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Efficacy of Unstable Platforms offer Massive Muscle work in Establishing the Strength an Important Motor Component in Athletes Sustaining Soft Tissue Injuries in Knee

N.Hari Priya[1], P.Balaji[2], V.Pasupatham[3]

[1]Lecturer in Physiotherapy, Division of Physical Medicine and Rehabilitation, Cuddalore Government Medical College and Hospital (Erstwhile Rajah Muthiah Medical College and Hospital, Annamalai University), Annamalai Nagar – 608002, Tamil Nadu, India.

[2]Reader in Physiotherapy, Division of Physical Medicine and Rehabilitation, Cuddalore Government Medical College and Hospital (Erstwhile Rajah Muthiah Medical College and Hospital, Annamalai University), Annamalai Nagar – 608002, Tamil Nadu, India.

[3]Lecturer in Physiotherapy, Division of Physical Medicine and Rehabilitation, Cuddalore Government Medical College and Hospital (Erstwhile Rajah Muthiah Medical College and Hospital, Annamalai University), Annamalai Nagar – 608002, Tamil Nadu, India.

***Corresponding Author:**

N.Haripriya1

Email ID: priyanataraj.23@gmail.com

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ABSTRACT

Background context: Balance strength and power forms the part of motor skill which integrates the nervous system, musculoskeletal system to intervene. Strength and speed adjoin balance to perform conventional activities in sports like walking stairclimbing running jumping and recreational activities. Balance and strength become an integral part of neuromuscular complex to undermine the complex movements which becomes the basic skills in sport. A standardised rehabilitation programme utilises specific training to compensate for the deficits of musculoskeletal system following injuries while indulging in sports. An unstable platform like wobble board Bosu Ball Trampoline offers degree of difficulty to restore the components related to Athletes Skills.

Objective: To determine the efficacy of unstable platform in establishing the components required for athletes in sport performance. To impose the challenges to develop the component like strength forms the part of skills in sports. Rehabilitation programme serves as the contributing factor to offer training in different platforms in Athletes sustaining soft tissue injuries in knee.

Eligibility Criteria and Methodology: The design of the research relies on Randomization methods with pre and post treatment observation and recordings in the sports science and rehabilitation Department. The Randomization method has been incurred by the researcher being single blinded of unaware of the allocation of individuals in the training groups. All participants received the instructions on procedure and purpose of the training and consent received from the participant prior to exposure of the research. The participants aged 18-25 belongs to the discipline of sports science and physical Education Department. The study based on the effects of Bosu Ball training Trampoline training and Conventional training for an exploration of eight weeks. The quantification of Strength an important component of sport relies on Dynamometer. 45 athletes were identified in department of Physical Education with Grade 1 and Grade 2 ACL Injury confirmed by the investigation under the division of Orthopaedics. The Consent and approval received from the Ethical Board of Erstwhile Rajah Muthiah Medical College and Hospital for commencing the research studies. The inclusion criteria have history of ACL injury or concomitant injuries recruited in the study.The exclusion criteria include Grade 3 injuries, Balance impairment, Recurrent knee injuries, internal derangement of knee patellar dislocations and fractures.

Key Points Based on Intervention: Strength and power are the major components for an athlete to return to sport participation. The protocol comprises of various training of Bosu Ball Trampoline and Conventional treatment. The muscle strength an important motor component gained through neuromuscular training on various platforms becomes the essential part of sports.

Keywords: *Athlete, Sport, Knee Joint, Rehabilitation, Bosu Ball, Trampoline, Motor skills.*

1. INTRODUCTION

An embryonic stage is the development of Neuromuscular system and Balance become an integral part of Neuromuscular complex. Balance is regarded as prime component of the Musculoskeletal system to coincide with the base of support with the line of gravity. Balance and co-ordination associates to develop the motor skill. To stabilize the body for skills Balance and co-ordination becomes the outcomes to record the performance of an individual. These outcomes integrate the vestibular somatosensory and visual system. Balance becomes the source of stability and Co-ordinates in performing activities of Daily life. Hence forth various platform of unstable surface makes similar exposure of challenging activities are Tilt Board, Wobble Board, Bosu Ball etc, for example Bosu Ball incorporates rigid platform with rubber hemisphere with the metric of 24.6 * 24.6 * 6 inches. Certain Movements takes the entire effort and skill of an individual like jumping and hopping initially endured to remain motionless and attempt to perform purposeful segmental motions. The maximum ground reaction forces obscured by an individual has become the platform to establish base of support. Establishing base of support and stabilising the body from movements to motionless attitude static postural control is required. The progression from stable position to explosive movements requires anticipation as Dynamic postural control.

