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EFFECT OF MUSCLE ENERGY TECHNIQUE VERSUS ULTRASOUND WITH STATIC STRETCHING IN IMPROVING THE HAMSTRING FLEXIBILITY IN INDIVIDUALS WITH HAMSTRING TIGHTNESS

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ABSTRACT

Background: Among the muscle undergoing adaptive shortening, hamstring is the one commonly going for adaptive shortening. Hamstring tightness could make the Musculo tendinous unit more susceptible to injury, increase resistance to various anatomical structures, which may lead to overuse syndrome. Thus, this study was aimed to found out the effect of MET technique versus ultrasound with static stretching in improving the hamstring flexibility in individuals with hamstring tightness.

Methods: A total of 30 normal individuals with hamstring tightness at physiotherapy outpatient department participated in this study, with age between 18 to 25 years both male and female were selected and divided into two experimental groups, Group A and group B. The values of outcome measures were recorded before the beginning of treatment regime Day 1 and at the end of treatment regime Day 7. Statistical tools used in this study is paired t- test and unpaired t- test.

Results: The results revealed pretest values of group A and Group B is analyzed by unpaired 't' test. The calculated 't' value is 0.294 < table 't' 1.701 at 5% level of significance. Post test value of Group A and Group B. Calculated 't' value is 3.53 > table 't' 1.701 at 5% level of significance.

Conclusion: Muscle energy technique is more effective than ultrasound therapy with static stretching in improving the hamstring flexibility in individuals with hamstring tightness

Keywords: Hamstring flexibility, Muscle energy technique, Ultrasound therapy with static stretching, Active knee extension test.

摘要：背景：在进行适应性缩短的肌肉中，腘绳肌是适应性缩短的常见肌肉。腘绳肌紧绷会使肌腱单位更容易受伤，增加对各种解剖结构的抵抗力，这可能导致过度使用综合症。因此，本研究旨在找出 MET 技术与超声结合静态拉伸在改善腘绳肌紧绷患者腘绳肌柔韧性方面的效果。

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方法：选取理疗门诊腘绳肌紧绷正常人30例，年龄18~25岁，男女不限，分为A组和B组两个实验组。在第1天治疗方案开始之前和第7天治疗方案结束时记录测量值。本研究使用的统计工具是配对t检验和非配对t检验。

结果：结果显示A组和B组的预测试值通过非配对“t”检验进行分析。在5%的显著性水平下，计算出的“t”值为 $0.294 < |t| < 1.701$ 。A组和B组的测试后值。计算出的“t”值为 $3.53 > |t| > 1.701$ ，显著性水平为5%。

结论：在改善腘绳肌紧绷患者腘绳肌柔韧性方面，肌肉能量技术比静态拉伸超声疗法更有效

关键词：腘绳肌柔韧性，肌肉能量技术，静态拉伸超声治疗，主动伸膝测试。

INTRODUCTION

Hamstring tightness is common in normal individual because of immobilization of a tissue in a shortened position results in adaptive shortening. As the muscle shortens, its elasticity of the normal tissue was decreased and a change in the length tension relationship of the muscle, loss of flexibility also occurs.

Muscle tightness also cause reciprocal inhibition. Increased muscle spindle activity in a specific muscle will cause decrease neural drive to that muscle's functional antagonist. This alter the normal arthrokinematics of the involved segment.

Anderson and Burke defined flexibility as the “range of motion available in a joint or a group of joints that is influenced by muscle, ligaments and bones”.

Loss of flexibility is defined as decrease in the ability of a muscle to deform. Loss of flexibility may lead to decrease in lumbar lordosis, reduction of muscle strength and Quadriceps dysfunction during gait, lumbar pelvic rhythm was disturbed, anterior pelvic tilt was restricted, lumbar motion was increased. Excessive mobility of lumbar spine leads to over stretching

of lumbar ligaments and consequently paying and instability. (Levangie and Norkin, 2001)

Loss of flexibility can also cause pain arising from muscle, connective tissue or periosteum. (Hardy, 1989; Tillmann and Cummings, 1992)

Hamstring tightness can be measured using the (1) Active unilateral straight leg raise test (2) Passive unilateral straight leg raise test (3) sit and rich test (4) active knee extension test. Active knee extension test is the reliable test.

