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Ashutosh Pandey
Research Scholar School of Studies in Physical Education Pt. Ravishankar Shukla University, Raipur, Chhattisgarh, India.

Dr. Reeta Venugopal
Professor School of Studies in Physical Education, Pt. Ravishankar Shukla University, Raipur, Chhattisgarh, India.

Correspondence
Ashutosh Pandey
Research Scholar School of Studies in Physical Education Pt. Ravishankar Shukla University, Raipur, Chhattisgarh, India.

Comparison of dynamic balance using SEBT between athletes and non-athletes

Ashutosh Pandey, Dr. Reeta Venugopal

Abstract
Objective: The purpose of the study was to compare dynamic balance between athletes and non-athletes using Star Excursion Balance test (SEBT).
Methodology: Thirty Athletes (15) from School of studies in Physical Education & Non-athletes (15) from different school of studies from Pt. Ravishankar Shukla University Raipur (C.G) were selected as subjects. Age of the subjects ranged from 18 to 24 years. Star excursion balance test was used to find out dynamic balance of athletes and non-athletes. Descriptive statistics was used to characterize dynamic balance in athletes and non-athletes. Independent t-test was used to compare the dynamic balance between athletes and non-athletes on dominant & non-dominant limbs. The level of significance was set at 0.05.
Results & Conclusions: The result showed significant difference (p<.05) in dynamic balance on dominant limb between athletes and non-athletes.

Keywords: Dynamic balance, Star excursion balance test, Proprioception etc.

Introduction
Balance can be defined as the ability to maintain a base of support with minimal movement as well as the ability to perform a task while maintaining a stable position, Balance can be classified in two categories, Static and Dynamic. (Winter *et al*. 1990) [14]. There are various instrumented and non-instrumented techniques for assessing static and dynamic balance. Grigg, (1994) [9] & Nashner *et al.* (1982) [10]. Reported sensory information obtained from somatosensory, vestibular & visual systems and motor responses that affect joint, range of motion (ROM), coordination & strength are the factors influencing balance.
Balance is ability of antigravital muscles to maintain posture. Somatosensory system which plays important role in maintaining the body in a particular position, whether in a static or in a dynamic in response to external stimulus. Somatosensory system works with the integration of subsystems namely visual system and vestibular system.
Star excursion balance test (SEBT) is a series of single limb excursion in eight directions intersecting at the centre grid (Gribble, 2003; Gray, 1995) [8, 6]. The goal of the task is to maintain a stable base of support on the stance limb & to reach maximum excursion while maintaining stable position. The advantage to assess dynamic postural control is that additional demand of proprioception, range of motion & strength are required while remaining in steady & upright positions. To our knowledge studies comparing balance between athletes and non-athletes have been done using balance assessing equipments but none of the studies have been done for assessing and comparing dynamic balance using star excursion balance test therefore the purpose of the study was to compare dynamic balance of athletes and non-athletes using star excursion balance test. It is hypothesized that dynamic balance of athletes would be better than non-athletes.

Methodology
Subjects
Thirty male Athletes (15) and non-athletes (15) were selected as subjects for the present study. The subjects were athletes from school of Physical Education and non-athletes were from different school of studies from Pt. Ravishankar Shukla University Raipur (C.G). For assessing the leg length measuring tape was used.

Leg length was measured from the anterior superior iliac spine and medial malleolus of the same leg. Leg length of both the legs was measured and the limb dominance was determined by asking the subjects to kick a ball. Dynamic balance was evaluated using star excursion balance test (SEBT).

Procedures

The SEBT protocol described by Gribble and Hertel (2003) [8]. Requires the subjects to stand in the centre of a grid formed by eight lines intersecting each other at 45^0. The subjects were asked to reach maximum distance along each of the eight lines, make a light touchdown and return back to a double limb stance maintaining balance at the centre of the grid. Subjects were given 3 trials in each of the eight directions.

Subjects may start with either of the leg preferably with right limb stance, after completing 3 trials with right limb in each direction, 5 minutes rest was given & subjects were asked to perform 3 trials in each of the eight directions with the other limb i.e. left limb stance. While performing the trails if subject took support of the ground or removed his foot from the centre of the grid or he was unable to maintain balance the trial was discarded or repeated.

Data analyses

The excursion distance scores for each direction from SEBT test were averaged for 3 trials and normalized to leg length to get the percentage of leg length (Percentage of leg length = Excursion distance/ leg length × 100). The normalized excursion distance in each of the direction was then summed for both the dominant and non-dominant limb.

