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EFFECT OF FOAM ROLLING VERSUS STATIC STRETCHING ON HAMSTRING TIGHTNESS IN NURSES

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ABSTRACT

Background: The purpose was to compare the effect of foam rolling versus static stretching on hamstring tightness in nurses.

Methodology: 30 participants were selected according to the selection criteria. They were randomly divided into 2 groups. Group A was given foam rolling and group B was given static stretching. Sit and reach test and active knee extension were used to assess for the hamstring tightness. The outcome measures were assessed before and after the intervention. The result was analyzed after the post intervention of both the treatments in both the groups using the Students paired and unpaired 't' test.

Result: In group A foam rolling and In group B static stretching there was significant improvement after post intervention sit and reach test and active knee extension 37.40+ 3.91, 56.53+ 5.83 58.07+ 6.36. 33.60+3.20, 51.67+5.77 49.13+ 5.00.

Conclusion: comparatively foam roller was more effective then static stretching for hamstring tightness.

KEYWORDS : Hamstring Tightness, Nurses, Foam Rolling, Static Stertching.

INTRODUCTION

Flexibility is related to the extensibility of musculotendinous units that cross a joint, based on their ability to relax or deform and yield to a stretch force .[1] Each individual is born with a particular range of motion for every joint in their body. Flexibility is the range of movement in a joint or series of joint and length in muscle that cross the joint to induce a motion or bending movement. Flexibility varies between individuals, particularly in term of differences in muscle length of multi-joint muscles. The range of motion of joint can be increased to certain degree by various stretching techniques, foam roller, self- myofascial release, yoga, etc.

Muscle tightness is caused by decreased in the ability of the muscle to deform, resulting in decreased range of motion at the joint at which its act. Inability to extend the knee completely when the hip is flexed accompanied by discomfort and pain. Muscular tightness is frequently postulated as a intrinsic risk factor for the development of a muscle injury. Loss of flexibility can be a predisposing factor for physical issues such as balance disorders or pain syndromes. There are many primary factors that affect the muscle tightness like age, gender, posture, occupation, strength, endurance, range of motion etc.[2,3] The hamstring muscle plays integral role in most leg movements. They are an important muscle group because they balance the actions of the quadriceps muscles. that causes factors hamstring tightness are inactivity, poor posture, prolong sitting, pathological changes, muscle tension, muscle strain, muscle injury, prolong bed rest, sedentary life style etc.[3]

The normal range of hip flexion permitted by the hamstring is in the region of 80 – 90 degrees. Anything less than 80 degree is considered "tight". Hamstring muscle injury is a complex problem for individual Hamstring muscle injuries are usually strains, but contusions also occur, mainly in contact sports [2]. Poor hamstring flexibility is often associated with knee pain, lower extremity injuries, low back pain. Tight hamstring can cause the hip and pelvic to rotate back flattening the lower back and causing lower back problem. Tight hamstring can be responsible for sacroiliac joint pain[5], it tends to pull the pelvis out of normal position. Hence Hamstring tightness is an important factor for sports injuries such as hamstring strain which is common among athletes. Thus, flexibility training is included in the all conditioning program with aerobic and strength training[2].

The risk factor cause of hamstring tightness that are decreased muscle control, muscle fatigue, poor posture, muscle tightness, decreased muscle strength, limited range of motion[2,3]. Prevention of hamstring muscle strain requires good hamstring flexibility which can be achieved by various physiotherapeutic techniques like massage therapy, static stretching, dynamic stretching, ballistic stretching, use of foam roller, proprioceptive facilitation stretching, myofascial released, positional release technique, aerobic and strength training etc.

Among that, foam roller is used for self-myofascial release. Foam roller is a multipurpose tool. Foam rolling is the most popular form self-myofascial release. A foam, is a light weight, cylindrical tube of compressed foam rollers come in different sizes and degrees of firmness it is of use in increasing range of motion and applying a massage like effect on the fascia and muscle. Foam rolling used by applying the body weight of an individual on a foam roller to exert pressure onto the targeted tissues, which allows the isolation of specific muscles to be rolled over[7]. Foam roller involves rolling over the muscle starting at either the proximal or distal end and rolling to the opposite end of the muscle.[7] The benefits of foam rolling are, it increases muscle and tissue recovery, used during warm-up or cool down phase as a part of stretching, increases the ability to balance, restore proper length-tension relationship to muscles, reduces tissue tension and muscle tightness to increase the range of motion, reduces risk of developing adhesions, reduce soreness after an exercise session to promote the recovery process release back pain[8]

Static stretching has been defined as elongating the muscle to tolerance sustaining the position for length of time [9]. A type of stretching activities has been presented in the literature in order to regain or the maintain muscle flexibility and avoid decrease in range of motion that can impair functional activities in an individual Static stretching is classified in 3 different categories; active-assisted , active, passive. [1] Static stretching involves taking a muscle to a point of tension and holding the position for a period of time. Effective duration of the stretched is found out by comparing the groups stretched for 15,30, and 60 seconds , among that 30 and 60 seconds stretched muscle fibers show more flexibility than the 15 second stretched muscle fibers[9].

