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Original Research Article

Comparison of Three Different Physiotherapeutic Interventions in Improving Hamstring Flexibility in Individuals with Hamstring Tightness

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ABSTRACT

Hamstring Tightness is more common and they are more prone to cause muscle strains and problems such as low back pain. Postisometric relaxation is a form of muscle energy technique which relaxes and lengthens the shortened muscle. It is a pretest and posttest experimental study design. 45 individuals were selected and divided into three groups as Group A, B and C. Each group consists of 15 patients. Group A received muscle energy technique (postisometric relaxation technique -PIR), Group B received ultrasound therapy with active static stretching, and Group C received passive static stretching. Treatment duration for all groups was once in a day, daily for two weeks. Hamstring flexibility was measured by active knee extension test. Statistical analysis was done by using one way analysis of variance (ANOVA) and student 't' test. Results of one way ANOVA showed that there was significant difference between the effects of all the three groups in improving hamstring flexibility. Unpaired t test showed that muscle energy technique (postisometric relaxation technique - PIR) produced more significant improvement than ultrasound therapy with active static stretching and passive static stretching on hamstring flexibility. This study concluded that muscle energy technique (postisometric relaxation technique - PIR) is more effective than ultrasound therapy with active static stretching and passive static stretching in improving the hamstring flexibility in individuals with hamstring tightness.

Keywords: Hamstring tightness, Muscle energy technique, Active static stretching, Passive static stretching, Active knee extension test

INTRODUCTION

Hamstring is the common muscle which undergoes for adaptive shortening when compared with other group of muscles. Hamstrings refer to the three posterior thigh muscles and its action includes hip extension and knee flexion. Flexibility has been defined as the ability of a muscle to lengthen and allows one joint or more than one joint in a series to move through a range of motion (Smith et al 2008, Sharon et al 1993). To prevent injury and its recurrence, adequate mobility of soft tissues and joints is required. (Kisner and Colby 2002). Due to immobilization of a tissue in a shortened position which in turn leads to decrease in elasticity of normal tissue, a change in the length tension relationship of the muscle and reduction of flexibility, thereby hamstring tightness occurs. Tight

hamstrings will cause reduction of muscle strength, quadriceps dysfunction during gait and postural deviation such as reduction in lumbar lordosis (Zachazewski et al 1989). Physiotherapy management for improving flexibility of hamstrings includes static stretching, ballistic stretching, Mulligan's traction straight leg raise, muscle energy technique, ultrasound therapy and short wave diathermy along with stretching exercises. These techniques were significant in improving the hamstrings flexibility. The purpose of this study is to compare the effect of muscle energy technique and ultrasound therapy with active static stretching, passive static stretching in improving the hamstring flexibility in individuals with hamstring tightness.

MATERIALS AND METHODS

In this study, a pretest and posttest experimental study design was adopted. The study was conducted at Physiotherapy Out Patient Department, KG College of Physiotherapy, Coimbatore. Normal individuals with tight hamstrings (inability to achieve greater than 160 degrees of knee extension with hip 90 degrees of flexion), age group between 18 to 25 years, both sexes were included in this study. Exclusive criteria includes individuals with acute or chronic low back pain, acute or chronic hamstring injury, soft tissue injuries around knee, pregnancy, metal implants in lower extremity, recent fracture and stiffness in lower extremity. By Simple random sampling, 45 individuals were selected and divided into three groups as Group A, B and C. Each group consists of 15 patients. Group A was given with muscle energy technique (Postisometric relaxation technique PIR), Group B was given with ultrasound therapy with active static stretching, and Group C was given with passive static stretching. Treatment duration for all the three groups was once in a day, daily for two weeks. Active knee extension test was used to measure hamstring flexibility. Data was collected before and after the treatment intervention. Statistical analysis was done by using one way analysis of variance (ANOVA) and student' 't' test and level of significance was 0.05.

Postisometric Relaxation (PIR)

With patient in supine lying, therapist stands facing the head of the table. Therapist flexes the affected hip fully and then extends the flexed knee with the back of lower leg resting on his/her shoulder. Ask the individual to flex the knee ie. applying downward pressure against the therapists shoulder with back of lower leg and at the same time therapist resist the individual voluntary effort so that, slight isometric contraction of hamstrings develops. Hold this contraction for 10 seconds, after this effort, the individual is asked to exhale and relax the muscle completely. Then therapist takes the muscle to its new restriction barrier without stretch. Starting from its new barrier, the same procedure is repeated two or three more times.

