Original Article

Physiotherapy and Occupational Therapy Journal
Volume 13 Number 2, April - June 2020
DOI: http://dx.doi.org/10.21088/potj.0974.5777.13220.3

Effects of Foam Rolling and Static Stretching on Lower Back, Hamstrings and Calf Muscles

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How to cite this article:
Bhavna Anand, Gautam Gupta, Rishika Deshmukh. Effects of Foam Rolling and Static Stretching on Lower Back, Hamstrings and Calf Muscles. Physiotherapy and Occupational Therapy Journal. 2020;13(2):75-79.

Abstract

Objective: To study the effect of static stretching and foam rolling among male collegiate who are recreational players. *Methodology:* 20 male subjects within age group of 18–25 yrs with bilateral hamstring tightness and who were recreational athletes participated in the study. Subjects were excluded if they had any lower limb musculoskeletal disorder or surgery, back and lower limb injury, neurological dysfunction, and those who were involved in any other stretching exercise or sports. Improvements were noted through sit and reach test and active knee extension test. *Result:* There was improvement in hamstring flexibility in all subjects, however static stretch for active lengthening of hamstring considering the muscle's strong fascial attachments. *Conclusion:* Foam rolling in combination with static stretching, when done on lower back, hamstrings and calf muscles gave desired effects of increased flexibility of hamstrings when measured with SRT after the intervention was done.

Keywords: Static Stretching; Foam Rolling.

Introduction

The relative tightness of the soft tissue structures in the body, joint capsules, muscles and their fascia can affect flexibility. Found surrounding the muscle, myofascia is a connective tissue that can restrict ROM and decrease strength and endurance if injured, inactive, or inflamed. Clinicians use manual pressure over the tissue to effect therapeutic change in this tissue using a variety of techniques including osteopathic soft-tissue manipulations, structural integration, various forms of massage, muscle energy techniques, and Graston. Alternatively, a technique to treat fascia independent of a practitioner, self-induced myofascial release (SMR), can be facilitated with a foam roller or roller massager. Foam rollers are cylinders made of varying densities and textures of foam and roller massagers are plastic rollers held in the hands. These tools utilize the same mechanism of treatment as traditional myofascial release, but pressure is applied by the individual externally or using body weight.[15]

Hamstring muscles are an important group of posterior thigh muscles. They include semimembranosus, semitendinosus, and biceps femoris. The hamstring muscles are important contributors to control the human movement and involved in wide range of activities from running and jumping to forward bending during sitting or standing and a wide range of postural control actions. The length of the hamstring muscles is considered to play an important role in both the effectiveness and the efficiency of basic human movements, such as walking and running.[19]

Adequate range of motion is necessary for activities of daily living, success in athletic competition, injury prevention, and occupational demands. These activities commonly require trunk

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flexion movements and lower-body extensibility. Therefore, numerous studies have investigated trunk and lower extremity flexibility. The most widely used lower-extremity flexibility assessment is the standard sit and-reach test (SRT). Several studies have demonstrated that this test exhibits greater criterion-related validity for hamstring, rather than lower back flexibility. It was also determined that subjects exhibited significantly greater flexibility performance in the plantar flexed ankle position. These findings support previous investigations that also reported higher flexibility scores when the ankle was permitted to plantar flex. It has been proposed that dorsiflexion increases sciatic nerve activation resulting in a reflexive decrease in lower extremity range of motion. Therefore, the plantar flexion ankle position can be used to negate the sciatic nerve reflex and subsequently provide an increase in lower-extremity flexibility.[8]

Need of the Study

Recreational players undergo injury because there muscles and aren't warmed up properly, stretching is a very basic warm up exercise which decreases muscle viscosity and thus allows for rapid and forceful muscle contraction and relaxation which enhances its mechanical efficiency. Connective tissue surrounding the muscles such as fascia also affect its ROM. Thus foam rolling is a self inducedmyofascial release technique which uses an individual's body weight to release fascia.

Methodology

A pilot study design consisting of 20 male subjects within age group of 18–25yrs who were in college and were recreational players participated in the study.[18–19]

Subjects who were willing to participate and were having bilateral hamstrings tightness which isdefined by an incomplete knee extension in the active-knee-extension test, when the subject failed to straighten the knee to its full extension by 20°.[19]

Subjects were excluded if they had any lower limb musculoskeletal disorder or surgery, back and lower limb injury, neurological dysfunction, subjects involved in any other stretching exercise or sports.[19]

Subjects who met the inclusion criteria were then asked to perform foam rolling and then static stretching over lower back, hamstrings and calf muscles.

Procedure

Written consent was taken from subject who fulfilled the inclusion criteria and who volunteered to participate in the study. Subject's demographic data was recorded.

A pretreatment Goniometry and SRT was performed to evaluate flexibility and knee extensiontest to evaluate the tightness of hamstring.