The ability to jump has got the significance in various sports like Baske ball Football and volleyball. Acceleration is initiated in a body with the combination of maximum muscle contraction while indulge in sports activities like volley ball. To coordinate the strength and power in assessment and examination the skill is required to jump hop pivot etc. Actions like heading a ball dribbling with speed shooting a ball in the air or receiving the ball from the player. Hence balance agility speed and strength complete the training and competition in sport Unstable training are designed to meet the ultimatum of sports in relation to the degree of difficulty and to achieve stability. The equipment mentioned in the research serve for unstable training to develop postural disequilibrium adds stress to the neuromuscular system to an extent. Thereby enhances the proprioception and strength to meet neuromuscular adaptations. The ambition and measures of rehabilitation depend on the concept of return to sports participation as early as possible.

1.To determine the efficacy of unstable platform in establishing the components required for athletes in sports performance.

2.To impose the challenges for developing motor component that is strength forms the part of skills in sport.

Hence Rehabilitation serves as the contributing factor to offer training in different platforms in Athletes sustaining soft tissue injuries in Knee joint, some athletes to sustain recurrent sprain and fallen of sports performance. Strength training becomes essential to improve neural factors and thereby improves proprioception and balance. The Balance training offered by such equipment with the terminology of multidirectional balance board comprising round disk shaped platform provided with partial or half ball attached to the core point permits multiplanar movements. The utilisation of both sides of balance training board (Bosu ball) has gained popularity in fitness.

2. STUDY INTERVENTION

MATERIALS AND METHODS

The design of the research relies on Randomization method with pre and post observation of individuals exposed in the research studies. Research has been single blinded without aware of the recruitment or allocation of training. Individuals allocated in anyone of the three groups as Group A to undergo Bosu Ball training Group B to undergo Trampoline training and Group C to undergo conventional training. An Appeal or consent taken from participants prior and procedures, benefits explained to the participant. An ethical clearance has been concurred from the Ethical board of Medicine, Cuddalore Government Medical College and Hospital (Erstwhile Rajah Muthiah Medical College and Hospital, Annamalai University). The participants aged 18- 25 athletes belong to the discipline of Sports science and physical Education department with a history of ACL injury were recruited for the study. The study based on the effects of multiple training of Bosu ball Trampoline and Conventional treatment with an exploration of eight weeks. The quantification of strength as one of the essential components of sport relies on Dynamometer.

45 athletes of ACL injury were identified and confirmed by investigation in Orthopaedics Department. The inclusion criteria comprise of ACL grade 1 and grade 2 injury and exclusion criteria include grade 3 injury Balance impairment Recurrent knee injuries, internal derangement of knee, patella dislocation and patellar fracture. The participants of the three groups were subjected to warm up of 10 minutes followed by 30 minutes of training session of five days in a week. The training program of eight weeks to record the outcomes of the study intervention. The pre and post measurements includes hamstring strength by Dynamometer to record the results and conclusion of the study.

Athletes who sustained Anterior cruciate Ligament Injury persistently exhibit impaired kinematics and strength Unstable platform recruits training to reduce high risk land mechanics and prevention of injuries by targeting core muscles of lower extremities. Certain deficits like reduced endurance and strength inefficiency of single leg stance and landing knee kinematics alters Neuromuscular output. The ability to jump has got significance in various sports like Basketball football and volleyball.

Acceleration is initiated in a body with the combination of maximum muscle contraction while indulge in sport activities like volleyball. To coordinate the strength and power in assessment and Examination the skill is required to jump hop pivot etc. A highly explosive actions like heading a ball, dribbling with speed shooting a ball in the air or receiving the ball from the player. Unstable surface training designed to meet the demands of sports in relation to degrees of difficulty and instability to enhance strength and speed constitutes proprioception. The equipment subjected to balance and proprioception are swiss Balls Bosu balls, pilates, exercise balls, wooden wobble board. For better interventional output groups were supervised by the training expert in sport science department (1).

Bosu Ball

Bosu Ball is regarded as inflatable disc, dome shaped and permits exercises on double sides of the equipment. This sort of equipment is regarded as platform of unstable training serve to initiate postural equilibrium adds stress to the neuromuscular system to an extent. Hence forth the postural equilibrium enhances proprioception and thereby meets neuromuscular adaptations (2). Some athletes to sustain recurrent sprain and fallen of Sport performance. Hence strength training becomes the integral part of Rehabilitation to improve neural factors and proprioception. The core training offered by such equipment with the terminology of multidirectional balance board comprising round disk shaped platform provided with partial or half ball attached to the core point permits multiplanar movements. The utilization of both sides of balance training board (Bosu Ball) has gained its popularity in fitness training. The impact of Bosu Ball has been investigated in various studies challenges strength agility and functional performance as phenomenon (6). Hence Health professional utilises postural control assessment to know the pitfall.

