Early Clinical Outcomes of Arthroscopic Treatment for Femoroacetabular Impingement: A Comprehensive Review

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Abstract

Background: Femoroacetabular impingement (FAI) has emerged as a major etiologic factor in the development of hip pain and early osteoarthritis among young and active individuals. The evolution of hip arthroscopy over the past two decades has provided a minimally invasive alternative to open surgical hip procedures, enabling precise correction of cam and pincer morphology, labral repair, and chondral management with reduced morbidity. This review synthesizes early clinical outcome data following arthroscopic intervention for FAI, with the aim of evaluating short-term functional improvement, complication profiles, return-to-sport metrics, and radiologic corrections reported across contemporary literature. Although numerous studies have demonstrated consistent short-term improvement in patient-reported outcome measures such as the Modified Harris Hip Score (mHHS), Hip Outcome Score (HOS), and the International Hip Outcome Tool (iHOT-12/33), variability persists regarding prognostic factors, rehabilitation protocols, and durability of results.

The purpose of this review is to provide a comprehensive synthesis of early postoperative outcomes within the first 6–24 months following arthroscopic FAI correction, drawing from validated clinical trials, prospective cohort studies, and high-quality retrospective analyses. A secondary objective is to identify predictors of early success or failure, including patient age, athletic demands, cartilage status, labral repair versus debridement, and the presence of psychological or systemic comorbidities. Gaps in current evidence are highlighted, particularly regarding standardized rehabilitation, the impact of capsular management, and inconsistencies in imaging criteria used to define FAI morphology and postoperative correction.

Early results suggest that arthroscopic treatment of FAI provides significant improvements in pain, function, and activity levels for most patients, with high rates of return to sport among athletes and low complication rates overall. However, outcomes may be less favorable in patients with advanced chondral damage, borderline dysplasia, or elevated BMI. Continued long-term follow-up and higher-quality randomized studies are needed to clarify the durability of benefit and to refine surgical indications and techniques.

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Keywords: *Early Clinical Outcomes, Arthroscopic Treatment, Femoroacetabular Impingement*

Introduction

Femoroacetabular Impingement (FAI) is recognized as a pathomechanical hip disorder arising from abnormal contact between the femoral head-neck junction and the acetabular rim, resulting in labral injury, delamination of cartilage and the potential evolution to early osteoarthritis in young, active patients [1]. The seminal description by Reinhold Ganz and colleagues established cam and pincer morphologies as fundamental contributors to intra-articular damage and hip degeneration [1]. Subsequent research has shown that both isolated and combined (mixed) types of FAI appear commonly in athletes and non-athletes alike, with prevalence possibly increased in younger, high-demand populations.

Over the past two decades, the surgical management of FAI has shifted dramatically. Open surgical hip dislocation, once standard, has largely been supplanted by minimally invasive arthroscopic techniques. These arthroscopic approaches allow reshaping of the femoral head/neck junction (femoroplasty), acetabular rim trimming (acetabuloplasty), labral repair or debridement, and management of chondral lesions—all with smaller incisions, less soft-tissue disruption, and faster rehabilitation [2]. The growing popularity of hip arthroscopy is underpinned by numerous studies showing improvements in pain, function, and return to activity in the short term [3–5].

Nevertheless, despite widespread adoption of arthroscopy for FAI, clear questions remain. First, **how reliably do early functional outcomes (within ~2 years) reflect meaningful clinical improvement?** Although multiple cohorts report improved patient-reported outcome measures (PROMs) after arthroscopy for FAI, heterogeneity exists in definitions of "early", surgical techniques (e.g., labral repair vs debridement, capsular closure vs non-closure), rehabilitation protocols, and reporting metrics [6]. Second, **which preoperative and intraoperative factors predict early success or failure?** Emerging evidence suggests that younger age, minimal cartilage damage, shorter symptom duration, and labral repair rather than debridement are associated with better outcomes [7,8], whereas older age, advanced chondral degeneration and elevated body mass index (BMI) may portend less favourable results [9]. Third, a significant research gap persists in standardisation of outcome reporting and in delineating the prognostic impact of technique variations, patient selection, and rehabilitation regimes. Additionally, while long-term outcomes (beyond 5–10 years) are increasingly reported [0], the specific pattern, magnitude and durability of **early** (6–24 month) results remain less comprehensively synthesised.

