

# Role of Maitland Mobilization Approach Combined with Conventional Physiotherapy to Improve Pain and Range of Motion in Subjects with Acetabular Femoral Impingement

Monika Babal<sup>1</sup>, Dr. Yash Prajapati<sup>2</sup>, Prof. (Dr.) Dhruv Taneja<sup>3</sup>,  
Prof. (Dr.) Waribam Ranjeeta<sup>4</sup>, Prof (Dr) Aklavya Bohra<sup>5</sup>, Dr. Aditi  
Buliya<sup>6</sup>

<sup>1</sup>MPT Scholar, Jaipur Physiotherapy College, MVGU

<sup>2</sup>Lecturer Swasthya Kalyan College of Physiotherapy RUHS

<sup>3</sup> Professor & Principal: Swasthya Kalyan College of Physiotherapy RUHS

<sup>4</sup>Professor: JPTC MVGU

<sup>5</sup>Principal Swasthya Kalyan Institute of Naturopathy And Yogic Sciences, Jaipur

Assistant Professor, Swasthya Kalyan College of Physiotherapy<sup>6</sup>

## ABSTRACT

**Background:** Femoroacetabular impingement (FAI) is a common musculoskeletal condition characterized by abnormal contact between the femoral head and the acetabular rim, leading to hip pain, reduced range of motion (ROM), and functional limitations. Conservative physiotherapy management plays an important role in reducing symptoms and improving functional outcomes in individuals with FAI. Manual therapy techniques such as the Maitland mobilization approach, combined with conventional physiotherapy exercises, may help restore normal joint mechanics and improve hip mobility.

**Aim:** The present study aimed to evaluate the effectiveness of the Maitland mobilization approach combined with conventional physiotherapy in improving pain and hip joint range of motion in subjects with femoroacetabular impingement.

**Methodology:** An experimental study design was conducted among 15 subjects diagnosed with femoroacetabular impingement, aged between 18 and 40 years. Participants were selected using a convenience sampling method from the physiotherapy department of a selected hospital. The intervention included Maitland mobilization techniques (Grade I–IV) along with conventional physiotherapy exercises such as stretching, strengthening, range of motion exercises, postural correction, and functional training. The treatment was administered three sessions per week for a duration of 4–6 weeks. Outcome measures included pain assessment using the Visual Analogue Scale (VAS), hip range of motion measured with a goniometer, and functional status assessed using the Harris Hip Score (HHS). Pre-treatment and post-treatment data were analyzed using the paired t-test.

**Results:** The results demonstrated a statistically significant reduction in pain and improvement in hip joint range of motion following the intervention ( $p < 0.05$ ). The mean VAS score decreased from 8.20 to 2.73. Significant improvements were also observed in hip flexion, extension, abduction, internal rotation, and

external rotation. Additionally, the Harris Hip Score improved from 33.07 to 80.33, indicating enhanced hip function and quality of life.

**Conclusion:** The findings of this study suggest that the Maitland mobilization approach combined with conventional physiotherapy is effective in reducing pain and improving hip joint mobility and functional outcomes in individuals with femoroacetabular impingement.

**Keywords:** Femoroacetabular impingement, Maitland mobilization, physiotherapy, hip range of motion, pain, Harris Hip Score.

## INTRODUCTION

Acetabular femoral impingement (AFI), commonly known as **femoroacetabular impingement (FAI)**, is a musculoskeletal condition characterized by abnormal contact between the femoral head–neck junction and the acetabular rim of the hip joint. This abnormal contact may lead to hip pain, reduced range of motion (ROM), and functional limitations during activities such as walking, sitting, squatting, and sports participation.

FAI generally occurs due to structural abnormalities such as **cam deformity**, **pincer deformity**, or a combination of both. These abnormalities can cause repetitive micro-trauma to the labrum and cartilage, eventually leading to hip joint degeneration if not managed properly.

Physiotherapy plays a crucial role in the conservative management of FAI. Treatment approaches commonly include pain management, joint mobilization, strengthening exercises, stretching, and functional rehabilitation.

