

Efficacy of Physiotherapy Rehabilitation Program In Post Operative Management of Femoroacetabular Impingement Syndrome: A systemic Review of Clinical Evidence

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Abstract

Background: Femoroacetabular impingement syndrome (FAIS) is a well-known cause of hip pain in adolescents and young adults. It is defined as the triad of symptoms, clinical signs and imaging findings in which structural morphology results in conflict between the femoral head and the acetabulum.

Aim: To summarize the effects of physiotherapy rehabilitation in post operative management of FAI syndrome

Method: A literature search was carried out on the PubMed, EMBASE, Scopus, Google Scholar, Chocrane, Research Gate and PEDro databases, using the following keywords: "femoroacetabular impingement", "FAI", in association with "surgery", "arthroscopy", "surgical" and "physiotherapy", "physical therapy", "rehabilitation", "exercise". Studies meeting all inclusion and exclusion were reviewed and data were extracted.

Results: The above review includes a total of 10 studies. In the present review, data from 1281 patients were retrieved. Out of 1281 patients 820 were Male and 461 were females. Furthermore, 117 cases were classified as a cam impingement, 40 as pincer impingement and 1124 as mixed FAI. The weighted mean age was 35.10 years, outcomes included iHOT-33, HOS ADL, HOS SPORTS, VAS, MHHS.

Conclusion: Rehabilitation protocols following hip arthroscopy for the management of FAI syndrome typically consist of four to five phase programs with set goals and progression criteria. The study found Clinically significant improvement in reported outcomes from baseline noted in majority of the studies reviewed that involved a structured rehabilitation program following arthroscopic management of FAI.

Keywords: "femoroacetabular impingement" "FAI" "physiotherapy" "physical therapy" "rehabilitation" "surgery", "arthroscopy"

Introduction

Femoroacetabular impingement syndrome (FAI) is a well-known cause of hip pain in adolescents and

young adults, with an overall incidence of FAIS of 54.4 per 100,000 person-years¹ It is defined as the triad of symptoms, clinical signs and imaging findings

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in which structural morphology results in conflict between the femoral head and the acetabulum² Although FAI syndrome is one of the most studied conditions in sports medicine, its etiology still remains unknown³ Mechanical conflict that results in the condition may be caused by abnormal sphericity of the femoral head, excessive protrusion of the acetabular edge or both⁴ Impingement can also in ballet dancers or gymnasts⁵

The morphological characteristics associated with FAI have helped define subtypes that include,

1. Cam impingement
2. Pincer impingement
3. Mixed-type hip impingement

Cam Impingement

Due to an abnormally formed femoral head that rotates into the acetabulum, particularly during strong flexion, cam-type morphology causes impingement⁶

Pincer Impingement

The foundation of morphology is an abnormally overextended component of the acetabulum, which can be localized (acetabular retroversion) or affect the entire acetabulum⁶

Repeated abutment of the femoral neck against the acetabular rim can result in injury to the labrum and adjacent cartilage⁷ FAI is a common cause of early onset osteoarthritis of the hip. Over time this repetitive mechanical insult to the articular tissues leads to hip degeneration and development of hip OA⁸

Clinical examination reveals "C sign" hip discomfort, reduced range of motion, and positive results on provocative tests (FADDIR and FABER)⁹

The main focus of radiologic findings is the detection of retroversion for pincer type and cam-

type¹⁰ Either surgical or conservative approaches can be proposed for treating FAI morphologies¹¹

Conservative treatment mainly consists of supervised physical therapy¹² Surgical treatment of FAI is aimed at correcting the anatomic abnormalities causing pathologic mechanics of the hip joint. Arthroscopic treatment adopted are acetabuloplasty, Femoroplasty, labral repair and debridement¹³

Several studies have reported the success of surgical intervention for patients with FAI syndrome^{14,15} The postoperative rehabilitation program is vital for successful outcome following surgery¹⁶ Its details remain unclear^{17,18}

The extent to which postoperative rehabilitation protocols are described and implemented in outcome studies is unclear. The aim of the present systemic review is to provide comprehensive analysis of physiotherapy for post operative rehabilitation programme for FAIS focusing on the all the clinical evidence.

