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Immediate Effect of Stretching and Post Isometric Relaxation on Calf Muscle Tightness

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Keywords:

calf muscle tightness, passive stretching, post isometric relaxation, ankle flexibilty test

Abstract

Background: The study is aimed at investigating the immediate effect of stretching and post isometric relaxation on calf muscle tightness

Methods: Ethical clearance was taken by Institutional Ethical Committee. Subjects with any history of hamstring tightness, plantar fasciitis, knee-flexion contracture, ankle fracture or any neurological were excluded as these can affect the results. The research was carried out on people between the ages of 20 and 40. 40 subjects were selected and were divided into two groups. Group A for Passive Stretching and group B for Post Isometric Relaxation. The calf muscle tightness was tested in a randomised study with the outcome measure Ankle Flexibility Test. After the respective procedure, post-assessment that is Ankle Flexibility Test, Ankle Active Dorsiflexion Range of Motion and Ankle Passive Dorsiflexion Range of Motion were taken. Further study was then carried out based on the comparison of pre and post-assessment as well as comparing the results of both the groups.

Conclusion: This study demonstrated greater improvements in Ankle Active Dorsiflexion Range of Motion, Ankle Passive Dorsiflexion Range of Motion and Ankle Flexibility Test with immediate effect of post isometric relaxation in group B than the immediate effect of passive stretching in the group A. Hence it is preferable to use Post Isometric Relaxation as it is shown to be more effective for reducing the tightness of the calf muscle rather keeping it untreated which can cause further problems like plantar fasciitis, hamstring tightness and so on.

1. INTRODUCTION

Muscle tightness is a feeling of stiffness in the muscles that frequently results in discomfort and makes movement difficult.It frequently develops as a result of altering workout regimens, prolonged periods of inactivity and most commonly by the overuse of muscles. Restricted ankle movement (equinus), deep vein thrombosis, peripheral vascular disease, muscle tears, poor circulation, drug side effects, dehydration, and an unbalanced diet are additional reasons of calf tightness. Depending on the underlying reason of the muscle stiffness, there may be different signs and symptoms but they mainly include cramping, soreness, weakness, spinal curvature, or trouble in balance. This also causes muscle shortening and prevents full passive and active range of motion.Calf muscle works as the primary source of power for ankle mobility.[1] When muscles get tight, they become pliable, which means they are unable to stretch adequately and hence impede the motion of the joint to which they are attached.[2]Calf muscle tightness is associated with a decrease in ankle dorsiflexion. There was a substantial increase in the prevalence of calf tightness in female individuals compared with males ($p < 0.01$).[3]

Stretching is crucial since it will help the sarcomeres' filaments become more pliable.Stretching relieves muscle tension and relaxes the body, promotes range of motion, helps prevent injuries like muscle strains, maintains existing flexibility, relieves post-exercise aches and pains, reduces muscular tension, and improves muscle relaxation.[4] It appears to have a considerable improvement in range of motion, owing to higher stretch tolerance as well as significant reductions in almost all forms of muscle performance.[5]Stretching programs have been demonstrated in recent research to greatly impact the viscosity of the tendon and make it significantly more

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compliant·It may also be useful for injury prevention when a sport requires high-intensity stretch-shortening cycles(SSCs).[6]

Muscle energy technique (MET) is a manual technique that is now employed by a variety of manual treatment professionals.MET are manipulative treatments in which a patient actively uses his or her muscles against a distinct counterforce from a regulated position and in a specific direction. Post Isometric Relaxation (PIR) and the Reciprocal Inhibition (RI) method are two regularly used MET forms that are used to characterise the process.Isometric muscular contractions are included in PIR. That is the antagonist is inhibited and the agonist is stretched in the intra-fibral space. A research was done by Chang, Won Jin from Azusa Pacific University.It claimed SS(Static Stretching) combined with PIR is more effective than SS alone in improving the flexibility of the hamstring muscles. Clinically important differences were found for an increase in the range of motion for both passive straight leg raise and active knee extension. Due to limited research, further studies were needed.

Stretching and PIR have been individually used to treat many conditions of muscles. Few studies have been done to treat calf muscular tightness with various techniques of stretching but there is none that have been conducted using PIR. There are studies that have found PIR and RI as effective ones for treatment. RI unlike PIR does not concentrate on contraction of affected muscle and is mostly used to treat acute conditions. PIR though involves contraction of affected muscle which thought to be of more greater use in treatment of calf muscle stiffness. Therefore this study was done focusing more on immediate effect of stretching and PIR to release tightness of calf musculature to know which of the either is more effective than the other.

