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Effect of slackline training and perturbation training in the management of postural sway among anterior cruciate ligament reconstruction patients

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Abstract

Background of the study: Anterior cruciate ligament (ACL) injuries are the most common and major knee injuries among the athletes and sports persons. This injury leads to loss of balance control and increase in the postural sway. Articular changes may occur following quadriceps weakness in ACL reconstruction patients, this causes loss of balance and postural control. Various physiotherapy approaches are available to treat the patients with ACL injury. This study was an attempt to compare the effects of slackline training and perturbation training on postural sway among ACL reconstructed patients.

Objective of the study: The objective of the study was to find and compare the effects of slackline training and perturbation training in the management of postural sway among ACL reconstructed patients.

Methodology: 30 patients with ACL reconstructed patients were selected based on the inclusion and exclusion criteria. They were randomly allocated into two groups (Group A and Group B) consists of 15 subjects each. Group A received slackline training and group B received perturbation training. Intervention lasted for 4 weeks, three days in a week and one hour per day. Postural sway was measured by lord's sway meter before and after 4 weeks of intervention.

Conclusion: Slackline training and perturbation training both significantly reduced postural sway in all directions. When comparing both slack line training is more effective than perturbation training in reducing postural sway thereby improves balance, postural stability and prevent the risk of fall among ACL reconstructed patients.

Keywords: ACL Reconstruction, Slack line training, Perturbation training, Lord's Sway meter

Introduction

The anterior cruciate ligament injuries are the most common major knee injuries among the athletes or sports person. Among all injuries the most commonest injury for football players is ACL injury [1]. Usual surgical treatment for ACL injury is an arthroscopic procedures which usually fails to eliminate the recurrent symptoms while during the activities of sports especially in football players. Recent evidence suggests that more than 50% of athletes are unable to return to their pre- level of function after ACL reconstruction. It is estimated that there will be more than 100,000 anterior cruciate ligament tears in the Indian population over this year [2].

During knee instability there is a reduction of motion and decrease proprioception which had more influence on the balance. Because of this reduced proprioception and mechanoreceptors there is an increased static postural sway which results in reduced activity of quadriceps contraction and activation of muscle fibers [3].

The proximal instability results in lower limb extremity injury, during hip flexion the hamstring muscles are more effective in preventing anterior tibial translation. If these muscle is not working properly then there is change in body alignment which further influences the change in muscle injury patterns [4]. The purpose of the study is to find and compare the effects of slackline training and perturbation training on postural sway among ACL reconstructed patients.

Methodology

Review Board of Sri Venkateshwaraa College of Physiotherapy, Pondicherry has approved this two group pre and post-test experimental study and a written consent was obtained from the participants after giving clear instructions regarding the treatment procedure and its implications. The study was conducted in Anna stadium, Cuddalore, Tamil Nadu, India.

Thirty ACL reconstructed patients age between 19 to 25 were selected for the study and randomly assigned into anyone of the two experimental groups. Group A fifteen subjects received slackline training, it includes tandem stance, single-limb stance and walking on slackline. Group B fifteen subjects received perturbation training, it includes tilt board, foam balance and roller board training. Intervention lasted for one hour per day, three days in a week and the same was continued for 4 weeks. Maximal postural sway was measured before and after 4 weeks of intervention by lord's sway meter [5] in anterior, posterior, right lateral and left lateral direction. All extraneous variables were clearly identified and ruled out from the study.



Fig 2: Tandem Walking and Single-limb Stance in Slackline



Fig 1: Postural Sway Measurement by Lord's Sway Meter



Fig 3: Perturbation Training in Tilt board



Data Analysis and Results

The study aims to compare and find the effects of slackline training and perturbation training on postural sway in

anterior, posterior, right lateral and left lateral direction among ACL reconstructed patients.

Table 1: Mean value, Mean Difference and Paired ‘t’ value of postural sway among group A and B

Postural Sway	Group	Pre test Mean	Post test Mean	Mean Difference	Paired 't' value
Anterior	A	1.80	1.40	0.40	13.0*
Posterior		2.89	2.06	0.83	3.53*
Right lateral		3.50	2.54	0.96	10.0*
Left lateral		2.90	1.50	1.40	13.0*
Anterior	B	1.77	1.42	0.35	14.6*
Posterior		2.19	1.54	0.65	8.12*
Right lateral		3.04	2.50	0.54	08.0*
Left lateral		2.52	1.59	0.93	12.0*

0.005 level of significance

In group A for postural sway in anterior, posterior, right lateral and left lateral directions the calculated paired ‘t’ values are 13, 3.53, 10 and 13 respectively and the ‘t’ table value is 2.977 at 0.005 level. Since all the calculated ‘t’ values are more than the ‘t’ table value, there is significant difference between pre and post test scores of postural sway in all directions following slackline training among ACL reconstructed patients.

In group B for postural sway in anterior, posterior, right lateral and left lateral directions the calculated paired ‘t’ values are 14.6, 8.12, 8 and 12 respectively and the ‘t’ table value is 2.977 at 0.005 level. Since all the calculated ‘t’ values are more than the ‘t’ table value, there is significant difference between pre and post test scores of postural sway in all directions following perturbation training among ACL reconstructed patients.

Table 2: Mean value, Mean Difference and Un Paired ‘t’ value of postural sway among group A and B

Postural Sway	Group A Mean	Group B Mean	Mean Difference	Un Paired 't' value
Anterior	0.40	0.35	0.05	3.18
Posterior	0.83	0.65	0.18	2.8
Right lateral	0.96	0.54	0.42	3.2
Left lateral	1.40	0.93	0.47	3.35

0.005 level of significance

In between group analysis the calculated unpaired ‘t’ values for postural sway in anterior, posterior, right lateral and left lateral directions are 3.18, 2.8, 3.2 and 3.35 respectively and the ‘t’ table value is 2.763 at 0.005 level. Since all the calculated ‘t’ values are more than the ‘t’ table value there is significant difference between slackline training and perturbation training in the management of postural sway among ACL reconstructed patients. When comparing the mean values of both the groups, group A subjects showed more difference in postural sway scores in all the four directions than group B subjects.

Discussion

The results of the present study shows that both slackline training and perturbation training are effective in reducing postural sway in all the directions among ACL reconstructed patients. The positive changes following slackline training may arise from enhanced reflex contributions acting on a spinal level. The authors say that withdrawal of presynaptic inhibition of Ia terminals, belonging to the motoneurons of the acting muscles, could account for the reduced postural sway. This neural mechanism could also be responsible for

the observed improvement following slackline training [6]. The subjects in perturbation training group also show significant reduction in postural sway. The positive results may be because of activation of particular muscle synergies in response to an external perturbation depend on initial body position, the initial support condition, the location and characteristics of the sensory stimuli triggering the response [7].

Conclusion

Slackline training and perturbation training both significantly reduced postural sway in all the four directions. When comparing both slack line training is more effective than perturbation training in reducing postural sway among ACL reconstructed patients. It is believed that as postural sway reduces patients balance, postural stability and risk of fall may also be positively improved.

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