The subjects were made to foam roll over the lower back by lying supine on the roller using arms and posterior muscles to support body weight. Proper draw in position is important in order to stabilize the spine. Subjecta were asked to roll from where "belt crosses pants" down to the PSIS joint[11], then over hamstrings the subjects were required to roll the right leg from the ischial tuberosity to the back of the knee. The hands were set on the floor and did not move during the rolling motion. The body shifted back and forth to a metronome cadence, with the left leg acting as a stabilizer. Subjects were instructed to keep maximum weight over the right leg. Pilot testing established a rolling cadence of 40 bpm. Rolling from ischial tuberosity to knee was considered one beat and then same procedure was followed on the left leg.[12] then the foam rolling was done on the calf muscles by rolling between the popliteal fossa and the myotendinous junction of the Achilles tendon[6] was considered one beat. 20 seconds for rest[14] was given after every 40 bpm of foam rolling.[5,6,10,11,12,13,14]

Then the subjects were asked to be in long sitting position with knees fully extended and the ankles together in dorsiflexion, and the feet flat against the wallthe subjectswere asked to bend forward from the hips to reach towards the feet, with the head in flexion. The examiner stood behind the subject and pushed him/her forward to stabilize the patient's position and knees[9] and held the position for 30 s and repeated for five sets, and the interval between each set was 20 s. To exclude the influence of pre-stretching and exercise, all subjects were instructed not to perform stretching and exercise just before the measurement.[14]

Results and Data Analysis

Data was compiled and exported to Microsoft excel for analysis. The data collected was arranged for comparison of pre and post results of foam rolling and static stretching which was analysed using descriptive statistics. Descriptive statistics was checked using mean and SD. The results were

analysed pre and post technique by using paired and unpaired t test. The p=<0.05 was taken as the level of significance for checking the significant differences in means. Data analysis was done by SPSS software.

A total of 20 subjects were taken. Analysis is done on the post treatment reading of the active knee extension and sit and reach test.

Table 1: Showing mean and standard deviation with distinct parameters.[15-16]

Stats. Parameter	Mean+SD
Age	21.85±1.72
Height	172.97±9.62
Weight	62.10±11.89
BMI	20.85±2.69

To summarize, this table shows mean and standard deviation of various parameters like, age, height, weight and BMI.

Paired T-Test:

Table 2: Showing difference in mean and standard deviation between pre and post test readings of sit and reach and active knee extension test for right leg.[15-16]

Test	Pre		Post	
	Mean	Stdev	Mean	Stdev
Srt	29.055	7.485	35.725	5.807
Ake	71.35	7.883	81.85	4.545

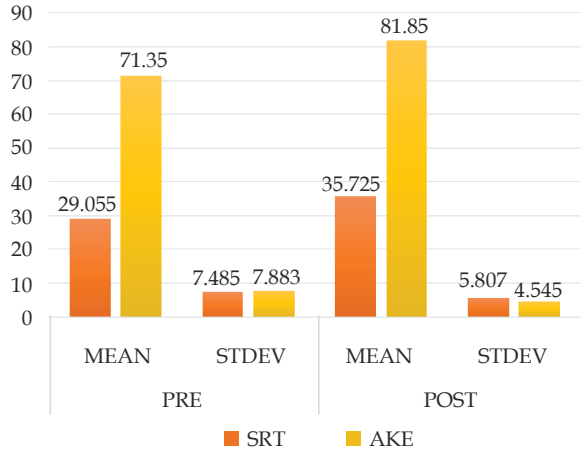

Fig. 1: Showing difference in mean and standard deviation between pre and post test readings of sit and reach, active knee extension for right leg.[15-16]

To summarize, this graph shows comparison of pre and post-test mean and standard deviation of sit and reach, active knee extension for right leg. The pre and post-test mean with standard deviation in sit and reach was 29.055±7.485 and 35.725±5.807 □P<0.05□and in active knee extension was 71.35±7.883 and 81.85±4.545 □P<0.05□which shows that there is highly significant difference between S□T and A□□ in improving hamstring □exibility.

Table 3: Showing difference in mean and standard deviation between pre and post test readings of sit and reach and active knee extension test for left leg.[15-16]

Test	Pre		Post	
	Mean	Stdev	Mean	Stdev
Srt	29.055	7.485	35.725	5.807
Ake	73.65	6.976	83.20	3.054

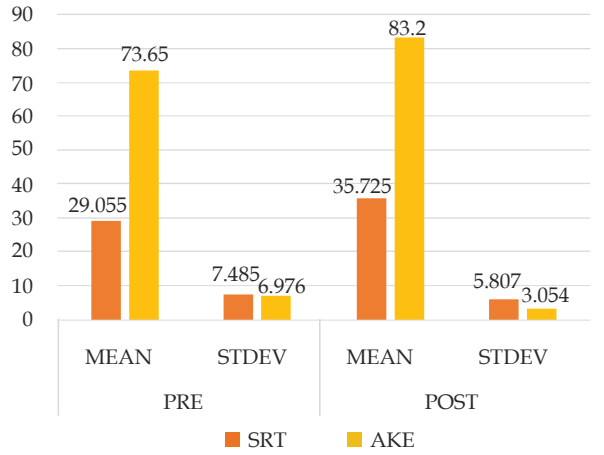

Fig. 2: Showing difference in mean and standard deviation between pre and post test readings of sit and reach, active knee extension for left leg.[15-16]

To summarize, this graph shows comparison of pre and post-test mean and standard deviation of sit and reach, active knee extension for right leg. The pre and post -test mean with standard deviation in sit and reach was 29.055±7.485 and 35.725±5.807 □P<0.05□and in active knee extension was 73.65±6.976 and 83.2±3.054□P<0.05□which shows that there is highly significant difference between S□T and A□□ in improving hamstring □exibility.

