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To compare the effect of foam roller with static stretching and static stretching only on hamstring muscle length in football players

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Abstract
Hamstring flexibility is an important aspect for football player. Research has shown decreased hamstring flexibility is major cause of lower limb injury. Passive stretch is traditional way of stretching muscle which involves therapist/coach which may not be available all time. So purpose of this study was to assess if using a foam roller to perform self-induced Myofacial release (SMR) in combination with static stretching on hamstring muscles would have positive effects and in turn increase hamstring muscle flexibility. Recreational football players60 were assessed. Intervention was given 6 days a week for 4 weeks. Outcome measure for study was hamstring flexibility by sit and reach box test. Results suggest that Self Myofacial Release (SMR) gave better results when combined with passive stretching than passive stretching alone. Hence SMR can be recommended for football players.

Keywords: foam roller, self myofacial release (SMR), hamstring flexibility

Introduction
Flexibility is an important aspect of normal human function. It is the ability to move a single joint or series of joints smoothly and easily through an unrestricted, pain free range of motion.
The hamstring muscles are required to stabilise the knee joint, decelerate the extension of the knee by contracting eccentrically, allows knee flexion and hip extension.[1] Hamstring tightness occurs due to lack of ability of the muscle to change its length from its state of full contraction to full stretch.
Improvement in kicking, running, jogging in football players on hamstring muscle length is correlated with increase in muscle flexibility, joint range-of-motion, whose events require a full range-of-motion [2].
Therefore it is essential to maintain football players overall fitness and musculoskeletal health benefits from flexibility training, maintaining a functional range of motion.
Static stretching is a common technique used in athletes and recreationally active people, in which soft tissues are elongated just past the point of tissue resistance and then held in the lengthened position with a sustained stretch force over a period of time [3, 4, 5] Recently a popular technique called Self Myofacial Release (SMR) using a foam roller is used in athlete and recreational players [6, 7]. SMR technique is facilitated with the use of foam roller. Foam roller is cylindrical in shape and made up of different densities and textures [3].
There has been limited research on the benefits of Self-Myofacial Release (SMR) even though practitioners use this technique in rehabilitation [8, 9]. Therefore the purpose of this Study is to identify if using a foam roller to perform self-induced Myofacial release (SMR) in combination with static stretching on hamstring muscles would have positive effects and in turn increase hamstring muscle flexibility

Aims
To compare the effect of foam roller with static stretching and static stretching only in football players with reduced hamstring muscle length.

Objectives
To evaluate the effectiveness of static stretching on hamstring muscle tightness.
To evaluate the effectiveness of foam roller and static stretching on hamstring muscle tightness.
To compare the effectiveness of foam roller and static stretching on hamstring muscle tightness.

Study Design
It was an interventional study. Study sample of (60) football players were assessed with convenient sampling for 4 weeks. Intervention was given 6 days a week. Outcome measure for study was hamstring flexibility which was assessed with sit and reach box test. (Reliability 0.96 to 0.99) & (Validity 0.59 to 0.89).

Inclusion Criteria
Age- 20 to 29
Recreational football player
Hamstring muscle tightness Present (sit-and-reach box) I.e. reaching till 29cm

Table 1

Age Category	20-29	
Gender	M	F
Excellent	40	41
Very Good	39	40
	34	37
Good	33	36
	30	33
Fair	29	32
	25	28
Needs Improvement	24	27

Exclusion Criteria
No recent injuries of hamstring muscles
Lower limb injury last 1 year
Low back pain

Materials
Sit and reach box
Foam roller
Yoga mat
Digital metronome (sets a 60 beats/min to maintain a consisting speed).

