Original Article

Effectiveness of Wobble Board Exercises on Dynamic Balance among Undergraduate Students

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ABSTRACT

BACKGROUND & OBJECTIVE: Control of posture and balance is vital in mobility. Board exercise provides information about the motor strategies associated with muscle activation patterns that result when a person is standing on a wobble board surface that unexpectedly translates or tilts, which stimulates proprioception on the ankle.

METHODOLOGY: This study recruited 37 Undergraduate medical students of Allied health sciences (including males and females) of age between 17 to 25 years, conducted at skill lab of Shalamar Institute of Health Sciences. It is a Pre-test, Post-test Quasi-Experimental study in which balance was assessed by performing SEBT while maintaining single-limb stance. After 2 weeks of training, a dynamic balance was reassessed using Star Excursion Balance Test (SEBT).

RESULTS: A total of 37 patients are included in this study with the age of 22.0 ± 1.65 years and BMI 20.9 ± 3.02 are considered. The study includes 15 male and 22 female patients. This study shows significant differences in Pre-SEBT and Post-SEBT values of legs as p-value <0.05.

CONCLUSION: There were significant differences in Pre-exercising and Post-exercising SEBT. Study shows that wobble board-based rehabilitation training has a positive impact on improving balance of participants.

KEYWORDS: Star Excursion Balance Test (SEBT), Wobble Board Exercises, Dynamic balance.

INTRODUCTION

Control of posture and balance is vital for human mobility. A person having good postural balance reduces the risk of imbalance, or subsequent injuries as well as optimize motor performance[1]. Balance depends upon the quick visual, somatosensory and vestibular feedback for performing smooth and coordinated neuromuscular movements without losing balance along with other components of body [2].

Balance can be classified into static balance and dynamic balance. Static balance is the ability to keep the body's center of gravity within a base of support during a still upright position while standing or sitting[3]. While dynamic balance (DB) is the ability of a body to move outside of its base of support (BOS) or the help in maintaining postural control while performing movement[2]. Along with balance, proprioception also plays a very important role in the maintenance of balance. Proprioception is the ability to integrate sensory inputs from several receptors to determine human's movements and position in space and plays a key role in balance control. Stabilometery is used to assess SB only, the results obtain from stabilometery may not be capable of measuring DB [4]. There are only few practical methods for measuring DB[4,5]. Tests which are used to measure DB provide an overall assessment of joint stability, strength, and sensorimotor function, which may help clinicians to identify balance deficits that may otherwise go undetected with static tests[6]. Then number of laboratory and clinically based balance measuring systems devised to quantify DB which are very expensive[7].

The SEBT (Star Excursion Balance Test) is functional screening tool used to assess DB and monitor rehabilitation progression undergoing balance training[8].

It also assesses balance deficiencies following any injury. It is very inexpensive test and provides fast method to asses balance, and it also has good reliability [9]. By using this test, it is found that players with instability of ankle had comparatively decreased in reach distances as compared to the contralateral uninvolved ankle joint and to the reaching distance of healthy participants [10]. The SEBT requires many components e.g. Strength, endurance, flexibility and coordination of lower extremity. By performing test in different directions muscle strength, endurance, flexibility and efficiency of multiple muscles can find out [11].

Balance training involves exercises that strengthen the muscles of legs and core and helps in maintaining balance and helps in the improvement of DB and physical fitness. It has seen in studies that balance-based rehabilitation training by using any balance tool, e.g., wobble board in individuals who have any issue regarding the balance of the body, produces significant improvement in balance[7].

However, in order to evaluate the efficacy of balance training programs, it is important to increase knowledge about the balance training effects on the actual balance of a person [12]. Although there are many methods in rehabilitation training for improving balance but in this study wobble board is selected for balance training in healthy individuals. Wobble board is a device onto which a person stands and maintains balance in such a way to keep the board in center and keep the edges of board from touching the ground and to keep from falling off the board. This board is used to develop balance or to improve balance, motor coordination skills, strength of core, to decrease risk of falls and injuries to prevent sports injuries in sports by improving balance especially injury of ankle and also used for rehabilitation after injuries.

Wobble board exercise provides information about the motor strategies and is associated with muscle activation patterns that result when a person is standing on a wobble board surface that unexpectedly translates or tilts, which stimulates proprioception on the ankle[13]. Previously wobble board exercises have shown significant improvement in standing balance but there is paucity regarding improvement in dynamic along with static balance.

The objective of this study is that balance training was performed on a wobble board by different methods for a specific period of time. After completion of the training program, balance is assessed by performing SEBT to measure any improvement in balance of a person and rationale of this study is to access whether dynamic mode or static mode is better to improve proprioception.

