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IMMEDIATE EFFECT OF MUSCLE ENERGY TECHNIQUE VERSUS CYCLIC STRETCHING TECHNIQUE ON HAMSTRING TIGHTNESS IN COLLEGE-GOING STUDENTS WITHIN AGE GROUP 18-25 YEARS: A COMPARATIVE STUDY

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ABSTRACT

Aim and Objective: The aim of this study was to compare the immediate effect of muscle energy technique and cyclic stretching technique on hamstring tightness in college going students within age group 18-25 years.

Methods: A comparative study was conducted on 64 college going students within age group 18-25 years. Subjects were selected according to inclusion criteria & exclusion criteria. The pre assessment was taken before intervention & post assessment was taken immediately after intervention by using Active knee extension test (AKET). Participants were randomly divided into two groups with n=32 in each group. Group A received Muscle Energy Technique while Group B received Cyclic Stretching Technique. Statistical analysis was carried out using paired & unpaired t test.

Results: Muscle energy technique and cyclic stretching technique was effective on improving AKET in college-going students. On intergroup comparison using unpaired t test, there was no significant difference between effect of Muscle energy technique & Cyclic stretching technique, which implies both techniques were equally effective on improving AKET in college-going students.

Conclusion: Muscle Energy Technique and Cyclic Stretching Technique were equally effective in improving hamstring flexibility in college-going students within age group 18-25 years with hamstring tightness.

Keywords: Hamstring tightness, Muscle energy technique, cyclic stretching technique, active knee extension test, college-going students.

INTRODUCTION

Tightness is adaptive shortening of the contractile and non-contractile elements of muscle.[1] Flexibility is an important component of physical conditioning related to muscle strength and endurance.[2,3] A tightened muscle may create imbalance in joints and faulty postural alignments that may results in joint dysfunction and injury.[4,5] Decrease in muscular flexibility and overuse of muscle may lead to decreased in functional level and also cause damage to skeletal system. Large functional exertion and high percentage of fast twitch fibres in multi joint muscle make it more prone to such damage.[6,7,8]

Hamstring muscles includes group of muscles semitendinosus, Semimembranosus, long head of biceps femoris and ischial head of adductor magnus. Which originate from ischial tuberosity and inserted at one of the bones of leg.[9] Hamstring is two joint muscle, so it helps in knee flexion and hip extension[10]. The hip should be fully flexed with knee fully extended to fully stretch the muscle. Stretching or full contraction of hamstring rarely occurred in normal day to day activity. As this mostly seen in individual who regularly do not do stretching there is possibility that it may result in tightness.[11]

Tightness of hamstring muscle causes posterior pelvic tilt which lead to decrease in lumbar lordosis result in low back pain.[12] The more the tightness of hamstring muscles higher the severity of low back pain patient experienced.[13,14] Tightness of muscle also affect length - tension relationship of muscle and shock absorbing ability of the limb. Decrease flexibility generates a vicious cycle of range reduction and cause increase in postural problems. Optimal performance also decreased as tight muscles compress the blood vessels.[15] The length of hamstring

muscles is very essential to maintain effectiveness and efficiency of fundamental human movements like walking and running.[16] Hamstring tightness may lead to prolonged forefoot loading and be a factor that increased repetitive injury to plantar fascia with the windlass mechanism.[17]

The prevalence of hamstring tightness is high among age group of 18-25 years.[18] Long hours of sitting results in altered length of soft tissues.[19] College student have most time sitting posture in daily life and long duration sitting can be lead to hamstring tightness.[20] There are different methods to lengthened short hamstring muscle like passive stretching, foam roller, mulligan traction, straight leg raises, PNF stretching technique, self-myofascial release and retro walking.

Muscle energy techniques (MET) are a form of soft tissue or joint, manipulation or mobilizations.[21] Osteopathic physician, Fred Mitchell, Sr. developed muscle energy technique. MET was refined and systematized by Fred Mitchell Jr, and has continued to evolve with different researchers' contribution. MET has been used for the treatment of weakened muscles, shortened muscles, pain relief, restricted joints and lymphatic drainage. MET is considered by some as biomechanics- based analytic diagnostic system that includes accurate physical diagnosis evaluation procedure to identify and qualify joint range of motion restriction.[22,23] Post isometric relaxation is a type of MET which include isometric contraction and relaxation of muscle.

