



ORIGINAL RESEARCH PAPER

Physiotherapy,

EFFECT OF PNF STRETCHING VERSUS SELF STRAP STRETCHING ON ANKLE DORSIFLEXION RANGE OF MOTION AMONG COLLEGIATE ATHLETES WITH CALF MUSCLE TIGHTNESS.

KEY WORDS: Calf tightness, PNF stretching, Self-strap stretching, Collegiate athletes, Calf flexibility.

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ABSTRACT

BACKGROUND: Calf muscle tightness is a very common occurring condition in athlete. Stretching is form of physical exercise in which a specific muscle or tendon (muscle group) is deliberately flexed or stretched in order to improve the muscle's elasticity and achieve comfortable muscle tone. Flexibility helps with injury prevention, reduction of soreness following a workout, and a general sense of well-being. There are different stretching technique and protocol for improvement in calf extensibility and flexibility. The purpose of this study was to investigate the effectiveness of two techniques PNF and SELF STRAP STRETCHING for improving calf flexibility among collegiate athletes.

MATERIALS AND METHOD: The selected 30 college athletes were randomly allocated to 2 groups equally. Group 1 (n= 15) were given PNF and Group2 (n=15) were given self-strap stretching technique. Calf flexibility for each group was measured using goniometer and knee to wall test. Treatment was given for four days a week for 4 weeks.

RESULT: The collected values were analyzed using paired 't' test and independent 't' test. The result showed an increase in the values of goniometric measurement and knee to wall test of the PNF technique (group A) compared to baseline value of self-strap stretching (group B) 16.4 and 10.88 at the end of 4 weeks.

CONCLUSION: This study concluded that PNF technique is found to be more effective in improving the calf muscle among collegiate athletes.

INTRODUCTION

Musculoskeletal injuries are common in athletes of all ages, with more than 2.6 million youth athletes treated in emergency departments annually for sport and recreation related injuries. Achilles tendon tightness with a resultant decrease in ankle dorsiflexion flexibility leads to increased stress through the mid-foot and fore-foot during impact activities, resulting in worsening of the number of athlete and adult. Moreover, recent studies have identified a high rate of Achilles tightness in children presenting with lower extremity injuries and pain. As a result, physicians treating youth athletes generally recommend routine lower extremity stretching exercises in those presenting with foot and ankle conditions with concurrent Achilles tendon tightness^[1].

Calf muscle tightness and reduced ankle joint dorsiflexion are related to number of lower limb disorders, including Achilles tendinitis and plantar fasciitis. As a result, calf muscle stretches are commonly prescribed in an attempt to increase dorsiflexion and reduce the symptoms of such disorders^[2].

Stretching refers to the movement applied by an external force or internal force in order to increase one's joint range of motion and flexibility^[3]. Proprioceptive neuromuscular facilitation is an advanced method of stretch training to increase flexibility. PNF is a stretching modality which intersperses static stretching with a series of muscle contraction or isometric activation. PNF uses this muscle activity to exploit certain neuromuscular traits and facilitate a greater stretch. The goal is to achieve improvements in range of motion beyond those that can be achieved by traditional stretching^[4, 5]. The most common PNF technique is termed "contract-relax" or more correctly "hold-relax". This is where the tight muscle is activated isometrically, and then the muscle is stretched further, here's step by step PNF example for attempting to increase dorsiflexion range of motion^[6].

Hold relax is a resisted isometric contraction of antagonistic muscle (shortened muscle) followed by relaxation. Goal to increase the range of motion and decreases the pain^[7].

Ankle stretching has been considered an essential part of rehabilitation and physical fitness programs for injury

prevention and improvement of ankle function. Previous study found that, for individuals with limited DFROM, mobilization with movement techniques using weight-bearing exercise was more effective than technique with a non-weight bearing component. To provide a self-stretching technique for facilitating gliding motion in the talo-crural joint in the weight bearing position, the novel technique termed ankle self-stretching using a strap (SSS) for individuals with limited ankle DFROM was introduced. Self-strap stretching (SSS) and Movement with mobilization (MWM) technique are performed in a weight-bearing position to improve DFROM, provide pain relief, and allow functional activities such as lunging and squatting. The SSS and MWM methods, which used talar posterior gliding in the closed chain position, have been recommended for improving DFROM^[8].

