Effect of Four Weeks Muscle Energy Technique Versus Retro-Walking on Hamstring Muscle Flexibility in Young Adult - A Comparative Study

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ABSTRACT

Background: Hamstring muscle flexibility is essential for athletic performance and injury prevention. Hamstring tightness is a common condition that affects many individuals, particularly students and office workers who engage in prolonged sitting. Hamstring tightness can lead to reduced muscle strength and endurance, decreased flexibility and range of motion, and increased risk of musculoskeletal injuries and low back pain.

Aim: Aim of study was to find out the effect of Muscle energy technique VS Retro-walking on hamstring flexibility in young adult.

Methodology: 40 participants were selected based on the selection criteria. Prior and after the treatment both the outcome measures popliteal angle were measured. Participants were randomly divided into two groups with n=20 in each group. Group A received MET while group B received Retro-walking. The treatment was given for 5 days in week for consecutive 12 weeks.

Results: Mean age of participants of group A and B were 20.15 ± 1.57 , 20.15 ± 1.73 years respectively. Group A participants showed marked improvement at popliteal angle outcome measurement compared to group B.

Conclusion: MET and Retro-walking were significant in terms of clinical outcome, but the data was not proven to have a significant p value. This study suggests that MET is more effective than retro walking in improving hamstring muscle flexibility in young adults. So, it can be implemented clinically as well.

Keywords: Muscle energy technique, Retro-walking, Hamstring tightness, popliteal angle.

INTRODUCTION

The Complex group of muscle hamstring which is at back of thigh assist in hip extension with knee flexion. It is two joint muscles, the role of hamstring in hip extension is strongly influenced by the knee position¹.

The prevalence of hamstring tightness among students aged between 18-25 is found

to be very high, which is $68\%^2$. Prolonged sitting can cause hamstring tightness, affecting 90% of the population, with 85.75% of office workers experiencing it after 6-8 hours of sitting³.

Flexibility is the ability of muscles, tendons, and joints to stretch and move freely, enhancing athletic performance, reducing injury risk, and improving quality of life⁴.

Muscular tightness, caused by postural adaptation or contraction, can limit range of motion and create imbalance, making flexibility a crucial component of rehabilitation⁵.

Muscular tightness occurs due to reduced muscle deformability⁶, limiting joint motion, hamstrings can and tight lead to dysfunctional motor control⁷, decreased strength and stability, and neuromusculoskeletal changes, Poor ergonomic chair design can exacerbate back pain and hamstring tightness⁸, while immobilization can lead to decreased elasticity, flexibility, and muscle strength, causing quadriceps dysfunction and postural deviations like reduced lumbar lordosis, highlighting the need for adequate mobility to prevent injury⁹.

There are variety of techniques used in physiotherapy for improving joint muscle flexibility in different set ups. Some of them include- Muscle energy techniques, passive and active stretches, positional release technique, retro walking, static stretching etc¹⁰. In this study we will be considering two techniques here -MET and retro walking. Muscle Energy Technique (MET) is a approach using isometric targeted contractions to enhance flexibility, differing stretching and involving from static controlled contractions against a therapist's counterforce. whereas retro walking dynamically engages hamstrings in a backward motion.

Muscle Energy Technique (MET) involves voluntary contractions of a patient's muscle in a controlled direction, utilizing autogenic inhibition, where a muscle contracts and relaxes, allowing for deeper stretches, and reciprocal inhibition, where contracting one muscle group relaxes its opposing group, promoting relaxation and lengthening of muscles through gentle isometric contractions¹¹.

Backward walking differs from forward walking in its biomechanics and muscle activation, with toes contacting the ground first and heels lifting off, accompanied by coactivation of limb muscles, knee extensors, and ankle plantar flexors, and is associated with increased cadence and decreased stride length, targeting different muscle groups and movement patterns, making it beneficial for addressing muscular imbalances and improving proprioception¹².

So, the purpose of this study is to find out the which one is better for clinical practice on hamstring flexibility in young adult.

MATERIALS & METHODS

- 1. Data collection form/consent form
- 2. Pen
- 3. Paper
- 4. Measuring tape
- 5. Stop watch
- 6. Plinth
- 7. 360-degree universal goniometer

PROCEDURE

- After obtaining Institutional Ethical Committee clearance, subjects were selected based on inclusion and exclusion criteria.
- The study included participants aged 18-25 years, both male and female, with unilateral or bilateral hamstring muscle tightness, defined as >15° or <70° on the Active Knee Extension Test. Exclusion criteria comprised individuals with low back pain, hamstring muscle injury, recent lower limb surgery, or bilateral lower limb radiating pain.
- informed about the study procedure, and provided written consent before being tested for hamstring tightness using the popliteal angle test.
- Subjects underwent popliteal angle before and after the study, and were conveniently divided into two groups: with blinding method Group A (Muscle Energy Technique) and Group B (Retrowalking), receiving interventions for 5 days per week for 4 weeks one session daily.

