual analogue scale (VAS)**	Measures the amount of pain that a patient feels.	0-10	Higher scores = worse pain	For adult patients undergoing hip arthroscopy for FAIS: -1.5 points[137](distribution method); -1.5 points[17](anchor method) PASS: 1.5 points[17] to 1.6 points[11] (anchor method) For adolescent patients: There are no published references when applied to FAIS or similar patient populations of which we are aware.
	Numerical rating scale (NRS)	Measures the amount of pain that a patient feels	0-10	Higher scores = worse pain	For adult patients presenting to EDs for acute pain: 1.65 points[11] For adult or adolescent patients: There are no published references when applied to FAIS or similar patient populations of which we are aware.

Type of measure	Outcome measure*	Components	Score range	Interpretation	MCID and PASS
	PainDETECT Questionnaire (PD-Q)	Rates the severity of seven sensory symptoms on a 6-point scale; ≤12: Neuropathic pain is unlikely 13-18: Neuropathic pain is possible >18: Neuropathic pain is likely	-1-38	Higher scores = increased pain	For adult or adolescent patients: There are no published references when applied to FAIS or similar patient populations of which we are aware.

ADL = activities of daily living; ED = emergency department; QoL = quality of life; FAIS = Femoroacetabular impingement syndrome; MCID = minimal clinically important difference; PASS = patient acceptable symptom state; THA = total hip arthroplasty.

*All outcome measures are patient-reported.

†Authors state that it was very difficult to be certain of the validity of this finding because of the large ceiling effects and reduced capacity for change. Therefore, they are not able to recommend the use of this subscale of the HAGOS.

3.2 Results: Overview

3.2.1 Number of studies retained

We identified 11 new studies (in 15 publications) for this report: three RCTs (in 7 publications),[9,96,102,105,138,139,157] one SR of case series,[196] six case series,[44,78,129,131,213,245] and one formal economic analysis.[247] We also included five studies from the 2019 report: three RCTs,[76,135,176] one NRSI,[182] one SR of case series,[43] and three formal economic analyses.[76,144,222] Two updates to RCTs included from the 2019 report that provided longer term data were additionally included.[74,175] In total, 18 studies (in 24 publications) were included for this report: six RCTs (in 12 publications),[9,74,76,96,102,105,135,138,139,157,175,176] one NRSI,[182] two SRs of case series,[43,196] six case series,[44,78,129,131,213,245] and four economic analyses.[76,144,222,247] See **Table 13** for a more detailed description of included studies.

Consistent with the prior 2011 and 2019 reports, this report is focused on efficacy of operative versus non-operative treatment of FAI. A comparison between surgical treatment of FAI with surgical procedures not involving alteration of bone was added for this update review. Not all studies were carried over from the 2019 report as differences in inclusion criteria meant studies previously included for the following comparisons were omitted: labral repair or reattachment versus labral debridement or resection; arthroscopic surgery versus open surgical dislocation; arthroscopic surgery with versus without labral detachment, open femoral osteochondroplasty with versus without rim trim, and case series for efficacy.

In addition, one retrospective comparative NRSI[163] that compared arthroscopy with versus without bone alteration for symptomatic cam type FAI in adults, one case series[115] of adults who underwent arthroscopic treatment for isolated labral tears without correction of the underlying FAI morphology, and five case series[70-73,217] that reported rare safety events in adults who underwent arthroscopy for FAI were identified. Although the NRSI and case series in adults did not meet the eligibility criteria for inclusion, they were summarized for context because they provided information on rare harms or provided limited information on the clinically important question of whether addressing the underlying bony morphology influences long-term outcomes.

Table 13. Overview of included studies

Population: Intervention vs. Comparator	2019 report	2026 update (new)	Total included
Adults: Arthroscopic Surgery vs. Lavage	Comparison not included	RCTs: 1[9,102,105]†	RCTs: 1[9,102,105]
Adults: Arthroscopic Surgery vs. Non-operative Treatment	RCTs: 3[76,135,176] Econ: 3[76,144,222]*	RCTs: 2[96,138,139,157] Additional publications for RCTs included from 2019 Report: 2[74,175] Econ: 1[247]	RCTs: 5[74,76,96,135,138,139,157,175,176] Econ: 4[76,144,222,247]
Adolescents: Arthroscopic Surgery vs. PT	NRSI: 1[182]	No new studies identified	NRSI: 1[182]
Adolescents: Arthroscopic Surgery only	SRs of case series: 1[43]	SRs of case series: 1[196]	SRs of case series: 2[43,196]

Population: Intervention vs. Comparator	2019 report	2026 update (new)	Total included
		Case series: 6[44,78,129,131,213,245]	Case series: 6[44,78,129,131,213,245]

NRSI = non-randomized study of interventions; RCT = randomized controlled trial; SR = systematic review.

*One economic study, Griffin 2018, is also included as an RCT.

†Jean, 2022 is an extension of the FIRST trial (Ayeni, 2021) that includes an additional non-randomized cohort.

3.2.2 Comparison with Previous Reports (2011 and 2019)

Table 14 and **Table 15** below provide a broad overview of the results and strength of evidence for the 2011 and 2019 reviews compared with this 2026 update review. (This overview does *not* connote any recommendations for policy). Evidence for adults and adolescents is presented separately. The focus of these reports was on the comparative effectiveness and safety of operative versus non-operative treatments; in addition, the 2026 report focused on comparisons of hip surgery with and without alteration of the bone. Across all three reports, there was no evidence available to assess the intermediate (>5 years to <10 years) or long term (≥10 years) effectiveness or safety of FAI surgery compared with no surgery or surgery that does not alter the bone for both adults and adolescents. All outcomes are short term (≤5 years).

Table 14. Adults: comparison of key findings between the 2011 and 2019 reports and the 2026 Update Report

Key Question	2011 Report	2019 Report Update	2026 Report Update
Effectiveness **Short-term (≤5 years)**	No evidence available to assess the short-term effectiveness of FAI surgery compared with no surgery.	• No studies comparing operative and non-operative care in asymptomatic patients were identified. • 3 RCTs comparing arthroscopy with PT for FAI in adults over the short-term (up to 24 months) were identified. Labral tear procedures were done in >90% of patients.	• Asymptomatic FAI was excluded • 5 RCTs (2 new) comparing arthroscopy with PT in adults over the short-term (up to 38 months) were identified. Labral tear procedures were done in >90% of patients. • One new RCT comparing surgical treatment involving bone modification versus no bone modification was identified.

Key Question	2011 Report	2019 Report Update	2026 Report Update
Effectiveness **Short-term (≤5 years)**	--	Arthroscopy vs. PT **Function** • More arthroscopy patients compared with PT patients achieved clinically important improvements in function in 1 RCT: MCID (≥9 points) and PASS (score >87 points) (SOE: moderate). • Improvement favoring arthroscopy versus PT was seen for function at 6 to 8 months based on the International Hip Outcome Tool (iHOT-33) (3 RCTs) and the HOS-Sport subscale (2 RCTs) but not the HOS-ADL subscale (2 RCTs); only the difference on the HOS-Sport subscale is likely clinically significant (SOE: moderate for iHOT-33 and HOS-Sport, low for HOS-ADL). • No clear difference between groups was seen for iHOT-33, HOS-ADL or HOS-Sport at 12 or 24 months (SOE: moderate for the i-HOT-33 at 12 months [2 trials]; insufficient for the i-HOT-33 at 24 months and the HOS-ADL and -Sport subscales at both times [1 trial]).	Arthroscopy vs. PT **Function** • Arthroscopy was associated with a moderately greater likelihood of achieving MCID at 8 months and slightly greater likelihood at 38 months, and a substantially greater likelihood of achieving PASS in 1 RCT: MCID (≥9 points) and PASS (score >87 points) (SOE: low). • At 3 months, in 1 RCT each, arthroscopy was associated with a clinically important improvement in iHOT-33 (SOE: low), HOS and HOOS ADL (SOE: low), and NAHS (SOE: low) scores, meeting or exceeding published MCIDs. There was insufficient evidence to draw conclusions on HOS and HOOS sport subscales. • At 6-8 months, arthroscopy was associated with a clinically important improvement in NAHS scores (2 RCTs), meeting or exceeding published MCIDs (SOE: low). Arthroscopy was also associated with an improvement in iHOT-33 (5 RCTS), and HOS and HOOS ADL scores (4 RCTs), but estimates were below published MCIDs (SOE: low). There was insufficient evidence to draw conclusions on HOS and HOOS sport subscales (4 RCTs).

Key Question	2011 Report	2019 Report Update	2026 Report Update
Effectiveness **Short-term (≤5 years)**	--	--	**Function (continued)** • At 12-14 months, arthroscopy was associated with a clinically important improvement in iHOT-33 scores across 5 RCTs (SOE: Moderate) and NAHS scores across 2 RCTs (SOE: Low), meeting or exceeding published MCIDs. Arthroscopy was also associated with an improvement in HOS and HOOS sport scores (4 RCTs), but estimates were below published MCIDs (SOE: Moderate). There was insufficient evidence to draw conclusions on HOS and HOOS ADL subscales (4 RCTs). • At 24-26 months, arthroscopy was associated with a clinically important improvement in iHOT-33 scores (3 RCTs), meeting or exceeding published MCIDs (SOE: low). Arthroscopy was also associated with an improvement in NAHS scores (2 RCTs), but estimates were below published MCIDs (SOE: low). There was no difference in HOS and HOOS ADL and Sport scores (3 RCTs) between arthroscopy and PT (SOE: Low). • At 36-38 months, arthroscopy was associated with a clinically important improvement in iHOT-33 (1 RCT) and HOS and HOOS ADL (1 RCT) scores, meeting or exceeding published MCIDs (SOE: moderate). Arthroscopy was also associated with an improvement in HOS and HOOS sport scores in 1 RCT (SOE: moderate) and NAHS scores in 1 RCT (SOE: low), but estimates were below published MCIDs.

Key Question	2011 Report	2019 Report Update	2026 Report Update
Effectiveness **Short-term (≤5 years)**	--	**Pain** • In one RCT, greater improvement in pain (HAGOS) was reported following arthroscopy versus PT at 8 months; the difference may be clinically important, but the confidence interval is wide. Fewer arthroscopy patients reported pain on hip flexion, adduction, and the FABER test but there were no differences between groups on other assessments; clinical relevance of differences is unclear (SOE: low).	**Pain** • At 3 months, arthroscopy was associated with a clinically important improvement in VAS pain scores (1 RCT), meeting or exceeding published MCIDs (SOE: low). • At 6-8 months, arthroscopy was associated with improvement in VAS pain scores (1 RCT), but estimates were below published MCIDs (SOE: low). There was insufficient evidence to draw conclusions on HAGOS and HOOS pain subscales (2 RCTs). • At 12-14 months, arthroscopy was associated with a clinically important improvement in HOOS and HAGOS pain scores (2 RCTs), meeting or exceeding published MCIDs (SOE: Moderate). There was no difference between groups in VAS pain scores in 1 RCT (SOE: low). • At 24-26 months, arthroscopy was associated with a clinically important improvement in HOOS and HAGOS pain scores (1 RCT), meeting or exceeding published MCIDs (SOE: low). There was no difference between groups in VAS pain scores in 1 RCT (SOE: low).
Effectiveness **Short-term (≤5 years)**	--	**Conversion to THA** • Across two RCTs, two arthroscopy patients (1.0%) compared with none who received PT required conversion to THA up to 24 months; sample size and short follow-up may impact the ability to adequately capture this event (SOE: low).	**Conversion to THA** • At 12-38 months, there was no difference between groups in conversion to THA across 4 RCTs (SOE: low).

Key Question	2011 Report	2019 Report Update	2026 Report Update
Effectiveness **Short-term (≤5 years)**	--	--	<u>Arthroscopy vs. Lavage (1 RCT)</u> **Function** • At 12 months, osteochondroplasty was associated with slightly worse HOS-ADL score, but estimates were below published MCIDs (SOE: low). There was no difference between groups in iHOT-12 or HOS-sport scores (SOE: low). **Pain** • At 12 months, there was no difference between groups in VAS pain scores (SOE: low). **Labral Re-Injury** At 24 months, there was no difference between groups in labral re-injury (SOE: low).
Safety	• **The risk of reoperation** (other than conversion to THA) occurred in 4% (arthroscopy and open dislocation) and 9% of the patients (mini-open). • There was only one reported head-neck **fracture** (0.1%) and no reports of AVN, osteonecrosis or trochanteric nonunion. • **Heterotopic ossification** occurred in 2 to 3% of those receiving arthroscopy or mini-open, and 6% in those receiving open dislocation. • **Neurological complications** (nerve palsy, paresthesia, and neuropraxia) were rare in those receiving arthroscopy or open dislocation; however, they occurred in 22% of 258 hips undergoing a mini-open procedure. Most were transient in nature.	<u>Arthroscopy vs. PT</u> • Across 2 RCTs comparing arthroscopy vs. PT there were no deaths; serious and non-serious treatment-related AEs were more common following arthroscopy as might be expected given its invasive nature. (SOE: low) • Across RCTs, SRs of case series, comparative surgery cohorts, and additional case series in adults, it appears that the frequency of most serious surgical complications may be low (<3%). • Surgical complications with higher risks from adult studies included transient nerve injury (0% to 25%; 0% to 9% excluding outliers) and revision surgery (0% to 8%).	<u>Arthroscopy vs. PT</u> • Hip pain or stiffness was common after arthroscopy with no difference vs. PT (SOE: Low). • Arthroscopy may lead to revision surgery, but frequency estimates could not be calculated because authors did not report as-treated populations (SOE: Low). • Nerve injury, particularly numbness, and superficial infection may be common after arthroscopy (SOE: Low). • Evidence was insufficient for mortality, any SAE, AEs potentially or definitely related to treatment, hip fracture, thromboembolic events, heterotopic ossification, and avascular necrosis. <u>Arthroscopy vs. Lavage</u> • At 12 months, there was no difference between groups in revision surgery (SOE: Low). • At 24 months, arthroscopy was associated with a substantial decrease in likelihood of revision (SOE: low). • There was no difference between groups in any hip complication or any hip complication not requiring surgery (SOE: low). • Evidence was insufficient for mortality, heterotopic ossification, and nerve injury.

Key Question	2011 Report	2019 Report Update	2026 Report Update
Differential Efficacy and Safety	• No evidence	• Evidence from two trials evaluating whether age, FAI type, sex, Kellgren Lawrence grade and study center modify the treatment effect following operative versus non-operative treatment was insufficient to draw conclusions.	• Evidence from four trials evaluating whether age, FAI type and severity, sex, Kellgren Lawrence grade, study center, baseline scores, BMI, health care system, smoking, symptom duration, various imaging measures, cartilage status and labrum treatment modify the treatment effect following operative versus non-operative treatment (3 RCTs) and arthroscopy versus lavage (1 RCT) was insufficient to draw conclusions.

Key Question	2011 Report	2019 Report Update	2026 Report Update
Cost-effectiveness	• No evidence	• Conclusions regarding the cost-effectiveness of hip arthroscopy compared with non-operative care were inconsistent across three CUAs • The only CUA (moderate quality) based on RCT data found that personalized PT was both more effective and less costly that arthroscopy at one year from the U.K. National Health Service perspective. The short-term horizon precluded evaluation of OA development or conversion to THA. • Two poor quality CUAs from the U.S. found that arthroscopy was more cost-effective than non-operative care from a societal perspective over 10 year and more cost-effective than observation from a hospital cost perspective for a lifetime. Primary data sources were case series, expert opinion and retrospective survey of arthroscopy patients. Both used an unvalidated method for determining utility.	• One moderate-quality CUA found arthroscopic osteochondroplasty (with or without labral repair) to dominate arthroscopic lavage (with or without labral repair), with lower lifetime costs and greater QALYs from the Canadian public payer perspective.

ADL = activities of daily living; AE = adverse event; AVN = avascular necrosis; CUA= cost-utility analyses; FAI = femoroacetabular impingement; FABER = flexion abduction and external rotation; HOS = hip outcome score; HAGOS = Copenhagen hip and groin outcome score; HOOS = hip disability and osteoarthritis outcome score; iHOT = international hip outcome tool; MCID = minimum clinically important difference; NAHS = non-arthritic hip score; NSAIDs = non-steroidal anti-inflammatory drugs; PASS = patient acceptable symptom state; PT = physical therapy; RCT = randomized controlled trial; SOE = strength of evidence; THA = total hip arthroplasty; U.K. = United Kingdom; U.S. = United States; VAS = visual analog scale.

Table 15. Adolescents: comparison of key findings between the 2011 and 2019 reports and the 2026 Update Report

Outcome	2011 Report	2019 Report Update	2026 Report Update
Effectiveness **Short-term (≤5 years):**	There is no evidence available to assess the short-term effectiveness of FAI surgery compared with no surgery	• One NRSI comparing arthroscopy, activity modification, and injection over the short term (2.2 years) was identified. **Function and Return to Sport** • At 2.2 years, there was no difference between groups in NAHS or mHHS scores, the proportion of hips achieving the stated or published MCID on the NAHS, or return to sport in one NRSI; however the SOE was insufficient. **Pain** • No evidence	• One NRSI comparing arthroscopy, activity modification, and injection over the short term (2.2 years) was carried over from the 2019 report. • Two SRs of case series and 6 additional case series of arthroscopy were identified. **Function and Return to Sport** • At 2.2 years, there was no difference between groups in NAHS or mHHS scores, the proportion of hips achieving the stated or published MCID on the NAHS, or return to sport in one NRSI; however the SOE was insufficient. • Across the SRs and case series, arthroscopy and open surgery were associated with clinically important improvements in mHHS, HOS-ADL, HOS-sport, and iHOT-33 scores. Most patients also experienced clinically important improvements in iHOT-12, HOOS-ADL, HOOS-sport, and NAHS scores based on adult MCIDs, however, no MCIDs have been established for adolescents. **Pain** • Across the SRs and case series, arthroscopy and open surgery were associated with clinically important improvements in HOOS and VAS pain scores, though no MCIDs have been established for adolescents.

Outcome	2011 Report	2019 Report Update	2026 Report Update
Safety	• The risk of reoperation (other than conversion to THA) occurred in 4% (arthroscopy and open dislocation) and 9% of the patients (mini-open).	• Across SRs of case series, comparative surgery cohorts, and additional case series in adolescents, it appears that the frequency of most serious surgical complications may be low (<3%). • In case series of adolescents, no cases of physeal arrest/growth disturbance, femoral fracture, nonunion of the greater trochanter, avascular necrosis, acute iatrogenic slipped capital femoral epiphysis, or iatrogenic instability were seen. (SOE: low)	• Revision surgery for arthroscopy or open surgery ranged from 0% to 55% among SRs and case series and from 2% to 14% when excluding outliers. • Additional surgery for arthroscopy or open surgery ranged from 2% to 21% among SRs and case series • Heterotopic ossification, avascular necrosis, fracture, nerve injury, infection appear to be rare in adolescents undergoing arthroscopy or open surgery
Differential Effectiveness and Safety; Cost-Effectiveness	No evidence identified	No evidence identified	No evidence identified

ADL = activities of daily living; FAI = Femoroacetabular impingement; HOS = hip outcome score; HOOS = hip disability and osteoarthritis outcome score; iHOT = international hip outcome tool; MCID = minimum clinically important difference; NAHS = non-arthritic hip score; NRSI = non-randomized study of intervention; SOE = strength of evidence; SR = systematic review; VAS = visual analog scale

3.3 Results: Adults

3.3.1 Key Question 1: Effectiveness (Adults)

3.3.1.1 Osteochondroplasty versus Lavage

3.3.1.1.1 Description of Included Studies

One RCT (N=220) (in 4 publications)[6,9,102,105] conducted in Canada compared arthroscopic osteochondroplasty versus arthroscopic lavage with or without labral repair for treatment of FAIS. Mean patient age was 36 years, and most patients were White (91%) and male (62%). Most presented with groin pain (92%) and an insidious onset (45%) of symptoms. More patients in the osteochondroplasty group were overweight versus the lavage group (43% vs. 29%), however fewer were obese (20% vs. 33%). Comorbidities (e.g., back pain, depression, previous lower extremity injury, arthritis, diabetes, smoking) were well balanced between the two treatment groups though patients in the osteochondroplasty group had a somewhat higher rate of previous lower extremity injury (12% vs. 6%). FAI types included cam (58.4%) and mixed cam and pincer (41.6%) and were primarily moderate (54%) to mild (38%) severity (based on alpha angle). A labral tear was present in most patients (86%). Most patients had no or mild hip osteoarthritis (Tönnis grade 0 or 1 in 91%); more patients in the osteochondroplasty group had grade 1 OA (52% vs. 39%). All patients were required to have failed at least 6 months of non-operative management that included hip-focused physical therapy. Follow-up was 12 months for effectiveness outcomes and 24 months for adverse events in the RCT portion of the trial;[9] subsequent publications of this trial (to include analyses incorporating an embedded non-randomized cohort) reported specific safety outcomes at 24 to 27 months.[6,102,105] See **Table 16** for complete demographic information.

Compared with the lavage group, the osteochondroplasty group had a higher proportion of complete labral tears identified at surgery (52% vs. 41%), whereas the proportion of partial tears was similar between groups (39% vs. 45%). Overall, 92% of patients in the osteochondroplasty group underwent labral treatment compared with only 66% in the lavage group. Labral repair was performed more frequently in the osteochondroplasty group (73% vs. 47%), while labral resection was performed at similar rates in both groups (19%). A capsulotomy was performed for most patients (96%) with capsular closure performed more often in the osteochondroplasty group (31% vs. 13%). See **Appendix Table E-3** for surgical details.

This trial was rated moderate risk of bias. Methodological limitations included imbalances between groups in some baseline characteristics, lack of care provider blinding, higher than acceptable loss to follow-up (30%) (**Appendix Table D-1).**

In addition, one retrospective comparative NRSI (N=40)[163] that compared arthroscopic labral resection and chondroplasty with versus without bone alteration for cam type FAIS and one case series (N=57)[115] of patients who underwent arthroscopic treatment for isolated labral tears without correction of the underlying FAI morphology were included for contextual purposes. These studies did not meet the inclusion criteria and provided limited information on the clinically important question of whether addressing the underlying bony morphology influences long-term outcomes. In the NRSI, patients in the bone alteration group underwent femoral osteoplasty through a mini-open approach. Mean follow-up was 16.0 years in the femoral osteoplasty group and 19.7 years in the labral resection only group ($p<0.001$). Several patient variables were unbalanced between the two groups (e.g., younger age and a higher proportion of males in the femoral osteoplasty group) and the authors did not adjust for these potential confounders.

Table 16. Demographic Information for FIRST Trial (osteochondroplasty vs. lavage in adults)

Study, Year	Osteochondroplasty	Lavage
N Randomized	110	110
Crossover During Study Period	1	1
Post-Operative PT	Yes	Yes
Age, years; mean (SD)	37	35
% males	61%	63%
Morphology type	Cam: 59% Mixed: 41%	Cam: 57% Mixed: 43%
Baseline function	NR	NR
Symptom duration (years)	≥6 months*	≥6 months*
Labral tears	85%	86%
Arthritis	Tonnis Grade 0: 44% 1: 52% 2: 5% 3: 0%	Tonnis Grade 0: 48% 1: 39% 2: 12% 3: 0.9%
Hip laterality	Left: 43% Right: 57%	Left: 47% Right: 53%
Mean LCEA	NR	NR
BMI	<18.5: 4% 18.5 to <25: 32% 25 to <30: 43% 30 to <40: 20% ≥40: 0.9%	<18.5: 0.9% 18.5 to <25: 35% 25 to <30: 29% 30 to <40: 33% ≥40: 1.9%
Current smoker	18%	15%
Country	Canada, Finland, Denmark	Canada, Finland, Denmark
Funding	Academic	Academic
Risk of Bias	Moderate	Moderate

LCEA = lateral center-edge angle, NR = not reported, PT = physical therapy, SD = standard deviation

* Inclusion criteria.

3.3.1.1.2 Function Outcomes

Arthroscopic osteochondroplasty was associated with worse Hip Outcome Score Activities of Daily Living (HOS ADL) scores compared with lavage at 12 months (N=178, adjusted MD in changes scores -5.03, 95% CI -10.40 to -0.03).[9] The estimate was imprecise and below the published MCID of 8.3 points;[171] it is unclear if this difference is clinically important. There were no differences between treatment groups on other functional measures (HOS Sport, International Hip Outcome Tool [iHOT]-12 scores) at 12 months. Again, differences between groups on both measures were below published MCIDs of 14.5[171] and 13.0,[137,171] respectively. Estimates were adjusted for treatment, baseline score, impingement subtype, and center. See **Table 17** for data.

3.3.1.1.3 Pain Outcomes

There was similar improvement between groups in visual analog scale (VAS) pain (0-100) scores at 12 months, however the estimate was very imprecise (N=187, adjusted MD in change scores 0.11, 95% CI -7.22 to 7.45).[9] Estimates were adjusted for treatment, baseline score, impingement subtype, and center. Multiple sensitivity analyses (center effects, missing data [i.e., complete cases], additional variables added to regression model) confirmed this result.

3.3.1.1.4 Conversion to THA

The RCT did not report on conversion to THA.

Information from the NRSI included for context would be considered insufficient to draw conclusions given substantial study limitations, primarily failure to adjust for important prognostic factors, selection bias and imprecision.

In the NRSI, patients who received femoral osteoplasty in addition to labral resection had a substantially lower frequency of conversion to THA compared with those who had isolated labral resection: 22% (5/23) vs. 59% (10/17); RR 0.37, 95% CI 0.15 to 0.88. Time to conversion was significantly shorter in the femoral osteoplasty group: mean 5.8 vs. 7.1 years (p=0.02). At the 15-year follow-up, Kaplan-Meier analysis demonstrated significantly greater THA-free survival in the femoral osteoplasty group than in the labral resection only group (78% vs. 41%, p=0.02). THA-free survival was similar between groups at 5 years (87% vs. 76%) but began to diverge by 10 years (78% vs. 59%).

In addition, one case series (N=59 hips in 57 patients)[115] that evaluated arthroscopic treatment for isolated labral tears without correction of the underlying FAI morphology (43% cam, 8% pincer, and 38% had mixed cam and pincer) reported that 16 hips (27%) converted to THA over 17 years. Conversion to THA occurred at a mean of 9 years. Of note, patients in this series were older than those in the RCTs (mean 48 years at surgery, 65 years at final follow-up) so it is possible that conversion to THA reflected natural progression of the disease. Also, the mean Tönnis grade at baseline was 1.3 (range, 0-2) and this population may have included a greater proportion of patients with Tönnis grade 2 than the RCTs.

3.3.1.1.5 Labral tear or Re-tear

There were fewer labral re-injuries in the osteochondroplasty group compared with the lavage group over 24 months, but the difference was not statistically significant (N=209, 3.8% vs. 7.7%; RR 0.50, 95% CI 0.15 to 1.59),[9] **Table 17**. All but one, which occurred in the lavage group, required revision surgery (3.8% vs. 6.7%; RR 0.57, 95% CI 0.17 to 1.88). Of note, at index surgery, labral repair was performed more frequently in the osteochondroplasty versus lavage group (73% vs. 47%), likely due to the higher proportion of complete labral tears identified in this group (52% vs. 41%). It is unclear how this may have impacted re-injury rates. Labral re-injury requiring reoperation is also included in the adverse events section below, as one indication for revision surgery.

3.3.1.1.6 Progression to OA

One patient who received arthroscopic osteochondroplasty progressed to hip OA (1.0% [1/105] vs. 0% [0/104] with lavage) by 24 months. This patient underwent revision surgery.[9]

3.3.1.1.7 Quality of Life

Both groups showed similar improvement in QoL scores at 12 months on all measures used: Short-Form 12 (SF-12) Physical Component Score (PCS) and Mental Component Score (MCS), EuroQol-5 dimensions (EQ-5D) Index score and EQ-5D VAS score (**Table 17**).[9]

3.3.1.1.8 Range of Motion

Hip range of motion generally improved from baseline to immediately post-treatment and 12 months with no between-group differences (**Table 17**).[9]

Table 17. Effectiveness Outcomes reported in the FIRST trial (arthroscopy vs. lavage)

Outcome Group	Outcome	Follow-Up	Arthroscopy vs. Physiotherapy MD or RR (95% CI), number of patients
Function	HOS-ADL (scale 0-100, higher=better)	12 months	Adj MD in change scores from baseline* -5.03 (-10.04 to -0.03), n=93 vs. 85
	HOS-Sport (scale 0-100, higher=better)	12 months	Adj MD in change scores from baseline* -6.72 (-14.13 to 0.69), n=84 vs. 79
	iHOT-12 (scale 0-100, higher=better)	12 months	Adj MD in change scores from baseline* -4.10 (-12.79 to 4.60), n=63 vs. 67
Pain	VAS Pain (scale 0-100, higher=worse)	12 months	Adj MD in change scores from baseline* 0.11 (-7.22 to 7.45), n=89 vs. 98
Labral Re-Injury	Any labral reinjury, % (n/N)	24 months	3.8% (4/105) vs. 7.7% (8/104), RR 0.50 (0.15 to 1.59)
	Labral re-injury requiring surgery	24 months	3.8% (4/105) vs. 6.7% (7/104), RR 0.57 (0.17 to 1.88)
	Labral re-Injury not requiring surgery	24 months	0% (0/105) vs. 1.0% (1/104)
QoL	EQ-5D Index (scale 0-1, higher=better)	12 months	Adj MD in change scores from baseline* -0.026 (-0.076 to 0.025), n=64 vs. 67
	EQ-5D VAS (scale 0-100, higher=better)	12 months	Adj MD in change scores from baseline* -0.81 (-7.44 to 5.81), n=64 vs. 68
	SF-12 PCS (scale 0 to 100, higher=better)	12 months	Adj MD in change scores from baseline* -0.93 (-3.34 to 1.49), n=93 vs. 88
	SF-12 MCS (scale 0 to 100, higher=better)	12 months	Adj MD in change scores from baseline* -0.18 (-2.72 to 2.36), n=93 vs. 88
Progression to Arthritis	Progression to Hip OA	24 months	1.0% (1/105) vs. 0% (0/104)
ROM	Flexion	Post-treatment	MD -3.0 (-10.04 to 4.04), n=77 vs. 80
	Flexion	12 months	MD 1.3 (-4.00 to 6.60), n=92 vs. 88
	Extension	Post-treatment	MD 1.3 (-3.07 to 5.67), n=66 vs. 70
	Extension	12 months	MD 1.9 (-1.99 to 5.79), n=92 vs. 88
	Abduction	Post-treatment	MD -2.5 (-7.78 to 2.78), n=70 vs. 72
	Abduction	12 months	MD 3.6 (0.00 to 7.20), n=90 vs. 87
	Adduction	Post-treatment	MD -1.3 (-4.42 to 1.82), n=68 vs. 70
	Adduction	12 months	MD 3.5 (0.09 to 6.91), n=89 vs. 87
	Internal Rotation (neutral)	Post-treatment	MD -2.5 (-6.59 to 1.59), n=71 vs. 75
	Internal Rotation (neutral)	12 months	MD 2.0 (-1.97 to 5.97), n=87 vs. 88
	External Rotation (neutral)	Post-treatment	MD 0.2 (-5.45 to 5.85), n=70 vs. 75
	External Rotation (neutral)	12 months	MD 2.8 (-0.39 to 5.99), n=87 vs. 88

Outcome Group	Outcome	Follow-Up	Arthroscopy vs. Physiotherapy MD or RR (95% CI), number of patients
	Internal Rotation (90 degree flexion)	Post-treatment	MD -2.1 (-6.29 to 2.09), n=67 vs. 73
	Internal Rotation (90 degree flexion)	12 months	MD 3.8 (-0.87 to 8.47), n=88 vs. 87
	External Rotation (90 degree flexion)	Post-treatment	MD 2.3 (-3.20 to 7.80), n=68 vs. 73
	External Rotation (90 degree flexion)	12 months	MD 4.2 (-0.19 to 8.59), n=88 vs. 87

Adj = adjusted, CI = confidence interval, HOS ADL = Hip Outcome Score activities of daily living score, HOS Sport = Hip Outcome Score sport activities score, iHOT-12 = International Hip Outcome Tool – 12 item questionnaire, MD = mean difference, no. = number, NR = not reported, RR = risk ratio, VAS = visual analog scale.
*From the multiple logistic regression analysis that includes treatment, baseline score, impingement subtype, and center as independent variables.

3.3.1.2 Arthroscopy versus Physical Therapy

3.3.1.2.1 Description of Included Studies

Five RCTs (in 9 publications)[74,76,96,135,138,139,157,175,176] compared arthroscopic surgery with physical therapy (PT).

