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Compare the effectiveness of static stretching and muscle energy technique on hamstring tightness among student population

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Abstract
Purpose: The objective of this study is to compare the effectiveness of Static stretching and muscle energy technique on hamstring tightness among student population.
Methods: 100 subjects were assessed for hamstring tightness and only 60 were recruited who are willing to who later were randomly allocated into two groups. Group A (n=30) received Static stretching, where as Group B (n=30) subjects received muscle energy technique. Outcomes used were AKE and Sit & Reach
Results: Statistical analysis of the data revealed that in within group comparison both group showed significant improvement for all parameters whereas in between group comparison showed there is significant improvement at 3rd week itself and highly significant at 4th week in between groups. Post Hoc analysis reported that MET has significant change in first week itself.
Conclusion: It was concluded that static stretching and muscle energy technique is more effective in improving flexibility of hamstrings in a week.

Keywords: hamstring tightness, ROM, AKE, static stretching, MET

1. Introduction
Flexibility is operationally defined to the total range of motion (ROM) around a joint which largely depend on the structural characteristics and mechanical properties of the connective tissue surrounding them [1]. This operational definition is commonly used in the literature because joint ROM depends on muscle flexibility [2]. However, peri articular connective tissue and arthrokinematics around the joint may contribute to ROM [3]. Structural Changes in muscle length alters the optimal point at which a muscle generates tension [4]. Therefore, any modifications in the joint angle in which a muscle produces maximal torque (peak torque angle) could be used to infer about changes in muscle length. These changes may lead to biomechanical alterations in posture and other effects on body posture. Reduced flexibility of muscle not only leads to functional levels but acts a source for overuse injury [5, 6, 7].
On order to overcome these possible biomechanical changes, Stretching is commonly used to enhance internal changes in muscle length [8]. Many stretching programs were effective in increasing joint ROM [9]. However, the effects seem to be due to muscle viscoleastic behaviour [2, 10]. Few variations in stretching were frequently used in restoring flexibility of tissues. Static type of stretch is one of them. According to D. Scott *et al.*, this type of stretching is a manovour that involve slow and controlled elongation of the muscle group through full ROM. This type of stretching is particularly used in athletic training to induce flexibility. On the other side to flexibility of muscle energy technique is also utilised by many researchers and physiotherapies in sports and etc [11].
Muscle energy technique (MET) was developed by Fred Mitchell. Sr and Jr which use voluntary contraction of the muscle by precisely controlled position in a specific direction, against a distinctly executed counterforce. Magnouson *et al.* and Hablertsma *et al.* demonstrated increased muscle extensibility after Met due to the viscoleastic changes in the muscle [11]. This change in extensibility is attributed to stretch tolerance. Hohns and Wright have demonstrated that there must be passive torque to move a joint to new ROM.
The objective of the study is to compare changes in Hamstrings flexibility using static stretching and Muscle energy technique.

2. Materials & Methods
Inclusion criteria: Individuals between 18-22 years with lack of flexibility in hamstrings were included in this study. Exclusion criteria are any pathology to low back or SI joints.
This study was conducted in GSL Hospital campus, Rajahmundry. A total of 100 participants were assessed for hamstring tightness using active knee extension test and Sit and reach tests. A total of 60 asymptomatic men age group ranging 18-22 were recruited from various departments.

2.1 Study design: Observational study

2.2 Study period: 4 Weeks

2.3 Randomisation: Concealed block method.

Table 1

Group	No. Of Participants	Treatment
Group A	30	Static Stretching
Group B	30	MET

Procedure

Participants were explained of the procedure and an informed consent was taken from everyone included in the study. Base line values were taken at the beginning of the study using Active knee extension ROM and Sit & Reach test.

2.4 Active knee extension ROM

Two therapists were involved one holding the limb but Measurement was performed by Primary investigator. The participant was requested to lay supine on a couch with the non-testing limb and pelvis strapped to the plinth for stabilisation. The leg to be tested was positioned on 90 degree hip and knee flexion. Hip flexion was maintained by the second therapist, universal goniometer was placed such a way that fulcrum was centred over the lateral condoyle of femur fixed arm secured along femur shaft; movable arm was aligned parallel to lateral malleoli of ankle. Participant was asked to extend the knee as much as possible until a mild stretch was felt over posterior knee. This procedure was repeated 3 times and the average was taken for analysis [12].

2.5 Sit and Reach test

Modified sit and reach protocol was used in this. Participant assumes a sitting position with head, back against wall and the foot against sit and reach box. A yard scale with 0-90 cm reading was placed on the box. The subject was instructed to place his hands on the scale and reach forward as much as possible. Reading was recorded after the participant does 3 attempts of toughing as far as they can by reaching forward on the box [13].

2.6 Static stretching group

Participants was instructed to lay supine on a couch and the therapist passively positioned the limb into straight leg raise position with hip in flexion, knee in extension and ankle neutral without pain or discomfort for participant. The position was then maintained for 30 seconds. This technique was then repeated four times with a 30 second rest interval in between [14].This stretch is given thrice a week for four weeks.

2.7 Muscle energy technique

Participants in this group received Post Isometric relaxation (PIR) of MET as intervention. The participant was instructed to be in supine lying position with the subjects hip passively flexed and knee extended until the primary resistance was felt by the therapist. The participant was then instructed to isometric all contract with 50% of Maximal voluntary contraction by flexing knee for 8-10 seconds. This was followed by 30 second passive knee extension by the therapist. This procedure was repeated 4 times with 30 second rest interval between each [15]. This stretch is given thrice a week for four weeks.