To our knowledge, study comparing effectiveness of foam roller versus static stretching on hamstring tightness in nurses has not been carried out previously. Hence the present study was conducted with the objective to compare the effect of foam roller versus static stretching on hamstring tightness in nurses.

MATERIAL AND METHOD

The study received ethical clearance from the Institutional Ethical Committee (PIMS/CPT/IEC/2019/211). 30 Participants were screened according to the inclusion and exclusion criteria. Written informed consent was taken from the participants. participants with hamstring tightness were included in the study. Participants was randomly allocated into 2 groups- group A and group B. Participants in group A were given foam rolling for 2 weeks and participants in group B were given static stretching for 2 weeks. 3 sessions/ week were given and 3 repetitions were given in each sessions for 30 seconds each. Evaluation of the participants was done before and after the intervention by active knee extension test and sit and reach test.

PROCEDURE

Outcome measure

Sit and reach test and active knee extension test were used to measure

hamstring tightness. Both the tests were performed before and after the intervention.

1. Sit and reach test: The participant sat on the floor with their back and head against a wall. The soles of their feet against of the box and with their hips flexed about 90^0 and then put the centimeter scale on the box. Then the participant was told to flex the hip or go forward as far as possible. The participants extended the knees until a strong resistance was felt, holding the final position for 2 seconds, and the reading of how much the participant can reach was noted

2. Active knee extension test: The participant flexed the hip of the limb to be tested to 90°. The contralateral limb was fully extended and stabilized in neutral rotation. With the foot at neutral position and knee flexed at 90°, a standard universal goniometer was placed over the lateral femoral condyle, with one arm aligned along the thigh in direction to the greater trochanter and the other arm aligned over the leg in direction to the lateral malleolus. The participant extended the knee until a strong resistance was felt, holding the final position for 2-3 seconds, to note down the goniometric reading. The same procedure is then executed for the contralateral limb.

Intervention

Group A- Foam Rolling (n=15):

Participants were in long sitting on the foam roller with the knee extended and ankle in relaxed position .The participants begin the foam rolling movement at ischial tuberosity and completed the movement at the popliteal fossa. Their body weight was supported with their arms extended as they will move the foam roller to and from the appropriate landmarks. The participants were asked to allow as much pressure between the hamstring muscle and foam roller as possible. The foam roller was moved at an approximate cadence of one second up and one second down. The protocol included 3 repetitions for 1 repetition one minute and 30 second break in between for recovery of arms supporting body weight.

Group B – Static stretching (n=15):

Participants were in supine lying without pillow under his/her head. The hip was 90 ^{0} flexed and the knee was also flexed 90^0 and then therapist lifted the participant leg by the posterior ankle while keeping knee in fully extended position. The therapist continues to lift the patient's leg by flexing the hip until the participant complains of pain or tightness in the back of the leg. The protocol included 3 repetitions with 30 seconds break after every repetition.

DATA ANALYSIS

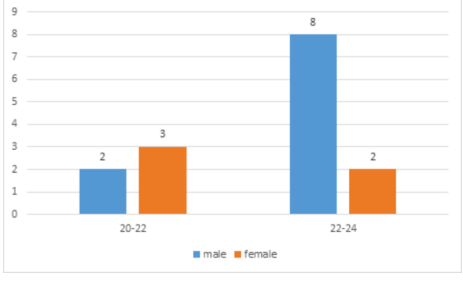
DEMOGRAPHICS

AGE: 30 participants in the age group of 20-24 years were randomly divided into 2 groups – group A is foam rolling and group B is static stretching.

GROUP A FOAM ROLLING

Table No. 1: Age Distribution in Group A (Foam Rolling)

AGE	MALE	FEMALE	TOTAL
20-22	2	3	5
22-24	8	2	10
TOTAL	10	5	15

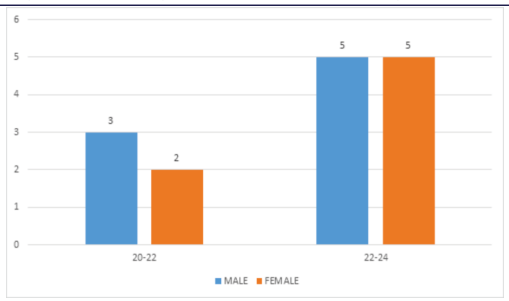


Graph No. 1: Age Distribution in Group A (Foam Rolling)