Accordingly, the aim of this review is to provide a comprehensive synthesis of **early clinical outcomes** following arthroscopic management of FAI (defined here as up to approximately 24 months). We will examine short-term functional improvements, return to activity/sport, complication and revision rates, radiographic correction of morphology, and prognostic factors for early success or failure. By focusing on the "early" window, the review intends to assist clinicians in optimizing timing, surgical selection, technique, and rehabilitation planning. In doing so, we will also highlight **research gaps**: namely the need for standardised definitions of early outcomes, uniform surgical and rehabilitation protocols, and higher-level evidence comparing techniques and patient subgroups.

Patient Selection Criteria

Appropriate patient selection is one of the strongest determinants of early success after arthroscopic management of femoroacetabular impingement (FAI). Candidates for arthroscopy typically include young to middle-aged adults with persistent hip pain, mechanical symptoms, or activity limitations despite a structured non-operative regimen lasting at least 3–6 months [10]. Physical examination findings such as positive FADIR testing, reduced internal rotation, and provocation with flexion-based maneuvers help support the diagnosis, while radiographic parameters—α-angle >55°, crossover sign, or acetabular overcoverage—confirm morphological abnormality [11]. Patients without advanced degenerative changes (Tönnis grade 0–1) consistently demonstrate the most favorable outcomes. Conversely, those with established osteoarthritis show diminished potential for improvement, particularly in early follow-up windows [12]. These considerations underscore the importance of integrating clinical, functional, and radiologic findings when determining eligibility for surgical

intervention.

Age and Symptom Duration

Age has repeatedly been identified as a prognostic factor influencing early outcomes. Younger patients, particularly under 40 years of age, tend to experience greater improvements in patient-reported outcome measures within the first postoperative year, likely owing to better biological healing capacity and fewer concomitant degenerative changes [13]. Prolonged symptom duration prior to surgery correlates with inferior outcomes due to progressive chondrolabral injury over time. Several prospective cohort studies have demonstrated that patients undergoing arthroscopy within one year of symptom onset show significantly greater early improvements in mHHS and iHOT-12 scores compared to those with chronic symptoms exceeding two years [14]. This highlights the potential advantage of timely intervention in appropriately selected patients.

Cartilage Status and Joint Degeneration

Preoperative cartilage status is a critical factor influencing early clinical results. Patients with minimal chondral damage—Outerbridge grades I–II—consistently achieve superior early postoperative outcomes relative to those with advanced cartilage lesions [15]. Multiple series have demonstrated that preoperative cartilage quality is an independent predictor of early functional improvement and return-to-sport likelihood [16]. Advanced chondral loss (Outerbridge III–IV) not only reduces early symptomatic improvement but is also associated with higher early revision rates and elevated risk of subsequent conversion to total hip arthroplasty (THA) [17]. These findings highlight the need for careful radiographic and, when appropriate, MRI evaluation of cartilage integrity during preoperative planning.

Labral Condition and Reparability

The condition of the acetabular labrum is a major determinant of early recovery following arthroscopic FAI correction. Biomechanical studies support that a functional labrum improves joint suction seal and fluid pressurization; therefore, its preservation is critical. Clinical studies have shown that labral repair yields superior early patient-reported outcomes compared with debridement, particularly in younger, active patients [18]. Early postoperative improvements in PROMs (iHOT-33, HOS-ADL, HOS-Sport) appear more predictable and larger in magnitude when the labrum is repairable and when circumferential sealing function can be restored [18]. These findings reinforce the shift toward labral preservation strategies in modern arthroscopic practice.

BMI and General Health Factors

Obesity has emerged as an important factor influencing early arthroscopic outcomes. Elevated BMI is associated with lower improvements in early PROMs, potentially attributable to increased hip joint loading, slower postoperative mobility, and more extensive cartilage damage at presentation [19]. Comorbidities such as diabetes mellitus, smoking, and psychological distress may also negatively affect early recovery trajectories due to impaired tissue healing or reduced adherence to rehabilitation protocols. While these factors do not constitute absolute contraindications, their presence warrants careful counseling and optimization prior to surgery.

Role of Radiologic Evaluation and Classification Systems

Radiologic evaluation is essential for preoperative planning and predicting early outcomes. Cam morphology severity quantified by α-angle and head-neck offset, and pincer morphology characterized by acetabular indices, guide surgical correction and correlate with early postoperative symptom resolution [20]. Advanced imaging such as MRI arthrogram adds diagnostic value for detecting labral pathology and cartilage damage, both of which strongly influence early functional gains. Standardized classification systems—including the Warwick Agreement and FAI morphological grading—improve diagnostic consistency and help identify patients most likely to achieve early improvement [21]. Their use contributes to reducing heterogeneity in patient selection, a recurrent limitation in FAI outcome studies.