2. Materials and Methods

The study was Interventional based comparative study.This was conducted in the neighborhood of Karad in the year 2022. This study was done in the year 2022 in Krishna College Of Physiotherapy, KIMS, Karad. 40 subjects with calf muscle tightness were selected by random sampling method by formula $n= (4pq/L^2)$ for the study. Subjects with age 20-40 years with calf muscle tightness checked with Ankle Flexibility Test with less than 11cm were included. Individuals with hamstring tightness, plantar fasciitis, knee-flexion contracture, ankle fracture, neurological disorder were excluded. Outcome measures like ankle flexibility test and range of motion were included. Written consent form was obtained from all the subjects. This study was approved by the ethical committee of the institution.

The participant was asked to put the foot perpendicular to the wall in order to test for lack of ankle mobility or tightness of the gastrocsoleus.Using a marker and adhesive tape, a 11cm distance from the wall was marked beforehand.The individual was instructed to lunge his/her kneetowards the wall while keeping his/her heel on the ground. Gradually returning the foot to its original position and re-evaluating until the measured distance of the foot without lifting the heel from the ground has reached the maximum distance from the wall.Finally,a measurement from the big toe to the wall was taken. The test results less than 11cm (4.5 in) of the ankle was considered to be immobile.[7]Active and Passive dorsiflexion range of motion (ADFROM) and (PDFROM) were measured with the help of goniometer.

Passive Stretching was provided to Group A were the subjects were taken in supine position with hip in flexion and the knee in full extension. The holding period of stretch was 30 seconds and relaxed.

For PIR, the subjects were in supine with the knees flexed over a rolled towel and were asked to make a small effort (no more than 20% of available strength) in plantar flexion while breathing properly. Holding the contraction for 7–10 seconds with the subject's aid, the ankle was dorsiflexed to slightly and painlessly beyond the new barrier on slow release, on an inhale. This was held into a new barrier for up to 30 seconds and relaxed.[8]

After the respective procedure, post-assessment that is AFT, ADFROM and PDFROM were taken. Further study was then carried out based on the comparison of pre and post-assessment as well as comparing the results of both the groups.

3. Discussion and Results

The current research was focused on "the immediate effect of stretching and post isometric relaxation on

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calf muscle tightness". This study was conducted in an effort to lower or avoid the chances of acquiring.Plantar fasciitis,[9,10] ankle sprains,[11] Achilles tendinitis,[12] forefoot pain,[13] navicular stress fractures,[14] calf muscle tightness,[15] Achilles tendinopathy,[16] and anterior cruciate ligament injury[17] . Plantar fasciitis, hallux valgus, and low back soreness are all caused by the gastrocsoleus muscle, often known as the calf muscle. Other muscles, such as the hamstrings or the TA, become stiff as a result, affecting hip and pelvic movement during gait. The hamstring or tendoachilles muscles are commonly targeted for treatment, although in many cases, the calf muscle is to blame.

Inadequate DFROM has been identified as a factor in ankle and foot injuries.[12]It's critical to keep the ankle joint aligned during ankle stretching if you want to improve your DFROM.[18] Stretching relieves muscle tension and relaxes the body, promotes range of motion, helps prevent injuries like muscle strains, maintains existing flexibility, relieves post-exercise aches and pains, reduces muscular tension, and improves muscle relaxation.[4]Ankle stretching has long been viewed as an important part of rehabilitation and physical training regimens for injury prevention and promotion of ankle function.[19] The PIR protocol includes isometric muscle contractions. The antagonist is thus blocked, while the agonist is stretched in the intra-fibral area.

According to Rahul Tanwar and colleagues, MET combined with traditional plantar fasciitis treatment improves ankle range of motion and foot functional index, as well as pain reduction in individuals with plantar fasciitis.[8]DiGiovanni et al[20] found that stretching the plantar fascia and Achilles tendon resulted in a high rate of improvement, which supports the findings of this study. They also stated that 77 percentof patients reported no limitations in recreational activities and 94 percent of patients reported a reduction in pain.Kent et al[21] observed that Achilles tendon stretching improved pain scale and foot functional index in plantar fasciitis, which is similar to the findings of this investigation.However, the study's first disadvantage is that it was conducted on a limited sample size, and the study's second weakness is the lack of long-term follow-up to assess the technique's long-term impacts.[8]

