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Effectiveness of PNF versus retro-walking on hamstring flexibility in college going students with hamstring tightness: A comparative study

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Abstract

Background: Hamstring muscle tightness can be defined as "inability to extend the knee completely when the hip is flexed". Prevalence of hamstring muscle tightness in young college going students is 40.17%. Proprioceptive neuromuscular facilitation techniques involve the activation of some reflex responses and the application of physiological concepts pertaining to interaction of antagonistic muscles. Retro Walking is a translatory and dynamic activity which can be used to treat the flexibility.

Aim: To study the effect of PNF Vs Retro Walking on hamstring flexibility in college going students with hamstring tightness.

Objective: To find the effect of PNF Vs Retro Walking on hamstring flexibility in college going students with hamstring tightness.

Methodology: This research had a sample size of 100 students. The participants approval was obtained, and those wanting to engage in the study were chosen. Active knee Extension test pre-analysis was done prior to intervention. The PNF and Retro Walking was given for 1 week. Participants were randomly divided into two groups with n =50 in each group. Group A received PNF while Group B received Retro walking for 1 week.

Result: The mean (\pm Sd) for pre-interventional active knee extension test in group a(PNF) was 76.46 ± 5.4256 and the mean (\pm Sd) for pre-interventional active knee extension test in group b (Retro walking) was 80.92 ± 5.580 .

While the mean (\pm SD) for post intervention active knee extension test in group a (PNF) was 76.46 ± 5.426 and the mean (\pm SD) for post interventional active knee extension test in group b (retro walking) was 81.12 ± 5.724 . The results showed that both the groups were comparable. Analysis done between Pre and Post interventional data in Group A (PNF) ($t=15.516$, $p<0.0001$) and between Pre and Post interventional data collected in Group B (retro walking) ($t=14.271$, $p<0.0001$) showed that there was not significant difference. However, there was greater improvement in Active Knee Extension test scores of the Group A

Conclusion: PNF Vs Retro Walking were significant in terms of clinical outcome. Hence, the study concluded that the PNF as well as Retro Walking is effective, simple and easy to apply in Hamstring tightness subjects. So, it can be implemented clinically as well.

Keywords: Retro walking, hamstring tightness, active knee extension

Introduction

Mobility and the ability to move freely are essential components of a healthy lifestyle. Maintaining healthy joints, strong bones, physical fitness, reflex activity, and flexibility contribute to overall well-being [1]. Flexibility, defined as the capacity to perform movements within a certain range in the joints, plays a crucial role in performing daily activities. This article explores the significance of hamstring flexibility, its impact on overall health, and various techniques to improve flexibility, with a focus on young college students [2]. Tightness relates to a muscle's physical length, indicating a decreased capacity to extend from a normal position [3]. Flexibility, on the other hand, is a physiological term that encompasses contributions from both soft tissue (muscles and nerves) and joint structures. Maintaining flexibility is vital for performing regular tasks with ease and reducing the risk of persistent physical issues. The hamstring muscle group, consisting of semimembranosus, semitendinosus, and biceps femoris, plays a crucial role in flexing the knee and extending the

hips. Limited hamstring flexibility affects 68% of people globally, with college students aged 18 to 25 being particularly susceptible [4]. Poor hamstring flexibility is associated with musculoskeletal issues, including orthopedic conditions like patellofemoral joint syndrome and low back pain. Maintaining hamstring flexibility is not only essential for optimal performance but also for preventing overuse-related musculoskeletal damage [5]. Multi-joint muscles with significant functional extensions and a high proportion of fast-twitch muscle fibers, such as the hamstrings, are prone to damage. Reports suggest that the hamstring muscle is the most commonly affected multi-joint muscle in the human body [6].

There are four primary stretching techniques: proprioceptive neuromuscular facilitation (PNF), static, ballistic, and slow active stretching. Among these, PNF techniques, involving reflex responses and physiological concepts related to antagonistic muscles, are considered more effective for improving flexibility than conventional static stretching exercises [7]. PNF stretching, widely regarded as one of the best stretching techniques, enhances muscle relaxation and lengthening. PNF stretching involves manual resistance and stretching on muscles engaged in mass movement patterns [8]. Dynamic commands encourage the patient's initiative, promoting muscle relaxation and increased joint range of motion. PNF patterns of movement, occurring in spiral or diagonal motions, lead to strong and coordinated muscle contractions, requiring core stability. Studies indicate that PNF stretch techniques effectively increase joint range of motion by lessening reflexive elements causing muscle contractions [9].

