The Effect of Single Session of Static and Ballistic Stretching on Lower Limb Power in Sedentary Physiotherapy Students

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Abstract

Background: To date there is lot of controversy regarding the optimal type of stretch to improve lower limb power. Furthermore, the majority of studies have been conducted in an athletic population. A large percentage of physiotherapy students are sedentary and it is important to understand the impact of different type of stretches on this population.
Aim: To study the effect of single session of static stretching and ballistic stretching on lower limb power in sedentary physiotherapy students.
Materials and methods: Sedentary physiotherapy students (n = 48) were allocated to two groups. Group A given static stretching and group B ballistic stretching. Outcome assessed with vertical jump test.
Result: Both static and ballistic stretching produced an increase in lower limb power. There was no significant difference in the change in power obtained by the two types stretches when they were compared as p value was 0.4858, which was not significant.
Conclusion: There was no significant difference in the effect between static stretching and ballistic stretching on lower limb power in sedentary physiotherapy students. Both were equally beneficial.
Key words: Ballistic stretching, Static stretching, Lower limb power, vertical jump test.

Introduction

Sedentary was defined as not being engaged in any form of exercise or sporting activity for the last two years.[1] Students spent an average of 3.46 hours per day engaged in sedentary behaviors. [2]

A popular stretching method used for rehabilitation is static stretching which involves elongating soft tissues just past the point of tissue resistance and maintaining the extended posture over time

with a constant stretch force.[3] Ballistic stretching is a rapid forceful intermittent stretch that is a high speed and high intensity stretch is commonly called ballistic stretching.

The majority of studies that have looked at the effect of stretching on power were conducted in different athletic populations. Experimental designs and outcome measures were quite varied therefore making it difficult to come to any conclusion regarding the benefit to any one type stretching on power.

Explosive power is thought to be generated by increased elastic energy stored in the muscle fibers.[4] It is therefore believed that exercise or stretching that increase this elastic energy will result in increased explosive power for that target group of muscle.[5]

Research investing the effects of stretching on jump performance has been variable. Powers[6] in 2004 reported that static stretching led to an immediate decrease in force output however vertical jump distance remained unchanged.

The majority of studies that have looked at the effect of stretching on power were conducted in different athletic populations. Experimental designs and outcome measures were quite varied therefore making it difficult to come to any conclusion regarding the benefit of any one type of stretching on power. The study aimed to investigate the effect of single session of static stretching and ballistic stretching on lower limb power in sedentary physiotherapy students.

Procedure

Ethical committee approval was taken from institutional committee to conduct the study. The participants were explained about benefits of study, right to withdraw from study in detail in their language. Informed consent was taken from the participants. A total number of 47 physiotherapy students, age group 18 to 33 years of both genders and who were willing to participate were included in the study. The participants having history of recent fracture of lower limb, recent muscle strain of lower limb, who were engaged in any form of exercise involving lower limb flexibility exercises since last 3 months were excluded. They were allocated into 2 groups i.e.; group A and group B by simple random sampling using closed envelop method. Outcome measure was Lower limb power which was assessed with vertical jump test. Baseline measurement was

recorded prior to the intervention. Following these three repetitions of static stretching was given to group A for the hip flexors, hamstring and gastrocnemius muscles.

For hamstring stretching subject position was long sitting on the plinth. They then reached forward to try and touch their toes. The spine was kept straight and they were asked to bend from the hip. For the calf stretch using a step subject were asked to stand with the toes on step and the heel of the leg to be stretched hanging off the step. For quadriceps stretch subjects were asked to assume a lunge position with one leg in front of the other and then bend the forward leg and while keeping back leg extended. Immediately after completing the stretches the vertical jump test measurements taken.

For group B procedure was same as group A only change was ballistic stretching given to subject. Ballistic stretching was done same positions as static stretching, however once subject reached the initial stretched position, they were asked to bounce up and down or back and forth. Each stretch was performed three times with a 20 second rest period between stretches. The position was held for 15 seconds and then repeated for total of three stretches.

Result

Table no. 1: Pre-Post comparison of static stretching group (Group A).

	Mean	**SD**	**T**	**p value**
Pre	227.42	15.407	10.858	<0.0001
Post	230.33	15.116		

The mean of pre and post of static stretching are 227.42 & 230.33 respectively and standard deviation values are 15.407 and 15.116 respectively. p value was <0.0001which was extremely statically significant. It meant stretching improved vertical jump in the participant.

Figure 1: Pre-Post comparison of static stretching group (Group A).

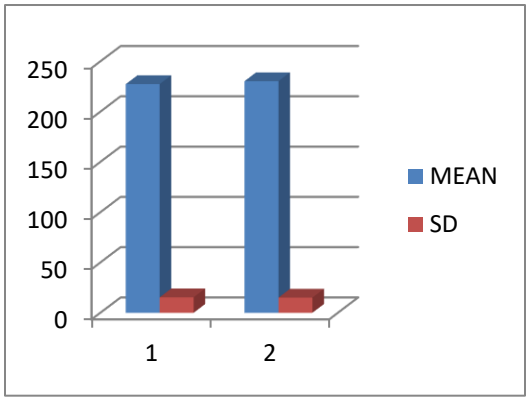


Table no. 2 Pre-Post comparison of ballistic stretching group (Group B).

