

Comparison between Immediate Effects of MET and Passive Stretching Techniques on Hamstring Flexibility in Patients with Hamstring Tightness: An Experimental Study

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Abstract

Background: Muscular flexibility is an important part of functioning of human being and hamstring muscle is prominently found to be tight in human body. Hamstring muscle flexibility can be improved by a variety of stretching method and other techniques, yet very little work has been done to compare muscle energy technique (MET) and passive stretching techniques. The objective of our study was to compare the immediate effectiveness of muscle energy technique (MET) and Passive stretching on hamstring flexibility in individuals with hamstring tightness.

Method: 42 participants who met the inclusion criteria were randomly divided into two equal groups, Group A – MET and Group B – Passive stretching. The range of motion (ROM) of knee extension was measured before and after both the techniques by AKET using universal goniometer.

Results: There was a significant improvement in hamstring flexibility in both the groups following the application of MET and Passive stretching.

Conclusion: From the present study we can conclude that both MET and passive stretching techniques have an immediate effect on reducing hamstring muscle tightness. From the mean difference values it is visible that MET (12.81) is slightly more effective than passive stretching (6.38) although statistically significant difference is not seen.

Keywords: Muscle energy technique, Passive stretching techniques, hamstring tightness.

Introduction

Flexibility means the ability to elongate skeletal muscle and tendons. In rehabilitation of any muscle, flexibility is a significant component. Static flexibility can be measured through Range of Motion (ROM), which is equivalent to tolerance threshold toward stretches, and dynamic flexibility which implies necessary resistance toward stretch is measured through stiffness. Muscle stiffness means the ratio of torque changes to muscle length changes.¹ There are multiple factors and varied reasons for decrease in joint ROM and one of which is muscular tightness. Muscle “tightness” is defined as an increase in tension from active or passive mechanisms.

Passively, muscles can become shortened through postural adaptation or scarring and actively, they can become shorter because of either spasm or contraction. This type of tightness will limit range of motion and may create a muscle imbalance.²

Hamstring muscles have a great tendency to shortening, due to their multi-joint function and their tonic postural character. It is very well known that the length of the hamstring muscles is known to play an essential role in both the effectiveness and efficiency of human movements like running, walking etc. It has been proved in the literature that reduced hamstring flexibility is a common clinical finding in the general population as

well as athletic populations which result in major muscle imbalances, predisposing athletes to muscle injuries, patellar tendinopathy, and patellofemoral pain. Also it may lead to low back pain.³

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, active release technique, static stretching etc. Out of which we will be considering two techniques here -MET and passive stretching. Passive stretching includes the stretching through the use of mechanical devices, the assistance of gravity, or use of a partner. In the process of passive stretch, an external force is applied, usually through a person in a rehabilitative setting and that person holds that stretch for a period of time and this is how the muscle gains new length. Passive stretching is also widely used in conjunction with active stretches as a part of warm up and cool down programs, apart from being a main intervention.⁴

Muscle energy technique (MET) is a procedure in which there is voluntary contraction of a patient's muscle in a precisely controlled direction with different levels of intensity. In this particular technique, the client provides the initial effort while the practitioner will facilitate the process. The benefits of MET are restoring normal tone in hypertonic muscles, strengthening weak muscles, preparing the muscle for subsequent stretching, improved joint mobility.⁵ It is hypothesized that one of the efficient treatments to increase hamstring flexibility is Muscle Energy Technique (MET), which includes controlled isometric contraction in the targeted muscle. The results of various studies have shown that MET was effective in improving the flexibility as well as reduction of pain and discomfort and caused more immediate and long term changes.¹ There are multiple studies showing the effectiveness of MET and Passive stretching in hamstring tightness.⁶⁻⁹ Apart from this, both the techniques have proved to be safe and easy for achieving hamstring flexibility. So in order to compare which of these techniques has more immediate effect on hamstring flexibility, this study was carried out on individuals with hamstring tightness.

Materials and Methodology

Study design: An experimental study

Sampling method: Simple random sampling

Sample size: Total 42

- **Group A:** 21 subjects received MET treatment
- **Group B:** 21 subjects received passive stretching treatment

Study setting: DattaMeghe College of Physiotherapy, Nagpur

Study duration: 2 months

Inclusion Criteria:

- Patients with Hamstring tightness of 15 degrees or more on AKET
- Gender – male and female both
- Patients willing to participate in the study

Exclusion Criteria:

- Patients with any low back pathology.
- Patients with history of any recent fracture or surgery of lower limb
- Patients with of knee joint pain or hypermobility
- Patients with any neurological disorder.
- Patients with history of recent hamstring injury

Material used: Plinth, Stabilising belt, Universal goniometer, Stop watch

Outcome measure: For measuring the hamstring flexibility, the active knee extension test was used in both the groups.

