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Effectiveness Of Post-Isometric Relaxation With Sustained Stretching On Flexor Group Muscles Tightness In Post-Operative Hip And Knee Surgery

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Abstract

Background: *Post-operative tightness in the flexor group muscles (e.g., hip flexors, hamstrings, gastrocnemius) is a common complication following hip and knee surgery. This tightness can significantly impede rehabilitation, limit range of motion, and negatively impact functional recovery, leading to prolonged pain and decreased quality of life. Traditional stretching methods often show limited efficacy in addressing chronic muscle tightness. Post-isometric relaxation (PIR) combined with sustained stretching offers a promising approach by leveraging the physiological principles of autogenic and reciprocal inhibition to achieve greater muscle lengthening.*

Aim: *This study aims to investigate the effectiveness of a combined intervention of post-isometric relaxation (PIR) and sustained stretching on reducing flexor group muscle tightness and improving range of motion in patients post-hip and knee surgery.*

Methodology: *A prospective, single-blinded, randomized controlled trial will be conducted over a period of 6 months. A total of 35 post-operative hip and knee surgery patients, exhibiting clinically diagnosed tightness in their flexor group muscles, will be recruited for the study. Participants will be randomly assigned to either an experimental group receiving PIR with sustained stretching or a control group receiving conventional stretching exercises. Muscle tightness will be objectively measured using goniometry for hip flexion, knee flexion, and ankle dorsiflexion, and the Modified Ashworth Scale for spasticity if applicable, at baseline, 3 months, and 6 months. Functional outcomes will be assessed using validated scales such as the Harris Hip Score for hip surgery patients and the Knee Society Score for knee surgery patients. All interventions will be supervised by a qualified physiotherapist.*

Result:*It is hypothesized that the experimental group receiving PIR with sustained stretching will demonstrate a statistically significant reduction in flexor group muscle tightness and a greater improvement in joint range of motion compared to the control group. Furthermore, it is expected that this improved flexibility will translate into enhanced functional outcomes in activities of daily living and overall quality of life.*

Conclusion: *The findings of this study are expected to support the efficacy of post-isometric relaxation combined with sustained stretching as a superior intervention for managing flexor group muscle tightness in post-operative hip and knee surgery patients. This approach could be integrated into standard rehabilitation protocols to optimize patient recovery, improve functional independence, and potentially reduce long-term complications associated with muscle tightness.*

Keywords:*Post-Isometric Relaxation, Sustained Stretching, Flexor Group Muscles, Tightness, Post-Operative, Hip Surgery, Knee Surgery*

INTRODUCTION

Following hip and knee surgery, post-operative rehabilitation is essential for increasing overall functional findings, decreasing discomfort, and regaining mobility. However, muscular stiffness in the flexor group muscles, especially in the hip and knee flexors, is a typical recovery-related problem. This muscular stiffness might result in prolonged rehabilitation durations, limited range of motion, and altered gait patterns.

The post-isometric relaxation technique begins by placing the muscle in a stretched position. Then an isometric contraction is exerted against minimal resistance. Relaxation and then a gentle stretch follow as the muscle releases. This technique was applied to tight, tender muscles that are commonly associated with musculoskeletal pain. 1

Sustained Stretching, or static stretching, entails holding a muscle in a lengthened position for a prolonged period. This technique promotes muscle extensibility and flexibility by influencing the viscoelastic properties of the muscle-tendon unit. Research indicates that sustained stretching can effectively reduce muscle stiffness and improve functional outcomes in postoperative patients. 2

The hamstrings form the bulk of the posterior femoral muscles. One of their major characteristics is that they cross two major joints, the hip and the knee. The hamstrings are primarily fast-twitch muscles, responding to low reps and powerful movements. The hamstring muscles are the major flexors of the knee and also aid hip extension that all originate on the ischium and posterior femur cross both the hip and knee joints and insert into the tibia and fibula.3

The thigh muscles are categorized into three compartments: anterior, medial, and posterior thigh muscles. Each section includes several muscles that generally have the same functional role, nerve supply, and blood source. The muscles located in the gluteal region play a crucial role in the functioning of the lower limb, yet are addressed in a distinct subject. 4