Procedure
After the approval from the Institutional ethical committee according to inclusion and exclusion criteria, 60 healthy individuals from football clubs in Pune were included in this study and their written consent was taken. Nature of study was explained to them.
Assessment was done for hamstring muscle tightness prior to the treatment using sit and reach test.
An explanation of treatment procedure, in understandable language and a demonstration of foam roller procedure was given to the subjects.
Individual were allowed to practice the correct way of performing the treatment procedure.
Assessment was done on the 1st day prior to the treatment and at the end of the 6th day after treatment, for every consecutive week, for 4 weeks.

There are two groups
Group A: Foam roller with static stretching
Group B: Static stretching
Group A: Foam roller with static stretching
Foam rolling procedure
The subjects were in long sitting position (Fig 1)
The foam roller was placed between the ischial tuberosity and subject's legs were maintained in an extended position, keeping their ankles relaxed. Subjects were then instructed to support their body weight with their arms extended on the ground and raise the upper body and to allow as much pressure between the hamstring muscle group and the foam roller.
The (FR) protocol included three 1 min repetitions with a 30 sec break between repetitions to allow subjects to rest their arms.

Fig 1: Foam rolling procedure

Fig 2: Static stretching procedure

Static stretching procedure
The subjects remained in supine position, (Fig 2) 3 passive stretches to the hamstrings were given to dominant leg while the non-dominant leg was stabilized with the therapist's leg, vice versa. For each stretch, the therapist moved the subject's leg to the point of discomfort without pain. The stretch was held for 1 min with a rest period of 30 seconds between each stretch [11, 12].

Group B: **Static stretching**
The subjects remained in supine position, 3 passive stretches to the hamstring was given to dominant leg while the non-dominant leg was stabilized with the therapists leg. For each stretch, the therapist moved the subject's leg to the point of discomfort without pain. The stretch was held for 1 min with a rest period of 30 seconds between each stretch. [13]

Data analysis and Results

Table 1: Distribution of subjects in both groups according to age.

Age Group	Count (A)	Count (B)
20-22	13	13
23-25	9	8
26-28	5	8
29-31	3	1
Total	30	30

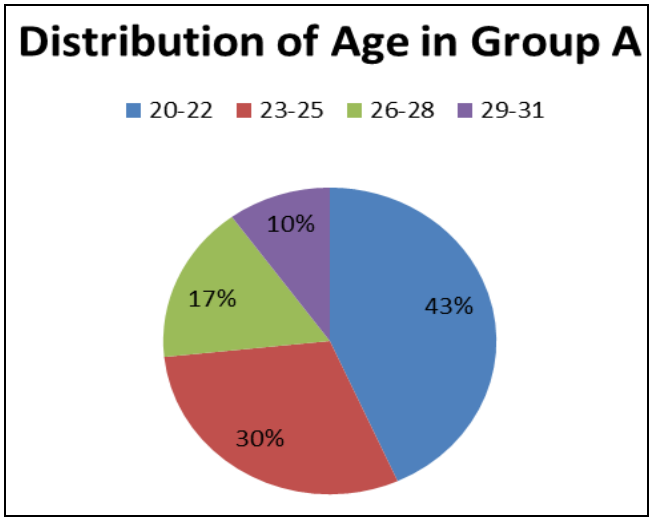

Fig 1: PIA chart showing distribution of Age in group A

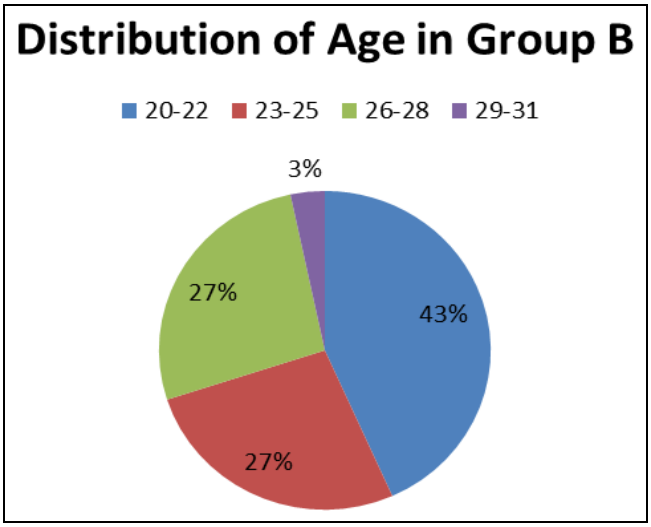

Fig 2: PIA chart showing distribution of Age in group B

Table 2: Mean value of Sit & Reach distance in centimeters for both right and left leg for Group A and Group B.

