

Original Article

CORRELATION OF ANKLE DORSIFLEXION RANGE OF MOTION WITH DYNAMIC BALANCE IN YOUNG NORMAL INDIVIDUALS

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ABSTRACT

This study was to examine correlation of ankle dorsiflexion range of motion with dynamic balance in young normal individuals. A cross sectional study has been done on 60 females by convenient sampling. The study was to examine dorsiflexion ROM by using star excursion balance test. It was performed in all directions for three trials. Distance was recorded with measure tape. Ankle ROM was performed by weight bearing lunge. Individuals who demonstrate impairments in dorsiflexion ROM may also demonstrate difficulty with portions of the SEBT. There is significant positive correlation in between dorsiflexion range of motion and star excursion balance test in anterior and postero lateral direction.

KEY WORDS: Star Excursion Balance Test (SEBT), Dorsiflexion range of motion (DROM), WBLT, Dynamic balance.

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INTRODUCTION

Postural control is often described as being either static (attempting to maintain a position) or dynamic (maintaining a stable base of support while completing a prescribed movement) [1]. Static postural control is commonly quantified through instrumented measurements of ground reaction forces or less sophisticated non-instrumented means. A clinician or researcher may assess static postural control by having an individual attempt to maintain a stationary position while standing on either one or both feet. Ground reaction forces may be measured by having a participant balance on a force plate. Postural control is then typically quantified through various measures of velocity, area, or variability of the ground reaction forces or related variable [2]. Non-instrumented measures

include variables such as time that a participant can maintain the prescribed stance [3] or subjective error scoring systems [4]. A common clinical example of static postural control assessment is the modified Romberg test, first described by Freeman [3]. This test is performed by having participants stand as motionless as possible, on one foot, as a series of task demands are added to challenge the postural control system. These task demands include closing the eyes, tilting the head up, and touching an index finger to the nose. Although this test is commonly used in the assessment of cerebral concussion (bilateral stance) and lower extremity joint injuries (unilateral stance), it typically does not place strength or movement demands on the participant.

Dynamic postural control often involves completion of a functional task without compromising

one's base of support. The advantage of assessing dynamic postural control is that additional demands of proprioception, range of motion (ROM), and strength are required along with the ability to remain upright and steady. Numerous tests have been developed to assess dynamic postural control in the pediatric [5] and geriatric [6,7] populations, but very few tests that truly stress the dynamic balance capabilities of the healthy, athletic population.

The Star Excursion Balance Test (SEBT) is one such test that provides a significant challenge to an athlete's postural control system. The SEBT involves having a participant maintain a base of support with one leg while maximally reaching in different directions with the opposite leg, without compromising the base of support of the stance leg. Strong intra-rater reliability of measurements with the SEBT has been demonstrated by Kinzey and Armstrong [8]. and Hertel et al. [9] The SEBT has shown sensitivity in screening for functional deficits related to musculoskeletal injuries; Miller [10], In addition, Lucinda demonstrated the usefulness of the SEBT for the recruitment of lower extremity musculature contraction and discussed its application in rehabilitating dynamic balances. There are lots of different considerations for maintaining joint dynamic posture. Dynamic posture could depend on leg strength muscle, core strength muscle, proprioceptive abilities, age, sex, body height, body mass etc., and of course, dorsiflexion range of motion (DROM), as a measure of flexibility of the ankle joint, is one of them. There are few studies [11,12] that have examined the impact of DROM on unilateral balance performance, but there is still limited evidence regarding the relationship between DROM and performance on clinical assessments of balance measures such as the Star Excursion Balance Test (SEBT) [12] or Biodex Stability System (BSS) etc.

MATERIALS AND METHODOLOGY

A cross sectional study was conducted in metropolitan city by taking institutional ethical clearance. Sixty recreationally active participants volunteered for this study by convenient sampling. Only females of age group between 17 to 23 years were included for the study with

limb length 85-90 cm. Any previous surgery to the lateral ankle ligament complex or ankle joint, previous injury within three months of the test of the lower limb, with ear infection at the time of study was excluded from this study. All participants self-reported that they were free of vestibular disorders, cerebral concussions and lower extremity injuries during the previous 6 months. Each participant read and signed an approved informed consent form.