Disrupted joint arthro-kinematics may also cause restricted ankle DFROM. Manual joint mobilization has been shown to increase ankle DFROM in both previously injured and healthy population. It is likely that the limited ability of the talus to glide posterior, relative to the tibia and fibula, reduce ankle DFROM, secondary to a disruption in joint arthro-kinematics. Mobilization aimed at improving ankle joint arthro-kinematics have shown a significant positive relationship between improved ankle DFROM and increases in talus' posterior glide relative to the tibia and fibula following treatment. Further, the use of a strap positioned to improve the posterior glide of the talus while concurrently stretching the plantar flexor musculature, increased ankle DFROM^[9].

AIM AND OBJECTIVES

AIM:

To compare the effectiveness of PNF stretching and self-strap stretching on calf muscle tightness of both the lower limb among collegiate athletes.

OBJECTIVE:

1. To know the effect of PNF stretching in bilateral calf muscle tightness among collegiate athletes.
2. To know the effect of Self-strap stretching on bilateral calf muscle tightness among collegiate athletes.
3. To compare the effects of PNF stretching and Self strap stretching on dorsiflexion range of motion on collegiate athletes.

MATERIALS AND METHODOLOGY:

This is a comparative study done among collegiate athletes to find the effect of PNF technique and self-strap stretching for calf flexibility. A total of 30 participants were recruited based on selection criteria and were divided into 2 groups with each group containing 15 members.

4.8.1. Inclusion Criteria:

- Ankle dorsiflexion range of motion below 19° [Normal range: 20°]
- Age: 18 – 23 male and female
- Subject without any previous injury in bilateral lower-limb.
- Unilateral stance of less than 1 minute.

4.8.2. Exclusion Criteria:

- Subject with history of ankle injury
- Musculoskeletal problem of bilateral lower limb
- Subject with congenital deformity of bilateral lower limb
- Person with ankle edema
- Amputation in lower limb.
- Unilateral stance of more than 2 minutes.

A total of 30 participants were included based on the inclusion and exclusion criteria. The selected subjects were randomly assigned into 2 groups A and B:

GROUP A – In group A, subjects were given PNF stretching-HOLD RELAX technique for both lower limbs.

GROUP B – In group B, subjects were taught self-strap stretching for both the lower limbs.

Study Procedure:

Goniometer

Ankle dorsiflexion range of motion was measured using universal goniometer for calf muscle tightness. Subject positioned in supine lying, and axis placed over the lateral malleolus at intersection of line through lateral midline of fibula and lateral midline of fifth metatarsal. With the table arm placed over lateral midline of fibula, in line with fibular head and movable arm over lateral midline of fifth metatarsal. Subject was asked to actively dorsiflex the foot from neutral ankle position. The range of motion was measured throughout the movement of foot.



Knee To Wall Test

A weight-bearing lunge test (WBLT) was used to measure ankle dorsiflexion range of motion. WBLT was performed in standing, with foot on lower limb in a standardized position such that the second toe, center of the heel, and knee were kept in a plane perpendicular to the wall and the heel firmly in contact with the ground. While in this position, the subject lunged forward until the anterior knee contacted the wall and maximum dorsiflexion was obtained. An inch tape was used to measure the distance between the second toe and the wall. Heel contact with the floor was maintained throughout the

test. Measurements of dorsiflexion range of motion were taken on both lower limbs.



Pnf Stretching [hold-relax Technique]:

The subject moved the ankle joint to the end of the passive or pain – free Range of motion using towel, subject was asked to make an isometric contraction of restricted muscle, the Contraction was maintained for 5-8 sec. Then the subject was asked to increase resistance slowly. No motion was intended by subject, after holding the contraction for 15-20 seconds then the subject was asked to relax for 2-3 sec. The joint was repositioned either actively or passively to new limit of range. The procedure was repeated for new limit of range.

Repetition- 5 repetition/ 3 sessions/ day

Duration- 4 days/week



Self Strap Stretching [sss]

While lunging, the subject performed ankle self-stretching on foot stool using a non-elastic strap approximately 30 cm long. The length and width of the foot stool was 30 and 10 cm, respectively. The testing foot was placed on stool, the opposite foot was placed on the ground in lunge position, and backward force was provided by pulling the strap. The front of strap was placed around the anterior aspect of talus of the tested foot on stool, and the back of the strap placed around the medial region of the opposite foot on the ground. The strap was positioned just inferior to medial and lateral malleoli of the tested foot. The patient was asked to perform the Self-strap stretching with the strap pulled taut in the initial position; the knee of the front leg was subsequently moved forward along a straight line to effect a lunge during SSS. The forward bending of knee or lunge was said to be continued until the muscle was stretched. The end position was then maintained by constantly applying pressure without lifting the heel for 20 sec and then returned to initial position.