A cyclic or intermittent stretch is described as a relatively transient stretch force which is gradually applied, released and then reapplied in repeated manner. During single treatment sessions cyclic stretching, by its very nature, is applied for multiple repetitions (stretch cycle). Cyclic stretching is not similar to ballistic stretching because in cyclic stretching the end range stretch force is applied at low intensity, at moderate velocity and in a controlled manner. The ballistic stretching is characterized by high velocity movements. There have been few studies on cyclic or intermittent stretching, in which cyclic stretching effective to increase flexibility as effectively as or more effectively than static stretching. However, there is limited research available to show significant impact of cyclic stretching on hamstring tightness.[24,1]

Therefore, this study was undertaken to compare the effects of MET and cyclic stretching on hamstring tightness.

NEED OF STUDY

The muscle energy technique has been compared with several other stretching techniques and has been proven to be more effective in lengthening hamstring muscles. Similarly, cyclic stretching technique proven to be same or more effective with other stretching techniques. But there is no study comparing immediate effect of muscle energy technique and cyclic stretching on hamstring tightness. Also, there is no study about immediate effect of cyclic stretching. So, now the question centre's on, which method lengthens tight structures to maximum limit after intervention immediately. So, this study was conducted to see which technique (i.e., MET or cyclic stretching) is more effective to increase hamstring muscle flexibility on college going students with hamstring tightness of age group 18-25 years.

AIM

To compare the immediate effect of muscle energy technique and cyclic stretching technique on hamstring tightness in college going students within age group 18-25 years.

OBJECTIVES

1) To evaluate the immediate effect of muscle energy technique on hamstring tightness in college going students within age group 18-25 years.

2) To evaluate the immediate effect of cyclic stretching technique on hamstring tightness in college going students within age group 18-25 years.

3) To compare the immediate effect of muscle energy technique and cyclic stretching technique on hamstring tightness in college going students within age group 18-25 years.

MATERIALS AND METHODOLOGY

The comparative study was done at Dr. Ulhas Patil College of Physiotherapy, Jalgaon. The study duration was 6 months and study population include college going students both males and females of age group 18-25 years. Sample size of the study was 64 and method of sampling used was simple random sampling using chit method. Materials used were goniometer, stabilizing belt, treatment couch, pen and patient evaluation sheet.

Inclusion criteria

1) Age group between 18-25 years
2) Both males and females
3) Bilateral hamstring tightness with active knee extension lag 20^0 or more.
4) Willingness of subject to participate in study.

Exclusion criteria

1) Recent muscle tendon injury of hamstring.
2) Low back pain.
3) History of any recent fracture or surgery of lower limb.
4) Knee joint pain or hypermobility.
5) Patients with any neurological disorder.
6) Any pathology around lumbar spine, hip, knee region.

Outcome Measures

Active Knee Extension Test (AKET)[25] – Subject was in supine lying position with non-testing side lower limb stabilized at knee with stabilizing belt. The hip of testing side was in 90^0 flexion using goniometer and subject is asked to self-stabilized hip at 90^0. Then subject actively extends the knee as far as possible (no verbal encouragement was given by the researcher). The greater trochanter, lateral epicondyle of the femur, and lateral malleolus were used as landmarks for the measurement and marked with a permanent marker to assure consistent measurement. Subjects having extension lag of 20^0 or more selected.

Fig. 1: AKET

PROCEDURE

1) Ethical clearance was taken from the ethical committee of Dr. Ulhas Patil College of Physiotherapy, Jalgaon prior to the commencement of the study.
2) Subject were screened as per inclusion and exclusion criteria. The aim of the study, its objective and procedure were explained to participant.
3) A written informed consent form was obtained from subjects who are willing to participate.
4) Selected participants demographics details outcome measure was recorded.
5) Then '64' subjects were divided in 2 groups group A and group B by simple random sampling by using chit method. 32 subjects were included in each group. Group A was given muscle energy technique and Group B was taught cyclic stretching technique.
6) Pre and immediate post intervention assessment was taken using active knee extension test (AKET).