Mean patient age ranged from 30 to 48 years and 34% to 61% of patients were male. Other patient demographics were not consistently reported across trials. Two trials reported race (White, 68% to 92%),[135,138] two trials reported BMI (mean 26.2 and 26.4; i.e., overweight)[138,176] and three trials reported the proportion of patients who were current smokers (range, 10% to 23%).[76,96,135] One trial was conducted in active duty, primarily enlisted, military personnel.[135] The majority of patients across four trials did not have arthritis or had mostly mild arthritis (no greater than grade 1 OA). The trial in military personnel did not report baseline OA status but based on the eligibility criteria, only patients with at least 2 mm of hip joint space on imaging were included, while those with joint space narrowing less than 2 mm (for whom hip OA was considered the more likely diagnosis) were excluded.[135] Patients generally presented with either hip or groin pain and had FAI confirmed via imaging. Across three trials,[76,96,135] symptom duration was at least 2 years; one trial required symptom duration greater than 3 months for inclusion, and one trial did not report symptom duration. The most common type of FAI was cam impingement (range, 44.3% to 94%), followed by mixed cam and pincer (range, 6% to 19%) and pincer (range, <1% to 17%). Labral tear was an inclusion criterion in one trial;[138,139] the other trials did not report the proportion of patients with labral tear at baseline. Two trials[135,138,139] required failure of conservative treatment ranging from 6 weeks to at least 3 months duration prior to enrollment. Only one trial[135] described conservative treatment, which included NSAIDs, patient education, and handout-based home exercise. Follow-up ranged from 12 to 38 months across trials. See **Table 18** for other demographic information.

Procedural details for individuals were not well-reported across trials. Three trials[76,135,138] primarily performed osteoplasty with one[76] reporting supplemental chondroplasty in 20% of patients. One trial[176] performed osteochondroplasty (91%) or a labral procedure alone (9%), and one trial performed osteoplasty or osteochondroplasty as indicated but did not report the frequency of either procedure. Labral treatment was performed to some extent in all trials. Two trials[76,176] reported labral repair (range, 25% to 71%) and labral debridement (25% to 40%) as the most common procedures. Partial capsulotomy was performed in all procedures in one trial;[138] capsular procedures were otherwise not

reported. All trials provided post-surgical physical therapy. Additional surgical details are presented in **Appendix Table E-4**. The non-operative groups received supervised physical therapy in all trials.[76,96,135,138,176] Patients attended an average of 6 to 12 sessions in most trials,[76,96,135,176] whereas one trial[138] provided a more intensive program consisting of at least 24 sessions. Physical therapy regimens were generally individualized but commonly included assessment of the patient, mobilization techniques, core strengthening, progressive exercise, patient education, and pain control. See **Appendix Table E-5 for other PT variables.**

Two trials each were performed in the United States[135,138] and United Kingdom[76,176] and one in Australia.[96] Three trials were government funded,[76,96,135] one was funded by an academic institution,[176] and one received nonprofit funding.[138] All five trials were rated moderate risk of bias. Methodological limitations included differences between groups in baseline characteristics, lack of provider and patient blinding, and unacceptable loss to follow-up.

Table 18. Demographic information for RCTs comparing arthroscopic surgery with physical therapy in adults with FAIS

Study, Year	UK FASHIoN Trial (Griffin, 2018; Griffin, 2022)[74,76]	FAIT Trial (Palmer, 2019; Palmer, 2025)[175,176]	Mansell, 2018[135]	Martin Trial (Martin, 2021; Martin, 2024)[138,139]	Australian FASHIoN Trial (Hunter, 2021; Murphy, 2023)[96,157]
N Randomized	348*	222	80†	110	99
Intervention	Arthroscopic surgery	Arthroscopic surgery	Arthroscopic surgery‡	Arthroscopic surgery	Arthroscopic surgery
Comparator	PT	PT	PT‡	PT	PT
Crossover During Study Period	Crossover to surgery: 8%	Crossover to PT: 4%§ Crossover to surgery: 3%	Crossover to PT: 5%§ Crossover to surgery: 70%	Crossover to Surgery: 71.1%	Crossover to Surgery: 6.0%
Post-Operative PT	Yes	Yes	Yes	Yes	Yes
Age, years; mean (SD)	35.3 (9.6)	36.2 (9.7)	30.1 (7.4)	48 (5.7)	33 (NR)
% males	61%	34%	59%	41%	58%
Morphology type	Cam: 75% Pincer: 8% Mixed: 17%	Cam: 94% Pincer: <1% Mixed: 6%	NR	Cam: 44.3% Pincer: 50.5%	Cam: 63% Pincer: 18% Mixed: 19%
Baseline function	iHOT-33: 37.4	HOS-ADL: 65.9	iHOT-33: 28.9	iHOT-33: 39.5 mHHS: 63.4 HOOS-ADL: 72.0 HOOS-Sport: 42.6	iHOT-33: 41.9 HOOS Symptoms: 49.9 HOOS-ADL: 67.5 HOOS-Sport: 47.4
Symptom duration (years)	39 months	NR	>2 years: 53.8%	>3 months††	Median 20 months
Labral tears	NR	NR‡‡	NR	100%††	NR
Arthritis	Tonnis Grade >1: 0%§§	Kellgren-Lawrence grade** 0: 80% 1: 15% ≥2: 0%§§	NR	Tonnis Grade 0: 35.1% 1: 47.4% 2: 17.5%	0%§§
Hip laterality	Right: 57% Left: 43%	Right: 57% Left: 43%	Right: 60% Left: 40%	Left: 47.4% Right: 52.6%	Left: 54% Right: 46%
Mean LCEA	31º	NR	NR	33.1º	>40 degrees††
BMI	NR	26.2	NR	26.4	NR

Study, Year	UK FASHIoN Trial (Griffin, 2018; Griffin, 2022)[74,76]	FAIT Trial (Palmer, 2019; Palmer, 2025)[175,176]	Mansell, 2018[135]	Martin Trial (Martin, 2021; Martin, 2024)[138,139]	Australian FASHIoN Trial (Hunter, 2021; Murphy, 2023)[96,157]
Current smoker	16%	NR	23%	NR	10%
Country	UK	UK	USA	US	Australia
Funding	Government	Academic, Government	Government	Nonprofit	Government
Risk of Bias	Moderate	Moderate	Moderate	Moderate	Moderate

ADL = activities of daily living subscale, HOS = Hip Outcome Score, HOOS = Hip Disability and Osteoarthritis Outcome Score, iHOT-33 = International Hip Outcome Tool – 33 question assessment, LCEA = lateral center-edge angle, mHHS = Modified Harris Hip Score, NR = not reported, PT = physical therapy, RCT = randomized control trial, SD = standard deviation, Sport = sport subscale, Symptoms = symptoms subscale.

* By 12 months, 16% of patients randomized to receive hip arthroscopy and 5% of personalized hip therapy patients had not received any treatment. Additionally, 8% of personalized hip therapy patients that had received some or all of their treatment went on to receive hip arthroscopy at their own request.

† 91% of patients were active-duty service members.

‡ All patients originally underwent 6 weeks of self-management following a self-management class. Patients were given the option to enroll in the study if they were unsatisfied after 6 weeks.

§ Patients that were randomized to receive arthroscopic surgery but received PT and never had surgery.

** 5% of patients did not have radiographs.

†† Inclusion criteria.

‡‡ 96% of patients underwent labral procedure and 70% underwent labral repair specifically, but it is not possible to determine true prevalence of labral tear

§§ Exclusion criteria.

3.3.1.2.2 Function Outcomes

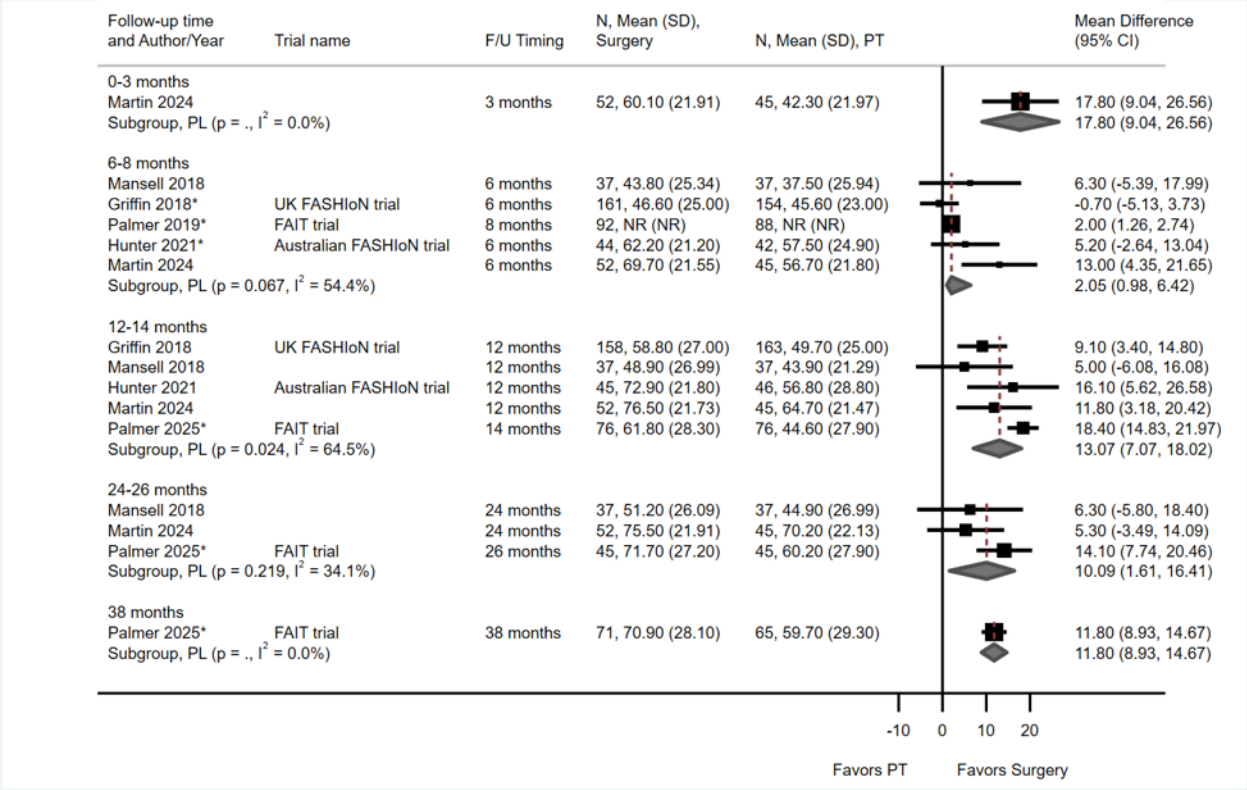
3.3.1.2.2.1 Responders (clinically meaningful improvement)

Only one RCT (in 2 publications)[175,176] reported the proportion of patients who achieved a clinically meaningful improvement in function. Based on the HOS-ADL subscale, arthroscopy was associated with a moderate increase in the likelihood of achieving a MCID of at least 9 points at 8 months post-randomization (51% [51/100] vs. 32% [29/91]; RR 1.60, 95% CI 1.12 to 2.29)[176] and small increase at 38 months post randomization (67% [58/86] vs. 48% [41/85], RR 1.40, 95% CI 1.07 to 1.82)[175] compared with PT. Arthroplasty was also associated with a substantially greater likelihood of achieving a patient acceptable symptom state (PASS), defined as an HOS-ADL score >87 points, at 8 months post-randomization (48% [48/100] vs. 19% [17/91]; RR 2.57, 95% CI 1.60 to 4.13).[176]

3.3.1.2.2.2 iHOT-33 measure

All five trials (6 publications)[76,96,135,139,175,176] reported function using the iHOT-33, **Figure 2**. Compared with PT, arthroscopy was associated with a clinically important improvement in iHOT-33 scores (0-100 scale) at all time points except 6 to 8 months. Clinically important improvements were seen at 3 months (1 RCT, N=97),[139] 12-14 months (5 RCTs, N=735),[76,96,135,139,175] 24-26 months (3 RCTs, N=261),[135,139,175] and 38 months (1 RCT, N=136),[175] with MDs ranging from 10.09 to 17.80, meeting or exceeding published MCIDs (range, 6.1 to 12.1)[107,155,171] At the 6 to 8 month timepoint (5 RCTs, N=752),[76,96,135,139,176] the pooled estimate was statistically significant favoring arthroscopy but did not meet MCID thresholds. It is unclear if this difference is clinically meaningful.

Figure 2. iHOT-33 scores following hip arthroscopy versus physical therapy in adults with femoroacetabular impingement syndrome.



CI = confidence interval; F/U = follow-up; iHOT-33 = International Hip Outcome Tool 33-questions; PL = profile likelihood; PT = physical therapy; SD = standard deviation.

* Adjusted MD as reported by authors. For Griffin 2018 at 6-8 months, MD is adjusting for the fixed effects of impingement type, sex, and baseline iHOT-33 score, where baseline scores are 39.2 vs. 35.6 for surgery and PT groups. Thus, although the follow-up score of surgery is higher, the adjusted MD is negative. Palmer 2019/2025 is adjusted for gender, age at randomization and the baseline value, using mixed-effects model. Hunter is based on regression model including adjustment for baseline.

3.3.1.2.2.3 HOS- and HOOS-ADL and HOS- and HOOS-Sport measures

Four trials (5 publications)[96,135,139,175,176] reported function using the HOS- or Hip Disability and Osteoarthritis Outcome Score (HOOS)-ADL and HOS- or HOOS-Sport subscales (0-100 scale for both), **Figure 3** and **Figure 4.**

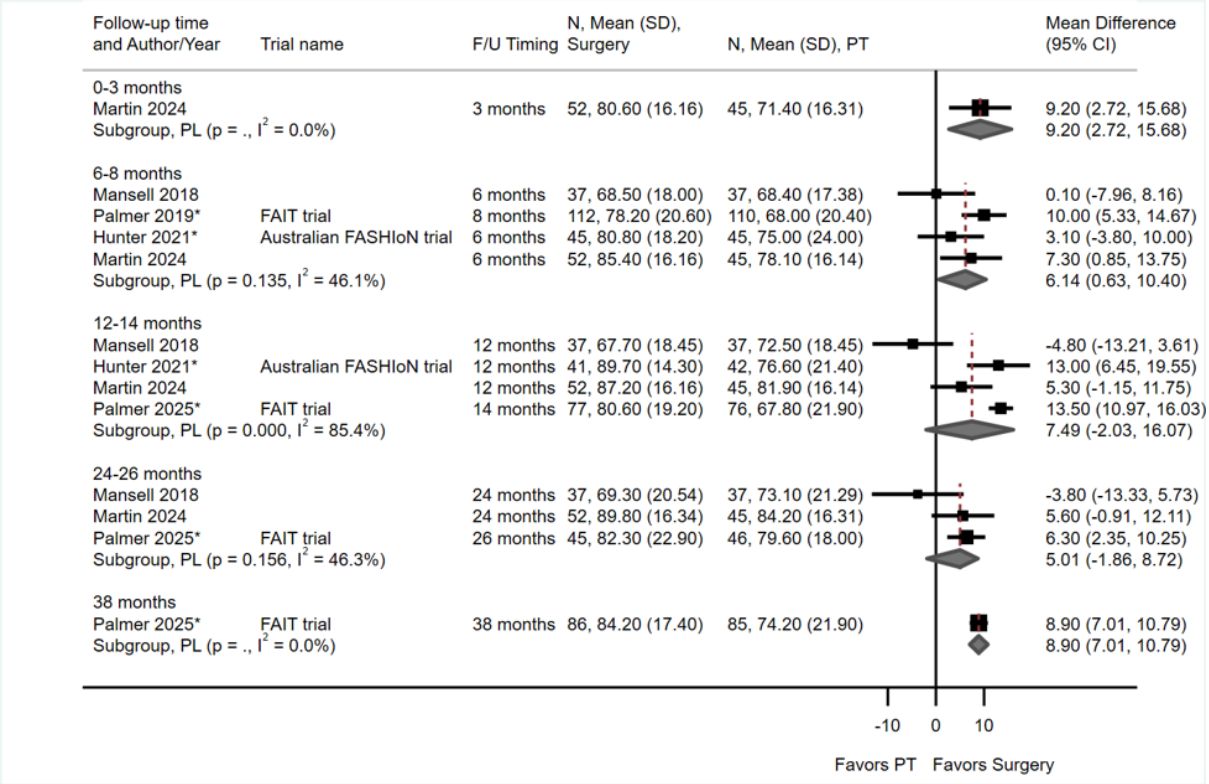
For the **HOS-/HOOS-ADL**, arthroplasty was associated with a clinically important improvement compared with PT at 3 months (1 RCT, N=97)[139] and 38 months (1 RCT, N=171)[175] with MDs of 9.20 and 8.90 respectively, meeting the published MCIDs of 6 to 8.3[171] (**Figure 3**). At 6-8 months (4 RCTs, N=483),[96,135,139,176] the pooled estimate favored arthroscopy and was statistically significant but did not meet the published MCID thresholds. It is unclear if this difference is clinically meaningful. There was no difference between groups at 12-14 months (4 RCTs)[96,135,139,175] and 24-26 months (3 RCTs).[135,139,175]

For the **HOS-Sport**, while arthroplasty was associated with a statistically significant improvement in scores compared with PT at 12-14 months (4 RCTs, N=407; MD 11.05)[96,135,139,175] and 38 months (1 RCT, N=171; MD 9.90)[175] the estimates did not meet the published MCID of 14.5.[171] It is unclear if these differences are clinically meaningful. Individually, the trial that reported the HOOS-Sport[96] found arthroscopy associated with a clinically important improvement at 12-14 months (MD 13.00; MCID 10) whereas none of trials that reported the HOS-Sport demonstrated a clinically important benefit. There

was no difference between groups at other timepoints: 3 months (1 RCT, N=97),[139] 6-8 months (4 RCTs, N=451),[96,135,139,176] and 24-26 months (3 RCTs, N=262)[135,139,175] (**Figure 4**).

One trial[135] was a consistent outlier for both outcomes, tending to slightly favor PT or finding no difference between groups at any timepoint. This RCT was conducted primarily in an active duty military population (91%), included the youngest participants of the included trials (30 years vs. 33-48 years), and had a very high rate of crossover (70%). It was also the only trial that did not report the type of FAI being treated (cam, pincer, mixed) or the grade of OA. In addition, it was the only trial to report the prevalence of mental health disorders and depression by treatment group, which were common in this population (34% and 15%, respectively). After removal of this outlier trial at 6-8 months, 12-14 months and 24-26 months,[135] arthroscopy was associated with improvement in HOS-/HOOS-ADL and Sport scores at all these timepoints compared with PT (**Appendix Figures G-1 and G-2**). However, only the effect estimate at 12-14 months for the ADL subscale was clinically meaningful (MD 12.47, 3 RCTs),[96,139,175] exceeding the published MCID of 8.3.[171] For the Sport subscale, the largest between-group difference favoring arthroscopy was also seen at 12-14 months (MD 12.44, 3 RCTs);[96,139,175] while neither the pooled estimate or the individual trials reporting the HOS-Sport (MDs 5.3 and 13.5)[139,175] reached the published MCID of 14.5,[171] the trial reporting the HOOS-Sport[96] found a clinically important difference between groups (MD 13.0) exceeding the published MCID of 10 for this specific measure.[107]

Figure 3. HOS-ADL and HOOS-ADL scores following hip arthroscopy versus physical therapy in adults with femoroacetabular impingement syndrome

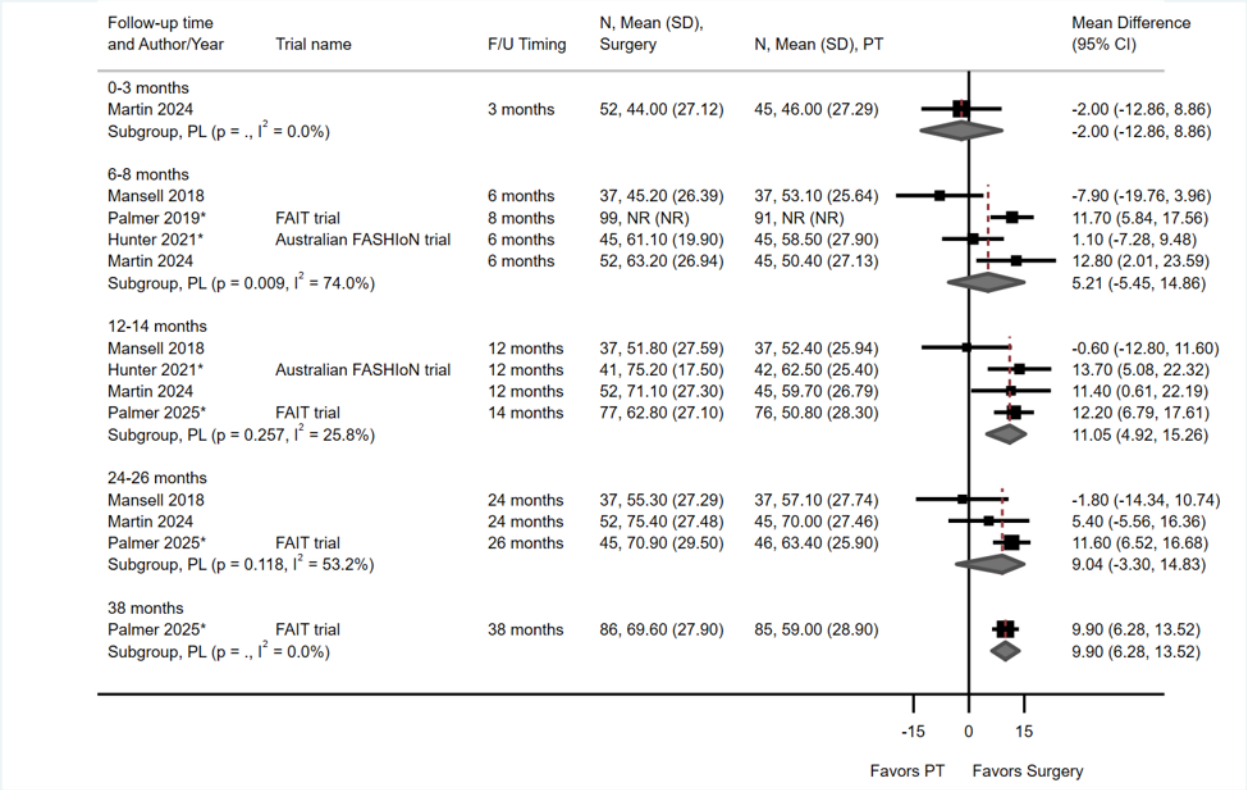


CI = confidence interval; F/U = follow-up; HOOS-ADL: Hip Disability and Osteoarthritis Outcome Score activities of daily living subscale; HOS ADL = Hip Outcome Score activities of daily living subscale; PL = profile likelihood; PT = physical therapy; SD = standard deviation.

NOTE: All trials used the HOS-ADL measure except for Hunter 2021 which used the HOOS-ADL.

*Adjusted MD as reported by authors. Palmer 2019/2025 is adjusted for gender, age at randomization and the baseline value, using mixed-effects model. Hunter 2021 is based on regression model including adjustment for baseline.

Figure 4. HOS-Sport and HOOS-Sport scores following hip arthroscopy versus physical therapy in adults with femoroacetabular impingement syndrome

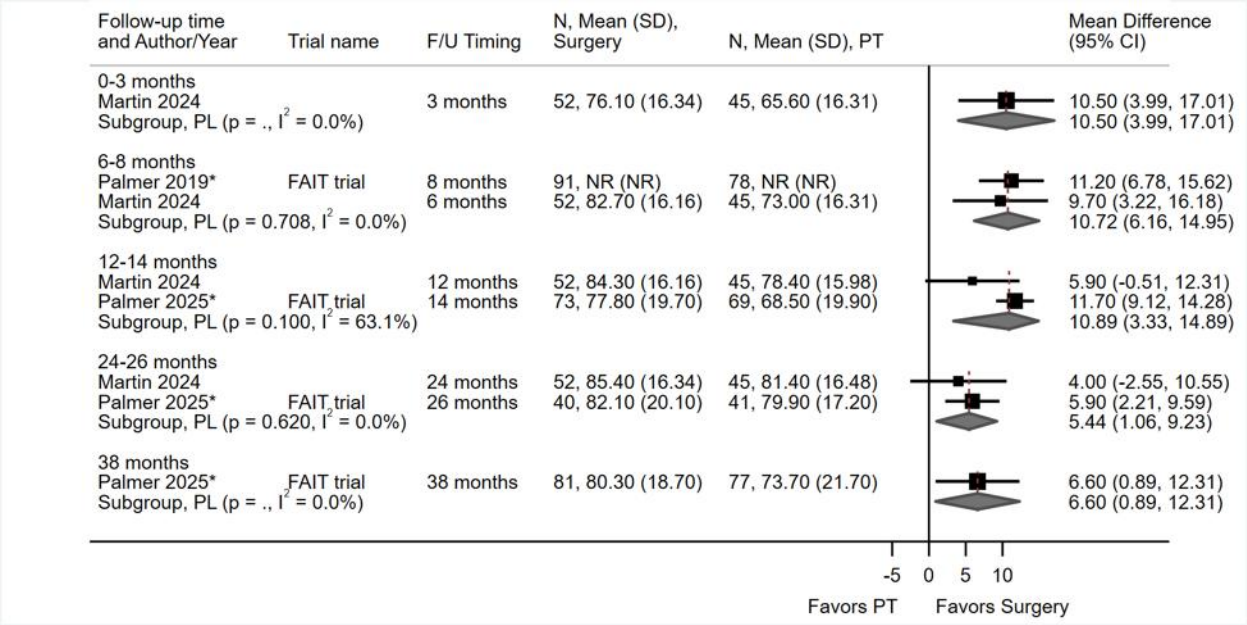


CI = confidence interval; F/U = follow-up; HOOS-Sport: Hip Disability and Osteoarthritis Outcome Score sports subscale; HOS Sport = Hip Outcome Score sports subscale; PL = profile likelihood; PT = physical therapy; SD = standard deviation.
NOTE: All trials used the HOS-Sport measure except for Hunter 2021 which used the HOOS-Sport.
*Adjusted MD as reported by authors. Palmer 2019/2025 is adjusted for gender, age at randomization and the baseline value, using mixed-effects model. Hunter 2021 is based on regression model including adjustment for baseline.

3.3.1.2.2.4 NAHS measure

Two trials (3 publications)[139,175,176] reported function using the Nonarthritic Hip Score (NAHS; 0-100 scale), **Figure 5.** Compared with PT, arthroscopy was associated with clinically important improvements in NAHS scores at 3 months (1 RCT, N=97),[139] 6 to 8 months (2 RCTs, N=266),[139,176] and 12 to 14 months (2 RCTs, N=239),[139,175] with MDs ranging from 10.50 to 10.89, exceeding the published MCID of 8.5.[22] At 24-26 months (2 RCTs, N=178)[139,175] and 38 months (1 RCT),[175] the estimates favored arthroscopy and were statistically significant but did not meet the MCID threshold (MD 5.44 and 6.60, respectively). The only published MCID we identified was derived from adult patients with various hip disorders and was not specific to FAIS. All estimates were imprecise.

Figure 5. NAHS scores following hip arthroscopy versus physical therapy in adults with femoroacetabular impingement syndrome



CI = confidence interval; F/U = follow-up; NAHS = Non-arthritic Hip Score; PL = profile likelihood; PT = physical therapy; SD = standard deviation.

*Palmer 2019/2025 reported adjusted MDs, adjusted for gender, age at randomization and the baseline value, using mixed-effects model.

3.3.1.2.2.5 Other Function Measures

Across several other function measures reported by two trials (**Table 19**),[139,175,176] arthroscopy was associated with improvements in scores at all timepoints compared with PT, with a few exceptions (modified Harris Hip Score [mHHS] at 12, 24 months; Low Extremity Function Scale [LEFS] at 3 months). Except for the Copenhagen Hip and Groin Outcome Score (HAGOS)-Sport, for which the between-group improvements met or exceeded the MCID at all time points, clinically important differences were not consistently observed across outcomes and were generally limited to the earlier follow-up timepoints. Based on a published validation study, the MCID for the HAGOS-Physical Activity (PA) scale could not be established and use of this HAGOS subscale is not recommended.[107]

Table 19. Additional function outcomes following hip arthroscopy versus physical therapy in adults with femoroacetabular impingement syndrome

Author Trial	Outcome*	Timing	Arthroplasty Mean (SD) (n)	PT Mean (SD) (n)	MD (95% CI)†	Published MCID
Palmer 2019, 2025[175,176]	HAGOS-ADL	8 mos.	NR (n=92)	NR (n=88)	Adj. MD 11.6 (6.7 to 16.6)	9
	HAGOS-ADL	14 mos.	77.7 (23.8) (n=76)	67.0 (25.7) (n=75)	MD 10.7 (7.8 to 13.5)	9
	HAGOS-ADL	26 mos.	83.6 (22.2) (n=45)	77.4 (19.8) (n=45)	MD 7.7 (2.9 to 12.5)	9
	HAGOS-ADL	38 mos.	82.1 (20.0) (n=70)	77.0 (23.2) (n=65)	MD 6.3 (3.8 to 8.8)	9
FAIT trial	HAGOS-Sport	8 mos.	NR (n=92)	NR (n=88)	Adj. MD 13.1 (7.0 to 19.1)	9
	HAGOS-Sport	14 mos.	58.5 (29.3) (n=75)	44.9 (28.3) (n=75)	MD 15.7 (10.2 to 21.3)	9

Author Trial	Outcome*	Timing	Arthroplasty Mean (SD) (n)	PT Mean (SD) (n)	MD (95% CI)†	Published MCID
	HAGOS-Sport	26 mos.	66.2 (29.9) (n=45)	59.4 (27.2) (n=45)	MD 12.4 (8.6 to 16.2)	9
	HAGOS-Sport	38 mos.	65.4 (30.9) (n=70)	56.6 (29.2) (n=64)	MD 11.9 (9.1 to 14.6)	9
	HAGOS-PA	8 mos.	NR (n=92)	NR (n=88)	Adj. MD 14.6 (7.2 to 22.0)	1‡
	HAGOS-PA	14 mos.	43.4 (33.3) (n=76)	26.4 (30.9) (n=74)	MD 17.7 (9.9 to 25.5)	1‡
	HAGOS-PA	26 mos.	57.8 (34.5) (n=45)	38.3 (36.4) (n=45)	MD 24.1 (19.3 to 28.9)	1‡
	HAGOS-PA	38 mos.	53.8 (36.6) (n=70)	43.5 (35.0) (n=65)	MD 13.2 (9.7 to 16.6)	1‡
	OHS	8 mos.	NR (n=92)	NR (n=87)	Adj. MD 5.3 (3.2 to 7.5)	5.2
	OHS	14 mos.	36.6 (10.2) (n=76)	31.3 (11.1) (n=75)	MD 5.4 (4.5 to 6.3)	5.2
	OHS	26 mos.	38.6 (10.2) (n=45)	36.7 (9.5) (n=45)	MD 3.3 (0.6 to 6.0)	5.2
	OHS	38 mos.	38.5 (9.8) (n=70)	35.4 (10.0) (n=65)	MD 3.7 (2.5 to 4.8)	5.2
	UCLA	8 mos.	NR (n=92)	NR (n=88)	Adj. MD 0.6 (0.1 to 1.0)	NR
Martin 2021, 2024[138,139]	mHHS	3 mos.	77.0 (16.4) (n=52)	64.4 (16.6) (n=45)	Adj. MD 12.6 (6.0 to 19.2)	range: 8-9.5
	mHHS	6 mos.	80.8 (16.0) (n=52)	73.5 (16.4) (n=45)	Adj. MD 7.3 (0.8 to 13.8)	range: 8-9.5
	mHHS	12 mos.	84.5 (16.4) (n=52)	78.5 (16.3) (n=45)	Adj. MD 6.0 (-0.5 to 12.5)	N/A (NS)
	mHHS	24 mos.	85.8 (16.4) (n=52)	81.0 (16.4) (n=45)	Adj. MD 4.8 (-1.8 to 11.4)	N/A (NS)
	LEFS	3 mos.	50.7 (15.3) (n=42)	49.1 (13.7) (n=39)	Adj. MD 1.6 (-4.7 to 8.0)	N/A (NS)
	LEFS	6 mos.	59.6 (15.1) (n=42)	50.8 (13.5) (n=39)	Adj. MD 8.8 (2.6 to 15.1)	9
	LEFS	12 mos.	62.5 (15.5) (n=42)	56.2 (12.8) (n=39)	Adj. MD 6.3 (0.1 to 12.5)	9

Adj. = adjusted; ADL = activities of daily living; HAGOS = Copenhagen Hip and Groin Outcome Score; HOS = Hip Outcome Score; LEFS = Lower Extremity Functional Scale; MCID = minimal clinically important difference; MD = mean difference; mHHS = modified Harris hip score; N/A = not applicable; NR = not reported; NS = not statistically significant; OHS = Oxford hip score; PA = participation in physical activities; PT = physical therapy; RR = risk ratio; UCLA = UCLA activity score.
*HAGOS and mHHS use a 0-100 scale; OHS uses a 0-48 scale; UCLA uses a 1-10 scale; and LEFS uses a 0-80 scale. For all outcomes a higher score means better function/activity levels.
†Palmer: adjusted estimates controlled for baseline patient reported outcome measure, sex, age, study site, and time from randomization.
‡Authors state that it was very difficult to be certain of the validity of this finding because of the large ceiling effects and reduced capacity for change. Therefore, they cannot recommend the use of this subscale of the HAGOS.

