ORIGINAL RESEARCH

IJPHY

EFFECTIVENESS OF PNF STRETCHING AND CYCLIC STRETCHING OF CALF TIGHTNESS ON COLLEGE GOING GIRLS

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ABSTRACT

Background: Flexibility helps with injury prevention, the reduction of soreness following a workout, and a general sense of well-being. There are different stretching techniques and protocols for improvements in calf extensibility and flexibility. The purpose of the study was to investigate the effectiveness of two techniques i.e. CYCLIC and PNF stretching which improves calf flexibility. This study was done to find the effectiveness of calf Cyclic and PNF stretching technique to improve calf flexibility.

Methods: 30 subjects with age group 21-22 years were randomly allocated to 2 groups equally. Group 1(n=15) were given CYCLIC and group 2(n=15) were given PNF stretching technique. Plantar flexion was used to measure the calf tightness which was done before and after the treatment. Treatment was given for 7 days and on the 7th day the calf tightness was again measured.

Results: The mean difference of the CYCLIC is 4.6 and mean difference of PNF is 4.7 which indicate that CYCLIC and PNF both are effective to improve calf flexibility but PNF is more effective than CYCLIC to improve calf flexibility.

Conclusion: The neurophysiological basis of PNF, stating that the excitatory efficient of the neuromuscular spindle or the inhibitory afferent of the Golgi tendon organ (GTO) or both are responsible for the effects. 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. Both the fascia & the spindle of the agonist adjust to the nearly lengthened position. 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 reflexly resist to the change in length, thus helping in lengthening the muscle.PNF stretching is more effective than cyclic stretching.

Keywords: Cyclic and PNF stretchimg, calf stretching, cyclic stretching, PNF stretching, Cyclic Vs PNF stretching, Calf stretching in school going girls, calf flexibility.

Received 18th May 2015, revised 02nd June 2015, accepted 03rd June 2015

DOI: 10.15621/ijphy/2015/v2i3/67030

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INTRODUCTION

Stretching is the general term used to describe any therapeutic manoeuvre designed to lengthen pathologically shortened soft tissue stretches and thereby to increase range of motion.[1] Factors that are responsible neurologically are Proprioceptors, Golgi Tendon Organ

The nerve endings that relay all the information about muscle skeletal system to the CNS are called proprioceptors. It detects any changes in physical displacement and changes in tension or force within the body. It related to stretching are located in the tendons and in the muscle fibres. Muscle spindle or stretch receptors: Primary (type 1) or Secondary (type 2). Afferent fibres arise from the muscle spindles, synapses on the other alpha or gamma motor neurons and facilitate contraction of the extrafusal and intrafusal fibres.[2, 3]

Golgi tendon organ is located near the musculotendinous junction and wraps around the ends of extrafusal fibres of a muscle. It is sensitive to the tension in a muscle caused by either passive stretch or active muscle contraction and has a high threshold for fib ring with passive stretch. When excessive tension develops in a muscle Golgi tendon organ fibres inhibit motor neuron activity and decreases tension in the muscle.[4, 5]
Pacinian Corpuscles Located closes to the Golgi tendon organ and is responsible for detecting changes in the movement and pressure within the body. When the muscle is stretched, muscle spindle records the change in the length and sends signals to the spine. Which convey this information triggering the stretch reflex which attempts to resist the change in muscle length by causing the stretched muscle contract. Gradually train stretch receptors to allow greater lengthening of the muscles. Component of the stretch reflex are; It has both a dynamic component and a static component. The reason that the stretch reflex has two components is because these are actually two kinds of intrafusal muscle fibres: nuclear chain fibres, which are responsible for the static component, and nuclear bag fibres, which are responsible for dynamic component.[6, 7, 8]

When the muscle contracts, they produce tension at the point. Where the muscle is connected to the tendon, where the Golgi tendon organ is located, that records the change in tension and rate of change of tension. When this tension is exceeds a certain thresholds ,it triggers the lengthening reaction ,which inhibits the muscles from contracting and causes them to relax that is inverse mitotic reflex ,autogenic inhibition and clasped knife reflex.[9] When an agonist contracts, in order to cause the desired motion, it usually forces the antagonist to relax. This phenomenon is called reciprocal inhibition because the antagonist is inhibited from contracting. Sometime called reciprocal innervations. There are 5 types of stretching a) PNF Stretching b) Cyclic Stretching c) Dynamic stretching d) Self stretching e) Static stretching.[10]