	MEAN	SD	T	p value
Pre	225.5	16.901	14.48	<0.0001
Post	230.17	17.168		

The mean value of pre and post ballistic stretching 225.5 and 230.17 respectively and standard deviation values are 16.901 and 17.168 respectively and p value was <0.0001which was statistically extremely significant. ballistic stretching improved vertical jump in the participant.

Figure 2 - Pre-Post comparison of ballistic stretching group (Group B).

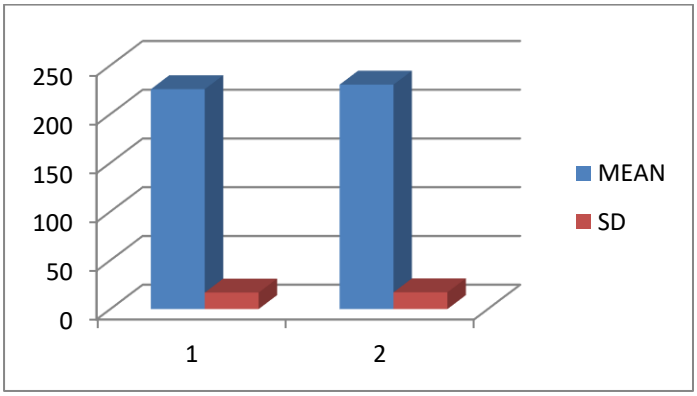
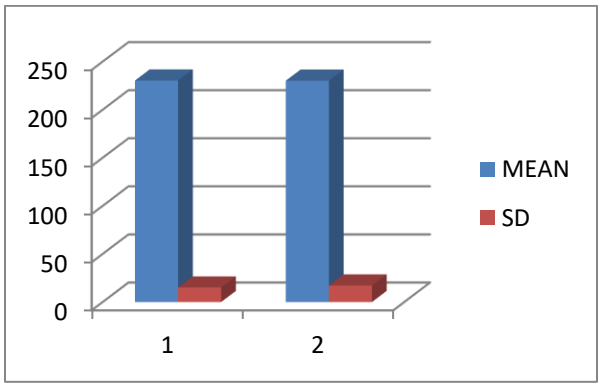


Table no. 3 Post treatment comparison between group A and group B.

	MEAN	SD	T	p value
Post A	230.33	15.116	0.03569	0.4858
Post B	230.17	17.168		

The mean value of group A was 230.33 and for group B was 230.17 and standard deviation values are 15.116 and 17.168 respectively. p value was 0.4858. These values suggests that there was no significant difference between static and ballistic stretching.

Figure 3. Post treatment comparison between group A and group B.



Discussion

The present non randomized controlled trail was carried out to evaluate the effect single session of static versus ballistic stretching on lower limb power in sedentary physiotherapy students. The result from the statistical analysis showed that the both static and ballistic stretching techniques produced an increase in lower limb power. But on comparing both stretching techniques, there was no difference found between the two.

Static stretching when applied, affects both the mechanical and neurophysiological properties of the muscles. The changes in viscoelastic properties could potentially reduce the effectiveness of muscle with regards to force generation.

On the other hand, ballistic stretching is thought to mainly work through neurophysiological mechanisms. It is likely that the bouncing associated with ballistic stretching improves the proprioceptive response of the muscle tendon units, making them more receptive to the stretch that

happens just prior to the take-off phase of a vertical jump. Sedentary individuals would potentially be more responsive to these small changes.

Young and Behm et.al. [6] observed that static stretching reduced explosive force, whereas jogging and jumping increased explosive force significantly. A study on acute effects of dynamic stretching exercise on power output during concentric dynamic constant external resistance leg extension showed that dynamic stretching routines in warm-up protocols enhance power performance because common power activities are carried out by DCER muscle actions under various loads.[7] The findings of the study on the effects of dynamic and static stretching on vertical jump performance and electromyographic activity revealed that static stretching has a detrimental impact on vertical jump performance whereas dynamic stretching has a beneficial one. Increased vertical jump performance after dynamic stretching may be due to post-activation potentiation, whereas decreased vertical jump performance after static stretching may be due to neurological impairment and a probable change in the viscoelastic characteristics of the muscular tendon unit (MTU). This study gives some physiological justification for the inclusion of dynamic stretching and the exclusion of static stretching in preparation for activities that require jumping performance.[8] Recent research imply that ballistic stretching increases performance through simulated movement patterns, and it has been documented in sporting activities such as sprinting, jumping, and peak force generating capability.[9] According to a research, Applying therapeutic stretches, which vary from slow, sustained static stretches to quick, repetitive ballistic stretches, can reduce muscle stiffness and discomfort and increase joint range of motion.[10] The most straightforward reason for the benefits of muscle stretching that have been clinically documented is that mechanical elongation of connective tissue or muscle affects collagenous or muscle tissue. An alternative explanation suggests that stretching muscle tissue elicits a burst of proprioceptive activity.

Conclusion

Static and ballistic stretching both were effective and improve lower limb power in sedentary physiotherapy students. But on comparison, it was found that there was no significant difference between static and ballistic stretching. The study concluded that both static and ballistic stretching were equally effective and can be used for physiotherapy rehabilitation.

Future scope

1. Sample can be taken from different population like students from other specialties.
2. Another outcome measures like dynamometer can be used.
3. Electromyography can be used to study the muscle activity of lower limb pre and post the stretching session.

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Conflict of Interest: None.

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