Materials and Methods

The present systematic review was performed according to PRISMA guidelines [Preferred Reporting Items for Systematic Reviews and Meta-analyses] Two independent reviewers completed title, abstract, and full-text screening, assessing for study inclusion. Discrepancies were resolved by discussion or by a third reviewer A literature search was carried out on the PubMed, EMBASE, Scopus, PEDRO, Google Scholar and Research Gate By two independent investigators using the following keywords "femoroacetabular Impingement" "FAI" "Arthroscopy" "Physiotherapy" "physical therapy" "rehabilitation" "surgery" "exercise" "Rehabilitation" "Post Operative Rehabilitation"

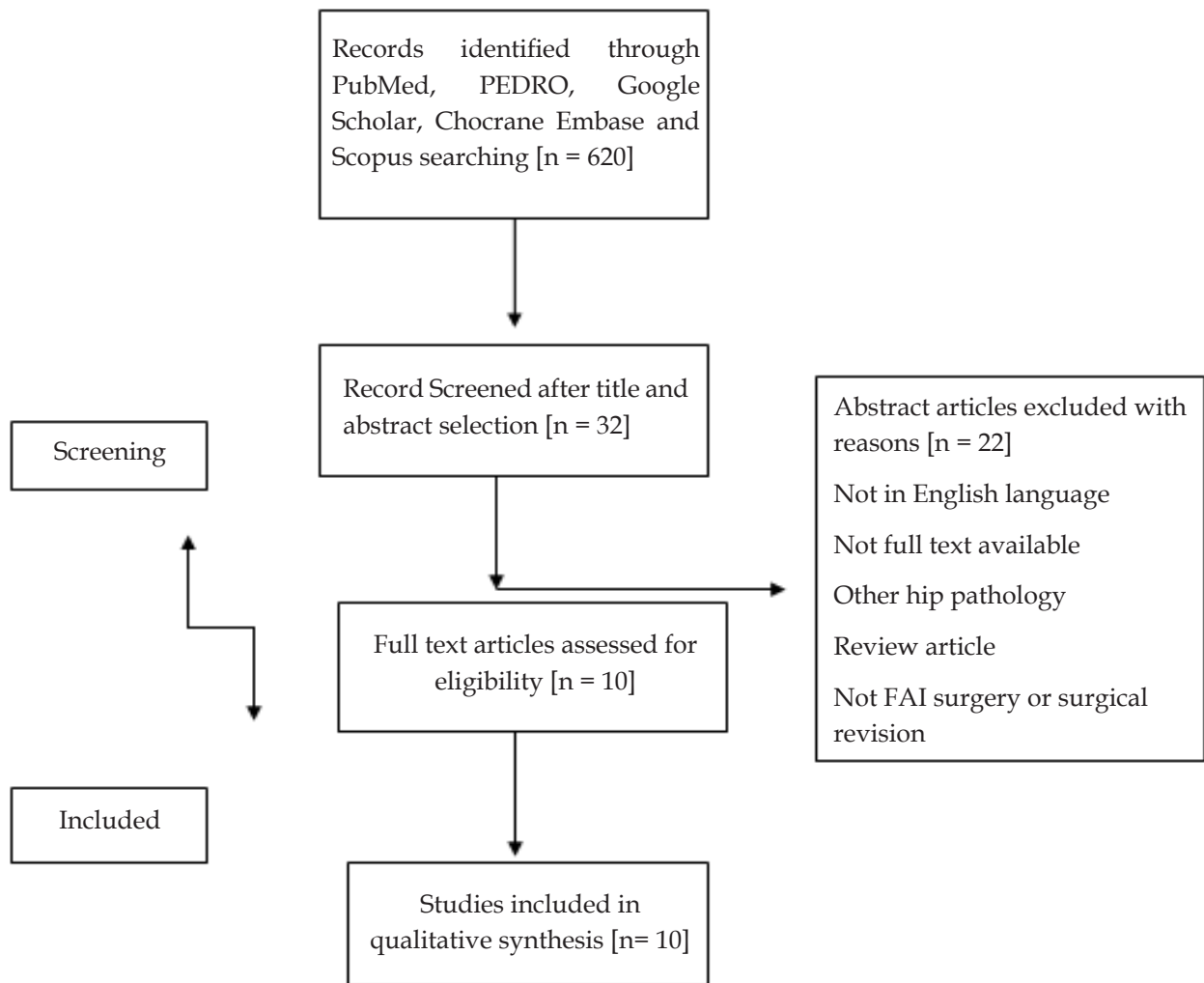


Figure 1. PRISMA Flowchart summarizing the selection process

First, all the retrieved articles were screened by title and abstract, using the following inclusion criteria for article selection.

