

Effect of single leg squatting on sit and reach test in normal individuals

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Abstract

Background: Sit and reach test is commonly used test in fitness batteries that specifically measures the flexibility of lower back and hamstring muscles. In this study squatting activity was used as an intervention, to improve the flexibility of hamstring and low back muscles as it a dynamic closed chain activity that recruits all the muscles of lower limb.

Method: In all 40 normal individuals between 18-25 years of age of both genders were selected. They were divided into two groups of 20 each, into control and squatting group. In control group each individual performed sit and reach test with 3 min rest in between, while in squatting group each subject performed sit and reach test before and after squatting.

Result: It was observed that single leg squatting significantly improved the values of sit and reach test. The mean difference between the pre and post values of sit and reach test in squatting group was 4.84cm while in control group it was only 0.58cm. **Conclusion:** According to the result obtained it was observed that single leg squatting improved the flexibility of hamstring and lower back muscles and it can incorporated as a light load activity to introduce warm-up and make the subsequent stretching exercises more effective thus improving the flexibility of low back and hamstring muscle.

Key Words: Single leg squatting, sit and reach test, squatting group, control group.

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Received Date: 22/02/2017 Revised Date: 10/03/2017 Accepted Date: 19/04/2017

DOI: <https://doi.org/10.26611/1017311>

Access this article online

Quick Response Code:



Website:

www.medpulse.in

Accessed Date:
12 July 2017

INTRODUCTION

As being a physiotherapist one of our role is to provide guidance to the people in maintaining good physical health¹⁻⁵. Due to changing trends in life style people have become less active, sedentary life style is the one of the major cause of prolonged immobility in people. Extended period of sitting leads to tightness of muscle mainly in lower limb, being tight at the back of the thighs can also make it more difficult to move with ease during every day activities, and can seriously affect ability to perform, and can increase the susceptibility to musculoskeletal injury. Flexibility is the extensibility of soft tissue that surround

the joint and maintaining flexibility is of keen importance even carrying day to day activities⁶. It is believed that maintaining flexibility of hamstring and low back can prevent many acute and chronic musculoskeletal injuries. So the aim of the study was to determine the effect of single leg squatting activity on sit and reach test. Sit and reach test is commonly used in many health related test batteries low back and hamstring muscles flexibility and was originally described by wells and Dillon (1952)⁷⁻⁸. There are several variation of sit and reach test. In this study, the test was performed using sit and reach box. Various studies reported that sit and reach test is moderately valid measure of hamstrings flexibility⁹⁻¹¹. However sit and reach test is frequently used to evaluate the extensibility of hamstring and low back as the procedure is easy simple easy to administer and require minimum skills. Single leg squatting is a dynamic activity that recruits all the muscles of lower limb. Being a closed chain activity it causes muscles to contract both eccentrically and concentrically, this continuous contraction of muscles of lower limb bring about their relaxation by the phenomena of autogenic inhibition. Joints are controlled by two group of muscles flexors and extensors, single leg squatting activity where the two

groups work at the same time, they has to work in synchrony with each other for smooth controlled movement. Single leg squatting activity where the opposing muscles has to continuously engage and disengage, has to work sequentially to produce smooth co-ordinated movement. Reciprocal inhibition facilitates the movement with ease by inhibiting one group of muscle when then other group of muscle is contracting. Thus increasing flexibility of hamstring. This study was carried out to determine effect of single leg squatting activity on hamstring and low back flexibility measured through sit and reach test. We also discussed that single leg squatting activity can be used as light load to introduce warm-up before strenuous exercises and make the subsequent stretching exercises more effective.

MATERIALS AND METHOD

Study design: It was an experimental type of study carried out on apparently normal individuals.

Sample size: The sample size was of 40 individuals between 18-25 years of age, out of which 20 individuals were in squatting group and 20 in control group.

Study setting: The study was carried out in V.S.P.M'S college of physiotherapy OPD setup.

Selection Criteria:

Inclusion Criteria

1. Age between 18-25 years.
2. Both male and females.
3. Subjects at present not undergoing any stretching program.

Exclusion Criteria

1. Any musculoskeletal or neuromuscular pathology.
2. Subjects having any limb length discrepancy.
3. Subjects with low back pain.
4. Subjects with any musculoskeletal deformities in lower limb.

Methodology: Total 40 apparently normal subjects were selected. These 40 subjects were divided into two groups (Group A and B). (Group A) Squatting Group: It consisted of 20 subjects. Each subject performed sit and reach test before and after single squatting. (Group B) Control Group: It consisted of 20 subjects. Each subject performed sit and reach test with 3 min of rest in between. The subjects of each group were allowed to perform the following trials SQUATTING: Each subject in group A performed single leg mini squats before and after sit and reach test 20 squat/leg at the rate of (1squat/sec) regulated by metronome beat. SITTING AT REST: Each subject in group B performed sit and reach test with 3 min of rest in between. SIT AND REACH TEST: Each subject was in long sitting in front of sit and reach box. Feet placed flat against the box. Both knee

held flat against the floor hand placed on top of each other palm facing downward elbows fully extended. The position of 3rd finger was calibrated as zero position. Then the subjects were ask to bend and reach forward as far as possible. The distance was measured 3 times and the maximum value obtain was taken as the test value.