Repetition-15repetition/ 3 sessions/ day

Duration- 4 days/week



RESULTS:

A total of 30 subjects were enrolled in to the study. The calf flexibility was measured using goniometer and knee to wall test.

Table 1:

		Meaurement tool	Mean Value		t Value	P Value
			Pre test	Post test		
PAIRED 't' TEST	Group A	Goniometer	16.4	20.4	20.64	<0.05
		Knee to wall test	10.88	13.6	37.59	<0.05
	Group B	Goniometer	16.2	18.1	10.39	<0.05
		Knee to wall test	10.86	11.8	19.54	<0.05

Table 2:

INDEP ENDEN T 't' TEST	Post test	Measurement tool	Pre test	Post test	t Value	p Value
			Group A	Group B		
			Goniometer	20.4		
		Knee to wall test	13.7	11.8	4.149	<0.05

Paired 't' Test:

Goniometer Measurement

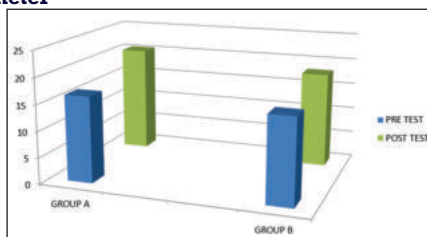
Group- A [pnf Stretching]

- The Pre-test and Post-test values of ankle dorsiflexion range of motion was analyzed using Paired 't' test. The table 't' value is 2.145 and calculated 't' value is 20.64. Since the calculated 't' value was greater than table 't' value, null hypothesis H₀₁ is rejected. Hence, there is a significant effect of PNF Stretching to improve flexibility.

Group-b [self Strap Stretching]

- The Pre-test and post-test value of ankle dorsiflexion range of motion was analyzed using the paired 't' test. The table 't' value is 2.145 and the calculated 't' value is 10.39. Since the calculated 't' value was greater than table 't' value, null hypothesis H₀₂ is rejected. Hence, there is a significant effect of Self strap stretching to improve flexibility.

Goniometer



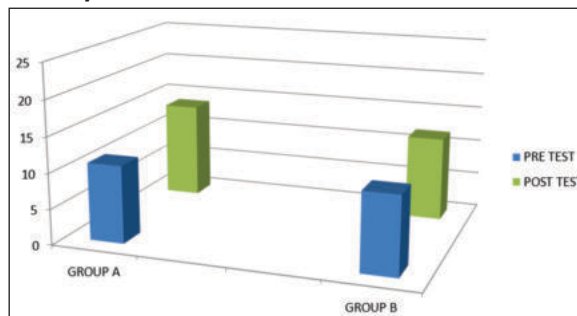
Knee To Wall Test

Group-a [pnf Stretching]

- The Pre-test and Post-test values of knee to wall test was analyzed using paired 't' test. The table 't' value is 2.145 and the calculated 't' value is 37.59. Since the calculated 't' value was greater than table 't' value, null hypothesis H₀₁ is rejected. Hence there is a significant effect of PNF Stretching to improve flexibility.

Group-b [self Strap Stretching]

The Pre-test and post-test value of knee to wall test was analyzed using paired 't' test. The table 't' value is 2.145 and calculated 't' value is 19.54. The calculated 't' value was greater than table 't' value, null hypothesis H₀₂ is rejected. Hence there is a significant effect of Self strap stretching to improve flexibility.



Independent 't' Test

Goniometer Measurement

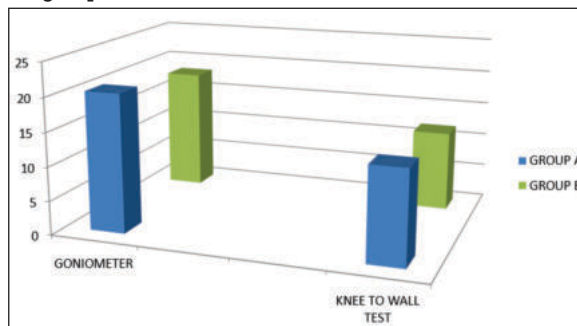
Post Test Values Of Group A And Group B

- The Post-test values of ankle dorsiflexion range of motion was analyzed using independent 't' test. The table 't' value is 2.048 and calculated 't' value is 5.050. Since the calculated 't' value was greater than table 't' value, null hypothesis H₀₃ is rejected. Hence there is a significant difference between the post-test value of group A and group B

Knee To Wall Test:

Post Test Values Of Group A And Group B

The post-test values of knee to wall test was analyzed using independent 't' test. The table 't' value is 2.048 and calculated 't' value is 4.149. Since the calculated 't' value was greater than table 't' value, null hypothesis H₀₃ is rejected. Hence there is a significant difference between the post-test value of group-A and group-B.