Surgical Technique Considerations

Arthroscopic Approach and Portal Placement

Hip arthroscopy for FAI typically employs the standard anterolateral and mid-anterior portals, allowing

access to both the central and peripheral compartments. Proper portal placement is fundamental to early outcomes because inadequate visualization or excessive soft-tissue distraction can increase iatrogenic risk and compromise the quality of bony resection [22]. Studies comparing portal strategies indicate that optimized placement reduces traction time, decreases postoperative neuropraxia, and improves early pain scores in the first 3–6 months postoperatively [23]. In addition, fluoroscopic guidance remains critical to achieving accurate portal establishment and minimizing chondral scuffing during instrumentation. These details contribute directly to the quality of early postoperative recovery, underscoring the importance of surgeon skill and familiarity with hip arthroscopy techniques.

Femoroplasty and Correction of Cam Morphology

Cam-type FAI correction involves arthroscopic femoroplasty to restore the femoral head–neck offset. Adequate cam resection is one of the strongest determinants of improved early outcomes because residual deformity is a well-documented cause of early failure and revision surgery [24]. Intraoperative dynamic assessment, using hip flexion–internal rotation maneuvers, is crucial for confirming that sufficient bony correction has been achieved. Several prospective studies have demonstrated that accurate femoroplasty correlates with improved short-term range of motion and significant early gains in iHOT and HOS scores within 6–12 months following surgery [25]. Conversely, over-resection has been associated with early instability and suboptimal recovery, emphasizing the need for precise technical execution.

Acetabuloplasty and Management of Pincer Lesions

Pincer-type FAI is corrected through acetabular rim trimming, which aims to reduce acetabular overcoverage while preserving labral function. Excessive rim resection may weaken the acetabular structure or compromise labral attachment, whereas inadequate resection may result in persistent impingement—both of which negatively influence early outcomes [26]. Studies have shown that calibrated rim trimming of 2–4 mm provides optimal early improvement in pain and ROM, with low complication rates [27]. When coupled with labral preservation or repair, acetabuloplasty has been linked to better early symptom resolution compared with debridement alone. Thus, achieving the appropriate balance in bony resection remains essential to maximizing early recovery.

Labral Preservation and Repair Techniques

Modern arthroscopic FAI management emphasizes labral preservation, with repair techniques—including simple loop, base-fixation, and circumferential suture methods—demonstrating superior early outcomes compared with debridement. Several comparative studies have shown that labral repair results in higher mHHS and iHOT-33 improvements within the first year postoperatively, particularly in younger and athletic patients [28]. Preservation of the labral suction seal not only enhances joint stability but also contributes to early improvements in pain and functional ability. In cases of irreparable labral tissue, reconstruction has emerged as a viable option with early outcomes comparable to repair, though long-term data continue to evolve [29]. The choice of repair strategy thus plays a significant role in shaping early postoperative results.

Capsular Management: Closure, Plication, or Leaving Open

Proper capsular management has become increasingly recognized as a key variable influencing early outcomes. Capsular closure or plication restores hip stability following extensive acetabuloplasty or femoroplasty and has been associated with superior early functional improvement compared with non-closure [30]. Inadequate capsular management has been implicated in early postoperative instability, persistent pain, and inferior PROM improvements within the first 12–18 months [31]. As a result, the trend in contemporary hip arthroscopy has shifted strongly toward routine capsular closure, particularly in hyperlax or female patients where stability concerns are heightened. This technical evolution has directly translated into improved early postoperative satisfaction.

Intraoperative Dynamic Testing and Fluoroscopic Validation

Dynamic testing during arthroscopy is crucial to ensure complete correction of impingement morphology. By assessing impingement-free hip flexion and internal rotation before closure, surgeons can identify residual cam or pincer lesions that may compromise early results [32]. Fluoroscopic

validation, particularly using 3D imaging or angled fluoroscopic views, assists in achieving accurate resection margins and reduces the risk of early revision surgery. Prospective studies have demonstrated that patients who undergo dynamic confirmation during surgery have significantly fewer early complications and better PROM improvements at 6 and 12 months [33]. This highlights the importance of intraoperative verification as a standard component of high-quality arthroscopic FAI management.

Postoperative Rehabilitation and Early Recovery

Rehabilitation Phases and Importance

Postoperative rehabilitation is a critical determinant of early outcomes following arthroscopic management of Femoroacetabular Impingement (FAI). A recent systematic review described a four-phase, criterion-based approach involving early protection and mobility, progressive strengthening, advanced neuromuscular and sport-specific drills, and return-to-activity training [22]. The authors reported an average return-to-sport (RTS) rate of 90.3% in the studies reviewed, underscoring how integral rehabilitation is to attaining functional recovery [22].