Trampoline

Trampoline are the platform popular for their high bounce intensity typically have less tension in the springs and viewed as an ideal low-impact exercises and offer practice in rehabilitation. (17). The generic term offered as rebound tumbler (18). A device compromising of piece of taut strong fabric stretched between steel frame often utilising multiple coiled springs which permits wide range of exercises. The reviews coded in the journal of Trampoline versus Resistance training in young adults. The trampoline based intervention increases lower extremity strength and muscle powers as long jump or vertical jump performance becomes the reliable outcomes to record the progression of an individual. Balance training targets both flexors and extensors of knee with static balance performance. Both knee flexors and extensors are core muscles involve in weight bearing makes the significant contribution in weight loading and transferring. The potentials of utilising trampoline have been highlighted by various aspects in the above mentioned study not only in the part of recreation activities also trampoline serve in the prevention of injuries. The previous study by Zhong M Tay et al., investigated the effects of trampoline training program in knee flexors and extensors strength and balance performance in young adults and a wide consideration of challenge in one's centre of mass on a complaint surface by enduring trampoline training. The study proved the significant impact by Trampoline training (5). Repetitive sprain leads to instability and subjective to recurrence of instability followed by episodes of giving way weakness and self-reported disability following physical activity and regarded as beyond the volition control of joint motion. Researchers' perspective of instability comprises impaired balance decreased joint position sense muscle contraction become slow with strength deficits and altered functional performance (6). The measures of Rehabilitation depend on the concept of return to sports participation as early as possible.

Conventional training or resistance training

ACL rehabilitation programs typically rely on four phases of exercises which focusses on restoration of knee range of motion, strengthen muscles, improve balance and proprioception and eventually resume sport activities. Specific exercises include Quadriceps strengthening, Hamstring strengthening Balance and proprioception functional activities and Sport specific training. Inclusion of exercises in this part are straight leg raises, mini squats, single leg balance board training lunges and drills resembles specific sports training (7).

The development of strength undermines several mechanisms with coordination of motor units with increased frequency of signals responsible for bringing motor units and also coactivation of agonist and antagonists muscle pairs. Development of strength after resistance training is inferred from the study (Brad shaw et al, 2017) is coded in the journal April 2019 adaptations of neurological nature in agonist pattern of muscles (5).

Groups explored the platforms with performance of 3 set of all exercises mentioned in the protocol (Jagruti et al, 2020 Effect of 4 weeks balance training program in healthy young adults: A randomised clinical trial study, 19). The quantification of strength in rehabilitation relies on the source called dynamometer a promising equipment reveals the motor components makes the athlete eligible for indulging in sports. Group A (Bosu ball training), Group B (Trampoline training), Group C (Conventional training) practises the following protocol in different platforms for the duration of 8 weeks.

Exercise	Repetitions
Double limb stance	1min
Anterior posterior tilts	10 min

Medial/ lateral tilts	10 min
Knee flexion	10 min
Rotations	10 min
Single limb stance	1 min

3. OUTCOME MEASURES

The inhibition of stretch reflex with the raise in strength of core muscles of lower extremities. Hamstrings and quadriceps become the integral source of recording isometric strength by utilising dynamometer. This study measures the strength of Hamstrings in Young athletes who sustained ACL by dynamometer. Proprioceptive training on multi apparatus challenge massive muscle work by rapid force generation to establish strength. The proprioception is being established further by the association of central and peripheral mechanism and the equipment provides a valid measure of motor components. For these reasons Dynamometer serve as the source of kinesiology for evaluation of strength following trauma or Dysfunction. To reveal the physical status, performance and task demands in part of ergonomics and kinesiology the dynamometer forms its valuable part in Rehabilitation hence dynamometer becomes the main source of outcome for evaluation of statistics and results.

4. DISCUSSION

It is coded in the study Lizardo F.et al (2016) and Gaurav S. et al, the inhibition of stretch reflex with the raise in strength of core muscles of lower extremities like plantar flexor dorsiflexor hamstring and gluteal muscle becomes the integral source of scores in sport performance. The proprioception is being established further by the association of central and peripheral mechanism in the form of muscular receptors but also cutaneous and tendinous receptors. For example, Co-ordination exercises help to gain motor components among professional football players. Split and Squat jump exercises improve proprioception among net ballers. Squat jump is effective in gaining motor skills in netball players (2,3).

Balance becomes significant component in performing numerous sport activities and responsible for changing positions, response to sudden movements thereby increases strength and endurance of muscles to cope up with physical activities (4). Also stated by Lizardo et al (2017) coded in the study devices of instability training like Bosu ball follows the principles of specificity which makes an ultimatum on the neuromuscular system to enhance dynamic movements thereby proprioception is responsible for establishment of Neuromuscular control.

