

# A comparative study of Muscle Energy Technique and Dynamic Stretching on Hamstring Flexibility in Healthy Adults

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## ABSTRACT

**Background and Objective:** Flexibility can be achieved by a variety of stretching techniques, yet little research has been performed on the most effective method. The objective of the study was to compare the effectiveness of muscle energy technique and dynamic stretching on hamstring flexibility in healthy male subjects. **Material and Methods:** Twenty healthy male subjects with hamstring tightness were randomly divided into two equal groups. Group A were subjected to muscle energy technique whereas the subjects in group B were subjected to dynamic stretching. Treatment was given for 6 consecutive days and the outcome was measured using active knee extension test. Range of motion was recorded at baseline, post intervention (day 6) and follow-up (day 10). **Results:** There was significant improvement in hamstring flexibility following application of muscle energy technique and dynamic stretching but the improvement in muscle energy technique ( $P<0.001$ ) was better than that of dynamic stretching ( $P<0.02$ ). **Conclusion:** It can be concluded that both the muscle energy technique and dynamic stretching improve hamstring flexibility in healthy adults.

**Key words:** Muscle Energy Technique, dynamic stretching, flexibility, hamstring muscle.

## INTRODUCTION

The hamstrings muscles are the most common musculo-tendinous injuries in athletic activities<sup>5</sup>. Reduced hamstring muscle flexibility has been implicated in lumbar spine dysfunction and showing strong positive correlation between decreased hamstring flexibility and low back pain<sup>25</sup>. Although most researchers and clinicians agree that hamstring flexibility plays an important role in lower extremity injury<sup>8</sup>, there is a lack of agreement as to what are the most effective methods to lengthen the hamstring group<sup>28</sup>.

Techniques previously investigated for hamstring flexibility include static stretching exercise, heat, and proprioceptive neuromuscular facilitation (PNF)<sup>3</sup>. Each of these interventions has demonstrated clinical and experimental success; no agreement has been reached on a standard protocol for treatment. Choice for a hamstring lengthening technique is typically based on provider specialty or preference<sup>11</sup>.

Muscle energy technique (MET) is a manual procedure that uses controlled, voluntary isometric contractions of a target muscle group and is widely advocated by authors in the field of osteopathy that is now used in many different manual therapy professions<sup>1</sup>. MET is claimed to be useful for lengthening a shortened muscle, improving range of motion at a joint and increasing drainage of fluid from peripheral regions<sup>12</sup>. This approach which targets primarily the soft tissue is also known as active muscular relaxation<sup>27</sup>.

Dynamic stretching (DS) has been recommended as an alternative to static stretching to increase muscle flexibility, it involves moving the limb from its neutral position to end range, where the muscles are at their greatest length and then moving the limb back to its original position. This dynamic action is carried out in a smooth, controlled manner and is repeated for a specified time period<sup>20</sup>. The effect of DS protocols on muscle performance had been investigated, which generally have a positive relationship<sup>15</sup>.

The aim of this study is to investigate and compare the effectiveness of muscle energy technique and dynamic stretching in increasing hamstring muscle flexibility in healthy male subjects.

## MATERIAL AND METHODS

### Subjects

Twenty healthy male volunteers, their age ranged from 18-26 years, were participated in the study. Subjects selected for the study met the following criteria: all have tight hamstring (inability to achieve greater than 160 of knee extension with hip at 90 of flexion)<sup>7</sup>, and those with hamstring tightness which affecting only the last degrees of knee extension. Subjects were excluded if they have any lower extremity pathology, hamstring injury, hamstring tightness associated with muscle soreness, acute or chronic low back pain, or who were already involved in any exercise programs for lower extremity at the time of the study. Subjects were recruited from the university students; they were informed about the study prior to participation and were free to withdraw at any time from the study.

### Procedure

#### Design of the study

This study was a pretest -posttest randomized controlled experimental design. Following assessment of AKE, subjects were randomly assigned by drawing lots into two equal groups, muscle energy technique group ( $n=10$ ) and dynamic stretching group ( $n=10$ ). The treatment was given as one treatment session in a day for 6 consecutive days. Measurements for both groups were taken as baseline in the 1<sup>st</sup> day, posttest in the 6<sup>th</sup> day and a follow-up measurement on 10<sup>th</sup> day. Assessment was done approximately at the same time in the day, in which a trained senior physiotherapist who was blinded about the subject conducting all the measurements.

#### Outcome measurement

The active knee extension test (AKE) was used to measure hamstring flexibility. The subject was requested to lie in supine position with the non-tested limb and the pelvis was strapped to the plinth for stabilization. The tested leg was positioned in 90 degrees of hip flexion and the knee flexed. Hip flexion was maintained through the use of a crossbar to maintain the proper position of hip and thigh<sup>23</sup>. A full circle universal goniometer (Enraf

Nonius, Netherlands) was used to measure the angle of knee ROM. The fulcrum of the goniometer was centered over the lateral condyle of the femur with the fixed arm secured along the femur using the greater trochanter as a reference. The movable arm was aligned with the lower leg using the lateral malleolus as a reference. Subject was asked to actively extend the tested knee as far as possible until a mild stretch sensation was felt. The procedure was repeated 3 times and the average was taken for analysis. Baseline, post- and follow-up measurement data on AKE were collected from both groups.