Groups	Pretreatment Group A	Pretreatment Group B
Right Leg Mean (CM)	26.13±1.655	25.73±1.617
T value	0.94665	
P value	0.3477> 0.05 (Non-Significant)	
Left Leg Mean(cm)	25.4±1.404	24.9±1.398
	T value	1.3819
	P value	0.1723> 0.05 (Non-Significant)

Inference: Both the groups are comparable.

Table 3: Comparison of pre and post intervention values of sit and reach distance for right leg in (A) group.

Week	Mean(cm)	SD(cm)	T-value	p-value
1	29.56667	±1.590561	33.089	2.2e-16
4	36.86667	±1.008014	17.895	2.2e-16

Inference: Comparison suggests that there was significant ($p<0.05$) improvement in hamstring length in group A at end of 4 weeks.

Table 4: Comparison of pre and post intervention values of sit and reach distance left leg in A group.

Week	Mean(cm)	SD(cm)	T-value	p-value
1	28.73333	±1.460593	19.796	2.2e-16
4	35.43333	±1.165106	19.977	2.2e-16

Inference: Comparison suggests that there was significant improvement in hamstring length in group A at end of 4 weeks.

Table 5: B) Static stretching

Table 5: Comparison of pre and post intervention values of sit and reach distance right leg in B group.

Week	Mean(cm)	SD(CM)	T-value	p-value
1	27.3	±1.744943	14.102	8.17E-15
4	32.73333	±1.680175	15.577	6.32E-16

Inference: Comparison suggests that there was significant improvement in hamstring length in group B (Right Leg) at end of 4 weeks

Table 6 B): Static stretching Left leg (intra group)

Table 6: Comparison of pre and post intervention values of sit and reach distance left leg in B group.

Week	Mean(cm)	SD(CM)	T-value	p-value
1	27.3	±1.744943	14.102	8.17E-15
4	32.73333	±1.680175	15.577	6.32E-16

Inference: Comparison suggests that there was significant improvement in hamstring flexibility for right leg at end of 4 weeks in Group B.

Table 7: Comparison of group A and B sit and reach distance for right leg.

	Group A	Group B
Pre treatment	26.13333	25.73333
Post treatment(4 week)	36.86667	34
T value	15.624	
P value	5.84E-16	

Inference: Comparison suggests that group A was significantly better than group B.

Table 8: Comparison of group A and B sit and reach distance for left leg. Left leg

	Group A	Group B
Pre-treatment	25.4	24.9
Post treatment(4 week)	35.43333	32.73333
T value	15.577	
P value	6.32E-16	

Inference: Comparison suggests that group A was significantly better than group B

Summary of results: Statistical analysis shows that significant improvement in hamstring flexibility was present in both groups but group A had better improvement than group B

Discussion

Foam roller was used to perform Self Myofacial Release (SMR) in combination with static stretching on hamstring muscle to increase hamstring muscle flexibility. This study was conducted on 60 subjects who were divided into two groups, - Group A (Foam roller + Static Stretching) and Group B (Static Stretching).

Group A was given foam roller + static stretching and Group B was given static stretching treatment for the duration of 4 weeks for 6 consecutive days. Hamstring flexibility was assessed using sit and reach box test at the beginning on the 1st day and at the end on 6 th day for 4 weeks.

