Effectiveness of Bosu Ball Exercises Versus Thera Band Exercises on Core Stabilization and Balance Performance

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Abstract

Background: Greater core stability provides a foundation for greater force production in the upper and lower extremities. When the core muscles are functioning optimally, the person will be able to safely perform specific athletic or other functional activities. Core muscle imbalances are the cause of core instability and reduced balance performance. Few studies have shown the effect of swiss ball exercises on core stabilization and balance performance as well as few studies also shown the comparison between core exercise on stable and unstable surfaces for core stabilization and balance performance. The core stability and balance performance needs to be treated by strengthening core muscles.

Objectives: To find the effect of 2 different types of strengthening exercises on core stability and dynamic balance in collegiate athletes.

Material and Method: In this pre-post intervention study 26 athletes were included. They were randomly divided into 2 groups with 13 individuals in each group. Group A was instructed to perform BOSU ball exercises and group B was instructed to perform thera band exercises for 6 weeks. After pre-post assessment, data was analysed with the help of appropriate statistical methods.

Results: According to the results there is significant increase in both right and left anterior, posteromedial and posterolateral directions with p value <0.0001 as well as in core stability with p value <0.0001

Conclusion: Both BOSU Ball exercises and thera band exercises are found to be equally effective in improving core stability and balance performance in collegiate athletes.

Keywords: *BOSU ball exercises, thera band exercises, Y balance test, flexor and extensor endurance test, side bridge test, single leg stance test.*

Abbreviations: BOSU ball: Both Sides Up ball

Introduction

The core is a muscular corset, which includes deep and muscles of the trunk[1,2.] It consists of abdominal muscles in the front, gluteals and paraspinal muscles in the back, the diaphragm at the top, and the pelvic floor and hip muscles at the base[3].The core is also referred as the lumbo-pelvic region[9.] They used to stabilize the spinal column, enhance performance when the extremities move and for align the body[1.] Core stability is defined as the level of strength or endurance in particular muscle groups of lumbo-pelvic complex[9.] Increased stability in core is produced by contraction of superficial and deep muscles, made up of both slow and fast twitch muscles. The local (deeper) muscle group are

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transverse abdominis, multifidus, and pelvic floor. They composed of type 1 (slow twitch) muscle fibers. They help to improve trunk endurance. The global (superficial) muscle group are rectus abdominis, obliques, latissmus dorsi, and erector spine. They composed of type 2 (fast twitch) muscle fibers. They control flexion and extension of trunk[3]. The core muscle weakness causes reduced proprioception, reduced balance, reduced strength, muscle imbalance, reduced endurance, reduced flexibility, etc[2].

Core strengthening is the provision of muscular control around the lumbar spine to maintain functional stability Strengthening of core muscles has strong central effect in the body, as well as in increasing stability of the trunk to extend during reach and functional activities[4]. Core exercises are the exercises to train the muscles that stabilize and control the movements of abdomen, waist, and hip[2,10]. There are different exercises to strengthen core muscles includes the crunch exercise, the bridge exercise, and the plank exercise[4]. There are many treatment options for core strengthening such as pilates, tai chi, yoga, graded abdominal exercises, swiss ball core strengthening exercises, hanging leg raise, static abdominals, mini stability ball exercises, etc[1]. Core muscle stability is important for preventing injuries to the knees, hip joints, and lumbar spine[1,2].

Body stabilization is the ability of the muscles around the lumbo-pelvic region during static and dynamic positioning[4]. Body stabilization exercises composed of exercises involving various muscular systems that provide lumbo-pelvic stability and ultimately stabilization of kinetic chain[4]. Core stability is the capacity to maintain equilibrium of the vertebral column within its physiologic limits by reducing displacement and by maintaining structural integrity[14]. Core stability mainly depends on three subsystems: passive, active, and neural control. The passive subsystem consists of static tissue, including vertebrae, intervertebral disc, ligaments, joint capsule, as well as passive properties of muscles. The active system comprises of the core musculature and provides dynamic stabilization to the spine and proximal appendicular skeleton as well as for the movement to the neural control subsystem. The neural control subsystem is the center for incoming and outgoing signals[14].

Balance is an integral component of activities of daily living. It is a dynamic process that involves coordination of multiple neurological pathways that allows for the maintenance of center of gravity over base of support[5]. Postural control is key part of the maintenance and control of balance. It needs proper coordination between afferent information input and efferent system for maintaining, achieving, and restoring state of balance during all activities. Factors responsible for deteriorating balance includes reduced sensation, muscle weakness of lower extremities, increased reaction time, sedentary lifestyle, physical inactivity, increased body mass index (BMI), lack of back muscle strength, and endurance capacity[6]. Dynamic balance is important aspect of everyday life[2]. Thus, it is crucial to find programs useful for measuring, maintaining, and improving balance[2].

