ORIGINAL RESEARCH PAPER

Volume-8 | Issue-6 | June-2019 | PRINT ISSN No. 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

THE IMMEDIATE EFFECT OF FOAM ROLLING VERSUS MUSCLE ENERGY TECHNIQUE ON HAMSTRING FLEXIBILITY IN HEALTHY YOUNG INDIVIDUALS WITH HAMSTRING TIGHTNESS

Physiotherapy

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ABSTRACT

Background: The purpose was to compare the effects of foam rolling and muscle energy technique (MET) on hamstring flexibility in healthy young individuals with hamstring tightness.

Methodology: 80 participants were selected according to the inclusion and exclusion criteria and were randomly allocated into 2 groups - Group A (Foam rolling) and Group B (MET). Straight leg raise (SLR) test and Active knee extension (AKE) tests were the outcome measures used to assess hamstring flexibility, pre and post intervention. Data was evaluated using paired t test and z test.

Result: Within group comparison demonstrated that the SLR and AKE scores improved significantly in both foam rolling and MET group ($p<0.0001$). Between group comparison demonstrated that there was no significant difference in SLR and AKE scores between both the groups ($p>0.0001$).

Conclusion: Both foam rolling and MET were equally effective in improving hamstring flexibility.

KEYWORDS

Foam rolling, Muscle energy technique, hamstring flexibility.

INTRODUCTION

The muscular system controls the movement of the human body[1]. Many factors cause decreased range of motion in synovial joints restricting the human movements, one of which is muscular tightness[2]. Flexibility can be defined as the ability of the muscle to lengthen to allow full range of motion of that particular joint[1]. A reduction in functional level as well as damage to the skeletal system due to overuse occurs due to reduction in muscular flexibility. Multi-joint muscles are prone to such damage due to large functional exertion and a high percentage of fast twitch fibres[3]. Reduced flexibility not only affects the length-tension relationship of the muscle but also leads to altered shock absorbing capacity and an increase in postural problems[4].

The hamstring muscle present at the back of the thigh originates in the gluteal region and inserts in the popliteal fossa. It is a two-joint muscle, so it helps in knee flexion as well as hip extension[1]. To fully stretch the muscle, the hip should be fully flexed with knee fully extended. For complete contraction of the hamstrings, hip needs to be fully extended and the knee fully flexed. In normal day to day activity full contraction or stretching of hamstrings rarely occurs. So, there are chances that it may go into tightness and it usually occurs in individuals who do not do stretching regularly[5]. The prevalence of hamstring tightness is high among individuals of age 18-25 years[6].

Hamstring tightness has been shown to correlate with chronic low back pain. Patellar tendinopathy as well as patellofemoral pain syndrome may also occur due to hamstring tightness[4]. Hamstring tightness is an important intrinsic factor for sports injuries such as hamstring strain which is common among athletes[7].

There are many interventions that are developed to reduce hamstring tightness. One of the most common ways to increase flexibility of hamstrings is through stretching. Various types of stretching techniques can be used including static, dynamic, ballistic or proprioceptive neuromuscular facilitation stretching[8].

In recent years myofascial release is commonly used to reduce the soft tissue adhesions and thereby increase flexibility[9]. Self-myofascial release is a technique that is independent of the practioner where the individuals use their own body weight to apply pressure over the muscle tissue[10]. Many objects such as tennis balls, massage sticks, foam rollers and medicine balls can be used in self-myofascial release. Foam rollers are commonly used for self-myofascial release[11].

Foam roller is a multipurpose tool and can be used for any age Group and body type. Patients can use rollers to isolate specific areas of the body and treat the tightness present in the soft tissue by varying their body positions[12]. Apart from flexibility it can also be used to improve balance, proprioception, core stability and body awareness. Foam rollers are available in many sizes, densities and firmness[13].

Another manual technique used by clinicians is muscle energy technique (MET). MET can be used for many purposes which include lengthening a muscle, relieving pain, strengthening muscles, increasing blood circulation, increasing ROM and many more[14]. MET is a technique in which the individual contracts the muscle voluntarily in a direction against resistance provided by the therapist[5].

To our knowledge, study comparing effectiveness of Foam Rolling and muscle energy technique (MET) on hamstring flexibility has not been carried out previously. Hence the present study was conducted with the objective to compare the effectiveness of Foam rolling and muscle energy technique on hamstring flexibility in healthy young individuals with hamstring tightness.

Outcome measures used in the study are Active knee extension test and Straight leg raise test.