Inclusion criteria

1. Prospective or retrospective intervention or observational and RCT dealing with the patients FAI syndrome and treated with either arthroscopy or an open surgical procedure.
2. Written in the English language
3. Published from 2000 to 2022
4. Dealing with the treatment of patients affected by FAI Syndrome.
5. Adults of both sexes, at least 16 years of age with clinically confirmed FAI

Exclusion criteria

1. Written in languages other than English
2. Not dealing with the treatment of FAI syndrome.
3. Systematic reviews, conference abstracts, case studies, narrative reviews, and non-peer-reviewed studies were excluded
4. Articles lacking access to the full text.
5. Studies reporting on hip surgery for a diagnosis other than FAI

Two independent reviewers extracted all the data. A third reviewer independently verified the data. The following data were extracted from each study.

Table 1. Showing Characteristics of Included Studies

Study	Study Design	Treatment Groups	Outcome Measures	Follow-Up	Rehabilitation Program	Main Results	Conclusion
1. Benjamin G. Domb et.al ¹⁹	Clinical review.	-	Modified Harris Hip Score (mHHS) Hip Outcome Score- Activitis of Daily Living (HOS-ADL) Hip Outcome Score Sport-Specific Subscale (HOS-SSS) Non-Arthritic Hip Score (NAHS) Visual analog scale (VAS)	2-Year	A preoperative program was initiated 1 month prior to the patients surgery. Phase 1 lasts for 3 weeks Phase 2 spans from week 4 through 8 Phase 3 (Weeks 9-12) Phase 4 (>12 Weeks)	Showing improvement at 2-year follow-up of 61.29 to 82.02 for (mHHS), 62.79 to 83.04 for (HOS-ADL), 40.96 to 70.07 for Hip Outcome Score-	Following a structured criteria-based program, patients undergoing HA may achieve excellent outcomes
2. Kim L Bennell et.al ²⁰	RCT	14-Physiotherapy 16- control group	International Hip Outcome Tool (iHOT-33) sport subscale of the Hip Outcome Score (HOS)	14 week and 24 weeks	The PT group received seven PT sessions (one preoperative and six postoperative)	For the 14-week the PT group showed significantly greater improvements on the iHOT-33 and HOS	An individual PT treatment and rehabilitation programme may augment improvements in patient reported outcomes following arthroscopy for FAI syndrome
3. Kim L Bennell et.al ²¹	RCT	100 people aged 16-35 years undergoing hip arthroscopy for symptomatic FAI randomly allocated to either a physiotherapy or control group.	International Hip Outcome Tool and the sports subscale of the Hip Outcome Score. Hip and Groin Outcome Score, HOS ADL	24 weeks.	The physiotherapy intervention will incorporate education and advice, manual techniques and prescription of a progressive rehabilitation program.	-	The findings will provide evidence for the efficacy of a specific physiotherapist-supervised rehabilitation program in improving outcomes following arthroscopic management of symptomatic FAI.
4. Luke Spence Gardner et.al ²²	RCT	19-Males 33-Females	Modified Harris hip score MHHS Hip outcome score (HOS).	1- year	Phase I: day 1 to week 4 Phase II: weeks 4-8 Phase III: weeks 8-12 Phase IV: weeks 12-16	Mean MHHS, HOS-ADL, and HOS-sport scores at a mean 12.5 months were 80.1 ± 19. 83.6 ± 19.2 and 70.3 ± 27	This five-phase rehabilitation programme provides a framework where progression from surgery to increasing post-operative activity level can take place in a predictable manner.