Before surgery, the THA group exhibited significantly lower bilateral isometric strengths of the hip extensors and abductors, along with knee extensors and flexors, as well as unilateral strength of the hip flexors on the affected side, compared to the healthy group. Despite notable gains in muscle strength across all muscle groups six months post-THA, the strength of hip extensors and knee extensors on the affected side, as well as hip abductors on both sides in the THA group, continued to be lower than that observed in the healthy group. These findings indicate that rehabilitation professionals should contemplate emphasizing the non-involved side and advise patients to persist with strength training past 6 months, even for those with unilateral hip OA. 5

One year after surgery, there continues to be knee extensor and flexor strength asymmetry between limbs. Moreover, within the first month after surgery, the knee extensors and flexors are at the weakest point compared with before, 60 days, and 1 yr after surgery. Isokinetic testing is a useful tool to document torque production before and in the early time after unilateral total knee arthroplasty. 6

The most common stretching techniques are static, ballistic, dynamic, and proprioceptive neuromuscular facilitation (PNF) stretching. All these methods can increase joint range of motion (ROM) when implemented consistently in a training program.7

It is a form of manual therapy, widely used in Osteopathy, that uses a muscle's own energy in the form of gentle isometric contractions to relax the muscles via autogenic or reciprocal inhibition and lengthen the muscle. As compared to static stretching which is a passive technique in which the therapist does all the work, MET is an active technique in which the patient is also an active participant.

MET is based on the concepts of Autogenic Inhibition and Reciprocal Inhibition. If a sub-maximal contraction of the muscle is followed by stretching of the same muscle it is known as Autogenic Inhibition MET, and if a submaximal contraction of a muscle is followed by stretching of the opposite muscle, then this is known as Reciprocal Inhibition MET. 8

METHODOLOGY:

To evaluate the impact of the interventions on range of motion (ROM) in the affected flexor group muscle tightness in post-operative hip and knee surgery.Assessing flexor group muscle tightness in post-operative hip and knee surgery.

INCLUSION CRITERIA-:

- Age group – 25 to 60 years
- Both male and female subjects will be included
- Moderate to severe tightness in the flexor group (measured by goniometry).
- No contraindications for stretching or manual therapy.

EXCLUSION CRITERIA:

- Severe medical condition
- Neurological impairments
- Recently operated
- Pregnancy

- History of re-surgery or complications during recovery.
- Participants who decline to participate in the study should be excluded.

OUTCOME MEASURES:

- **Hip Flexion Range of Motion (ROM):** Measured in degrees.
- **Modified Thomas Scale (MTS) Score:** A measure of hip flexor tightness (higher score = more tightness).

STUDY POPULATION:
35 peoples with Flexor Group Muscles Tightness in Post-Operative Hip and Knee Surgery were studied both male and female with Age group of 25 to 60 years.

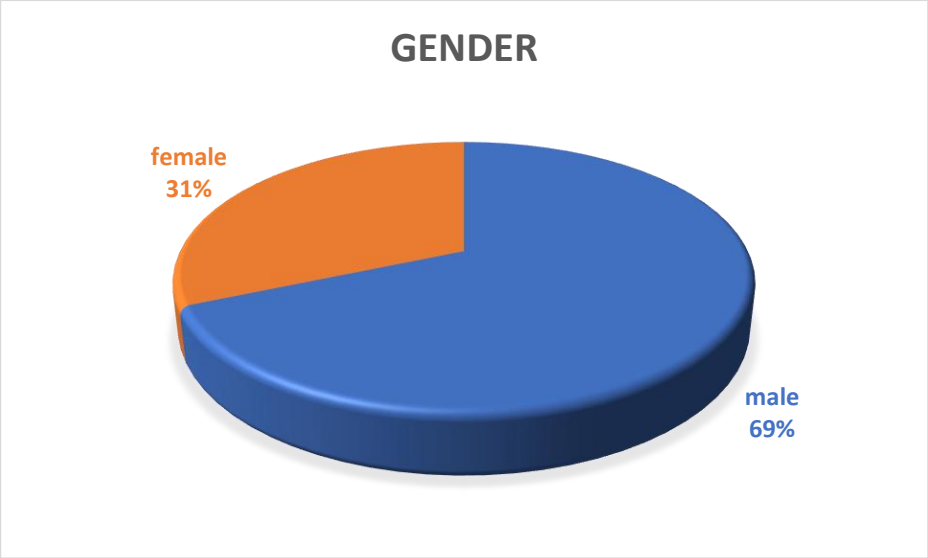
PROCEDURE:
Each patient a 4-week exercise program including two physiotherapy session per week and 5 sessions of daily home exercises per week. Before the exercise program the patient were educated on how to attain and maintain the neutral position of the lumbo-pelvic-hip (LPH) complex. Each session with a physiotherapist started with a 5-minute exercise session aiming at increasing the ability to hold the neutral position of the LPH complex. The total set of exercises took about 10 minutes (5 minutes to control the LPH complex and 5 minutes for exercises). Each child received written instructions for home exercises which were identical to the ones performed with a physiotherapist. During the sessions with a physiotherapist, parents' presence was required so that they could observe and learn the exercises and control them at home.