Muscle energy techniques (MET) are manually applied stretching techniques that use principles of neurophysiology to relax overactive muscle and stretch chronically shortened muscles. When using muscle energy techniques (MET), it is important to relax/ inhibit the Nero muscular component before attempting to stretch the involved musculature. Two fundamental neuro physiological principles account for the neuromuscular inhibition. The first principle of muscle energy techniques (MET) is post contraction inhibition/ autogenic inhibition/ post isometric relaxation. The second principle is reciprocal inhibition, muscle energy technique produced an immediate increase in passive knee extension in individuals with hamstring tightness

(Ballantyne2003). Muscle energy technique is significantly improving the hamstring flexibility in collegiate males (Wassim. M et al 2009).

continuous ultrasound therapy increases tendon length by changing their viscosity and plasticity (Ziskin et al, 1986). Low absorption of ultrasound waves is seen in tissue that are high in Water content (e.g., fat), whereas absorption is higher in tissue rich in protein (e.g., skeleton muscle) (Dyson, 1987; Low and Reed, 1990).

Elevation of collage tissue temperature effects on mechanical and physical characteristics of tissue and facilitates deformation of the collagen. As pain and discomfort was reduced during stretching and collagen fiber ability to tolerate greater forces was increased. Ultrasound increase soft tissue extensibility and may be an effective adjunct in the treatment of knee contractures secondary to connective tissue shortening (Folconer et al 1992).

static stretching is effective in increasing the length of muscles due to the prolonged stretching, which may allow the muscle spindle to adapt overtime and cease firing (Gordon and Ghez, 1991).

Combination of ultrasound therapy with 30 seconds stretch is more effective than ultrasound therapy with 15 seconds stretch in increasing hamstring flexibility (A. Akbari, H. Moodi, A. A. Moein, and R. Nazok 2006).

Continuous ultrasound therapy, static stretching, muscle energy techniques are significant in improving Hamstring flexibility in individuals with hamstring tightness. These methods of treatment are well accepted and practiced by various researchers according to previous literature, but there was no study to compare the effect of muscle energy technique and ultrasound therapy with static stretching in improving the hamstring flexibility in individuals with

hamstring tightness. So the purpose of this study is to compare the effect of muscle energy technique and ultrasound therapy with static stretching in improving the hamstring flexibility in individuals with hamstring tightness.

METHODOLOGY

On the basis of simple random sampling method, 30 normal individuals with hamstring tightness who fulfilled the predetermined inclusive and exclusive criteria were selected and divided into two experimental group. Group A and Group B consists of 15 patients. Criteria for selection; Inclusive criteria-age between 18 to 25 years, both males and females, normal individuals with hamstring tightness (inability to achieve greater than 160°knee extension with at 90°flexion). Exclusive criteria-acute or chronic low back pain, acute or chronic hamstring injury, soft tissue injury around knee, recent fracture and stiffness in lower extremity.

Study is conducted at physiotherapy outpatient department, Moolchand hospital, New Delhi. Total duration was one week, once in a day. Subject was assessed for hamstring tightness using the active knee extension test. The subject was in supine position with hip flexed 90 degrees and knee flexed. Pelvis was strapped down to the table for stabilization and controls the accessory movement. The subject was then asked to erect the knee until a mild stretch sensation was felt. Three repetitions were performed and an average of the three was taken as the final reading.

Group A- Individual's supine lying position. Therapist flexes the affected hip fully and then extends the flexed knee with the back of lower leg resting on the shoulder of the therapist who stands facing the head of the table. Individual is asked to flex i.e. causing downward pressure against the therapist shoulder with the back of the

lower leg at the same time therapist resist the individual's voluntary effort so that, slight isometric contraction of hamstrings develops, and individuals hold this for 10 sec.