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5. Alexis Müller-Torrente et al. ²³	RCT	45- Control group 45- Experimental Group	Visual Analogue Scale (VAS) Goniometry (ROM) Harris Hip Score (mHHS).	14- Weeks	This protocol consists of an education program exercises focused on stabilization, proprioception, flexibility and strengthening 45 min each, once every two weeks for a total of 7 sessions	At 14 weeks the experimental group showed a, a greater improvement in mHHS	The rehabilitation program proposed in this study has been shown to achieve benefits in pain reduction and recovery of hip mobility in patients with FAIS undergoing HA
6. Melissa Saavedra et al. ²⁴	Retrospective study	From a total of 684 hip surgeries, 103 subjects entered kinesiotherapy rehabilitation from which 48 subjects are eligible.	16- Weeks	Harris Hip Score (HHS) Vail Score	Phase 1 Tissue protection, mobility and motor control phase (1-4 weeks post-surgery) Phase 2 Neuromuscular control phase (4-8 weeks postsurgery) Phase 3 Strength, resistance and functional movement patterns (8-12 weeks) Phase 4 Return to sport activities.		This study found significant differences in the measurement of self-report scales (HHS and VHS) on the three occasions of evaluation during the kinesiotherapy rehabilitation process.
7. Danielle Lovett Carter and Norelee Kennedy ²⁵	Retrospective study	Eight eligible participants were interviewed.		Ability to Participate in Sport. Perception of Hip and Rehabilitative Process	Personalised Hip Therapy (PHT), consists of four core components led by physiotherapists: detailed patient assessment, education and advice, help with pain relief and an exercise-based programme	A retrospective qualitative approach was adopted using semistructured interviews.	Overall, athletes were relatively satisfied with their outcome 1 y after hip arthroscopy, despite some having to adapt their sporting activities. protocol.
8. Kristian Thorborg et al. ²⁶	Cohort study	From September 2011 to March 2014, 97 consecutive patients	12- Months	Hip and Groin Outcome Score (HAGOS) Modified Harris Hip Score (mHHS).	97 consecutive patients (mean age, 37 years; range, 19-59 years)] hip Standardized post-operative rehabilitation instructions were provided	Improvements for all HAGOS subscales and mHHS results were seen at 3 months	Statistically and clinically relevant improvements in HAGOS and mHHS results after hip arthroscopy and rehabilitation can be seen at 3 months and up to 1 year.

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9. A N Bennett et.al ²⁷	prospective	101 participants	12 months	Visual Analogue Scale (VAS) Non-Arthritic Hip Score (NAHS)	Initial postoperative rehabilitation included protecting the integrity of the repaired tissue, restoring range of motion, restoring normal gait pattern and weight-bearing status	Preoperative NAHS mean=62.9(SD 16.4), 12-month postoperative NAHS mean=78.8 (18.3), Preoperative VAS pain mean=51.3 (20.9), 12-month postoperative VAS pain=25.6 (24.5).	These data confirm that HA as part of a structured evidence-based multidisciplinary care pathway produces significant and continued symptomatic, functional and vocational improvements over a 12-month period in a military population exposed to high intensity, weight-bearing exercise
10.Michihisa Aoyama et.al ²⁸	RCT	10- Trunk stabilization 10- control group	8-weeks	Vail hip score International hip outcome tool 12 (iHOT12)	20 female patients with symptomatic FAI comprising 2 groups (10 hips in trunk stabilization exercise group vs 10 hips in control group).	Vail hip score and iHOT12 were significantly increased at 8 weeks in the trunk training group	The addition of trunk stabilization-on exercise to a typical hip rehabilitation protocol improves short-term clinical outcomes

Results

In the present review, data from 1281 patients were retrieved. Out of 1281 patients 820[59.16%] are Male and 461[40.83] are females. Furthermore, 117[14.79%] cases are classified as a cam impingement, 40[5.05%] as pincer impingement and 1124[80.15] as mixed FAI. The mean age was 35.10 years. Out of 1281 patients 361 patients gone through Acetabuloplasty and Femoroplasty techniques, 150 gone through labral repair procedure and remaining 770 patients has gone through other arthroscopic procedures. Mean Duration of post operative rehabilitation is 18 weeks.

Table 2 Demographic Characteristics of Included Studies

Demographic Characteristics of Included Studies

- Population n= 1281
- Male n= 820
- Females n= 461

FAI morphology

- Cam impingement n= 117
- Pincer impingement n= 40
- Mixed n= 1124

Surgical Procedure

- Acetabuloplasty n= 361
 - Femoroplasty n= 361
 - Labral repair n= 150
- Rehabilitation Duration n= 18 weeks

Reported clinical outcomes

International Hip Outcome Tool (iHOT-33) It is a questionnaire designed for self-administration and can be provided to young active patients with pathologies affecting the hip²⁹

Kim L Bennell et.al reported a statistically significant improvement in iHOT-33 from baseline to 14 - weeks between both the groups.

Hip Outcome Score of Daily Living (HOS-ADL) and Sports (HOS-Sports) This are self-reported outcomes with evidence of reliability and responsiveness for patients who are treated for HA.