According to Hee-jin Jang and coworkers,the duration of preserved calf muscular flexibility differed amongst the three therapies.[22] A significant improvement in calf muscle flexibility (ADFROM and PDFROM) was maintained for 30 minutes in both the ETS and ETU therapies. ADFROM after 9 minutes and PDFROM after 6 minutes in the SS intervention, on the other hand, were not statistically different from baseline. Furthermore, the findings indicate that ETS and ETU may be more beneficial than SS in maintaining calf muscular flexibility in young people.According to Depino et al. (2000), four consecutive 30 second bouts of static stretching helped increase hamstring flexibility, although the impact only lasted 3 minutes. Sperrnoga et al. (2001) developed a hold-relax approach that promoted hamstring flexibility in just 6 minutes.After 8 weeks of static stretching, Gajdosik et al (2006) discovered a considerable increase in dorsiflexion range of motion. After 6 weeks of eccentric exercise, Mahieu et colleagues (2007) found that healthy volunteers' ankle dorsiflexion increased.However, one of our drawbacks was the limited sample size; as a result, the findings should be interpreted with caution, and a larger study should be conducted. Second, the current study included only young participants, and various age groups may give different outcomes. Finally, the carry-over impact could not be avoided. Fourth, dominant and non-dominant foot traits were not taken into account. Fifth, the loads or stress exerted to the ankle ligaments and around the calf muscles were not taken into account. Finally, because we examined the effect on calf muscle flexibility immediately, as well as at 3, 6, 9, 15, and 30 minutes after stretching, the data do not include any long-term effects that may last longer than 30 minutes.[22]

After performing these exercise protocol on particular groups there found to be considered improvement in reduction of calf muscle tightness. Post-test effects are found to be more effective when compared to pre-test assessment. So eventually it improves the scores of AFT, ADFROM and PDFROM.

The above study clearly indicates that stretching and post isometric relaxation was considered significant in calf muscle tightness. While stretching was considered as significant in calf muscle tightness, post isometric relaxation was found to be extremely significant in calf muscle tightness.

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As calf is the primary source of power for ankle movement, it is critical to prioritise calf muscle tightness treatment.The goal of this study was to see how stretching and PIR affected calf muscular tension. Furthermore, given the extensive usage of calf-stretching exercises in sports, fitness, and rehabilitation. To conclude, it is preferable to use PIR as it is shown to be more effective for reducing the tightness of the gastrocsoleus muscle rather keeping it untreated which can cause further problems like plantar fasciitis, hamstring tightness and so on.

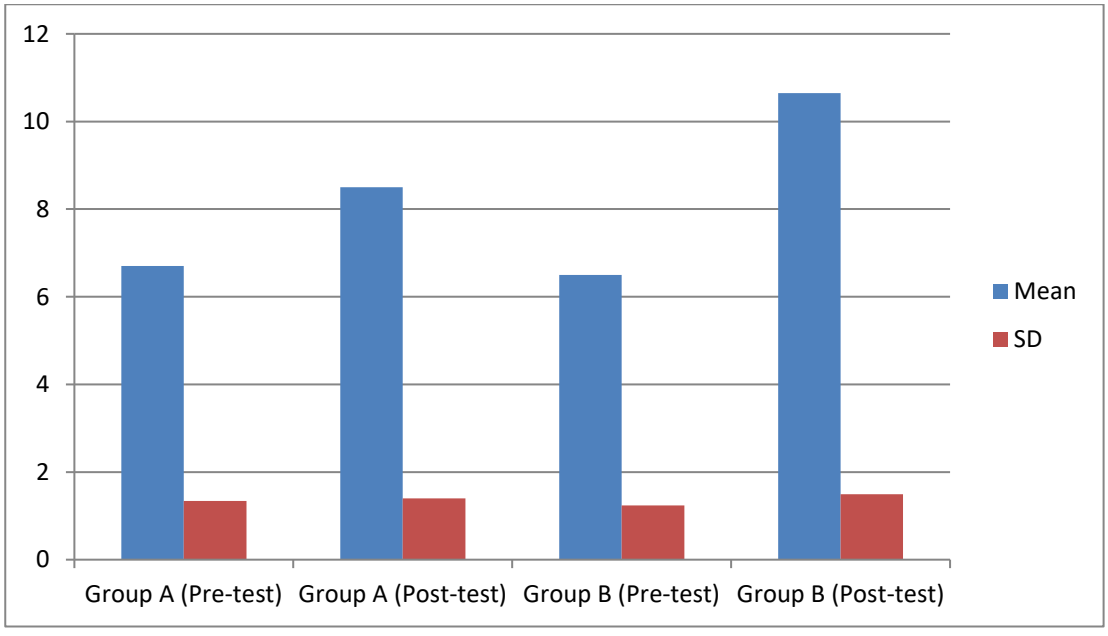
4. Conclusion

The above study showed that the use of both stretching and post isometric relaxation were effective in increasing the AFT, ADFROM and PDFROM scores in subjects. This study demonstrated greater improvements in ADFROM, PDFROM, and AFT with immediate effect of post isometric relaxation in group B than the immediate effect of passive stretching in the group A. We recommend post isometric relaxation to increase DFROM in individuals with limited DFROM. Hence it is preferable to use PIRas it is shown to be more effective for reducing the tightness of the gastrocsoleus muscle rather keeping it untreated which can cause further problems like plantar fasciitis, hamstring tightness and so on.