INTERVENTION PROTOCOL

Group A - Muscle energy technique (n=32)

1) The subject was in supine lying on a couch. Therapist standing beside the side on which MET was applied to subject at the foot end of subject with one leg kneeling on couch.
2) The muscle energy technique was applied to the experimental group by using post isometric relaxation.
3) The non-treated leg of subject needed to be straight on the table. This side knee stabilized in extension with stabilization belt.
4) The treated leg of subject was passively flexed at hip and extended at knee to the position up to the barrier point.
5) Then the subject was asked to flexed knee against therapist resistance starting slowly and with minimal isometric contraction (approx. 20% of available strength) of the hamstring muscle. The degree of efforts should be mild and no pain should be felt.
6) The contraction was held for period of 7 to 10 seconds, by placing heel of subject on therapist`s shoulder.
7) After use of the isometric contraction (which induces post isometric relaxation PIR in the previously contracted tissues). The subject was asked to breathe in and out, and to completely relax, and as subject exhaled, the limb is gently guided to the new resistance barrier, where bind was once more sensed. The procedure was repeated at new resistance barrier.
8) The technique was then repeated for three times.

Fig. 2: MET

Fig. 3: Cyclic stretching

Group B - Cyclic stretching technique (n=32)

1) Subject was supine lying on a couch. Therapist was in walk standing position.
2) Therapist support the patient's lower leg with one arm or shoulder with patient's knee fully extended.
3) Stabilization of opposite extremity knee in extension with stabilization belt.
4) The limb to be treated was flexed at hip to 90° and then extended at knee till the tolerable limit. It was held in this position for 30 seconds (critically comfortable period of time for muscle stretching).
5) The procedure was repeated 3 times by increasing the knee extension angle gradually.

STATISTICAL ANALYSIS

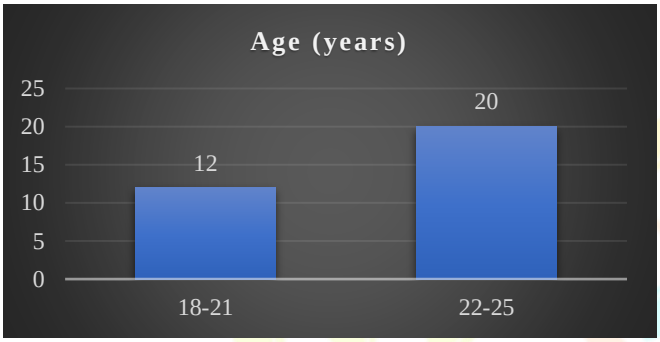
The data was collected, analysed and was entered in Microsoft excel 2021. Statistical analysis was done using GraphPad InStat version 3.05 software. The statistical analysis was done using paired and unpaired t-test. Paired t-test was used for statistical analysis to compare pre and immediate post intervention values within group. The unpaired t-test was used for between groups statistical analysis to compare pre and immediate post intervention difference values of both the groups. Statistical significance was set at $p>0.10$

RESULT

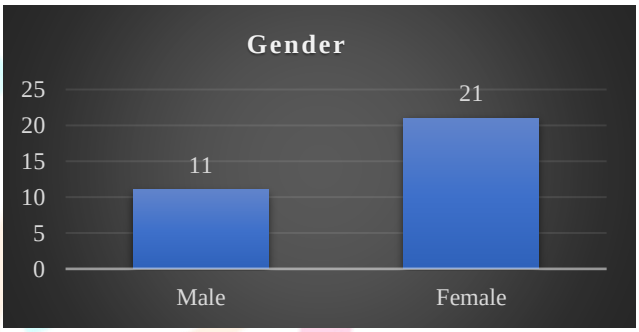
The present study included 64 subjects with hamstring muscle tightness within age group of 18-25 years who met the inclusion criteria. The subjects given intervention. The outcome measures were assessed pre and immediate post intervention.