METHODOLOGY

This study recruited 37 Undergraduate medical students (including males and females) of age between 17 to 25 years, conducted at skill lab of Shalamar Institute of Health Sciences from March-June 2021. Ethical permission was taken from ethical review board of Shalamar Medical & Dental College (SMDC-IRB/AL/82/2021).

Subjects were recruited on the basis of inclusion and exclusion criteria. Inclusion criteria includes **a)** Participants between the age of 17-25 of age. **(b)** undergraduates of Allied health sciences students. Exclusion criteria include **a)** participants having a neurological and vestibular impairment. **B)** History of recent trauma and musculoskeletal injury. **C)** Any red or yellow flag sign. This criteria opted because we want to rule out participants who have balance impairment due to already pre-existing disease. Prior to the training, written consent was obtained from study participants. Each subject had completed a baseline performa and performed SEBT (Star Excursion balance test) bare feet. It is a pre-test, post-test quasi-experimental study in which balance was assessed by performing SEBT while maintaining a single-limb stance. The subject stands on 1 lower extremity, with the most distal aspect of their great toe on the center of the grid, and then perform reach in eight directions i.e. anterior, anterolateral, medial, posterior, posteromedial, poster lateral, lateral and antero-medial, drawn on the grid [14]. The distance covered by subject in each direction without losing their balance is recorded separately [14]. All the movements were performed three times, and the average range was calculated. After that, the subject had performed wobble board-based exercises for a specific period i.e., 3 days\week for 2 weeks.

- Standing Balance on wobble board (30 sec.)
- Squat Hold (30 sec.)
- High Planks (Hands on board) (30sec.)
- Low Planks (Elbows on board) (30sec.)

After 2 weeks of training, dynamic balance was reassessed using SEBT. Shapiro Wilk test use to determine normality, and paired sample t-test was used to see difference within the group. (Pre and post SEBT). Among the procedure we did pre SEBT then we got base line. Then we started Wobble board based balance training 3 sessions per week for 2 weeks then we reassessed again by using SEBT.

All the data were analysed using statistical package for social sciences (SPSS 20). Mean with SD were given for quantitative variables and frequency with percentages for qualitative variables. Data was normally distributed as the p-value measured by the Shapiro-Wilk test was greater than 0.05. Paired sample t-test was used to check significant differences between pre-exercising and post-exercising measurement of SEBT. Significant differences were considered at p-values of less than or equal to 0.05.

RESULTS

The total study participants were 37, males 15 (40.54%) and females 22 (59.45%). The demographic characteristics of the study participants are presented in table-I. Subjects have a mean age of 22.0 ± 1.65 years and BMI of 20.9 ± 3.02. Comparisons between the pre-SEBT test and post-SEBT test showed significant differences (p-value <0.05) at the right and left leg as shown in table-II and table-III respectively.

Table-I: Demographic variables of Participants.

Demographic variables		Mean ± SD
Age(years)		22.0±1.65
BMI(cm\kg)		20.9 ±3.02
Variable	Category	n(%)
Gender	Male	15 (40.5)
	Female	22 (59.5)
Discipline	DPT (Dr of Physical therapy)	15 (40.5)
	MLT (Medical Laboratory technolo-gist)	5 (13.5)
	MIT (Medical Imaging technologist)	5 (13.5)
	OTT (Opration Theatre Techonologist)	7 (18.9)
	Optometery	5 (13.5)
Study Year	1	6 (16.2)
	3	5 (13.5)
	4	18 (48.6)
	5	8 (21.6)

Table-II: Parametric Test (Paired Sample T Test): Pre and Post SEBT findings of rt. leg.

		Mean ± SD	Mean difference± SD	Sig. (2tailed)
Pair 1	Pre-SEBT of right leg in anterior direction of participant	17.89 ±2.66		
	Post-SEBT of right leg in anterior direction of participant	20.76±2.68	-2.86±1.47	<0.001
Pair 2	Pre-SEBT of right leg in anterio-medial direction of participant	17.00±2.87		
	Post-SEBT of right leg in anterio-medial direction of participant	19.81±2.85	-2.81±2.49	<0.001
Pair 3	Pre-SEBT of right leg in medial direction of participant	16.49±3.31		
	Post-SEBT of right leg in medial direction of participant	19.00±2.67	-2.51±3.46	<0.001
Pair 4	Pre-SEBT of right leg in postero-medial direc-tion of participant	14.68±3.79	2.16±3.27	
	Post-SEBT of right leg in postero-medial direc-tion of participant	16.84±3.39		<0.001
Pair 5	Pre-SEBT of right leg in posterior direction of participant	15.43±3.41	-3.02±2.69	
	Post-SEBT of right leg in posterior direction of participant	18.46±3.46		<0.001
Pair 6	Pre-SEBT of right leg in posteriolateral direc-tion of participant	15.70±3.22	-2.91±2.36	
	Post-SEBT of right leg in posteriolateral direc-tion of participant	18.62±2.98		<0.001
Pair 7	Pre-SEBT of right leg in lateral direction of par-ticipant	17.24±2.793	-2.86±2.61	
	Post-SEBT of right leg in lateral direction of participant	20.11±3.46		<0.001
Pair 8	Pre-SEBT of right leg in anterio-lateral direction of participant	17.78±2.83	-2.56±3.24	
	Post-SEBT of right leg in anterio-lateral direc-tion of participant	20.35±3.65		<0.001