Phase I: Protection and Early Motion (0-6 Weeks)

The initial phase typically emphasizes pain control, restoration of hip range of motion (ROM) within safe limits, and protection of surgical repair (e.g., labral repair, capsular closure). Use of crutches may continue bearing protective weight as dictated by the surgeon. Manual therapy and aquatic therapy have shown benefits in early pain reduction and mobility gains [22]. Early restricted motion and adherence to protective protocols support optimized healing of labral and chondral repairs.

Phase II: Strengthening and Neuromuscular Control (6-12 Weeks)

After the initial healing phase, the focus shifts to strengthening the hip abductors, external rotators, and core musculature, as well as addressing neuromuscular control and proprioception. Programs emphasize closed-kinetic-chain exercises, gradual advancement to open chain, and eliminating movement compensations. The systematic review highlighted that earlier initiation of structured strengthening corresponded with better early improvements in hip outcome scores [22].

Phase III: Advanced Activity and Sport Preparation (12-20 Weeks)

During this phase, rehabilitation intensifies with sport-specific drills, plyometrics (if relevant), agility exercises, and higher-level functional tasks. Objective criteria (e.g., hip strength > 90% of contralateral side, symmetric hip ROM, pain-free gait) guide progression. An accelerated rehab protocol study found that athletes could safely RTS at a mean of approximately 5.3 months (±3.5 months) post-arthroscopy when protocolled appropriately [23].

Phase IV: Return to Sport and Maintenance (>20 Weeks)

The final phase is tailored to the individual's sport or activity level and includes full return to competition or high-demand tasks. Importantly, patients must demonstrate hip strength normalization, absence of compensatory movement patterns, and psychological readiness. The study of accelerated rehab observed a 79% RTS within six months using a structured pathway [23]. However, variability remains, and clinicians should caution that RTS does not uniformly equate to full performance restoration or maintenance of early gains.

Rehabilitation Heterogeneity and Need for Standardisation

Although rehabilitation protocols are widely accepted as essential, considerable heterogeneity exists in timing, exercise selection, progression criteria, and RTS benchmarks [22]. The absence of standardised guidelines limits comparison across studies and may contribute to variable early outcomes. Authors recommend future work to adopt criterion-based algorithms, integrate surgeon-therapist communication, and report rehabilitation details in outcome studies.

Implications for Early Outcomes

Robust rehabilitation contributes substantially to the magnitude and speed of early recovery following arthroscopic management of FAI. Patients adhering to structured rehab protocols demonstrate quicker pain relief, better early functional scores, and higher RTS rates. Conversely, inadequate rehab or delayed initiation may blunt early improvements, prolong recovery, and potentially compromise long-term durability of results.

Early Functional Outcomes and PROMs

Magnitude of Early Functional Improvement

Early functional outcomes following arthroscopic treatment of femoroacetabular impingement (FAI) have consistently demonstrated meaningful improvements within the first 6–24 months postoperatively. Multiple prospective cohort studies report notable gains in validated PROMs such as the modified Harris Hip Score (mHHS), Hip Outcome Score for Activities of Daily Living (HOS-ADL), Hip Outcome Score for Sports Subscale (HOS-Sport), and International Hip Outcome Tool (iHOT-12 or iHOT-33) [24]. These early improvements reflect reductions in pain, enhanced mobility, and restoration of hip function. The greatest magnitude of improvement often occurs within the first 6–12 months, aligning with the intensive phases of rehabilitation and activity reintroduction [24].

Modified Harris Hip Score (mHHS)

The mHHS remains one of the most frequently reported metrics in early outcome studies for FAI arthroscopy. Early postoperative improvements commonly range from 20 to 30 points above baseline, exceeding the minimal clinically important difference (MCID) for this measure [25]. Patients with isolated cam lesions often demonstrate slightly greater mHHS improvements than those with mixed or pincer morphologies, likely attributable to differing patterns of chondral involvement [25]. Importantly, individuals with Tönnis grade 0–1 consistently show better early mHHS gains compared with those displaying early degenerative signs. This underlines the importance of early intervention and appropriate patient selection for maximizing early outcomes.

Hip Outcome Score (HOS-ADL and HOS-Sport)

HOS-ADL and HOS-Sport subscales provide complementary insights into daily function and athletic capability during early recovery. Studies have reported significant early improvement in both subscales by 6 months, with continued gains up to 12–18 months postoperatively [26]. HOS-Sport tends to lag behind HOS-ADL in the early period due to the longer time required for neuromuscular recovery, proprioceptive restoration, and strengthening necessary for high-demand athletic tasks [26]. Predictors of early HOS-Sport success include younger age, minimal cartilage degeneration, and labral repair rather than debridement—factors that enhance early joint stability and biomechanical restoration.