Discussion

The present study compared the pre and post effects of foam rolling and static stretching on the lower back, hamstring and calf muscle □exibility using A□□ and S□T. 20 male participants were selected on the basis of inclusion and exclusion criteria. Various criteria included variables like extent of tightness in muscles, decreased range of motion, age group 18□25.

The procedure was explained to each participant and the possible risk involved. A written informed consent from each participant was obtained. All subjects well tolerated the interventions given and no one was dropped out of the study.

Active knee extension test and Sit and reach was collected before the protocol □preintervention□and after the protocol □post intervention□.

Comparison of the data obtained before and after the protocol for both groups was statistically analyzed for significant difference among groups using paired T testwas done to explore the effects of interventions in respect of effectiveness of it. The paired t test is used to compare the data obtained before and after the interventions as per the protocol and there have been significance difference is seen in the results. ($p<0.05$)(Table 1 & 2) (Fig 1 & 2).[17]

The study conducted by the Jung J. who studied immediate effect of self myofacial release on hamstring flexibility on 25 individuals with mean age of 22 years. Then the researcher explained the technique of foam rolling was conducted for 4 minutes on the specified area and then outcome were measured. Significant difference in the pre and post treatment valued were observed by them by using ANOVA but we have seen significance in paired t test.($p<0.05$).[21]

The study conducted by Mohd Waseem who studied improvement of Hamstring flexibility by using static stretching and eccentric training on 20 normal healthy collegiate males. Then the reseachers explained the technique of static stretching and eccentric stretching which was conducted for 30 seconds 3 times per limb. Significant difference in the pre and post treatment values were observed.[20]

A few hypotheses have been proposed to explain the gender differences in neuromuscular properties and viscoelastic changes. These include fluctuations in hormone levels, discrepancies in muscle cross-sectional area (CSA) and anthropometry, and differences in passive properties such as viscoelastic stress relaxation or viscoelastic creep. Many studies have examined the effect of estradiol and progesterone on active MTS and anterior cruciate ligament (ACL) laxity throughout the menstrual cycle with equivocal findings. When a change in MTS or ACL laxity was observed across the menstrual cycle, it was generally at or near ovulation when estradiol levels peak.[1,2,3,6] Therefore, when tested during menses when estradiol levels are lowest, the observed gender differences may have been even greater if it was tested at or near ovulation. Overall, it indicated that an acute bout of passive stretching increased ROM for the women, but not for the men. There were no changes in MTS, which is commonly used to assess the viscoelastic properties of the muscle. It has been suggested that a decrease in MTS reduces the total amount of strain through a given ROM, which may reduce the risk of strain injuries.[4]

Stretching the soft tissues in the back, legs and buttock such as the hamstrings, erector muscles of[7,9] the spine and hip flexor muscles, ligaments and tendons can help to mobilise the spine, and an increase in the range of motion of the spine can assist back pain. This is because stretching can improve the flexibility of the muscle-tendons and ligaments in the back, which is important to increase the range of motion of the joints. Therefore an improved range of motion assists with patients' movement and ability to complete activities of daily living, as most everyday tasks such as lifting and bending require trunk flexion, which involves a complex movement combining lumbar and hip motion. Also stretching exercises decrease the muscle stiffness as a result of changes in viscoelastic properties, due to the decreased actin-myosin cross-bridges and the reflex muscle inhibition.[11]

Limitations of the Study

- Number of subjects were less due to COVID 19.
- Due to the difference in the weight, the pressure exerted during foam rolling is mainly subjective in nature.
- Long term effects weren't measured.
- Since it's a pilot study, results weren't impressive.
- Due to small sample size only two parameters (pre and post-test of sit and reach and active knee extension) were measured, more parameters (comparison between foam rolling and static stretching and intensities with which both the techniques are being used) could be measure with large sample size.

Conclusion

The results of this study show that there is improvement in hamstring flexibility in all subjects, however static stretch for active lengthening of hamstring considering the muscle's strong fascial attachments (Table 1 & 2).[17]

Foam rolling in combination with static stretching, when done on lower back, hamstrings and calf muscles gave desired effects of increased flexibility of hamstrings when measured with SRT after the intervention was done.

Conflict of Interest: There are contradicting theories about foam rolling on lower back. Some say its safe and some thinks the opposite is right.

Funding: Funding was not involved in this study.

Acknowledgement

The authors are thankful to the Head of Physiotherapy Department of A+ Orthopaedic and Sports Med Centre in Delhi for permitting to carry out this work.

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