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A Study to Compare the Effect of Myofascial Release Technique and Proprioceptive Neuromuscular Facilitation Technique on Iliopsoas and Hamstring Tightness among Young Adult Population

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Abstract: ***Background: Hamstring and iliopsoas tightness are common musculoskeletal issues in young adults, often resulting from sedentary lifestyles and postural imbalances. Limited flexibility in these muscle groups can lead to functional limitations, discomfort, and increased risk of injury. This study aims to compare the effects of Myofascial Release (MFR) and Proprioceptive Neuromuscular Facilitation (PNF) techniques on reducing tightness in the hamstring and iliopsoas muscles. Purpose: To evaluate and compare the effectiveness of MFR and PNF Contract-Relax techniques in improving hamstring and iliopsoas flexibility among young adults, using the Active Knee Extension Test (AKET) and Modified Thomas Test as outcome measures. Methodology: A total of 45 young adults aged 18–25 years with clinically measured hamstring and iliopsoas tightness were randomly allocated into three groups (n=15 per group): Group A (control – moist heat and active stretching), Group B (MFR), and Group C (PNF Contract-Relax technique). Interventions were administered five days a week for two weeks. Pre- and post-intervention flexibility was assessed using AKET and Modified Thomas Test. Statistical analysis was performed using repeated measures ANOVA and Tukey-Kramer post hoc tests. Results: All three groups showed statistically significant within-group improvements ($p < 0.05$). Between-group analysis revealed that Group C (PNF) demonstrated the greatest improvement in both AKET and Modified Thomas Test values, followed by Group B (MFR), with Group A showing the least improvement. Post hoc tests confirmed significant differences between Group C and Group A ($p < 0.01$), while the difference between Group B and C was not statistically significant but favored PNF in mean values. Conclusion: Both Myofascial Release and PNF techniques are effective in reducing hamstring and iliopsoas tightness in young adults. However, the PNF Contract-Relax technique showed slightly superior outcomes, likely due to its neuromuscular inhibition mechanisms and active muscle engagement. These findings support the use of both techniques in clinical practice, with PNF being especially beneficial when rapid functional flexibility gains are desired.***

Keywords: Hamstring tightness, Iliopsoas, Myofascial Release, Proprioceptive Neuromuscular Facilitation, Flexibility, Young adults

1. Introduction

Maintenance of muscular flexibility is an essential component of healthy human body which allows performance of daily activities smoothly, prevents injuries, and enhances physical performance. [1] Adaptive reduction of the muscle's contractile and non-contractile components is referred as tightness.[2] It is characterized by a mild to moderate reduction in muscle length, evident through restricted movement in the direction of muscle elongation.[3]

Hamstring tightness is a common musculoskeletal impairment frequently seen among athletes and is becoming increasingly prevalent in sedentary populations as well. According to research focusing on young adults aged 18 to 25 years, such as university students, indicates that around 82.24% of participants displayed signs of hamstring tightness.[4] A unique aspect of the hamstrings is their biarticular nature, which allows them to cross both the hip and the knee joints which enhances their flexibility, but it also makes them vulnerable to injuries, especially when subjected to excessive strain or tightness.[5]

Alongside the hamstring, iliopsoas muscle which is a strong hip flexor with attachments to the spine, pelvis, and femur, plays a key role in trunk stability and hip mobility.[6,7] Tightness of this muscle is associated with bursitis, impingement, and anterior groin pain, particularly in young and active individuals, its reported prevalence of tightness is 64.14% on dominant side and 30.12% on nondominant side. [8,9]

The management of iliopsoas and hamstring tightness includes both electrotherapy and manual therapy interventions. Several stretching and manual therapy techniques have been proposed for improving hamstring flexibility, including static stretching, proprioceptive neuromuscular facilitation (PNF) [10] Myofascial Release (MFR) is a gentle manual technique applying sustained pressure to reduce fascial restrictions, restore pliability, and improve circulation and mobility.[11] Proprioceptive Neuromuscular Facilitation (PNF), developed by Kabat, Knott, and Voss, uses specific contraction relaxation methods to enhance neuromuscular control and flexibility.[12,13]

While each technique has demonstrated individual efficacy, they operate through different mechanisms, MFR being more mechanical and tissue-focused, while PNF is neurologically driven approach. Despite their widespread use, limited comparative studies exist on their relative effectiveness, particularly in young adults with functional tightness, prompting the need for studies like the present one to determine their clinical utility.