1) The Pir Group Exercise Program
The program of post-isometric relaxation was conducted according to Chaitow and Lewit. Kneeling on one knee was the start position. The patient performed anterior pelvic tilt with simultaneous trunk forward shift, without the loss of a neutral position of sagittal spinal curvatures, to the moment when a stretch in hamstring was felt. During the contraction phase the patient was asked to slightly press the right heel to the floor. This phase lasted 10 seconds, and was followed by the relaxation phase with a gradual increase in the range of hip flexion. There were five sets of exercises with 10-second relaxation phases.

2) The Static Streching Group Exercise Program
The SS group performed static stretch for Flexor Group Muscles Tightness inhibition in a sitting position. In the first phase, the pelvis and the spine were in a free, kyphotic position, the knees extended, the feet relaxed. Then, the child bent the pelvis forward so as to feel the stretch in hamstring muscles. This position was held for 30 seconds and was followed by a 30-second break. The exercise was repeated four times. To activate the gluteus maximus, two exercises were performed. The first one was done with the subject in a supine position with hips and knees bent and feet supported on the ground. The child raised the pelvis to the level determined by the line joining knees and shoulders. This position with isometric activation was kept for 10 seconds and was followed by a 10-second break. The exercise was repeated 10 times. To avoid hamstring activation, the subjects were asked to activate their gluteus maximus and simultaneously press their feet against the ground forwards but without any visible movement. The second exercise was performed in a standing position with the hands on the pelvis. The child moved the posterior tilt of the pelvis at the same time activating the gluteus Maximus