One of the effective manual therapy techniques used in physiotherapy is the **Maitland Mobilization Approach**, developed by Geoffrey Douglas Maitland. Maitland mobilization involves graded oscillatory passive movements applied to the joint to reduce pain, improve joint mobility, and restore normal movement patterns.

When Maitland mobilization is combined with conventional physiotherapy interventions—such as therapeutic exercises, stretching, and strengthening—it may enhance treatment outcomes by improving joint mechanics and reducing symptoms in individuals with acetabular femoral impingement.

## Role of Maitland Mobilization in Acetabular Femoral Impingement

Maitland mobilization focuses on restoring normal joint arthrokinematics and reducing pain through controlled oscillatory movements. The technique is applied in different grades depending on the patient's symptoms and stage of rehabilitation.

The major therapeutic roles of Maitland mobilization in patients with FAI include:

1. **Pain Reduction:** Maitland mobilization helps stimulate mechanoreceptors in the joint capsule, which can inhibit pain signals through neurophysiological mechanisms.
2. **Improvement of Joint Mobility:** Gentle oscillatory movements improve capsular extensibility and decrease joint stiffness, thereby increasing hip ROM.
3. **Restoration of Normal Arthrokinematics:** Mobilization techniques help correct abnormal joint gliding movements between the femoral head and acetabulum.
4. **Reduction of Muscle Guarding:** Passive mobilization reduces reflex muscle spasm around the hip joint.

5. **Improved Functional Movement:** Increased joint mobility and decreased pain allow patients to perform daily activities more comfortably.

### **Role of Conventional Physiotherapy**

Conventional physiotherapy interventions are essential in managing FAI and often include the following components:

#### **1. Stretching Exercises**

- Hip flexor stretching
- Hamstring stretching
- Adductor stretching
- Piriformis stretching

These exercises help reduce muscle tightness around the hip joint.

#### **2. Strengthening Exercises**

Strengthening focuses mainly on the muscles that stabilize the hip joint, including:

- Gluteus medius
- Gluteus maximus
- Core muscles
- Hip abductors and external rotators

Improving muscular strength enhances joint stability and reduces abnormal hip movement.

#### **3. Range of Motion Exercises**

Active and passive ROM exercises help maintain joint mobility and prevent stiffness.

#### **4. Postural and Functional Training**

Patients are educated on proper posture and movement patterns during activities such as walking, squatting, and sitting.

### **Combined Effect of Maitland Mobilization and Conventional Physiotherapy**

The combination of Maitland mobilization with conventional physiotherapy provides a comprehensive rehabilitation approach for individuals with acetabular femoral impingement.

The expected benefits include:

- Significant **reduction in hip pain**
- **Improvement in hip joint range of motion**
- **Enhanced functional ability**
- **Improved quality of life**
- **Prevention of further joint degeneration**

Manual therapy addresses joint restrictions, while exercise therapy improves muscular strength and stability. Together, they promote optimal hip joint function.

Acetabular femoral impingement is a common cause of hip pain and limited mobility in young and active individuals. Conservative physiotherapy management plays an important role in reducing symptoms and improving functional outcomes.

The Maitland mobilization approach, when combined with conventional physiotherapy interventions such as strengthening, stretching, and ROM exercises, can effectively reduce pain and improve hip joint mobility. Therefore, this combined rehabilitation approach may be considered an effective treatment strategy for individuals with acetabular femoral impingement.

## Aim, Objectives, Hypothesis, and Methodology

### 1. Aim of the Study

To evaluate the effectiveness of the **Maitland Mobilization approach combined with conventional physiotherapy** in improving pain and hip joint range of motion in subjects with femoroacetabular impingement.

### 2. Objectives of the Study

#### Primary Objectives

1. To assess the effect of Maitland mobilization combined with conventional physiotherapy on **pain reduction** in subjects with femoroacetabular impingement.
2. To evaluate the improvement in **hip joint range of motion (ROM)** following the intervention.

#### Secondary Objectives

1. To analyze the **functional improvement** in patients with femoroacetabular impingement after physiotherapy treatment.
2. To compare **pre-treatment and post-treatment outcomes** of pain and ROM in the subjects.