IN GROUP B STATIC STRETCHING

Table No. 2: Age Distribution in Group B(Static Stretching)

AGE	MALE	FEMALE	TOTAL
20-22	3	2	5
22-24	5	5	10
TOTAL	8	7	15



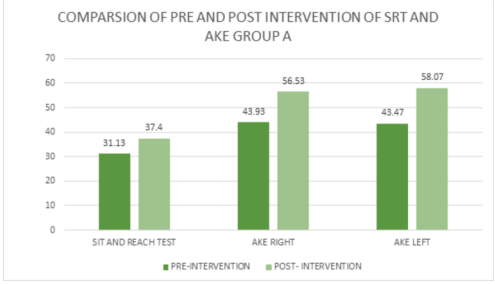
Graph No. 2: Age Distribution in Group B (Static Stretching)

Comparison Of Pre-intervention And Post-intervention Values Of Sit And Reach Test (srt) And Active Knee Extension (ake) In Group A (foam Rolling)

The mean difference ± SD of sit and reach test of group A was 31.13± 4.45 before intervention and 37.40±3.91 after intervention. The mean difference ± SD of active knee extension of right leg of group A was 43.93± 5.61 before intervention and 56.53± 5.83 after intervention. The mean difference ± SD of active knee extension of left leg of group A was 43.47 ±5.00 before intervention and 58.07±6.36 after intervention. The students paired "t" test value was significant for the pre and post intervention scores.

Table No. 3- Comparison of Pre and Post-Intervention values of Outcome Measures in Group A (Foam Rolling)

OUTCOME MEASURES		PRE-INTERVENTION	POST-INTERVENTION	STUDENTS PAIRED t TEST	RESULT
SIT AND REACH TEST		31.13+4.45	37.40+3.91	4.87	P=0.001, significant
ACTIVE KNEE EXTENSION	RIGHT	43.93+5.61	56.53+5.83	6.64	P=0.001, significant
	LEFT	43.47+ 5.00	58.07+6.36	6.71	P=0.001, significant



Graph No. 3 : Comparison of Pre and Post-Intervention values of Outcome Measures in Group A (Foam Rolling)

By applying Students paired 't' test there is a significant improvement in the mean values of SRT and AKT from Pre intervention in Group A.

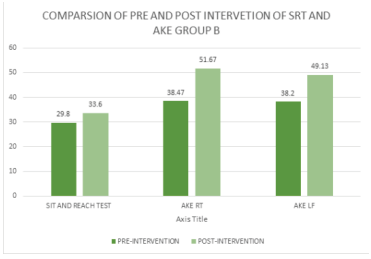
Comparison Of Pre-intervention And Post-intervention Values Of Sit And Reach Test (srt) And Active Knee Extension (ake) In Group B (static Stretching)

The mean difference ± SD of sit and reach test of group B was29.80± 3.41 before intervention and 33.60± 3.20 after intervention. the mean difference ± SD of active knee extension of right leg of group B was 38.47 ± 6.85 before intervention and 51.67± 5.77 after intervention. the mean difference ± SD of active knee extension of left leg of group B was 38.20 ± 2.34 before intervention and 49.13± 5.00 after intervention. the students paired "t" test value was significant for the pre and post intervention scores.

Table No. 4: Comparison of Pre and Post-Intervention values of Outcome Measures in Group B (Static Stretching)

OUTCOME MEASURES	PRE-INTERVENTION	POST-INTERVENTION	STUEDENTS PAIRED "t" TEST	RESULT

SIT AND REACH TEST		29.80+ 3.41	33.60+ 3.20	2.82	P=0.001, significant
ACTIVE KNEE EXTENSION	RIGHT	38.47+6.85	51.67+ 5.77	4.09	P=0.001, significant
	LEFT	38.20+2.34	49.13+5.00	5.18	P=0.001, significant



Graph No. 4: Comparison of Pre and Post-Intervention values of Outcome Measures in Group B (Static Stretching)

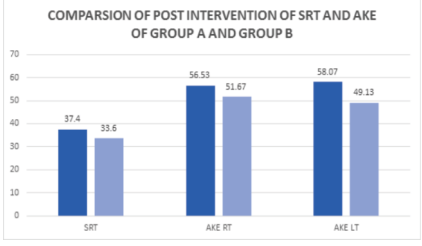
- By applying Student's Paired 't' test there is a significant improvement in the mean values of SRT and AKT from Pre intervention in Group B.

Comparison Of Post Intervention Values Of Sit And Reach Test(srt) And Active Knee Extension (ake) Of Group A(foam Rolling) And Group B(static Stretching)

The mean difference ± SD of sit and reach test of group A was after intervention 37.40±3.9. The mean difference ± SD of active knee extension of right leg of group A was after intervention 56.53± 5.83. The mean difference ± SD of active knee extension of left leg of group A was after intervention 58.07±6.36. The mean difference ± SD of sit and reach test of group B was after intervention 33.60±3.20. The mean difference ± SD of active knee extension of right leg of group B was after intervention 51.67± 5.77. The mean difference ± SD of active knee extension of left leg of group B was after intervention 49.13±5.00.