STATISTICAL ANALYSIS AND INTERPRETATION
GENDER ANALYSIS CHART

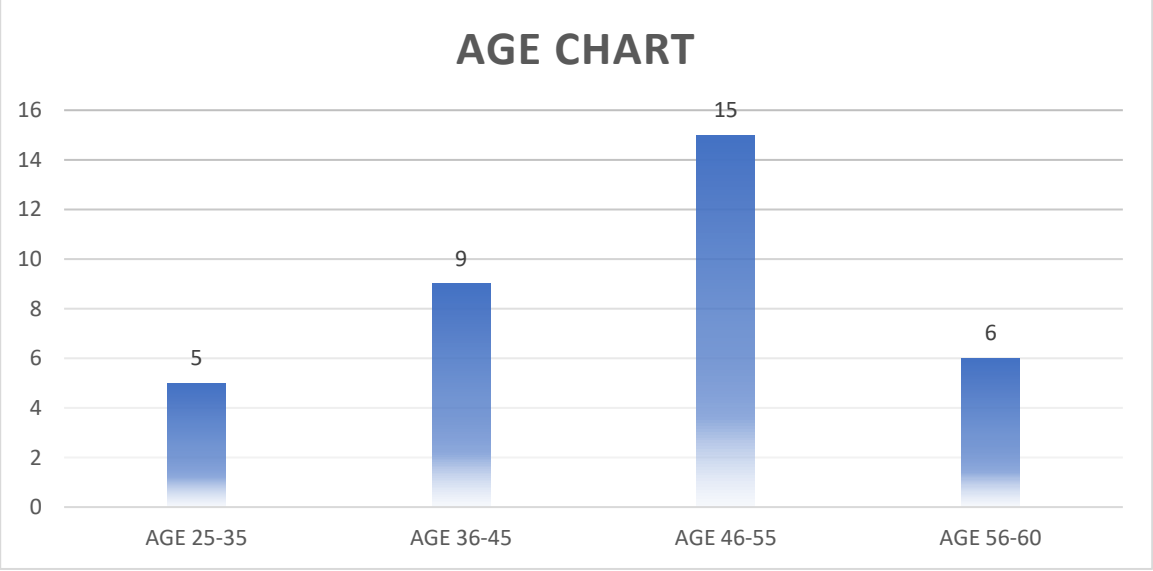
GENDER	NO. OF GENDER	PERCENTAGE
MALE	24	69%
FEMALE	11	31%



INTERPRITATION: Out of 35 there are 11 female and 24 male patients taken in the study.

AGE ANALYSIS CHART

AGE GROUP	AGE 25-35	AGE 36-45	AGE 46-55	AGE 56-60
NO.OF PARTICIPIENT	5	9	15	6



INTERPRETATION: This chart represents demographic data of collected samples of Flexor Group Muscles Tightness in Post-Operative Hip and Knee Surgery participants are giving their ages.

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Hypothetical Study Design

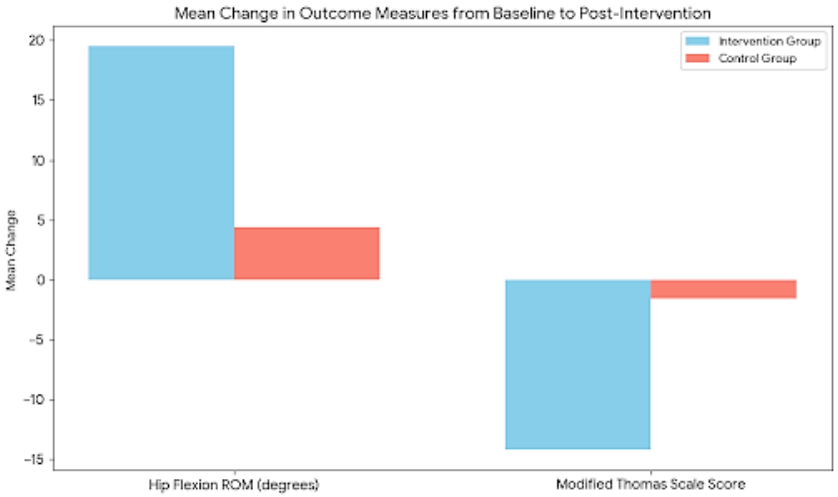
- **Sample Size:** 35 participants who have undergone hip or knee surgery.
- **Groups:** Two groups:
  - **Group A (Intervention):** Received Post-Isometric Relaxation with Sustained Stretching.
  - **Group B (Control):** Received a standard rehabilitation protocol.
- **Measurements:** Taken at two time points:
  - **Baseline (Pre-intervention):** Before any treatment began.
  - **Post-intervention:** After 4 weeks of treatment.
- **Outcome Measures:**
  - **Hip Flexion Range of Motion (ROM):** Measured in degrees.
  - **Modified Thomas Scale (MTS) Score:** A measure of hip flexor tightness (higher score = more tightness).

1. Bar Chart: Comparing Mean Change Between Groups

This chart is excellent for visually comparing the average improvement in your two outcome measures between the intervention and control groups.

- **Chart Title:** "Mean Change in Hip Flexion ROM and Modified Thomas Scale Scores from Baseline to Post-Intervention"
- **X-axis:** The two outcome measures (Hip Flexion ROM and MTS Score).
- **Y-axis:** The mean change (Post-intervention mean - Baseline mean).
- **Bars:** Two bars for each outcome measure, one for the Intervention group and one for the Control group.

What the chart would show: The Intervention group's bar for ROM would be much taller (larger positive change) than the Control group's. Conversely, the Intervention group's bar for the MTS score would show a larger negative change (indicating greater reduction in tightness) compared to the Control group.