The SEBT was performed with the participants standing in the middle of a grid formed by eight lines extending out at 45° from each other. Participants were allowed to practice reaching in each of the eight directions six times to minimize the learning effect (Hertel et al., 2000). Following a 5-min rest period, participants performed three trials in each of the eight directions. After completion of the three trials in the eight directions and another 5-min rest period, the test continued with a left stance leg. The investigator recorded each reach distance with a mark on the tape as the distance from the center of the grid to point of maximum excursion by the reach leg. At the conclusion of all trials, the investigator measured the distances of each excursion with a standard tape measure.

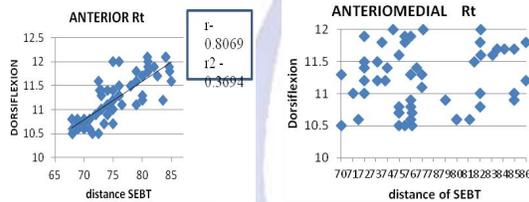
Ankle dorsiflexion ROM was measured using a weight-bearing lunge facing a wall. Maximal dorsiflexion ROM was defined as the maximum distance of the toe from the wall while maintaining contact between the wall and knee without lifting the heel [1]. Heel contact with the ground was monitored by the rater by lightly placing their fingers on the heel to feel for heel movement, while also visually examining the heel for movement.

Data analysis and results: Linear regression was used to determine the relationship between ankle dorsiflexion ROM and measures of dynamic balance. Mean and SD of SEBT left side and right side has been taken. It was measured in anterior, antero medial, medial, postero medial, posterior, postero lateral, lateral and antero lateral. Mean and SD of left side is 73.62±4.78, 79.72±5.27, 83.17±4.46, 76.16±3.17, 62.11±7.31, 51.38±5.14, 48.58±4.12 and 62.11±6.7 respectively. Mean and SD of right side is 74.83±4.63, 77.39±4.54, 82.52±4.42,

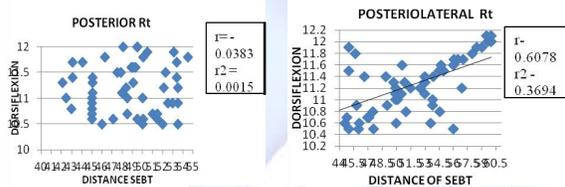
75.85±3.26, 48.41±3.48, 50.75±4.60, 48.37±4.09 and 79.32±5.26 respectively.

The mean and SD of right side dorsiflexion is 11.49±0.484 and left side 11.24±0.492 respectively. Mean and SD of age is 20.55 and 2.25. The mean of limb length is 87.53 and SD is 1.47

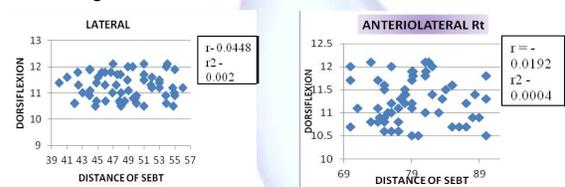
Graph 1a and b: showing strong correlation ship in right anterior side and weak in antero medial side during SEBT.



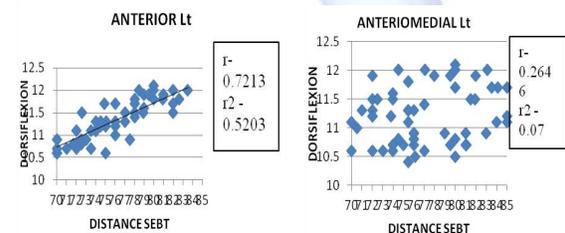
Graph 2a and b: Showing weak positive correlation right medial and right postero medial side during SEBT.



