

Investigation of Neuromuscular Concept by Bosu Ball and Trampoline Training in Athletes Sustaining Soft Tissue Injuries of Knee using Randomized Controlled Study Design

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Abstract: Introduction: In this study the effects of unstable platform as neuromuscular concept to gain balance and strength are investigated. Individuals sustained Anterior cruciate ligament injury with and without isolated meniscal injuries are recruited for the study.

Objective: The objective of the study has centralised the concept of studying the effects of unstable platform following ACL injury.

Materials and Methods:

This study records the outcomes after exploration of the individual in unstable platform for the establishment of Neuromuscular control. Balance and strength are the output by Vertical jump test after training of eight weeks. 30 Male athletes in the age group of 18-28 were recruited for the research recorded the means with the t value and p value -18.500 and 0.000 value respectively.

Results: P value <.05 records the significant value through outcomes after both the groups underwent training on unstable platform. A minimum difference exists between the two groups as Bosu Ball training records the mild significant value in comparison with Trampoline exercises.

Conclusion: A positive influence of unstable surface develops the motor skills required for sport perspective. There by unstable surfaces as equipment in ACL Rehabilitation are quite hard for adaptability but in still the motor skills in Sport activities.

Keywords: Athletes, Bosu ball, Trampoline training, Neuromuscular, Knee injury.

1. Introduction

The Anterior cruciate ligament constitutes as primary restraint during tibial translation and offers significant contribution of movements in Knee joint. An isometric stabilization has been provided by collagenous wide band of structure called Anterior cruciate ligament. A significant contribution of ACL rescues the injuries or fall of an individual indulge in sport venture like dynamic cutting pivoting and deceleration movements. Challenging attitude of cutting pivoting deceleration demands 70 percentage of contribution ACL. ACL and meniscal knee injuries called concomitant or unhappy triad makes one traumatized to the level of medical concern universally. In long term unacceptable knee symptoms persistent functional deficits and impaired quality of life becomes the factors to approach Rehabilitation professionals. Clinical guidelines emphasize the importance of Rehabilitation to restore balance strength proprioception and safely return to sport activities. A thorough evaluation and assessment follow injury

in rehabilitation to know the deficits of sport injury. Thereby Rehabilitation serves for symptomatic functional or quality of life outcomes and prevention of injury. Rehabilitation follows Neuromuscular control exercises Knee braces continuous passive mobiliser Open versus closed kinetic chain exercises training on balance boards. Neuromuscular control interventions like balance perturbation training backward walking wobble boards Bosu ball and trampoline exercises. The training indicates two to three neuromuscular control training sessions of a week for few months in the ambition of return to sport. A rehabilitation measures to bring the integrity of Hamstring and quadriceps strength to cope up with the strategies of sport (3). The primary ambition and measures of Rehabilitation to return to sports for athletes and prevention of recurrence of injury. Athletes in the verge of Rehabilitation lacks Balance and strength. Balance and strength are the components to gain proprioception and thereby neuromuscular control. Hence the Rehabilitation measure target the integrity of Hamstring and quadriceps by offering Unstable platform.

2. Materials And Methods

The research was executed in the Department of Sport Science after consideration of inclusion and exclusion criteria with the utilization of Randomized controlled study design. Participants were randomly subjected to anyone of the training as in Bosu Ball or Trampoline training. An informed written consent confirmed the exposure of the participant in the research. And the study fetched an approval for commencing the research from the Ethical board of Erstwhile Rajah Muthiah Medical college and Hospital. A population of 30 athletes in the age group of 18-28 were incorporated in the study. Inclusion criteria comprising of athletes sustain injuries ACL grade 1 and 2 injury and concomitant injury determined by investigations and prior to commencement of the study participants were asked to visit the Department of Orthopaedics for Medical intervention. Investigations were helpful to categorise the individuals based on contraindication of the study. Exclusion criteria comprising of Avulsion fracture and patellar dislocation Grade 3 ACL tear are excluded in the study.

The participants are partitioned in to Group 1 and Group 2 to endure Bosu Ball training and Trampoline training respectively. The study participants undergone five days in a week of 40 minutes with warm up and cool down period for eight weeks. The equipment of unstable training meant for postural equilibrium and thereby adapts for Neuromuscular concept (1). Pre and post values recorded by Vertical Jump test for balance and strength forms the output of the training.

Bosu Ball is the modernised multipurpose gymnasium amenity for the restoration of basic skills with inflated hemisphere with prominent lines provided non slippery experience. (9). Bosu Ball device is utilized on both sides, hence becomes the popular instrument in fitness centre and effect of agility and ability to anticipate the movement of opposition demonstrated.

Bosu Ball is identified as challenging rehabilitation modality in reducing risk of injury and establishing centre of stability and balance which reflects in physical and functional performance and Bosu ball is recognised larger and quicker direction changes in kinematics of lower extremity. The integration of nervous system musculoskeletal system and sensory system responsible for Dynamic balance with the alteration of position in the torso associates with the stress to the knee joint. It was reported 28.5 percent of significance in static balance and 82.5 percent significance in dynamic balance after Bosu Ball training. It has been coded that balance training program improves concentric and eccentric muscle contraction, proprioception coordination and postural control. The study also coded the Bosu ball makes remarkable effect on vertical jump performance and agility after training compared to baseline (4).