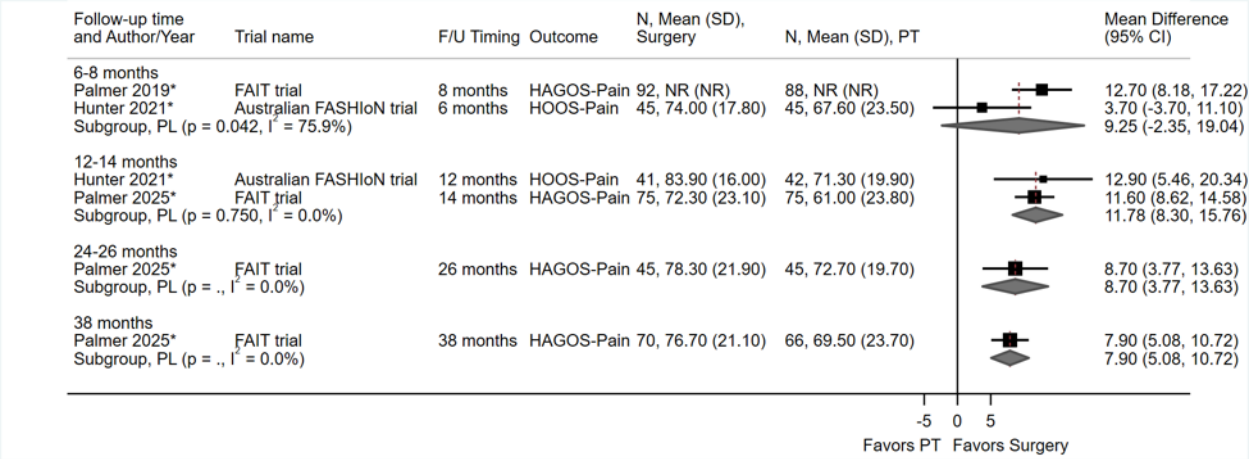
3.3.1.2.3 Pain Outcomes

3.3.1.2.3.1 HAGOS and HOOS pain scales

Two RCTs (in 3 publications)[96,175,176] reported pain using different but similar measures, the HAGOS pain scale and HOOS pain scale (0-100 scale for both). Compared with PT, arthroscopy was associated with clinically important improvements in pain across both trials at 12-14 months (2 RCTs, N=233; MD 11.78)[96,175] and at 26 months (1 RCT, N=90; MD 8.70) and 38 months (1 RCT, N=136; MD 7.90) in one trial,[175] meeting or exceeding the published MCIDs (HAGOS-pain: 6; HOOS-pain: 9).[107] At the earliest timeframe, 6 to 8 months post-randomization, the pooled estimate showed no difference between groups (2 RCTs, N=270; MD 9.25, 95% CI -2.35 to 19.04, I^2=75.9%),[96,176] however there was substantial heterogeneity and the estimate was imprecise. Individually, one trial showed a clinically important improvement in HAGOS pain scores favoring arthroscopy (MD 12.70, 95% CI 8.18 to 17.22)[176] while the other showed no difference between groups in HOOS-pain scores (MD 3.70, 95% CI -3.70 to 11.10).[96] Populations differed slightly with the trial that favored arthroscopy enrolling fewer males (58% vs. 34%)

and a higher proportion of patients with cam type FAI type (94% vs. 63%).[176] It is unclear whether these differences or other factors may have impacted results.

Figure 6. HAGOS-Pain and HOOS-Pain scores following hip arthroscopy versus physical therapy in adults with femoroacetabular impingement syndrome.



CI = confidence interval; F/U = follow-up; PL = profile likelihood; HAGOS = Copenhagen Hip and Groin Outcome Score; HOOS = Hip Disability and Osteoarthritis Outcome Score; PT = physical therapy; SD = standard deviation.

*Adjusted MD as reported by authors. Palmer 2019/2025 is adjusted for gender, age at randomization and the baseline value, using mixed-effects model. Hunter 2021 is based on regression model including adjustment for baseline.

3.3.1.2.3.2 Other Pain Measures

Two trials reported additional pain measures (**Table 20**). Arthroscopy was associated with improvements in PainDETECT scores compared with PT at all timepoints (8, 12, 24 and 38 months) in one trial.[175,176] We were unable to find a published MCID for this measure, so it is unclear if these differences are clinically meaningful. In the other trial, arthroscopy was associated with a clinically important improvement in VAS pain scores (i.e., met or exceeded the published MCID of 1.5)[17,137] at 3 months but not at 6 months (estimate below the MCID) compared with PT; there were no differences between groups at later timepoints.[139] One of these trials also reported that fewer patients who received arthroscopy versus PT reported pain on hip flexion (N=185, 47% vs. 66%; RR 0.72, 95% CI 0.56 to 0.93), hip adduction (N=181, 31% vs. 46%; RR 0.67, 95% CI 0.46 to 0.97) and the FAbER (flexion, abduction, and internal rotation) test (N=180, 44% vs. 62%; RR 0.71, 95% CI 0.53 to 0.94) at 8 months.[176] There were no differences between groups on other assessments: hip extension, abduction, internal and external rotation, and the FAdIR (flexion, adduction, and internal rotation) test. The clinical relevance of these differences is unclear.

Table 20. Additional pain outcomes following hip arthroscopy versus physical therapy in adults with femoroacetabular impingement syndrome

Author, year	Outcome*	Timing	Arthroscopy Mean (SD) (n)	PT Mean (SD) (n)	MD (95% CI)
Palmer 2019, 2025[175,176]	PainDETECT	8 months	NR (n=61)	NR (n=62)	Adj. MD -2.1 (-4.0 to -0.2)†
	PainDETECT	12 months	8.5 (7.7) (n=45)	9.5 (6.9) (n=49)	-1.8 (-3.4 to -0.2)
	PainDETECT	24 months	8.5 (5.7) (n=21)	8.8 (6.0) (n=27)	-3.7 (-6.0 to -1.4)

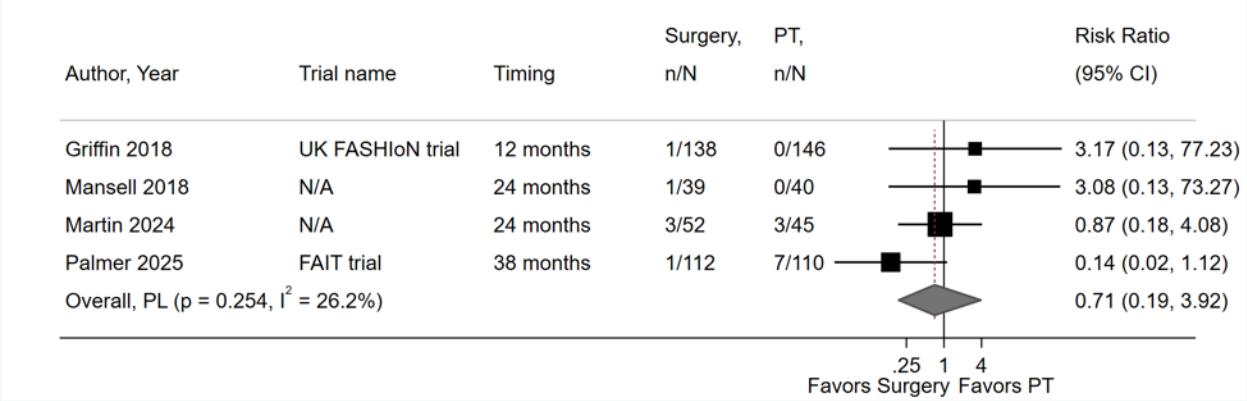
Author, year	Outcome*	Timing	Arthroscopy Mean (SD) (n)	PT Mean (SD) (n)	MD (95% CI)
FAIT trial	PainDETECT	38 months	8.7 (6.5) (n=46)	8.8 (7.3) (n=42)	-2.7 (-3.3 to -2.2)
Martin 2024[139]	VAS Pain	3 months	2.8 (2.8) (n=52)	5.0 (2.9) (n=45)	-2.2 (-3.3 to -1.1)
	VAS Pain	6 months	2.4 (2.8) (n=52)	3.6 (2.9) (n=45)	-1.2 (-2.3 to -0.1)
	VAS Pain	12 months	2.3 (2.8) (n=52)	2.8 (2.7) (n=45)	-0.5 (-1.6 to 0.6)
	VAS Pain	24 months	2.4 (2.9) (n=52)	2.6 (2.9) (n=45)	-0.2 (-1.4 to 1.0)

Adj. = adjusted; FABER = flexion abduction and external rotation; FADIR = flexion adduction and external rotation; HAGOS = Copenhagen Hip and Groin Outcome Score; HOOS = Hip Disability and Osteoarthritis Outcome Score; MD = mean difference; PT = physical therapy; RR = risk ratio; SD = standard deviation; VAS = visual analog scale.
* PainDETECT uses a -1 to 38 scale and VAS uses a 0-10 scale; for both scales a lower score is better (i.e., less pain).
†Palmer: adjusted estimates controlled for baseline patient reported outcome measure, sex, age, study site, and time from randomization.

3.3.1.2.4 Conversion to THA

Arthroscopy was associated with a similar risk of conversion to THA compared with PT across four RCTs (N=682)[76,135,139,175] over follow-up periods ranging from 12 to 38 months (RR 0.71, 95% CI 0.19 to 3.92, I^2=26.2%); the pooled estimate was imprecise (**Figure 7**). The trial with the longest follow-up reported fewer conversions to THA in the arthroplasty group but the difference was not statistically significant (0.9% vs. 6.4%, RR 0.14, 95% CI 0.02 to 1.12).[175] Sample sizes may not have been large enough and follow-up may not have been long enough in these trials to adequately capture conversion to THA.

Figure 7. Conversion to total hip arthroplasty following hip arthroscopy versus physical therapy in adults with femoroacetabular impingement syndrome.



CI = confidence interval; PL = profile likelihood; PT = physical therapy.

3.3.1.2.5 Labral Tear or Re-Tear

No trial reported the incidence of labral tear or re-tear following treatment.

3.3.1.2.6 Progression to OA

There was no difference in the risk of progression to OA following randomization to arthroscopy compared with PT (12.8% [5/39] vs. 7.5% [3/40]; RR 1.71, 95% CI 0.44 to 6.67) over 24 weeks in one

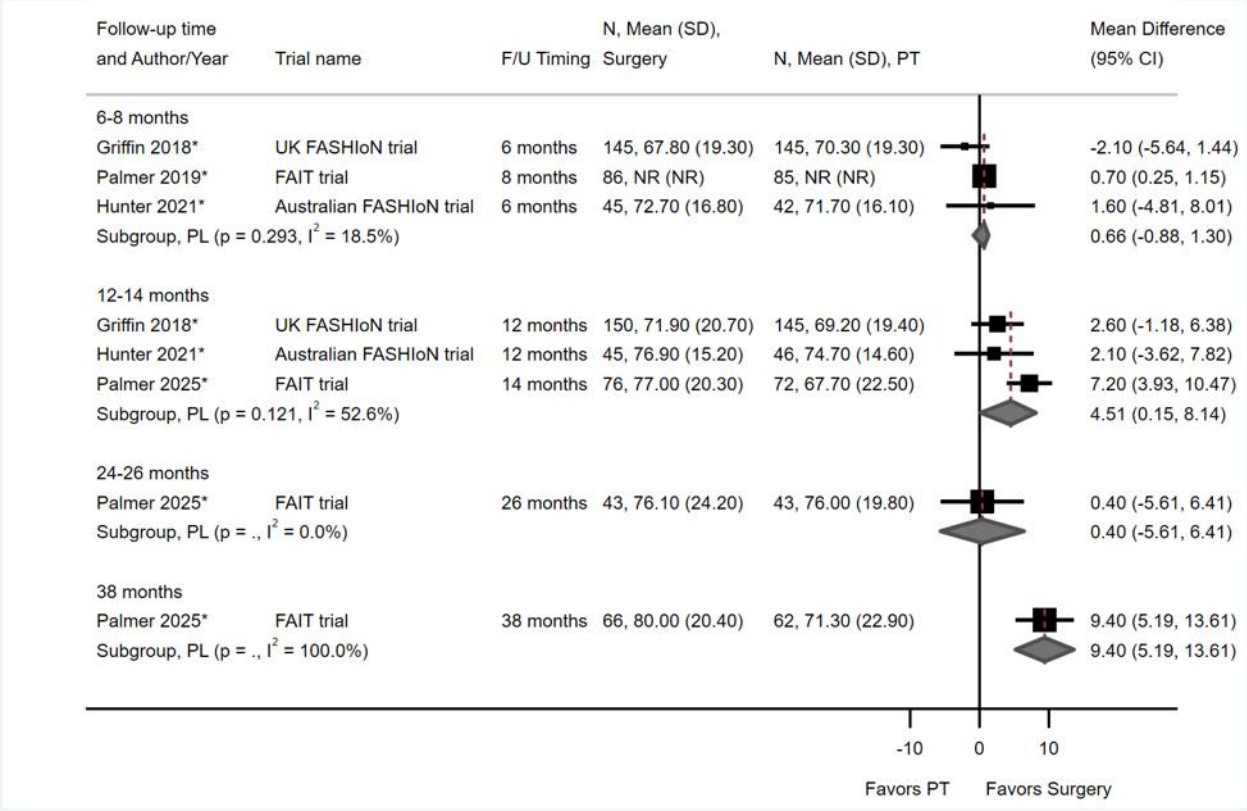
small trial conducted in active duty, primarily enlisted, military personnel.[135] The estimate is imprecise. When considering the as-treated population, accounting for PT patients that crossed over to surgery, seven of the patients who had surgery progressed to OA (10.8% [7/65]) versus only one patient who did not have surgery (7.1% [1/14]). Of note, this trial did not report patients' baseline OA grade or define how OA progression was assessed. Based on the eligibility criteria, only patients with at least 2 mm of hip joint space on imaging were included, while those with joint space narrowing less than 2 mm (for whom hip OA was considered the more likely diagnosis) were excluded.

3.3.1.2.7 Quality of Life

3.3.1.2.7.1 EQ-5D questionnaire

Three trials (in 4 publications) reported QOL using EQ-5D VAS (0-100 scale) (**Figure 8**) and EQ-5D index scores (0-1 scale) (**Figure 9**).[76,96,175,176] For both measures, arthroscopy was associated with improvement in scores at 12-14 months and 38 months compared with PT, but there were no differences at other timepoints. We could not find a published MCID for these measures, so it is unclear if the differences are clinically meaningful.

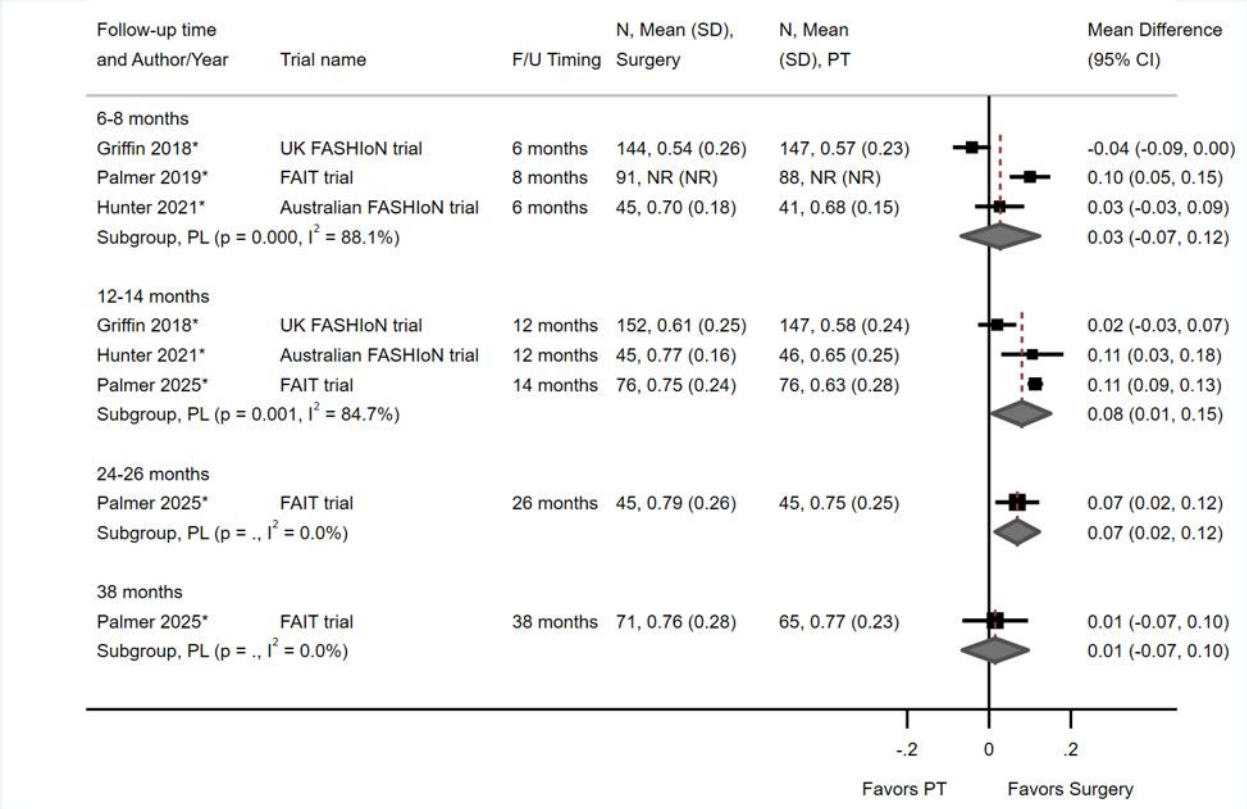
Figure 8. EQ-5D visual analogue scale scores following hip arthroscopy versus physical therapy in adults with femoroacetabular impingement syndrome



CI = confidence interval; F/U = follow-up; NR = not reported; PL = profile likelihood; PT = physical therapy; SD = standard deviation.

*Adjusted MD as reported by authors. Palmer 2019/2025 is adjusted for gender, age at randomization and the baseline value, using mixed-effects model. Hunter 2021 is based on regression model including adjustment for baseline. Griffin 2018 used a mixed-effects regression model adjusting for impingement type, sex, baseline scores and recruiting center.

Figure 9. EQ-5D-5L index scores following hip arthroscopy versus physical therapy in adults with femoroacetabular impingement syndrome



CI = confidence interval; F/U = follow-up; NR = not reported; PL = profile likelihood; PT = physical therapy; SD = standard deviation.

*Adjusted MD as reported by authors. Palmer 2019/2025 is adjusted for gender, age at randomization and the baseline value, using mixed-effects model. Hunter 2021 is based on regression model including adjustment for baseline. Griffin 2018 used a mixed-effects regression model adjusting for impingement type, sex, baseline scores and recruiting center.

3.3.1.2.7.2 Other QOL measures

Three trials (in 4 publications) evaluated QOL using a variety of measures (**Table 21**).[76,96,175,176] One trial found no differences between arthroscopy and PT in **SF-12 PCS or MCS** scores (0-100 scale) at 6 and 12 months.[76] Another trial[96] found arthroscopy associated with a clinically important improvement in **HOOS-QOL scores** (0-100 scale) compared with PT at 12 months (adj. MD 14.9; published MCID: 11[107]) but not 6 months; however, both estimates were imprecise. The third trial[175,176] found arthroscopy associated with clinically important improvements in **HAGOS-QOL scores** (0-100 scale) at 8, 12 and 24 months compared with PT with MDs ranging from 11.0 to 13.2, meeting or exceeding the published MCID of 11.[107] At 36 months, arthroscopy was favored compared with PT but the between-group difference (MD 8.0) did not meet the MCID threshold. The same trial also reported HADS Anxiety and Depression. Arthroscopy was associated with improvements in **HADS Depression** scores at all time points and **HADS Anxiety** scores at 12 months compared with PT; however, none of the between-group differences met the published MCID (ranges, 1.4-1.5 to 4.4-4.8).[42] There were no differences between groups in **HADS anxiety** scores at other timepoints.

Table 21. Additional quality-of-life outcomes following hip arthroscopy versus physical therapy in adults with femoroacetabular impingement syndrome

Author, year	Outcome	Timing	Arthroscopy Mean (SD) (n)	PT Mean (SD) (n)	MD (95% CI)
Griffin 2018,[76] UK FASHIoN trial	SF-12 PCS	6 months	43.4 (7.0) (n=146)	44.2 (6.6) (n=142)	Adj. -0.7 (-2.1 to 0.7)
	SF-12 PCS	12 months	45.1 (6.3) (n=145)	44.2 (6.4) (n=132)	Adj. 1.1 (-0.2 to 2.5)
	SF-12 MCS	6 months	42.1 (7.3) (n=146)	42.1 (7.2) (n=142)	Adj. -0.1 (-1.5 to 1.3)
	SF-12 MCS	12 months	43.2 (7.1) (n=145)	42.6 (6.9) (n=132)	Adj. 0.4 (-1.2 to 2.0)
Hunter 2021,[96] Australian FASHIoN trial	HOOS-QOL	6 months	47.2 (24.2) (n=45)	42.2 (23.3) (n=45)	Adj. MD in change scores 0.8 (-7.4 to 9.1)
	HOOS-QOL	12 months	62.7 (25.3) (n=41)	46.0 (24.3) (n=42)	Adj. MD in change scores 14.9 (4.9 to 24.8)
Palmer 2019 2025,[175,176] FAIT trial	HAGOS-QOL	8 months	NR (n=91)	NR (n=88)	Adj. 13.2 (7.5 to 19.0)
	HAGOS-QOL	12 months	50.3 (27.0) (n=76)	38.2 (24.4) (n=74)	11.0 (6.7 to 15.2)
	HAGOS-QOL	24 months	58.8 (26.5) (n=45)	49.3 (25.8) (n=45)	11.5 (7.8 to 15.2)
	HAGOS-QOL	36 months	57.2 (28.3) (n=70)	48.9 (27.1) (n=65)	8.0 (5.9 to 10.2)
	HADS Anxiety	8 months	NR (n=91)	NR (n=88)	Adj. -0.6 (-1.4 to 0.3)
	HADS Anxiety	12 months	6.0 (4.9) (n=75)	5.9 (4.6) (n=76)	-0.7 (-1.0 to -0.3)
	HADS Anxiety	24 months	5.2 (4.3) (n=45)	5.0 (5.5) (n=44)	-0.6 (-1.4 to 0.3)
	HADS Anxiety	36 months	5.5 (4.8) (n=70)	4.7 (4.2) (n=64)	-0.1 (-0.6 to 0.4)
	HADS Depression	8 months	NR (n=91)	NR (n=88)	Adj. -1.3 (-2.2 to -0.4)
	HADS Depression	12 months	4.6 (4.3) (n=75)	5.0 (3.7) (n=76)	-0.5 (-1.0 to -0.1)
	HADS Depression	24 months	3.5 (3.7) (n=45)	4.6 (4.3) (n=44)	-1.2 (-2.0 to -0.4)
	HADS Depression	36 months	3.7 (4.2) (n=70)	3.9 (3.8) (n=64)	-0.5 (-0.8 to -0.2)

Adj. = adjusted; CI = confidence interval; HADS = Hospital Anxiety and Depression Scale; HAGOS = Copenhagen Hip and Groin Outcome Score; HOOS = Hip Disability and Osteoarthritis Outcome Score; MCS = mental component summary; MD = mean difference; NR = not reported; PCS = physical component summary; PT = physiotherapy; QoL = quality of life; SD = standard deviation; SF-12= 12-item Short Form Questionnaire.

3.3.1.2.8 Symptoms

One trial (N=83) reported **HOOS-Symptoms scores** (0-100) and found arthroscopy associated with a clinically important improvement at 12 months (MD 11.7; published MCID: 9[107]) compared with PT but not at 6 months; both estimates were imprecise.[96] A second trial (N=180)[175,176] reported a different but

similar measure, the **HAGOS-Symptoms scale** (0-100), and found arthroscopy associated with a clinically important improvement in symptoms at 8 and 12 months compared with PT with MDs of 13.3 and 12.2, respectively, exceeding the published MCID of 10.[107] At 26 and 36 months, arthroscopy was favored compared with PT and the difference was statistically significant, but the between-group differences (MDs 8.6 and 7.6) did not meet the MCID threshold (**Appendix E**). The hip and/or groin symptoms assessed with these measures were primarily related to stiffness and noises such as clicking or sensations such as grinding.

3.3.1.2.9 Return to Work

Fewer patients who underwent arthroscopy returned to work by 24 months versus those who received PT, although the difference between groups was not statistically significant: 44.1% (15/34) vs. 63.2% (24/38), RR 0.70 (95% CI 0.45 to 1.09).[135] This trial enrolled active duty, primarily enlisted, military personnel.

3.3.1.2.10 Range of Motion

At 8 months in one trial,[176] the arthroscopy group had a greater range of hip flexion compared with the PT group (adjusted MD 4.8 degrees, 95% CI 0.5 to 9.1) but there were no differences between groups on all other ROM measurements (extension, abduction, adduction, internal and external rotation).

3.3.2 Key Question 2: Safety (Adults)

All RCTs included for effectiveness were evaluated for safety outcomes. The RCT (across 3 publications)[9,102,105] comparing osteochondroplasty with lavage (with or without labral treatment) and four RCTs[76,96,135,176] comparing arthroscopy with physical therapy reported on harms. No NRSIs that met inclusion criteria were identified. Five case series were identified that reported rare safety events in adults who underwent arthroscopy for FAI.[70-73,217] An additional case series of patients who underwent arthroscopic treatment for isolated labral tears without correction of the underlying FAI morphology was included to provide context regarding outcomes when the underlying osseous deformity was not addressed.[115] Although adult case series did not meet the eligibility criteria for inclusion, they were summarized for context because they provided information on rare harms or addressed a clinically relevant question that was not adequately examined in the included studies. In addition, a summary of the safety data from the prior report is provided at the end of the section comparing arthroscopy with physical therapy for context.

3.3.2.1 Osteochondroplasty versus Lavage

3.3.2.1.1 Mortality

One death occurred in the osteochondroplasty group (1% vs. 0% in lavage group). There was no information on cause or timing of death; it is unlikely the death was treatment-related.[9]

3.3.2.1.2 Any hip-related complication

Osteochondroplasty was associated with a similar risk of any hip-related complication over 24 months compared with lavage (N=209, 21.0% vs. 27.9%; adjusted OR 0.69, 95% CI 0.36 to 1.30).[9]

3.3.2.1.3 Hip-related complication requiring surgery (i.e., Revision surgery)

At 12 months, there were fewer revisions (defined as a hip-related complication requiring reoperation) in the osteochondroplasty group compared with the lavage group, but the difference was

not statistically significant (N=214, 1.9% vs. 4.7%, RR 0.39, 95% CI 0.08 to 1.98).[105] At 24 months, compared with lavage, osteochondroplasty was associated with a substantially lower risk of revision surgery, however substantial imprecision is noted (N=209, 7.6% vs. 18.3%; adjusted OR 0.37, 95% CI 0.15 to 0.89),[9] **Table 22**. The most common reason for revision was recurrent or persistent **hip pain** which occurred substantially less frequently in the osteochondroplasty group (2.9% vs. 11.5%; RR 0.25, 95% CI 0.07 to 0.85), followed by **re-injury of the labrum** (3.8% vs. 6.7%; RR 0.57, 95% CI 0.17 to 1.88) and **heterotopic ossification** (1.0% vs. 0%), both of which occurred with similar frequency between groups. There is substantial imprecision for all estimates. The authors mention that, among patients requiring revision surgery, labral repair at the index surgery was more common in the osteochondroplasty group than in the lavage group (87.5% [7/8] vs. 52.6% [10/19]). They noted that it is therefore difficult to determine the extent to which differences in labral treatment may have influenced revision rates.

In the NRSI,[163] patients who received femoral osteoplasty in addition to labral resection had no non-THA reoperations compared with four patients in the labral resection only group (0% [0/23] vs. 24% [4/17]). The overall reoperation rate (to include THA) was substantially lower: 22% (5/23) vs. 71% (12/17); RR 0.31, 95% CI 0.13 to 0.71. At the 15-year follow-up, Kaplan-Meier analysis demonstrated significantly greater overall operation-free survival in the femoral osteoplasty group than in the labral resection only group (78% vs. 29%, p=0.003). Operation-free survival was similar between groups at 5 years (87% vs. 71%) but began to diverge by 10 years (78% vs. 53%). Overall operation rates were driven by conversion to THA, which is described above under effectiveness.

In addition, one case series (N=59 hips in 57 patients)[115] that evaluated arthroscopic treatment for isolated labral tears without correction of the underlying FAI morphology (43% cam, 8% pincer, and 38% had mixed cam and pincer) reported five revisions (2 open with complete labral excision and 3 arthroscopic for pincer and/or cam with labral repair or cam resection alone) at a mean of 5.5 years (range, 0.5 to 21.2 years).

3.3.2.1.4 Hip-related complications not requiring surgery

Osteochondroplasty was associated with a similar risk of hip-related complications not requiring surgery over 24 months compared with lavage (N=209, 14.3% vs. 12.5%, adjusted OR 1.18, 95% CI 0.53 to 2.62),[9] **Table 22**. The most common hip-related complication managed non-operatively was **hip pain** (7.6% vs. 7.7%) followed by **hip tendinopathy** (2.9% vs. 1%) and **hip popping** (2.9% vs. 0%). Other complications, each of which occurred in 2% or less of patients, included **nerve injury, labral re-injury, erectile dysfunction, superficial infection and hip osteoarthritis** (labral re-injury and hip osteoarthritis are included above as primary outcomes for the purposes of this report).

3.3.2.1.5 Individual events included above under any hip-related complication

3.3.2.1.5.1 Hip pain

Fewer patients who received osteochondroplasty reported recurrence or persistence of hip pain over 24 months compared with those who received lavage, but the difference was not statistically significant and substantial imprecision is noted (10.5% vs. 19.2%; RR 0.54, 95% CI 0.27 to 1.08).[9] As noted above, osteochondroplasty was associated with a substantially lower risk of hip pain requiring revision surgery (2.9% vs. 11.5%; RR 0.25, 95% CI 0.07 to 0.85), the most common indication for revision surgery in this population. Hip pain not requiring surgery was similar between groups (7.6% vs. 7.7%). The authors did not report the criteria or decision-making process used to distinguish hip pain requiring surgery from hip pain managed non-operatively.

3.3.2.1.5.2 Heterotopic ossification

Over 24 months, one patient in the arthroscopic osteochondroplasty group was diagnosed with heterotopic ossification which required additional surgery (1.0% [1/105] vs. 0% [0/104] in the lavage group).[9] This event is included under revision surgery above.

3.3.2.1.5.3 Nerve damage and Infection

There were two cases of nerve injury (unspecified), one in each treatment group (1% vs. 1%) and one case of superficial infection (1%) which occurred in the osteochondroplasty group (there were none in the lavage group).[9]

3.3.2.1.5.4 Sexual Dysfunction and Urinary Events

Urinary and sexual dysfunction events (presumably related to nerve damage), were reported in a secondary analysis of this trial that included both the randomized patients and a nonrandomized group of patients who declined participation or did not meet the trial eligibility criteria and received osteochondroplasty.[102] There were a total of two events in each group. Events included: one case of numbness in the tip of the penis in the lavage group, which was reported at 6 months and resolved by 10 months; two cases of erectile dysfunction diagnosed at 3 months, one in each treatment group (resolved after 4 months in the osteochondroplasty group but persisted through the 24-month follow-up in the lavage group); and one case of urinary tract infection in the osteochondroplasty group. The sample size in each group was unclear for this secondary analysis.[102]

Table 22. Adverse events reported in the FIRST Trial (arthroscopy vs. lavage)

AE Grouping	Complication	Follow-Up	Author	Arthroscopy vs. Physiotherapy % (n/N), RR (95% CI)
Mortality	Mortality (cause unclear)	24 months	Ayeni, 2021[9]	0.9% (1/110) vs. 0% (0/110)
Any AE	Any hip complication*	24 months	Ayeni, 2021[9]	21.0% (22/105) vs. 27.9% (29/104), Adj OR 0.69 (0.36 to 1.30)
	Any hip complication not requiring surgery†	24 months	Ayeni, 2021[9]	14.3% (15/105) vs. 12.5% (13/104), Adj OR 1.18 (0.53 to 2.62)
	Any hip complication requiring surgery (i.e., revision surgery)‡	12 months	Kay, 2022[105]	1.9% (2/108) vs. 4.7% (5/106), RR 0.39 (0.08 to 1.98)
	Any hip complication requiring surgery (i.e., revision surgery)‡	24 months	Ayeni, 2021[9]	7.6% (8/105) vs. 18.3% (19/104), Adj OR 0.37 (0.15 to 0.89)
Nerve Injury	Nerve injury	24 months	Ayeni, 2021[9]	1.0% (1/105) vs. 1.0% (1/104), RR 0.99 (0.06 to 15.63)
Infection	Superficial infection	24 months	Ayeni, 2021[9]	1.0% (1/105) vs. 0% (0/104)
Sexual dysfunction and urinary events§	Any urinary or sexual function AE	24 months	Jean, 2022[102]	2 events vs. 2 events
	Erectile dysfunction	24 months	Jean, 2022[102]	1 event vs. 1 event
	Numbness in tip of penis	24 months	Jean, 2022[102]	0 events vs. 1 event

AE Grouping	Complication	Follow-Up	Author	Arthroscopy vs. Physiotherapy % (n/N), RR (95% CI)
	Urinary tract infection	24 months	Jean, 2022[102]	1 event vs. 0 events
Heterotopic Ossification	Heterotopic ossification requiring surgery	24 months	Ayeni, 2021[9]	1.0% (1/105) vs. 0% (0/104)
Hip Pain	Any hip pain	24 months	Ayeni, 2021[9]	10.5% (11/105) vs. 19.2% (20/104), RR 0.54 (0.27 to 1.08)
	Hip pain requiring surgery	24 months	Ayeni, 2021[9]	2.9% (3/105) vs. 11.5% (12/104), RR 0.25 (0.07 to 0.85)
	Hip pain not requiring surgery	24 months	Ayeni, 2021[9]	7.6% (8/105) vs. 7.7% (8/104), RR 0.99 (0.39 to 2.54)
Other AEs not requiring surgery	Hip popping	24 months	Ayeni, 2021[9]	2.9% (3/105) vs. 0% (0/104)
	Hip tendinopathy	24 months	Ayeni, 2021[9]	2.9% (3/105) vs. 1.0% (1/104), RR 2.97 (0.31 to 28.11)

AE = adverse event; CI = confidence interval; OR = odds ratio; RR = risk ratio.
* From most to least common: hip pain, re-injury of the labrum, and heterotopic ossification; listed separately in the table.
† From most to least common: hip pain, hip tendinopathy, hip popping, nerve injury, erectile dysfunction, hip osteoarthritis, and superficial infection; listed separately in the table.
‡ At 12 months: Includes worsened hip pain and reinjury of the labrum (not reported by treatment group). At 24 months: Includes heterotopic ossification, labral re-injury (included as a primary outcome, not as a harm, for this HTA), and hip pain.
§ Total group Ns not reported.