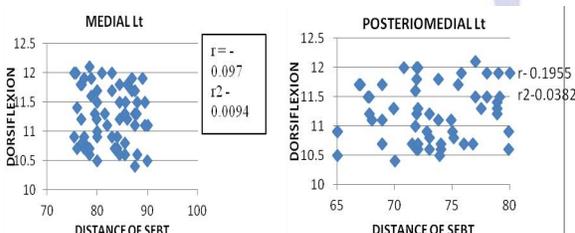
Graph 3a and b: Showing weak positive correlation in posterior right and moderate positive in postero lateral side during SEBT.



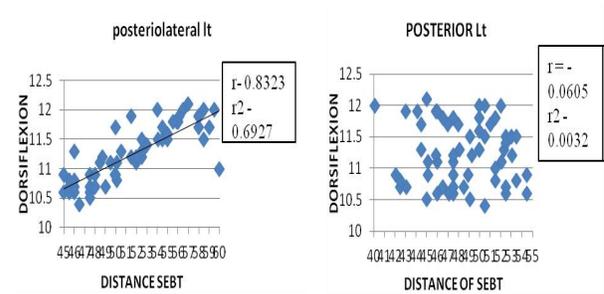
Graph 4a and b: Showing weak positive correlation in lateral and antero lateral side during SEBT.



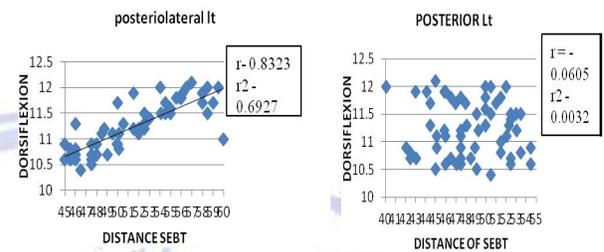
Graph 5a and b: Showing strong positive correlation of distance of SEBT on left anterior side and weak positive in antero medial side.



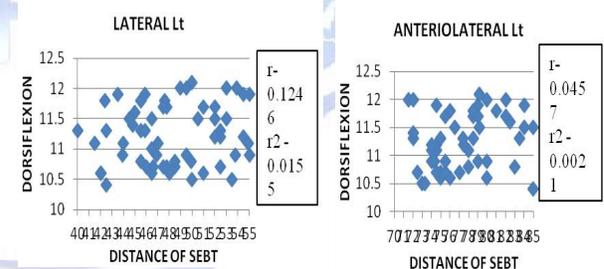
Graph 6a and b: Showing weak correlation on medial left and weak positive postero medial side.



Graph 7a and b: Showing strong positive correlation in postero lateral left side n weak in posterior left side



Graph 8a and b: Shows weak correlation on lateral and antero lateral left side SEBT.



DISCUSSION

The purpose of this study was to examine the relationships between dorsiflexion range of motion on the weight-bearing lunge test (WBLT) and normalized reach distance in three directions on the Star Excursion Balance Test (SEBT). Sixty young adult of age 20 to 55 limb length 87-53 participated. All subjects performed three trials of maximum lower extremity reach in the all directions of the SEBT on each limb to assess dynamic balance. Researchers have provided evidence that the SEBT is sensitive for screening musculoskeletal impairments, such as chronic ankle instability [13], quadriceps strength deficits [10], and patella femoral pain syndrome [14]. Olmsted et al. reported decreased reaching distances during performance of the SEBT in patients with chronic ankle instability compared to matched-healthy control participants [13]. Subjects performed three trials of the WBLT to

measure maximum dorsiflexion range of motion. Linear regression was used to determine the relationship between ankle dorsiflexion ROM and measures of dynamic balance. Significant correlation is found in anterior and postero lateral direction of SEBT and ankle dorsiflexion range of motion with r value r- 0.8321(right), r- 0.7213(left) and r- 0.6078 (right), r- 0.8323(left) respectively.

Individuals who demonstrate impairments in dorsiflexion ROM may also demonstrate difficulty with portions of the SEBT. Clinicians may use this information to better optimize rehabilitation programs that address ankle dorsiflexion ROM and dynamic balance. Sample size is small for this study. Further study can be done by considering knee range of motion.

CONCLUSION

The above study concludes that there is significant positive correlation in between dorsiflexion range of motion and star excursion balance test in anterior and postero lateral direction.

Conflicts of interest: None

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