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Research Article

Comparing Two Methods to Reduce Hamstring Tightness from Prolonged Sitting in Sedentary Individuals

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Abstract

Prolonged sitting, a common feature of modern sedentary lifestyles, is associated with adaptive shortening of the hamstring muscles, resulting in decreased flexibility, postural imbalances, and an increased risk of lower back pain and musculoskeletal injuries. This study investigated the comparative effectiveness of Muscle Energy Technique (MET) and passive stretching in improving hamstring flexibility among sedentary young adult males. Sixty sedentary male participants aged 20–30 years with hamstring tightness, defined as ≥15° on the Active Knee Extension Test (AKET), were randomly divided into two groups of 30 each. One group received MET while the other received passive stretching, with both interventions applied for one week across sessions consisting of three repetitions. Hamstring flexibility was assessed pre- and post-intervention using the AKET. Statistical analysis with paired and unpaired t-tests ($p < 0.05$) revealed that both groups experienced significant improvement in hamstring flexibility. Group A (MET) improved from 51.14° ± 3.67 to 46.00° ± 2.73, while Group B (passive stretching) improved from 51.10° ± 2.86 to 49.00° ± 2.26. However, no statistically significant difference was found between the two techniques. These results suggest that both MET and passive stretching effectively reduce hamstring tightness. MET may act through neuromuscular mechanisms such as autogenic and reciprocal inhibition, whereas passive stretching targets the viscoelastic properties of muscles. Although MET showed a slightly greater numerical improvement, the techniques demonstrated comparable efficacy. Therefore, either method can be utilized effectively depending on individual preferences, clinical settings, or therapist discretion. This study supports the inclusion of both interventions in physiotherapy strategies aimed at enhancing flexibility in sedentary individuals.

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1. INTRODUCTION

In the contemporary digital and corporate era, sedentary behaviour has become a defining characteristic of daily life. The widespread use of computers, long hours spent at desks, and reduced opportunities for physical activity have led to a surge in health issues associated with prolonged sitting. One such frequently overlooked yet clinically significant outcome is hamstring muscle tightness, particularly prevalent among young adults who engage in minimal physical activity. Hamstring tightness, though not always symptomatic, can be a precursor to various musculoskeletal disorders and functional limitations.

The World Health Organization (WHO) reports that over 1.4 billion adults globally are insufficiently active, a figure that has remained largely unchanged for nearly two decades. In India alone, studies estimate that up to 70% of urban working professionals spend more than 8 hours a day seated, with limited movement during work hours. This sedentary lifestyle not only affects cardiovascular and metabolic health but also imposes significant biomechanical strain on the musculoskeletal system—especially on the posterior chain muscles, including the hamstrings. Anatomically, the hamstrings comprise a group of three muscles—biceps femoris, semitendinosus, and semimembranosus—originating at the ischial tuberosity and inserting below the knee. They play a crucial role in hip extension and knee flexion. During prolonged sitting, the hip remains in a flexed position, leading to sustained shortening of the hamstring muscles. Over time, this habitual shortening results in adaptive muscle tightness, which reduces flexibility, affects lumbar-pelvic alignment, and may contribute to lower back pain, anterior pelvic tilt, and compensatory movement patterns. Muscle tightness refers to a reduction in a muscle's capacity to lengthen, often due to disuse, neuromuscular inefficiency, or connective tissue changes. In the case of the hamstrings, this condition can be easily assessed using standardized tests such as the Active Knee Extension Test (AKET) or the 90-90 straight leg raise test, both of which provide objective metrics for diagnosing and tracking flexibility limitations. Notably, hamstring tightness has been identified as one of the leading contributors to reduced lumbar spine mobility in young, sedentary adults, often presenting even in the absence of overt musculoskeletal pathology.