3. Statistical Analysis

Statistical analysis of the present study was done by using IBM SPSS software version 21 and manually. For analysis of primary outcome, student t test (independent) were used to find out the significance in between groups and ANOVA (one way) and post hoc analysis were used to find out the significance within the group. Then for analysis of secondary outcome (SIT & REACH), student t test (independent) were used to find out the significance in between groups student t test (independent) were used to find out the significance within the group.

4. Results

The results of this study were analyzed in terms of increased range of motion and improved hamstring flexibility on AKE-ROM using universal goniometer and Sit & Reach test respectively.

Comparison was done both within each group(within group) as well as in between the two groups(between groups), so as to evaluate the intra group and inter group effectiveness of static stretching and muscle energy technique which are under considerations in the present study.

Table 2: mean changes in AKE-ROM component (with in Groups)

Knee ROM	Group A		Group B	
	Mean	SD	Mean	SD
Pre Test	51.00	8.749	55.00	7.598
Post Test 1	55.00	8.749	59.50	7.450
Post Test 2	58.70	8.738	63.80	7.117
Post Test 3	71.10	7.184	76.50	5.444
Post Test 4	76.20	6.835	82.50	4.369

Table 2: Multiple comparisons of AKE-ROM component (with in Group- A)

(I) Group A	(J) Group A	P value
0	1	.058
	2	.000
	3	.000
	4	.000
1	0	.058
	2	.079
	3	.000
	4	.000
2	0	.000
	1	.079
	3	.000
	4	.000
3	0	.000
	1	.000
	2	.000
	4	.016
4	0	.000
	1	.000
	2	.000
	3	.016

*. The mean difference is significant at the 0.05 level.

Table 3: Multiple comparisons of AKE-ROM component (with in Group- B)

(I) Group B	(J) Group B	P value
0	1	.008
	2	.000
	3	.000
	4	.000
1	0	.008
	2	.012
	3	.000
	4	.000
2	0	.000
	1	.012
	3	.000
	4	.000
3	0	.000
	1	.000
	2	.000
	4	.000
4	0	.000
	1	.000
	2	.000
	3	.000

*. The mean difference is significant at the 0.05 level.

Table 4: Mean changes in AKE-ROM component (between group A & B)

ROM	Group	p value
Pre test	SS	.064
	MET	.064
Post test Week 1	SS	.036
	MET	.036
Post test Week 2	SS	.016
	MET	.016
Post test Week 3	SS	.002
	MET	.002
Post test Week 4	SS	.000
	MET	.000

Table 5: mean changes in sit & reach test component (with in groups)

Group	Pre test		Post test		p-value
	mean	SD	mean	SD	
Group A	26.13	1.432	36.00	1.486	.000
Group B	26.60	1.429	37.60	1.812	.000

Table 6: mean changes in sit & reach test component (between group A & B)

Group	Post test mean	SD	p-value
SS	36.00	1.486	.000
MET	37.60	1.812	.000

5. Discussion

Group A which received static stretching had a significant change in AKE-ROM and Sit & Reach test with a p value of 0.000. Marcelo Tavella Navega *et al.* (2014) who concluded a study had reported the same findings that static stretching is effective in improving knee ROM and hamstring flexibility [16].

J. Brent Feland *et al.* (2001) stated that static stretching exercises focuses on one particular muscle or one group muscle only [17]. When a muscle is stretched, muscle spindle will elongate. Passive static stretching fires the Golgi tendon organ and inhibits the tension in the muscle, allowing the parallel elastic component of the muscle to lengthen. According to Hutton (1993) the aim of stretching is to inhibit the reflex activity, which reduces resistance and thereby improves joint range of motion [18].

Group B which received muscle energy technique has a significant change with a p value of 0.00, and the results of this study is in correlation to the study conducted by Azadeh Shadmehr *et al.* (2009) who concluded that Muscle energy technique is very much effective in improving knee ROM and hamstring flexibility [19].

Ballantyne F *et al.* (2003), Prasad Naik *et al.* (2015) stated that Muscle energy technique has been shown to improve muscle extensibility in both short and long term [20, 21]. The increased active range of motion following MET may be due to various factors like neural, viscoelastic and thixotropic properties. After application of MET, musculotendinous junction acts in a viscoelastic manner and lead to the properties of creep and stress relaxation.

In Post isometric relaxation, a strong muscle contraction against equal counterforce triggers the Golgi tendon organ. The afferent nerve impulse from the GTO enters the dorsal root of spinal cord and meets with an inhibitory motor neuron. This stops the discharge of the efferent motor neurons impulse and therefore prevents further contraction, the muscle tone decreases, which in turn results in the agonist relaxing and lengthening [22].

Based on the result of our study we found that there is a significant change in flexibility for those who received MET than Static stretching. This shows the superiority of Met to static stretching.

During the application of the static stretching participants often addressed their discomfort due to stretch and this is due to their low pain threshold, where as participants who received MET has fewer complaints of pain during the application of technique. This might be due to lesser force of contraction and due to attaining new range which lead to reduced intrinsic force on muscle. Hence MET can be applied for individuals with low pain threshold to stretch.

In sports flexibility is an important component which can prevent injury to the athlete. As muscle energy technique has shown significant improvement in flexibility of hamstrings, this technique can be used in improving the flexibility of hamstrings with a fewer number of sessions and with less pain. Athletes with less time in preparing for their games can be benefitted with this technique.

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7. Conclusion

It was concluded that Static stretching and muscle energy technique are effective in improving knee ROM and decreasing hamstring tightness among student population but muscle energy technique is much more effective when compared to static stretching in improving with less duration effectively.

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