After this effort, the individual is asked to exhale and relax the muscle completely. Then the therapist takes the muscle to its new restriction barrier without stretch. Starting from this new barrier, the same procedure is repeated two or three more times. Frequency of treatment once in a day for one week. Group B: ultrasound therapy with static stretching. Ultrasound therapy- Individual in prone lying position with frequency-1MHz, Intensity 2W/cm², mode continuous, area of application hamstring area, duration for 5minutes daily (two minutes for medial hamstring, two minutes for lateral hamstrings and one min for between the two tendon). Frequency of treatment once in a day for one week.

Static stretching: - static stretching with standing position. Subject performed the hamstring stretch by standing erect with the foot planted on the floor and toes pointed forward. The heel of the foot to be stretched was placed on a plinth with the toes directed towards the ceiling. The subject then flexed forward at the hip, maintaining the spine in neutral position while reaching the arm forward. The subjects continued to flex the hip until a gentle stretch was felt in the posterior thigh. Then hold this position for 30 seconds and then relax for 10 seconds and repeat the same procedure for three more times a day. Frequency of treatment once in a day for one week. Statistical tools used in this study is paired t- test and Unpaired t- test.

Statistical Tools

The following statistical tools used in this study is Paired t-test and Unpaired t-test.

Formula: Paired t-test

$$S = \sqrt{((\sum d^2 - (\sum d)^2/n)/(n-1))}$$

$$t = (d\sqrt{n})/s$$

Where,

d = difference between the pretest versus post test

d = mean difference

n = total number of subjects

S = standard deviation

RESULT

The paired 't' test was used to find out the improvement within the group. Unpaired' test was used to find out the difference between two groups.

Table-I

Paired 't' test. Pre test and post test values of group A. Group A-Muscle energy technique

S. NO	GR OUP A	ME AN	MEAN DEVIATION	STAND ARD DEVIATION	't' VAL UE
1.	Pre test	135.2	22.87	6.46	30.03
2.	Post test	158.07		4.50	

Table -II

Paired 't' Test. pretest and post test values of group B- Ultrasound therapy with static stretching.

S. NO	GR OUP B	ME AN	MEAN DEVIATION	STAND ARD DEVIATION	't' VAL UE
1.	Pre test	134.5	17.5	5.95	21.6
2.	Post test	152		5.11	

TABLE-III

UNPAIRED't' TEST

COMPARISON BETWEEN THE PRE-TEST VALUES OF GROUP A AND B

HAMSTRING FLEXIBILITY - ACTIVE KNEE EXTENSION

The comparative mean values, mean differences, standard deviation and

Unpaired' t' test values of Group A and Group B, who were treated with Muscle energy technique and Ultrasound therapy with static stretching.

S. N O	GRO UPS	ME AN	MEAN DEVIATION	STAN DARD DEVIATION	't' VA LUE
1.	Grou p A	135. 2	0.67	6.46	0.29 40
2.	Grou p B	134. 5		5.95	

TABLE-IV

UNPAIRED't' TEST

COMPARISON BETWEEN THE POST-TEST VALUES OF GROUP A AND B

HAMSTRING FLEXIBILITY - ACTIVE KNEE EXTENSION

The comparative mean values, mean differences, standard deviation and

Unpaired 't' test values of Group A and Group B, who were treated with Muscle energy technique and Ultrasound therapy with static stretching.

S. N O	GRO UPS	ME AN	MEAN DEVIATION	STAN DARD DEVIATION	't' VA LUE
1.	Grou p A	158. 07	6.07	4.50	3.53

2.	Grou p B	152		5.11	
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Paired 't' test Group A- Muscle energy technique; using paired 't' test with 14 degrees of freedom and 5% at level of significance, the calculated 't' value is 30.03 which is greater than the table 't' value 1.761. This test showed that there is a significant effect of muscle energy technique in improving the hamstring flexibility in individuals with hamstring tightness.