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 contractions or isometric activations. 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.[11, 12] the most common PNF technique is termed "contracts relax" or more correctly "holds relax". This is where the tight muscle is placed into a passive stretch, the tight muscle is activated isometric ally, and then the muscle is stretched further, here's step by step PNF example for attempting to increase dorsiflexion range of motion.[13]

Autogenic inhibition refers to the relaxation of a muscle in response to high tension, it is a protective mechanism designed to protect muscle from potential damage. The isometric activation of the 'tight' muscle during PNF is designed to induce autogenic inhibition within the muscle and therefore reduce the muscle resistance to stretch. The second technique that is often utilized is known as the "contract-relax-agonist-contract" method. This technique utilises active contraction of the antagonist, or opposite muscle to get into the stretched position.[14,15] Reciprocal inhibitionrefers to relaxation of a muscle in response to the activation of its antagonist: in PNF, contraction of the opposing muscle is designed to induce reciprocal inhibition within the tight muscle and reduce the resistance to stretch.[15,16] In Hold Relax The patient performs the end range is isometric contraction of tight muscle before it is passively lengthen by autogenic inhibition, the GTO may fire inhibit the muscle so that it can be easily lengthen.[17]

In Hold relax with agonist contraction technique Pre-stretch isometric contraction of tight muscle followed by a concentric contraction of the muscle opposite to tight muscle. In Agonist Contraction the patient dynamically contracts the muscle opposite the tight muscle against resistance. Hold relax actually involves the use of dynamic or ballistic stretching in conjunction with static and isometric stretches.[18, 19]

Cyclic Stretching is a form of passive stretching, which is relatively of short duration and the stretch force is applied repeatedly but gradually. The multiple repetitions of stretch cycles are applied in one session. Each cycle of stretch is held between 5-10 seconds. Speed of stretch, whenever slow facilitates the stretch reflex and decreases tension in muscle being stretched: low speed stretch affects the viseoelastic properties of connective tissue, making them more compliant. Local relaxation like warming up of soft tissue will increase the extensibility of shortened tissue. Warm muscle relax and tighten more easily, as the temperature of muscle increases the amount of force required to elongate non contractile and contractile tissue and time for which stretch force must be applied diseases warm up minimize the chances of minor trauma to the muscle and decreases domes.[19]

Many causes of calf tightness like wear high heeled shoes; in this calves are kept in a state of perceptually shortened length. It is also due to sudden overstretching of the calf muscle. Pain and tenderness present in the calf rather than Achilles tendon. Also there is absence of gap which is the diagnostic feature of rupture of the tendo-achilles. Resisted plantar flexion is painful with loss of toe push off while walking. Though painful, it is possible for the patient to stand on the toes, raising heel from the ground. Spontaneous relief occurs with local ice application, compression bandage and avoiding over stretching activities along with medication. Adequate functional recovery occurs within a week. However, sportsmen should keep away from vigorous manoeuvres for at least 3 weeks. Calf tightness can also be symptomatic of weakness elsewhere in the leg, if the gluteus and/or hamstring are weak ,calf will often try to make up for that weakness. This means the muscle gets overused, which in turn exacerbates calf tightness. In these cause given stretching for 1 week and 1-2 times per day that increases the flexibility of calf muscle.[20]

METHODOLOGY

Before participation in the study all the subjects were explained the procedure and made signed on informed consent form. Subject who met the selection criteria was included in the study. Age should be 20-21 years. Subject should not have any effect from any previous ankle joint injury that would limit active range of motion. Subject should have ability to stand in a static position for two minutes at a time.In this study experiment done only on female. Exclusion criteria were History of ankle joint injury. Metabolic disease. Any type of congenital deformity like fixed flexion deformity. Prolonged calf tightness cause spondylolisthesis. Initial assessment was done and before administration of treatment ROM of ankle joint should be taken using the Goniometer.

Effective manual stretching technique requires adequate stabilization of patient & sufficient strength. Patient's position should be stable and comfortable before testing. Direction of the stretch should be exactly opposite to the direction of tightness. Passive movements are necessary before stretching. At least 10 repetitions should be there. Explain the subject; it is important to be as relax as possible throughout stretching period. Area should be stretched should free from any restriction like clothing. Explain the whole procedure to the patient.

PROCEDURE

PNF stretching: The subject is sitting position with knee flexion and therapist stand in front of the subject and give the command to the subject and ask the subject to hold the theraband over the ankle and move the ankle at 30 degree and 90 degree.