Benjamin G. Domb et.al conducted a study to analyze the effect of physical therapy protocol after HA showing improvement from preoperative to 2-year follow-for(HOS-ADL), for (HOS-SSS). **Kim L Bennell et.al**³³ reported a statistically

significant improvement in HOS-Sports from baseline to 14 - weeks **Luke Spencer-Gardner**³² et. al found significant difference in HOS - ADL after five phase rehabilitation programme.

Rom and Pain

Alexis Müller³³ Torrente et.al reported significant improvement in hip ROM and VAS after 14- weeks of intervention. **Benjamin G. Domb** 30 et.al showing improvement at 2-year follow-up in (VAS) scores from 5.86 to 2.94. **A N Bennett et.al** found significant at 12-month postoperative VAS

Modified Harris Hip Score (mHHS)

Alexis Müller-Torrente et.al conducted a study to analyze the Benefits of a Supervised post operative Rehabilitation Program in FAI Patients showed greater improvement in mHHS ($p < 0.001$). **Melissa Saavedra et.al**³⁴ conducted a study to analyze the effect of kinesiotherapy after hip arthroscopy and found significant difference in HHS. **Kristian Thorborg et.al**³⁶ Improvements for mHHS at 3 months.

Post-operative rehabilitation protocols

Four out of the ten studies contained phase-based post-operative rehabilitation protocols for FAI syndrome. Benjamin G. Domb et.al include a pre operative phase and 4- phase post operative re rehabilitation protocol that last for more than 12 weeks.

Alexis Müller-Torrente et.al didn't use a phase-based approach, but instead included adequate pre- and postoperative care, including health education and an exercise plan. Luke Spencer-Gardner et.al include a pre operative phase and four phase post operative programme for 16 weeks.

Melissa Saavedra et.al include four phase rehabilitation programme for around 16 weeks. Kristian Thorborg et.al also include a four phase phases (mobility, stability, strength, and return to sport/competition) A N Bennett et.al³⁷ included rehabilitation initially followed the principles of postoperative rehabilitation and then progressed to a more individualized hip and groin programme.

Discussion

The present review highlighted the effectiveness of physiotherapy rehabilitation programme in post operative management of FAI syndrome. The above review includes a total of 10 RCT and four contained phase-based post-operative rehabilitation protocols for FAI syndrome. The studies included in this review have documented significant improvements in PROs following structured postoperative rehabilitation programs for patients with FAI.

Hari K. Ankem et.al conducted a review to determine the effect of Structured physical therapy protocols following hip arthroscopy and found clinically significant improvement in PROs²⁹. Similarly Michael P. Reiman et.al conducted a scoping review to determine the effect of post operative rehabilitation for FAI syndrome and conclude that Surgical outcome studies do not provide sufficient detail to replicate a postoperative rehabilitation protocol for FAI³⁰. Mark J. Holling et.al conducted Review of the Recent Literature for Athletes after HA of FAI syndrome and found that four-phase approach to rehabilitation following hip arthroscopy for FAI is widely used with general uniformity³¹.

Cheatham et al.'s systematic review suggested a 4-5 phase rehab programme³². De SA et al emphasized the importance of an individualized rehabilitation strategy that emphasizes progressive development through various stages.³³

The majority of the literature on physical therapy has been on non-surgical management of FAI which cannot be applied to a post-operative population^{34,35}. By using specific inclusion criteria, we were able to synthesize our review from a very uniform set of studies, with the same time frames, criteria, and objectives for progressing through various phases of rehabilitation.

The subjective scores considered by the authors included iHOT-33, SF-12, EQ-5D-5L and HOS. iHOT-33 is considered one of the main questionnaires to quantitatively evaluate patients symptoms³⁶.

Conclusion

Rehabilitation protocols following hip arthroscopy for the management of FAI syndrome typically consist of four to five phase programs with set goals and progression criteria. Study found Clinically

significant improvement in reported outcomes from baseline noted in majority of the studies reviewed that involved a structured rehabilitation program following arthroscopic management of FAI.

Limitations

There is limited available evidence surrounding the specific post-operative Rehabilitation for FAI syndrome. Second, there were significant differences in the mean follow-up timepoints for PROs Therefore, it wasn't possible to draw meaningful conclusions as to which PT protocol was ideal. Meta Analysis of these studies could not be done due to quantitative difference in patient's properties, duration of intervention, outcome measures and treatment therapies.

Future Directions

Further high-quality comparison studies are required because it is impossible to determine which protocol is the most successful due to the variety in patient-specific features among the included researches.

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