#### Muscle energy technique group

Muscle energy technique was applied using post isometric relaxation. While the subject was lying in supine position, the subject's hip was passively flexed and the leg extended until tension was sensed by the researcher and the subject reported a moderate stretching sensation. The subject provided a moderate knee flexion isometric contraction (approximately 50% of maximal contraction), by pressing his ankle joint against the top of the researcher's shoulder for 7–10 s. This was followed by 2–3 s of relaxation, and then the leg was passively stretched by the researcher to the palpated barrier and/or tolerance to stretch and held for 30 s. The leg was then lowered to the table for a short resting period (approximately 10 s). This procedure was repeated two more times<sup>6</sup>.

#### Dynamic stretching group

Subject in this group was instructed to actively swing the leg to be stretched forward into hip flexion until a stretch was felt in the posterior thigh whilst keeping their knee extended and their ankle planter-flexed. The leg was then allowed to swing back into slight hip extension. This was repeated for 30 seconds, such that the dynamic stretch consisted of repeated hip flexion/extension<sup>21</sup>.

#### Data Analysis

All data were described and presented as mean  $\pm$  SD using the Statistical Package for Social Sciences (SPSS) version 13. Paired t-test, independent-t-test, and the repeated

measure ANOVA test were used. All level of significance was set at  $P<0.05$  level.

## RESULTS

Physical characteristics (age, height and weight) for both groups are summarized in table (1) which showed no significant difference between them ( $P>0.05$ ) at the beginning of the study.

The mean changes in knee range of motion at baseline, post intervention and follow-up in both groups are summarized in

table 2. Comparisons revealed that there were no significant difference in the baseline measurement of knee range of motion across the two groups before intervention ( $P>0.05$ ). Both groups showed significant improvements at post intervention but the improvement in muscle energy technique ( $P<0.001$ ) was better than that of dynamic stretching ( $P<0.02$ ).

Results of follow-up test showed significant difference in both groups ( $P<0.05$ ). The follow-up values were higher than that of the baseline measurements but lower than the post-intervention values.

**Table (1): The physical characteristics in both groups.**

Group	Age (Years) Mean $\pm$ SD	Height (cm) Mean $\pm$ SD	Weight (Kg) Mean $\pm$ SD
MET	22.0 $\pm$ 2.4	167.2 $\pm$ 4.5	68.7 $\pm$ 5.1
DS	22.3 $\pm$ 1.8	168.8 $\pm$ 3.2	67.5 $\pm$ 4.9
P. value	0.805 **	0.804 **	0.513 **

MET: Muscle energy technique

DS: Dynamic stretching

\*\* non significant

**Table (2): Mean $\pm$ SD of Baseline (1<sup>st</sup> day), post-test (6<sup>th</sup>), and follow-up (10<sup>th</sup> day) AKE ranges in both groups.**

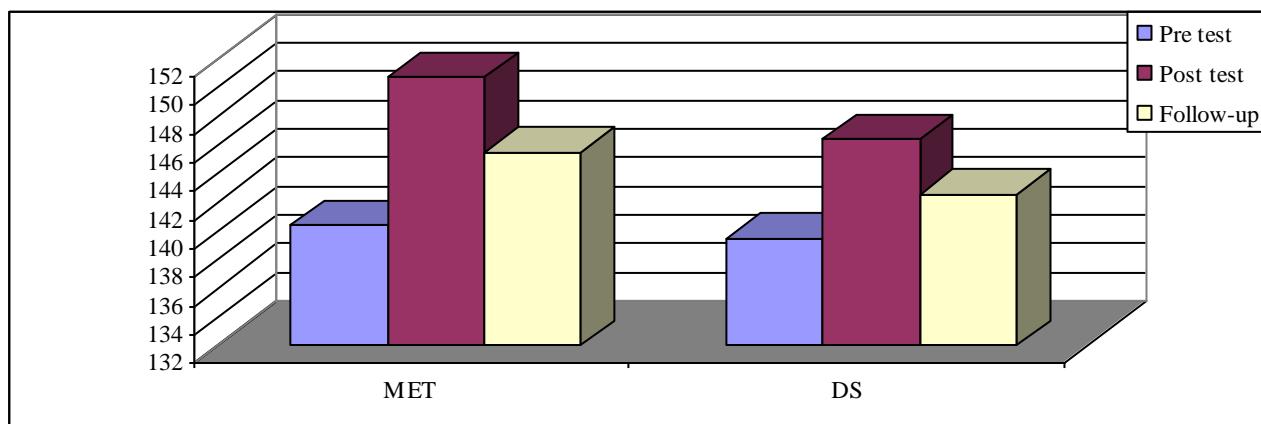
Group	Baseline(1 <sup>st</sup> day) Mean $\pm$ SD	Post ( 6 <sup>th</sup> day) Mean $\pm$ SD	Follow-up(10 <sup>th</sup> day) Mean $\pm$ SD
MET	140.3 $\pm$ 4.33	150.6 $\pm$ 4.66	145.4 $\pm$ 5.64
DS	139.4 $\pm$ 4.19	146.3 $\pm$ 4.74	142.5 $\pm$ 5.41
P. value	0.727**	0.017*	0.015*