DISCUSSION

Flexibility is the ability to move a single joint or a series of joint smoothly and easily through an unrestricted pain free range of motion. The benefit of enhancing flexibility reduces the risk of injury, provides pain relief and improves athletic performances. In sports, flexibility is the major component in preventing any injury. Calf and hamstring muscles are commonly injured in athletic events. Tight calf muscle has been linked to injuries such as Achilles tendinitis, gastrocnemius strain and plantar fasciitis in athletes.

Physical therapies have used many different methods to

maintain and increase joint motion and prevent deformity and dysfunction resulting from the muscle contracture. The intention of physical therapy is to lengthen the musculotendinous unit, supporting connective tissue and increase range of motion. Flexibility can be increased by doing active and passive warm ups such as stretching, thermotherapy, cryotherapy, massage and various modalities.

The principal findings from this study were that youth athletes enrolled in a routine gastrocnemius stretching program experienced increased ankle dorsiflexion in both groups, when compared to self-strap stretching, PNF stretching experienced more flexibility of calf muscle and increased range of motion.

The aim of the study was to increase the flexibility of the calf muscle among the collegiate athletes with PNF stretching and self-strap stretching.

The study was conducted with 30 subjects who were selected under inclusion and exclusion criteria. And they were divided into 2 Groups, with Group A – PNF stretching, Group B- Self strap stretching. Both groups were assessed by ankle dorsiflexion range of motion test by Goniometer and Knee to wall test.

During PNF stretch and isometric contraction of stretched agonists for extended period may cause activation of its neuromuscular spindle. The increase in tension created during the isometric contraction of the pre – lengthened agonist contracts concentrically. These impulses travel via causing post synaptic inhibition of the motor neuron to agonist increasing the tension from the GTO. These impulses can override the impulses coming from the neuromuscular spindles arousing the muscle to reflex resist to the change in length, thus helping in lengthening the muscle.

In lunge position self-strap stretching, both the middle of the heel and the second toe were aligned directly over a straight line to minimize subtalar pronation and other compensatory movements during stretching of the ankle joint. This may provide a greater stretching force than static stretching does. The greater stretching force produced by shifting the body weight forward there by improving the flexibility of the muscle.

Paired 't' test was used to interpret the result within the group and independent 't' test was used to interpret the result between the both groups.

The value of dorsiflexion range of motion was increased at the end of 4 weeks in both the groups- Group A- PNF stretching and Group B- Self-strap stretching. But on comparison between the groups, greater flexibility was found with the PNF stretching group.

Lucas et al. studied the effect of static, dynamic and PNF stretching technique on the flexibility of hamstring – gastrocnemius muscle on 63 college women. The finding indicated all 3 method of flexibility training produced significant improvements when pretest and posttest mean scores were compared.

Sady et al. compared the effect of static and PNF stretching technique for hamstring muscles on the flexibility. A Leighton flexo-meter was used to measure ROM at the joint traversed by the tested muscle group. Only the PNF group had an increase in flexibility greater than the control group.

Bradley PS et al. studied the effectiveness of static, light ballistic, PNF stretching on strength performance. PNF stretching enhanced the strength performance while other form of stretching did not because, PNF stretching encourage the muscle inhibition.

So this study also supports that PNF stretching is more effective to improve the flexibility of calf muscle when compare to the other form of stretching.

CONCLUSION

This study was done to find out the effectiveness of PNF Stretching and Self strap stretching on calf muscle tightness among colligate athletes.

Group A 15 Subject:Received PNF Stretching
Group B 15 Subject:Received Self strap stretching

Goniometer- Ankle dorsiflexion range of motion test, Knee to wall test were used to assess the outcome measure and the efficacy of intervention provided.

Pre and post values were collected and analyzed using independent 't' test and Paired 't' test.

The study concluded that both PNF and Self strap stretching are effective in improving calf muscle flexibility but PNF Stretching was more effective when compared to Self strap stretching on improving calf muscle flexibility.

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