

# Immediate Effects of Two Different Types of Muscle Energy Techniques (MET) on Hamstring Muscle Flexibility in Young Healthy Females: A Comparative Study

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## ABSTRACT

Flexibility is essential in sports related fitness as well as in daily life. Tight hamstring muscles increase the risk of injury and affect the sports performance among young athletes. Various manual therapy approaches has been studied for reducing muscle tightness. Previous available literature showed the effectiveness of muscle energy technique for increasing muscle flexibility. Variations of MET were suggested by number of authors, but very less literature is available regarding their efficacy over other. Therefore, current study aimed to compare the effectiveness of two approaches of MET- Pulsed and Isolytic technique on hamstrings flexibility in young healthy female which differed in the type of muscle contraction used.

A double blinded, prospective, randomized controlled trial was carried out after taking approval from institutional ethical committee. 39 females of 18-24 years, with bilateral hamstrings tightness were included and allocated to two groups randomly. The written informed consent was sought. Participants in Group 1 and 2 were treated with Pulsed and Isolytic MET for Hamstring muscle respectively. Active knee extension test and Hamstring contracture test were assessed at pre and post intervention.

Statistical analysis was done using SPSS v.20 software and level of significance was set at 0.05 at 95 % CI. Both the interventional groups showed improvement in hamstrings flexibility immediately after the intervention (pre-post analysis- p-value <0.05). However, in between group comparison showed non-significant difference post intervention (p value >0.05).

Both the muscle energy techniques were found to be equally effective in improving hamstrings flexibility immediately after the intervention.

**Keywords:** pulsed, isolytic MET, hamstrings flexibility.

## INTRODUCTION

Flexibility is one of the most important elements of fitness and is essential in sports as well as in daily life. [1] Hamstring strains and tears are one of the common musculotendinous injuries in

sports [2,3] due to its reduced flexibility. [4] Tight hamstring muscles not only increase the risk of injury but also can affect the sports performance among young athletes. [1,5] Available literature suggests that post isometric relaxation approach of Muscle

Energy Technique [MET] was superior to intervention like stretching, massage, cryotherapy and other forms of manual therapies for lengthening the shortened tissue. [6-8] Muscle energy technique is defined as a form of soft-tissue treatment, in which the patient's muscles are actively used, from a precisely controlled position, in a specific direction and against a distinctly executed therapist applied counterforce. [9] According to Mitchell, MET improves muscle flexibility and restricted range of motion (ROM) irrespective of the causes responsible for restriction in a gentle manner. [10] Patient's active participation is the most important factor which differentiates Muscle Energy Technique from most of the manual therapy techniques.

Variety of muscle energy techniques was described in the literature such as post isometric relaxation, reciprocal inhibition, isokinetic, Isolytic, Pulsed, slow-fast eccentric MET etc. by different authors. But as there exist a dearth of literature proving the effectiveness of variations of MET, we proposed the present study to compare these techniques for their effectiveness in hamstring flexibility.

Isolytic MET type involves controlled eccentric contraction of the agonist muscle before stretching the muscle. Hence origin and insertion of the muscle are pulled away in spite of the patients efforts to approximate them. [11] The pulsed MET involves patient induced introduction of a series of rapid pulsating isometric contractions by antagonist muscle at a rhythm a little faster than pulse rate against the practitioner's resistance. Therefore TJ Ruddy has described it as 'osteopathic rhythmic resistive duction therapy'. These short, rapid and rhythmic contractions without wobble or bounce are performed to relax muscle before stretching. [11]

Current study was carried out to compare the immediate effects of two approaches of MET - Pulsed and Isolytic MET respectively on hamstring muscle

flexibility in young females to provide current evidence.

## METHODOLOGY

This study was approved by institutional ethical committee. A double blinded, prospective, randomized controlled trial was carried out in our institute for period of 6 months. After screening 110 females within the age group of 18-24 years and having normal BMI (ranged from 18.5 to 24.9), total 39 females with bilateral hamstrings tightness (popliteal angle less than 160 degrees) were included. Females with history of lower limb or pelvic, traumatic or pathological conditions were excluded including myositis, knee pain, involvement in sports activities were excluded.

They were divided in two groups randomly by alternate allotment. Participants in Group 1 were treated with Pulsed MET whereas participants in group 2 were treated with Isolytic MET for Hamstring muscle following the written informed consent. Outcome measures- Active knee extension test and Hamstring contracture test were assessed at baseline and immediately after the intervention.