Sr no	Variables	Group	Frequency	Percentage
1	Age	18-21	12	37.5
		22-25	20	62.5
2	Gender	Male	11	34.4
		Female	21	65.6

TABLE 1: Baselines characteristics for group A (MET)



GRAPH 1: Age group Distribution

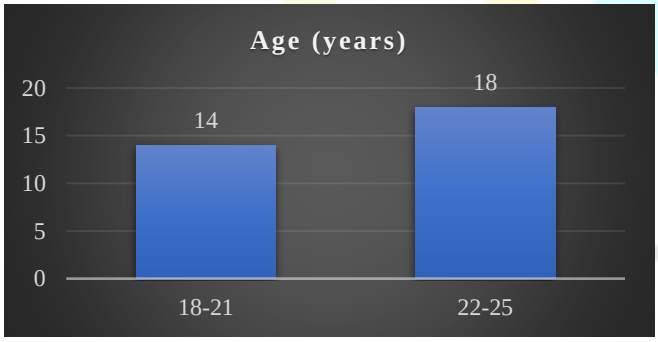


GRAPH 2: Gender distribution

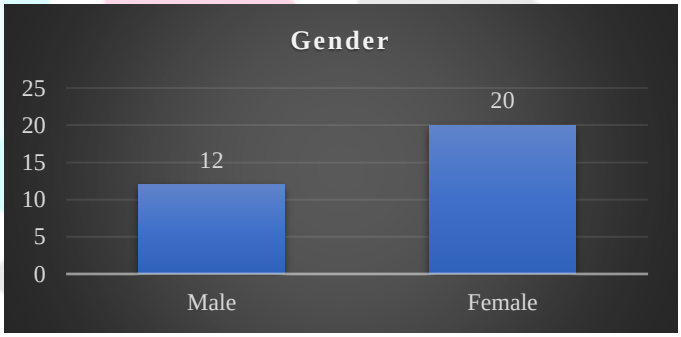
Interpretation - Table 1 depicts the frequency of AGE and GENDER of the participants for Group A MET. The age group was divided into two groups, 18-21 years and 22-25 years. The frequency of 18-21 group was 12 and frequency of another group was 20. Frequency of gender distribution for male was 11 and for female 21. Graph 1&2 depicts age and gender wise distribution.

Sr. No.	Variables	Group	Frequency	Percentage
1	Age	18-21	14	43.75
		22-25	18	56.25
2	Gender	Male	12	37.50
		Female	20	62.50

TABLE 2: Baselines characteristics for group B (Cyclic stretching)