Therefore, the present study aims to compare the effect of Myofascial Release and Proprioceptive Neuromuscular Facilitation techniques on iliopsoas and hamstring tightness among young adults.

2. Methodology

Study Design: Quasi-Experimental study comparative in nature.

Duration of study: Total duration of study was one and half year.

Sample size: 45 subjects were enrolled for the study by convenient sampling method, with 15 subjects allocated in each group**.**

Sampling criteria: All the subjects were selected on the basis of the following inclusion and exclusion criteria**,**

Inclusion criteria:
- Age group in between 18 to 25 years.
- Both genders were included.
- Subjects willing to participate in the study.
- Ten or more than ten degrees of iliopsoas tightness.
- No history of problem such as arthritis, ligament injury, meniscal damage.
- Subjects with iliopsoas muscle tightness having positive Modified Thomas test
- Subjects with hamstring muscle tightness having positive Active Knee Extension test. (Greater than 30 degrees loss of knee extension)

Exclusion criteria:
- Subjects having recent history of injury/trauma, fracture of lumbosacral region, hip, knee & ankle joint.
- Subjects with early osteoarthritis of knee.
- Pregnant women
- Skin infection
- Patient with past two year of hamstring injury.
- History of neurological disorder affecting lower extremity.

Outcome Measures
- Hamstring tightness: Active Knee Extension Test (AKE)
- Iliopsoas tightness: Modified Thomas Test

Both outcomes were measured using a universal goniometer at baseline, after the 5th session, and after the 10th session.

Statistical Analysis
Data were analyzed using SPSS version 27. Normality was assessed with Shapiro–Wilk test. Intragroup comparisons were performed using repeated measures ANOVA. Intergroup comparisons were analyzed using one-way ANOVA followed by Tukey–Kramer post hoc tests. Statistical significance was set at $p < 0.05$ with 95% confidence interval.

Protocol

Group A (N=15) Control group- Moist hot pack, active stretching of hamstring and iliopsoas tightness.
- A moist hot pack was given for 20 minutes over hamstring and iliopsoas muscle in a comfortable position according to patient preference**.**
- Active stretching of iliopsoas and hamstring muscle (4 repetitions with 30 seconds hold) was performed.

Group B (N=15) Experimental group 1 - Moist Hot Pack, active stretching and Myofascial release technique (MFR).
- A moist hot pack was given for 20 minutes over hamstring and iliopsoas muscle in a comfortable position according to patient preference**.**
- Active stretching of iliopsoas and hamstring muscle (4 repetitions with 30 seconds hold) was performed.
- Myofascial release Technique on iliopsoas muscle was performed for a duration of 90 to 120 seconds in one session.[14]
- Myofascial release technique on hamstring muscle for 3 sets of duration of 60 seconds making the treatment time to be 3 to 5 minutes.[15]

Group C (N=15) Experimental group2 - Moist Hot Pack, active stretching and Proprioceptive neuromuscular facilitation technique (contract-relax)
- A moist hot pack was given for 20 minutes over hamstring and iliopsoas muscle in a comfortable position according to patient preference**.**
- Active stretching of iliopsoas and hamstring muscle (4 repetitions with 30 seconds hold) was performed.
- Proprioceptive neuromuscular facilitation technique, performed on iliopsoas muscle with 3-5 repetitions for 10 seconds hold, each followed by 1-2 min rest period in-between.[16]
- Proprioceptive neuromuscular facilitation technique will be performed on hamstring muscle with the stretch held for 10 seconds, followed by a 5-second ramped maximal isometric contraction at the end range of motion.[17]

Figure 1: Active stretching of iliopsoas

Figure 2: MFR for Hamstring muscle

Figure 3: PNF (contract-relax) technique for iliopsoas muscle

Figure 4: PNF (contract-relax) technique for hamstring muscle

3. Results

Demographic Characteristics:
A total of 45 participants completed the study (15 per group). The mean age was comparable across groups (Group A: 21.33 ± 2.38; Group B: 21.26 ± 2.15; Group C: 21.13 ± 2.29; $p = 0.975$). Each group included 10 females (67%) and 5 males (33%). No significant baseline differences were observed in age or gender distribution.