To counteract hamstring tightness and restore functional range of motion, physiotherapists commonly employ stretching techniques. Among these, two of the most prevalent and clinically supported approaches are the Muscle Energy Technique (MET) and passive stretching. Both are intended to improve muscle extensibility, yet differ fundamentally in their mechanisms and application. Muscle Energy Technique (MET) is an active, therapist-assisted intervention wherein the patient performs an isometric contraction against manual resistance. First introduced by Fred Mitchell, Sr. in the 1940s, MET is based on the principles of autogenic and reciprocal inhibition. When a muscle contracts isometrically, the Golgi tendon organs are stimulated, which in turn inhibits the same muscle (autogenic inhibition), allowing it to lengthen more effectively after relaxation. Simultaneously, activation of the agonist muscle facilitates relaxation of the antagonist (reciprocal inhibition), further enhancing the stretch. This neuromuscular facilitation allows MET to not only improve flexibility but also engage the patient actively in the treatment process, thereby promoting muscle control, proprioception, and functional recovery.

On the other hand, passive stretching is a more traditional and widely utilized method where an external force—usually the therapist—applies the stretch to the targeted muscle while the individual remains relaxed. Passive stretching acts primarily on the viscoelastic properties of muscle and connective tissues, and is thought to increase flexibility by reducing resistance to lengthening. It also triggers the Golgi tendon organ response, promoting reflexive relaxation and lengthening of the muscle being stretched. While it is simpler to administer and generally well-tolerated, passive stretching requires consistency over time to maintain its benefits and may be less effective in cases where active neuromuscular re-education is needed.

Several studies have explored the efficacy of these two methods. Sathe et al. reported that while both MET and passive stretching improve hamstring flexibility, MET offered slightly superior gains. Similarly, Desai (2021) found MET to be more effective in improving hamstring extensibility in healthy individuals due to its neuromuscular engagement. Conversely, Kaniz Rabia et al. (2019) observed no significant difference in flexibility outcomes between the two techniques, suggesting that both are effective when applied consistently

2. AIMS AND OBJECTIVES

Aim:

To assess and compare the effectiveness of MET and passive stretching in increasing hamstring flexibility among sedentary individuals.

Objectives:

- To measure the change in hamstring flexibility using the AKET.
- To evaluate the relative effectiveness of MET versus passive stretching.

3. METHODOLOGY

Design & Participants: A total of 60 sedentary male participants aged 20–30 years with ≥15° hamstring tightness (as per AKET) were selected and randomly divided into two groups (Group A: MET; Group B: passive stretching).

Inclusion Criteria:

- Males aged 20–30 years
- AKET angle ≥15°
- BMI: 18.5–24.9
- Sedentary lifestyle

Exclusion Criteria:

- Muscular disorders
- BMI >24.9
- Regular yoga/exercise practitioners
- Age <20 or >35

Interventions:

- **Group A (MET):** Participants performed isometric hamstring contractions (25% strength) for 7–10 seconds, followed by relaxation and stretching, repeated 3 times.
- **Group B (Passive Stretching):** Static hamstring stretches were held for 30 seconds, repeated 3 times.

Outcome Measure:

- **Active Knee Extension Test (AKET)** was used pre- and post-intervention to assess hamstring flexibility.

Statistical Analysis: Paired and unpaired t-tests were used. $p<0.05$ was considered statistically significant.

4. RESULTS

The objective of this study was to compare the effectiveness of Muscle Energy Technique (MET) and passive stretching on hamstring flexibility in sedentary male individuals aged 20–30 years. The Active Knee Extension Test (AKET) was employed as the primary outcome measure to assess changes in hamstring flexibility pre- and post-intervention in both groups.

A total of 60 participants were included, with 30 subjects in each group. Group A received MET-based intervention, while Group B underwent passive stretching exercises. Each intervention was administered for one week, with sessions comprising three repetitions of the respective stretching technique. All participants completed the protocol without any dropouts or adverse effects.

Pre- and Post-Intervention Results:

Group A (MET) showed a statistically significant improvement in hamstring flexibility.