The journal coded the concept that the utilisation of Bosu ball training recorded significant improvements in the balancing abilities of athletes in particular sport context and in generalised participation.

The challenges imposed in Athletes to maintain the balance on unstable surfaces initiates the stabilizer and core muscles (Badau et al 2019), (Prathibha D et al,2014). This becomes the platform to develop the components strength stability and coordination essential to develop musculoskeletal system thereby the balance integrity of athletes (8) and pivoting during sports. The research on proprioceptive training on Balance, Strength and Agility. The implementation of core training on unstable surfaces raises the flexibility and balance in young competitors which becomes the essential components in cutting the research work (10), neuromuscular control has been established by the factors muscle reflex activity reaction time rate of force development and electromyographic activity and functional performance expressed as outcomes termed as postural control, agility, muscle strength jump performance and Sprint time. (11 12 13 14 15). Thereby strength of muscle imparts proprioception record its significance in sports performance to maintain the position of the body. and to withstand for various activities (16).

5. STATISTICAL INTERVENTION

Table 1 Independent Sample Test

Tram	Lovene's Test for Equality of variances		t-test for Equality of Means						
	F	Sig	T	df	Sig (2-tailed)	Mean difference	Std. Error difference	95% confidence interval of the difference	
								Lower	Upper
Equal	2.172	0.152	5.034	28	0.000	18.20000	3.61549	10.79401	25.60599

Variance Assumed									
Equal Variance Not assumed			5.034	23.163	0.000	18.20000	3.61549	10.72371	25.67629

Table 2 Descriptives

BOSU BALL.	N	Mean	Std Deviation	Std. Error	95% confidence interval for mean		Maximum	Maximum
					Lower Bound	Upper Bound		
0.00	15	294.2000	7.04273	1.81842	298.2999	298.1001	279.00	304.00
1.00	15	278.6667	7.29644	1.88393	282.7073	282.7073	265.00	292.00
2.00	15	260.4667	11.95149	3.08586	267.0852	267.0852	240.00	285.00
Total	45	277.7778	16.50880	2.46099	282.7376	282.7376	240.00	304.00

Table 3 ANOVA

Bosu ball	Sum of Squares	df	Mean Square	F	Sig	
Between groups	8552.311	2	4276.156	52.217	0.000	
Within groups	3439.467	42	81.892			
Total	11001.778	44				

Table 4 Group Statistics

	Anova	N	Mean	Std. Deviation	Std. Error Mean
B Ball	0.00	15	294.2000	7.04273	1.81842
	1.00	15	278.6667	7.29644	1.88393
Tram	0.00	15	278.6667	7.29644	1.88393
	1.00	0[a]			

a. t cannot be computed because at least one of the groups is empty

Table 5 Group Statistics

	Anova	N	Mean	Std. Deviation	Std. Error Mean
Tram	2.00	15	278.6667	7.29644	1.88393
	3.00	15	260.4667	11.95149	3.08586
Conven	2.00	15	260.4667	11.95149	3.08586
	3.00	0[a]			

a. t cannot be computed because at least one of the groups is empty

Table 6 Independent Samples Test

B Ball	Lovene's Test for Equality of variances		t-test for Equality of Means						
	F	Sig	T	df	Sig (2-tailed)	Mean difference	Std. Error difference	95% confidence interval of the difference	
								Lower	Upper
Equal Variance Assumed	0.000	0.995	5.932	28	0.000	15.53333	2.61837	10.16984	20.89683
Equal Variance Not assumed			5.932	27.965	0.000	15.53333	2.61837	10.16984	20.89713

The method of Analysis of Variance (ANOVA) has been utilised to test for the significance of the various training. The analysis that depends on multiple inputs and the mean scores are computed to raise the influence of the treatment methods utilised in the study. Mild difference exists between the groups but all the methods are significant by the f ratio mentioned in the table. Hence ANOVA prove as powerful tool for understanding, analysing multiple methods of the study. All the three methods record the significance by statistical Analysis and this reveals different platforms explored in the study can be utilised for athletic performance following soft tissue injuries of the knee joint.

6. CONCLUSION

Thereby strength becomes the primary source to make the athlete eligible for sport proficiency. In this study the strength of Hamstrings becomes the part of motor component to establish the athlete skills, maintain the body positions and stabilize during change of directions. The reduced strength of muscle fails to support the similar soft tissues around the joint and repetition of injuries are quite common. The unstable platform serves to raise the integrity of musculoskeletal system and sustain the individual in sport to meet the requirements. Following the practices in the unstable platform offer neuromuscular training athlete could set the goals and measures in the initial stage and make achievement in the final stage of training.

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