The hold-relax technique, a painless and efficient method, aims to extend muscles reacting against movement. Whether active or passive, movement continues until restricted by tension or discomfort. This technique utilizes the Golgi tendon organ to relax muscles after sustained contractions. Incorporating PNF techniques in therapeutic settings helps improve range of motion in both active and passive domains [10]. Retro walking involves walking backward, which alters joint kinematics and engages posterior muscles like hamstrings and gluteus. This type of movement increases metabolic cost compared to forward walking and has been shown to improve fundamental motor skills, including balance, strength, and flexibility [11]. The distinct process of backward walking, where toes contact the ground first, offers unique benefits for hamstring flexibility. In conclusion, hamstring flexibility is crucial for overall musculoskeletal health, particularly in young college students [12]. A combination of techniques, including PNF stretching and retro walking, can effectively enhance hamstring flexibility, reduce the risk of injury, and improve overall physical well-being. Understanding the distinct benefits of each technique allows individuals to tailor their approach to suit their needs, promoting a holistic and proactive approach to musculoskeletal health [13]. Hamstring Flexibility can cause Acute and Chronic Musculoskeletal problems, postural deviation, gait deviation. Many students have hamstring tightness which may cause chronic low back pain and musculoskeletal problem. Studies have proven that both Proprioceptive neuromuscular facilitation and Retro walking are used for the individuals having hamstring tightness. But there is lack of evidence which conducted to compare effectiveness of Proprioceptive neuromuscular facilitation with retro walking. The study is conducted to compare the effectiveness of both the maneuvers.

Materials and Methods

The study received Ethical Clearance by Institutional Ethical Committee of Dr. APJ Abdul Kalam College of Physiotherapy. Study was conducted for 6 months. Total of 100 participants had participated in the study. The inclusion criteria were as follow: Young college going students with hamstring tightness. Both the genders that is Males and Females. Age group between 18-25 years with hamstring tightness. Individuals with normal BMI. Who are willing to give informed consent. Regarding Exclusion Criteria: Visual Swelling in the region of hamstring muscle. Person who are ready involved in any exercise programs for lower extremity. Individuals with recent fracture of lower limb. Subjects who recently completed an active warm up or participated in sporting activities earlier that day or athletes. Total 100 participants were included and written consent was taken then Baseline data and Preintervention assessment was done. After that the Randomization within the groups was done Group A (n=50) (PNF) and Group B (n=50) (Retro-Walking). In PNF Hold and Relax technique was practised everyday for a week. The effectiveness of intervention was assessed using the outcome measure Active Knee Extension Test. (AKET). The stopwatch was used to standardize the stretching, contracting, and relaxing time. The researcher passively flexed the hip while keeping the knee fully extended, preventing any hip rotation, to stretch the hamstring muscle for each stretch. The hamstring muscle was stretched for seven seconds, or until the participant initially reported feeling a slight stretch. The participant next tried to press his leg down toward the table against the investigator's resistance, isometrically contracting the hamstring muscle for three seconds. The patient was then instructed to relax for five seconds. This sequence was repeated 5 times with each sequence separated from each by a 20 second interval. This treatment was given for 7 days for a period of 1 week. In Group B the subject were made to walk for 10 minutes that is 1000 steps to and fro in a closed environment and the time for same was monitored using stopwatch. The subjects were made to do for 7 day for a week. After a week of Protocol immediate effects were assessed according to outcome measures and then they were compared.

Outcome measures

Active knee extension test (AKE) It involves movement at the knee joint and the patient controls the movement's end point. The test measures the angle of knee flexion with a pendulum goniometer after active knee extension with the hip stabilized at 90 degrees flexion. The angle of knee flexion represents hamstring tightness.

Results

Statistical analysis was carried out utilizing INSTAT software and P value 0.05 is considered as level of significance. Unpaired 't' test was applied to analyse the data.

Hamstring flexibility analysis			
Group a pnf	Age	Pre-test	Post-test
Mean	19.52	76.46	80.92
SD	0.9739	5.425601	5.57999
t value			15.516
Group b retrowalking			
Mean	20.56	76.46	81.12
SD	1.8201	5.4256	5.723
t value			14.271
Mean Difference between both the groups -1.98			

Discussions

In this study, young adults were given PNF Vs Retro Walking for one. Participants were chosen based on inclusion and exclusion criteria, and then pre-intervention Active Knee Extension test was taken, followed by one week of PNF and Retro Walking. After the training, participants were assessed again with Active Knee Extension Test.