### 3. Hypothesis

#### Null Hypothesis ( $H_0$ )

There will be **no significant difference** in pain reduction and improvement in hip joint range of motion in subjects with femoroacetabular impingement following Maitland mobilization combined with conventional physiotherapy.

#### Alternative Hypothesis ( $H_1$ )

There will be a **significant improvement** in pain reduction and hip joint range of motion in subjects with femoroacetabular impingement following Maitland mobilization combined with conventional physiotherapy.

## METHODOLOGY

### Study Design

Experimental study design.

### Study Setting

The study will be conducted in the Physiotherapy Outpatient Department of a The Royal Orthopaedic Hospital & sports injury centre and Nirmal Hospital

### Study Population

Patients diagnosed with **femoroacetabular impingement (FAI)** presenting with hip pain and limited range of motion.

### Sample Size

The sample size will be determined using **power analysis with G\*Power software**.

- Total sample size: **15 subjects**
- Group A: Maitland mobilization + conventional physiotherapy

### Sampling Method

Convenience sampling method.

### Inclusion Criteria

- Subjects aged **18–40 years**
- Diagnosed with **femoroacetabular impingement**
- Patients experiencing **hip pain and restricted ROM**

- Both **male and female participants**
- Patients willing to participate and sign informed consent

#### **Exclusion Criteria**

- History of **hip fracture or hip surgery**
- Severe **osteoarthritis of the hip**
- **Neurological disorders** affecting lower limb function
- **Inflammatory joint diseases**
- Patients currently receiving other forms of hip rehabilitation

#### **Outcome Measures**

##### **1. Pain Assessment**

- Visual Analogue Scale (VAS)

##### **2. Range of Motion Assessment**

- Hip ROM measured using **goniometer**

#### **Intervention Protocol**

##### **Group (Intervention Group): Maitland Mobilization + Conventional Physiotherapy**

Treatment will include:

##### **Maitland Mobilization Techniques**

- Grade I and II mobilization for pain relief
- Grade III and IV mobilization for improving joint mobility
- Hip joint mobilization (posterior, inferior, and lateral glide)

##### **Conventional Physiotherapy**

- Stretching exercises (hamstrings, hip flexors, adductors)
- Strengthening exercises (gluteal muscles, hip abductors, core muscles)
- Range of motion exercises
- Postural correction and functional training

##### **Treatment duration:**

**3 sessions per week for 4–6 weeks**

##### **Data Collection Procedure**

1. Subjects will be screened according to the inclusion and exclusion criteria.
2. Written informed consent will be obtained from participants.
3. Baseline assessment of **pain and hip ROM** will be recorded.
4. Subjects will receive physiotherapy intervention for the specified treatment period.
5. Post-treatment assessment will be conducted after completion of the intervention.

