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Original Article

Physiotherapy Section

Comparative Efficiency of Muscle Energy Technique and Static Stretching in Enhancing Triceps Surae Flexibility

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ABSTRACT

Introduction: Flexibility is termed as resilience and painless extensibility of a joint. The reduced flexibility will lead to decreased performance and results in abnormal coordination of movements. To prevent such damages, there are number of treatments based on stretching that will enhance the functionality of the subject. Flexibility exercises on triceps surae are regularly prescribed as a component of lower extremity rehabilitation programs.

Aim: To investigate the difference in the effectiveness of Muscle Energy Technique (MET) and static stretching along with foam roller in increasing the flexibility of triceps surae muscle in male athletes.

Materials and Methods: Experimental study with 30 subjects of age between 18-25, divided into 2 groups equally, A and B, treated with muscle energy technique and static stretching along with foam roller respectively. Flexibility of muscles following pre and post training were analysed by Foot and ankle ability measure questionnaire and goniometer. The data analyses were done using student t-Test, with significance level of $p < 0.001$.

Results: Foot and Ankle Outcome Measure (FAAM) and goniometer analysis showed a significant difference in triceps surae muscle flexibility between pre and post training of Group A and B and it was clear that there was an increase in the triceps surae muscle flexibility with the use of muscle energy technique with foam roller rather than static stretching with foam roller.

Conclusion: It was clear from the experimental study that MET along with foam roller gives better flexibility of triceps surae muscles than static stretching with foam roller exercise.

Keywords: Foam roller, Foot and ankle ability measurement, Muscle energy technique, Static stretching

INTRODUCTION

Application of external force is well needed for any system that requires motion. In addition, upward-directed force is also important for keeping the body in equilibrium thus, preventing it from falling. Plantar flexor muscle group which includes triceps surae muscles helps in maintaining these two forces by implementing their action at the interface between human body and the ground [1]. In the case of athletes, these muscle groups experience a higher frequency of developing muscle tightness. Considering running as a regular activity, athletes encounter a condition called hypertrophy in these muscles groups which results in concomitant inflexibility [2].

Trauma-mediated contraction and inflexibility can lead to muscle shortenings, which in turn generate the muscle imbalance and cause poor postures [3]. Joint stiffness and muscle tightness decreases the athletic performance and increases musculoskeletal injuries. Adequate flexibility is important to maintain balance, agility and musculoskeletal function [4]. All exercises including stretching procedures should be preceded to increase the extensibility of triceps surae muscles.

The flexibility of a muscle or a tendon depends on its ability to lengthen. In addition, flexibility can be both static and dynamic. Static flexibility is defined as the Range of Motion (ROM) available to a joint or series of joints which are performed when the athlete is advised to relax [5]. In order to attain static stretching, a constant amount of tension is sustained on a muscle for a specific period to create a progressive deformation and lengthen the tissues [6]. Also, through static stretching, muscle tones can be decreased by stimulating the Golgi tendon organs present in the myotendinous junction and in turn reduces the degree of myotatic reflex contraction. Neurophysiologic responses are involved in the effectiveness of this technique to elongate a muscle through both elastic and plastic deformation of its non-contractile components [7].