3.3.2.2 Arthroscopy versus Physical Therapy

Adverse events were reported variably across four RCTs comparing arthroscopy with PT.[76,96,135,175] Follow-up ranged from 8 to 38 months. Five case series were identified that reported rare safety events in adults who underwent arthroscopy for FAI and are summarized under the surgery-specific adverse events for context only.[70-73,217]

3.3.2.2.1 Mortality

No treatment-related deaths were report by one RCT (N=348) over 12 months.[76] A second trial reported that one patient (2.5%, 1/40) randomized to arthroscopy died during the study period (24 months) due to an unrelated condition.[135]

3.3.2.2.2 SAEs and Any AEs

The risk of any SAE was low and somewhat greater following arthroscopy versus PT across two trials over 12 and 36 months, though the pooled estimate was not statistically significant and the confidence interval was very wide, signaling substantial imprecision (N=506, 2.4% vs. 0.4%; RR 6.14, 95% CI 0.75 to 50.67).[76,175] Individually, neither trial found a difference between groups in the risk of any SAEs; one trial reported that none occurred in either group (**Table 23**). When treatment-related SAEs were considered separately, one RCT[76] found arthroscopy associated with a greater risk compared with PT at 12 months: 3.6% (5/138) vs. 0% (0/146), p=0.02.[76] The serious treatment-related adverse events included an overnight admission post-arthroscopy, scrotal hematoma requiring readmission, superficial wound infections that required oral antibiotics (2 patients), hip joint infection that required further surgery and ultimately a THA (this patient is also included under conversion to THA in the effectiveness section above).

The risk of any AE was somewhat greater following arthroscopy versus PT across the same two RCTs, though the differences between groups in both the pooled (N=479, 43.5% vs. 36.4%; RR 1.21, 95% CI 0.91 to 1.93, I^2=24.2%) and individual estimates were not statistically significant.[76,175] Again, the individual trials were inconsistent, and the pooled estimate was driven by the trial with 12-month follow-up (**Table 23**).

One trial reported a significantly greater risk of adverse events possibly related to treatment after arthroscopy versus PT (N=284; 5.8% vs. 0.7%, RR 8.46, 95% CI 1.07 to 66.79); the estimate was very imprecise.[76] However, there is overlap with the events reported as any SAEs and it was not possible to separate the two outcomes. A second trial reported a similar risk of other AEs possibly or definitely related to the interventions (N=92; 15.6% vs. 23.4%, RR 0.66, 95% CI 0.28 to 1.56).[96] See **Table 23** below for details.

3.3.2.2.3 Hip Fracture

Across three RCTs (N=455) with 12- to 24-months follow-up, hip fracture was rare and was reported in only one patient randomized to PT (2.5%, 1/40) who crossed over to receive arthroscopy; pooled frequencies were 0% (0/222) vs. 0.4% (1/233)[76,96,135] (**Table 23**). This event occurred in a small trial of active duty military personnel with a very high crossover rate (70%).[135] When analyzed according to treatment received, the frequency of hip fracture in the arthroscopy group ranged from 0% to 1.5% (1/65) across the trials, with pooled proportions of 0.4% (1/248) vs. 0% (0/207) in the arthroscopy and PT groups, respectively.

3.3.2.2.4 Hip Pain/Stiffness

Arthroscopy was associated with a similar risk of hip pain or stiffness compared with PT across two trials with 12 to 36 months of follow-up (N=506, 14.4% vs. 14.8%; RR 0.92, 95% CI 0.43 to 2.83, I^2=63.8%).[76,175] The trial with 36 months of follow-up defined this event specifically as appointments for hip pain or stiffness (20.5% vs. 27.3%), whereas the other trial defined it simply as hip pain or stiffness (9.4% vs. 5.5%) (**Table 23**).

3.3.2.2.5 Other Adverse Events

Other adverse events that occurred with similar frequency between groups included muscle soreness, which was common in both groups (42.0% vs. 47.3%), and unscheduled hospital appointments in one trial (N=284)[76] and regional pain syndrome (neuropathic groin pain) in another, small trial (N=92)[96] (**Table 23**). One small trial (n=79) reported that six patients (15.0%) randomized to PT underwent contralateral hip surgery during the 24 months follow-up (there were none in the arthroscopy group).

Table 23. Adverse events following hip arthroscopy versus physical therapy in adults with femoroacetabular impingement syndrome: randomized controlled trials

Outcome	Author, year	Trial	F/U	Surgery % (n/N)	PT % (n/N)	RR (95% CI)
Death, treatment related	Griffin, 2018[76]	UK FASHIoN trial	12 months	0% (0/171)	0% (0/177)	N/A
Death, unrelated to treatment	Mansell, 2018[135]	N/A	24 months	2.5% (1/40)	0% (0/40)	NC, p=0.32

Outcome	Author, year	Trial	F/U	Surgery % (n/N)	PT % (n/N)	RR (95% CI)
Any SAE	Griffin, 2018[76]	UK FASHIoN trial	12 months	4.3% (6/138)*	0.7% (1/146)	6.35 (0.77 to 52.06)
	Palmer, 2025[175]	FAIT trial	3 years	0% (0/112)	0% (0/110)	N/A
Any AE	Griffin, 2018[76]	UK FASHIoN trial	12 months	72.5% (100/138)	60.3% (88/146)	1.20 (1.02 to 1.42)
	Palmer, 2019[176]	FAIT trial	6 months	3.0% (3/99)	0% (0/96)	NC, p=0.09
Hip Fracture	Griffin, 2018[76]	UK FASHIoN trial	12 months	0% (0/138)	0% (0/146)	N/A
	Hunter, 2021[96]	Australian FASHIoN trial	12 months	0% (0/45)	0% (0/47)	N/A
	Mansell, 2018[135]	N/A	24 months	0%† (0/39)	2.5% (1/40)	occurred in patient who crossed over to arthroscopy
Hip pain or stiffness	Griffin, 2018[76]	UK FASHIoN trial	12 months	9.4% (13/138)	5.5% (8/146)	1.72 (0.74 to 4.02)
	Palmer, 2025‡[175]	FAIT trial	3 years	20.5% (23/112)	27.3% (30/110)	0.75 (0.47 to 1.21)
Muscle soreness	Griffin, 2018[76]	UK FASHIoN trial	6 weeks	42.0% (58/138)	47.3% (69/146)	0.89 (0.69 to 1.15)
Unscheduled hospital appointments	Griffin, 2018[76]	UK FASHIoN trial	12 months	9.4% (13/138)	4.1% (6/146)	2.29 (0.90 to 5.86)
Other AEs possibly related to intervention	Griffin, 2018[76]	UK FASHIoN trial	12 months	5.8%§ (8/138)	0.7%§ (1/146)	8.46 (1.07 to 66.79)
Other AEs possibly or definitely related to intervention	Hunter 2021[96]	Australian FASHIoN trial	12 months	15.6%** (7/45)	23.4%** (11/47)	0.66 (0.28 to 1.56)
Regional pain syndrome (neuropathic groin pain)	Hunter, 2021[96]	Australian FASHIoN trial	12 months	0% (0/45)	2.1% (1/47)	NC, p=0.33
Contralateral hip surgery	Mansell, 2018[135]	N/A	24 months	0% (0/39)	15.0% (6/40)	NC, p=0.01

AE = adverse event; CI = confidence interval; F/U = follow-up; N/A = not applicable; NC = not calculable; PT = physiotherapy; RR = risk ratio

* 5 of the 6 in the hip arthroplasty group were related to treatment (1 patient not discharged from the day surgery unit and required an overnight admission, 1 patient had a scrotal haematoma requiring re admission, 2 patients had superficial wound infections that required oral antibiotics, 1 patient had a hip joint infection that required further surgery and ultimately a THR and 1 patient had a fall unrelated to surgery); the 1 in the PT group was not (biliary sepsis).

† 1/65 vs. 0/14 as treated.

‡ Specifically appointments for hip pain or stiffness

§ Arthroscopy: 2 numbness proximal thigh, 1 scrotal infection, 1 scrotal bruising, 1 labial swelling, 1 ankle pain, 1 erratic International Normalised Ratio, 1 nausea secondary to analgesia, 1 numbness to tip of tongue for 2 weeks after operation; PT: muscle spasm
** Arthroscopy: 1 lump from cannula insertion for 1 month; 1 delayed post-op physio; 1 quads and knee pain 2-3 weeks post-op; 1 deep pain in hip after slept in prone position; 1 GP stitched small section of wound because oozing; 1 ankle felt unstable after surgical traction; 1 given inappropriate exercise program post-op- cause pain & anxiety.
PT: 1 endoscopic inguinal ligament repair (unsure if related); 4 increased pain in hip after physio; 2 flare up 'old' knee injury; 1 back pain; 1 migraines; 1 plantar fasciitis on recommencing running.

3.3.2.2.6 Surgery-specific adverse events

3.3.2.2.6.1 Revision Surgery

Across all five RCTs (N=774), the frequency of revision surgery in patients randomized to arthroscopy (n=386) ranged from 0% to 4.5% and from 0% to 12.5% in those randomized to PT (n=388) over 12 to 38 months of follow-up. Excluding the small trial in active duty military personnel,[135] the range in the latter group was 0% to 3.6%. All patients in the PT groups who experienced a revision had crossed over to arthroscopy during follow-up. As-treated denominators were not available to estimate event frequencies by treatment received. Only two trials reported the reason for revision which included removal of a bursa and a hip joint infection in patients randomized to arthroscopy.[76,96] Further details regarding revision surgery can be found in the **Table 24** below.

Table 24. Revision surgery following hip arthroscopy versus physical therapy in adults with femoroacetabular impingement syndrome: randomized controlled trials

Trial and/or Author Follow-up	Arthroscopy, % (n/N)	PT – after Crossover, % (n/N)	Reasons for Revision
Australian FASHIoN Trial, Hunter 2021[96] 12 months	2.2% (1/45)	0% (0/47)	**Arthroscopy** – 1 patient experienced pain over tensor fascia lata and bursa several weeks following arthroscopy, had surgical removal of bursa
FAIT Trial, Palmer 2025[175] 38 months	4.5% (5/112)	3.6% (4/110)	**Arthroscopy** – 4 patients had revision arthroscopy procedures during trial follow-up – 1 patient had two revision arthroplasties after 8 month follow-up – Reasons unclear **PT** – 1 patient had a revision arthroplasty after crossover – 3 patients had two arthroplasties after crossover – Reasons unclear
Mansell, 2018[135] 24 months	0% (0/39)	12.5% (5/40)	**PT** – 5 patients crossed over and received index arthroscopy followed by revision surgery – Rate out of all patients who received arthroscopy was 7.7% (5/65) – Reasons unclear
Martin, 2024[139] 24 months	0% (0/52)	0% (0/45)	– No revisions occurred
UK FASHIoN Trial, Griffin 2018[76] 12 months	0.7% (1/138)	0% (0/146)	**Arthroscopy** – 1 patient experienced a hip joint infection which required further surgery and ultimately a THA

PT = physiotherapy; THA = total hip arthroplasty.

3.3.2.2.6.2 Nerve injury

The most common adverse event with arthroscopy was numbness in the groin, leg or foot which was reported in 25.4% and 33.3% of patients across two RCTs with a pooled frequency of 27.3% (50/183)[76,96] (**Table 25**). Other adverse events related to nerve injury included numbness in the proximal thigh (1.4%) and in the tip of the tongue (0.7%), described as potentially related to treatment, in one trial (N=138)[76] and injury to the lateral cutaneous nerve of the thigh (2.0%) in another trial (N=99),[176] which was treatment-related and transient resolving by the 8-month follow-up.

3.3.2.2.6.3 Infection

The next most common adverse event was superficial wound infection requiring antibiotics which ranged from 1.0% to 6.7% across three trials with a pooled frequency of 2.8% (8/282).[76,96,176] Hip joint infection was rare and occurred in one patient across two RCTs (0.6%, 1/177).[76,135] This patient required additional surgery and eventually a total hip replacement.[76] Other adverse events related to infection reported by one RCT (N=138) included a scrotal infection (0.7%) deemed potentially related to treatment and superficial wound infections not requiring antibiotics (3.6%)[76] (**Table 25**).

3.3.2.2.6.4 Thromboembolic Events

There were no cases of deep vein thrombosis (DVT) or thrombosis of the lower extremity reported across three trials (N=222)[76,96,135] over 12 to 24 months of follow-up (**Table 25**).

One case series reported that 2.7% of patients (10/372) showed a femoral head infarction on MRI over a mean follow-up of 29 months following arthroscopy for FAI (70% mixed cam and pincer and 30% cam morphology) with labral tear.[71]

3.3.2.2.6.5 HO and Avascular Necrosis

Once case of HO was reported over 24 months in a small trial of active-duty military personnel (ITT: 2.6% [1/39]; As-treated: 1.5% [1/65]).[135] This same trial reported that there were no cases of avascular necrosis (**Table 25**).

Two case series reported HO rates ranging from 2.1% (15/700) to 5.4% (13/242)[73] over 24 months. Four patients in the latter trial required revision surgery due to HO (1.7%; 4/242). Neither trial reported information regarding morphology or labral tear for the overall population.

3.3.2.2.6.6 Hospital Readmission

Two patients required readmission to the hospital (1.4%, 2/138) over 12 months in one trial, one due to a scrotal hematoma and one required an overnight stay the day of surgery (**Table 25**).[76]

3.3.2.2.6.7 Other Adverse Events

One case series reported acetabular rim osteophyte development in over half of the patients (52.1%; 37/71) identified on CT at a mean follow-up of 28 months after arthroscopy for mixed cam and pincer FAI with labral tear.[70] Another series[72] reported that 10.7% (21/196) of patients were diagnosed with femoral head cartilage injury on MRI at a mean of 26 months after arthroscopic treatment for FAI (primarily mixed type) and labral tear; only one required revision to address the injury (0.5%, 1/196).

Table 25. Revision surgery following hip arthroscopy versus physical therapy in adults with femoroacetabular impingement syndrome: randomized controlled trials

Complication category	Complication	Author	F/U	Arthroscopy
Nerve injury	Numbness in groin, leg, or foot	Griffin, 2018[76] UK FASHIoN trial	12 months	25.4% (35/138)
	Numbness in groin, leg, or foot	Hunter, 2021[96] Australian FASHIoN trial	12 months	33.3% (15/45)
	Numbness in proximal thigh*	Griffin, 2018[76] UK FASHIoN trial	12 months	1.4% (2/138)
	Numbness in tip of tongue*	Griffin, 2018[76] UK FASHIoN trial	12 months	0.7% (1/138)
	Injury to lateral cutaneous nerve of thigh†	Palmer, 2019[176] FAIT trial	8 months	2.0% (2/99)
Infection	Superficial wound infection (any)§	Griffin, 2018[76] UK FASHIoN trial	12 months	6.5% (9/138)
	Superficial wound infection requiring antibiotics‡	Griffin, 2018[76] UK FASHIoN trial	12 months	2.9% (4/138)
	Superficial wound infection requiring antibiotics	Palmer, 2019[176] FAIT trial	8 months	1.0% (1/99)
	Superficial wound infection requiring antibiotics	Hunter, 2021[96] Australian FASHIoN trial	12 months	6.7% (3/45)
	Scrotal infection*	Griffin, 2018[76] UK FASHIoN trial	12 months	0.7% (1/138)
	Hip joint infection (requiring further surgery, eventually THA)	Griffin, 2018[76] UK FASHIoN trial	12 months	0.7% (1/138)
	Hip joint infection	Mansell, 2018[135]	24 months	0.0% (0/39)
Thromboembolic events	DVT	Griffin, 2018[76] UK FASHIoN trial	12 months	0.0% (0/138)
	DVT	Hunter, 2021[96] Australian FASHIoN trial	12 months	0.0% (0/45)
	Thrombosis of lower extremity	Mansell, 2018[135]	24 months	0.0% (0/39)
HO, avascular necrosis	Heterotopic ossification	Mansell, 2018[135]	24 months	2.6% (1/39)
	Avascular necrosis	Mansell, 2018[135]	24 months	0.0% (0/39)
Rehospitalization	Scrotal hematoma requiring readmission	Griffin, 2018[76] UK FASHIoN trial	12 months	0.7% (1/138)
	Hospital admission day of surgery (overnight)	Griffin, 2018[76] UK FASHIoN trial	12 months	0.7% (1/138)

DVT = deep vein thrombosis; F/U = follow-up; HO = heterotopic ossification; THA = total hip arthroplasty.
* Potentially related to treatment per authors.
† Treatment-related; transient, resolved by 8 month follow-up.
‡ There is discrepancy in reporting in the article; the text says 2 patients while the table says 4 patients. Listed as a serious AE.
§ Four patients required antibiotics; included as a separate outcome in the table.
** Authors report as a serious AE but unclear if related to surgery; occurred several weeks after surgery.

3.3.2.2.6.8 Summary of safety data from prior report

The frequency of adverse events reported by this HTA was comparable to that reported by the prior HTA. A total of 12 comparative NRSIs (N range 23 to 950; mean age, 20 to 41 years),[24,27,33,52,92,121,149,197,199,207,242,251] three SRs of case series (range across SRs: 28 to 68 studies; mean

age, 30 to 36 years),[23,154,204] and 28 case series (29 publications) not included in the SRs (N range, 14 to 14,970; mean age, 19.5 to 44.6 years)[18,32,36,38,40,49,53,73,81,85,87,93,100,110,119,140,151,160,167,178,179,184,185,202,208,209,216,218,250] were identified for the 2019 report and evaluated safety outcomes following various operative treatments for FAI in adults. Follow-up periods ranged widely, from 2 to 120 months. Surgical treatment included arthroscopy (primarily) and open or mini-open approaches; several studies compared arthroscopic labral refixation or repair with labral debridement. This summary is based on Table 38 of the 2019 report. Only safety data from the eight case series with at least 300 patients are included in this summary (N=317 to 14,945).[40,49,119,151,167,185,202,250]

Total complication rates ranged from 1.7% to 14% across two SRs (N=1,981 and 7,241) and two NRSIs (N=1,989 and 201). The frequency of HO ranged from 0% to 4.7% across two SRs (N=1,981 and 7,241), four NRSIs (N range, 23 to 198), and four case series (N range, 360 to 1,870) (excluding one outlier). Nerve injuries were not uncommon, but the frequency varied from 0% to 25% across two SRs (N=1,981 to 7,241), five cohorts (N=23 to 198) and four case series (n=317 to 1615). The frequency of revision surgery ranged from 0% to 12% across two SRs (N=1,981 and 7,241), 10 NRSIs (N range, 23 to 950) and three case series (N range, 314 to 1,870). The following events were rare: avascular necrosis (range, 0% to 0.4% across 1 SR [N=7,241], 4 NRSIs [N range, 23 to 96], and 1 case series [N=1,870]), femoral fracture (range, 0% to 1% across 2 SRs [N=1,981 and 7,241], 3 NRSIs [N=23 to 96] and 6 case series [N=317 to 1,870]), deep infection (range, 0% to 0.1% across 1 SR [N=7,241], 2 NRSIs [N=23 and 56] and 1 case series [N=1,615]), thromboembolic events (PE, DVT) (range, 0% to 1.2% across 2 SRs [N=4,577 to 7241], 3 NRSIs [N=23 to 198], and 4 case series [N=360 to 1,860]), and nonunion of the greater trochanter (range, 0% to 2% across 2 cohorts [N range, 198 to 201]).

3.3.3 Key Question 3: Differential Effectiveness and Safety in Subpopulations

Five trials, one that compared osteochondroplasty versus lavage[9] and four that compared arthroscopy versus PT[76,139,157,176] reported subgroup analyses for effectiveness outcomes. All but one[138] provided formal tests for interaction. Analyses in all trials were likely to have low power for detecting effect modification by factors that were evaluated. Confidence in findings from stratified analyses from included studies is very low (i.e., insufficient SOE).

These trials are described in previous sections. All trials pre-specified subgroup analyses. However, not all subgroup variables were specified a priori, and it is unclear whether these analyses were considered in the sample size determinations. All performed analyses for a single outcome. Only one trial specified hypotheses to be tested and expected direction; however, this trial did not perform a formal test for interaction.

3.3.3.1 Osteochondroplasty vs. Lavage

The trial comparing osteochondroplasty versus lavage with or without labral treatment evaluated treatment effect modification and found no interaction by FAI type, baseline impingement severity, sex, cartilage status, labrum treatment and center, and the outcome of VAS pain scores. See **Table 26** below for data.

Table 26. Results of subgroup analyses evaluating effect modification for the FIRST trial comparing osteochondroplasty with lavage

Author, year	Subgroup Category	Subgroup	Osteochondroplasty vs. Lavage MD (95% CI)	p-value for interaction
Ayeni, 2021[9] (N=220) FIRST trial *Outcome measure:* VAS pain (0-100 scale) F/U: 12 months*	**FAI type**	**Cam** (n=109)	0.73 (-8.30, 9.75)	0.733
	FAI type	**Mixed** (n=45)	-2.18 (-16.33, 11.97)	0.733
	Baseline impingement severity	**Severe** (n=12)	3.86 (-24.53, 32.25)	0.360
	Baseline impingement severity	**Moderate** (n=89)	-5.08 (-15.23, 5.07)	0.360
	Baseline impingement severity	**Mild** (n=53)	6.60 (-6.27, 19.48)	0.360
	Sex	**Males** (n=93)	2.93 (-6.93, 12.79)	0.335
	Sex	**Females** (n=61)	-4.80 (-17.01, 7.40)	0.335
	Cartilage status	**Grade 0/1** (n=145)	-1.26 (-9.12, 6.61)	0.661
	Cartilage status	**Grade 2/3** (n=9)	7.31 (-30.31, 44.92)	0.661
	Labrum treatment	**Repair** (n=93)	-2.96 (-13.40, 7.48)	0.738
	Labrum treatment	**Resection** (n=30)	6.71 (-11.30, 24.72)	0.738
	Labrum treatment	**Neither** (n=31)	3.09 (-17.23, 23.42)	0.738
	Center	**Center 1** (n=40)	8.18 (-6.56, 22.91)	0.323
	Center	**Center 2** (n=19)	2.75 (-18.58, 24.08)	0.323
	Center	**Center 3** (n=21)	-0.37 (-20.62, 19.88)	0.323
	Center	**Center 4** (n=13)	18.78 (-7.08, 44.64)	0.323
	Center	**Center 5** (n=20)	-13.20 (-34.03, 7.63)	0.323
	Center	**Center 12** (n=31)	-12.85 (-29.82, 4.12)	0.323
	Center	**Centers 6, 7, 8, 10 combined** (n=10)	-1.03 (-31.62, 29.56)	0.323

CI = confidence interval; FAI = femoroacetabular impingement; F/U = follow-up; MD = mean difference; VAS = visual analog scale.

3.3.3.2 Operative vs. Non-operative Treatment

Three RCTs that compared arthroscopy with PT formally evaluated effect modification.[76,157,176] Age was found to modify the treatment effect in only one of the three trials and results suggested that difference in the HOS-ADL may be greater and in favor of arthroscopy compared with physiotherapy for younger patients with the effect decreasing with increasing age.[176] This trial evaluated age as a continuous outcome which may have given it more power to detect an effect. No evidence of an interaction was seen for all other variables assessed including sex in two trials,[157,176] type of FAI (e.g., cam, pincer, mixed) in two trials,[76,176] Kellgren-Lawrence grade (0 vs. 1), study site, and baseline HOS-ADL scores in one trial,[176] and BMI, health care system, smoking status, duration of symptoms, and several imaging measures (maximum alpha angle, lateral center edge angle, Hip Osteoarthritic MRI Scoring System measures, and delayed gadolinium-enhanced MRI of cartilage score) in another trial.[157] Two trials used the iHOT-33 outcome measure[76,157] and one used the HOS-ADL.[176] Length of follow-up ranged from 8 months[76] to 12 months.[157,176] Two trials provided data for subgroup analyses which are presented in **Table 27.** The third trial only provided data from their regression models.[157]

A fourth trial[138] did not perform a formal test for interaction but reported subgroup analyses based on Tönnis grade – grade 0 or 1 OA (n=50) and grade 2 OA (n=19) – in all patients who received arthroscopy (i.e., those randomized to surgery and those who crossed over from PT). Authors report that, compared with Tönnis grade 2, patients with Tönnis grade 0 or 1 showed greater improvement on several outcomes measures, though differences were not statistically significant at all timepoints. Greater improvement was seen in the iHOT-33 scores (0-100 scale) at 6 months (adj. MD 11.71, 95% CI 2.74 to 20.68); mHHS scores (0-100 scale) at 3 months (adj. MD 14.52, 95% CI 3.03 to 26.00) and 6 months (adj. MD 13.96, 95% CI 6.95 to 20.98); HOS-ADL scores (0-100 scale) at 3 months (adj. MD 11.43, 95% CI 0.27 to 22.60) and 6 months (adj. MD 8.65, 95% CI 1.50 to 15.81); NAHS (0-100 scale), LEFS (0-80 scale), and VAS (0-10 scale) scores at 6 months (adj. MD 7.76, 95% CI 0.95 to 14.56; adj MD 9.80, 95% CI 3.29 to 16.31; and adj. MD 1.86, 95% CI 0.71 to 3.01, respectively). See **Table 27** for more details.

Our confidence in these findings is very low based on study limitations, inadequate sample size leading to substantial imprecision and failure to specify subanalyses and hypotheses a priori.

Table 27. Results of subgroup analyses evaluating effect modification for RCTs comparing arthroscopy versus physiotherapy

Author, year	Subgroup Category	Subgroup (n's for arthroscopy vs. PT)	Arthroscopy vs. PT Adj. MD (95% CI)‡	p-value for interaction
Griffin 2018[76] (N=358) *Outcome measure:* iHOT-33 F/U: 12 months*	**FAI type**	**Cam** (n=120 vs. 124)	8.3 (2.5, 14.2)	0.567
	FAI type	**Pincer** (n=12 vs. 12)	4.0 (-14.6, 22.7)	0.567
	FAI type	**Mixed** (n=26 vs. 27)	1.1 (-11.5, 13.7)	0.567
	Age (years)	**<40** (n=103 vs. 117)	5.0 (-1.2, 11.3)	0.302
	Age (years)	**≥40** (n=55 vs. 46)	10.9 (1.7, 20.1)	0.302
Palmer 2019[176] (N=222) FAIT trial *Outcome measure:* HOS-ADL F/U: 8 months*	**FAI type**	**Cam** (n=92 vs. 83)	10.1 (4.3, 15.9)	NS
	FAI type	**Mixed** (n=7 vs. 5)	-5.7 (-28.1, 16.8)	NS
	Sex	**Female** (n=68 vs. 58)	9.7 (3.0, 16.5)	NS
	Sex	**Male** (n=32 vs. 30)	8.4 (-1.18, 18.0)	NS
	KL grade	**Grade 0** (n=80 vs. 67)	11.1 (4.9, 17.2)	NS
	KL grade	**Grade 1** (n=14 vs. 17)	9.7 (-3.8, 23.1)	NS
	Study center	**Center 1** (n=67 vs. 58)	12.0 (5.3, 18.8)	NS
	Study center	**Center 2** (n=15 vs. 14)	13.0 (-1.0, 27.0)	NS
	Study center	**Center 3** (n=1 vs. 4)	26.3 (-15.9, 68.4)	NS
	Study center	**Center 4** (n=8 vs. 5)	-3.4 (-24.9, 18.1)	NS
	Study center	**Center 5** (n=4 vs. 3)	-4.9 (-33.7, 23.9)	NS
	Study center	**Center 6** (n=5 vs. 3)	-20.1 (-47.6, 7.4)	NS
	Age (years)	**Age, continuous variable**	-0.31 (-0.44, -0.18)	0.001
	Baseline scores	**Baseline HOS-ADL, continuous variable**	-0.19 (-0.41, 0.03)	0.084

Adj = adjusted; CI = confidence interval; FAI = femoroacetabular impingement; F/U = follow-up; HOS-ADL = Hip Outcome Score – Activities of Daily Living; iHOT-33 = International Hip Outcome Tool, 33-items; KL = Kellgren-Lawrence; MD = mean difference; PT = physiotherapy.
*Post-randomization
‡Griffin: Adjusted for treatment group, impingement type, sex and baseline scores, recruiting center and interaction term between subgroup of interest and treatment group. Palmer: Adjusted for all covariates included in primary analysis model.
§ the interaction effect between the two variables (treatment and age) represents a change for each one unit increase in age in the arthroscopy group; adjusted for baseline HOS ADL, sex, age at randomization, and site.

3.3.4 Key Question 4: Cost Effectiveness (Adults)

3.3.4.1 Summary of Studies and Key Points

One cost-utility analysis (CUA) published since the 2019 review compared arthroscopic osteochondroplasty (with or without labral repair) with arthroscopic lavage (with or without labral repair).[247] No new full economic evaluations comparing hip arthroscopy with non-operative care were identified for this update. The three CUAs comparing hip arthroscopy with non-operative care were included in the 2019 HTA and are summarized below.[76,144,222]

3.3.4.2 Arthroscopic Osteochondroplasty vs. Lavage

One CUA (moderate quality)[247] found that arthroscopic osteochondroplasty (with or without labral repair) was cost-effective compared with arthroscopic lavage (with or without labral repair), providing greater health benefits (quality adjusted life years [QALYs]) at an acceptable additional cost from a Canadian healthcare payer perspective.

Authors developed a Markov state-transition model from the perspective of the Canadian public payer to compare arthroscopic osteochondroplasty (with or without labral repair) with arthroscopic lavage (with or without labral repair) in patients with FAIS (N=220, mean age 36 years). Costs were reported in 2023 Canadian dollars and included direct medical costs over a lifetime time horizon. Clinical effectiveness, health utility, and cost data were primarily obtained from the FIRST trial,[9] with long-term outcomes extrapolated using parametric survival models. Some modeling imputes were based on two poor quality CUAs comparing arthroscopy and conservative care (Mather and Shearer) detailed below.[144,222] Deterministic and probabilistic sensitivity analyses were conducted to assess the robustness of the findings. The study found arthroscopic osteochondroplasty to be the dominant strategy, resulting in greater QALYs and lower lifetime costs than arthroscopic lavage.[247]

Methodological strengths included the use of patient-level data from a multicenter RCT, validated health utility measures, one-way and probabilistic sensitivity analyses. However, the FIRST trial followed patients for only 2 years, requiring extrapolation of outcomes over a lifetime horizon and introducing structural uncertainty. Consideration of adverse events for modeling is not clear. Long-term progression to THA and other model inputs were informed by published literature and expert opinion, while post-THA health utility estimates were also derived from published literature rather than trial data. The analysis was conducted from the Canadian public payer perspective which may limit the generalizability of the findings to other healthcare systems and perspectives.[247]

3.3.4.2.1 Detailed results: Operative care versus lavage

Yan, 2024[247]

Study characteristics and framework

A moderate quality (QHES 78/100) CUA conducted in Canada evaluated the long-term economic and health-related QoL impacts of arthroscopic osteochondroplasty (with or without labral repair) compared with arthroscopic lavage (with or without labral repair) for young adults (mean age 36 years) with FAIS.[247] Conducted from the Canadian public healthcare payer perspective, the study used an 8-state Markov cohort state-transition model informed primarily by a RCT. The model simulated standard annual transitions between reoperation, progression to THA, successful THA, failed THA, and death, for an initial cohort aged 36 years across a lifetime horizon up to age 100 years. Future costs and QALYs were discounted at an annual rate of 1.5%; rationale for this discount versus more usual 3% was not provided. All costs were reported in 2023 Canadian dollars (CAD).