MET: Muscle Energy Technique

DS: Dynamic stretching

\*Significant

\*\*non significant



**Fig. (1): The mean of the pre-test (1<sup>st</sup> day), post-test (6<sup>th</sup>), and follow-up(10<sup>th</sup> day) AKE ranges in both groups.**

## DISCUSSION

The effect of different stretching techniques for lengthening of shortened muscles reveals a confusing picture. Little can be yet concluded concerning the most efficacious application. Therefore the current study was undertaken to investigate and compare the influence of MET and DS, two

commonly methods used in muscle stretching, and to determine which is better in improving hamstring flexibility. A comparison of the pre-test and the post-test values of the AKE showed that there was a significant improvement in both groups, which demonstrate that both techniques are effective individually in improving flexibility of hamstrings.

The results of MET in the present study are in agreement with previous research<sup>1,26,27</sup>. Most researches involving MET has focused on a single application of treatment<sup>1,19</sup>. It was reported that the application of post-isometric stretching technique, such as MET, produce greater changes in range of motion and muscle extensibility than static or ballistic stretching<sup>14,17</sup>. It was concluded that 30 seconds as the optimal duration for an effective stretch, MET may produce an increase in muscle length by a combination of creep and plastic change in the connective tissue<sup>22</sup>. The probably mechanism of increasing muscle extensibility involves both neurophysiological (including changes to stretch tolerance) and mechanical factors (such as viscoelastic and plastic changes in the connective tissue elements of the muscle)<sup>10</sup>. Also, the effectiveness MET was attributed to the inhibitory Golgi tendon reflex. This reflex is believed to be activated during isometric contraction of muscle, which is claimed to produce stretch on the golgi tendon organs and a reflex relaxation of the muscle<sup>1,9</sup>.

There has been limited research on the effects of dynamic stretch on hamstring extensibility. One previous study<sup>4</sup> found that static and dynamic stretching results in similar level of extensibility. Another study found that static stretching increase flexibility significantly more than dynamic stretching<sup>2</sup>. There is consistent evidence that dynamic stretching improve muscle performance measures such as agility, speed and strength<sup>16,18,24</sup>. Repeated muscular contraction during dynamic stretch may results in disruption and membrane damage<sup>13</sup>, this could be a cause of less improvement of muscle flexibility in dynamic stretching than MET seen in this study.

The present study showed that both method of stretching found to produce significantly greater gains in range of motion on both group, suggesting that both techniques were effective for increasing hamstring flexibility. At the time of follow-up, the values of hamstring flexibility were higher than that of the pre-test but a decreased from the post-test values, which came in consistence with the earlier studies<sup>27</sup>. This demonstrates that

muscles did not reveal a significant maintenance of their flexibility after cessation of stretching program that clarifies the importance of program's continuity.

Results also suggested that a longer period of intervention may produce further gains in muscle flexibility, which can be studies in future. It should be noted that all the subjects in this study are asymptomatic and younger than a typical patient population. This is important, because it is possible that the efficacy of the two techniques may be interchanged when treating patient population.

## Conclusion

It can be concluded that both muscle energy technique and dynamic stretching will improve hamstring flexibility. Muscle energy technique resulted in better improvement as compared to dynamic stretching on hamstring flexibility. Those techniques are very simple and can be easily used on subjects who are experiencing lack of muscle flexibility.

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**دراسة مقارنة بين أسلوب الطاقة العضلية والشد динамический  
على ليونة العضلة الخلفية في الأشخاص الأصحاء**

يمكن استعادة مرونة العضلات باستخدام أساليب متعددة من تمارين الاستطالة. الهدف من هذه الدراسة هو مقارنة تأثير أسلوب الطاقة العضلية والشد динамический على مرونة العضلة الخلفية للأشخاص الأصحاء. أجريت الدراسة على عشرين شخصاً من الرجال الأصحاء والذين يعانون من قصر العضلة الخلفية وقد قسموا إلى مجموعتين متساويتين: المجموعة الأولى خضعت لتمارين الاستطالة باستخدام أسلوب الطاقة العضلية فيما خضعت المجموعة الثانية لتمارين الاستطالة динамическая. أعطى العلاج لمدة 6 أيام متتالية وتم قياس المدى الحركي الأيجابي لمفصل الركبة عند بداية التجربة وبعد 6 أيام ، و 10 أيام من المتابعة . وقد أظهرت النتائج تحسن ذو دلالة احصائية في كلا المجموعتين إلا أن التحسن كان واضح احصائياً في المجموعة الأولى عند مقارنتها بالمجموعة الثانية . من هذه النتائج يمكن استدلال فعالية تمارين الاستطالة بأسلوب طاقة العضلات والاستطالة динاميكية على ليونة العضلة الخلفية عند الرجال .