Trampoline raises the strength of lower extremity and muscle power, outcomes become evident through vertical jump performance to record the ability of an individual. Trampoline as a bouncing mechanism become the modality for influencing balance and enhancing musculoskeletal health. It is coded in the journal with extensive concept that static and dynamic balance improves by Trampoline training and thereby repetition of injuries reduced. Neuromuscular concept enhances by proprioception visual signals and vestibular system and thereby adaptation of movements by individuals indulging in bouncing exercises (12).

Exercises practised by Group 1 and Group 2 in Bosu Ball and Trampoline respectively

Exercises	Repetition
Double limb stance	1 min
Anterior / Posterior tilts	10

Medial Lateral tilts	10
Knee flexion	10
Lunges	10
Single limb Stance	1 min

Groups undergone training with performance of exercises mentioned in the protocol (16).

Performance in any field especially sport associates with individuals health and variables like balance and strength becomes the integral part of determining the ability of an individual. Henceforth vertical jump is a promising measure available to measure the outcomes or variables required in athletic performance.

The Vertical jump test or Sargent jump is utilised to record pre and post values of training follows computation of statistical calculation and results. The vertical Jump is exclusively measure to record the sports performance and physical fitness & the correlation of Vertical jump test and lean mass lower extremity coded by Stephenson et al 2015. Further the vertical jump associated with Neuromuscular status coded by Gathercole et al 2015 (13). Application of Vertical Jump becomes the key information of Athlete s functional capacity & Sports performance. Landing on the same spot Athlete is initiated to jump as maximum as possible to reach highest swivel vane in the vertec equipment (14).

3. Data Analysis and Results

Comparison of Bosu Ball and Trampoline group of mean scores recorded in pre and post training values are presented in the Table. Significant improvement of strength and balance are observed in both the groups exposed to the training. A mild difference observed in statistical values i.e., Bosu Ball Training recorded significant values than trampoline training.

Data analysis of the research compiled by Statistical analysis software package for window version. Standard deviation and mean were recorded to know the level of significance of intervention in a study population. To check the hypothesis, whether pre and post training values are same for these groups. The paired ‘t’ Test a variety of Student’s test was computed. The t and p values were found to be -61.00 and 0.00 respectively. Since the P value is less than that .05 indicates the existence of significant difference between pre and post sessions and hence null hypothesis is rejected.

The pre and post vertical jump scores of Trampoline the paired t test was computed. The t and p values were found to be -18.500 and .000 respectively. since the p-value is less than that .05 there exists significant difference between pre and post sessions. Null hypothesis rejected. To compare the mean difference between the groups Trampoline and Bosu ball, independent sample t test was applied. The t and p values were found to be 10.733 & .000 respectively. This indicates there exists significant difference between the groups and the null hypothesis is rejected.

Paired sample statistics

Pair 1 Bosu Ball pre and post values	Mean	N	Standard Deviation	Standard Error Mean
	36.2000	15	2.70449	69830
	40.2667	15	2.76371	71359

Paired sample test

			Paired	Differences		
	Mean	Standard deviation	Upper	t	Df	Sig 2 tailed
Pair 1 Bosu ball Pre and post values	-4.06667	25820	-3.92368	-61.000	14	.000d

Paired sample correlations

Pair 1 Bosu ball Pre and Post scores	N	Correlation	Sig
	15	.995	.000

Paired samples statistics

Pair 1 Trampoline pre and Post values	Mean	N	Std. Deviation	Std Error Mean
	36.2667	15	2.37447	61.308
	38.7333	15	2.08624	53866

Paired samples correlations

	N	Correlation	Significance
Pair 1 Trampoline pre and post values	15	.981	.000

Paired samples Test

	Paired Differences				t	df	Significance (2-tailed)	
	Mean	Standard Deviation	Standard Error Mean	95% Confidence Interval of the difference				
				Lower				Upper
Pair 1 Trampoline pre and post values				2.75264	2.18070	18.500	14	.000

4. Discussion

Proprioception and balance become the significant component of health. Hamstring becomes the core muscle in bringing movement in lower extremities especially movement pertaining to knee joint. Musculoskeletal flexibility reported as significant element for physical fitness (5,6,7,8). The integrity of Hamstring and quadriceps becomes the key factor in development of skills in return to sport after injury. The integrity has been ensured by the Vertical jump performance in which Balance and strength are considered as the conventional outcome for making Athlete eligible in sport performance. Adaptation of exercises become hard in unstable surfaces but the exercises are required for cutting pivoting activities in sports and could serve for the prevention of injuries. Rehabilitation becomes the core concept of developing strength of all the group of the muscles supporting lower extremities.

In this study Vertical jump test is the outcome measure utilised to identify the components for neuromuscular control to withstand sport activities, Vertical jump test has been exclusively designed to demonstrate skill level position risk of injury and greatly identified as a tool to measure Neuro muscular status .It is stated in the journal as a monitor to avoid overtraining in (16) and Vertical jump measurements are linked with Lower extremity lean mass and strength.

5. Conclusions

Vertical jump measurements provide insights to the health care professionals to understand the sequence of transfer of momentum and force to withstand for longer activities. The decline in Neuromuscular status in the initial hour of training shows the deficits in soft tissue injuries and it is evident quadriceps and hamstring strength are key structures to support ACL and meniscus thereby Vertical jump test which forms the context to record the improvement of training. Hence Neuromuscular status and jump test serve as the guidelines for ACL Rehabilitation includes Bosu Ball training and Trampoline training.

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