Pre-intervention mean AKET value: 51.14° ± 3.67

- **Post-intervention means AKET value:** 46.00° ± 2.73
- **Mean difference:** 5.14°
- **Statistical significance:** $p < 0.05$ (paired t-test)

Group B (Passive Stretching) also demonstrated a significant improvement in flexibility.

- **Pre-intervention mean AKET value:** 51.10° ± 2.86
- **Post-intervention means AKET value:** 49.00° ± 2.26
- **Mean difference:** 2.10°
- **Statistical significance:** $p < 0.05$ (paired t-test)

Both groups exhibited statistically significant changes within their respective interventions, indicating that each stretching technique effectively increased hamstring flexibility throughout the treatment period.

Inter-Group Comparison:

To evaluate whether one intervention was superior to the other, an unpaired t-test was conducted to compare the post-intervention AKET values between the two groups. Despite a numerically greater reduction in hamstring tightness in the MET group (mean improvement of 5.14° vs. 2.10° in the passive stretching group), the difference between groups was not statistically significant *($p > 0.05$)*.

Graphical Analysis:

A visual representation of pre- and post-intervention changes was presented through bar graphs and a pie chart summarizing the outcomes:

- **Bar Graph 1.1** illustrates the average AKET values before and after intervention for both groups. The graph visually reinforced the observed statistical trend, with Group A showing a larger drop in AKET angle.
- **Pie chart analysis** depicted overall outcome distribution, highlighting that both interventions contributed positively to improving flexibility, with no single technique demonstrating dominance in effectiveness.

Summary of Findings:

Group	Pre-Intervention (°)	Post-Intervention (°)	Mean Difference (°)	Significance (Within Group)
A (MET)	51.14 ± 3.67	46.00 ± 2.73	5.14	Significant ($p < 0.05$)
B (Passive Stretching)	51.10 ± 2.86	49.00 ± 2.26	2.10	Significant ($p < 0.05$)

Between-group comparison: $p>0.05$ → Not statistically significant

Interpretation:

The results suggest that both MET and passive stretching are effective in improving hamstring flexibility, and that these improvements can be observed within a relatively short treatment period of one week. Although MET yielded a greater mean improvement, it did not surpass passive stretching by a statistically significant margin. Therefore, from a clinical standpoint, either technique can be employed effectively, and the choice may be guided by factors such as therapist preference, patient comfort, or treatment setting.

5. DISCUSSION

Hamstring tightness is a prevalent musculoskeletal concern, especially among individuals with sedentary lifestyles marked by prolonged sitting. The shortening of the hamstring muscle group due to sustained hip flexion not only contributes to decreased flexibility but is also linked to lower back pain, altered pelvic alignment, and increased risk of strain or injury. In this study, we aimed to compare the effectiveness of two widely used therapeutic interventions—Muscle Energy Technique (MET) and passive stretching—for improving hamstring flexibility in sedentary males aged 20–30 years.

The results of the current study demonstrated that both MET and passive stretching significantly improved hamstring flexibility as measured by the Active Knee Extension Test

(AKET). While both groups showed notable within-group improvements, inter-group analysis revealed no statistically significant difference in outcomes between MET and passive stretching, indicating that both interventions are comparably effective.

The findings are consistent with those of Samiksha Sathe et al., who found that while both MET and passive stretching improve hamstring flexibility, MET demonstrated slightly superior results. However, the difference was not statistically significant, mirroring the outcomes of our study. Similarly, Kaniz Rabia et al. (2019) concluded that both interventions showed significant intragroup improvement, but no significant difference was observed in intergroup comparisons, reinforcing the equivalence of MET and passive stretching in clinical practice.