##### **Statistical Analysis**

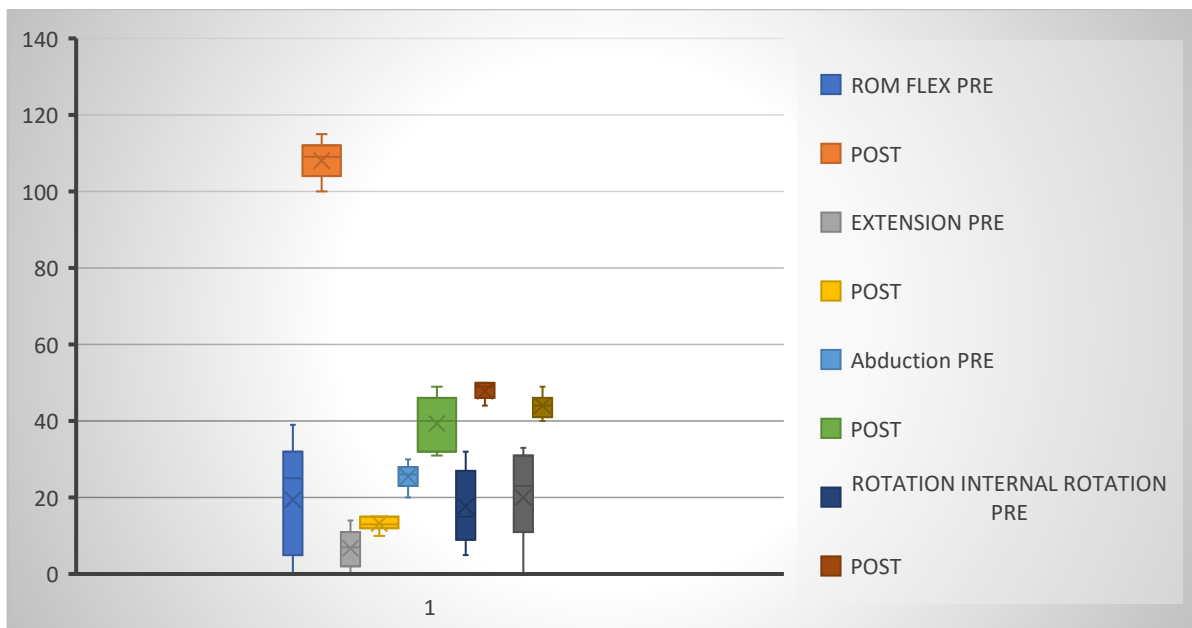
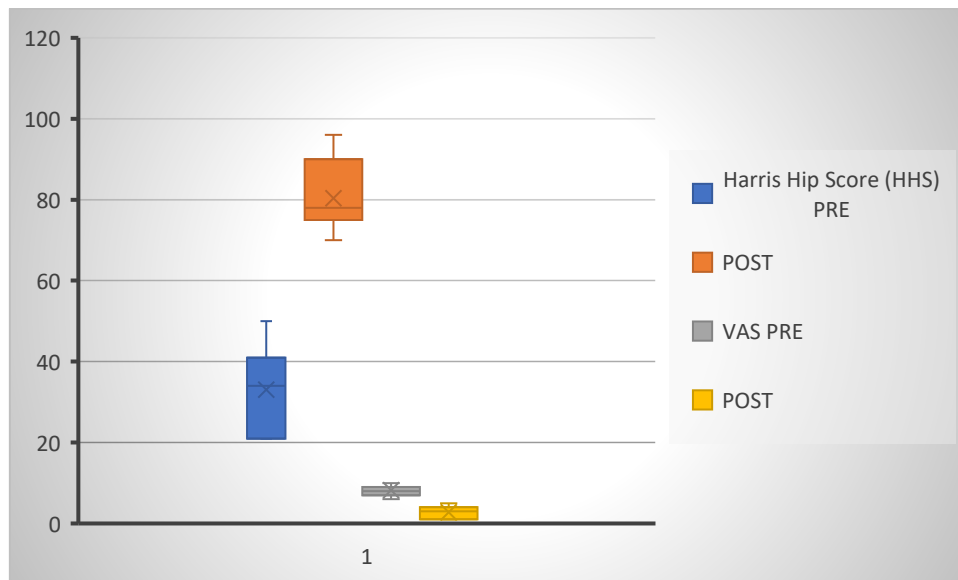
Data will be analyzed using appropriate statistical software.

- **Paired t-test** for comparison of pre- and post-treatment values within groups.
- **Independent t-test** for comparison between groups.
- Significance level set at **p < 0.05**

**RESULTS**

**Table:1 Comparison of Pre and Post Values in Intervention Group (Paired t-test, n = 15)**

Outcome Measure	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	t value	p value
VAS (Pain)	8.20 ± 1.15	2.73 ± 1.44	-10.25	<0.001
Hip Flexion ROM	19.40 ± 14.12	108.00 ± 4.80	23.91	<0.001
Hip Extension ROM	6.73 ± 4.56	13.27 ± 1.79	5.15	0.00015
Hip Abduction ROM	25.47 ± 2.92	39.33 ± 6.56	7.70	<0.001
Hip Internal Rotation	17.67 ± 9.29	47.80 ± 2.14	13.35	<0.001
Hip External Rotation	20.00 ± 10.52	44.00 ± 3.07	8.49	<0.001
Harris Hip Score (HHS)	33.07 ± 10.61	80.33 ± 7.94	13.33	<0.001



The paired t-test analysis demonstrated a statistically significant improvement in pain, hip range of motion, and functional outcome following the intervention.