International Hip Outcome Tool (iHOT-12 / iHOT-33)

The iHOT instruments are highly sensitive to early postoperative changes in young, active patients. Numerous studies document substantial improvements in iHOT-12 scores within 3–6 months after surgery, often exceeding the MCID earlier than other PROMs [27]. iHOT-33, a more comprehensive tool, reflects early functional recovery in domains including symptoms, sports function, social activity, and quality of life. This metric is particularly responsive to early changes in dynamic activities, making it valuable for assessing early return-to-sport trajectories. Patients undergoing labral repair, capsular closure, or combined cam-and-pincer correction show superior early iHOT improvements compared with those receiving isolated procedures [27].

Return to Activity and Early Sport Participation

Early improvement in PROMs strongly correlates with early return to activity (RTA) and return to sport (RTS). Athletes frequently reach early RTS benchmarks within 4–6 months, though this varies based on sport intensity and preoperative cartilage status [28]. Studies have shown that early improvements in iHOT-12 and HOS-Sport scores serve as reliable indicators of accelerating recovery and predict the likelihood of returning to pre-injury performance levels. Early RTA rates are highest in patients with minimal chondral damage, shorter preoperative symptom duration, and strict adherence to postoperative rehabilitation protocols [28].

Predictors of Early PROM Success

Several factors influence the degree of early improvement in PROMs following arthroscopic management of FAI. Strong predictors of early success include labral repair (vs debridement), thorough correction of impingement morphology, high preoperative function, patient age under 40, and absence of advanced osteochondral injury [29]. Conversely, older age, high BMI, cartilage degeneration (Outerbridge III–IV), and preoperative psychological distress are associated with smaller early gains.

These findings reinforce the interconnectedness of patient selection, surgical precision, and rehabilitation in shaping early functional outcomes.

Clinical Significance and Early Patient Satisfaction

High levels of patient satisfaction are commonly reported within the first postoperative year, with numerous studies citing >80–90% satisfaction at early follow-up intervals [30]. Satisfaction is tightly linked to achieving MCID and patient acceptable symptomatic state (PASS) thresholds early after surgery. Patients who meet these thresholds within the first 6–12 months tend to maintain superior outcomes in the mid-term, supporting the importance of the early postoperative period as a predictor of long-term success. Early functional gains thus play a crucial role not only in immediate quality of life but also in setting the trajectory for sustained postoperative improvement.

Early Complications and Revision Rates

Overview of Early Complication Patterns

Arthroscopic management of femoroacetabular impingement (FAI) is generally considered safe, with low rates of early postoperative complications compared with open surgical dislocation. Reported early complication rates typically range between **1% and 8%**, depending on study design and reporting methodology [31]. Most early complications are transient and minor, including temporary neuropraxia, superficial portal site irritation, and temporary postoperative stiffness. Importantly, improved surgical techniques—particularly refined traction protocols, routine capsular closure, and optimized portal placement—have contributed to the substantial reduction in early complication incidence over the past decade [31].

Neurological Complications and Traction-Related Issues

Traction-related complications represent some of the earliest and most frequently reported adverse events following hip arthroscopy. Transient neuropraxia of the pudendal, lateral femoral cutaneous, or sciatic nerves may occur due to prolonged traction time or excessive force. Prospective studies have shown that such neuropraxias typically resolve within days to weeks, with persistent deficits being exceedingly rare (≤0.5%) [32]. Implementation of traction-minimizing techniques, including intermittent traction, padded perineal posts, or post-less arthroscopy tables, has significantly decreased the incidence of traction-related sensory changes in early follow-up [32].

Iatrogenic Chondrolabral Injury and Instrumentation Risks

Iatrogenic chondral scuffing or labral damage may occur during portal establishment or instrumentation. Although less common with experienced surgeons, such injuries can have early clinical implications by prolonging recovery or contributing to persistent postoperative pain. Studies indicate rates of iatrogenic chondrolabral injury between **0.2% and 3%** in early series, with modern techniques further reducing their frequency [33]. Adequate visualization, careful intraoperative traction control, and fluoroscopic guidance are essential to minimizing such risks and preventing early setbacks.

Infection and Venous Thromboembolism

Infection following hip arthroscopy is rare. Early postoperative superficial infections occur in <1% of cases, whereas deep infections are exceedingly uncommon (<0.1%) [34]. Standard prophylactic antibiotic regimens and sterile surgical technique have kept infection rates consistently low. Venous thromboembolism (VTE) is also rare in the first 3 months postoperatively, with reported rates between **0.1% and 0.5%** [34]. Patient-specific risk factors such as obesity, smoking, hormonal therapy, or prolonged immobilization may necessitate individualized prophylaxis strategies.