Group B-Ultrasound therapy with static stretching- Using paired' t' test with 14 degrees of freedom and 5% at level of significance, the calculated 't' value each is 21.6 which is greater than table 't' value 1.761, this test showed that there is a significant effect of ultrasound therapy with static stretching in improving the hamstring flexibility in individuals with hamstring tightness. Unpaired 't' test: (a) Comparing pre test values of active knee extension test between Group A and Group B Pre-test values of group A and group B is analyzed by unpaired' t' test. The calculated' t' value is 0.294 which is lesser than table 't' value 1.706 at 5% level of significance. This test showed that there is no significant difference between the effect of muscle energy technique and ultrasound therapy with static stretching in improving hamstring flexibility in individuals with hamstring tightness. (b) Comparing post test values of active knee extension test between Group A and Group B: Post test values of Group A and Group B is analysed by unpaired' t' test. The calculated 't' value each 3.53 which is greater than table value 1.701 at 5% level of significance. This test showed that there is a significant difference between the effect of muscle energy technique and ultrasound therapy with static stretching in

improving hamstring flexibility in individuals with hamstring tightness.

V. DISCUSSION

The purpose of this study was to find out the effect of muscle energy technique versus ultrasound therapy with static stretching in improving the hamstring flexibility in individuals with hamstring tightness. Thirty subjects were selected who fulfilled the predetermined inclusive and exclusive criteria. The subjects were divided into two groups 15 in each group. Group A underwent muscle energy technique and group B underwent ultrasound therapy with static stretching. Statistical analysis using unpaired t test showed that there was a significant difference between muscle energy technique and ultrasound therapy with static stretching in improving hamstring flexibility in individuals with hamstring tightness. Paired 't' test concluded that there was a significant improvement in hamstring flexibility in both muscle energy technique and ultrasound therapy with a static stretching which was supported by studies as follows. Increase in hamstring flexibility decreases overuse injuries in lower extremities (Donald E Hartig, 1999). Continuous ultrasound therapy increases soft tissue extensibility and may be an effective adjunct in the treatment of knee contracture secondary to connective tissue shortening. Ultrasound absorption is higher in tissues rich in protein like skeletal muscle. Continuous ultrasound therapy increases tendon and muscle length due to change of their viscosity and plasticity. (Folconer 1992, Dyson 1987, Low and Reed 1990). Longer hold times during stretching of hamstring muscles result in greater gains in range of motion. (Feland, 2001)

Static stretching increases muscle length by allowing muscle spindle to adapt overtime and cease firing. It also elicits Golgi tendon response and therefore provides an effective flexibility training stimulus. (Robert and Wilson, 1999). Muscle energy technique is claimed to be effective for lengthening the shortened muscles, as a lymphatic or Venous pump to aid the drainage of fluid or blood and increasing the range of motion. (Ballantyne F, Fryer G, Mc Laughlin, 2003).

Muscle energy technique produced an immediate increase in passive knee extension. This observed change is due to an increased tolerance to stretch. (Ballantyne F, Fryer G, Mc Laughlin P, 2003)

Muscle energy technique is an active, direct technique (engaging the barrier) that promotes muscle relaxation by activating the Golgi tendon reflex. (Ward, Robert C, 199)

The heating effects of continuous ultrasound may be more effective than non-thermal properties of pulsed ultrasound for increasing the flexibility of shortened hamstrings. (Shadmer.A, Astaneh. H. N, 2010)

The duration of 30 seconds of stretching is an effective time of enhancing the flexibility of the hamstring muscles. (Bandy WD, Irion JM, 1995)

Static stretching may be effective in increasing the length of muscles due to the prolonged stretching which allows the muscle spindle to adapt overtime and cease firing. (Gordon and Ghez, 1991)

VI. CONCLUSION

This study concluded that muscle energy technique is more effective than ultrasound therapy with static stretching in improving the hamstring flexibility in individuals with hamstring tightness.

Conflict of interest: There is no conflict of interest in conducting this study.

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