The VAS score significantly decreased from  $8.20 \pm 1.15$  to  $2.73 \pm 1.44$  ( $p < 0.001$ ) indicating substantial pain reduction.

Similarly, hip range of motion showed significant improvement in flexion, extension, abduction, internal rotation, and external rotation.

The Harris Hip Score significantly improved from  $33.07 \pm 10.61$  to  $80.33 \pm 7.94$  ( $p < 0.001$ ) indicating marked improvement in hip joint function.

These results suggest that Maitland mobilization combined with conventional physiotherapy is effective in improving pain, mobility, and functional status in subjects with femoroacetabular impingement

## DISCUSSION

The present study aimed to determine the **effectiveness of the Maitland Mobilization approach combined with conventional physiotherapy in improving pain and range of motion in subjects with femoroacetabular impingement (FAI)**.

The study was conducted using an **experimental study design** with a **sample size of 15 subjects** diagnosed with femoroacetabular impingement. Participants were recruited using a **convenience sampling method** from the physiotherapy department of a selected hospital. The intervention consisted of **Maitland mobilization techniques along with conventional physiotherapy**, administered **three sessions per week for 4–6 weeks**. Outcome measures included **pain assessment using the Visual Analogue Scale (VAS)** and **hip range of motion measured with a goniometer**. Functional improvement was also assessed using the **Harris Hip Score (HHS)**.

The findings of the present study demonstrated **statistically significant improvements in pain reduction, hip joint range of motion, and functional outcome following the intervention**.

### **Pain Reduction (VAS)**

The results of the present study showed a **significant reduction in pain levels**, with the mean VAS score decreasing from  **$8.20 \pm 1.15$  before treatment to  $2.73 \pm 1.44$  after treatment ( $p < 0.001$ )**.

Pain reduction following Maitland mobilization may be attributed to the **stimulation of mechanoreceptors in the joint capsule**, which inhibits nociceptive input through the **gate control theory of pain**. Gentle oscillatory mobilizations (Grade I and II) help reduce pain by promoting relaxation of periarticular muscles and improving synovial fluid movement within the joint.

These findings are consistent with the work of Geoffrey Douglas Maitland, who emphasized that graded oscillatory mobilizations are effective in reducing pain and improving joint function in musculoskeletal conditions.

Similar results were reported by Freddy M. Kaltenborn, who suggested that joint mobilization techniques can significantly reduce pain and improve joint mobility in patients with hip dysfunction.

### **Improvement in Hip Range of Motion**

The present study showed **significant improvements in all measured hip range of motion parameters**, including flexion, extension, abduction, internal rotation, and external rotation.

The mean hip flexion ROM increased from  **$19.40^\circ$  to  $108.00^\circ$** , while abduction improved from  **$25.47^\circ$  to  $39.33^\circ$** . Internal rotation also showed a significant increase from  **$17.67^\circ$  to  $47.80^\circ$** , indicating improved hip joint mobility.

These improvements may be explained by the **mechanical and neurophysiological effects of joint mobilization**. Maitland mobilization techniques help restore normal **arthrokinematics of the hip joint** by improving capsular extensibility and reducing joint stiffness. In addition, stretching and strengthening exercises used in conventional physiotherapy help improve muscle flexibility and joint stability.

The findings of the present study are supported by research conducted by Chad Cook, who reported that manual therapy combined with therapeutic exercise significantly improves hip joint mobility and reduces symptoms in patients with hip impingement.

Similarly, studies by Carolyn Kisner and Lynn Allen Colby reported that combining manual therapy with strengthening and stretching exercises improves joint range of motion and functional performance in musculoskeletal disorders.

### **Improvement in Functional Outcome (Harris Hip Score)**

Functional improvement was assessed using the **Harris Hip Score**, which showed a significant increase from **33.07 ± 10.61 before treatment to 80.33 ± 7.94 after treatment (p < 0.001)**.

This improvement indicates that the intervention not only reduced pain but also enhanced the participants' **functional ability in activities of daily living** such as walking, sitting, and climbing stairs.