BOSU ball (Both Sides Up balance trainer) is an apparatus especially designed for balance training in athletes and recreationally active individuals. It has solid plastic base integrated with an inflatable rubber bladder that resembles a halved swiss ball. It has a solid surface which faces down provides an unstable surface on stable ground. It is also used to improve stability when user maintains upright position as well as in horizontal position[7]. It is used to increased difficulty of various body weight and traditional free weight resistance exercises[2]. Unstable surfaces like BOSU ball may be used to improve strength, balance and coordination. Core training performed on unstable surfaces showed an increase in EMG activity of core muscles[9]. The exercises performed on BOSU ball are sit-ups, planks, single leg balance, stepping up and down, push-ups, crunches, back extension, two leg rises, cross sit-ups, etc[6,8,9].

Elastic resistance band is a unique type of resistance training[12]. It is used in sports and rehabilitation medicine for improving muscular strength and endurance[13]. The resistance of elastic band depends upon the amount of band is stretched. Elastic bands are available in different colours according to assortment of grades. This colour coding denotes the thickness of product and grade of resistance[12]. These colour coding denotes the resistance levels. It includes following colours: yellow (thin), red (medium), green (heavy), blue (extra heavy), silver (super heavy), golden (max). Use of thera band improves flexibility, mobility, daily activities, metabolic parameters, etc[12]. The exercises performed with thera band are curl up, bridging, side bridging, quadruped stabilization, push ups, etc[4].

Core stability is important for injury prevention and for improving athletic performance[18]. There are

different tests to check core stability. It includes trunk stability test, plank test, sahrmann core stability test, unilateral hip bridge endurance test, flexor endurance test, extensor endurance test, side bridge test, etc[14]. The reliability of flexor endurance test (0.93), extensor endurance test (0.97), side bridge test (0.91) is more as compared to others[17,19,20].

Balance ability has correlation with athletic performance and sports injury risk[16]. Static balance can be assessed by single leg stance test, tandem stance test, functional reach test, flamingo test, but the reliability of single leg stance test (0.61-0.81) is more as compared to other tests[15]. Dynamic balance can be assessed by timed up and go test, star excursion balance test, y balance test, dynamic leap and balance test, modified bass test, single leg squat test, single leg hop test, but the reliability of Y balance test (0.80-0.85) is more as compared to others[15,20].

Methodology

The ethical clearance was taken from ethical committee of Krishna institute of medical sciences, Karad. There were 26 participants in the study. The study was taken place in the Physiotherapy department, Krishna institute of medical sciences. The study was effectiveness of BOSU ball exercises versus thera band exercises on core stability and balance performance. The treatment protocol was of 6 weeks. The subjects were assessed for core stability and balance at first. The type of study was experimental study. The study design was pre and post. The samples were chosen using the simple random sampling method. Participants were included as per inclusion criteria.

Procedure

All the subjects were selected for the study according to the selection criteria. Demographic data and consent from was taken from them. Included participants divided in 2 groups by simple random sampling method. Pre and post assessment were taken after 6 weeks of the treatment respectively with the help of outcome measures.

Group A received BOSU ball exercises. Participants were instructed to perform Seated crunches, Plank, Bridging, Hip extension and knee flexion prone ball hold with knee drive. This exercises were performed for 6 weeks, 3 sets of 15 repetitions in the 1st week; 4 sets of 15 repetitions in the 2nd week; 4 sets of 20 repetitions in the 3rd and 4th weeks; and 4 sets of 25 repetitions in the 5th and 6th weeks.

Group B received thera band exercises. Participants were instructed to perform Curl up, Bridging, Side bridging, Push ups, Lower abdominal crunches.

Session will consist of: 3 sets of 15 repetitions in the 1st week; 4 sets of 15 repetitions in the 2nd week; 4 sets of 20 repetitions in the 3rd and 4th weeks; and 4 sets of 25 repetitions in the 5th and 6th weeks

The effect of the treatment given to each group was noted immediately using the outcome measures. The experimental results were statistically analysed. The significant difference between the two groups was investigated with the un-paired t test and within the group with paired t test.

Results

Pre and post data was analysed, according to the result the within the Group A the flexor endurance test, extensor endurance test, side bridge test, single leg stance test, and Y balance test are considered extremely significant with p value <0.0001.