Materials: Materials used were sit and reach box, Metronome beat.

RESULTS

Table 1: Pre and post mean sit and reach values of both the groups

	Paired Samples Statistics				t value
	Mean	SD	SEM		
Before Squatting	24.860	5.4369	1.2157	13.79	<0.001
After Squatting	29.705	5.7407	1.2837		
Before Rest	25.200	5.1078	1.1421	4.01	<0.001
After Rest	25.780	5.5991	1.2520		



Figure 1: Showing pre and post mean sit and reach values of both groups

Table 2: Difference of mean sit and reach values of both the groups

	Unpaired Differences				
	Mean	SD	SEM	t value	p value
Squatting Group	4.8450	1.5706	0.3512	11.26	<0.001
Control Group	0.5800	0.6321	0.1413		

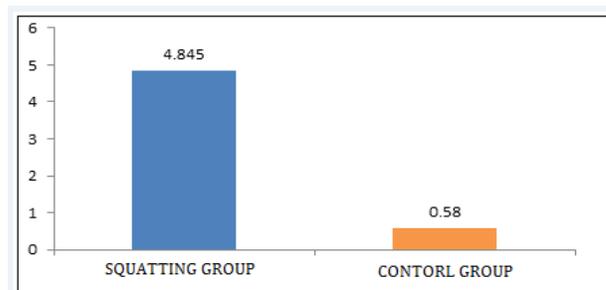


Figure 2: Showing difference of mean sit and reach values of the groups



Figure 3:



Figure 4:



Figure 5:



Figure 6:



Figure 7:

DISCUSSION

In this study the subjects were divided into two groups to determine the effect of squatting activity on hamstring and lower back flexibility measured through sit-and-reach test. The study showed significant increase in the sit-and-reach values in squatting group. Squatting is a closed chain activity and is brought about by the alternate contraction of flexor and extensor group of muscles around the hip and knee joint. While analyzing the squatting activity when the subject bend knee to squat the hamstring group of muscle is activated flexing the knee, the gluteal maximus and tibialis anterior are also activated simultaneously and as the subject approaches to standing quadriceps femoris activated as knee extensor and hip flexor. Thus from the above analysis both it is assumed that both the hamstring and quadriceps groups of muscle are active during the single leg squatting activity and working in synchrony with each other. The inhibitory effect of one group of muscles on the other group of muscles around the hip and knee joint during the single leg squatting activity can be the reason behind the increase in the test values in squatting group. The possible inhibitory effect is reciprocal inhibition, which comes into action when two opposing group of muscles has to work in synchrony with each other to produce a smooth co-ordinated movement. As in this case

quadriceps muscle is contracting repeatedly in synchrony with the hamstring muscle when the knee is flexing and extending during squatting activity. Being stronger group of muscles it may have brought an inhibitory force on the opposite group of muscle that is hamstring during the squatting activity thus causing relaxation of the same and increasing its flexibility. Another possible inhibitory effect that may have increased the test values in squatting group is autogenic inhibition. During the single leg squatting activity hamstring muscle is repeatedly contracting causing high tension in the muscle, to protect the muscle against tear due to high tension developed, a self-induced, inhibitory, negative feedback is activated, which causes relaxation of the hamstring muscle and thus protecting it. This relaxation brought about by the autogenic inhibition reflex may have increased the flexibility of hamstring, resulting an increase in forward reach distance. Hence, both the mechanism i.e reciprocal inhibition and autogenic inhibition may be occurring due to activation of Golgi tendon organ, in response to the changes in tension and length of the hamstring muscle inhibiting its contraction and causing its relaxation. Squatting is dynamic closed chain activity where the muscle is repeatedly contracting and relaxing, this pumping action of muscles increases the peripheral blood flow and cause subsequent increase in the temperature of

calf muscles i.e. hamstring. This increase in muscle temperature increases the elasticity of the hamstring brings about changes in the viscosity and reduction in the antagonist muscle thus improving the flexibility and extensibility of the muscle. So combine effect of reciprocal inhibition autogenic inhibition and increase in peripheral blood flow and rise in muscle temperature has possibly increased the flexibility of hamstring muscle and increased the forward reach distance in the squatting group and has significantly increased the test value in squatting group as the p value is <0.001(Table A)

CONCLUSION

In this study the squatting activity had significant effect on the flexibility of hamstrings and low back muscles in normal adults. The test values in squatting group were significantly improved. So we it can be concluded that squatting improves the flexibility of hamstring and lower back muscles. So the therapist can include mini squats as a light load activity to introduce warm-up and make the subsequent stretching exercises more effective. It can be used as simple and safe pre-stretching maneuver before stretching the hamstring muscle. As squatting is a dynamic closed chain are working both eccentrically and concentrically. Situation where the is need of both flexibility and strength squatting activity can be used as an exercise. In young adults where tightness is a common factor because of sedentary lifestyle single leg squatting activity can be recommended to maintain flexibility.

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Source of Support: None Declared
Conflict of Interest: None Declared