Primary model inputs for the base case were based on patient-level data in the Femoroacetabular Impingement Randomised Controlled Trial (FIRST), however, some modeling inputs were from two poor quality CUAs[144,222] of arthroscopy versus conservative care. Short-term clinical parameters from the trial's 2-year window were extrapolated over the lifetime horizon using a generalized gamma survival model with independent shape parameters selected based on the lowest Akaike information criterion (AIC) in order to capture important differences in costs and outcomes. Costs were derived primarily on documented expenses from the FIRST trial but specifics for some costs are not detailed. Initial surgical costs were primarily influenced by operating room time, with baseline costs of $4,129.42 for osteochondroplasty and $2,597.41 for lavage. Medication costs were estimated based on patient-level medication use data with the corresponding costs from the Ontario Drug Benefit Formulary. Mean medication costs were estimated separately for patients with and without reoperation, while patients experiencing THA failure were assumed to incur medication costs 7.5-fold higher because of six months of antibiotic therapy.

Health state utilities for the primary states were estimated from the EuroQol 5-dimensions (EQ-5D-3L) questionnaire collected during the FIRST trial and valued using the Canadian population value set. Baseline utilities were set at 0.816 for the “no operation” state, and 0.700 for the “reoperation” state, while utility following progression to THA was fixed at 0.500. Disutilities of 0.050 and 0.100 were applied for reoperation and THA, respectively. Notably, the FIRST trial reported a significantly lower reoperation rate following osteochondroplasty (7.62%) than lavage (18.27%), which was incorporated into the model.

Base case results

In the deterministic base-case analysis, arthroscopic osteochondroplasty was the dominant treatment strategy compared to arthroscopic lavage. Over the lifetime, mean costs were $7,792 for osteochondroplasty (with or without labral repair) and $8,748 for lavage. Osteochondroplasty was associated with an incremental gain of 0.63 QALYs and cost savings of CAD $955.89 per patient compared with lavage.

Sensitivity analyses

To evaluate parameter and structural uncertainty, the authors conducted a probabilistic sensitivity analysis utilizing 2,500 Monte Carlo simulations, with model parameters assigned appropriate beta and gamma distribution. The base-case findings remained robust, with osteochondroplasty having an 85.3% probability of being cost-effective at a willingness-to-pay (WTP) threshold of CAD $5,000 per QALY and a 90.5% probability at a threshold of CAD $50,000 per QALY. Across one-way sensitivity analyses, authors report that osteochondroplasty remained the dominant strategy in all but two scenarios. Specifically, when using a log-normal common-shapes survival model (incremental cost-effectiveness ratio [ICER] CAD $3,726/QALY) and when using a shorter 10-year time-horizon (ICER CAD $2,676/QALY),

osteochondroplasty remained cost-effective but was no longer cost-saving. In all other scenarios, including alternative reoperation probabilities, a log-normal model with independent shape parameters, and varying discount rates (0% and 3%), osteochondroplasty remained the dominant strategy compared with lavage. Overall, the results remained robust across most sensitivity analyses, with differences observed primarily when assumptions regarding long-term outcomes or the time horizon were varied. ICERs for other one-way parameters were not provided.

Conclusions and limitations

The authors concluded that, over a lifetime horizon, arthroscopic osteochondroplasty was a robustly cost-effective and dominant treatment strategy compared with arthroscopic lavage for young adults with FAIS. These findings appear to be influenced by the lower reoperation rates observed in the FIRST trial together with assumptions regarding long-term disease progression to estimate lifetime costs and health outcomes. However, several limitations should be considered. First, the underlying FIRST trial followed patients for only 2 years, requiring extrapolation of clinical outcomes over a lifetime horizon and introducing structural uncertainty. Additionally, although long-term outcomes were estimated using parametric survival models, progression to THA and other long-term model inputs were informed by published literature and expert opinion. Explicit modeling of adverse events is not clear. Consequently, the projected lifetime differences in costs and QALYs depend on assumptions regarding the long-term natural history of FAIS and durability of treatment effect not directly observed in the FIRST trial. From other RCTs included in this review, the long-term risk and rate of progression to osteoarthritis and need for THA are also unclear, and the published literature on these consists primarily of poor-quality nonrandomized studies, including case series. Second, because the trial did not directly measure health utilities following THA, utility estimates for these health states were obtained from published literature. Third, authors provide only limited discussion of how potential biases could impact findings, in terms of their magnitude or direction. Finally, the analysis was conducted from the perspective of the Canadian public healthcare payer, which may limit the generalizability of the findings to other healthcare systems.

3.3.4.3 Arthroscopy vs. Non-operative Care

- No new full economic studies comparing HAS with conservative care were identified for this update. Three CUA studies were included in the 2019 report. The information below is from the prior review.
- Conclusions regarding the cost-effectiveness of hip arthroscopy compared with non-operative care were inconsistent across the three studies.
- The only CUA (moderate quality) based on RCT data found that personalized PT was both more effective and less costly than arthroscopy at one year from the U.K. National Health Service perspective. The short-term horizon precluded evaluation of OA development or conversion to THA.
- Two poor quality CUAs from the U.S. found that arthroscopy was more cost-effective than non-operative care from a societal perspective over 10 year and more cost-effective than observation from a hospital cost perspective for a lifetime. Primary data sources were case series, expert opinion and retrospective survey of arthroscopy patients. Both used an unvalidated method for determining utility

Three full economic studies met the inclusion criteria; all were CUA and were included in the prior HTA.[76,144,222] The included studies ranged from poor to moderate quality (QHES from 65 to 79 out of 100 points, see Appendix D, Table D-4). Within all three analyses, hip arthroscopy was considered as the

intervention, while the non-operative care comparator varied in definition in each of the studies (including "observational", "non-operative" and "best conservative care").

Costing years ranged from 2010 to 2016, and time horizons from 1 year to lifetime models. Two of the studies took on a societal perspective that included indirect costs[76,144] while one evaluated only direct costs.[222] The average patient age ranged from 33 to 36 years. All tested the robustness of their results through various sensitivity analyses. Conclusions regarding the cost-effectiveness of hip arthroscopy were inconsistent across the studies. One study was based on a head-to-head trial of operative versus non-operative care (UK FASHiON Trial[76]), and the other two studies relied on published literature and surgical cases.[144,222]

One study of moderate quality (QHES 79/100) was conducted in the UK and funded by the HTA program of the National Institute of Health Research.[76] As part of a larger randomized control trial comparing arthroplasty with personalized PT, the level of evidence was considered to be of high quality, however, the short follow up time of only 1 year and the applicability to the U.S. health care systems raised some concerns. The insufficient follow up period prevented authors from fully capturing long term risks such as the development of osteoarthritis, future surgeries, recurrent pain or recurrent labral tears. There also remained some ambiguity surrounding the methodology of approximating indirect costs. The study found hip arthroscopy to be dominated by personalized physical therapy (meaning that personalized PT care was both more effective and less costly).

In contrast, there were two poor quality CUAs conducted in the U.S.,[144,222] both of which concluded that surgical intervention for FAI may be cost-effective. The more recent study (QHES 67/100 points) was performed by surgeons doing high volumes of arthroscopy with various ties to commercial interests.[144] It cites some of the same methods and clinical data sources as the other U.S. study. The study implemented a Markov decision tree model that forecasted a 10-year time horizon for a hypothetical cohort to evaluate cost effectiveness. The study found non-operative care to be dominated by hip arthroscopy in patients who had failed non-operative treatment lasting on average 6 weeks. The other poor-quality study (QHES 65/100) relied on costing data from a single site in California and clinical effectiveness data from a review of published literature.[222] It constructed a lifetime Markov model. The study found that the cost of adding one quality-adjusted-life-year by using hip arthroscopy to treat FAIS was ICER = $21,700/QALY when compared to the observation-only group. Methodological concerns across these two studies included apparent use of data and assumptions for condition progression from case series (some of which may not be specific to FAI) or from expert opinion, unclear rationale for modeling various health states, and use of unvalidated methods for converting effectiveness estimates to the quality-of-life values.

3.3.4.3.1 Detailed results: Arthroscopy vs. non-operative care

Studies are summarized below in **Table 28.** Additional study details found in **Appendix F**.

Griffin 2018[76]

Study characteristics and framework

A moderate-quality (QHES 79/100) CUA conducted in the U.K. assessed the cost-effectiveness of hip arthroscopy compared to best conservative care for treating FAIS.[76] The analysis was as part of a RCT evaluating surgical versus non-surgical personalized hip PT that is included in this HTA; it was rated as moderately low risk of bias. As such, it relied on patient level data, itemized hospital costs and care usage. It assumed a British societal perspective and incorporated costs relating to resource use, deliveries of interventions, and lost productivity. All costs were reported in 2016 British pounds sterling and converted to U.S. dollars using official U.S. Department of Treasury exchange rates for that year.[1]

The average age was 35.3 years with patients over the age of 16 years and 39% were female. Therapy lasted 12 to 24 weeks and time of final follow-up for both groups was 12 months. Failure of previous non-operative treatment was not an inclusion criterion.

Being part of an RCT, high-quality effectiveness data were derived directly from patients using health-related quality of life instruments including EQ-5D-3L, EQ-5D-5L and SF-12. Patients presenting with hip pain and radiographic evidence of cam or pincer morphology were randomly allocated to surgery (n=171) or to physical therapy (n=177). The majority of surgical procedures involved treatment of labral tear. Patients with osteoarthritis were excluded (Tönnis grade >1 or less than 2mm or superior joint space on an antero-posterior radiograph). Furthermore, any patients with a previous hip injury or shape-changing surgery were also excluded. Crossover between groups was allowed and occurred at a rate of 7.3% moving from therapy to surgery in the first 12 months, however, pertinent details relating to how these patients were accounted for was not explicitly discussed and the long-term implications of the effects were not fully explored.

Base Case Results

The mean cost for surgery was reported to be $4,083 ranging from $3,068 to $53,793 (upon review, the upper limit is suspiciously high and is perhaps inaccurately reported). Meanwhile, hip PT was delivered primarily by physiotherapists at an assumed hourly rate of $73.83/hour which include the facilities, administrative and other overhead costs. The total cost to society of surgery was estimated to be $5,023 while the best conservative care group saw costs of $2,055 in the first year. QALYs were not reported individually by treatment group, however, the difference between groups favored conservative care by a small amount of 0.02 QALYs. Therefore, surgery was both costlier and less effective and found to be dominated by PT. The authors published an additional analysis in the same population in 2022.[74] Some inputs varied compared to the original 2018 study, but the results were comparable: surgery was associated with an adjusted mean cost of £2,483 (95% CI £1,533 to £3,432) and adjusted mean additional QALY of –0.018 (95% CI –0.051 to 0.015) per patient compared to PT, with an ICER of -£140,361 per QALY gained for surgery compared to PT.

Sensitivity Analyses

Many of the underlying assumptions and conceivable uncertainties were tested in both pre-specified and post-hoc sensitivity analyses. The results from the base case analysis remained, for the most part, robust. The unadjusted model (not accounting for differences in age, sex, treatment allocations, study site, impingement type, and baseline quality of life and costs) changed to slightly favor surgery in QALYs generated but conservative care remained cost effective with a WTP threshold of $67,114. Assuming that same WTP, there was a 0.08 probability that surgery became cost-effective. In all post hoc sensitivity analyses PT dominated surgery while varying key costs such as the cost of surgery from $1,919 to $8,573. Subgroup analysis investigated the impact of age, gender, and length of time after randomization patients had surgery and impingement type. Isolating the analysis by these characteristics did not change the base case findings, however in some cases, small sample sizes of the subgroups caused greater variability which led the results to be less conclusive.

Conclusions and Limitations

The 12-month time horizon did not show that surgery was a cost-effective alternative to conservative care for treating FAIS. While well conducted in many regards, the limited follow up time did not allow for a full exploration of all relevant costs and health outcomes. Longer term risks including development of osteoarthritis, future surgeries, recurrent pain or recurrent labral tears all would likely impact costs and effectiveness. Also important to consider is the 7.3% crossover rate to surgery. Over

time, this may significantly increase costs of the physical therapy group and make surgery increasingly cost-effective.

The authors claim to assume a societal perspective and that their model includes indirect costs such as lost wages. It was unclear how these costs were estimated. The findings in the other economic studies meeting the inclusion criteria show such costs to be among the leading factors of determining cost effectiveness and given their importance (even given the shorter time horizon) more details would be helpful in drawing comparisons.

Furthermore, when compared to the other two cost utility analyses that met the inclusion criteria, both of which were based on the U.S. healthcare system, there were many relevant differences. Cost structures for interventions were different as were sources of clinical data. Clinical data for this study were based on a head-to-head comparison of operative care versus personalized PT while data for the U.S. studies were derived from sources that did not directly compare treatment options (e.g., case series). The type of non-operative care (which was not well specified in the U.S. studies), access to therapy and healthcare systems also differed across studies.

Mather 2018[144]

Study characteristics and framework

A poor-quality (QHES 67/100) CUA examined differences in hip arthroscopy versus a broad non-operative comparator for the treatment of FAIS.[144] The study used a Markov decision model to project 10-year cost effectiveness of the two groups. Surveys from patients who received arthroscopy from two high-volume (>300 hips/year) surgeons between April 2013 and May 2014 were gathered to estimate effectiveness parameters. Non-operative patient treatment was loosely defined and described as what a panel of surgeons would recommend as alternatives for patients who did not have access to surgery; specifics were not provided. In addition to expert opinion, most model utility parameters and transition probabilities came from another cost utility analysis and related case series (reviewed below).[222] A societal perspective was assumed with the indirect costs being inferred from a separately constructed complex model that used a regression analysis to link an increase functionality resulting from surgery to an increase in productivity and therefore, in earnings in patients who had failed non-operative care and went on to have surgery. The increase in earnings was then incorporated into the primary decision model. However, the complexity of this model and the overall reliance on expert opinion pose potential challenges in reproducing the author's findings.

A five-stage Markov Model was implemented. After the initial treatment, patients remained in a posttreatment state for the first year. Following that a non-operative treatment patient was assumed to have either recovered fully or seen no benefit. If not benefiting from treatment a patient either remained in that "fair" state or moved to a "poor" state where they required a THA. Patients undergoing surgery either experienced a full recovery, no benefit, or had a procedural complication. All outcomes that were not favorable led to an eventual THA, in which case, the authors assumed a good outcome followed without giving further justification. Transition probabilities were based on expert opinion and case series.

Model information for patient-reported pre- and post-surgical functional status was based on surveys of arthroscopy patients who had failed six months of non-operative treatment obtained from two surgeons' institutions. Based on reported survey methods, selection bias for the sample is highly likely (patient sampling methods were not described; surveys with incomplete responses were excluded, less than 50% response rate). Patients (N=91, 70% female) had "noncontroversial indications for hip arthroscopy". Data on patients receiving non-operative care was not described. It appears that pre-surgical functional status recalled by patients served as a surrogate for patients receiving non-operative

care and may be subject to recall bias; it is unclear how representative such data are, particularly for patients who may have FAI but not have "noncontroversial indications" for arthroscopy which seemed to include Tönnis grade 0 or 1 and no more than mild hip dysplasia (<20% angle) in this patient cohort, information regarding specific surgical procedures, or prevalence of labral tears was provided. Based on CPT codes used to determine direct costs from a commercial administrative database for 365 patients, it appears that modeled patients all had labral tears and acetabuloplasty and/or femoral osteochondroplasty. The mean age modeled was 33 years (ranging from 18 to 50 years).

For the model, the following utility parameters were assumed: FAIS 0.75, primary THA 0.9, post-arthroscopy 0.94 and post-surgical complications 0.5. Health state utilities were sourced primarily from another cost utility analysis (also reviewed here)[222] that relied on unvalidated methodologies using modified Harris Hip Scores and a process of linear extrapolation to generate utility values. Transition probabilities were derived primarily from expert opinion and were as follows: non-operative success rate 0.23, reoccurrence if non-operative treatment initially effective 0.67, major arthroscopy complications 0.10. Symptom severity was assumed to progress at a rate of 0.05 annually.

Base Case Results

The initial cost of hip arthroscopy was reported to be $14,363 with postoperative rehabilitation costing an additional $3,296. Non-operative costs were found to be $1,669 annually. The productivity gap derived from the secondary regression model suggested that the surgery created $8,968 in additional earnings each year.

As a result, over the course of a decade, the authors found hip arthroscopy and non-operative treatment to cost an average of $23,120 and $91,602 respectively. Their corresponding effectiveness was 8.51 and 6.48 QALYs, respectively. Surgery was therefore found to be both less expensive and more effective and thus dominant.

Sensitivity Analyses

One, two and three-way sensitivity analyses were performed as well as probabilistic simulations. All variables were found to be robust with a WTP threshold of $100,000. The time horizon, cost of surgery and post-surgery productivity were the most sensitive variables, however costs of the procedure would need to reach $76,826 in order for the two groups to cost the same after 10 years. Looking at only direct costs yields an ICER of $2,751, which would still make surgery a cost-effective intervention by commonly accepted WTP thresholds. The non-operative rate of success would need to exceed 90% and simultaneously reduce the rate of reoccurrence for costs to be equal. Probabilistic Monte Carlo simulations suggest arthroscopy was cost effective in 99% of trials.

Conclusions and Limitations

Authors conclude that arthroscopy reduced the economic cost of FAI while contributing to improved quality of life from a societal perspective. Authors acknowledge the importance of 6 to 12 weeks of non-operative treatment before surgery.

Potential conflicts of interest were noted and include numerous ties to industry coupled with the heavy reliance on expert opinion. While their analyses suggest that the findings are robust, a number of methodological limitations including the use of data from a selected patient population and case series, some of which may not be representative of patients with FAIS, need to be considered. It should also be noted that the utility values used were sourced using an unvalidated method. Many key assumptions also went unjustified particularly with regards to how non-operative patients were defined and regarding the lasting benefits of arthroscopy. Authors acknowledge that outcome data for non-operative treatment of FAIS are limited and that results may not be generalizable. The primary cost

drivers are the time horizon and productivity difference both of which depend heavily results from their secondary analysis calculating the indirect cost on earnings which in turn relied on numerous assumptions, many of which came from expert opinion. It should also be noted that only procedural costs were considered in the other U.S. study that met the inclusion criteria. In the Mather study,[144] based on direct non-operative treatment costs ranged from costing $68,483 more than arthroscopy to being cost saving by $5,625. Although they present information on direct costs, they argue that the societal perspective that incorporates indirect costs from lost productivity provides a more complete picture of the impact of arthroscopic surgery for FAI.

Shearer 2012[222]

Study characteristics and framework

One poor quality (QHES 65/100) CUA modeled the cost-effectiveness of hip arthroscopy and observation, though it was unclear whether those under observation received specific non-operative treatments.[222] Authors hypothesize that arthroscopy may prevent or delay the progression of osteoarthritis in patients with FAI. This study implemented a lifetime Markov model that derived its parameters from the weighted average of five reviewed studies with "symptomatic FAIS" from 2008 to 2010.[13,14,88,120,188] The comprehensiveness of the literature search, data abstraction and methodology for determining patient population/characteristics were not well described. Clinical inputs were based primarily on case series of surgical patients with FAI and the progression of osteoarthritis was based on a small prognostic study of radiographic features at high risk of selection bias.[14] No crossover to surgery arm was allowed.

The average age of the hypothetical cohort was 36 years. This study used findings from a small prognostic study of radiographic parameters, including those pertaining to FAI, in patients with a history of symptomatic idiopathic arthritis to assume that all patients progressed uniformly to poor hip function at a rate of 3.3% per year (33% over 10 years).[14] Three years was the longest follow up for arthroscopy treatment found in their review of the literature. Nevertheless, they forecasted a lifetime model. It was further assumed that both groups moved towards THA in the event of progression to end stage arthritis.

A narrower cost perspective was used compared to the other studies meeting the inclusion criteria. A hospital's perspective assessing direct, procedural costs was taken for the analysis as authors report there was insufficient means to calculate societal costs, and the authors assumed the findings would be similar across groups. The costs were sourced from a review of 10 procedures at a single site using a cost-to-charge ratio to evaluate payments received.

Eight discrete health states were considered in the model. All patients in the observation group began with fair hip function, defined as a state of hip pain and function in untreated symptomatic FAI. If patients progressed to poor hip function it was assumed that they suffered from hip pain and hip function comparable to end stage arthritis and required total hip arthroplasty. If a patient underwent arthroscopy they could either experience only symptomatic relief or they could delay the progression of arthritis. However, the authors cite that because the longest follow up available for arthroscopic treatment was limited to 3 years the model conservatively assumed that patients could only experience benefits for that amount of time. Minor and major complications were also considered but specific events for each category were not described.

To measure effectiveness, modified Harris Hip Scores[84] that included both pain and function domains were abstracted from published literature. Linear extrapolation was then used to generate utility values. This method for determining health utilities has not been validated. For the model the following utility parameters were used: FAIS 0.75, primary THA 0.9, post-arthroscopy 0.94, poor hip function 0.5, fair hip function 0.75, good hip function 0.94. A complication rate of 1.5% during

arthroscopies was assumed. Afterwards, the probability of major complications for arthroscopy was 0.1 and 0.117 for THA.

The cost of a hip arthroscopy procedure was estimated to be $11,850. The cost of a primary THA was $24,200 with a revision costing $34,700.

Base Case Results

The study did not report the cost or QALYs for each treatment group but presented their differences. The estimated ICER for the primary analysis was found to be $21,700. For patients with preoperative arthritis the ICER climbed to $79,500/QALY as a result of less post-operative utility and poorer hip functionality.

Sensitivity Analyses

The authors examined a variety of their assumptions and approached their sensitivity analysis by assuming a willingness to pay threshold of $50,000 for each additional QALY then calculating how the parameters would need to change in order to yield an ICER = WTP.

Varying the durations of benefit from 3 years to 13 months resulted in the ICER of $50,000/QALY or less. If arthroscopy delays OA progression by 3 years, the ICER decreased to $19,200/QALY. Similarly, increasing cost of arthroscopy to $27,300 would have the same impact. The ICER was robust for wide range of cost and outcome of THA. The reported threshold for the duration of benefit resulting in an ICER <$50,000 /QALY was 8 years.

Furthermore, a probabilistic Monte Carlo simulation suggested that the ICER was less than $50,000 in 85% of trials and less than $100,000 in 97%.

Conclusions and Limitations

Authors conclude that arthroscopy in patients without arthritis is cost effective for a commonly accepted WTP threshold of $50,000.

Uncertainty remains regarding the quality of life, duration of benefits and effect on subsequent THA following arthroscopy. A key limitation of this study relates to the quality of literature available for clinical input (i.e., surgical case series). The authors acknowledge that the impact of arthroscopy on progression of arthritis is unclear, that the scenario of progression is hypothetical and that conclusions are limited based on the poor quality of available evidence. In addition, they state that their model suggests that in patients with FAI and osteoarthritis, arthroscopy would have a relatively small incremental benefit which would negatively impact the cost-effectiveness.

In terms of cost estimates, only direct costs were considered and sourced on a single hospital with a small sample of patients; accuracy as well as broader applicability therefore may be questionable.

The study used unvalidated methods for converting effectiveness estimates to the quality-of-life values. This limitation was made more significant by the fact that the sensitivity analysis revealed postoperative utility to be a highly influential parameter in the model.

Table 28. Summary of economic studies comparing arthroscopic surgeries to other interventions for FAIS

Author, Year, Country Funding QHES	Population (N), sources	Intervention vs. Comparator	Design/model, Perspective, Currency	Time horizon, Discounting	Primary findings (ICER, dominance, key outcomes)
Yan, 2024[247] Canada Funding: government QHES: 78	N=220 patients presenting with a documented period of failed non-operative management (≥6 months) with cam- or mixed-type FAIS diagnosed using radiography/ MRI and obtained temporary pain relief from a diagnostic intra-articular hip injection. Mean age: 36 years Gender: 38% female Based on FIRST Trial; costs validated by clinical experts	Osteochondroplasty (with or without labral repair) vs. arthroscopic lavage (with or without labral repair)	CUA, Markov cohort 8 state model Canadian public payer, 2023 CAD	Lifetime, 1.5% discounting	Osteochondroplasty (with or without labral repair) dominated lavage (with or without labral repair); ($7,792.5/QALY vs. $8,748.4/QALY) **One-way SA**: Probabilistic sensitivity analyses show that the probability of osteochondroplasty (with or without labral repair) was 90.5% at WTP of $50,000/QALY. Across nearly all one-way sensitivity analyses, surgery remained a cost-effective option.
Griffin, 2018[*76] UK Funding: government QHES: 79[*]	N=348 patients presenting with hip pain and radiographic evidence of cam or pincer morphology; no osteoarthritis Mean age: 35.3 years Gender: 39% female Based on UK FASHiON Trial	Hip arthroscopy vs. personalized hip therapy (12-24 weeks) and best conservative care	CUA, Micro-costing/sampling direct costs Societal (UK NHS), 2016 British pounds converted to USD[†]	1 year, No discounting (short time horizon)	ICER = $3,184/-0,02 QALY[‡] PT was more cost-effective than hip arthroscopy with hip arthroscopy being associated with an additional cost of $1,767 and additional QALYs of -0.018 per patient compared with PT **One-way SA:** unadjusted model slightly favored surgery in QALY's generated with WTP threshold of $67,114 there was a 0.08 probability that surgery was cost-effective. Adjusting for sex, study site, impingement type, and healthcare service, surgery was significantly more expensive. **Other SA:** In all post-hoc sensitivity analyses, PT dominated hip arthroscopy while reasonably varying costs and assumptions behind utility measures

Author, Year, Country Funding QHES	Population (N), sources	Intervention vs. Comparator	Design/model, Perspective, Currency	Time horizon, Discounting	Primary findings (ICER, dominance, key outcomes)
Mather, 2018[*144] USA Funding: Industry QHES: 67[*]	N=102 patients with "non-controversial indications for surgery", Tönnis grade 0 or 1 and no more than mild (<20% angle) hip dysplasia. Mean age: 33 Gender: 70% female All patients underwent 6 weeks non-operative treatment prior to inclusion Based on published case series and patient surveys collected by surgeons; relied heavily on expert opinion	Hip arthroscopy vs. non-operative care (oral NSAIDs, activity modification, physical therapy, and corticosteroid injection)	CUA, Markov decision tree 5 state model Societal, 2015 USD	10 years, 3% discounting	Hip arthroscopy dominates non-operative care ($2,713/QALY vs. $2,906/QALY) One-way SA: All variables robust with WTP of $100,000. Time horizon, cost of surgery, and post-surgery productivity most sensitive variables. Costs are equal when procedure reaches $76,826. Looking at only direct costs yields an ICER of $2,751. Must change non-operative rate of success to >90% AND reduce rate of recurrence of symptoms to <5% to make it dominant. Other SA: Probabilistic Monte Carlo simulations suggest arthroscopy is cost effective in 99% of trials.
Shearer, 2012[*222] USA Funding: unclear QHES: 65[*]	N=NR Weighted average of 5 reviewed surgical case series with FAIS from 2008 to 2010 Patients were assumed to progress to poor hip function at a rate of 3.3% per year, with an assumed benefit of 3 years for arthroscopy Mean age: 36 years	Hip arthroscopy vs. observation followed by THA if progression to end-stage arthritis	CUA, Markov decision tree 8 state model Hospital or payer (unclear), 2010 USD	Lifetime, 3% discounting	ICER = $21,700/QALY One-way SA: Varying the durations of benefit to 13 months the ICER <$50,000/QALY; increasing cost of arthroscopy to $27,300 the ICER = $50,000/QALY; with arthritis the ICER = $79,500/QALY ICER is robust for wide range of costs and outcome of THA Other SA: Probabilistic Monte Carlo simulations suggest ICER <$50,000 in 85% of trials, <$100,000 in 97% of trials

CAD = Canadian dollars; CUA = cost-utility analysis; FAIS = femoroacetabular impingement syndrome; FIRST = femoroacetabular impingement randomized controlled trial; ICER = incremental cost-effectiveness ratio; MRI = magnetic resonance imaging; NHS = national health service; NR = not reported; NSAIDs = nonsteroidal anti-inflammatory drugs; PT = physical therapy; QALY = quality-adjusted life-year; QHES = quality of health economic studies; QoL = quality of life; RCT = randomized controlled trial; SA = sensitivity analysis; THA = total hip arthroplasty; UK = united kingdom; USA = united states of America; USD = united states dollars; WTP = willingness-to-pay

* In 2019 HTA.

† Using $1 = £0.745.

‡ Representing net QALY loss.

3.4 Results: Adolescents

No new RCTs or NRSIs were identified investigating operative versus non-operative treatment or lavage in adolescent populations. One NRSI was included from the 2019 HTA investigating operative treatment compared to either PT/activity modification or intra-articular steroid injection.[182] Sample size was 76 (93 hips), mean age was 15, and 65% were female. FAI type included 29% cam, 32% pincer, and 39% mixed. When recruited, all patients followed the same algorithm for intervention based on the recurrence of symptoms. Initially, all patients underwent a trial of rest, PT, and activity modification; sporting activities were halted for six weeks, PT focused on core stability and flexibility exercises, and any resumed activities were to be modified to avoid deep flexion. If patients remained symptomatic, they were offered an image-guided intra-articular steroid injection (Kenalog, 40 mg). Finally, if symptoms were recurrent, they were offered arthroscopic treatment. Sixty-five hips were included in the activity modification group, 11 hips were in the injection group, and 17 received arthroscopic surgery. Six patients elected to forego the injection and proceeded directly to surgery. 78% of patients had a labral tear at baseline (including 100% of injection patients, followed by 76% and 70% of arthroscopy and activity modification patients respectively). Patients were followed for mean 2.2 years, and the study took place in the United States. The NRSI was at high risk of bias. Concerns included differences between groups at baseline, unclear blinding of outcomes assessors, and lack of controlling for confounding factors.

Two SRs of case series in adolescent populations were identified. One was also included in the previously published 2019 HTA and focuses on complications within adolescents receiving arthroscopic surgery in eight studies.[43] The other was published in 2025, and focuses on effectiveness, but included limited data on safety in 24 studies.[196] Three case series were included in both SRs.[58,189,237] An additional six case series not included in either SR were identified.[44,78,129,131,213,245] In total, 35 unique studies were identified.[12,16,29,30,35,41,44,58,64,78,123,126,129-131,133,134,147,150,156,165,168,169,172,186,189,190,210,212,213,219,226,237,245,246] Because no RCTs and no new cohort comparing operative versus non-operative care were identified for adolescent populations, case series evaluating adolescents are included here for completeness. See **Table 29** for details. Strength of evidence was not done for any of these outcomes/studies, as case series are considered at high risk of bias because they do not compare alternative treatment options, are subject to selection bias and information bias, and do not control for prognostic factors.