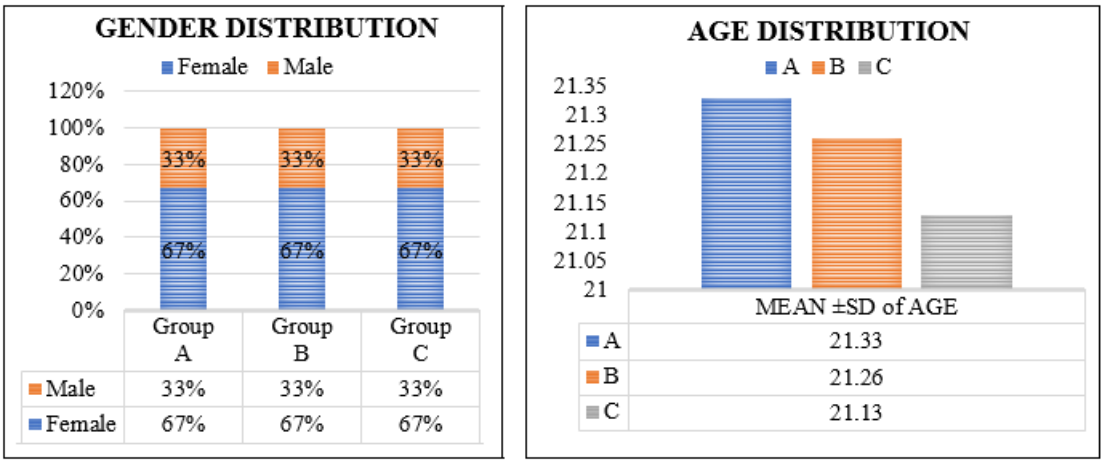
Within-Group Analysis:
Repeated measures ANOVA revealed significant improvements ($p < 0.001$) in hamstring and iliopsoas flexibility across all three groups from baseline to post-intervention. Group C (PNF) showed the largest mean improvements, followed by Group B (MFR), with Group A (control) showing the least.

Between-Group Analysis:
One-way ANOVA demonstrated significant post-intervention differences between groups ($p < 0.01$). Tukey–Kramer post hoc analysis indicated:

- Group C vs. Group A: Significant improvement in both AKE and Modified Thomas Test scores ($p < 0.01$).
- Group B vs. Group A: Significant improvement ($p < 0.05$).
- Group C vs. Group B: Non-significant difference, though mean values favored Group C.

Table 1: Baseline Demographic Characteristics of Participants (N = 45)

Variable	Group A (Control) (n=15)	Group B (MFR) (n=15)	Group C (PNF) (n=15)	*p*-value
Age (years, Mean ± SD)	21.33 ± 2.38	21.26 ± 2.15	21.13 ± 2.29	0.975
Gender (n, %)	Female: 10 (67%) Male: 5 (33%)	Female: 10 (67%) Male: 5 (33%)	Female: 10 (67%) Male: 5 (33%)	-