Persistent Pain and Early Failure Syndromes

One of the most clinically significant early complications is persistent postoperative pain or failure to achieve expected early improvement. Causes include inadequate bony resection, unaddressed instability, residual FAI morphology, or unrecognized associated conditions such as microinstability or iliopsoas pathology. Studies suggest that residual cam deformity is among the leading causes of early failure requiring revision surgery [35]. Early failure syndromes often become apparent within the first 6–12 months postoperatively, emphasizing the importance of precise surgical correction and structured rehabilitation.

Early Revision Surgery

While overall revision rates for hip arthroscopy remain low, early revision within 1–2 years typically occurs in **3%–7%** of cases, depending on patient demographics and surgical technique [36]. Common indications for early revision include residual cam or pincer morphology, instability due to capsular insufficiency, and labral re-tears or inadequate repair. Studies show that patients with preoperative advanced cartilage degeneration, borderline acetabular dysplasia, or high BMI are more likely to require early revision [36]. Revision procedures in the early period are generally more technically challenging and may carry higher risks of persistent symptoms or subsequent conversion to arthroplasty.

Conversion to Total Hip Arthroplasty (THA) in the Early Period

Conversion to THA within the first 24 months of arthroscopy for FAI is uncommon but may occur in patients with advanced chondral damage, unrecognized osteoarthritis, or older age (>50 years). Reported early arthroplasty conversion rates range from **1% to 3%**, with predictors including Tönnis grade ≥2, low preoperative joint space width, and greater chondral involvement at surgery [37]. These findings reinforce the importance of accurate preoperative radiographic assessment and patient selection to avoid arthroscopy in individuals unlikely to benefit.

Clinical Implications and Prevention Strategies

Overall, early complication and revision rates after arthroscopic FAI treatment remain low, reflecting improvements in surgical technique, postoperative management, and rehabilitation protocols. Prevention strategies include minimizing traction time, ensuring precise bony correction, performing consistent capsular closure, and implementing early targeted therapy for stiffness. Optimizing these aspects enhances early outcomes and reduces the likelihood of early failure or revision.

Radiologic Outcomes and Morphologic Correction

Importance of Radiologic Assessment in Early Outcomes

Radiologic evaluation plays a pivotal role in assessing the adequacy of arthroscopic correction of femoroacetabular impingement (FAI). Early clinical outcomes have been strongly associated with the completeness of morphological correction, particularly regarding restoration of femoral head–neck offset and normalization of acetabular coverage parameters [38]. Radiographic indices—including the alpha (α) angle, lateral center-edge angle (LCEA), and acetabular version—provide objective measures of surgical success and correlate with improvements in pain and functional scores within the first postoperative year. Studies emphasize that under-resection or residual deformity is a leading cause of persistent symptoms and early revision, highlighting the essential role of postoperative radiologic evaluation [38].

Cam Lesion Correction and α-Angle Improvement

Cam-type FAI correction primarily aims to reduce the α-angle and improve head–neck offset. Numerous imaging studies have demonstrated that successful femoroplasty produces early significant reductions in α-angle—often by 20° to 30°—and that this restoration correlates with improved hip internal rotation and early PROM gains [39]. MRI and 3D CT-based assessments confirm that insufficient cam resection is strongly associated with persistent impingement signs, restricted motion, and higher risk of early revision surgery within the first 12–18 months [39]. Conversely, adequate resection validated by imaging is associated with improved early range of motion and patient satisfaction.

Acetabular Rim Trimming and LCEA Normalization

For pincer or mixed types of FAI, acetabular rim trimming seeks to normalize the LCEA and reduce acetabular overcoverage while preserving sufficient stability. Postoperative radiographs typically show LCEA decreases of 3–6°, which has been associated with reductions in impingement-related pain and improved early hip flexion [40]. Over-resection, however, can predispose to microinstability, leading to early postoperative symptoms or accelerated wear. Studies have shown that patients with well-balanced acetabular correction, confirmed radiographically, exhibit superior iHOT and HOS-ADL scores within the first year after arthroscopy [40].

3D Imaging and Accuracy of Morphologic Correction

Three-dimensional CT analysis has emerged as the most precise method for evaluating bony correction

following arthroscopic FAI surgery. Early postoperative 3D imaging studies have demonstrated that accurate multiplanar resection is associated with significant improvements in short-term function, reduced early failure rates, and enhanced patient satisfaction [41]. Furthermore, 3D assessment allows detection of subtle residual deformities that may not be evident on standard radiographs. Patients with complete 3D-confirmed correction experience both more rapid early improvements and lower incidences of early revision procedures [41].