Amongst individual studies, sample sizes ranged from 10 to 157 (54% of studies had sample sizes below 50), mean age ranged from 13 to 19, and, other than one study each in all boys[213] and all girls,[186] the proportion of girls ranged from 15% to 96%. Morphology was uncommonly reported, with cam type ranging from 10% to 72%, pincer type 4% to 24%, and mixed type in 14% to 77%. Mean follow-up time ranged from 0.7 to 9.8 years. Twenty-nine studies observed adolescent patients receiving arthroscopy,[12,16,29,30,35,41,44,58,64,123,126,129-131,133,134,147,150,165,169,172,186,189,190,210,212,213,237,246] three in open procedures,[78,168,226] one study[245] did not give specifics, but reported that patients received orthopedic procedures, and two[156,219] reported on patients receiving arthroscopic or open surgery. Thirty studies took place in the United States,[16,29,30,35,41,44,58,64,123,126,129-131,133,134,147,150,156,165,168,169,186,189,190,210,212,213,219,226,245] two in Australia,[172,237] one in Germany,[78] one in Spain,[12] and one in Denmark.[246]

Table 29. Demographic information for case series evaluating operative treatment in adolescents with femoroacetabular impingement syndrome

Source	Study	Design	Intervention	Location	Sample Size*	Mean Follow-up (Years)	Mean Age	% Female	% Athletes	FAI Type
Newly identified for current HTA	Willimon, 2019[245]	Prospective case series	Orthopedic procedures	USA	17†	NR‡	13	59%	NR	NR
	Loewen, 2026[131]	Retrospective case series	Arthroscopy	USA	22	1	16	73%	NR	Cam: 72% Pincer: 14% Mixed: 14%
	Schaefer, 2026[213]	Retrospective case series	Arthroscopy	USA	27§	9.8	17	0%	100%	NR
Included in 2019 HTA, but otherwise not found in Rathore 2025[196] or de Sa 2015[43]	Degen, 2017[44]	Retrospective case-control	Arthroscopy	USA	34	3	16	47%	NR	NR
	Guindani, 2017[78]**	Retrospective case series	SHD	Germany	51	3	14.2	43%	NR	NR
	Litrenta, 2019[129]	Prospective case series	Arthroscopy	USA	43	2	16.1	79%	NR	NR
De Sa, 2015[43]	Byrd, 2016a[29]	Retrospective case-control	Arthroscopy	USA	108	1	15.9	54%	96%	Cam: 33% Pincer: 16% Mixed: 64%
	O'Donnell, 2012[172]	Prospective case series	Arthroscopy	Australia	76	1.5	17	44.8%	NR	NR
	Philippon, 2008[190]	Retrospective case series	Arthroscopy	USA	16	1.4	15	87.5%	100%	NR
	Novais, 2016[168]	Retrospective case series	SHD	USA	24	1	15.5	50%	100%	Cam: 50% Pincer: 4% Mixed: 46%

Source	Study	Design	Intervention	Location	Sample Size*	Mean Follow-up (Years)	Mean Age	% Female	% Athletes	FAI Type
	Sink, 2013[226]	Retrospective case series	SHD	USA	44	2.25	16.2	84%	NR	NR
Rathore, 2025[196]	Fukase, 2022[64]	Prospective case-control	Arthroscopy	USA	157	8.9	17	31%	NR	Cam: 6% Pincer: 18% Mixed: 76%
	McConkey, 2019[147]	Prospective case-control	Arthroscopy	USA	12	2	16	64%	100%	Cam: 25% Pincer: 14% Mixed: 61%
	Newman, 2016[165]	Prospective case-control	Arthroscopy	USA	84	3.8	16	81%	NR	Cam: 17% Pincer: 6% Mixed: 77%
	Morris, 2024[156]	Prospective NRSI	Arthroscopy or SHD	USA	27	NR	16	84%	NR	NR
	Saks, 2022[212]	Prospective propensity-score matched NRSI	Arthroscopy	USA	47	3	19	96%	100%	NR
	Menge, 2021[150]	Prospective case series	Arthroscopy	USA	60	12	16	70%	100%	Cam: 13% Pincer: 11% Mixed: 76%
	Nwachukwu, 2017[169]	Prospective case series	Arthroscopy	USA	47	1	17	68%	NR	NR
	Perets, 2017[186]	Prospective case series	Arthroscopy	USA	10	2.9	15	100%	NR	NR

Source	Study	Design	Intervention	Location	Sample Size*	Mean Follow-up (Years)	Mean Age	% Female	% Athletes	FAI Type
	Ruzbarsky, 2023[210]	Prospective case series	Arthroscopy	USA	111	≥2	16	67%	NR	NR
	Serbin, 2023[219]	Prospective case series	Arthroscopy or SHD	USA	91	2	16	74%	85.7%	NR
	Barastegui, 2023[12]	Retrospective case series	Arthroscopy	Spain	14	3.2	15	21%	NR	NR
	Beck, 2021[16]	Retrospective case series	Arthroscopy	USA	85	5	18	76%	76.2%	NR
	Byrd, 2016b[30]	Retrospective case series	Arthroscopy	USA	104	3.1	16	55%	100%	Cam: 28% Pincer: 14% Mixed: 58%
	Chandrasekaran, 2017[35]	Retrospective case series	Arthroscopy	USA	90	2.6	16	86%	NR	NR
	Cvetanovich, 2018[41]	Retrospective case series	Arthroscopy	USA	37	2.4	17	70%	81%	Cam: 26% Mixed: 74%
	Larson, 2019[123]	Retrospective case series	Arthroscopy	USA	28	3.3	16	25%	100%	NR
	Lee, 2022[126]	Retrospective case series	Arthroscopy	USA	96	6	16	23%	NR	NR
	Litrenta, 2020[130]	Retrospective case series	Arthroscopy	USA	69	3.8	16	75%	100%	NR
	Maldonado, 2022[133]	Retrospective case series	Arthroscopy	USA	22	2	19	44%	NR	NR
	Maldonado, 2023[134]	Retrospective case series	Arthroscopy	USA	249	2.2	16	75%	NR	NR

Source	Study	Design	Intervention	Location	Sample Size*	Mean Follow-up (Years)	Mean Age	% Female	% Athletes	FAI Type
	Winge, 2021[246]	Retrospective Case series	Arthroscopy	Denmark	29	>5	16	62%	NR	Cam: 10% Pincer: 24% Mixed: 66%
Both Rathore 2025[196] and de Sa 2015[43]	Tran, 2013[237]	Prospective case series	Arthroscopy	Australia	34	1.1	16	15%	94%	Cam: 78% Mixed: 22%
	Fabricant, 2012[58]	Retrospective case series	Arthroscopy	USA	21	1.5	18	43%	100%	Cam: 19% Pincer: 11% Mixed: 70%
	Philippon, 2012[189]	Retrospective case series	Arthroscopy	USA	60	3.5	15	69%	100%	Cam: 10% Pincer: 15% Mixed: 75%

FAI = femoroacetabular acetabular impingement; FAIS = femoroacetabular impingement syndrome; NR = not reported; NRSI = non-randomized study of intervention; SHD = surgical hip dislocation.

* In studies with matched adult cohorts, N represents only adolescent patients

† Willimon 2019 reports on 10 different orthopedic procedures for various conditions, and reports outcomes by conditions. n=17 patients were included for FAIS out of a total N=206.

‡ Patients were followed until they returned to school. Mean time to return to school was 13 days (SD 15.2)

§ All patients were nonprofessional football players.

** 34% of patients had FAI, 28% with Legg-Calve-Perthes disease, 24% with slipped capital femoral epiphysis, 8% with multiple hereditary exostoses.

3.4.1 Key Question 1: Effectiveness (Adolescents)

3.4.1.1 Operative treatments

3.4.1.1.1 Cohort Studies Included

Only one NRSI (high RoB) was included (N=93 hips in 76 patients).[182] Mean patient age was 15 years and 65% were female. FAI type included 29% cam, 32% pincer, and 39% mixed. Mean follow-up was 2.2 years.

3.4.1.1.1.1 Function

There was no difference in the likelihood of achieving the study-defined MCID (8 points) on the mHHS between arthroscopy and activity modification (84.6% [11/13] vs. 43/64; RR 1.26, 95% CI 0.94 to 1.68) or injection (11/13 vs. 8/10; RR 1.06, 95% CI 0.72 to 1.56).[182] The published MCID for adolescents with FAIS is 9.5 points.[169]

There were no differences in function between arthroscopy and either activity modification or injection based on the mHHS (0–100 scale) or NAHS (0–100 scale). Compared with activity modification, the mean difference was −1.0 (95% CI −7.11 to 5.11) for the mHHS and −0.4 (95% CI −7.91 to 7.11) for the NAHS. Compared with injection, the corresponding mean differences were −1.0 (95% CI −8.6 to 6.6) and 0.4 (95% CI −5.47 to 6.27), respectively.[182] All estimated are imprecise.

3.4.1.1.1.2 Return to Sport

Approximately half of patients returned to sport, with no differences between arthroscopy and either activity modification or injection, however substantial imprecision is noted for the estimate.[182] There were no differences in the likelihood of returning to sport overall (arthroscopy vs. activity modification: RR 0.89, 95% CI 0.49 to 1.64; arthroscopy vs. injection: RR 0.93, 95% CI 0.41 to 2.12), returning to the same sport (vs. activity modification: RR 0.58, 95% CI 0.24 to 1.43; vs. injection: RR 0.67, 95% CI 0.22 to 2.07), or returning to a different sport (vs. activity modification: RR 1.84, 95% CI 0.50 to 6.80; vs. injection: RR 2.00, 95% CI 0.24 to 16.61). Similarly, there were no differences in the likelihood of quitting sport overall (vs. activity modification: RR 1.28, 95% CI 0.54 to 3.04; vs. injection: RR 0.83, 95% CI 0.29 to 2.37) or quitting sport because of pain (vs. activity modification: RR 1.15, 95% CI 0.35 to 3.79; vs. injection: RR 2.00, 95% CI 0.24 to 16.61).[182]

3.4.1.1.2 Case Series Included

An updated search identified three[131,213,245] new case series that do not appear in previously published SRs or the 2019 HTA and three[44,78,129] case series were carried over from the 2019 HTA (**Table 29**). Four studies were retrospective[44,78,131,213] and two[129,245] were prospective, and all took place in the United States except for one study that was conducted in Germany.[78] Two studies[129,245] reported no funding, one reported industry funding,[213] and three[44,78,131] did not report any source of funding. Five case series[44,78,129,131,213] were smaller (range, 22 to 51), and one of these studies included only nonprofessional American football players.[213] The sixth study included 206 patients with various conditions treated by common orthopedic procedures (N=206), with only 17 patients included for FAIS correction; all other patients were not relevant to the current analysis[245] Mean age ranged from 13 to 17 years, the proportion of female patients ranged from 43% to 79% across five studies[44,78,129,131,245] and the sixth[213] included only athletic males. BMI ranged from 20.9 to 28.1 (3 studies).[129,131,213] Morphology type was only reported in one study, with the majority (72%) of patients having cam-type FAI.[131] Hip laterality was only reported in two studies,[129,213] with most patients (48%) experiencing FAIS in the right hip, followed by bilateral (33%) and left-sided (19%) FAIS in one study,[213] and a balance of patients in the

other (52% left vs. 48% right);[129] these same studies reported a mean LCEA of 29.3 (SD 4.9) to 31.6 (SD 6.3). The other two studies did not report on these patient characteristics. Other patient characteristics were poorly reported. The study in athletic males reports that all patients received femoroplasty, and 86% of hip received acetabuloplasty.[213]

Common procedures included acetabuloplasty (range, 81% to "most patients"), decompression (26% to 100%), capsular closure (94% to 97%), labral repair (range 9% to 85%), femoroplasty (50%), labral debridement (13% to 24%), femoral osteoplasty (range 2% to 66%), iliopsoas fractional lengthening (75%), lesion fixation (4%), synovectomy (0% to 4%), capsular release (6% to 13%), ligamentum teres debridement (19%), AIIS/subspine decompression (2% to 73%), capsular repair/plication (up to 88%), and microfracture (0%).[44,78,129]

The other two studies did not give details on arthroscopic treatments.[131,245] One study reported that all patients had labral tears (as an inclusion criteria).[213], one study did not report on the proportion of labral tears, but did report that 85% of patients received labral repair treatments[44] The other four studies did not report the number of patients with labral tears.[78,129,131,245]

One SR by Rathore, et al.[196] was identified as being most complete and included 24 unique studies, including two NRSI,[156,212] three case-case controls,[64,147,165] 13 retrospective case series,[12,16,30,35,41,58,123,126,130,133,134,189,246] and six prospective case series.[150,169,186,210,219,237] For the purpose of this report and to be consistent with the methods of this SR, NRSIs and case control studies were treated as case series, with each arm representing a separate series. Sample size ranged from 10 to 249, mean age ranged from 15 to 19 years, most patients were male (range 15% to 96%, excluding two outliers that only included male or female patients) and most studies were based in the United States. When reported, the proportion of athletes was 76% to 100%. Surgical procedures included the following: labral repair (80%), femoroplasty (60%), acetabuloplasty (52%), capsular closure (47%), ligamentum teres debridement (16%), capsular plication and repair (15%), combined acetabuloplasty and femoroplasty (13%), iliopsoas fractional lengthening (13%), plication (12%), labral debridement (10%), ligamentum teres treatment (6%), labral reconstruction (6%), capsular treatment (5%), synovectomy (4%), femoral osteochondroplasty (4%), acetabular rim trimming (3%), capsular release (3%), capsular repair (1%), trochanter bursectomy (1%), labral suture (1%), other <1% (including femoral osteoplasty, acetabular osteoplasty, cartilage stabilization, chondroplasty, acetabular microfracture, femoral head microfracture).

There was significant overlap between the old report and Rathore. Three studies were included in the 2019 report but not included in Rathore.[44,78,129] There may be some differences in inclusion criteria.

3.4.1.1.2.1 Function

3.4.1.1.2.1.1 mHHS measure

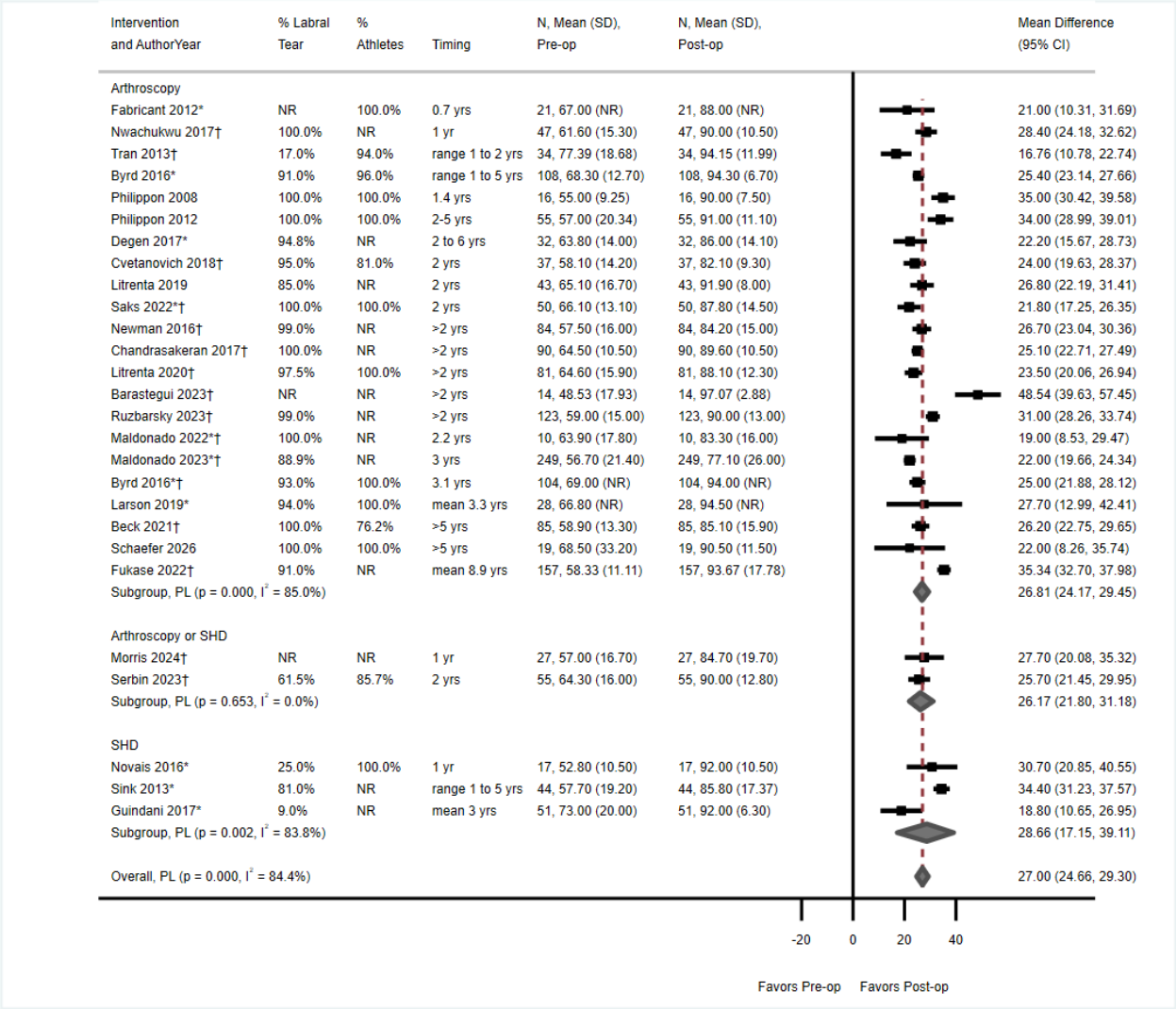
Twenty-eight case series reported **mHHS** (0–100 scale). Across all studies, arthroscopy and/or SHD were associated with clinically important improvements from baseline (MCID 9.5) at 1–9 years of follow-up.[12,16,29,30,35,41,44,58,64,78,123,129,130,133,134,156,165,168,169,189,190,210,212,213,219,226,237]

When stratified by intervention type, pooled estimates for arthroscopy[12,16,29,30,35,41,44,58,64,123,129,130,133,134,165,169,189,190,210,212,213,237] (22 studies, N=1,532), SHD[78,168,226] (3 studies, N=112), or mixed arthroscopy/SHD[156,219] (2 studies, N=92) all demonstrated clinically important improvements from baseline, although heterogeneity was substantial (**Figure 10**).

Excluding one outlier study that likely misreported baseline scores had little effect on the pooled estimates (**Appendix Figure G3**). Twelve studies reported the proportion of patients achieving the MCID, with 70% to 100% of patients meeting this threshold (**Appendix Table E-**

6).[16,41,64,123,129,133,134,156,169,210,212,213]

Figure 10. mHHS change from baseline following operative treatment in adolescents with FAIS



CI = confidence interval; mHHS = modified Hip Harris Score; NR = not reported; PL = profile likelihood; SD = standard deviation; SHD = surgical hip dislocation.

* MDs and 95% CIs as reported in individual study.
† Study included within Rathore 2025.

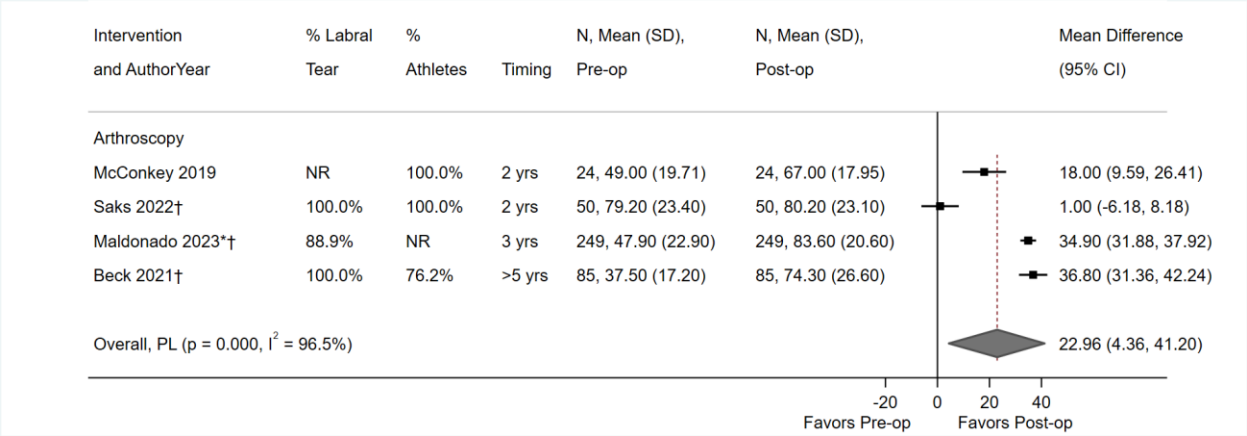
3.4.1.1.2.1.2 iHOT-12 and iHOT-33 measure

Four case series reported **iHOT-12** (0–100 scale). Pooled estimates demonstrated improved iHOT-12 scores following arthroscopy at 2 to >5 years of follow-up compared with baseline (4 studies, N=582).[16,134,147,212] Heterogeneity was substantial (I^2=97%), and one study reported no improvement.[212] No published MCID has been established for the iHOT-12 in adolescents with FAIS. However, two studies[16,134] reported that 75% to 80% of patients met the published MCID thresholds established for adult populations (**Figure 11** and **Appendix Table E-6**).

Two additional case series reported **iHOT-33** scores (0–100 scale). Pooled estimates demonstrated clinically important improvements from baseline at 1–6 years of follow-up (pooled MD in change scores

38.09, 95% CI 21.15 to 53.59; MCID 10.7; I^2=86.6%; **Table 30**).[44,169] One study reported that 94% of patients met the published MCID of 10.7 (**Appendix Table E-6**).[169]

Figure 11. iHOT-12 change from baseline following operative treatment in adolescents with FAIS



CI = confidence interval; FAIS = femoroacetabular impingement syndrome; iHOT = International Hip Outcome Tool; NR = not reported; PL = profile likelihood; SD = standard deviation.

* MDs and 95% CIs as reported in individual study.
† Study included within Rathore 2025.

3.4.1.1.2.1.3 HOS- and HOOS-ADL and HOS- and HOOS-Sport measure

Twenty case series reported function using the HOS-ADL or HOOS-ADL and HOS-SSS or HOOS-Sports subscales (0–100 scale for all outcomes).

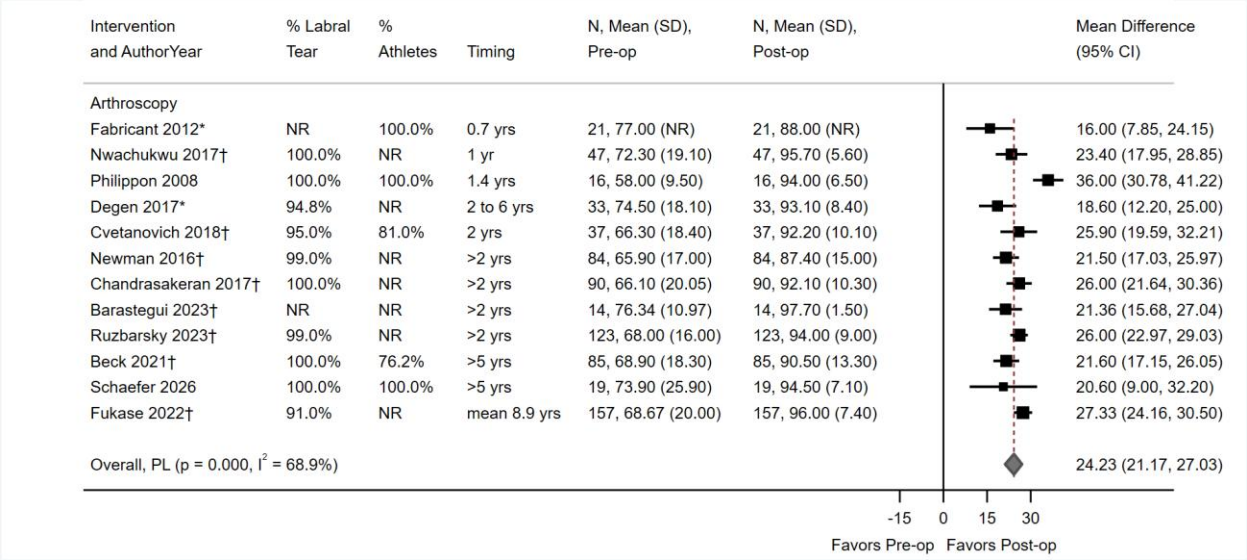
Twelve case series (N=726) reported clinically important improvements in **HOS-ADL** scores following arthroscopy at 1–9 years of follow-up (MCID 9.8; **Figure 12**).[12,16,35,41,44,58,64,165,169,190,210,213] Seventeen case series (N=1,250) similarly reported clinically important improvements in **HOS-SSS** scores following arthroscopy at 1–9 years of follow-up (MCID 12.1; **Figure 13**).[12,16,35,41,44,58,64,129,130,133,134,165,169,189,190,210,212]

Six studies reported that 70% to 100% of patients achieved the published MCID for the HOS-ADL,[16,41,64,169,210,213] while nine studies reported that 60% to 100% achieved the published MCID for the HOS-SSS (**Appendix Table E-6**).[16,41,64,133,134,169,210,212,213]

Two case series (N=72) reported **HOOS-ADL** and **HOOS-Sports** scores, with both arthroscopy and SHD associated with improvements from baseline at 1–2 years of follow-up (**Figure 14** and **Figure 15**).[168,219] No published MCIDs have been established for these measures in adolescents with FAIS, limiting interpretation of the clinical importance of these findings. Improvements appeared greater following SHD, although the small number of studies precludes firm conclusions.

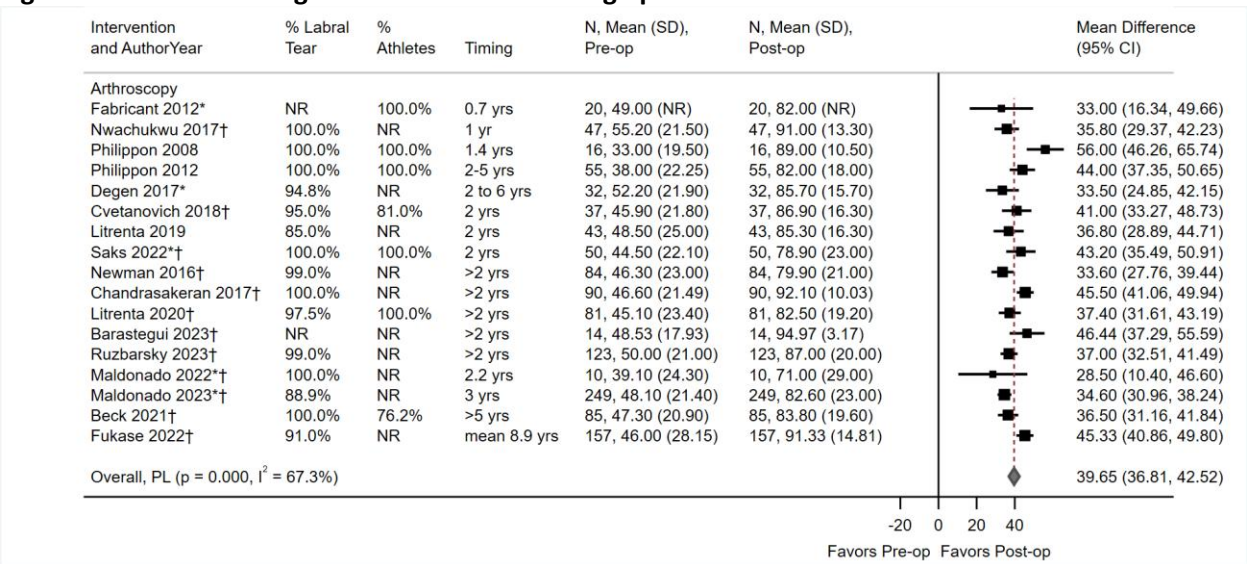
Heterogeneity was substantial across studies for all outcomes (I^2=67% to 79%).

Figure 12. HOS-ADL change from baseline following operative treatment in adolescents with FAIS



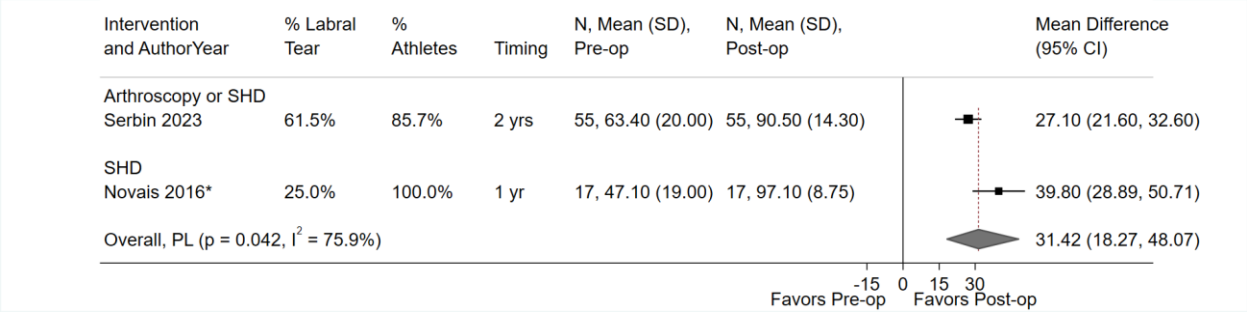
ADL = activities of daily living; CI = confidence interval; FAIS = femoroacetabular impingement syndrome; HOS = Hip Outcome Score; NR = not reported; PL = profile likelihood; SD = standard deviation.
* MDs and 95% CIs as reported in individual study.
† Study included within Rathore 2025.

Figure 13. HOS-SSS change from baseline following operative treatment in adolescents with FAIS



CI = confidence interval; FAIS = femoroacetabular impingement syndrome; HOS = Hip Outcome Score; NR = not reported; PL = profile likelihood; SD = standard deviation; SSS = sport-specific subscale.* MDs and 95% CIs as reported in individual study.
† Study included within Rathore 2025.

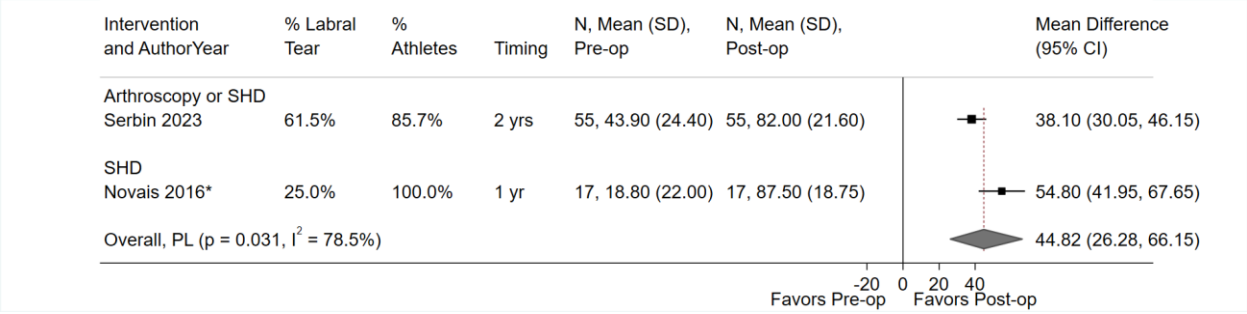
Figure 14. HOOS-ADL change from baseline following operative treatment in adolescents with FAIS



ADL = activities of daily living; CI = confidence interval; FAIS = femoroacetabular impingement syndrome; HOOS = Hip Disability and Osteoarthritis Outcome Score; NR = not reported; PL = profile likelihood; SD = standard deviation.

* MDs and 95% CIs as reported in individual study.

Figure 15. HOOS-Sport change from baseline following operative treatment in adolescents with FAIS



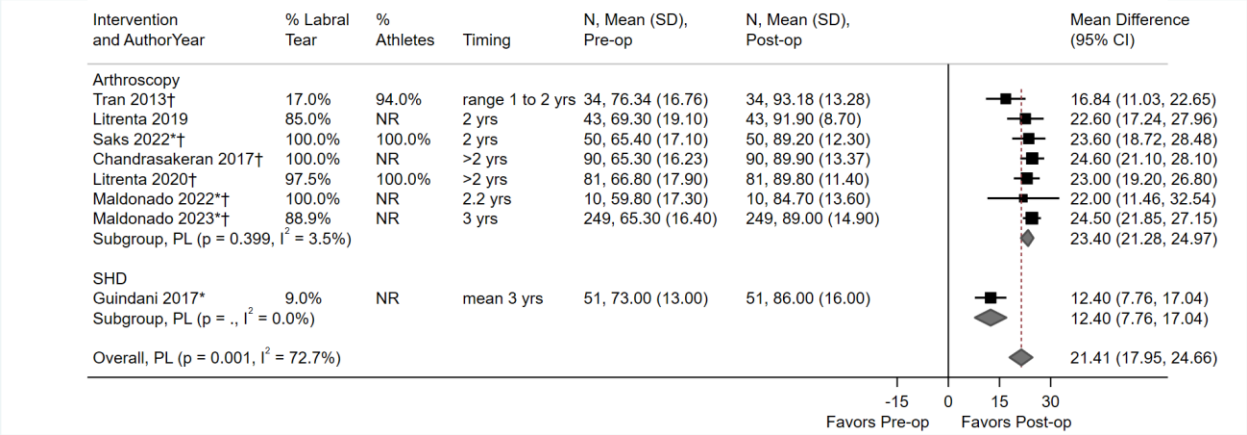
CI = confidence interval; FAIS = femoroacetabular impingement syndrome; HOOS = Hip Disability and Osteoarthritis Outcome Score; NR = not reported; PL = profile likelihood; SD = standard deviation.

* MDs and 95% CIs as reported in individual study.

3.4.1.1.2.1.4 NAHS measure

Eight case series (N=653) reported on NAHS.[35,78,129,130,133,134,212,237] Pooled estimates demonstrated improved scores at 1-3 years compared with baseline (**Figure 16**). Only one study[78] reported on SHD, with change slightly more conservative change scores than arthroscopy. Heterogeneity was substantial overall (I^2=72.7%) but low among arthroscopy studies (I^2=3.5%). No published MCID has been established for this outcome in adolescent populations receiving surgery for FAIS. Two studies by the same author group report that 60% to 83% of patients met the MCID using the thresholds published for adult populations (**Appendix Table E-6**).[133,134]

Figure 16. NAHS change from baseline following operative treatment in adolescents with FAIS.



CI = confidence interval; FAIS = femoroacetabular impingement syndrome; NAHS = Non-arthritic Hip Score; NR = not reported; PL = profile likelihood; SD = standard deviation.

* MDs and 95% CIs as reported in individual study.
† Study included within Rathore 2025.

3.4.1.1.2.1.5 Other Function measures

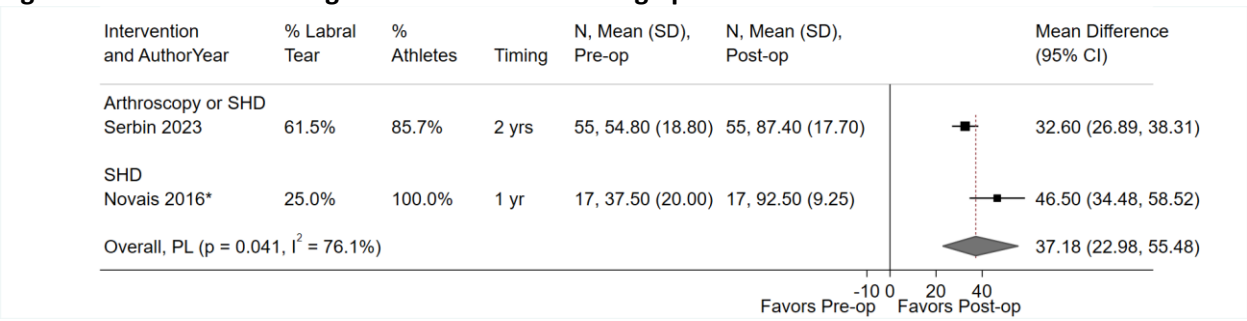
One case series reported on the UCLA activity score. Authors report that there was no difference between baseline and 1-year follow-up (MD in change scores 0.90, 95% CI –0.70 to 2.50).[168]

3.4.1.1.2.2 Pain

3.4.1.1.2.2.1 Hoos-Pain measure

Two case series (N=72) reported HOOS-Pain scores (0-100 scale). Arthroscopy and/or SHD were associated with improvements compared to baseline at 1-2 years follow-u (**Figure 17**).[168,219] No published MCIDs have been established for these measures in this population, limiting interpretation of the clinical importance of these findings. Improvements appeared greater following SHD, although the small number of studies precludes firm conclusions. Heterogeneity was substantial (I^2=76%).