MATERIALS AND METHOD

The study received ethical clearance from the Institutional Ethical Committee (PIMS/CPT/IEC/2018/578). 80 Participants aged between 18-24 years were screened according to the inclusion and exclusion criteria and were randomly allocated into 2 groups- Group A (Foam Rolling) and Group B (MET). Written informed consent was taken from the participants and the demographic data was collected. Participants with any history of lower extremity injury or surgical procedure in last 12 months, neurological disorders, spinal deformity and those involved in regular exercise program were excluded.

PROCEDURE

Outcome measure

Active knee extension and straight leg raise tests were used to measure hamstring tightness. Both the tests were performed before and after the intervention.

1. Active knee extension test: The participant was in supine position with the hip of the limb to be tested flexed to 90°. The contralateral limb was fully extended and stabilized. A standard universal goniometer was placed over the lateral femoral condyle, with one arm aligned along the thigh and the other arm aligned over the leg. The participant extended the knee until a strong resistance was felt, holding the final position for 2-3 seconds, allowing the goniometric reading. The same procedure was then executed for the contralateral limb.

2. Straight leg raise test: The participant was in supine position. The limb to be tested was flexed by the examiner with knee fully extended

and foot in relaxed position. The contralateral limb was fully extended and stabilized in neutral rotation. The hip was flexed until a strong resistance was felt. The goniometer was placed over the greater trochanter, with one arm aligned with lateral femoral condyle and other one aligned parallel to the table, in direction to the mid axillary line. The goniometric reading was taken, and the same procedure was repeated for the contralateral limb.

Intervention

Group A- Foam Rolling (n=40):

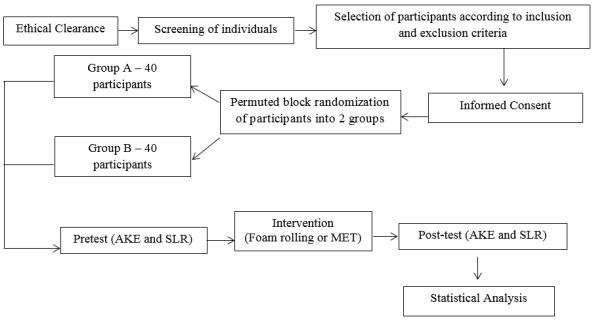
Position – sitting on the foam roller with the legs extended and ankle in relaxed position.

The participants began the foam rolling movement at ischial tuberosity and completed the movement at the popliteal fossa. Their body weight was supported with their arms extended as they moved the foam roller to and from the appropriate landmarks. The subjects had allowed as much pressure between the hamstring muscle and foam roller as possible. The foam roller moved at an approximate cadence of one second up and one second down. The protocol included 3 one minute repetitions with a 30 second break in between for recovery of arms supporting body weight.

Group B- Muscle energy technique (n=40):

Position- supine lying

The therapist kneeled on the mat and the participant's heel was placed against her shoulder. The opposite extremity was stabilized in extension by the therapist's knee. The participant's knee was extended to the position up to the barrier point and moderate (75% of maximum) isometric contraction of hamstring muscle was facilitated for a period of 5-8 seconds. After a period of 3 seconds relaxation, the technique was repeated 3 times. The same procedure was then repeated for contralateral leg.



DATA ANALYSIS

Table 1: Demographic data of Group A and Group B

Variables	Group A	Group B
Age	20.675±0.9443	20.45±1.061
Gender	Male 2	Male 3
	Female 38	Female 37
BMI	21.06±3.98	21.18±4.26

Table 2: Pre and Post SLR scores of Group A and Group B

Group	Intervention		Mean	SD	p value	t value	Result
A	Right	Pre	53.75	10.250	<0.0001	10.209	Extremely Significant
		Post	67.55	9.353			
	Left	Pre	55.925	8.965	<0.0001	10.809	Extremely Significant
		Post	70.225	8.696			
B	Right	Pre	54.775	9.275	<0.0001	10.786	Extremely Significant
		Post	69.525	7.848			
	Left	Pre	60.375	8.637	<0.0001	9.181	Extremely Significant
		Post	70.45	8.747			

Table 3: Pre and Post AKE scores of Group A and Group B

Group	Intervention		Mean	SD	p value	t value	Result
A	Right	Pre	37.125	7.813	<0.0001	13.465	Extremely Significant
		Post	52.05	7.795			
	Left	Pre	40.25	5.651	<0.0001	13.231	Extremely Significant
		Post	54.575	8.098			
B	Right	Pre	35.5	7.525	<0.0001	8.996	Extremely Significant
		Post	47.675	10.852			
	Left	Pre	40.45	7.334	<0.0001	11.138	Extremely Significant
		Post	51.7	8.172			