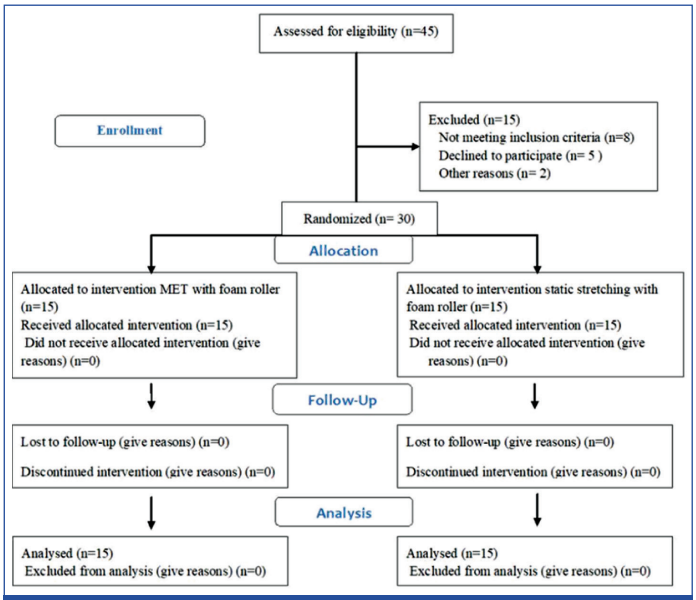
Another stretching method to be discussed in this work is Muscle Energy Technique (MET). This technique involves osteopathic procedures to lengthen fascias, muscles and also joints. The ideology of MET depends on neurophysiology through manual stretching procedures for lengthening the shortened muscles and also relaxing the super active muscles. During MET, the subjects undergo isometric contractions followed by an active contraction force to lengthen the muscle that has previously contracted, in order to obtain amplitude gain. This contraction shall be retained for 10 seconds, an optimum time required to stimulate the tendinous body of Golgi, followed by the inhibition of muscular spindle, and finally, the muscle can lead to a new range of movement [3].

Self-Myofascial Release (SMR) technique enhances the myofascial mobility by implementing pressure on trigger points to enhance the joint ROM and also offer relief to muscle pain and soreness [8]. Common SMR tools include the foam roll and various types of roller massagers. Commercial foam rolls are typically available in two sizes: standard (6×36 inches) and half size (6×18 inches). Using a foam roller, subjects can use their bodyweight to apply pressure to the soft tissues during the rolling motion and it is often applied with the upper extremities to the target muscle [9]. In this research study, we have employed the usage of foam rollers along with static stretching and MET to achieve triceps surae flexibility in male athletes.

MATERIALS AND METHODS

This study was based on experimental analysis in which the individuals were placed into separate groups in order to have the effects evaluated under controlled conditions by observation [3]. Moreover; this study is a comparative approach between static stretching exercises and MET along with foam roller to reduce the tightness of triceps surae muscle. The research was carried out

between January and March 2016. The data were collected at faculty of Physiotherapy, Educational and Research Institute University. Initially 45 male athletes were selected for the experimental study, in which 15 were dropped out as did not meet the inclusion criteria [Table/Fig-1] [10]. The sampling size of 30 male athletes between age group of 18 and 25 years were taken. The subjects were assigned to 2 groups (Group A and Group B) using simple random sampling method, making up to a total of 15 individuals in each group. Subjects of Group A were given MET along with foam roller technique whereas Group B was employed with static stretching exercises along with foam roller.



[Table/Fig-1]: CONSORT Flow diagram of the parallel-randomised trial of the two groups.

Inclusion and Exclusion Criteria

Male athletes with an age group between 18 to 25 years, Unilateral Triceps Surae Muscle tightness and with shortening of triceps surae muscle (inability to achieve 20° of active dorsiflexion) were taken as inclusion criteria for this study. Subjects under medication, skin disease, wound, recent lower limb fracture, neurological problem, hypermobility and any other circulatory problem or metal implants in the leg were recognised as exclusion criteria.

Flexibility Assessment of Triceps Surae Muscle

After collecting detailed history, subjects were assessed completely via physical examination. Data was collected on structured FAAM questionnaire enclosing questions targeting to assess the tightness of the triceps surae muscle. Before the treatment procedure, the exercise techniques were explained and informed consent was obtained from the subjects. The baseline measurement was taken with FAAM and goniometer.

GROUP – A: Muscle Energy Technique (MET)

The subject was in supine position with feet extending over the edge of the table with the knee flexed for soleus and the knee straight for gastrocnemius. The subjects were asked to exert a small effort towards a plantar flexion, against the resistance given by the therapist, with appropriate deep breathing. This isometric contraction was held for 7-10 seconds with a heldbreath. On slow release, on an exhalation the ankle was dorsiflexed slightly without pain beyond the new range with subject's assistance. This cycle would be repeated for 5 times daily for five days in a week for the total period of 4 weeks [11].