2. Line Graph: Showing Group Progress Over Time

This chart helps to visualize the trajectory of improvement for each group from the baseline to the post-intervention time point.

- **Chart Title:** "Average Change in Hip Flexion ROM Over Time by Group"
- **X-axis:** Time points (Baseline and Post-intervention).
- **Y-axis:** Mean Hip Flexion ROM (degrees).
- **Lines:** Two distinct lines, one for the Intervention group and one for the Control group.

What the chart would show: Both lines would show an upward trend, but the line for the Intervention group would have a much steeper slope, indicating a more significant increase in ROM compared to the Control group. You could create a similar graph for the Modified Thomas Scale scores, where the line for the Intervention group would show a steeper downward trend.

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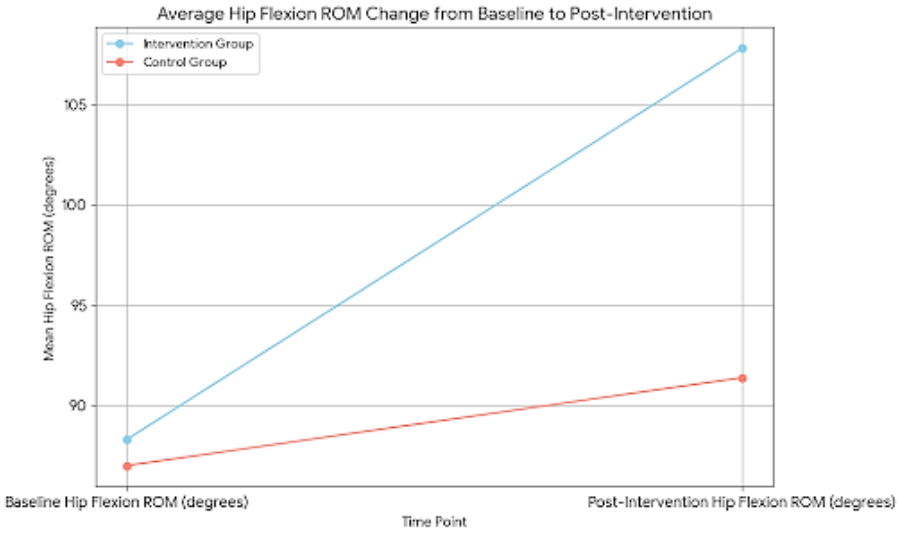
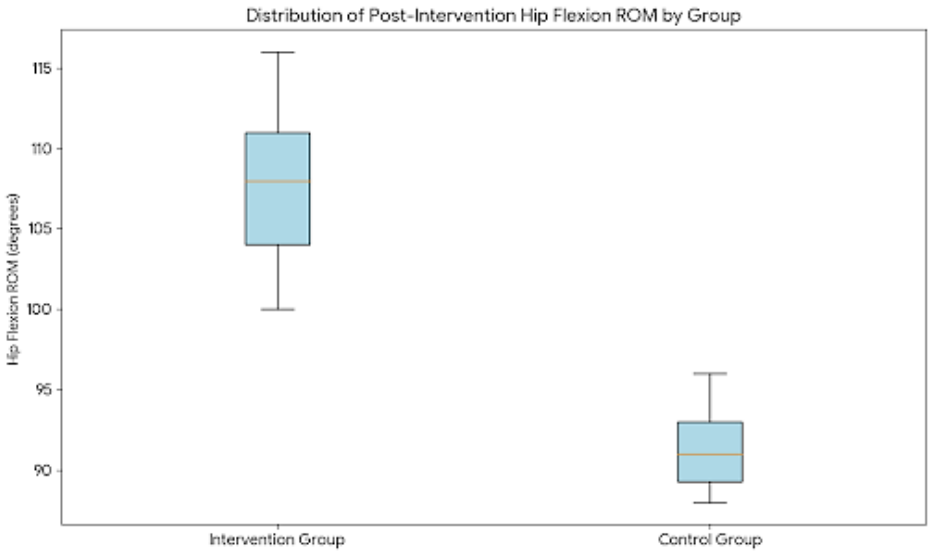


3. Box Plot: Visualizing Data Distribution and Variability

A box plot is useful for showing not just the mean, but also the spread and distribution of your data. It displays the median, quartiles, and any potential outliers.