ULTRASOUND THERAPY WITH ACTIVE STATIC STRETCHING

Ultrasound therapy:

With individual in prone lying, ultrasound therapy with frequency of 1 MHZ, continuous mode, intensity of 2 W/cm^2 for the duration of 5 minutes was given over the hamstring area.

Active static stretching:

Individual was asked to perform the hamstring stretch by standing erect with foot planted on the floor and toes pointing forward. The heel of the foot to be stretched is placed on a plinth with toes directed towards ceiling. Individual then flexed forward at the hip, maintaining the spine in neutral position while reaching the arms forward. Individual is continued to flex the hip until a gentle stretch is 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.

Passive Static Stretching

With patent in supine lying, individual was asked to relax, and therapist flexed the individual's hip and extended their knee until the point of maximum stretch tolerance of their hamstring muscle. This was held for 30 seconds and then placed back into a neutral position.

RESULTS

Table 1 shows the results of one way ANOVA for pretest values of hamstring flexibility (active knee extension) between and within all groups.

Source of variations	Sum of squares	Degrees of freedom	Mean squares	F ratio
Between groups	4.044	2	2.022	0.1465
Errors	579.7	42	13.80	
Total	583.8	44		

Table 2 shows the results of one way ANOVA for posttest values of hamstring flexibility (active knee extension test) between and within all groups.

Source of variations	Sum of squares	Degrees of freedom	Mean squares	F ratio
Between groups	354.2	2	177.1	11.98
Errors	620.8	42	14.78	
Total	975.0	44		

Table 3 shows the results of unpaired t test for posttest values of hamstring flexibility (active knee extension test) of all three groups

Groups	Posttest values		Unpaired t value
	Mean	SD	
Group A	150	2.71	3.01
Group B	146	3.75	
Group B	146	3.75	2.04
Group C	143	4.79	
Group A	150	2.71	4.83
Group C	143	4.79	

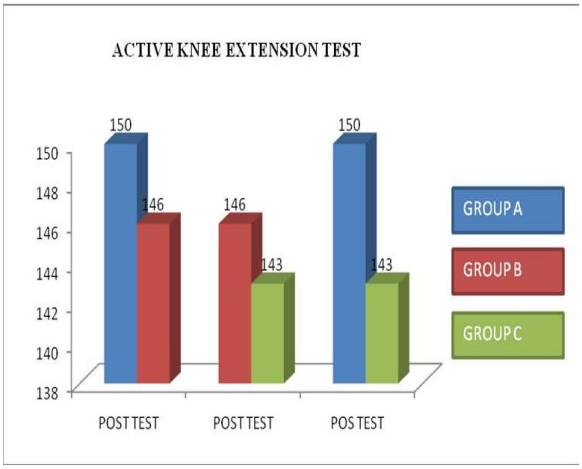

Figure 1 shows the results of unpaired t test for posttest values of hamstring flexibility (active knee extension test) of all three groups (Group A vs B, Group B vs C, Group A vs C).

Table 4 shows the results of paired t test for pretest and posttest values of hamstring flexibility (active knee extension test) of all three groups.

Groups	Pretest		Posttest		Paired t value
	Mean	SD	Mean	SD	
Group A	134	3.67	150	2.71	21.0
Group B	133	4.03	146	3.75	15.6
Group C	134	3.42	143	4.79	11.8

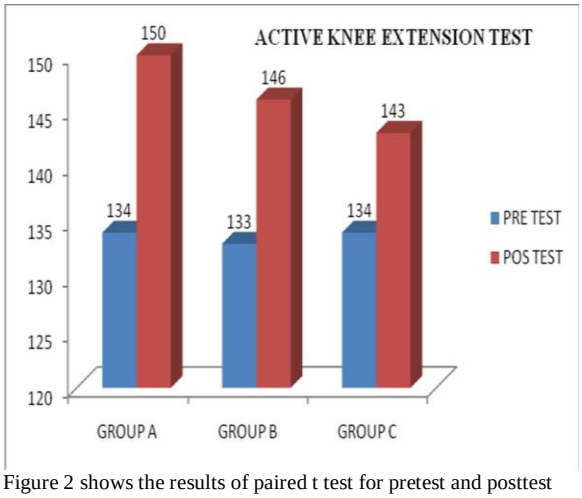

Figure 2 shows the results of paired t test for pretest and posttest values of hamstring flexibility (active knee extension test) of all three groups.