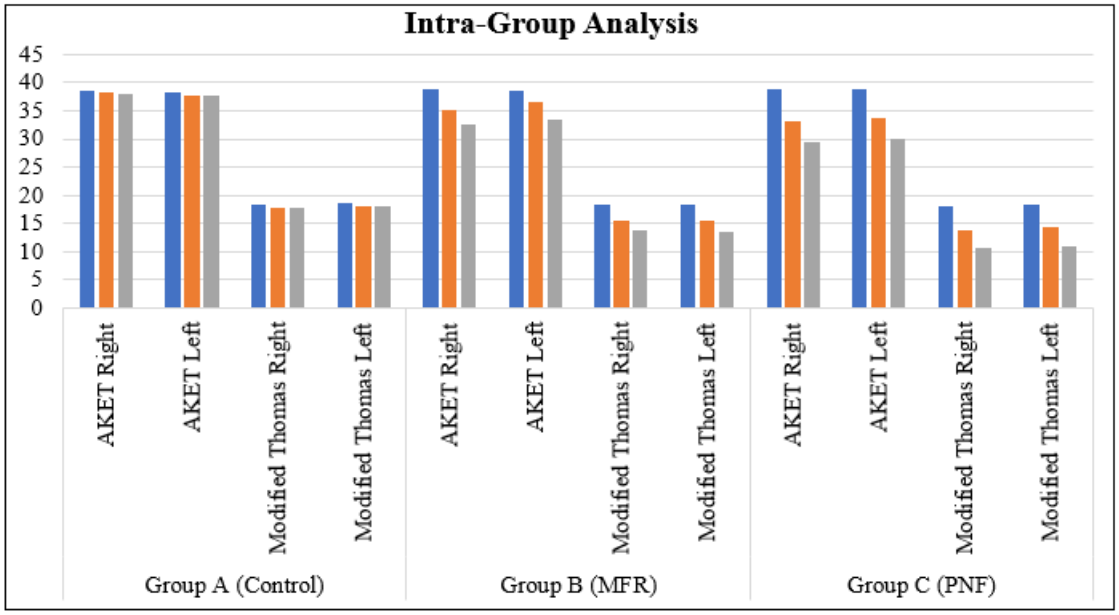


Graph 1: Graphical representation of demographic details

Table 2: Intra-Group Analysis of Outcome Measures (Repeated Measures ANOVA)

Group	Outcome Measure	Pre-Intervention (Mean ± SD)	Post-5th Session (Mean ± SD)	Post-10th Session (Mean ± SD)	F-value	p-value
Group A (Control)	AKET Right	38.67 ± 5.71	38.20 ± 5.99	38.06 ± 5.76	5.94	0.007*
	AKET Left	38.13 ± 5.50	37.73 ± 5.64	37.67 ± 5.64	6.54	0.005*
	Modified Thomas Right	18.40 ± 5.36	17.93 ± 5.44	17.86 ± 5.40	5.78	0.008*
	Modified Thomas Left	18.53 ± 5.52	18.13 ± 5.50	18.06 ± 5.56	5.62	0.009*
Group B (MFR)	AKET Right	38.80 ± 6.21	35.20 ± 6.08	32.53 ± 5.80	77.26	<0.001*
	AKET Left	38.53 ± 6.16	36.46 ± 5.40	33.33 ± 5.76	99.69	<0.001*
	Modified Thomas Right	18.33 ± 4.23	15.53 ± 3.70	13.86 ± 3.56	56.68	<0.001*
	Modified Thomas Left	18.40 ± 4.89	15.40 ± 4.93	13.53 ± 4.76	81.53	<0.001*
Group C (PNF)	AKET Right	38.86 ± 7.79	33.06 ± 8.11	29.46 ± 8.27	112.08	<0.001*
	AKET Left	38.73 ± 6.51	33.60 ± 5.99	29.93 ± 5.82	168.21	<0.001*
	Modified Thomas Right	18.06 ± 3.65	13.86 ± 3.56	10.66 ± 2.71	32.92	<0.001*
	Modified Thomas Left	18.26 ± 4.18	14.26 ± 4.07	10.93 ± 3.41	55.67	<0.001*

*Significant at $p < 0.05$.

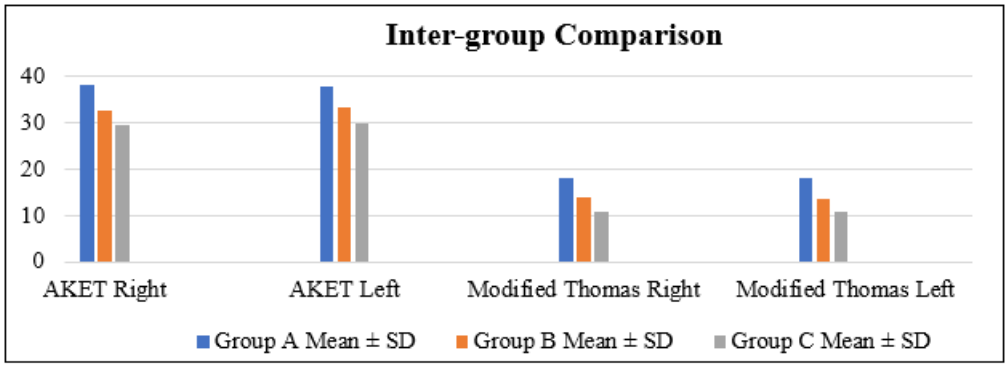


Graph 2: Graphical representation of intra group analysis performed by repeated measure ANOVA.