1. Flexor endurance test:

Table no.1: pre and post results of flexor endurance test

	Group A		**Group B**	
	Pre	Post	Pre	Post
Mean	8.46	11.61	8.30	12
SD	3.099	3.22	2.05	2.27
P value	<0.0001 (extremely significant)	<0.0001 (extremely significant)		
t value	20.50		12	

2. Extensor endurance test:

Table no.2: pre and post results of extensor endurance test

	Group A		**Group B**	
	Pre	**Post**	**Pre**	**Post**
Mean	2.69	6.38	3.23	6.69
SD	1.60	3.07	1.87	2.65
P value	<0.0001 (extremely significant)		<0.0001 (extremely significant)	
t value	6.89		11.07	

3. Side bridge test:

Table no.3: pre and post results of side bridge test

	Group A				**Group B**			
	Pre		**Post**		**Pre**		**Post**	
	Left	Right	Left	Right	Left	Right	Left	Right
Mean	21.07	23	30.15	32.84	28.61	28.38	40.53	39.30
SD	8.91	7.17	9.24	7.75	7.73	6.91	8.66	9.41
P value	<0.0001 (extremely significant)				<0.0001 (extremely significant)			
t value	L=7.95, R=10.63				L=17.20, R=11.10			

L= left, R= right

4. Single leg stance test:

Table no.4: pre and post results of single leg stance test

	Group A				**Group B**			
	Pre		**Post**		**Pre**		**Post**	
	EO	EC	EO	EC	EO	EC	EO	EC
Mean	7.84	5.15	11.53	7.92	7.84	5.53	11.38	9.92
SD	2.19	2.11	2.75	2.39	2.06	0.77	2.15	2.69
P value	<0.0001(extremely significant)				<0.0001(extremely significant)			
t value	EO=10.64, EC=12				EO=16.43, EC=5.61			

EO= eyes open, EC= eyes closed

5. Y balance test:

Table no.5: pre and post results of Y balance test for right leg

	Group A						**Group B**					
	Pre			**Post**			**Pre**			**Post**		
	Ant	**PM**	**PL**	**Ant**	**PM**	**PL**	**Ant**	**PM**	**PL**	**Ant**	**PM**	**PL**
Mean	57.17	57.56	57.20	59.29	59.54	59.23	56.20	56.56	56.27	58.43	58.76	58.48
SD	7.38	6.25	6.46	7.41	6.95	6.67	5.39	5.36	5.26	5.64	5.49	5.27
P value	<0.0001(extremely significant)						<0.0001(extremely significant)					
t value	Ant=11.48, PM=9.92, PL=9.54						Ant=8.44, PM=7.86, PL=6.61					

Ant= anterior, PM= posteromedial, PL= posterolateral

Table no.6: pre and post results of Y balance test for left leg

	Group A						Group B					
	Pre			Post			Pre			Post		
	Ant	PM	PL	Ant	PM	PL	Ant	PM	PL	Ant	PM	PL
Mean	55.53	55.68	55.36	57.79	57.74	57.94	54.50	54.73	54.86	56.76	56.84	57.02
SD	6.72	6.53	6.61	7.19	6.67	6.99	5.33	5.47	5.82	5.49	5.66	5.91
P value	<0.0001(extremely significant)						<0.0001(extremely significant)					
t value	Ant=11.97, PM=10.06, PL=12.34						Ant=9, PM=7.06, PL=6.74					

Ant= anterior, PM= posteromedial, PL= posterolateral

Discussion

The aim of this study was to study the effect of BOSU ball exercises versus thera band exercises on core stabilization and balance performance in athletes with an objective of finding the benefits of each exercise and comparing its effects to fulfil the aim of the study.

The individuals included in this study were collegiate athletes which were assessed and scored according to the outcome measure were included in the study.

The study was taken place in Physiotherapy department, Krishna institute of medical sciences. There were 26 participants selected according to the criteria and they were randomly divided into 2 groups (group A and group B) with each containing 13 participants. Group A was asked to perform BOSU ball exercises according to given procedure and group B was asked to perform thera band exercises. This study was carried out for 6 weeks and 3 times per week and pre and post assessment was taken using outcome measures after 6 weeks. After the pre and post assessment the data was statistically analysed.

According to this both the exercise groups appeared to be equally effective in improving the core stabilization and balance performance in the participants and were considered extremely significant with p value <0.0001.

According to a literature variety of exercises must have been used in improving balance and core stability. Some literature suggests that the swiss ball exercises were helpful in improving the core stability and balance performance[3,4]. Some studies also proved that BOSU ball trainer is useful for ankle muscle activation and for improving balance[10].

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Conclusion

On the basis of the result of the study it is concluded that the BOSU ball exercises and thera band exercises appears to be equally effective for core stabilization and balance performance in athletes.

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Conflict of Interest: There were no conflicts of interest in my study.

Ethical Clearance: The Institutional Ethics committee has hereby given permission to initiate the research project titled, " Effect of BOSU ball exercises versus thera band exercises on core stabilization and balance performance"

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