Group – B: Static Stretching

The subjects were made to stand an arm length away from a wall and with feet shoulder width apart. One leg with tightened calf muscle was 2 feet away from the other leg. Heels of both the leg were kept flat on the floor leaning towards the wall by bending the normal knee. The tightened leg was kept straight and the static group was asked to statically stretch the muscle for 30 seconds daily for 5 days per week. This procedure was continued for 4 weeks [12,13].

Implication of Foam Roller

Both Groups after finishing their respective stretching exercise, were advised to do foam rolling. The subjects were allowed to sit on the floor with one leg straight and calf resting on the roller which was kept horizontally in front of them. The roller was positioned slightly below the calf muscles but higher than the ankle and rolled from back of the knee to the ankle for one minute. Foam roller size used in this study was 6×18 inches.

At the end of the fourth week, the effect of static stretching and MET along with foam roller were determined by analysing pre and post-test scores of the subjects.

STATISTICAL ANALYSIS

The pre and post-test scores collected from the subjects were tabulated and analysed. Mean and standard deviation were used to assess all the parameters of the data using Statistical Package For Social Science (SSPS). Paired t-test was used to find out the significant difference in improvement between pre and post treatment values for goniometer, FAAM within the group. The student t-test, with significance level of $p<0.001$ was used to evaluate whether there was any significant difference between the averages of two groups of techniques, MET and static stretching with foam roller.

RESULTS

The present study compares the efficacy of two different techniques; MET along with foam roller and static stretching along with foam roller. 30 subjects were taken for this study and grouped equally under A and B and given respective exercises for four weeks. Pre and post-test were taken using goniometer and FAAM scale before and after training.

[Table/Fig-2] shows the flexibility range of the Group – A subjects attained pre and post MET by the use of goniometer and FAAM. Using goniometer, the average flexibility of the subjects measured pre-MET was recorded as 14.06° (SD=1.48), while the average flexibility obtained post-MET was 18.13° (SD=0.91). In case of FAAM study, the average flexibility during pre-MET was recorded as 48.72 % (SD=11.99), while the average flexibility obtained post-MET was 87.53 % (SD=6.91). Through both goniometer and FAAM studies, a flexibility gain was noticed statistically significant after the exercise ($p < 0.001$).

Group A	Pre-Test		Post-Test		t-test	Significance
	Mean	SD	Mean	SD		
Goniometer	14.06	1.48	18.13	0.91	15.25	.000*
FAAM	48.72	11.99	87.53	6.91	14.86	.000*

[Table/Fig-2]: Comparison of Goniometer and FAAM in group A between pre and post test of MET analysis
This table shows statistically significant difference in Goniometer, FAAM score between pre and Post test values (p***≤0.001) of MET analysis.

The series of flexibility attained by Group – B subjects of pre and post static stretching was assessed by the use of goniometer and FAAM [Table/Fig-3]. In this, by using goniometer the average flexibility of the subjects measured pre static stretching was recorded as 13.13° (SD=1.95), while the average flexibility obtained post static stretching was 15.80° (SD=1.85). In case of FAAM study, pre static stretching was recorded as 53.38 % (SD=14.57), while the average flexibility obtained post static stretching was 72.60 % (SD=9.64). Through

both goniometer and FAAM studies, a flexibility gain statistically significant after the exercises was noticed (p <0.001).

Group-B	Pre-Test		Post-Test		t-test	Significance
	Mean	SD	Mean	SD		
Goniometer	13.13	1.95	15.80	1.85	21.16	.000*
FAAM	53.38	14.57	72.60	9.64	8.07	.000*

[Table/Fig-3]: Comparison of Goniometer and FAAM in group – B between pre and post test of static stretching analysis.
This table shows statistically significant difference in Goniometer, FAAM score between pre and post test values (p***≤0.001) of static stretching analysis.

By comparing the pre and post test data obtained from goniometer of Group A and B subjects it is clear that there is no significant difference in pre test values of the goniometer between GROUP-A and GROUP-B (***-p>0.05) and there is statistically significant difference in post test values of goniometer between GROUP-A and GROUP-B (***-p≤0.001) [Table/Fig-4]. In the same way, the difference between pre and post-test values from FAAM of Group A and B subjects were also assessed [Table/Fig-5]. This table shows that there is no significant difference in pre test values of the FAAM between GROUP-A and GROUP-B (***-p>0.05) and there is statistically significant difference in post test values of FAAM between GROUP-A and GROUP-B (***-p≤0.001).