Improved functional outcomes may be attributed to the combined effect of **pain reduction, improved joint mobility, and increased muscle strength**. Strengthening exercises targeting the **gluteal muscles, hip abductors, and core muscles** help stabilize the hip joint and reduce abnormal movement patterns associated with femoroacetabular impingement.

These findings are supported by research conducted by Michael P. Reiman, who reported that conservative physiotherapy programs including manual therapy and strengthening exercises significantly improve hip function in individuals with femoroacetabular impingement.

### **Clinical Implications**

The findings of this study suggest that **Maitland mobilization combined with conventional physiotherapy is an effective conservative management approach for patients with femoroacetabular impingement**.

The combination of manual therapy and therapeutic exercises provides a comprehensive rehabilitation strategy that addresses:

- Pain reduction
- Restoration of joint mobility
- Improvement of muscle strength
- Enhancement of functional performance

This approach may help delay or prevent the need for surgical intervention in some patients with early-stage femoroacetabular impingement.

Overall, the results of the present study demonstrate that **Maitland mobilization combined with conventional physiotherapy significantly improves pain, hip range of motion, and functional outcomes in patients with femoroacetabular impingement**.

The improvements observed in this study are consistent with previously published research supporting the effectiveness of **manual therapy and exercise-based rehabilitation in the management of hip joint disorders**.

### **Limitations of the Study**

Although the study produced significant findings, several limitations should be considered:

1. The **sample size was relatively small (n = 15)**, which may limit the generalizability of the results.

2. The study used a **convenience sampling method**, which may introduce selection bias.
3. The **duration of the intervention was limited to 4–6 weeks**, and long-term follow-up was not conducted.
4. The study did not include a **control group**, which limits the ability to compare the effectiveness of the intervention against other treatment approaches.
5. External factors such as **daily activity levels, lifestyle habits, and patient compliance** with exercises outside therapy sessions were not controlled.
6. The study focused mainly on **pain and range of motion outcomes**, while other factors such as muscle strength and gait mechanics were not extensively evaluated.

### Recommendations for Future Research

Based on the findings and limitations of the present study, the following recommendations are suggested for future research:

1. Future studies should include a **larger sample size** to improve the reliability and generalizability of results.
2. **Randomized controlled trials (RCTs)** should be conducted to provide stronger evidence regarding the effectiveness of Maitland mobilization.
3. Studies with **long-term follow-up assessments** should be performed to evaluate the sustainability of treatment outcomes.
4. Future research may compare **different manual therapy techniques**, such as Maitland mobilization versus Mulligan mobilization, in patients with femoroacetabular impingement.
5. Additional outcome measures such as **muscle strength, gait analysis, and functional performance tests** should be included.
6. Research can also investigate the **effectiveness of physiotherapy interventions in different age groups and activity levels**, including athletes and elderly populations.

### CONCLUSION

The present study aimed to evaluate the **effectiveness of the Maitland mobilization approach combined with conventional physiotherapy in improving pain and range of motion in subjects with femoroacetabular impingement (FAI)**.

The study included **15 participants diagnosed with femoroacetabular impingement**, who received Maitland mobilization along with conventional physiotherapy for **3 sessions per week over a period of 4–6 weeks**. Outcome measures included **Visual Analogue Scale (VAS) for pain, hip range of motion measured using a goniometer, and functional status using the Harris Hip Score (HHS)**.

The results of the study demonstrated a **statistically significant reduction in pain levels**, as indicated by a decrease in VAS scores following the intervention. Additionally, significant improvements were observed in **hip joint range of motion**, including flexion, extension, abduction, internal rotation, and external rotation.

Furthermore, the **Harris Hip Score showed a substantial improvement**, indicating enhanced functional ability and quality of life among participants.

The findings suggest that the **Maitland mobilization approach combined with conventional physiotherapy is an effective conservative treatment method for reducing pain and improving hip mobility and function in patients with femoroacetabular impingement**.

Therefore, this combined rehabilitation approach can be considered a **valuable physiotherapy intervention in the management of femoroacetabular impingement**.

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