Figure 17. HOOS-Pain change from baseline following operative treatment in adolescents with FAIS.



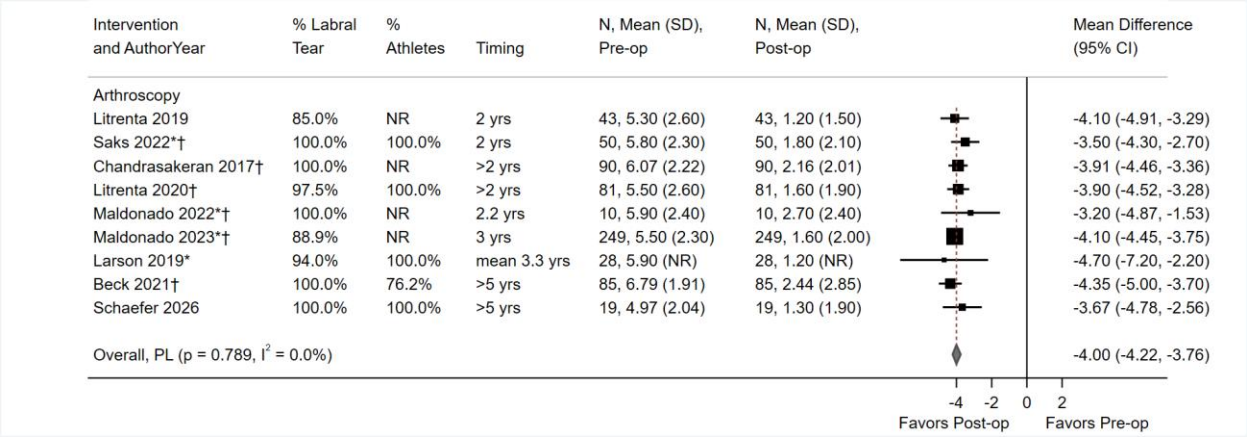
CI = confidence interval; FAIS = femoroacetabular impingement syndrome; HOOS = Hip Disability and Osteoarthritis Outcome Score; NR = not reported; PL = profile likelihood; SD = standard deviation.

* MDs and 95% CIs as reported in individual study.

3.4.1.1.2.2.2 VAS Pain measure

Nine case series (N=693) reported VAS Pain scores (0-10 scale). Arthroscopy was associated with improvements compared to baseline at 2 to >5 years follow-up (**Figure 18**).[16,35,123,129,130,133,134,212,213] No published MCIDs have been established for these measures in this population, however, one study reports that 80% of patients met the MCID as calculated by taking half of the baseline SD (**Appendix Table E-6**).[133]

Figure 18. VAS pain change from baseline following operative treatment in adolescents with FAIS.



CI = confidence interval; FAIS = femoroacetabular impingement syndrome; NR = not reported; PL = profile likelihood; SD = standard deviation; VAS = visual analogue scale.

* MDs and 95% CIs as reported in individual study.
† Study included within Rathore 2025.

3.4.1.1.2.3 Secondary Outcomes

3.4.1.1.2.3.1 HOOS Symptoms and Quality of Life

Two case series (N=72) reported HOOS-Symptoms and Quality of Life scores (0-100 scale for both measures). Arthroscopy and/or SHD were associated with improvements compared to baseline at 1-2 years follow-up for each outcome (**Table 30**).[168,219] No published MCIDs have been established for these measures in this population, limiting interpretation of the clinical importance of these findings. Improvements appeared greater following SHD, although the small number of studies precludes firm conclusions. Heterogeneity was substantial for each outcome (I^2=64% to 67%).

Table 30. Pooled effectiveness outcomes from case series evaluating operative treatment in adolescents with FAIS

Outcome (number studies)	Follow-up	N, range	Mean age (years)	Pooled MD (95% CI)	MCID
iHOT-33 (2 studies)	1 to 6 years	N=72, range 25 to 47	16	38.09 (95% CI 21.15 to 53.59), I^2=86.6%	10.7
HOOS Symptoms (2 studies)	1 to 2 years	N=72, range 17 to 55	15.8	26.10 (95% CI 16.03 to 40.00), I^2=63.9%	NR

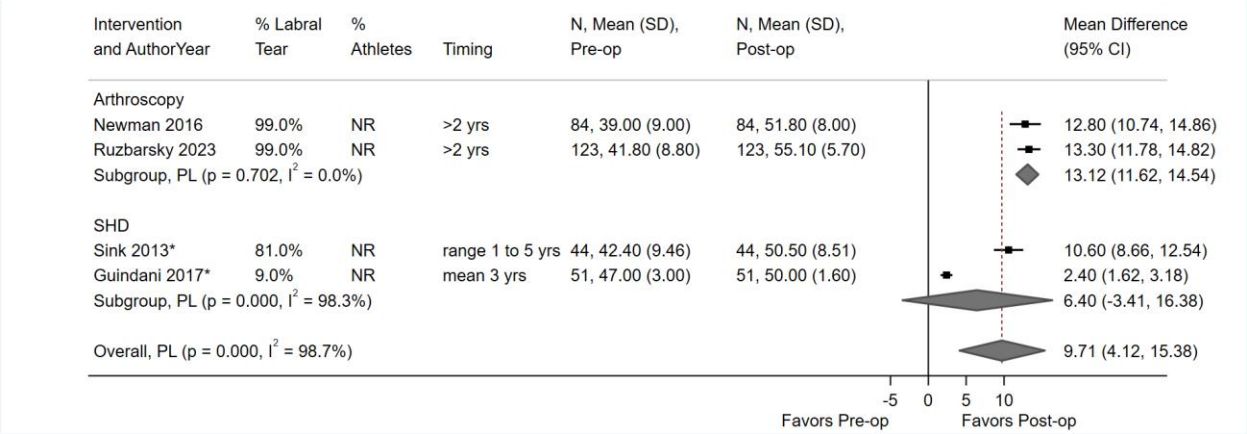
Outcome (number studies)	Follow-up	N, range	Mean age (years)	Pooled MD (95% CI)	MCID
HOOS QoL (2 studies)	1 to 2 years	N=72, range 17 to 55	15.8	43.9 (95% CI 36.48 to 55.60), I^2=42%	NR

CI = confidence interval; ADL = activities of daily living; HOOS = Hip Disability Osteoarthritis and Outcomes Score; iHOT = international Hip Outcomes Tool; MD = mean difference; MCID = minimal clinically important difference; NR = not reported; QoL = quality of life.

3.4.1.1.2.3.2 SF-12 PCS and MCS

Four case series (N = 302) reported SF-12 PCS scores. Overall, arthroscopy and SHD were associated with improved PCS scores at 1–5 years of follow-up compared with baseline (**Figure 19**).[78,165,210,226] Heterogeneity was substantial (I^2=98.7%). Stratified analyses showed that arthroscopy was associated with improved PCS scores, whereas the pooled estimate from the two SHD studies[78,226] (N=95) was not statistically significant. One study each reports on SF-12 MCS in arthroscopy[210] and SHD[226] with pooled results (N=167) showing no difference between follow-up and baseline (**Figure 20**). There is substantial heterogeneity (I^2=98%) between the two studies, with pooled results largely driven by the non-significant results of the arthroscopy study.[210] There are no published MCIDs for these outcomes in this population.

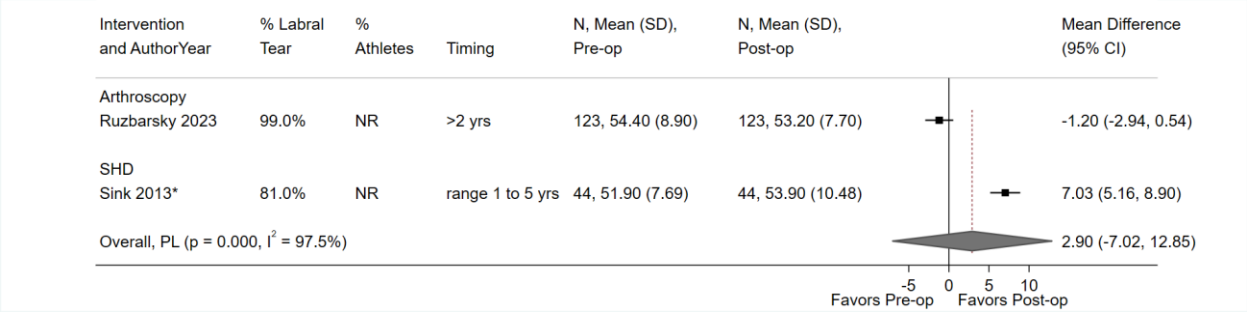
Figure 19. SF-12 physical component summary scores following hip arthroscopy versus physical therapy in adults with FAIS



CI = confidence interval; FAIS = femoroacetabular impingement syndrome; NR = not reported; PCS = physical component summary; PL = profile likelihood; SD = standard deviation; SF-12 = 12-item Short Form Questionnaire

* MDs and 95% CIs as reported in individual study.

Figure 20. SF-12 mental component summary scores following hip arthroscopy versus physical therapy in adults with FAIS



CI = confidence interval; FAIS = femoroacetabular impingement syndrome; MCS = mental component summary; NR = not reported; PL = profile likelihood; SD = standard deviation; SF-12 = 12-item Short Form Questionnaire

* MDs and 95% CIs as reported in individual study.

3.4.1.1.2.3.3 Return to Activity

Eight studies reported return to sport (**Table 31**). In the most recent study, authors reported that only 59% (16/27) of all athletes returned to football within five years post-arthroscopic surgery.[213] However, eight patients never attempted to return to football; when limiting the analysis only to patients that attempted to return, 84% (16/19) succeeded.[213] Three studies reported that 100% of patients returned to sport after mean one to two years following arthroscopic surgery.[12,41,190] Among all other arthroscopy studies, return to sport ranged from 76% to 93%.[29,123,130,212,237] In adolescents receiving open surgery, one study reported that 88% (21/24) of patients returned, with 90% of those patients returning at a level that was equivalent to or greater than their level before joining. Common reasons for not returning to sports included choosing not to return, being unable due to another unrelated injury, and completing their school sports careers.

One case series reported the average time to return to school for patients receiving FAIS correction.[245] On average, patients needed 10.8 (SD 5.1) days to return to school following orthopedic procedures (n=17).

Table 31. Return to sport following operative treatment in adolescents with FAIS

Author, year	Intervention	Mean age (years)	Athletes	Mean F/U (years)	Return to sport, % (n/N)
Barastegui, 2023[12]	Arthroscopy	15	100%	1	100% (14/14)*
Byrd, 2016b[29]	Arthroscopy	16	100%	3.2	86% (n's NR)
Cvetanovich, 2018[41]	Arthroscopy	17	81%	2.3	100% (29/29)
Larson, 2019[123]	Arthroscopy	15.9	100%	3.3	93% (n's NR)
Litrenta, 2020[130]	Arthroscopy	15.9	100%	2	83.9% (68/81)
Novais, 2016[168]†	SHD	15.5	100%	1.8	87.5% (21/24)‡
Philippon, 2008[190]	Arthroscopy	15	100%	1.4	100% (16/16)
Saks, 2022[212]	Arthroscopy	19.5	100%	3	75.6% (34/45)
Schaefer, 2026[213]	Arthroscopy	17	100%	9.8	59% (16/27)§
Tran 2013[237]	Arthroscopy	15.7	94%	≥1	90.6% (29/32)

F/U = follow-up; NR = not reported; SHD = surgical hip dislocation.
* At final follow-up (mean 3.2 years), 2 patients had experienced homolateral ACL injuries unrelated to the treatment; one had to drop out of competition, while the other returned to sport again 8 months later.
† Evaluated open surgical dislocation (all other studies evaluated arthroscopy).
‡ 90% (19/21) of patients that returned to sport returned at a level that was equivalent to or greater than their level before recruitment.
§ Not all patients attempted to return to sport. Of those that attempted, 84% (16/19) succeeded.

3.4.1.1.2.3.4 Range of Motion

Five Studies reported range of motion (ROM) in adolescents (**Table 32**).[41,78,129,156,226] Two studies found a difference at 2 years post-treatment in hip flexion and internal rotation compared to baseline, one following arthroscopy[41] and the other following SHD.[226] All other studies reported no difference regardless of intervention or ROM measure. One additional study reported that there was no difference in pre- versus post-operative hip flexion at the point of maximum squat, maximum pelvic tilt, or maximum hip flexion (all p>0.05) at mean 1 year follow-up.[131]

Table 32. Range of motion following operative treatment in adolescents with FAIS

Range of motion	Range of Motion	Intervention	Preoperative, mean (SD)	Post-operative, mean (SD)	MD (95% CI) or p-value of difference between pre- and post-operative measure
Mean hip flexion, degrees	Cvetanovich, 2018[41]	Arthroscopy	114 (12)	124 (5)	p<0.0001
	Litrenta, 2019[129]	Arthroscopy	119 (NR)	122.2 (NR)	p=0.243
	Guindani, 2017[78]	SHD	93 (32)	100 (24)	MD 5.4 (95% CI –14.4 to 3.6)
	Morris, 2024[156]	Arthroscopy	41.5 (6.3)*	43.4 (5.6)*	p=0.053
	Morris, 2024[156]	SHD	41.4 (5.9)*	43.1 (5.7)*	p=0.114
	Sink, 2013[226]	SHD	97.5 (range 80 to 125)	106.2 (range 90 to 125)	MD 13.1, p<0.001
Mean Hip extension, degrees	Guindani, 2017[78]	SHD	2 (7)	1 (8)	MD 1.1 (95% CI –4.5 to 2.3)
Mean Hip internal rotation, degrees	Cvetanovich, 2018[41]	Arthroscopy	15.7 (11.3)	25 (6)	p<0.0001
	Guindani, 2017[78]	SHD	15 (21)	16 (15)	MD 1.4 (95% CI –8.4 to 5.5)
	Litrenta, 2019[129]	Arthroscopy	26.8 (NR)	29.7 (NR)	p=0.219
	Sink, 2013[226]	SHD	18.2 (range –5 to 45)	34 (range 15 to 50)	MD 19.4, p<0.001
Mean hip external rotation, degrees	Cvetanovich, 2018[41]	Arthroscopy	45 (9.7)	48 (10)	p=0.86
	Guindani, 2017[78]	SHD	29 (27)	28 (17)	MD 2.3 (95% CI –6.1 to 10.7)
	Litrenta, 2019[129]	Arthroscopy	52.8 (NR)	54.1 (NR)	p=0.691
Mean hip abduction, degrees	Guindani, 2017[78]	SHD	28 (16)	27 (15)	MD 1.3 (95% CI –6.3 to 8.8)
	Litrenta, 2019[129]	Arthroscopy	44.3 (NR)	44.7 (NR)	p=0.790

CI = confidence interval; MD = mean difference; NR = not reported; ROM = range of motion; SD = standard deviation; SHD = surgical hip dislocation.
* Represent walking mechanic ROM. All other studies report clinical ROM.

3.4.2 Key Question 2: Safety (Adolescents)

3.4.2.1 Cohort Studies Included

No NRSIs reported on safety outcomes.

3.4.2.2 Case Series Included

One SR of case series that reported complications following surgical treatment of FAIS in adolescent populations (8 studies; mean age range 15 to 17.6 years) was carried over from the prior report; 81% of hips underwent arthroscopy and 19% had open hip dislocation.[43] An additional SR published in 2025 reporting minimal complications was identified which included adolescent populations receiving surgical treatments for FAIS (24 studies; mean age 15 to 19 years).[196] There is some overlap between the SRs regarding included case series.[58,189,237] An additional four case series were included that were not included in either SR.[29,44,78,129,213] Among these five studies, mean age ranged from 14 to 17 years, 43% to 75% (excluding Schaefer 2026 which only included male adolescents) were female. All additional case series (except one which reported on surgical hip dislocation[78]) reported on arthroscopic surgery.

Some studies otherwise included in the SRs were not cited or reported on for some outcomes – including four[41,123,130,147] for the 2025 SR[196] and four[29,168,226,237] for the 2015 SR[43] – and are reported here for completeness. Of note, Rathore 2025 includes three studies (McConkey 2019,[147] Larson 2019,[123] and Cvetanovich 2018[41]), but does not include their data when reporting revision surgery.

3.4.2.3 Serious AEs, Treatment-related AEs, Deaths

No SR or case series reported on serious AEs, treatment-related AEs, or deaths in adolescents receiving surgical treatments for FAIS.

3.4.2.4 Heterotopic Ossification (HO)

In one SR in adolescent patients[43], one case of asymptomatic HO (0.2%; 1/435 hips) was reported in a patient that had undergone open hip dislocation surgery (1.2%; 1/81 hips with open surgery). Another SR reported that 5.5% of patients (n's and interventions NR) experienced HO[196].

One additional case series reported one case (2.3%) of HO over mean follow-up periods of 50 months after arthroscopic surgery,[129] respectively. One case series reported no cases of HO.[168] See **Table 33** for details.

3.4.2.5 Avascular Necrosis (AVN)

In one SR in adolescent patients (435 hips),[43] no cases of AVN were reported over mean follow-up periods ranging from 3 to 75 months. Similarly, no cases of AVN were reported by three additional case series with follow-up ranging from 14 to 40 months.[41,123,237] See **Table 33** for details.

3.4.2.6 Fracture

No cases of iatrogenic femoral neck fracture were reported in one SR in adolescent patients (435 hips) over mean follow-up periods ranging from 3 to 75 months[43] or in one additional small case series of 44 adolescents treated with open hip dislocation surgery and followed for 24 months.[226]. There is likely overlap between the two studies. See **Table 33** for details.

3.4.2.7 Nerve injury

In one SR in adolescent patients (435 hips),[43] the frequency of nerve injury was 0.4% (0.6% with arthroscopy [2/354]; 0% with open surgery [0/81]) over mean follow-up periods ranging from 3 to 75 months. Four case series reported the frequency of nerve injury in pediatric populations which ranged from 1.9% to 8.3%[29,30,41,44,147]; rates of specific injuries were as follows: pudendal nerve injury in one study (2.7%),[29,41] one study reporting femoral cutaneous nerve injury, (8.3%)[147] and one study reporting other non-specific injuries (3%).[44] Of note, the study reporting the highest rate of nerve injury was in adolescent athletes undergoing simultaneous bilateral arthroscopy for FAIS.[147] See **Table 33** for details.

3.4.2.8 Infections

In one SR in adolescent patients (435 hips),[43] no cases of post-operative infection were reported over mean follow-up periods ranging from 3 to 75 months. In an additional SR (N=1767), authors report that only 2 cases (<1%) of mild infections occurred [196] Across three additional care series in pediatric patients,[41,226,237] only one case (2.7%) of superficial infection was reported in one small study with a mean 28 month follow-up.[41] See **Table 33** for details.

3.4.2.9 Revision surgery and additional operations

The older SR[43] reports that revision surgery was required in 4% of hips over mean follow-up periods ranging from 3 to 75 months. In the more recent SR[196], authors report that revision varied from 0% to 10% across 4 months to 75 months. There was overlap across the two SRs, the reasons for revision were poorly reported, and it is unclear which specific studies were cited for each SR's summary estimates. Looking at case series individually and including three case series not reported on in either SR (27 studies,[16,29,30,35,41,44,64,123,126,129,130,133,134,147,150,165,168,172,186,189,190,210,213,219,226,237,246] the proportion of patients that required revision ranged from 0% to 55%. Six studies reported that no patients required revision surgery.[41,123,147,190,213,237] Three outlier studies reported that 28%[126], 34%[226], and 55%[133] required revision surgeries respectively, however sample sizes were small. Excluding these outliers, proportions ranged from 0% to 14%. Most studies reported on revision following arthroscopy; however, two studies reported revision following surgical hip dislocation (proportions were 4.2%[168] and 34%[226] respectively), and a third[219] study reported that overall, 13% (including 7.4% [6/81] following index arthroscopy and 6.2% [5/81] following index surgical hip dislocation) of patients required revision following primary arthroscopy or surgical hip dislocation. The overall proportion of patients receiving revision surgery was 7.9% (143/1817). See **Figure 21** and **Table 34** for details.

Five case series also reported the frequency of additional operations which ranged from 2% to 23%;[78,129,168,213,226] the highest frequency was reported in one case series of open hip dislocation surgery which was for screw removal (n=9) and periacetabular osteotomy (n=1) (**Table 33)**.[226]

Table 33. Summary of surgical adverse events across SRs of case series and ranges across surgical arms of case series in adolescents with FAIS.

Author year	de Sa 2015[43]	Rathore, 2025[196]	Additional case series included
Heterotopic Ossification	1.2% (1/81)*	5.5% (n's NR)	2.3% (1/43), 1 case series[129] 0% (0/24), 1 case series[168]
Avascular Necrosis	0% (0/435 hips)	NR	0% (0/197), 4 case series[29,41,123,237]
Femoral Fracture	0% (0/435 hips)	NR	0% (0/44), 1 case series[226]

Author year	de Sa 2015[43]	Rathore, 2025[196]	Additional case series included
Nerve Injury	0.4% (2/435 hips)†	NR	Femoral cutaneous nerve injury: 8.3% (1/12), 1 case series[147] Perineum nerve injury: 1.9% (2/108), 1 case series[29] Non-specific nerve injury: 3% (1/32), 1 case series[44]
Infections	0% (0/435 hips)	<1% (2/1767)‡	0% (0/78), 2 case series[226,237] 2.7% (1/43), 1 case series[41]
Revision Surgery	3% (13/435 hips)	Range 0% to 13% (n's unclear)	Range§ 0% to 11.6%, 7 case series[29,41,44,123,129,147,21317,26,29,62,64,76,117]
Additional Operations	NR	NR	
Other Complications	Neurapraxia: n=2 Physeal arrest: 0% Growth disturbance: 0% Acute iatrogenic slipped capital femoral epiphysis: 0% Broken instrumentation: 0% Abdominal compartment syndrome: 0% Urinary/sexual dysfunction: 0% Chondral scuffing: 0% Labral penetration: 0% Inadequate deformity correction: 0% Instability/dislocation: 0% Premature physeal closure and proximal femoral growth arrest: 0%	Neuropraxia involving the pudendal nerve: n=3 Numbness: n=5 Erectile dysfunction: n=1 Lateral thigh impairment: n=1 Cam recurrence: 1.7% (n's NR)	Neurapraxia: n=1[44] Partial implant removal: n=1[78] Pelvic osteotomes mobilization under anesthesia: n=1[78] Fall resulting in pain over the lateral aspect of the surgical hip: n=1[168] Physeal arrest: 0%[41] Growth disturbance: 0%[29,123] Acute iatrogenic slipped capital femoral epiphysis: 0%[237] Transient lateral femoral cutaneous nerve symptoms: 0%[29] Physeal injury: 0%[29] Iatrogenic instability: 0%[29] Chondrolysis: 0%[41] Asymmetric physeal closure: 0%[168] Recurrence of cam-type FAI: 0%[168]

FAI = femoroacetabular impingement; NR = not reported.

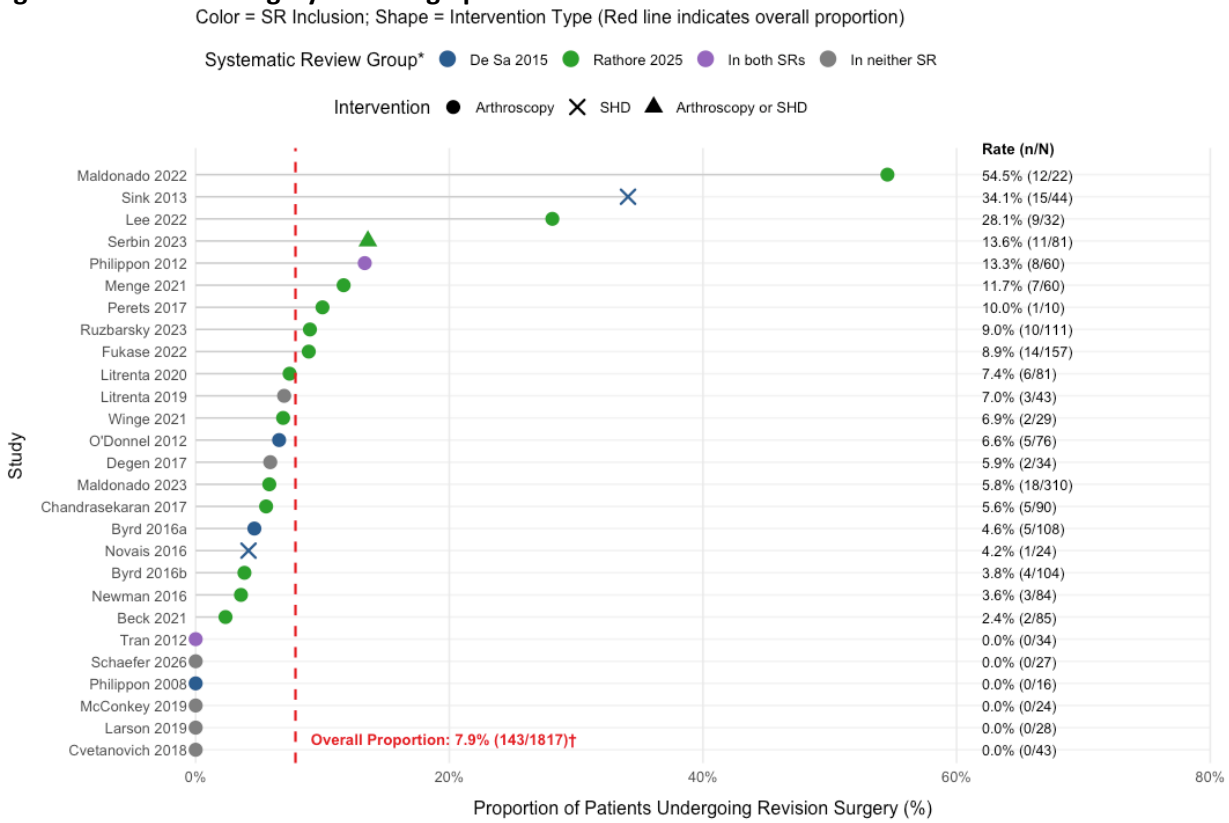
* The one case of HO was asymptomatic and occurred in a patient that received open surgical dislocation.

† Both cases of nerve injury occurred in adolescents following arthroscopy. No open surgery patients experienced this outcome.

‡ Rathore does not mention that Tran 2013 experienced no cases of infections, nor does it report which studies these two cases came from. It is likely that one came from Cvetanovich 2018.

§ Although McConkey 2019, Larson 2017, and Cvetanovich 2018 report on this outcome and were included in Rathore 2025, they were not included in the range reported in the SR.

Figure 21. Revision surgery following operative treatment in adolescents with FAIS



SHD = surgical hip dislocation; SR = systematic review.

* Not all studies were cited within their respective SR for revision surgery. In particular, De Sa 2015 does not give citations for their data, and Rathore 2025 only cites 11 studies in their table 6 (Chandrasekaran 2017, Byrd 2016, Winge 2021, Lee 2022, Litrenta 2020, Maldonado 2022, Maldonado 2023, Fukase 2022, Perets 2017, Philippon 2012, and Ruzbarsky 2023).

† Represents the total number of patients that had revision.

Table 34. Revision surgery rates and reasons for revision following operative treatment in adolescents with FAIS

Source	Individual studies	Original intervention	Rate of revision	Reasons for revision*
De Sa, 2015[43]	Byrd, 2016a[29]	Arthroscopy	4.6% (5/108)	- 4 required revision surgery after index operation - 1 underwent a periacetabular osteotomy
	O'Donnell, 2012[172]	Arthroscopy	6.6% (5/76)	Unclear
	Philippon, 2008[190]	Arthroscopy	0% (0/16)	No revisions occurred
	Novais, 2016[168]	SHD	4.2% (1/24)	- Screws used for fixation were broken and trochanteric osteotomy was minimally displaced. Patient underwent partial screw excision and trochanteric osteotomy was fixed.

Source	Individual studies	Original intervention	Rate of revision	Reasons for revision*
	Sink, 2013[226]	SHD	34% (15/44)	- 9 underwent screw removal - 5 underwent revision arthroscopy - 1 underwent periacetabular osteotomy revision
Rathore, 2025[196]	Beck, 2021‡[16]	Arthroscopy	2.4% (2/85)	- 2 patients underwent revision due to continued pain
	Byrd, 2016b[30]	Arthroscopy	3.8% (4/104)	- 1 required excision of capsulolabral adhesions with healed labrum - 1 required acetabuloplasty with labral refixation and revision femoroplasty - 1 required excision of capsulolabral adhesions and revision femoroplasty with healed labrum - 1 required excision of capsulolabral adhesions with healed labrum
	Chandrasekaran, 2017[35]	Arthroscopy	5.6% (5/90)	- 3 required revision following injury after returning to sport/dance (selective debridement) - 1 required capsular release for postoperative stiffness - 1 unclear
	Cvetanovich, 2018‡[41]	Arthroscopy	0% (0/43)	No revisions occurred
	Fukase, 2022[64]	Arthroscopy	8.9% (14/157)*	- 7 required femoroplasty (cam resection alone [15%] or combined rim trimming [39%]) - 1 required acetabuloplasty - 9 required labral treatment (repair: 39%, debridement only: 8%, reconstruction: 23%) - 12 required lysis of the capsulolabral adhesions
	Larson, 2019‡[123]	Arthroscopy	0% (0/28)	No revisions occurred
	Lee, 2022[126]	Arthroscopy	28.1% (9/32)†	- 8 hips underwent secondary hip arthroscopy due to labral retear - 1 hip underwent revision because of grade 2 damage
	Litrenta, 2020[130]	Arthroscopy	7.4% (6/81)	- Revision arthroscopy (reason NR)
	Maldonado, 2022[133]	Arthroscopy	54.5% (12/22)	- Revision arthroscopic labral reconstruction
	Maldonado, 2023[134]	Arthroscopy	5.8% (18/310)	- Secondary hip arthroscopy (reason NR)
	McConkey, 2019‡[147]	Arthroscopy	0% (0/24)	No revisions occurred

Source	Individual studies	Original intervention	Rate of revision	Reasons for revision*
	Menge, 2021‡[150]	Arthroscopy	11.7% (7/60)*†	- 1 patient required revision labral repair after reinjury - 3 patients had lysis of adhesions and frayed labrum - 2 patients had lysis of adhesions and new labral tears (which were repaired) - 1 patients required decompression due to a pincer lesion - 2 patients required decompression due to small cam deformities
	Newman, 2016‡[165]	Arthroscopy	3.6% (3/84)	- 1 patients required revision due to adhesions, trochanteric bursitis, and an external snapping hip - 2 patients required revision for adhesions
	Perets, 2017[186]	Arthroscopy	9.1% (1/10)	- Subsequent injury
	Ruzbarsky, 2023[210]	Arthroscopy	9% (10/111)*	- 10 required revision due to adhesions - 5 required revision due to FAI recurrence - 2 required revision due to labral tear - 2 required revision due to labral deficiency
	Serbin, 2023‡[219]	Arthroscopy or SHD	13.6 (11/81)*	- 11 patients required revision due to persistent pain - 4 patients underwent repeat arthroscopy, 3 underwent repeat surgical hip dislocation, and 4 had combination arthroscopy and periacetabular osteotomy
	Winge, 2021[246]	Arthroscopy	6.9% (2/29)	- 2 patients required resection of capsulolabral adherences
In both SRs	Philippon, 2012[189]	Arthroscopy	13.3% (8/60)	- 8 needed second-loop hip arthroscopy due to intra-articular adhesions
	Tran, 2013‡[237]	Arthroscopy	0% (0/34)	No revisions occurred
Case series not reported in either SR	Degen, 2017[44]	Arthroscopy	5.9% (2/34)	Reasons NR
	Litrenta, 2019[129]	Arthroscopy	7% (3/43)	- 1 patients required removal of HO - 1 patients required revision due to a fall - 1 patients required revision due to recurrence of pain after treatment of a contralateral foot injury
	Schaefer, 2026[213]	Arthroscopy	0% (0/27)§	No revisions occurred.