Graph 3: Age group Distribution

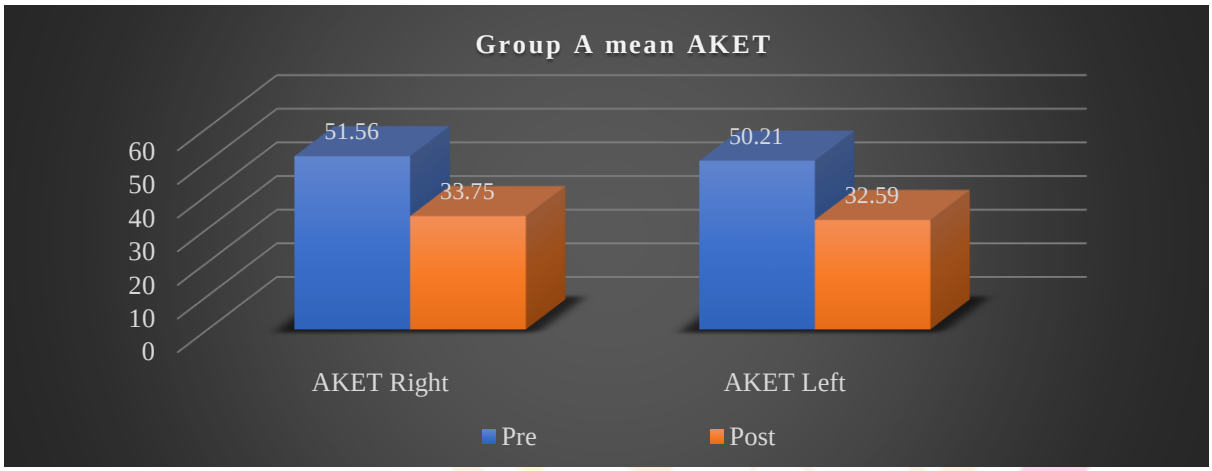


Graph 4: Gender distribution

Interpretation- Table 2 depicts the frequency of AGE and GENDER of the participants for Group B. The age group was divided into two groups, 18-21 years and 22-25 years. The frequency of 18-21 group was 14 and frequency of another group was 18. Frequency of gender distribution for male was 12 and for female was 20. Graph 3&4 depicts age and gender distribution.

AKET		Mean ± Std. Deviation	P value	T value	significance
Right	Pre	51.563 ± 9.715	<0.0001	18.488	Extremely significance
	Post	33.750 ± 9.102			
Left	Pre	50.218 ± 7.889	<0.0001	17.420	Extremely significance
	Post	32.593 ± 9.308			

Table 3: Intra group comparison of pre and immediate post value of AKET in group A (MET)

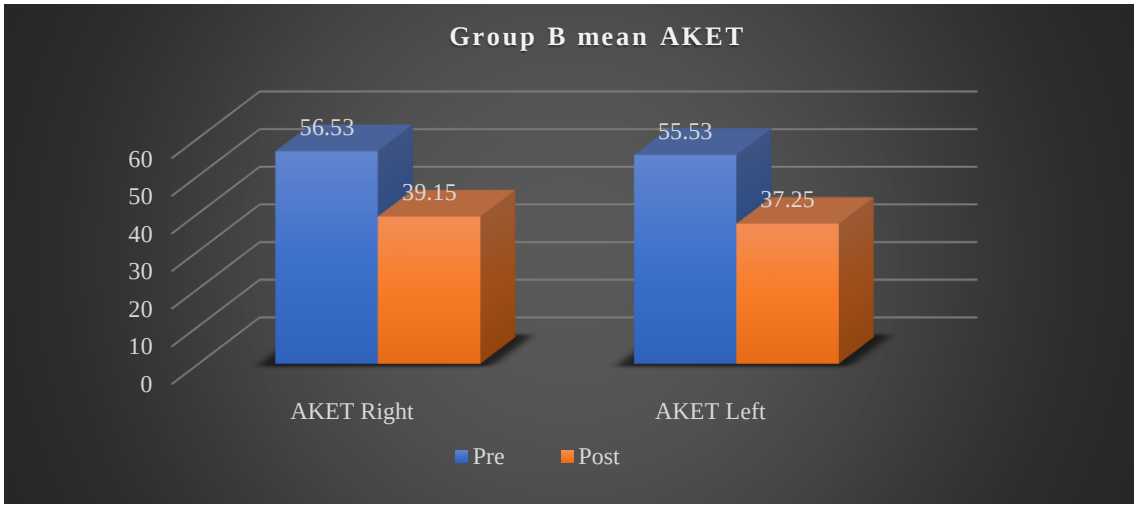


Graph 5

Interpretation - Table 3 and graph 5 depicts the intra group comparison of pre and immediate post value of AKET in group A (MET). Pre data of right-side AKET mean was 51.56 with SD 9.71; when it was compared with immediate post intervention mean 33.75 with SD 9.102, the obtained p value was <0.0001 which represents there was significant improvement in AKET value after intervention. Same result was obtained for the left side.