A foam roller is commonly used for both clinical and home therapy and has shown therapeutic effect. Hence we decided to incorporate foam roller before static stretching in the treatment protocol. The foam roller can be used by the subjects on their own but the pressure is applied by the individuals externally or using their own body weight, foam rolling movement doesn't need any assistance it is an independent technique of a practitioner, foam roller gives an effect of self-induced Myofacial release (SMR) [2].

While performing foam rolling technique mechanical friction is caused between the foam roller and superficial and deep layers of soft tissue which stimulates the primarily mast cells and produce histamine (which is a vasodilator), vasodilatation increases the blood flow to the area treated and allows quicker and more complete diffusion of waste products from the tissue to the blood and likely to increase intramuscular tissue temperature and blood flow, possibly both these effects causes increase in viscoelastic properties of muscle [11].

Viscosity is also sensitive to changes in temperature. High temperature decreases the viscosity [12].

Viscosity refers to a material resistance to flow. It is a fluid property and depends on the water composition of the tissue.[12] Viscoelasticity property is a time-dependent property of soft tissues that initially resist deformation, such as a change in length of the tissue when a stretch force is applied, when a stretch force is sustained viscoelasticity allows a change in length of the tissue and enables it to return gradually to its pre-stretched state after the stretch force is removed [13].

Constant stretch results in increased tissue length. When the applied load is kept for a constant length, it results in decrease internal tension in the tissue.

The most common theory used to explain is that when undisturbed fascia becomes more viscous, solid form can restrict movement. If the heat from rolling friction, mechanical stress, massaging pressure is applied to the fascia, it can become more gel-like and pliable, allowing it greater flexibility, in turn, increases ROM [9].

One more explanation is the mechanical behavior of the connective tissue (The Stress-Strain Curve) is used to interpret what is happening to connective tissue under stress. When stress is applied on the connective tissues, initially, the collagen tissue is straightened. With additional stress the recoverable deformation occurs in the elastic range. Once the elastic limit is reached sequential failure of collagen fibers and tissue occurs in plastic range resulting in the release of heat and new length when the stress is released [17].

Similarly, Table and fig 7 and 8 (Static stretching Group B) shows that there was a significant increase in hamstring muscle flexibility after giving 4 weeks of static stretching treatment (Group B)

Static stretching is a well-accepted as an effective form of stretching to increase flexibility. The static stretching technique requires assistance. In Static stretching soft tissues are elongated past the tissue resistance and then held in the lengthened position with a sustained stretch. During static stretching it is thought that the GTO, which monitors tension created by stretch of a muscle-tendon unit, may contribute to muscle elongation by overriding any facilitative impulses from the primary afferents of the muscle spindle (I a afferent fibers) and may contribute to muscle relaxation by inhibiting tension in the contractile units of the muscle being stretched [14].

According to the American Massage Therapy Association SMR is believed to have similar effects that of massage like the relief of muscle tension and stiffness, reduced swelling and spasm, reduction in muscle pain, greater joint flexibility, faster healing of strained muscles and sprained ligaments and even enhance athletic performance [15].

Massaging causes an increase in the rate of blood flow by mechanically emptying the blood vessels and allowing them to refill with fresh blood. SMR technique has been

popularized using a foam roller that also serves as an inhibitory technique of muscle which decreases overactive myofascial tissue. SMR technique using a foam roller is reported to be similar to MFR [16].

Foam roller movement causes friction and in turn causes pressure on the trigger points (the overactive part of the tissue) appears to cause the Golgi tendon organ (GTO) complex to elicit an inhibitory effect on the muscles, allowing it to become less tense and more pliable, leading it to an increase in joint range-of-motion [3, 6].

The stretch reflex reacts when excess pressure is placed on the foam roller and stimulates the muscle fiber to prevent excess stretching, thus increasing or maintaining the stiffness by stimulating the muscle fibres.6 Foam rolling likely acts by reducing neural inhibition, resulting in better communication from afferent receptors in the connective tissue [15].