Muscle Energy Technique

Muscle Energy Technique (MET) is a manual therapy using gentle isometric

contractions to relax and lengthen muscles through autogenic or reciprocal inhibition, requiring active patient participation, and involves a specific protocol of contraction, and stretching to increase relaxation. flexibility particularly effective for hamstring flexibility. Healthy subjects with hamstring tightness, identified by a popliteal angle of > 15 or < 70 degrees on the Active Knee Extension Test, underwent Muscle Energy Technique using post-isometric relaxation, where the subject lies supine, their hip is passively flexed until tension is felt, and then their leg is placed on the therapist's shoulder for 7-10 seconds. After contracting the hamstring, the leg is taken further into flexion for 30 seconds, followed by a 10-second rest period, and this process is repeated for 5 repetitions.

Retro Walking

Moving backwards is a vital aspect of everyday life, requiring functional mobility and coordination. Healthy subjects with hamstring tightness walked at their own pace for 10 minutes along a 20-meter path, performing retro walking.

Pre-Intervention Test Popliteal Angle Test:

The popliteal angle is a measure used to assess hamstring flexibility, with a smaller angle indicating greater flexibility. It's measured using an inclinometer or goniometer during the passive knee extension test, where the angle between the tibia and femur is recorded. Popliteal angle can indicate improvements or declines in hamstring flexibility.

- 1. The test is performed in a supine position with the opposite limb extended and the test limb flexed at 90 degrees at both hip and knee.
- 2. The therapist passively extends the knee until maximum tolerable stretch of the hamstring muscle is felt.
- 3. The angle is measured to assess hamstring flexibility.

STATISTICAL ANALYSIS

The statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS) software, version 16, to ensure accurate and reliable results. To determine the distribution of the data, the Shapiro-Wilk test was employed to check for normality, which is a crucial step in selecting appropriate statistical tests. the The Wilcoxon signed-rank test compared prepost-intervention outcomes within and groups, while the Mann-Whitney U test compared post-intervention outcomes between groups.

RESULT

After, conducting 55 evaluations, 50 subjects started study, which completed 40. While follow-up dropout subjects were 5 in Group A Muscle Energy Technique group and 5 in Group B Retro walking group respectively. Participants baseline characteristics are presented in CONSORT flow in fig.1 Participants' baseline characteristics are presented in Table 1. That Shows the mean, standard deviations. Baseline data comparison pre intervention presented in Table 2,



FIG.1 CONSORT FLOW DIAGRAM

Т	TABLE 1: BASELINE DATA COMPARISON							
	VARIABLES	GROUP A	GROUP B					
		MEAN±SD	MEAN±SD					
	AGE	20.15±1.57	20.15±1.73					
	GENDER	1.50±0.51	1.50±0.51					

TABLE 2: BASELINE DATA COMPARISON PRE-INTERVENTION

VARIABLE SIDE		GROUP A	GROUP B	U VALUE	P VALUE
		MEAN±SD	MEAN±SD		SIGNIFICANCE
POPLITEAL ANGLE	RIGHT	38.15±7.45	39.15±7.16	173.00	0.478
					Not significant
	LEFT	37.30±1.19	39.60±5.94	180.00	0.602
					Not significant

The Mann-Whitney U test was used to compare the baseline pre intervention values between Muscle Energy Technique and retro walking. For intergroup analysis, The Wilcoxon signed rank test was used to compare the pre- and post-intervention outcomes of popliteal angle within the group which is presented in Table 3

GROUP	SIDE	PRE/POST	MEAN±	Ζ	Р	SIGNIFICANCE
			SD	VALUE	VALUE	
GROUP A	RIGHT	PRE	38.15 ± 7.45	0.036	0.972	Not significant
MET		POST	33.50 ± 7.96			
	LEFT	PRE	37.30 ± 1.19	1.000	0.317	Not significant
		POST	34.25 ± 8.31			
GROUP B	RIGHT	PRE	39.15 ± 7.16	0.648	0.517	Not significant
RETRO-		POST	37.25 ± 6.58			
WALKING	LEFT	PRE	39.86 ± 5.94	0.220	0.826	Not significant
		POST	36.95 ± 6.47			

TAB LE 3: WITHIN GROUP COMPARISON OF POPLITEAL ANGLE

The Mann-Whitney U test was used to compare the post intervention popliteal angle values between the MET and retro-walking groups which is presented in Table 4 and 5