The mean (\pm Sd) for pre-interventional active knee extension test in group a(PNF) was 76.46 ± 5.4256 and the mean (\pm Sd) for pre-interventional active knee extension test in group b (Retro walking) was 80.92 ± 5.580 .

While the mean (\pm SD) for post intervention active knee extension test in group a (PNF) was 76.46 ± 5.426 and the mean (\pm SD) for post interventional active knee extension test in group b (retro walking) was 81.12 ± 5.724 .

Students Paired 't' test comparison of Active Knee Extension test Scores between both the groups was done and it was seen that there was significant increase in active knee extension test score from pre to post in Group A and Group B. Thus, in group A showed more significant effect of active knee extension test as compared to group B (i.e. $p < 0.0001$) extremely significant. Proprioceptive stimulation is used in proprioceptive neuromuscular facilitation procedures to either strengthen or relax muscle groups. One PNF tenets states that voluntary muscle contractions should be performed in conjunction with muscle stretching (ROM) in order to reduce the reflexive components of muscle contraction, promote muscular relaxation, and ultimately increase joint range of motion. This would also aid in improvement of flexibility, balance and agility. Khodayari, Behroz, and Yahgoob Dehghani, conducted research to investigate the mid-term effect of different intensity of PNF Stretching on improving Hamstring flexibility, and showed the use of sub-maximal CR PNF training on Hamstring lead to more flexibility [14].

The result of the present study for retro walking is supported by research conducted by Bhakti Desai, which observed the effects of Retro-walking and suboccipital muscle inhibition technique in Hamstring Muscle flexibility in collegiate students. The study showed that both techniques were improve hamstring muscles flexibility suboccipital muscle inhibition technique is more effective than the retro walking technique [15]. Adilah Logde studied effect of retro walking on hamstring flexibility in normal healthy individual. The study indicates that retro walking in young adults with below average hamstring tightness who underwent backward walking training protocol, showed significant improvement in hamstring flexibility [16]. Atharva S. Hegishte*, Neeraj Kumar conducted a study on Effect of proprioceptive neuromuscular facilitation and dynamic stretching on flexibility, agility, and balance in hamstring tightness among collegiate level badminton players the study showed that there is significant improvement in the flexibility, balance, and agility after implication of 4 weeks of PNF and dynamic stretching in collegiate level badminton players having hamstring tightness. However, there was no significant improvement seen between groups. This evidence substantiates that these exercises do recruit the hamstring muscles and provides further insight into the role of the hamstring muscles to keep the body flexible [17]. Amine *et al.* conducted research to investigate the effects of different types of proprioceptive neuromuscular facilitation stretching on dynamic balance control, which showed that CRAC stretching of the quadriceps, hamstrings, anterior tibialis, and calf muscles improved dynamic balance [18]. In a previous study Misty *et al.* conducted research to study the effects of proprioceptive

neuromuscular facilitation stretching on agility performance among volleyball varsity players, which showed that PNF stretching administered as a post-training flexibility exercise of volleyball varsity players is an effective method in improving agility when compared with the traditional static stretching technique [19].

Comparing the post interventional AKE scores of both the groups, the study proved that both the interventions were extremely significant in improving AKE and were effective in increasing hamstring flexibility in college going students from age 18-25 years. The post-intervention comparison of mean Ake in Group A and Group B; using student's unpaired "t" test showed that it was extremely significant, and both the groups were effective in improving hamstring flexibility in college going students from age group 18-25 years. This revealed that Group A (PNF) can be used to improve hamstring flexibility. The overall result of the present revealed that PNF is beneficial and Retro walking has additional effect, as the post intervention comparison was significant in groups.

The results showed that both the groups were comparable. Analysis done between Pre and Post interventional data in Group A (PNF) ($t=15.516$, $p < 0.0001$) and between Pre and Post interventional data collected in Group B (retro walking) ($t=14.271$, $p < 0.0001$) showed that there was not significant difference. However, there was greater improvement in Active Knee Extension test scores of the Group A (PNF) in improving hamstring flexibility.

Conclusion

The Present Study Concluded That 1 Week of PNF and Retro Walking both are effective in reducing Hamstring Tightness and Improving Hamstring Flexibility. However, Group A is more effective.

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