DISCUSSION

Total of 37 Participants were recruited on the basis of inclusion criteria. SEBT was performed three times to measure dynamic balance. This study concluded that participants with age of 22.0± 1.65 years and BMI 20.9±3.02 showed significant differences ($p>0.05$) in Pre-exercising and Post-exercising measurement of SEBT. However, a study was conducted on young female athletes to evaluate the effect of a neuromuscular training program (NMTP) on balance using the Y-balance test. They found significant improvement in core stability as well as legs balance in individuals with NMTP when controlled athletes compared to non-trained controls [15].

Table-III: Pre and Post SEBT findings of Left Leg using Paired Sample t-test.

		Mean ± SD	Mean difference± SD	Sig. (2tailed)
Pair 1	Pre-SEBT of left leg in anterior direction of participant	17.68±2.40	-3.24±20.1	
	Post-SEBT of left leg in anterior direction of participant	20.92±3.22		<0.001
Pair 2	Pre-SEBT of left leg in antro medial direction of participant - Post-	16.78±3.0	-2.91±2.74	
	SEBT of left leg in antro medial direction of participant	19.70±3.72		<0.001
Pair 3	Pre-SEBT of left leg in medial direction of par-ticipant - Post-	16.59±3.15	-3.08±2.5	
	SEBT of left leg in medial direction of partici-pant	19.68±3.18		<0.001
Pair 4	Pre-SEBT of left leg in postro medial direction of participant – Post SEBT of left leg in	13.73±4.00	-3.75±2.16	
	Postro-medial direction of participant	17.49±3.99		<0.001
Pair 5	Pre-SEBT of left leg in posterior direction of	15.68±3.22	-3.02±3.98	
	participant – Post SEBT of left leg in posterior direction of participant	18.70±4.64		<0.001
Pair 6	Pre-SEBT of left leg in postro lateral direction of participant - Post-	15.97±2.91	-3.16±2.30	
	SEBT of left leg in postro-lateral direction of participant	19.14±3.35		<0.001
Pair 7	Pre-SEBT of left leg in lateral direction of partic-ipant - Post-	17.46±2.37	-3.48±2.78	
	SEBT of left leg in lateral direction of participant	20.95±3.31		<0.001

Other studies also confirmed improvement in postural control and balance following rehabilitation and training programs in individuals with chronic ankle instability using single leg standing[16]. The current study has used SEBT in normal individuals without any injury or sprain and found that SEBT is a reliable tool rather than single-leg standing only to measure the dynamic balance.

A study conducted to examine the repeatability measurement of three balance scores that was taken by Clever Balance Board, and compared it with two existing clinical balance tests and found that there was a high intra- and inter-session reliability of all balance scores obtained from the Clever Balance Board [17]. The findings are supportive of using the balance board for measuring the dynamic balance.

There was a study conducted by Andrea Fusco, that worked to determine the intrasession and intersession reliability and concurrent validity of a computerized wobble board during single limb standing assessment and found that computerized wobble board showed fair to excellent reliability and poor correlation between wobble board and Y-balance test [18]. But this study has the limitation of using a manual wobble board rather than a computerized one to measure the dynamic balance.

According to the researcher's knowledge, no study has been conducted among healthy undergraduates to measure dynamic balance with the star excursion balance test.

CONCLUSION

There were significant differences in pre-exercising and post-exercising SEBT. Study shows that wobble board-based rehabilitation training has a positive impact on improving the balance of participants.

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Author's Contribution:

Ushna Yalnaz: Substantial contributions to the conception or design of the work.

Muhammad Usman Sarwar: Drafting the work or revising it critically for important intellectual content.

Sumair Qureshi: Analysis, or interpretation of data for the work.

Hafiz Salman Saeed: Facilitation and material analysis.

Imran Manzoor: Final approval of the version to be published.

Nusrat Rasheed: Acquisition, analysis, or interpretation of data for the work.