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Original Research Article

Immediate effects of static stretching and post isometric relaxation on hamstring flexibility among sedentary young adults: a pilot study

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ABSTRACT

Background: 'Hamstrings' is a group of muscles in the posterior compartment of the thigh crossing both hip and knee joints. Hamstring muscles are frequently subjected to reduced flexibility, especially among young adults 18-25 years old. Hamstring tightness is found to cause several conditions affecting the human body. Stretching has immediate effects on muscle stiffness, such that, positive effects can be obtained within few seconds or minutes after a stretching session.
Methods: A total of 32 Undergraduates who satisfied the inclusion criteria were recruited for the pilot study. The subjects needed to have hamstring tightness measured by active knee extension (AKE) to be included to the study. The subjects with a history of recent injury or surgery to the spine or lower limbs, those who involved in sports activity at competitive level and obese subjects were excluded. The subjects were allocated randomly by 1:1 ratio to the Static Stretching (SS) and Post Isometric Relaxation (PIR) groups.
Results: The data of both the groups was normally distributed. The baseline values of AKE for both the groups (SS=46.68±5.31; PIR=49.03±6.53) were matched and there was no significant difference before stretching. Independent sample T-Test was used to compare the means of the two groups post stretching. There was a significant difference in the mean of the AKE values of the two groups. The improvement was higher in the PIR group (SS= 42.62±4.78; PIR=36.28±6.51), such that the range of flexion was lesser in the PIR group indicating a greater degree of knee extension.
Conclusions: Immediate effects from single bout with few repetitions of Post Isometric Relaxation stretching were more effective in reducing hamstring tightness among sedentary young adults compared to static stretching.

Keywords: Hamstring flexibility, Stretching exercises, Static stretching, Post isometric relaxation

INTRODUCTION

'Hamstrings' is a group of muscles in the posterior compartment of the thigh crossing both hip and knee joints. It is responsible for extension of the hip with flexion of the knee. Hamstring muscles, predominantly biceps femoris, are important in maintaining the trunk upright from a stooping posture against the influence of gravity.[1] Flexibility refers to the ability to rotate a single joint or series of joints smoothly and easily through an unrestricted, pain-free range of motion. Muscle length, joint integrity, and periarticular soft tissue extensibility are the factors which determine flexibility. Shortening or decreased flexibility of soft tissues may lead to activity limitations and participation restrictions.[2]

Hamstring muscles are frequently subjected to reduced flexibility. Prevalence of hamstring tightness is very high among 18-25 years old college students in India, This problem is common among university students in Lahore, Pakistan, too, where 23.33% of males and 16.6% of females between the ages of 17-25 years present with hamstring tightness.[3] In this study, both sedentary individuals and individuals who engage in sports were included.[4] Majority of sedentary university students

between the ages of 16-30 years have tightness in hamstring muscles.[5]

Adverse effects of hamstring tightness

Hamstring tightness is found to cause several conditions affecting the human body. Individuals with hamstring tightness are 8.7 times more prone to experience plantar fasciitis.[6] It induces prolonged forefoot loading and increases repetitive injury to plantar fascia.[7] Moreover, shorter hamstring muscles are common among patients with patellofemoral pain than among asymptomatic individuals, although it is not certain whether this is a cause or an effect of the condition.[8] Among the patients suffering from chronic low back pain, 28% with moderate disability and 19% with severe disability have hamstring tightness.[9] Both intrinsic and imposed hamstring length can influence pelvic rotation (posterior pelvic tilt) during bilateral hip flexion of healthy young adults.[10] This posterior pelvic tilt can lead to reduced L1-S1 angle and lumbar spine lordosis in standing.[11] Moreover, low back pain has an association with reduced lumbar lordosis.[12]

Static stretching and post-isometric relaxation for hamstrings

Stretching is an important therapeutic manoeuvre which improves flexibility and range of motion by elongating the shortened structures. This technique imposes significant immediate effects on range of motion and muscle stiffness, which means, positive effects can be obtained within few seconds or minutes after a stretching session.[13]

In static stretching (SS), soft tissues are elongated just beyond the point of tissue resistance and held in the lengthened position with sustained stretch force over a period of time. SS is a safer and more effective method in increasing flexibility and range of motion. A systematic review and meta-analysis by Medeiros et al revealed that static stretching is effective in increasing hamstring flexibility in sedentary healthy adults between 18-40 years.[14] According to Babault et al, maximal concentric torque was significantly reduced in individuals with low and high hamstring flexibility immediately after a SS session (6 × 30s).[15] However, other interventions such as neurodynamic sliding, active isolated stretching and ballistic stretching, and modified dynamic stretching were found to be more effective than SS of hamstrings, while proprioceptive neuromuscular facilitation and eccentric training showed almost similar effects.[16-20]

Post-isometric relaxation (PIR) technique can be applied to tight muscles by placing the muscle in a stretched position and isometrically contracting it against minimal resistance. This is followed by relaxation and gentle stretch as the muscle releases.[21] This technique was very effective in increasing hamstring flexibility of national-level football players in India.[22] Among 18-25 years-old healthy college students in India, PIR when performed thrice a week for three weeks was revealed to be a more effective technique in reducing hamstring tightness than reciprocal inhibition.[23] Naweed et al report that PIR and active isolated stretch are equally effective in immediate, short-term, and long-term effects on hamstring flexibility of young, healthy college students between 18-25 years of age.[24]

Justification

Many studies have been conducted so far comparing the effects of SS and PIR with other physiotherapy interventions, but the number of studies which include a comparison of the two interventions (SS and PIR) is few. Moreover, studies comparing the immediate effects of SS and PIR on hamstring flexibility are far more less. SS and PIR are easy and safe manoeuvres to treat hamstring tightness. It is crucial to identify the most effective technique, which will be helpful in augmenting the improvement, and recognizing the immediate effects will help fast recovery.