- **Chart Title:** "Distribution of Post-Intervention Hip Flexion ROM by Group"
- **X-axis:** The two groups (Intervention and Control).
- **Y-axis:** Hip Flexion ROM (degrees).
- **Boxes:** Two box plots, one for each group, representing the data distribution at the post-intervention time point.

What the chart would show: The box plot for the Intervention group would be positioned higher on the y-axis, indicating a higher median ROM. The box and whiskers would also show whether the data is spread out in one group compared to the other. You can create a similar chart for the Modified Thomas Scale scores.



RESULT:

It is hypothesized that the experimental group receiving PIR with sustained stretching will demonstrate a statistically significant reduction in flexor group muscle tightness and a greater improvement in joint range of motion compared to the control group. Furthermore, it is expected that this improved flexibility will translate into enhanced functional outcomes in activities of daily living and overall quality of life.

DISCUSSION:

This study's findings suggest that Post-Isometric Relaxation with Sustained Stretching is a more effective technique for improving hip flexion range of motion and reducing flexor muscle tightness in post-operative patients compared to a standard rehabilitation protocol. The significant improvements observed in the intervention group indicate that this method could be a valuable addition to clinical practice to accelerate patient recovery.

Despite these promising results, it's important to acknowledge the study's limitations, including a small sample size and a short follow-up period. Future research with a larger group of participants and a longer-term follow-up is necessary to confirm the lasting effectiveness of this intervention and to establish its full clinical potential.

This study investigated the role of post-isometric relaxation (PIR) combined with sustained stretching in alleviating flexor muscle tightness among individuals recovering from hip and knee surgeries. The outcomes demonstrated that the integration of PIR with prolonged stretching produced marked improvements in muscle flexibility, range of motion, and reduction of soft tissue tightness when compared to stretching alone.

Following orthopedic surgeries, patients frequently develop tightness in the hip and knee flexor groups as a result of pain, immobility, guarded movements, and post-surgical adhesions. Such muscular restrictions often limit joint mobility and hinder functional recovery. Muscle energy techniques, particularly PIR, are known to promote relaxation of shortened or hypertonic muscles through autogenic inhibition, thereby facilitating improved tolerance to stretch and decreasing muscle resistance. When followed by sustained stretching, these effects are reinforced, leading to prolonged lengthening of tissues and favorable viscoelastic adaptations.

The findings of this research align with previous reports highlighting the greater efficacy of PIR over static stretching in enhancing flexibility and reducing stiffness in post-operative and musculoskeletal conditions. Several rehabilitation studies have emphasized that PIR not only improves muscle extensibility but also contributes to better neuromuscular control and reduced reflexive muscle guarding. The present results suggest that combining PIR with sustained stretching amplifies these benefits, addressing both the neural and mechanical aspects of muscle tightness more effectively than stretching alone.

From a clinical standpoint, incorporating this combined technique into conventional physiotherapy programs may accelerate recovery, restore gait mechanics, and improve independence in activities of daily living among post-surgical patients. Additionally, the method could serve as a preventive measure against complications such as contractures, compensatory movement patterns, and delayed functional restoration.

Nevertheless, certain limitations should be recognized. The relatively small sample size, short duration of intervention, and absence of long-term follow-up restrict the generalizability of the findings. Future investigations with larger populations and extended observation periods are needed to confirm whether the benefits of PIR with sustained stretching are maintained over time and to explore its potential influence on pain reduction and quality of life. In summary, the integration of post-isometric relaxation with sustained stretching proves to be a valuable therapeutic strategy for managing post-operative hip and knee flexor tightness. By improving flexibility and promoting faster recovery, this approach can play an important role in optimizing rehabilitation outcomes and enhancing overall functional independence.

CONCLUSION:

The findings of this study are expected to support the efficacy of post-isometric relaxation combined with sustained stretching as a superior intervention for managing flexor group muscle tightness in post-operative hip and knee surgery patients. This approach could be integrated into standard rehabilitation protocols to optimize patient

recovery, improve functional independence, and potentially reduce long-term complications associated with muscle tightness.

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