AKET		Mean ± Std. Deviation	P value	T value	significance
Right	Pre	56.531± 11.573	<0.0001	18.932	Extremely significance
	Post	39.156 ± 11.704			
Left	Pre	55.438 ± 8.769	<0.0001	20.242	Extremely significance
	Post	37.250 ± 8.955			

Table 4: Intra group comparison of pre and immediate post value of AKET in group B (Cyclic stretching)

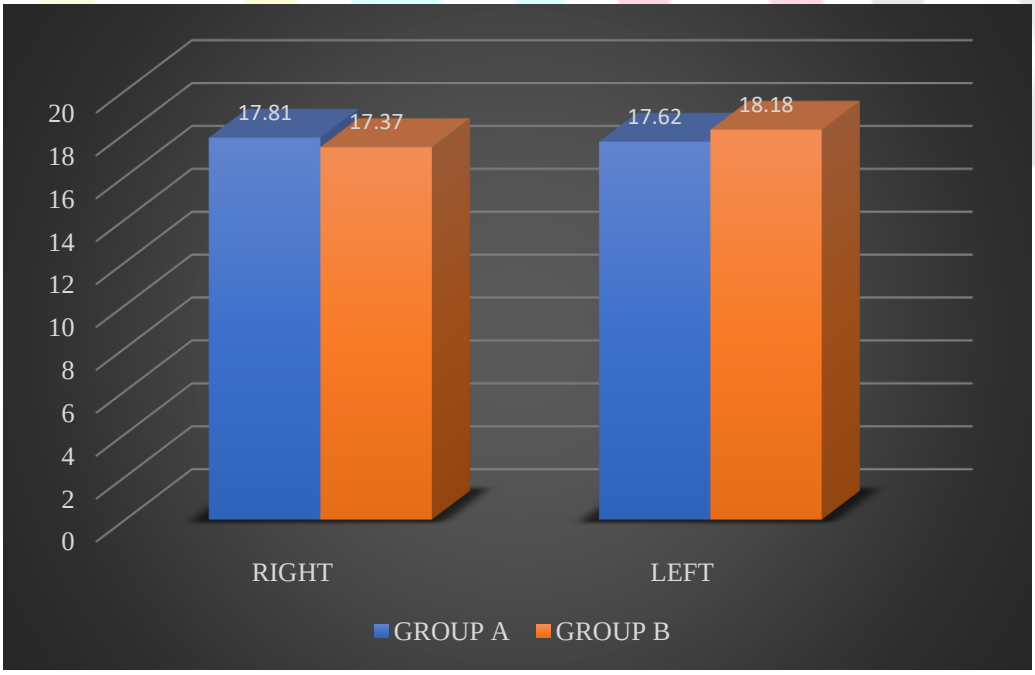


Graph 6

Interpretation- Table 4 and graph 6 depicts intra group comparison of pre and immediate post value of AKET in group B (cyclic stretching). Pre data of right-side AKET mean was 56.57 with SD 11.75; when it compared with immediate post intervention mean 39.15 with SD 11.704, the obtained p value was <0.0001 which showed that there was significant improvement in AKET value after intervention. Same result was obtained for the left side.

Mean Difference of pre and post AKET		Mean ± Std. Deviation	P value	T value	significance
Right	Group A	17.812 ± 5.450	0.743	0.328	Not significant
	Group B	17.375 ± 5.191			
Left	Group A	17.625 ± 5.723	0.679	0.415	Not significant
	Group B	18.187 ± 5.083			

Table5: Inter group comparison of the mean of difference between pre and immediate post intervention AKET value in group A (MET) and group B (Cyclic Stretching)



Graph 7

Interpretation- Table 5 and graph 7 depicts between group comparison of mean of difference between pre and immediate post intervention AKET value of group A (MET) and group B (Cyclic stretching). Analysis using unpaired t-test showed that comparison of right-side group A and group B was statistically not significant with p value 0.743. For left side intra group comparison was statistically not significant with p-value 0.679. which indicates that both the intervention techniques have equal effects on hamstring tightness.

DISCUSSION

This study was designed to compare the immediate effect of muscle energy technique and cyclic stretching technique on hamstring tightness in college going students. This study proved the efficacy of muscle energy technique and cyclic stretching technique on hamstring tightness by improving active knee extension range. In comparison, of both these techniques for their immediate effectiveness, it was found that both the techniques were equally effective in reducing the hamstring tightness.