### Intervention:

*Procedure of Pulsed MET:* Isometric type of contraction was performed by Quadriceps i.e. antagonist muscle with the force 15% of maximum contraction means the effort was directed towards the restriction barrier. Examiner stood in walk stance position while the subject was in supine lying. Stabilization was achieved manually at the ankle joint while it was placed on shoulder of examiner. Tension in the hamstrings muscle was palpated by the examiner while carrying out the technique. As there was no significant movement in any of the bone segment while performing MET, position of the examiner was relatively stationary. A cycle of MET consisted 3 phases i.e. phase of contraction relaxation and stretch, performed in consecutive order for 10 seconds each. This cycle was repeated for 5

times for each side while the frequency of contraction was kept to 2 per second. They were asked to inform if any discomfort within 72 hours was experienced.

**Procedure of Isolytic MET:** Eccentric isotonic type of contraction was performed by hamstrings i.e. agonist muscle with the force 15% of maximum contraction means the effort was directed away from the restriction barrier.

This type of contraction was brought about by lunging up and down by the examiner while subject was asked to press her ankle against the shoulder of the examiner. Distal thigh of subject was grasped by the examiner. This helped in palpating tension in the hamstrings as well as manually stabilizing the hip joint at 90 degrees of angle. A 4 to 5 contraction were performed by most of the participants in 10 seconds according to comfort and convenience.

**Outcome measures:**

**Active Knee Extension Test:** [12]

Procedure of measurement: active knee extension was measured with goniometer while the subject was in supine lying with hip stabilized at 90 degrees. AKE angle is also called as popliteal angle which is measured by taking tibial and femoral shaft as reference. Hence complete knee extension being 180 degrees. The goniometer was placed in such a way that non movable arm was aligned along the femoral shaft pointing greater trochanter and the movable arm along tibial shaft pointing the lateral malleolus with lateral knee joint-line as a fulcrum. The participants were asked to extend the testing knee actively as much as possible. Three readings were taken for active knee extension of which average was calculated.

**Hamstrings contracture test:** [13]

Procedure of measurement: For this, the participants were instructed to sit with one knee flexed against chest and try to reach forwards as much as possible when hip and ankle was stabilized. The distance that they covered was measured with a scale

in centimeters. Average of two readings was considered.

**Statistical Analysis:** Statistical analysis was done using SPSS v.20 software and level of significance was set at 0.05 at 95 % CI.

**RESULTS**

**Table 1:** - Following table shows comparison of basic demographic data between two groups, analyzed by unpaired t test.

	Group1(n=20)	Group2(n=19)	p Value
	mean ± SD	mean ± SD	
Age(years)	20.5 ± 1.39	20.63 ± 1.77	0.797 <sup>#</sup>
BMI(kg/meter <sup>2</sup> )	22.13 ± 3.13	22.33 ± 2.62	0.838 <sup>#</sup>

Level of significance was set at 0.05. # - p value is statistically not significant.

**Table 2-** Following table shows comparison of baseline parameters between the two groups, analyzed by unpaired t test.

Outcome Measures	Group 1	Group 2	P value
	mean ± SD	mean ± SD	
AKE Right (degrees)	134.95 ± 8.89	136.1 ± 11.71	0.732 <sup>#</sup>
AKE Left	136.71 ± 7.57	138.122 ± 9.19	0.606 <sup>#</sup>
S&R Right (cm)	12.785 ± 4.48	15.69 ± 6.7	0.117 <sup>#</sup>
S&R Left	12.43 ± 4.136	14.528 ± 6.791	0.249 <sup>#</sup>

Level of significance was set at 0.05. # - p value is statistically not significant.

**Table 3-** Following table shows comparison of baseline and values post intervention in 'Group 1' analyzed by paired t test.

Outcome Measures	Pre	Post	P value
	mean ± SD	mean ± SD	
AKE Right (degrees)	134.95 ± 8.89	149.81 ± 8.34	0.00*
AKE Left	136.71 ± 7.57	150.1 ± 10.66	0.00*
S&R Right (cm)	12.785 ± 4.48	15.82 ± 4.56	0.001*
S&R Left	12.43 ± 4.136	15.342 ± 5.25	0.00*

Level of significance was set at 0.05. \* - p value is statistically significant.

**Table 4-** Following table shows comparison of baseline and post intervention values in 'Group 2', analyzed by paired t test.

Outcome Measures	Pre	Post	P value
	mean ± SD	mean ± SD	
AKE Right (degree)	136.1 ± 11.71	149.1 ± 11.8	0.00*
AKE Left	138.12 ± 9.19	154.29 ± 11.96	0.00*
S&R Right (cm)	15.69 ± 6.7	19.38 ± 7.44	0.00*
S&R Left	14.528 ± 6.791	18.42 ± 8.038	0.00*

Level of significance was set at 0.05. \* - p value is statistically significant.