Table 3: Inter-group Comparison of Post-Intervention Outcomes (One-way ANOVA with Tukey–Kramer Post Hoc Test)

Outcome Measure	Group A Mean ± SD	Group B Mean ± SD	Group C Mean ± SD	F-value	p-value (ANOVA)	Post Hoc Pairwise Comparison (p-value)
AKET Right	38.07 ± 5.76	32.53 ± 5.80	29.47 ± 8.27	6.32	0.0039*	A vs B: 0.073 (NS) A vs C: 0.003* B vs C: 0.43 (NS)
AKET Left	37.67 ± 5.63	33.33 ± 5.76	29.93 ± 5.82	6.83	0.0027*	A vs B: 0.065 (NS) A vs C: 0.002* B vs C: 0.27 (NS)
Modified Thomas Right	17.86 ± 5.40	13.86 ± 3.56	10.66 ± 2.71	9.74	<0.001*	A vs B: 0.013* A vs C: <0.001* B vs C: 0.081 (NS)
Modified Thomas Left	18.06 ± 5.56	13.53 ± 4.76	10.93 ± 3.41	10.21	<0.001*	A vs B: 0.010* A vs C: <0.001* B vs C: 0.097 (NS)

*Significant at $p < 0.05$. NS = Not Significant



Graph 3: Graphical representation of Inter group analysis performed with One way ANOVA followed by post hoc analysis

4. Discussion

The present study compared the effects of Myofascial Release (MFR) and Proprioceptive Neuromuscular Facilitation (PNF) techniques on hamstring and iliopsoas tightness in young adults. Both experimental groups showed significant improvements compared to the control group, with PNF demonstrating slightly superior outcomes, although the difference between MFR and PNF was not statistically significant.

The improvement in flexibility observed with PNF is in line with previous studies. O'Hora et al. reported that a single PNF session produced greater gains in hamstring range of motion than static stretching in healthy adults.[18] Similarly, Nagarwal et al. found that PNF stretching techniques, including contract relax and contract relax antagonist contract, were more effective in enhancing hamstring flexibility compared to no intervention.[19] With respect to iliopsoas flexibility, Harini et al. demonstrated that PNF stretching significantly reduced hip flexor tightness and improved hip extension in young adults with low back pain.[20]

The effectiveness of MFR observed in the current study also agrees with earlier findings. Sakhalkar et al. concluded that MFR produced greater improvements in hamstring flexibility than passive stretching among amateur football players.[21] This supports the idea that sustained fascial release reduces stiffness and improves muscle extensibility by eliminating adhesions and improving circulation. While PNF showed slightly better results than MFR in the present study, both techniques were effective, indicating that they address muscle tightness via distinct but complementary mechanisms, MFR through mechanical release of fascial restrictions and PNF through neuromuscular mechanisms such as autogenic and reciprocal inhibition.

The superior outcomes associated with PNF may be explained by its physiological basis. The contract relax method enhances stretch tolerance by activating Golgi tendon organ mediated autogenic inhibition and by promoting reciprocal facilitation of antagonist muscles, leading to greater elongation of muscle fibers and improved joint range of motion. In contrast, MFR produces its effects by improving soft tissue mobility, enhancing interstitial fluid dynamics, and restoring fascial pliability, which together contribute to muscle lengthening.[22]

Clinically, the findings suggest that both PNF and MFR can be effectively incorporated into physiotherapy practice for managing young adults with functional tightness in the hamstring and iliopsoas muscles. PNF may be particularly beneficial when rapid gains in functional flexibility are required, such as in athletes or individuals preparing for return to sport. Conversely, MFR may be preferred in cases where fascial restriction is dominant or when a more passive technique is required for patient comfort.

This study has some limitations of sample size being relatively small and participants were limited to young adults, which restricts the generalizability of findings. The intervention duration was short, and long-term effects were not evaluated. Additionally, functional outcomes beyond flexibility, such as gait and posture, were not included. Future studies should explore larger and more diverse populations, longer intervention periods, and the potential

synergistic effects of combining MFR and PNF are recommended.

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