Table No. 5: Comparison of Post-Intervention values of Outcome Measures in Group A (Foam Rolling) & Group B (Static Stretching)

OUT COME MEASUES		GROUP A	GROUP B	STUDENT UNPAIRED "t" TEST	RESULT
SIT AND REACH TEST		37.40+3.91	33.60+3.20	2.92	p=0.0021, significant
ACTIVE KNEE EXTENSION	RT	56.53+5.83	51.67+5.77	2.29	P=0.0014, significant
	LT	58.07+6.36	49.13+5.00	3.52	P=0.0001, significant



Graph No 5: Comparison of Post-Intervention values of Outcome Measures in Group A (Foam Rolling) & Group B (Static Stretching)

- By applying Student's unpaired 't' test there is a significant improvement in the mean values of SRT and AKT from Post intervention in Group A and Group B.

DISCUSSION

The present study was done to compare the effectiveness of foam rolling versus static stretching on hamstring flexibility in nurses with hamstring tightness. 30 participants were recruited in the study on the basis of inclusion and exclusion criteria and were divided into 2 group. Group A participants foam rolling and Group B performed static stretching.

Active knee extension (AKE) and sit and reach test (SRT) were used to assess hamstring flexibility. The study supporting it was conducted by Neto T et al (2014) to find out the reliability of AKE test. The study concluded that tests had excellent inter-rater reliability with ICC values of 0.87- 0.94 for AKE [10]. The study concluded that findings showed high reliability for the sit and reach test (SRT), 0.95 ICC[17]

In the present study, the pre and post intervention AKE and SRT scores of Group A (Foam Rolling) were compared using the paired t test. The results showed an increase in hamstring flexibility after performing foam rolling on hamstrings. There are two prevailing theories why foam rolling works. The first theory states that foam rolling creates length change based on the principle of autogenic inhibition, which involves the sensory receptors of the Golgi tendon organ (GTO) and muscle spindle. The GTO senses tension placed on the muscle, while the spindle identifies the length change and the rate of change within the particular muscle .Autogenic inhibition is the response that occurs when a muscle is placed under tension and the GTO sends a signal to the spindles to the allow muscle to lengthen. The pressure of the foam roller on the muscle increases tension on the muscle fibers, signaling the GTO to allow the muscle spindles and fibers to lengthen [18]. The second hypothesis suggests that the rolling muscle and connective tissue on a foam roller creates friction between the roller and the involved muscle that generates heat, which causes the tissue to become more a pliable. This could have occurred due to changes in the length of rate of change of central nervous system and muscle fiber. The muscle spindle and Golgi tendon organ are the neural receptors located in the skeletal muscle tissue[3].

Muscle tension is increased due to foam rolling which causes the Golgi tendon organ to relax the muscle, decrease pain, restore muscle length tension and improve function. This is supported by a study conducted by Patrick Keys (2014) to compare the effects of foam rolling and static stretching on hamstring range of motion [3]. The study concluded that there was 28.9% increase in hamstring range of motion after an acute bout of myofascial release through foam rolling. Macdonald G. et al (2014) conducted a study to understand the effectiveness of foam rolling as a recovery tool after an intense bout of physical activity. The results showed that foam rolling substantially reduced the muscle soreness and helped in improving active and passive ROM, vertical jump height and muscle activation[19].

In static stretching, the muscle is elongated gently and maintained for the long period without pain. The Golgi tendon organ protects the muscle from the stretch by firing the type Ib fibers. This Ib fibers further relaxes the muscle by efferent impulse. So, the muscle fiber goes for more relaxation and flexibility. The stretch reflex is triggered when the central nervous system senses change in fiber length. [9] The length-tension relationship is altered through 3 mechanisms: The muscle responds to the stretch, sensory impulse from the spindle to the spinal cord is sent via the afferent nerve which decreases the alpha motor neuron firing and lastly the efferent nerves from the spinal cord send impulse to the muscle fiber which alters the normal length tension relationship.

Similarly the pre and post AKE and SRT scores of Group A (Foam Rolling) and Group B (Static stretching) were compared using the paired "t" test. There was a significant increase in hamstring flexibility after receiving foam roller .The post intervention AKE and SRT scores of Group A and Group B were compared using the Student's unpaired "t" test. On the basis of statistical analysis, the results showed that the group A was more effective than group B in improving hamstring flexibility.

CONCLUSION

The study concluded that foam rolling was more effective than static stretching on hamstring tightness in nurses.

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