**Table 5-** Following table shows comparison of post intervention values analyzed by unpaired t test.

Outcome Measure	Group 1	Group 2	P value
	mean ± SD	mean ± SD	
AKE Right (degree)	149.81 ± 8.34	149.1 ± 11.8	0.83 <sup>#</sup>
AKE Left	150.1 ± 10.66	154.29 ± 11.96	0.256 <sup>#</sup>
S&R Right (cm)	15.82 ± 4.56	19.38 ± 7.44	0.079 <sup>#</sup>
S&R Left	15.342 ± 5.25	18.42 ± 8.038	0.163 <sup>#</sup>

Level of significance was set at 0.05. # - p value is statistically not significant.

## DISCUSSION

As previous studies contributed in establishing ideal parameters of MET such as duration of stretch, contraction and relaxation along with force, type of contraction etc, we compared the variations of MET in terms of type of contraction used.

This study was aimed at investigating and comparing immediate effects of pulsed and isolytic muscle energy technique on hamstring flexibility in young healthy females. Pulsed and Isolytic MET significantly increased flexibility of hamstring muscle ( $p < 0.05$ ) in the sampled population whereas in between group comparison showed non-significant difference. ( $p > 0.05$ )

Participants treated with Pulsed MET showed approximately 14.12 degrees of popliteal angle and 2.97cm of hamstring contracture test distance improvement in hamstrings flexibility bilaterally. These findings of the study are supported by Ballantyne et al (2003) in which immediate effect of muscle energy technique was studied on hamstring muscles for its effectiveness. [14] Also, in a study done by Mehta and Hatton in which effect of MET after a single session was studied on hamstrings muscle flexibility showed significant improvement. [15]

These beneficial effects were justified by Ruddy - enhanced oxygenation and improved venous and lymphatic circulation through the muscle being treated, proprioceptive re-education, strengthening weak antagonist, inhibition of tense agonist, which is less supported by recent studies. [12,14]

Also, participants treated with Isolytic MET showed approximately 14.58 degrees of popliteal angle and 3.79cm of hamstring contracture test distance improvement in hamstrings flexibility bilaterally. This finding of the study supported by Parmar et al (2011) in which passive muscle stretch was compared with Isolytic type of muscle energy technique for improving knee ROM and reduce pain in

patients who underwent hip replacement. Isolytic MET was found significantly effective in improving ROM of knee and reducing knee pain. [8]

It was assumed that this type of MET promote orientation of collagen fibers along the lines of stress and direction of movement. It also prevents muscle stiffness by limiting infiltration of cross bridges between collagen fibers, and excessive collagen formation. [16] It involves stretching to an extent that fibrotic tissue and adhesions are broken also called controlled microtrauma. [11] This injury is seen useful in relation to alter interface between fibrous and non fibrous tissue. [18]

On comparison of two MET for effectiveness, a non-significant difference was obtained ( $p \text{ value} > 0.05$ ) indicating that both the MET types were equally effective in improving the outcome. These findings of current study were supported by a study done by Smith and Fryer (2008) where comparison of effect of two types of muscle energy technique on hamstring flexibility with varying duration of stretch was studied. They found both the muscle energy approaches produced significant amount of increase in active knee extension angle immediately after the intervention. Whereas similar to our findings, no significant difference was observed in between two techniques. Hence it was suggested that variation of the elements in the technique e.g. type of stretch may not have significant influence on the efficacy of the technique for increasing flexibility of the hamstrings. [17]

This study found that both types of muscle energy techniques were equally effective in improving hamstrings flexibility immediately after the intervention. Ballantyne et al (2003) proposed the mechanism of altered flexibility and suggested that a single application of MET produced no biomechanical or viscoelastic change to the muscle, but created a change in tolerance to stretch due to reduction in pain (hypoalgesic effect) [8,15] in both the techniques. This change may prepare the

muscle for athletic activity and may delay or prevent the injuries. [18] Carry over effect of this technique was for 1 week according to Fryer G, [15] so it might be useful in pre competition protocol for healthy female athletes. Further studies can be carried out in the future to see if it can prevent occurrence and severity of hamstring injuries that occur during sports events.

It was observed during the study that some of the participants treated with pulsed MET could not maintain the recommended frequency of 20 contractions in 10 seconds; therefore approximately 15 contractions were performed. None of the participants reported any discomfort post application of technique, so these techniques could be used frequently and safely on field for immediate results. This might be due to lesser force of contraction, continuous verbal feedback given during application. Visual and breathing synkinesis was not considered in this study which might have additional beneficial effect. Another limitation of this study was smaller sample size. Also, quadriceps and hamstring being the larger and the stronger group of muscles, the procedure can be little tiring. Hence adaption of correct postures and ergonomics during application of technique is recommended to avoid musculoskeletal pain and discomfort to therapist.

## CONCLUSION

Pulsed and Isolytic MET significantly increase flexibility of hamstring muscle bilaterally in young healthy females whereas in between group comparison showed non-significant difference suggesting both the groups were equally effective.

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