In this study, subjects showed significant increase in hamstring flexibility after performing Muscle energy technique and Cyclic stretching technique. As the mean pre-AKET score for Group A was 51.56 and 50.21 for right and left respectively which later reduced to 33.75 and 32.59 respectively, with p value <0.0001. Similar results were found in Group B participants as the mean pre-AKET score was 56.53 and 55.43 for right and left leg respectively which later reduced to 39.15 and 37.25 respectively with p value <0.0001. When comparing between groups the study was statistically not significant which shows equal effect of both techniques on hamstring tightness with p value 0.74 and 0.67 for right and left side respectively. Hence, the study accepts null hypothesis.

MET have an inhibitory effect on motor activity by activation of the muscle spindle and Golgi tendon organs. During post-isometric relaxation of the muscle the afferent nerve impulses entering the dorsal route linked up with the inhibitory motor neuron inhibiting the efferent motor neuron impulse discharge, thus preventing further contraction and decreasing the tone of muscle. This resulted in the relaxation of the agonist's muscle. During this period due to reduced tone, lengthening becomes easier. Kuchera et al. in a study supported similar reasons for MET effectiveness.[26]

A study conducted by Sajal Sailor et al. on comparison of effect of muscle energy technique and position release technique on hamstring flexibility in healthy individuals showed that there was an improvement in hamstring flexibility in AKE and SLR in MET group was more than PRT group. Which might be due to increase in muscle length by a combined effect of creep which is temporary lengthening of the connective tissue during the stretch period (viscoelastic property) and plastic change in connective tissue.[27]

According to the study conducted by Rupa Patel et al. the MET was effective in increasing hamstring have flexibility which could occurred due to neurophysiological factor (changes to stretch tolerance) and mechanical factors (plastic and viscoelastic changes in the connective tissue elements of the muscle).[8]

Cyclic stretching involves short duration stretch force with slow velocity and low intensity that repeatedly applied, release and then reapplied. During stretching the Golgi tendon organ, controlling tension resulting from stretch of a muscle-tendon unit, which resulted in muscle lengthening by interfering with any assisting impulses from primary afferents of the muscle spindle (type 1a afferent fibres) and contribute to muscle relaxation by inhibiting tension in the contractile unit of the muscle being stretch.[1]

A study conducted by Deborah Turner Starring et al. (2018) to compare the effect of cyclic and sustained passive stretching to increase resting length hamstring muscles. The study concluded that cyclic stretching group show significant increase in resting length of hamstring muscles (p value <0.001). The increment in hamstring muscle extensibility because of stretching protocol may create a reduction in muscle spindle activity. This could be due to changes in the hamstring muscle sensitivity to stretch or the inherent resting state of the contractile elements.[28]

A study conducted by S. P. Magnusson et al. to study a biomechanical evaluation of cyclic and static stretch in human skeletal muscle shows that 10 mins after cyclic stretch there was an increase in joint range of motion with a concomitant increase in load on the muscle-tendon unit suggesting elevated stretch tolerance which proven to determine flexibility.[29]

As this study proved the immediate effect of both intervention techniques. Further research can be incorporated to study the long-term results of such intervention on hamstring tightness subjects to improved hamstring flexibility.

CONCLUSION

This study concluded that a single session of both the muscle energy technique and cyclic stretching technique was equally effective on hamstring tightness. By improving hamstring flexibility as expressed by improvement in active knee extension test. Thus, both of these techniques can be used further for improving hamstring muscle flexibility immediately after the application.

CLINICAL IMPLICATION

Both the techniques MET and Cyclic stretching can be individually used in patients with hamstring tightness to give immediate effect.

LIMITATIONS

1) Long term follow-up effect was not monitored.
2) Unequal distribution of gender.

FUTURE SCOPE

1) Study can be done for a longer duration.
2) Further study should be done on the different age groups to evaluate age-wise those techniques' effectiveness on muscle tightness.
3) This study should be further carried out in the athletic population.

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