CYCLIC STRETCHING:

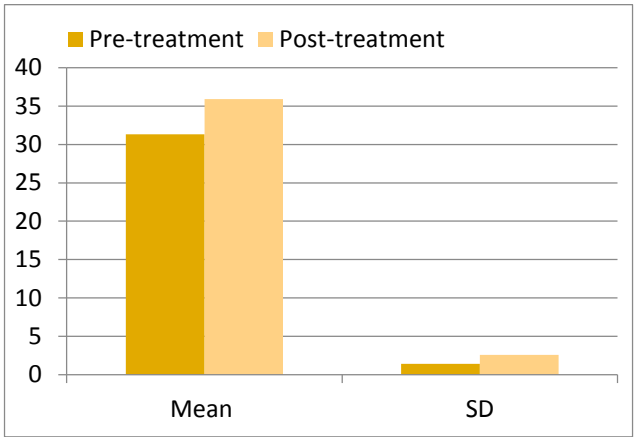
The subject is standing position and therapist stand near the subject and gives the command to the subject and then subject stand in front of the wall and put hand and one leg over the wall and bend forward then feel the stretch and this stretching give intermittently.

DATA ANALYSIS

Table 1: Mean of cyclic stretching group

	Mean + SD
Pre-treatment	31.33 + 1.39
Post-treatment	35.93 + 2.56

Graph-1 Mean of cyclic stretching group

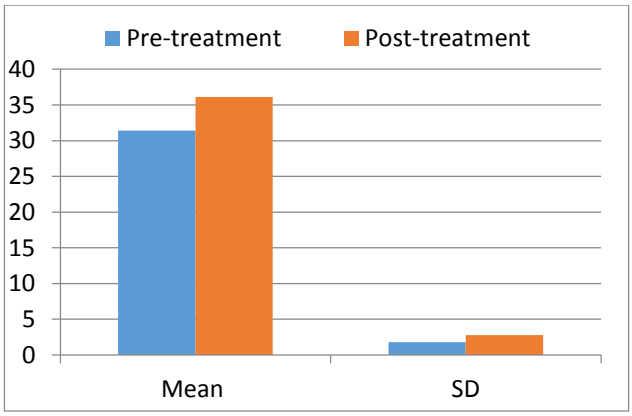


The Paired t- test was done to find out the significance of the cyclic to improve calf flexibility with degree of freedom 14 conclude that the difference is significant and it is not due to chance. This suggests that cyclic is effective in improving the active ankle plantar flexion of calf.

Table 2: Mean of PNF stretching group

	Mean + SD
Pre-treatment	31.43 + 1.8
Post-treatment	36.13 + 2.79

Graph- 2 Mean of PNF stretching group



Paired t- test was done to find out the significance of PNF to improve calf flexibility in group B with degree of freedom 14 conclude that the difference is significant and it is not due to chance. This suggests that PNF stretching is effective in improving the active ankle plantar flexion of calf.

RESULTS

The results shows that the mean difference of Static is 7.73 and mean difference of PNF is 15.33 which suggests that Static and PNF stretching both are effective to improve calf flexibility but PNF stretching is more effective compared to Static.

DISCUSSION

Theorists have focused on the neurophysiological basis of PNF, stating that the excitatory efficient of the neuromuscular spindle or the inhibitory afferent of the Golgi tendon organ (GTO) or both are responsible for the effects. 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. Both the fascia & the spindle of the agonist adjust to the nearly lengthened position. 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 reflexly resist to the change in length, thus helping in lengthening the muscle. PNF stretching is more effective than cyclic stretching. Small Sample sizes, short follow up, lack of objective outcome measure are limitations. Velocity & amplitude of force while applying stretching and Pressure applied while giving stretching was not controlled.

CONCLUSION

The neurophysiological basis of PNF, stating that the excitatory efficient of the neuromuscular spindle or the inhibitory afferent of the Golgi tendon organ (GTO) or both are responsible for the effects. 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. Both the fascia & the spindle of the agonist adjust to the nearly lengthened position. 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. PNF stretching is more effective than cyclic stretching. Thus improving calf flexibility. PNF stretching is more effective than cyclic stretching technique, giving better improvement.

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Citation
Sirari, A., & Patel, K. (2015). EFFECTIVENESS OF PNF STRETCHING AND CYCLIC STRETCHING OF CALF TIGHTNESS ON COLLEGE GOING GIRLS. *International Journal of Physiotherapy*, 2(3), 552-556.