Muscle Energy Technique, introduced by Fred Mitchell Sr. in 1948, functions through neuromuscular mechanisms like autogenic and reciprocal inhibition. During MET, the patient actively contracts the target muscle against resistance, triggering the Golgi tendon organ (GTO) to inhibit the contracting muscle (autogenic inhibition), while the antagonist muscle is facilitated (reciprocal inhibition). This leads to enhanced muscle relaxation and a greater range of motion. MET's active nature, involving patient participation, is often cited as beneficial for improving neuromuscular coordination and proprioception. This is supported by the systematic review and meta-analysis by Yeh-Hyun Kang et al., which found MET more efficacious for hamstring flexibility than either passive stretching or no treatment. In contrast, passive stretching relies on an external force to elongate the muscle without active contraction from the participant. The technique primarily affects the viscoelastic properties of the musculotendinous unit, leading to temporary increases in muscle length. The underlying physiological mechanism involves the activation of GTOs during sustained stretching, promoting muscle relaxation and increased pliability of connective tissue. A study by Shadmehr et al. (2009) supports the efficacy of passive stretching in increasing hamstring flexibility, but also noted that the effects are often short-lived and require repeated sessions for long-term benefit. One possible reason for the similar outcomes observed in both groups in our study could be the short duration of intervention (1 week) and relatively homogenous sample (young, healthy sedentary males), which might have limited the scope for detecting significant differences. Additionally, both techniques were applied in a controlled clinical environment with standardized procedures, reducing the variability in treatment delivery and increasing the likelihood of comparable outcomes. It is important to consider individual differences when selecting an intervention. For instance, MET may be more suitable for patients who prefer active engagement and have sufficient cognitive and physical capabilities to follow instructions. Passive stretching, on the other hand, may be ideal for individuals who cannot actively participate due to injury, fatigue, or other limitations. The study by Desai et al. (2021) highlighted that MET is simple, well-tolerated, and more impactful among healthy young adults, whereas stretching is often easier to apply and requires less patient effort.

Despite the lack of significant difference between the two techniques in this study, the results support the use of both interventions as effective tools in clinical and preventive physiotherapy. This is particularly relevant in occupational health settings, where sedentary workers often present with hamstring tightness due to prolonged sitting.

6. CONCLUSION

The present study was designed to evaluate and compare the effectiveness of two widely practiced physiotherapy techniques—Muscle Energy Technique (MET) and passive stretching—in reducing hamstring tightness among sedentary male individuals aged 20–30 years. Prolonged sitting, a hallmark of sedentary behaviour, contributes significantly to musculoskeletal problems, particularly shortening and tightness of the hamstring muscles. This not only impairs flexibility and mobility but also predisposes individuals to postural dysfunction and increased risk of lower back pain and injuries.

Both MET and passive stretching were administered over a short intervention period, and outcomes were assessed using the Active Knee Extension Test (AKET), a reliable and standardized tool for evaluating hamstring flexibility. The results demonstrated that both interventions led to statistically significant improvements in hamstring flexibility within their respective groups. However, no statistically significant difference was observed between the two groups post-intervention, suggesting that both techniques are equally effective in addressing hamstring tightness caused by prolonged sitting.

Muscle Energy Technique, which involves active muscle contractions from the participant, likely achieved its effects through neuromuscular mechanisms such as autogenic and reciprocal inhibition. This approach engages both the muscular and nervous systems, enhancing muscle coordination and flexibility. On the other hand, passive stretching, which involves an externally applied stretch without participant effort, likely improves flexibility through viscoelastic changes in muscle and connective tissue and inhibition of the muscle spindle reflex.

Despite the small numerical advantage seen in the MET group, the findings reinforce the idea that both approaches can be considered equally beneficial in clinical practice, especially for young, sedentary individuals. This has important implications for physiotherapists and rehabilitation professionals, who may choose either technique based on patient preference, clinical setting, physical condition, and resource availability.

It is also important to highlight that short-term interventions, such as the one-week protocol used in this study, can yield noticeable improvements in flexibility. However, long-term adherence and consistency are likely needed to maintain gains and prevent recurrence of tightness, especially in individuals who continue to engage in prolonged sitting.

In conclusion, this study supports the use of both MET and passive stretching as safe, effective, and practical interventions for improving hamstring flexibility in sedentary individuals. The choice between the two can be guided by clinical judgment, individual needs, and therapeutic goals, with both methods offering valuable benefits in musculoskeletal health and injury prevention

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