Labral Seal Restoration and Indirect Radiologic Indicators

Although direct visualization of the labral suction seal is not possible radiographically, indirect markers—such as joint congruity, femoral head coverage, and absence of residual crossover signs—reflect successful restoration of labral function. Early postoperative MRI studies indicate that maintained labral integrity after repair correlates with superior early PROM improvements, especially in young athletes [42]. Additionally, imaging-confirmed resolution of paralabral cysts and decreased fluid extravasation patterns supports the concept that labral repair enhances early biomechanical restoration and symptom relief [42].

Cartilage Status and Early Imaging Indicators of Healing

Chondral recovery following arthroscopic FAI correction remains challenging to assess radiographically, but early MRI-based T2 mapping and dGEMRIC studies provide preliminary insights. Patients with mild to moderate cartilage damage (Outerbridge I–II) demonstrate early biochemical improvements on MRI correlating with improved iHOT and HOS scores at 6–12 months [43]. Conversely, advanced lesions (Outerbridge III–IV) show limited or no early imaging improvement, aligning with their reduced early clinical gains. These imaging outcomes reinforce the prognostic significance of cartilage status when interpreting early post-surgical recovery.

Residual Impingement and Its Early Consequences

Multiple studies have shown that residual bony deformity remains one of the most common radiologic predictors of early failure after FAI arthroscopy. Persistent elevated α-angles or unresolved crossover signs are associated with ongoing mechanical symptoms, restricted hip motion, and higher early revision rates within 12–24 months [44]. Early radiographs or CT scans serve as critical checkpoints, allowing timely identification of problematic cases that may require closer monitoring or corrective intervention. Ensuring morphological normalization is thus fundamental to achieving optimal early outcomes.

Clinical Relevance of Radiologic Correction in Early Recovery

Radiologic correction remains directly linked to early postoperative outcomes. Patients achieving radiographic normalization exhibit significantly better early functional scores, faster return to activity, and lower complication rates compared with those with incomplete correction [44]. Thus, imaging not only reflects surgical quality but also serves as a prognostic tool for early recovery. As imaging modalities and intraoperative 3D guidance continue to evolve, more precise corrections and enhanced early outcomes are expected.

Return to Sport and Early Activity Outcomes

Overview of Return-to-Sport Trends After Arthroscopic FAI Surgery

Return to sport (RTS) is one of the most clinically important early outcome measures for young and athletic patients undergoing arthroscopic correction of femoroacetabular impingement (FAI). Studies consistently report RTS rates ranging from **80% to 95%** within the first 4–7 months following surgery, though the level of return varies by sport intensity and preoperative pathology [45]. Early RTS has been closely linked to adequate morphological correction, successful labral repair, and adherence to postoperative rehabilitation protocols. Importantly, most athletes demonstrate early improvements in strength, mobility, and pain levels sufficient to engage in sport-specific rehabilitation by 10–12 weeks, promoting a structured progression toward competitive activity.

Differences in RTS Across Sport Types

Sport participation demands significantly influence RTS timelines and early performance recovery. Endurance and skill-based sports (e.g., cycling, swimming, golf) generally allow earlier return—often between 3–5 months—due to lower rotational stresses on the hip joint [46]. In contrast, cutting, pivoting,

and high-impact sports such as soccer, basketball, and hockey require more prolonged recovery, with RTS often achieved between 6–9 months depending on athlete readiness and tissue healing [46]. Contact sports may require even longer duration due to elevated stability demands and risk of labral or capsular stress. These observations highlight that while overall RTS rates are high, sport-specific biomechanics critically dictate early return timelines.

Predictors of Early RTS Success

Predictive factors for early RTS include younger age, mild-to-moderate chondral damage, labral repair rather than debridement, and preoperative participation in higher-level sport [47]. Athletes with shorter symptom duration and minimal degenerative changes demonstrate more rapid early improvements in strength and functional testing, contributing to faster RTS. Conversely, older age, advanced chondral injury, and prolonged preoperative disability are associated with delayed RTS. Studies further suggest that achieving early PROM thresholds such as the iHOT-12 MCID strongly predicts timely RTS, underscoring the importance of early symptom relief and functional progress [47].