TABLE 4: BETWEEN GROUP COMPARISON OF MEAN DIFFERENCE OF RIGHT SIDEPOPLITEAL ANGLE

OUTCOME	GROUP A	GROUP B	U VALUE	P VALUE SIGNIFICANCE	Cohn's d
POPLITEAL ANGLE RIGHT SIDE	4.65±0.51	1.90±0.58	38.00	0.38 NOT SIGNIFICANT	0.3

TABLE 5: BETWEEN GROUP COMPARISON OF MEAN DIFFERENCE OF LEFT SIDE POPLITEAL ANGLE

OUTCOME	GROUP A	GROUP B	U VALUE	P VALUE SIGNIFICANCE	Cohn's d
POPLITEAL ANGLE LEFT SIDE	3.05±7.12	3.05±0.53	28.00	O.39 NOT SIGNIFICANT	0.3

The results of the study revealed that muscle energy technique as well as retro-walking has extremely significant effect on popliteal angle test but Muscle Energy Technique group showed decreases in both right and left mean ranks, indicating better improvement



DISCUSSION

The primary objective of this study was to investigate and compare the effects of Muscle Energy Technique and Retro Walking on hamstring flexibility in young adult students. A total of 40 participants, selected based on their popliteal angle measurements, were randomly divided into two equal groups to receive either Muscle Energy Technique or Retro Walking interventions.

This study demonstrated that both Muscle Energy Technique and Retro Walking are effective in improving hamstring flexibility in young adults with hamstring muscle tightness. The results showed a significant reduction in popliteal

angle, indicating improved hamstring flexibility, in both groups, with Muscle Energy Technique showing a greater improvement. Muscle Energy Technique is more superior than Retro Walking.

Muscle Energy Technique works for muscle flexibility by contracting the muscle to be stretched, activating muscle spindles and providing proprioceptive feedback, and then lengthening the muscle against gentle, sustained force, activating Golgi tendon organs and inhibiting muscle spindles, leading to decreased muscle tone and relaxation. As the muscle relaxes, the therapist can further lengthen the muscle, increasing its range of motion and flexibility. Repeated applications of Muscle

Energy Technique led to neuroplasticity and motor learning, allowing the muscle to adapt to new lengths and ranges of motion, ultimately enhancing muscle flexibility and overall mobility¹³.

Retro walking involves a unique set of biomechanical movements, characterized by a reverse movement pattern, increased hip and knee extension, and an altered foot strike pattern, which reduces ground reaction forces and increases muscle activity in the hip and knee extensors, ultimately providing a low-impact exercise option that can improve balance and coordination, reduce joint impact, and increase muscle strength and flexibility¹⁴.

Gender and dominance can impact flexibility, with females generally exhibiting greater flexibility than males due to biomechanical differences, including wider pelvis, greater Q-angle, and increased femoral anteversion, which affect joint mobility and muscle length. Additionally, dominant individuals tend to have reduced flexibility compared to non-dominant individuals, as dominance is often associated with altered movement patterns, increased muscle stiffness, and reduced range of motion, whereas non-dominant individuals may have greater flexibility due to reduced muscle stiffness, increased joint mobility, and more efficient movement patterns, highlighting the complex interplay between gender, dominance, biomechanics, and flexibility¹⁵.

In clinical practice, the findings of this study suggest that both Muscle Energy Technique and retro walking are viable treatment options for improving hamstring flexibility in patients with restricted range of motion. Clinicians can consider Muscle Energy Technique as a primary treatment option, using specific techniques such as postisometric relaxation and reciprocal inhibition the hamstring target muscles. to Alternatively, retro walking exercises can be prescribed as a standalone treatment or in conjunction with Muscle Energy Technique to further enhance flexibility and range of These findings suggest that motion. clinicians can consider both Muscle Energy Technique and Retro Walking as viable treatment options for improving hamstring flexibility, providing patients with alternative choices based on individual needs and preferences.

The study had several limitations including a small sample size and limited follow-up period, lack of diversity in participant demographics, and limited duration of the study, which may not accurately reflect long-term effects.

CONCLUSION

This study concluded that four weeks of Muscle Energy Technique (MET) is more

effective than retro walking in improving hamstring muscle flexibility in young adults, as evidenced by significant improvements in popliteal angle scores. The findings suggest that MET can be a valuable addition to exercise programs aimed at enhancing flexibility, particularly in young adults. Overall, the study provides new insights into the effectiveness of MET in improving hamstring flexibility, and highlights the potential benefits of incorporating this technique into training programs for young adults.

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