Active knee extension test (AKET): The patient lies in supine lying with hip flexed to 90 degrees. The patient is asked to perform active knee extension movement and stop when he/she feels strong resistance to the movement. The range of motion of knee joint is measured with the help of goniometer at this end range.¹⁰

Procedure: The study was carried out at the DattaMeghe College of Physiotherapy, Wanadongri, Nagpur. Ethical approval was obtained from Institutional Ethical Committee & an informed consent was obtained from the participants. Total 47 patients were assessed for the study. Inclusion and exclusion criteria were applied and 5 patients were excluded from the study. The study was conducted on 42 patients fulfilling the inclusion criteria. The participants were randomly divided into two groups by computer generated randomized table into groups of 21 each. Group A received Muscle energy

technique treatment and Group B received passive stretching treatment. The pre and the immediate post reading of AKET were measured

Group A - MET For Hamstrings tightness

- The contralateral leg may be either flexed or may lie straight on the plinth.
- The affected leg was flexed at both the hip and knee joints, and then slowly straightened by the therapist until the restriction barrier was identified
- The limb was moved a little away from the restriction barrier and the isometric contraction against resistance was introduced.
- The patients were asked to resist the movement with no more than 25% of strength. The contraction was held for 7-10 seconds followed by complete relaxation of the limb.
- On exhalation, the knee joint was straightened (extended) towards its new barrier and through that barrier a stretch was applied and maintained for 30 seconds.
- 3 repetitions of this process were done¹¹

Group B - Passive stretching For Hamstrings tightness: The patient were in supine lying with a small pillow below the contralateral knee. The patient were asked to maintain the hip in 90 degrees of flexion, with the help of both hands. The ankle joint was in a relaxed

position. The patient’s foot was placed on therapist’s shoulder and the hamstring muscles were maximally stretched from this position. The stretch was maintained for a period of 30 seconds and the procedure was repeated for a total of three times.^{12,13}

Results

The software MYSTAT 12 was used in this study. Active knee extension test (AKET) was used as an outcome measure. Descriptive statistics such as mean and standard deviations were calculated to describe all the variables. The paired t-test and the unpaired t-test were used to verify differences between pre- and post-intervention. The statistical analysis was conducted at 95% confidence level, and p<0.05 was considered statistically significant.

The gender ratio was 13:8 (13 females and 8 males) in Group A – MET group and 11:10 (11 females and 10 males) in Group B – Passive stretching group. The difference in the mean age of both the groups was statistically not significant (Table 1)

Comparison of the pre and post intervention values (student’s paired t test) of the outcome measure showed that there was statistically significant difference in AKET values in both the groups. (Table 2 and table 3) Inter group comparison (student’s unpaired t test) showed that there was no statistically significant difference between the two groups in terms of AKET (Table 4).

Table 1: Baseline demographic data of both the groups

Group	Group A	Group B	t value	p value	Inference
Age (years)	38.19±14.12	38.38±13.81	2.02	0.96	Not significant
Gender ratio (M:F)	13:8	11:10			

Table 2: Mean and SD scores of Group A(Paired t test)

Group A - MET				
			Paired t test	
	Pre intervention	Post intervention	Mean Difference	p value
AKET	144.14 ± 18.33	156.95 ± 15.44	12.81	0.000

Table 3: Mean and SD scores of Group B (Paired t test)

Group B - Passive stretching				
			Paired t test	
	Pre intervention	Post intervention	Mean Difference	p value
AKET	146.81 ± 18.19	153.19 ± 15.93	6.38	0.000

Table 4: Result of post-intervention values of both the groups (Unpaired t test)

	Group A	Group B	Unpaired t test	
	Post intervention	Post intervention	p value	Inference
AKET	156.95 ± 15.44	153.19 ± 15.93	0.44	Not Significant