Source	Individual studies	Original intervention	Rate of revision	Reasons for revision*
Total	22 case series	Open surgery: 7% (2/27) Arthroscopy: 89% (20/27) Arthroscopy or SHD: 4% (1/27)	7.9% (143/1817)	Total reasons include adhesions (lysis, excision, or resection of capsulolabral/intra-articular adhesions, including capsular release for stiffness): 30.1% (43/143), labral pathology (repair, debridement, reconstruction, tear, deficiency, or frayed labrum): 25.2% (36/143), persistent or continued pain: 9.1% (13/143), screw-related (removal or broken screw fixation): 7.0% (10/143), femoroplasty/acetabuloplasty or osseous decompression (pincer/cam lesion): 7.7% (11/143), revision following subsequent injury or trauma: 4.2% (6/143), periacetabular osteotomy (index, revision, or combined procedure): 4.2% (6/143), FAI recurrence: 3.5% (5/143), combined labral/adhesion + femoroplasty procedure: 1.4% (2/143), grade 2 chondral damage: 0.7% (1/143), heterotopic ossification removal: 0.7% (1/143)

FAI = femoroacetabular impingement; NR = not reported; SHD = surgical hip dislocation; SR = systematic review.

* Some patients had multiple indications for revision.

† Reported as hips, but reasonable to assume from author descriptions that these are unique patients.

‡ Study was part of Rathore 2025 but not cited for this outcome.

§ Authors report that no revision surgeries occurred, but that 1 patient each underwent reoperations due to heterotopic ossification excision and periacetabular osteotomy respectively.

3.4.2.10 Other Complications

Other complications were poorly reported. The newer SR reported that overall reporting of any AE was rare, with <1% of patients experiencing them. More specifically, there were 3 cases of neuropraxia involving the pudendal nerve, 5 cases of numbness, 1 case of erectile dysfunction, and 1 case of lateral thigh impairment; additionally, authors report that 1.7% (n's NR) of patients in one study experienced cam recurrence.[196] Additionally reported complications include 2 cases and 1 case of transient neurapraxia across a single SR[43] and individual case series[44] respectively, 1 case of partial implant removal[78], 1 case of pelvic osteotomes mobilization under anesthesia,[78] and 1 fall resulting in pain over the lateral aspect of the surgical hip.[168]

No cases of physeal arrestor growth disturbance or acute iatrogenic slipped capital femoral epiphysis were reported over mean follow-up periods ranging from 3 to 75 months in the SR (435 hips)[43] or over 14 to 40 months across four additional case series (N range, 18 to 108) (there may be some overlap between studies and the SR).[29,41,123,237] The older SR reported that several additional complications that did not occur, including broken instrumentation, abdominal compartment syndrome, urinary/sexual dysfunction, chondral scuffing, labral penetration, inadequate deformity correction, instability/dislocation, premature physeal closure and proximal femoral growth arrest.[43] Additional

individual case series reported that there were no instances of transient lateral femoral cutaneous nerve symptoms,[29] physeal injury[29], Iatrogenic instability,[30], chondrolysis,[41] asymmetric physeal closure,[168] or recurrence of cam-type FAI.[168]

3.4.3 Key Question 3: Differential Effectiveness and Safety in Subpopulations (Pediatrics)

No studies were included that assessed differential effectiveness and safety in subpopulations in pediatric populations

3.4.4 Key Question 4: Cost Effectiveness (Pediatrics)

No economic studies in pediatric populations were identified.

4 Strength of Evidence (SOE)

The following SOE summaries are based on the highest quality of studies available across the totality of the evidence. Only primary outcomes are rated for SOE. A summary of the primary outcomes for each Key Question are provided in the tables below and are sorted by timeframe and/or comparator. Details of other outcomes are available in the report. The method used by Aggregate Analytics, Inc. (AAI) for assessing the overall SOE is based on established AHRQ methods for systematic reviews. The SOE for all primary health outcomes was assessed by two researchers following the principles for adapting GRADE (Grading of Recommendation Assessment, Development and Evaluation) as outlined by the Agency for Healthcare Research and Quality (AHRQ).[1,7,24,25]

Table 35. Strength of evidence summary for adults, Key Questions 1 and 2: effectiveness and safety results for arthroscopic osteochondroplasty versus lavage with or without labral treatment for FAIS

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Osteochondroplasty vs. Lavage Effect estimate (95% CI) Conclusion	Quality (SOE)
iHOT-12 (scale 0-100)	12 months	1 RCT (N=130) Ayeni, 2021	Yes (-1)	Unknown	No	Yes (-1)	Adj MD in change scores -4.10, 95% CI -12.79 to 4.60 <u>Conclusion</u>: No difference between groups	⊕⊕◯◯ LOW
HOS-ADL (scale 0-100)	12 months	1 RCT (N=178) Ayeni, 2021	Yes (-1)	Unknown	No	Yes (-1)	Adj MD in change scores -5.03, 95% CI -10.04 to -0.03 <u>Conclusion</u>: Slightly worse scores with osteochondroplasty. The estimate was imprecise. Effect is below the published MCID of 8.3 points; unclear if difference is clinically important.	⊕⊕◯◯ LOW
HOS-Sport (scale 0-100)	12 months	1 RCT (N=163) Ayeni, 2021	Yes (-1)	Unknown	No	Yes (-1)	Adj MD in change scores -6.72, 95% CI -14.13 to 0.69 <u>Conclusion</u>: No difference between groups	⊕⊕◯◯ LOW

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Osteochondroplasty vs. Lavage Effect estimate (95% CI) Conclusion	Quality (SOE)
VAS pain (scale 0-100)	12 months	1 RCT (N=187) Ayeni, 2021	Yes (-1)	Unknown	No	Yes (-1)	Adj MD in change scores 0.11, 95% CI -7.22 to 7.45 <u>Conclusion</u>: No difference between groups	⊕⊕◯◯ LOW
Labral re-injury (%)	24 months	1 RCT (N=209) Ayeni, 2021	Yes (-1)	Unknown	No	Yes (-1)	Any: 3.8% (4/105) vs. 7.7% (8/104); RR 0.50, 95% CI 0.15 to 1.59 Requiring surgery: 3.8% (4/105) vs. 6.7% (7/104), RR 0.57, 95% CI 0.17 to 1.88 Not requiring surgery: 0% (0/105) vs. 1.0% (1/104) <u>Conclusion</u>: No difference between groups	⊕⊕◯◯ LOW
Mortality (%)	24 months	1 RCT (N=209) Ayeni, 2021	Yes (-1)	Unknown	No	Yes (-2)	1.0% (1/105) vs. 0% (0/104) <u>Conclusion</u>: Insufficient evidence to draw conclusions. Sample size was likely too small to detect rare events. Cause and timing of death was not reported.	⊕◯◯◯ INSUFFICIENT

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Osteochondroplasty vs. Lavage Effect estimate (95% CI) Conclusion	Quality (SOE)
Any hip complication and hip complications not requiring surgery (%)	24 months	1 RCT (N=209) Ayeni, 2021	Yes (-1)	Unknown	No	Yes (-1)	Any: 21.0% (22/105) vs. 27.9% (29/104), Adj OR 0.69, 95% CI 0.36 to 1.30 Not requiring surgery: 14.3% (15/105) vs. 12.5% (13/104); Adj OR 1.18, 95% CI 0.53 to 2.62 Conclusion: No difference between groups.	⊕⊕◯◯ LOW
Hip complications requiring surgery (i.e., Revision surgery) (%)	12 months	1 RCT (N=214) Kay, 2022	Yes (-1)	Unknown	No	Yes (-1)	1.9% (2/108) vs. 4.7% (5/106), RR 0.39, 95% CI 0.08 to 1.98 Conclusion: No difference between groups.	⊕⊕◯◯ LOW
	24 months	1 RCT (N=209) Ayeni, 2021	Yes (-1)	Unknown	No	Yes (-1)	7.6% (8/105) vs. 18.3% (19/104), Adj OR 0.37, 95% CI 0.15 to 0.89 Conclusion: Substantial decrease in likelihood of revision favoring arthroscopic surgery. Most common reason was hip pain (2.9% (3/105) vs. 11.5% (12/104), RR 0.25 (95% CI 0.07 to 0.85), followed by re-injury of the labrum and heterotopic ossification which were similar between groups.	⊕⊕◯◯ LOW

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Osteochondroplasty vs. Lavage Effect estimate (95% CI) Conclusion	Quality (SOE)
Heterotopic ossification (%)	24 months	1 RCT (N=209) Ayeni, 2021	Yes (-1)	Unknown	No	Yes (-2)	1.0% (1/105) vs. 0% (0/104) <u>Conclusion:</u> Insufficient evidence to draw conclusions. Sample size was likely too small to detect rare events.	⊕◯◯◯ INSUFFICIENT
Nerve injury (%)	24 months	1 RCT (N=209) Ayeni, 2021	Yes (-1)	Unknown	No	Yes (-2)	1.0% (1/105) vs. 1.0% (1/104), RR 0.99, 95% CI 0.06 to 15.63 <u>Conclusion</u>: Insufficient evidence to draw conclusions. Sample size was likely too small to detect rare events.	⊕◯◯◯ INSUFFICIENT

Adj = adjusted; ADL = activities of daily living; CI = confidence interval; HOS = hip outcome score; iHOT = international hip outcome tool; MCID = minimum clinically important difference; MD = mean difference; mos. = months; OR = odds ratio; PT = physical therapy; RCT = randomized controlled trial; RR = risk ratio; SOE = strength of evidence; VAS = visual analog scale.

*Higher values indicate better outcomes except for VAS pain where a higher score indicates a worse outcome.

Table 36. Strength of evidence summary for adults, Key Question 1: effectiveness results for operative (arthroscopy) versus non-operative (physiotherapy) treatment for FAIS

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Arthroscopy vs. PT Effect estimate (95% CI) Conclusion	Quality (SOE)
Proportion achieving clinically important improvement in HOS-ADL (scale 0-100)	8, 38 mos.	1 RCT (N=222) Palmer 2019, 2025	Yes (-1)	Unknown	No	Yes (-1)	MCID (≥9 points) • 8 months: 51% (51/100) vs. 32% (29/91); RR 1.60 (1.12 to 2.29) • 38 months: 67% (58/86) vs. 48% (41/85); RR 1.40 (95% CI 1.07 to 1.82) PASS (score >87 points): • 8 months: 48% (48/100) vs. 19% (17/91); RR 2.57 (1.60 to 4.13) Conclusion: Arthroscopy associated with a moderately greater likelihood of achieving MCID at 8 months and slightly greater likelihood at 38 months, and a substantially greater likelihood of achieving PASS.	⊕⊕◯◯ LOW
iHOT-33 (scale 0-100)	3 mos.	1 RCT (N=97) Martin 2024	Yes (-1)	Unknown	No	Yes (-1)	MD 17.80, 95% CI 9.04 to 26.56 Conclusion: Arthroscopy associated with a clinically important improvement; exceeded the published MCIDs (range, 6.1–12.1).	⊕⊕◯◯ LOW
	6-8 mos.	5 RCTs (N=752) Griffin 2018 Mansell 2018 Palmer 2019 Hunter 2021 Martin 2024	Yes (-1)	No	No	Yes (-1)	MD 2.05, 95% CI 0.98 to 6.42, I^2=54.4% Conclusion: Marginal statistical significance. Estimate did not meet the published MCIDs (range, 6.1–12.1). Clinical importance is unclear.	⊕⊕◯◯ LOW

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Arthroscopy vs. PT Effect estimate (95% CI) Conclusion	Quality (SOE)
	12-14 mos.	5 RCTs (N=735) Griffin 2018 Mansell 2018 Hunter 2021 Martin 2024 Palmer 2025	Yes (-1)	No	No	No	MD 13.07, 95% CI 7.07 to 18.02, I^2=64.5% Conclusion: Arthroscopy associated with a clinically important improvement; exceeded the published MCIDs (range, 6.1–12.1).	⊕⊕⊕◯ MODERATE
	24-26 mos.	3 RCTs (N=261) Mansell 2018 Martin 2024 Palmer 2025	Yes (-1)	No	No	Yes (-1)	MD 10.09, 95% CI 1.61 to 16.41, I^2=34.1% Conclusion: Arthroscopy associated with a clinically important improvement; met or exceeded the published MCIDs (range, 6.1–12.1).	⊕⊕◯◯ LOW
	38 mos.	1 RCT (N=136) Palmer 2025	Yes (-1)	Unknown	No	No	MD 11.80, 95% CI 8.93 to 14.67 Conclusion: Arthroscopy associated with a clinically important improvement; met or exceeded the published MCIDs (range, 6.1–12.1).	⊕⊕⊕◯ MODERATE
HOS-ADL and HOOS-ADL (0-100)	3 mos.	1 RCT (N=97) HOS-ADL Martin 2024	Yes (-1)	Unknown	No	Yes (-1)	MD 9.20, 95% CI 2.72 to 15.68 Conclusion: Arthroscopy associated with a clinically important improvement; met or exceeded the published MCID for HOS-ADL (8.3).	⊕⊕◯◯ LOW

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Arthroscopy vs. PT Effect estimate (95% CI) Conclusion	Quality (SOE)
	6-8 mos.	4 RCTs (N=483) HOS-ADL Mansell 2018 Palmer 2019 Martin 2024 HOOS-ADL Hunter 2021	Yes (-1)	No	No	Yes (-1)	MD 6.14, 95% CI 0.63 to 10.40, I^2=46.1% Excluding outlier [Mansell], N=409: MD 7.69, 95% CI 2.46 to 11.66, I^2=24.5% <u>Conclusion</u>: Arthroscopy favored but estimate was below the published MCID for HOS-ADL (8.3). Results were similar following exclusion of one outlier trial. Unclear if differences are clinically important.	⊕⊕◯◯ LOW
	12-14 mos.	4 RCTs (N=407) HOS-ADL Mansell 2018 Palmer 2025 Martin 2024 HOOS-ADL Hunter 2021	Yes (-1)	Yes (-1)	No	Yes (-1)	MD 7.49, 95% CI -2.03 to 16.07, I^2=85.4% Excluding outlier [Mansell], N=333: MD 12.47, 95% CI 5.02 to 16.57, I^2=63.1% <u>Conclusion</u>: Insufficient evidence to draw conclusions.	⊕◯◯◯ INSUFFICIENT

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Arthroscopy vs. PT Effect estimate (95% CI) Conclusion	Quality (SOE)
	24-26 mos.	3 RCTs (N=262) HOS-ADL Mansell 2018 Palmer 2019 Martin 2024	Yes (-1)	No	No	Yes (-1)	MD 5.01, 95% CI -1.86 to 8.72, I^2=46.3% Excluding outlier [Mansell], N=188: MD 6.11, 95% CI 1.94 to 10.10 I^2=0% <u>Conclusion</u>: No difference between groups. After exclusion of outlier trial, arthroscopy was favored but the estimate was below the published MCID for HOS-ADL (8.3). Unclear if difference is clinically important.	⊕⊕◯◯ LOW
	38 mos.	1 RCT (N=171) HOS-ADL Palmer 2025	Yes (-1)	Unknown	No	No	MD 8.90, 95% CI 7.01 to 10.79 <u>Conclusion</u>: Arthroscopy associated with a clinically important improvement; met the published MCID for the HOS-ADL (8.3).	⊕⊕⊕◯ MODERATE
HOS-Sport and HOOS-Sport (scale 0-100)	3 mos.	1 RCT (N=97) HOS-Sport Martin 2024	Yes (-1)	Unknown	No	Yes (-1)	MD -2.00, 95% CI -12.86 to 8.86 <u>Conclusion</u>: Insufficient evidence to draw conclusions.	⊕◯◯◯ INSUFFICIENT

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Arthroscopy vs. PT Effect estimate (95% CI) Conclusion	Quality (SOE)
	6-8 mos.	4 RCTs (N=451) HOS-Sport Mansell 2018 Palmer 2019 Martin 2024 HOOS-Sport Hunter 2021	Yes (-1)	Yes (-1)	No	Yes (-1)	MD 5.21, 95% CI -5.45 to 14.86, I^2=74.0% Excluding outlier [Mansell], N=377: MD 8.65, 95% CI 0.12 to 16.85, I^2=57.5% <u>Conclusion</u>: Insufficient evidence to draw conclusions.	⊕◯◯◯ INSUFFICIENT
	12-14 mos.	4 RCTs (N=407) HOS-Sport Mansell 2018 Palmer 2025 Martin 2024 HOOS-Sport Hunter 2021	Yes (-1)	No	No	No	MD 11.05, 95% CI 4.92 to 15.26, I^2=25.8% Excluding outlier [Mansell], N=333: MD 12.44, 95% CI 7.96 to 16.98, I^2=0% <u>Conclusion</u>: Arthroscopy favored but estimate was below the published MCID for HOS-Sport (14.5). Results were similar following exclusion of one outlier trial. Unclear if differences are clinically important.	⊕⊕⊕◯ MODERATE

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Arthroscopy vs. PT Effect estimate (95% CI) Conclusion	Quality (SOE)
	24-26 mos.	3 RCTs (N=262) HOS-Sport Mansell 2018 Palmer 2025 Martin 2024	Yes (-1)	No	No	Yes (-1)	MD 9.04, 95% CI -3.30 to 14.83, I^2=53.2% Excluding outlier [Mansell], N=188: MD 10.50, 95% CI 2.00 to 16.22, I^2=1.2% Conclusion: No difference between groups. After exclusion of one outlier trial, arthroscopy was favored but the estimate was below the published MCID for HOS-Sport (14.5). Unclear if differences are clinically important.	⊕⊕◯◯ LOW
	38 months	1 RCT (N=171) HOS-Sport Palmer 2025	Yes (-1)	Unknown	No	No	MD 9.90, 95% CI 6.28 to 13.52 Conclusion: Arthroscopy favored but estimate was below the published MCID for HOS-Sport (14.5). Unclear if differences are clinically important.	⊕⊕⊕◯ MODERATE
NAHS (scale 0-100)	3 mos.	1 RCT (N=97) Martin 2024	Yes (-1)	Unknown	No	Yes (-1)	MD 10.50, 95% CI 3.99 to 17.01 Conclusion: Arthroscopy associated with a clinically important improvement; exceeded the published MCID of 8.5 (validated in adults with various hip disorders, not FAIS).	⊕⊕◯◯ LOW

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Arthroscopy vs. PT Effect estimate (95% CI) Conclusion	Quality (SOE)
	6-8 mos.	2 RCTs (N=266) Martin 2024 Palmer 2019	Yes (-1)	No	No	Yes (-1)	MD 10.72, 95% CI 6.16 to 14.95, I^2=0% Conclusion: Arthroscopy associated with a clinically important improvement; exceeded the published MCID of 8.5 (validated in adults with various hip disorders, not FAIS).	⊕⊕◯◯ LOW
	12-14 mos.	2 RCTs (N=239) Martin 2024 Palmer 2025	Yes (-1)	No	No	Yes (-1)	MD 10.89, 95% CI 3.33 to 14.89, I^2=63.1% Conclusion: Arthroscopy associated with a clinically important improvement; exceeded the published MCID of 8.5 (validated in adults with various hip disorders, not FAIS).	⊕⊕◯◯ LOW
	24-26 mos.	2 RCTs (N=178) Martin 2024 Palmer 2025	Yes (-1)	No	No	Yes (-1)	MD 5.44, 95% CI 1.06 to 9.23, I^2=0% Conclusion: Arthroscopy favored but estimate was below the published MCID (8.5) (validated in adults with various hip disorders, not FAIS). Unclear if differences are clinically important.	⊕⊕◯◯ LOW

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Arthroscopy vs. PT Effect estimate (95% CI) Conclusion	Quality (SOE)
	38 months	1 RCT (N=158) Palmer 2025	Yes (-1)	Unknown	No	Yes (-1)	MD 6.60, 95% CI 0.89 to 12.31 <u>Conclusion</u>: Arthroscopy favored but estimate was below the published MCID (8.5) (validated in adults with various hip disorders, not FAIS). Unclear if differences are clinically important.	⊕⊕◯◯ LOW
HAGOS and HOOS pain subscales (scale 0-100)	6-8 mos.	2 RCTs (N=270) HOOS-Pain Hunter 2021 HAGOS-Pain Palmer 2019	Yes (-1)	Yes (-1)	No	Yes (-1)	MD 9.25, 95% CI -2.35 to 19.04, I^2=75.9% 1 RCT, HAGOS pain: MD 12.70, 95% CI 8.18 to 17.22) [clinically important] 1 RCT: HOOS-pain (MD 3.70, 95% CI -3.70 to 11.10) [no difference] <u>Conclusion</u>: Insufficient evidence to draw conclusions; there was substantial heterogeneity and imprecision.	⊕◯◯◯ INSUFFICIENT
	12-14 mos.	2 RCTs (N=233) HOOS-Pain Hunter 2021 HAGOS-Pain Palmer 2025	Yes (-1)	No	No	No	MD 11.78, 95% CI 8.30 to 15.76, I^2=0% <u>Conclusion</u>: Arthroscopy associated with a clinically important improvement; exceeded the published MCIDs of 6 (HAGOS) and 9 (HOOS).	⊕⊕⊕◯ MODERATE

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Arthroscopy vs. PT Effect estimate (95% CI) Conclusion	Quality (SOE)
	26 mos.	1 RCT (N=90) HAGOS-Pain Palmer 2025	Yes (-1)	Unknown	No	Yes (-1)	MD 8.70, 95% CI 3.77 to 13.63 Conclusion: Arthroscopy associated with a clinically important improvement; exceeded the published MCID of 6 (HAGOS).	⊕⊕◯◯ LOW
	38 mos.	1 RCT (N=136) HAGOS-Pain Palmer 2025	Yes (-1)	Unknown	No	Yes (-1)	MD 7.90, 95% CI 5.08 to 10.72 Conclusion: Arthroscopy associated with a clinically important improvement; exceeded the published MCID of 6 (HAGOS).	⊕⊕◯◯ LOW
VAS (scale 0-10)	3 mos.	1 RCT (N=97) Martin 2024	Yes (-1)	Unknown	No	Yes (-1)	MD -2.2, 95% CI -3.3 to -1.1 Conclusion: Arthroscopy associated with a clinically important improvement; exceeded the published MCID of 1.5.	⊕⊕◯◯ LOW
	6 mos.	1 RCT (N=97) Martin 2024	Yes (-1)	Unknown	No	Yes (-1)	MD -1.2, 95% CI -2.3 to -0.1 Conclusion: Arthroscopy favored but estimate was below the published MCID (1.5). Unclear if differences are clinically important.	⊕⊕◯◯ LOW
	12 mos.	1 RCT (N=97) Martin 2024	Yes (-1)	Unknown	No	Yes (-1)	MD -0.5, 95% CI -1.6 to 0.6 Conclusion: No difference between groups	⊕⊕◯◯ LOW
	24 mos.	1 RCT (N=97) Martin 2024	Yes (-1)	Unknown	No	Yes (-1)	MD -0.2, 95% CI -1.4 to 1.0 Conclusion: No difference between groups	⊕⊕◯◯ LOW

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Arthroscopy vs. PT Effect estimate (95% CI) Conclusion	Quality (SOE)
Conversion to THA (%)	12-38 mos.	4 RCTs (N=682) Griffin 2018 Mansell 2018 Martin, 2024 Palmer, 2025	Yes (-1)	No	No	Yes (-1)	1.8% (6/341) vs. 2.9% (10/341); RR 0.71, 95% CI 0.19 to 3.92, I^2=26.2% Conclusion: No difference between groups; sample size and follow-up likely impacted the ability to adequately capture this event	⊕⊕◯◯ LOW

ADL = activities of daily living; CI = confidence interval; FAIS = Femoroacetabular impingement syndrome; HOS = hip outcome score; HAGOS = Copenhagen hip and groin outcome score; HOOS = hip disability and osteoarthritis outcome score; iHOT = international hip outcome tool; MCID = minimum clinically important difference; MD = mean difference; mos. = months; NAHS = non-arthritic hip score; PASS = patient acceptable symptom state; PT = physical therapy; RCT = randomized controlled trial; RR = risk ratio; SOE = strength of evidence; THA = total hip arthroplasty; VAS = visual analog scale.
*Higher values indicate better outcomes except for VAS pain where a higher score indicates a worse outcome.

Table 37. Strength of evidence summary for adults, Key Question 2: safety results for operative (arthroscopy) versus non-operative (physiotherapy) treatment for FAIS

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Arthroscopy vs. PT Effect estimate (95% CI) Conclusion	Quality (SOE)
Mortality (%)	12-24 mos.	2 RCT (N=428) Griffin 2018 Mansell 2018	Yes (-1)	No	No	Yes (-2)	1 RCT (N=348): no treatment-related deaths occurred 1 RCT: death unrelated to treatment, 2.5% (1/40) vs. 0% (0/40) Conclusion: Insufficient evidence to draw conclusions. Sample sizes may have been too small to detect rare events.	⊕◯◯◯ INSUFFICIENT
Any SAE (%)	12-38 mos.	2 RCTS (N=506) Griffin 2018 Palmer 2025	Yes (-1)	Unknown	No	Yes (-2)	Pooled: 2.5% (6/250) vs. 0.4% (1/256); RR 6.14, 95% CI 0.75 to 50.67 1 RCT, 12 months: 4.3% (6/138) vs. 0.7% (1/146), RR 6.35, 95% CI 0.77 to 52.06 1 RCT, 36 months (N=220): no SAEs occurred Treatment-related (1 RCT): 3.6% (5/138) vs. 0% (0/146), p=0.02 Conclusion: Insufficient evidence to draw conclusions. Sample sizes may have been too small to detect rare events.	⊕◯◯◯ INSUFFICIENT

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Arthroscopy vs. PT Effect estimate (95% CI) Conclusion	Quality (SOE)
AEs possibly or definitely related to the interventions	12 mos.	1 RCT (N=92) Hunter 2021	Yes (-1)	Unknown	No	Yes (-1)	15.6% (7/45) vs. 23.4% (11/47), RR 0.66, 95% CI 0.28 to 1.56 Conclusion: No difference between groups.	⊕⊕◯◯ LOW
Hip fracture	12-24 mos.	3 RCTs (N=455) Griffin 2018 Hunter 2021 Mansell 2018	Yes (-1)	No	No	Yes (-2)	Pooled: 0% (0/222) vs. 0.4% (1/233) 2 RCTs, 12 months (N=376) reported that no hip fractures occurred 1 RCT, 24 months (N=79): 1 hip fracture (2.5%) in a patient randomized to PT who crossed over to arthroscopy Conclusion: Insufficient evidence to draw conclusions	⊕◯◯◯ INSUFFICIENT
Hip pain or stiffness	12-38 mos.	2 RCTs (N=506) Griffin 2018 Palmer 2025	Yes (-1)	Unknown	No	Yes (-1)	14.4% (36/250) vs. 14.8% (38/256); RR 0.92, 95% CI 0.43 to 2.83, I^2=63.8% 1 RCT, 12 months: 9.4% (13/138) vs. 5.5% (8/146); RR 1.72, 95% CI 0.74 to 4.02; 1 RCT, 36 months: 20.5% (23/112) vs. 27.3% (30/110); RR 0.75, 95% CI 0.47 to 1.21 Conclusion: Hip pain or stiffness was common; occurred with similar frequency between groups.	⊕⊕◯◯ LOW

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Arthroscopy vs. PT Effect estimate (95% CI) Conclusion	Quality (SOE)
Revision Surgery (*surgery-specific AE*)	12-38 mos.	5 RCTs (N=774) Griffin 2018 Hunter 2021 Mansell 2018 Martin 2024 Palmer 2019	Yes (-1)	No	No	Yes (-1)	Randomized to arthroscopy (n=386): range, 0% to 4.5% PT (after cross-over to arthroscopy) (n=388): range, 0% to 12.5%; 0% to 3.6% excluding small trial in active duty military personnel [Mansell] <u>Conclusion</u>: Arthroscopy may lead to revision. Frequency estimates could not be calculated because authors did not report as-treated populations.	⊕⊕◯◯ LOW
Nerve injury (*surgery-specific AE*)	8-12 mos.	3 RCTs (N=282 in arthroscopy arm) Griffin 2018 Hunter 2021 Palmer 2019	Yes (-1)	No	No	Yes (-1)	Numbness in groin, leg, or foot (2 RCTs): pooled, 27.3% (50/183); range, 25.4% to 33.3% Numbness in proximal thigh (1 RCT): 1.4% (2/138) Numbness in tip of tongue (1 RCT): 0.7% (1/138) Injury to lateral cutaneous nerve of thigh (1 RCT): 2.0% (2/99) <u>Conclusion</u>: Numbness in groin, leg or foot may be common. Other nerve injuries appear to be less common.	⊕⊕◯◯ LOW

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Arthroscopy vs. PT Effect estimate (95% CI) Conclusion	Quality (SOE)
Infection (*surgery-specific AE*)	8 to 12 mos.	3 RCTs (N=282 in arthroscopy arm) Griffin 2018 Hunter 2021 Palmer 2019	Yes (-1)	No	No	Yes (-1) (superficial infection) Yes (-2) Hip joint and scrotal infection	Superficial wound infection requiring antibiotics (3 RCTs): Pooled 2.8% (8/282); range, 1.0% to 6.7% Hip joint infection (2 RCTs): pooled 0.6% (1/177); range, 0% to 0.7%; 1 patient required further surgery and ultimately a THA Scrotal infection (1 RCT): 0.7% (1/138) Conclusion: Superficial infection may not be uncommon after arthroscopy. Hip joint infection and scrotal infection were rare.	⊕⊕◯◯ LOW (superficial infection) ⊕◯◯◯ INSUFFICIENT (hip joint and scrotal infection)
Thromboembolic events (*surgery-specific AE*)	12-24 mos.	3 RCTs (N=222) Griffin 2018 Hunter 2021 Mansell 2018	Yes (-1)	Unknown	No	Yes (-1)	No DVT or thrombosis of the lower extremity occurred in any trial Conclusion: Insufficient evidence to draw conclusions. Sample sizes likely too small to detect rare events.	⊕◯◯◯ INSUFFICIENT
Heterotopic ossification (*surgery-specific AE*)	24 mos.	1 RCT (N=39 in arthroscopy arm) Mansell 2018	Yes (-1)	Unknown	No	Yes (-2)	ITT: 2.6% (1/39) As-treated: 1.5% (1/65) Conclusion: Insufficient evidence to draw conclusions. Sample size likely too small to detect rare events.	⊕◯◯◯ INSUFFICIENT

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Arthroscopy vs. PT Effect estimate (95% CI) Conclusion	Quality (SOE)
Avascular necrosis (*surgery-specific AE*)	24 mos.	1 RCT (N=39 in arthroscopy arm) Mansell 2018	Yes (-1)	Unknown	No	Yes (-2)	No cases of avascular necrosis occurred. Conclusion: Insufficient evidence to draw conclusions. Sample size likely too small to detect rare events.	⊕◯◯◯ INSUFFICIENT

AE = adverse event; CI = confidence interval; DVT = deep vein thrombosis; ITT = intention-to-treat; mos. = months; PT = physical therapy; RCT = randomized controlled trial; RR = risk ratio; SAE = serious adverse event; SOE = strength of evidence; THA = total hip arthroplasty.

Table 38. Strength of evidence summary for adolescents, Key Question 1: effectiveness results for operative (arthroscopy) versus non-operative (activity modification or injections) treatment for FAIS

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Arthroscopy vs. Activity Modification and vs. Injections Effect estimate (95% CI) Conclusion	Quality (SOE)
Proportion achieving clinically important improvement in mHHS (0-100)	Mean 2.2 years	1 NRSI (N=93 hips in 76 patients) Pennock, 2018	Yes (-1)	Unknown	No	Yes (-1)	Arthroscopy vs. Activity Modification: 84.6% (11/13) vs. 67.2% (43/64); RR 1.26, 95% CI 0.94 to 1.68 Arthroscopy vs. Injection: 84.6% (11/13) vs. 80% (8/10); RR 1.06, 95% CI 0.72 to 1.56 Conclusion: Insufficient evidence to draw conclusions.	⊕◯◯◯ INSUFFICIENT

Outcome*	Time	Studies, Year, N	Serious Risk of Bias	Serious Inconsistency	Serious Indirectness	Serious Imprecision	Arthroscopy vs. Activity Modification and vs. Injections Effect estimate (95% CI) Conclusion	Quality (SOE)
mHSS (scale 0-100)	Mean 2.2 years	1 NRSI (N=93 hips in 76 patients) Pennock, 2018	Yes (-1)	Unknown	No	Yes (-1)	Arthroscopy vs. Activity Modification: MD −1.0, 95% CI −7.11 to 5.11 Arthroscopy vs. Injection: MD −1.0, 95% CI −8.6 to 6.6 <u>Conclusion</u>: Insufficient evidence to draw conclusions.	⊕◯◯◯ INSUFFICIENT
NAHS (scale 0-100)	Mean 2.2 years	1 NRSI (N=93 hips in 76 patients) Pennock, 2018	Yes (-1)	Unknown	No	Yes (-1)	Arthroscopy vs. Activity Modification: MD −0.4, 95% CI −7.91 to 7.11 Arthroscopy vs. Injection: MD 0.4, 95% CI −5.47 to 6.27 <u>Conclusion</u>: Insufficient evidence to draw conclusions.	⊕◯◯◯ INSUFFICIENT

CI = confidence interval; FAIS = Femoroacetabular impingement syndrome; mHHS = modified Harris Hip Score; MCID = minimum clinically important difference; MD = mean difference; NAHS = Non-Arthritic Hip Score; SOE = strength of evidence.

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