Another possible explanation is the thixotropic property reported in muscle and fascia, thixotropic is a physical property of the muscle and tissue. Many writers have proposed that connective tissue fascia can be transformed from a gel (thickened) state to a (liquid) state by the application of force, the force that is generated within the soft tissue is by the application of pressure (force) with the direction along with the foam rolling movement [14, 16, 8].

This transformative process, of gel to liquid, is referred to as Thixotropy property. The thixotropic property will result in the reduction of stiffness and change in property in muscles and fascia by decreasing tissue resistance [7].

Since foam roller as self–Myofacial release showed comparatively more beneficial effects over static stretching, so it is beneficial to include foam roller technique before static stretching. Since foam roller as self–Myofacial release showed comparatively more beneficial effects over static stretching, so it is beneficial to include foam roller technique before static stretching.

Conflict of interest: None

Source of funding: Nil.

Conclusion

The study concluded that foam roller when combined with static stretching protocol had greater effect on hamstring muscle flexibility when compared to only static stretching group only.

References

1. Carolyn Kisner, Lynn allen Colby. 5th edition Chp no (4):66.
2. Lark RA. Hamstring injuries: risk assessment and injury prevention. Annals Academy of Medicine Singapore. 2008; 37(4):341.
3. Roylance DS, George JD, Hammer AM, Rencher N, Fellingham GW, Hager RL, *et al.* Evaluating acute changes in joint range-of-motion using self-myofascial release, postural alignment exercises, and static stretches. International Journal of Exercise Science. 2013; 6(4):6.
4. Couture G, Karlik D, Glass SC, Hatzel BM. The effect of foam rolling duration on hamstring range of motion. The open orthopaedics journal. 2015; 9:450.
5. Gregory EP. Pearcey, MSc, David J, Bradbury-Squires. Foam rolling for delayed-onset muscle soreness and recovery of dynamic performance measures. Journal of Athletic training. 2015; 50(1):5-13.
6. Martínez-Cabrera FI, Núñez-Sánchez FJ. Acute effect of a foam roller on the mechanical properties of the rectus femoris based on tensiomyofigy in soccer players. International Journal of Human Movement and Sports Sciences. 2016; 4(2):26-32.
7. Mohr AR, Long BC, Goad CL. Effect of foam rolling and static stretching on passive hip-flexion range of motion. Journal of sport rehabilitation. 2014; 23(4):296-9.
8. Peacock CA, Krein DD, Silver TA, Sanders GJ, Von Carlowitz KP. An acute bout of self-myofascial release in the form of foam rolling improves performance testing. International journal of exercise science. 2014; 7(3):202.
9. Sullivan KM, Silvey DB, Button DC, Behm DG. Roller- massager application to the hamstrings increases sit- and- reach range of motion within five to ten seconds without performance impairments. International journal of sports physical therapy. 2013; 8(3):228.
10. MacDonald GZ. Foam rolling as a recovery tool following an intense bout of physical activity (Doctoral dissertation, Memorial University of Newfoundland).
11. Cantu RI, Grodin AJ. Myofascial manipulation: theory and clinical application. Aspen, 2001.
12. Cynthia C. Norkins. Joint structure and function.5th edition chp no, (2):84-91.
13. Carolyn Kisner, Lynn Allen Colby. 5th edition Chp no (4):70.
14. Carolyn Kisner, Lynn allen Colby.5th edition Chp no, 4:79-80.
15. Allison N. Schroeder, BS and Thomas M. Best. Is self myofascial release an effective preexercise and recovery strategy. American journal of sports medicine, 2015, 14.
16. Robert I. Cantu Alan J. Grodin. Myofascial manipulation theory and clinical application.2nd edition chp no, (4):59.
17. Carolyn Kisner, Lynn allen Colby. 5th edition Chp no, (4):66.
18. Direct realease of myofascial techinique. Chp no, (2):8.