Discussion

In our study we found out that there was an immediate positive effect on hamstring tightness in terms of AKET in both the groups. Various studies have shown similar effects of MET on hamstring muscle tightness.^{5,14} Desai Sonali et al conducted a study to compare effectiveness of Muscle Energy Technique (MET) & Static Stretching on hamstring tightness in healthy young individuals and found that both MET and static stretching showed significant improvement in reducing Hamstring Tightness in agreement to our study⁹

Bandy et al in their research have stated, the optimal duration for an effective stretch as a duration of 30 seconds.¹³ During MET, muscle elongation is maintained for this duration thus leading to increased muscle length with a combined effect of creep and plastic changes occurring in the connective tissue.^{15,16} Holuskova et al stated that the variations in the connective tissue show mechanical properties associated with both elastic and viscous constituents. Creep is the temporary lengthening of the connective tissue during the stretch period (viscoelastic property).¹⁷ Fryer et al in their study have explained that the reasons of increased flexibility after MET may be the result of biomechanical or neuro-physiological changes or increased stretch tolerance.^{15,18}

Ivan et al affirmed MET as an effective and non-traumatic manipulative technique. MET is said to have an inhibitory effect on motor activity acting through the muscle spindles or the Golgi tendon organs.¹⁹ Post isometric relaxation technique reduces of the tone of the muscles. The afferent nerve impulses entering the dorsal route links up with the inhibitory motor neuron, stopping the efferent motor neurons impulse discharge, thus preventing further contraction and decreasing the muscle tone. This in turn relaxes the agonist muscle.²⁰ During this period, as a result of reduced tone, lengthening becomes easier. Kuchera et al in their study discussed similar reasons.^{9,21} They explained that the inhibitory golgi tendon reflex is said to be activated during isometric contraction of muscles leading to reflex relaxation of the muscle.²²

June-Su Yua et al, on 51 healthy individuals with tight hamstrings compared the immediate effect of hamstring stretching techniques and found that static stretching and PNF-hold relax showed a significant effect on ROM measured by active knee extension (AKE) test.²³ Phil Page in clinical commentary on current concepts in muscle stretching for exercise and rehabilitation has also stated that Static passive stretching is effective at increasing ROM. A static stretch of 15-30 seconds applied 2 to 4 times showed increase in ROM not because of increased length (decreased tension) of the muscle but simply due to an increased tolerance of the individual to stretching.²⁴ Patrick G De Deyne in his perspective on Application of Passive Stretch and Its Implications for Muscle Fibers explained that the increase in the range of motion immediately after application of static passive stretch can be because of the viscoelastic behaviour of muscle and short-term changes in muscle extensibility. Passive stretching leading to positive changes in range of motion often may involve biomechanical, neurological, and molecular mechanisms.²⁵ Static stretching leading to increased range of motion might be due to increase in the number of sarcomeres in series (muscle length) due to prolonged exposure to the stress. In addition, stretching causes increase in viscoelasticity and decrease in stiffness of muscular and connective tissues that results in improved muscular extensibility.²⁶ Also, during passive stretching it is assumed that the Golgi Tendon Organ, monitoring tension resulting from stretch of a muscle-tendon unit, may result in muscle elongation by intervening any assisting impulses from the primary afferents of the muscle spindle (Ia afferent fibers) and may contribute to muscle relaxation by inhibiting tension in the contractile units of the muscle being stretched.⁴

Maryam Azizi et al in their pilot study concluded that a single session of MET (3 repetitions) resulted in significant immediate improvement in flexibility and reduction in stiffness of hamstring.¹ Yuichi Nishikawa et al in their study on Immediate effect of passive and active stretching on hamstrings flexibility found that both active and passive static stretching had significant effect on

improving hamstring flexibility immediately however, passive stretching elicited greater improvements in hamstring flexibility than active stretching.²⁷ Shadmehr et al. in their study related to passive stretch and MET on hamstring flexibility concluded that both techniques relatively had the same effect on increasing the flexibility in healthy young females which is similar to our results as well. Thus the results of our study corroborates the previous findings about a significant immediate effect of single session of MET and passive static stretching (3 repetitions each) on improving flexibility of hamstring.

Ethical Clearance: Taken from institutional ethics committee.

Source of Funding: Self.

Conflict of Interest: Nil.

Conclusion

From the present study we can conclude that both MET and passive stretching techniques have an immediate effect on reducing hamstring muscle tightness. From the mean difference values it is visible that MET (12.81) is slightly more effective than passive stretching (6.38) although statistically significant difference is not seen.

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