Data presentation

Table 1: AFT

	Pre-test		Post-test	
	Mean	SD	Mean	SD
Group A	6.7	1.342	8.5	1.395
Group B	6.5	1.235	10.65	1.496



Graph No. 1-AFT

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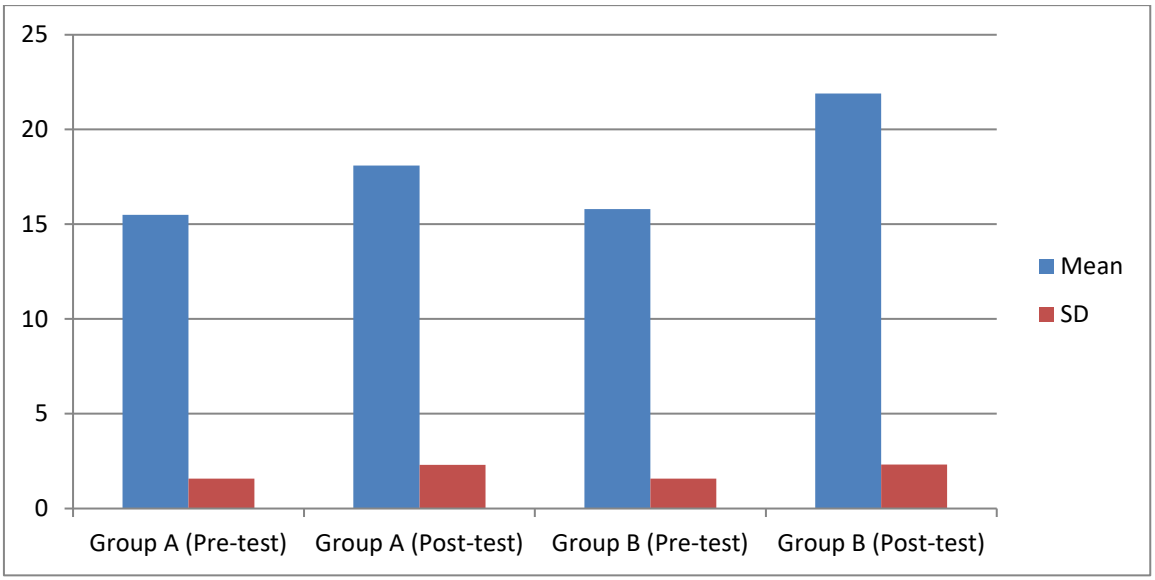
Table 2: ADFROM

	Pre-test		Post-test	
	Mean	SD	Mean	SD
Group A	15.5	1.573	18.1	2.198
Group B	15.8	1.576	21.9	2.315



Graph No. 2-ADFROM

Table 3: PROM

	Pre-test		Post-test	
	Mean	SD	Mean	SD
Group A	17.45	1.731	20.25	2.403
Group B	18.4	1.789	24.7	2.473

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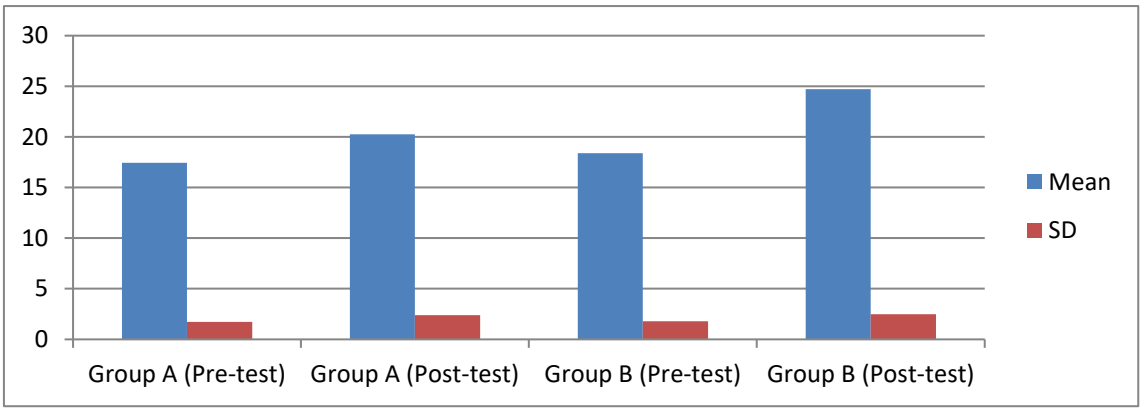

Graph No. 3-PDFROM

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