This pilot study will aid in finding the better stretching method of the two for reducing hamstring tightness with regard to the immediate effects among sedentary young adults. Further, there are ample studies among athletes and sports persons; however, there are limited studies and none in Sri Lanka to assess hamstring flexibility and to determine effectiveness of stretching exercises among sedentary young adults.

Physiologically, the sedentary young adults differ from those involved in competitive sports, hence, the prevalence of hamstring tightness and the effectiveness of stretching exercises among the two may differ as well. The present study aimed at finding the immediate effects of two types of stretching as a pilot study. Based on the findings, future studies to determine the risk factors for hamstring tightness specific to sedentary University students and short-term, long-term effects of stretching exercises will be carried out.

METHODS

The pilot study was conducted among two batches of undergraduates studying the Physiotherapy Degree Programme. The age was between 20-30 years and those who consented to participate were included.

A total of 35 undergraduates consented to participate and those satisfying the inclusion criteria were allocated by 1:1 ratio to the SS and PIR group.

The subjects needed to have hamstring tightness measured by active knee extension (AKE) to be included to the study. The subjects with a history of recent injury or surgery to the spine or lower limbs, those who involved in sports activity at competitive level and obese subjects were excluded. Finally, three subjects were

excluded, because they had normal hamstring flexibility and 32 subjects were included (Males- 7, Females- 25).

The subjects performed a warm-up by walking around in a room. The subjects were in comfortable clothes, and they were positioned in supine with the contralateral extremity in extension. The ipsilateral hip and the knee were flexed to 90°, the subjects were asked to actively extend the ipsilateral knee with the foot relaxed. Knee extension stretched the hamstring muscles until myoclonus occurred.

The subjects were then told to slightly flex the knee till the myoclonus stopped. At this point, the degree of knee flexion was recorded using a universal goniometer. Hamstring flexibility was measured on the dominant side for all the subjects.

Static stretch

The starting position was long sitting position, with both knees straight, subjects were asked to raise the arms forward and bend at the pelvis attempting to touch the toes. The stretch was held for 30 seconds and repeated 4 times with a rest period.

Post isometric relaxation

The starting position was kneeling, the dominant limb was stretched straight ahead with knee in extension, the subjects were asked to bend at the pelvis to feel a stretch at the hamstrings then they were instructed to press the heel on the ground for 10 seconds and relax. This was repeated 5 times with a rest period. A greater range of trunk flexion was encouraged with each attempt.

The angle of AKE was measured soon after the stretching exercise. The cut-off for hamstring tightness was: males >23.40, females >330, these values were taken from a study that determined this cut off among University students.[25]

RESULTS

The details of the participants are presented in the Table 1. The baseline data of the subjects of the two groups for hamstring flexibility was matched using Independent sample t-test. There was no significant difference in the hamstring flexibility of the subjects of the two groups before stretching exercise.

Table 1: Baseline data of the subjects of two groups.

Variables	Age (years) (Mean±SD)	BMI (Mean±SD)	AKE angle (Mean±SD)
SS	24.12±0.71	21.98±5.21	46.68±5.31
PIR	23.93±0.85	19.33±2.16	49.03±6.53

BMI= Body Mass Index, AKE = Active Knee Extension, SS=Static Stretch, PIR=Post Isometric Relaxation

According to the results in Table 2, there was a significant difference between the SS (M=42.62, SD=4.78) and PIR (M=36.28, SD=6.51) group; t (30)=2.64, p=0.01. The mean value of knee flexion measured with AKE for PIR group was lesser than the static stretching group.

This indicates that the improvement was significantly higher in the PIR group.

Table 2: Results of independent sample t-test comparing the two groups post stretching exercises.

Variables	F	Sig.	t	df	Sig. (2-tailed)
Equal variance assumed	0.919	0.24	2.643	30	0.013
Equal variance not assumed			2.643	27.52	0.013

DISCUSSION

The subjects of the PIR group had a significantly higher score immediately after stretching exercise when compared to the static stretching group. There are limited studies among sedentary young adults. Most studies are among young athletes. Some of the studies conducted among sedentary young adults show similar findings to the present study. Healthy, young students between 18-22 years of age with reduced hamstring flexibility were grouped and given SS and PIR separately. SS was performed for 4 weeks. This was repeated 4 times with 30s rest interval between each and given thrice a week for 4 weeks. It was found that PIR was more effective in improving knee ROM and decreasing hamstring tightness in less duration than SS.[26]

PIR was more effective than ultrasound therapy with active static stretching and passive static stretching in improving hamstring flexibility among healthy individuals between 18-25 years, when the treatments were administered once a day daily for 2 weeks.[27]

Furthermore, PIR was found to be more effective than SS in improving iliopsoas flexibility of healthy young adults (18-30 years) as well.[28] None of these studies had assessed the immediate effects of the stretching.

The sample of the present study comprised University Undergraduates, who are sedentary and do not involve in sporting activities. It aimed to determine the immediate effects as an initial step and further studies will be conducted to determine specific risk factors to hamstring tightness and short term and long term effects of the stretching exercises for this population will be studied.

CONCLUSION

Immediate effects from single bout with few repetitions of Post Isometric Relaxation stretching were more effective in reducing hamstring tightness among sedentary young adults compared to static stretching. Further, during initial assessment only 3 subjects out of 35 had normal hamstring flexibility and were excluded from this study. This shows that the prevalence of hamstring tightness is high, there is need to determine risk factors specific to sedentary young University students and address them with the most effective stretching programme.

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