Goniometer	Group A		Group B		t-test	Significance
	Mean	SD	Mean	SD		
Pre-Test	14.06	1.48	13.13	1.95	1.47	0.153**
Post-Test	18.13	0.91	15.80	1.85	4.36	.000***

[Table/Fig-4]: Comparison of Goniometer between group-A and group-B in pre test and post test.
(**p > 0.05)(***p ≤ 0.001)

FAAM	Group A		Group B		t-test	Significance
	Mean	SD	Mean	SD		
Pre-Test	48.72	11.99	53.38	14.57	.958	.346**
Post-Test	87.53	6.91	72.60	9.64	4.87	000***

[Table/Fig-5]: Comparison of FAAM between group-A and group-B in pre and post test.
(**p > 0.05) (***p ≤ 0.001).

DISCUSSION

Several factors such as body composition, sex, age, activity level, genetics, connective tissue elasticity, composition of tendons, joint structure, strength of opposing muscle groups, previous injuries and repetitive movements have an influence on flexibility [14]. Moreover, in this study, the inflexibility of triceps surae muscle acquired by athletes was due to repetitive movements. In order to regain the lost flexibility, exercises like MET and static stretching along with foam roller technique were followed. In addition, the effect of these two techniques on flexibility was differentiated using two experimental groups namely, MET and foam rolling and static stretch and foam rolling.

As proposed by early researchers, MET which belongs to an active type of flexibility training results in lengthening of a shortened muscle, improving range of motion and increasing drainage of fluid from peripheral regions [15]. On the contrary, Static stretching which belongs to the corrective type of flexibility training targets to raise joint ROM, advance muscle imbalances and correct altered joint motion. Whereas, foam roller which belongs to SMR technique has been used to correct existing muscle imbalance, relieve pain (reduce trigger points) and inhibit overactive musculature also regarded as one of the most effective ways of immediate pain relief [9,16].

Despite the fact that foam rolling and static stretching both belong to corrective flexibility training; their functions are not exactly the same. However, the combination of above two techniques can increase flexibility significantly [17]. Besides, a previous research states that foam rolling has been treated as an effective aid for muscle recovery in athletes [18]. But other research studies have demonstrated that MET has been the more effective procedure than static stretching for improving the extensibility of shortened muscles [19-21]. Since, the recovery effect is considered as one of major concern for an athlete, MET along with foam roller can be treated as an efficient way to improve their muscle flexibility.

The above statement is proved by this study which followed a conventional pre test-post test design involving two experimental groups namely, Group-A and Group-B. The pre and post intervention of both groups shows improvement in dorsiflexion ROM. The post intervention in MET along with foam roller showed more improvement in dorsiflexion ROM. Both the group shows a significant increase in the post test mean but (GROUP-A) which has the higher mean value is more effective than (GROUP-B), hence alternate hypothesis is accepted.

CONCLUSION

This study reveals that there is a significant difference in MET with foam roller versus static stretching with foam roller in collegiate male athletes with unilateral triceps surae muscle tightness. Both groups (MET and static stretching along with foam roller) tend to reduce tightness of the triceps surae muscle and improve the muscle flexibility of the subjects. The study concluded that triceps surae muscle flexibility gains made from one bout of MET with foam roller (GROUP A) is better than the gains made by a static stretch with foam roller group (GROUP B).

LIMITATION

Sample size was small, only male athletic subjects were used. FAAM questionnaire can be used in combination with other techniques and exercises also provide more effective results. Duration of session can be increased for better result, age group above 25 should be used for future studies, other sports persons and females can be included.

CONFLICTS OF INTEREST

All contributing authors declare that they have no conflicts of interest. The study was approved by Institutional Review Board of Faculty of Physiotherapy, Dr. MGR Educational & Research Institute University, Chennai.

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