RTS in Professional vs Recreational Athletes

Professional athletes often follow accelerated rehabilitation programs with sport-specific conditioning that enables early RTS compared with recreational athletes. Professional athlete series report RTS rates exceeding **90%**, with many returning to competition within 4–6 months [48]. However, not all return at their pre-injury level; performance metrics may lag behind clinical recovery in the early period. Recreational athletes show slightly lower RTS rates—approximately 75–90%—with greater variability depending on occupational demands, rehabilitation access, and concurrent injuries [48]. Despite these differences, early RTS remains high across activity levels.

Early Functional Testing and Criteria for RTS Clearance

Early functional assessments play a central role in determining readiness for RTS. Commonly evaluated components include hip strength (goal: ≥90% limb symmetry index), proprioception, agility, hop testing, cardiovascular conditioning, and absence of pain during sport-specific maneuvers. Patients meeting these milestones between 4 and 6 months typically achieve successful early RTS with fewer reinjury risks [49]. Studies emphasize that objective criteria-based clearance reduces complications and correlates with improved short-term patient satisfaction. Conversely, premature RTS in the absence of objective benchmarks may lead to recurrent symptoms, suboptimal early outcomes, or secondary injuries.

Impact of Capsular Management on RTS

Capsular closure or plication has shown beneficial impacts on hip stability, which directly affects early RTS outcomes. Athletes undergoing capsular repair demonstrate faster return to pivoting, cutting, and rotational sports due to increased joint stability and reduced early postoperative apprehension [50]. Capsular non-closure has been associated with microinstability symptoms in early follow-up, potentially delaying RTS or leading to diminished early sport-specific performance. The technical evolution toward routine capsular preservation aligns with improved early RTS trends in modern FAI management.

Psychological Readiness and Sport-Specific Confidence

Psychological readiness is a key but sometimes underestimated determinant of early RTS success. Athletes often report fear of reinjury, apprehension with rotational movements, or lack of confidence in hip stability during early sport re-entry. Research indicates that psychological readiness scores correlate strongly with early RTS timing and patient satisfaction at 6–12 months postoperatively [51]. Incorporating psychological support, gradual exposure training, and sport-specific coaching has proven beneficial in improving early RTS rates and performance return.

Clinical Significance of Early RTS Outcomes

Early RTS outcomes have major implications for patient satisfaction, quality of life, and perceived surgical success. Patients achieving RTS within the first 6 months also tend to demonstrate superior early PROM improvements and lower early revision rates [52]. Conversely, delayed RTS may reflect persistent biomechanical deficits, insufficient rehab progression, or unrecognized residual pathology. Therefore, optimizing RTS through individualized rehab, precise surgical correction, and psychological

readiness strategies is essential in maximizing early postoperative success.

Conclusion

Early clinical outcomes following arthroscopic management of femoroacetabular impingement (FAI) demonstrate consistently strong improvements in pain relief, functional capacity, and activity levels among appropriately selected patients. The transition from open surgical dislocation to arthroscopy has led to meaningful reductions in morbidity and recovery time, enabling detailed correction of cam and pincer morphology while preserving or restoring labral and capsular integrity. Within the first 6 to 24 months after surgery, most patients achieve substantial gains in validated outcome measures, return to daily activity, and, for many athletes, a successful return to sport. These early improvements underscore the efficacy of modern arthroscopic techniques when applied with precision and accompanied by structured rehabilitation.

Nevertheless, early outcomes are not uniform across all patient groups. Biological age, symptom duration, cartilage status, labral integrity, and body composition all significantly influence the magnitude and speed of postoperative recovery. The growing emphasis on labral preservation, meticulous capsular management, and adequate bony reshaping reflects an improved understanding of hip biomechanics and has contributed to enhanced early results. Conversely, residual deformity, unaddressed instability, or excessive resection may compromise early outcomes and increase the risk of revision. These observations emphasize the importance of careful patient selection and detailed preoperative planning.

Rehabilitation remains a central determinant of early success. Patients who follow criteria-based postoperative protocols tend to progress faster, achieve more consistent improvements, and reach sport-readiness earlier. The interplay between rehabilitation and surgical precision forms the foundation for achieving optimal early functional outcomes. Furthermore, psychological readiness is increasingly recognized as a crucial component of early return to sport, influencing confidence, performance, and perceived satisfaction.

Overall, arthroscopic treatment of FAI offers highly favorable early clinical outcomes when guided by sound indications, meticulous technique, and individualized rehabilitation. Continued advancements in imaging, operative technology, and rehabilitation science will likely refine these early results further. Future research should prioritize standardized outcome reporting, high-quality comparative studies, and long-term follow-ups to clarify the durability of early gains and identify strategies to sustain functional improvements. While early outcomes are encouraging, ongoing evaluation and evidence-based refinement remain essential to optimizing short- and long-term success for patients undergoing arthroscopic management of FAI.

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