Table 4: Comparison of post intervention SLR scores between Group A and Group B

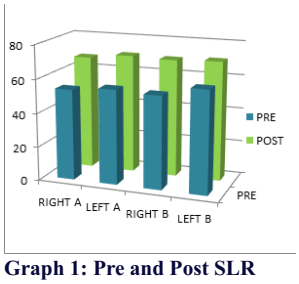
Extremity	Group	Mean	SD	P value	z value	Result
Right	A	13.8	8.549	>0.0001	-0.473	Not significant
	B	14.75	8.649			
Left	A	14.3	8.367	<0.0001	2.485	Significant
	B	10.075	6.941			

Table 5: Comparison of post intervention AKE scores between Group A and Group B

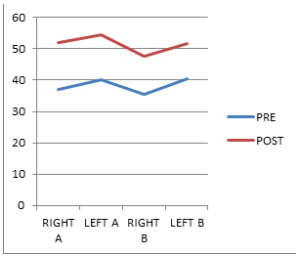
Extremity	Group	Mean	SD	P value	z value	Result
Right	A	14.925	7.011	>0.0001	-0.473	Not significant
	B	11.875	8.349			
Left	A	14.375	6.739	>0.0001	2.485	Not significant
	B	11.25	6.388			

RESULT

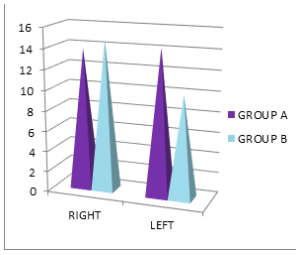
There was significant increase in SLR and AKE scores after intervention in both foam rolling and MET groups (Table2 and 3, Graph 1 and 2). On comparing the post intervention scores of Group A and B, the results showed that there was no significant difference in SLR and AKE scores (Table 4 and 5, Graph 3 and 4).



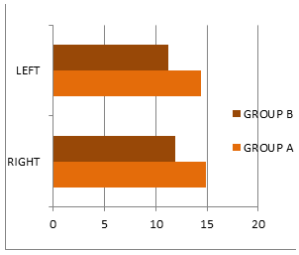
Graph 1: Pre and Post SLR scores of Group A and B



Graph 2: Pre and Post AKE scores of Group A and B



Graph 3: Post intervention SLR scores



Graph 4: Post intervention AKE scores

DISCUSSION

The present study was done to compare the immediate effects of foam rolling and muscle energy technique (MET) in healthy young individuals with hamstring tightness.

Straight leg raise test (SLR) and active knee extension test (AKE) was used to assess hamstring flexibility. SLR and AKE are the most commonly used outcome measures to assess flexibility of hamstring muscles as they have high reliability. A study supporting it was conducted by Neto T et al (2014) to find out the reliability of SLR and AKE test. The study concluded that both the tests had excellent intrarater reliability with ICC values of 0.87 – 0.94 and 0.93 – 0.97 for AKE and SLR respectively[15].

In the present study, foam rolling was effective in improving hamstring flexibility. This could have occurred due to changes in the length of muscle fiber and rate of change of central nervous system. The muscle spindle and Golgi tendon organ are the neural receptors located in the skeletal muscle tissue. The stretch reflex is triggered when the central nervous system senses change in fiber length. The length-tension relationship is altered through 3 mechanisms: The muscle responds to the stretch, sensory impulse from the spindle to the spinal cord is sent via the afferent nerve which decreases the alpha motor neuron firing and lastly the efferent nerves from the spinal cord send impulse to the muscle fiber which alters the normal length tension relationship.

Muscle tension is increased due to foam rolling which causes the golgi tendon organ to relax the muscle, decrease pain, restore muscle length tension and improve function. This is supported by a study conducted by Patrick Keys (2014) to compare the effects of foam rolling and static stretching on hamstring range of motion. The study concluded that there was 28.9% increase in hamstring range of motion after an acute bout of myofascial release through foam rolling[7].

Similarly there was a significant increase in hamstring flexibility after receiving MET which could have occurred due to mechanical (plastic and viscoelastic changes in the connective tissue elements of the muscle) and neurophysiological factors (changes to stretch tolerance). The effectiveness of MET is based on the inhibitory golgi tendon reflex. During isometric contraction of the muscle, the reflex is activated which produces a stretch on the Golgi tendon organs and reflex relaxation of the muscle. Supporting this, a study was conducted by Adel Rashad Ahmed comparing the effects of MET and dynamic stretching on hamstring flexibility. The results showed that the effects of MET ($p<0.001$) were better than that of dynamic stretching ($p<0.02$)[16].

MET and Foam rolling were equally effective and can be used clinically in improving hamstring flexibility.

CONCLUSION

The study concluded that single session of both foam rolling and muscle energy technique were equally efficient in improving hamstring flexibility as expressed by improvement in straight leg raise test and active knee extension test.

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