DISCUSSION

This study was done to compare the effect of three physiotherapeutic interventions in improving hamstring flexibility in individuals with hamstring tightness. In this study, physiotherapeutic interventions such as muscle energy technique (postisometric relaxation PIR), ultrasound therapy with active static stretching and passive static stretching were compared for their effectiveness on hamstring flexibility. Group A received muslce energy technique (postisometric relaxation technique PIR), Group B received ultrasound therapy with active static stretching, and Group C received passive static stretching. One way ANOVA for pretest values showed that there was no significant difference between and within the three groups, where one way ANOVA for posttest values showed that there was significant difference between and within the three groups in improving hamstring flexibility in individuals with hamstrings tightness. In Paired 't' test, muscle energy technique (postisometric relaxation – PIR), ultrasound therapy with active static stretching and passive static stretching showed significant effect in improving hamstring flexibility in individuals with hamstring tightness. When comparing the posttest values of group A and B by using unpaired't' test, the results showed that there was significant difference between the effect of group A and B in improving hamstring flexibility. So muscle energy technique is better than ultrasound therapy with static stretching in improving hamstring flexibility in individuals with hamstrings tightness. This is due to effect of muscle energy technique which uses the principles of neurophysiology inorder to relax overactive muscles and / or stretch chronically shortened muscles (Chaitow L 1991, 1997, Evjenth O 1984, Holt LE 1976). In case of autogenic inhibition after a muscle contracts, it is automatically in a relaxed state for a brief latent period. Following muscle energy technique, measurements of the Hoffman reflex (representative of the excitability of the alpha motor neuron pool) showed that activity is decreased for 25 to 30 seconds but in case of inhibition from static stretching lasts only for 3 to 5 seconds. These effects are neurophysiologically mediated (Chaitow L 1997, 1991, Lewit K 1985, 1984, Liebenson CL 1990, 1989). An increase in flexibility after muscle energy technique (MET) occurred due to biomechanical or neuro-physiological changes or due to an increase in tolerance to stretching (Freyer et al 2000, Richard et al 1993). When comparing the posttest values of group B and C by using unpaired 't' test, the results showed that there was significant difference between the effect of group B and C. Therefore ultrasound therapy with active static stretching is better than passive static stretching in improving hamstring flexibility in individuals with hamstrings tightness.

Mechanical and physical characteristics of tissues are influenced by the elevation of collagen tissue temperature thereby facilitates deformation of the collagen. Thus, pain and discomfort was reduced during stretching and collagen fiber ability to tolerate greater forces was increased (Coakley 1978). Ultrasound therapy and 30 sec stretch were greater than ultrasound and 15 sec stretch in improving passive knee extension in subjects with tight hamstrings (Akbari et al 2006). Active stretching showed greater gain in hamstring flexibility than passive static stretching group(Meroni et al 2010).

When comparing the posttest values of group A and C by using unpaired't' test, the results showed that there was significant difference between the effect of group A and C in improving hamstring flexibility. Therefore muscle energy technique is better than passive static stretching in improving hamstring flexibility in individuals with

hamstrings tightness. Muscle energy technique has been shown to improve muscle extensibility than passive static stretching both in the short and long term (Feland et al 2001, Ferber et al 2002, Mehta et al 2002).Post isometric relaxation may principally be a biomechanical event in which a combination of viscoelastic creep and plastic change in parallel and series connective tissue elements of the muscle may occur and these changes were above and beyond that obtained by passive stretch (Fryer 2000).

Passive static stretching fires the golgi tendon organ and inhibits the tension in the muscle, allowing the parallel elastic component (the sarcomere) of the muscle to lengthen. Where the ultrasound therapy with active static stretching elevates the collagen tissue temperature and increases the extensibility of the soft tissues. Following muscle energy technique, alpha motor neuron pool excitability was decreased for 25 to 30 seconds during which the muscle can be stretched or taken to new restriction barrier but in case of static stretching, it lasts only for 3 to 5 seconds. Therefore in muscle energy technique an increase in muscle length may be due to biomechanical event, neurophysiological changes, and increase in tolerance to stretching.

CONCLUSION

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

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