Statistical Analysis

Independent variables used of the present study are the groups (Athletes and Non-athletes) and limb used during testing (dominant and non-dominant). The dependent variable for the study was normalized excursion distance (measure of dynamic balance). Independent t test was used for comparing the dynamic balance between athletes and non-athletes. The level of significance was set at 0.05.

Findings and Results

Table 1: Descriptive Statistics for Dynamic Balance of Athletes and Non-athlete

Measures	Dominant limb		Non-Dominant limb	
	Athletes	Non-athletes	Athletes	Non-athletes
Mean	831.16	722.80	708.54	690.11
Std. Error of Mean	9.59	17.86	16.70	19.81
Std. Deviation	37.17	69.18	64.69	76.72
Skewness	-.068	.551	-.907	.015
Std. Error of Skewness	.580	.580	.580	.580
Kurtosis	-1.374	.763	-.451	-.798
Std. Error of Kurtosis	1.121	1.121	1.121	1.12
Minimum	775.46	617.64	586.73	563.31
Maximum	886.00	879.46	774.97	818.47

Table 1 clearly shows the mean & standard deviation of athletes and non-athletes on dominant limb are 831.16, 722.80, 37.17 and 69.18 respectively. Similarly the mean and standard deviation of athletes and non-athletes in non-dominant limb are 708.54, 690.11, 64.69 & 76.72 respectively. The above table also indicates mean difference on dominant limb between athletes & non-athletes. The mean of athletes are higher as compared to non-athletes.

Table 2: Comparison of Dynamic Balance between Athletes and Non-Athletes on Dominant and Non-dominant limb

t-test for Equality of Means								
		t	D f	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Dominant leg	Equal variances assumed	5.343	28	.000	108.36	20.28	66.81	149.90
Non-dominant leg	Equal variances assumed	.711	28	.483	18.42	25.91	-34.65	71.51

Table 2 clearly indicates statistically significant difference on dominant leg between athletes and Non-athletes as the calculated t-value (t= 5.343) was greater than the required tabulated value ($t_{.05}$ (28) =2.048) at 0.05 level of significance. The table also indicates insignificant difference between athletes and non-athletes on non-dominant leg since the calculated t-value (t=.711) is lesser than the required tabulated value at 0.05 level of significance, hence it can be concluded that dynamic balance for athletes is better than non-athletes on dominant limb.

Discussion

The researcher hypothesized that dynamic balance (normalized excursion distance) of athletes would be better than non-athletes by assessing performance on star excursion balance test. The athletes performed well on star excursion balance test with their dominant leg. The difference observed between athletes and non-athletes on dominant leg may be due to different daily routine of athletes as compared to non-athletes. Athletes used to involve themselves in physical activities including balancing activities, skill training etc which leads to improve joint strength, range of motion of joints and neuromuscular coordination. This supports the result of the study. Insignificant difference was seen between athletes and non-athletes on their non-dominant leg, although no direct evidence support this contention, but the reason may be less use of non-dominant limb as compared to dominant limb by both athletes & non-athletes,. A similar comparison on static balance and dynamic balance was done by Eadric *et al.*; 2007) [2], on female collegiate level Soccer, Basketball and Gymnastics athletes. They reported insignificant difference between gymnasts and soccer players in terms of their static and dynamic balance; in contrast Basketball players displayed inferior static balance when compared with gymnast and inferior dynamic balance when compared with soccer player. Studies have also reported reasons for acquiring superior balance in trained & experienced athletes which up-to maximum extent depends on the nature of repetitive training experiences which ultimately influences the motor responses rather than the

sensitivity of the Vestibular system (Balter *et al.*; 2004) [3]**.** The training experiences responsible for attaining superior balance in experienced athletes influences individuals ability to attend proprioceptive and visual cues (Ashton *et al.*; 2001) [1]. In the light of these studies it was seen that balance performance is influenced by both sensory and motor systems.

Conclusion

The objective of the study was to compare dynamic balance between Athletes and non-athletes using Star excursion balance test as a measuring tool. The result of the study showed better dynamic balance on dominant leg in athletes than non-athletes. It also concluded insignificant difference on non-dominant leg of athletes and non-athletes. The study would help the coaches & sport personnel to incorporate star excursion balance test as a tool to assess the dynamic balance of the athletes.

It is recommended for the coaches, experts and trainers to incorporate Star excursion balance test in their normal training program for measuring dynamic balance. Further Studies can be done to understand the effect of fitness level on dynamic balance with a larger sample.

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