Vol.06,Issue03,March2018

INTERNATIONAL JOURNAL OF RESEARCH PEDAGOGY AND TECHNOLOGY IN EDUCATION AND MOVEMENT SCIENCES (IJEMS) ISSN: 2319-3050

PRESSURE ANALYSIS OF THE DOMINANT FOOT AND NON DOMINANT FOOT OF VOLLEYBALL PLAYERS

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ABSTRACT

Analyzing foot pressure is helpful in clinical diagnosis. Possible applications include the diagnosis of back injuries, prevention of diabetic foot ulceration, and adaptation of insoles for orthopedic applications. Consequently, several approaches to measure foot pressure distributions exist. Most people pay little attention to their feet, feet have to withstand physical strain occurring when standing for hours, carrying heavy objects, or moving rapidly during sports. In volleyball player's take off and landing plays a great role during spiking and blocking, so by knowing the bilateral difference in application of pressure and oscillation we may know about their status of joints and also prevent it from injury. Ten male Inter University right handed volleyball players of LNIPE, Gwalior were selected as subjects for the study by employing purposive sampling. Players were asked to stand on Baropodometric Platform BTS with dominant foot and non dominant foot with a gap of 3 minutes in between so that fatigue will not affect the oscillation. Initially tested lower limb was alternated between right and left in a consecutive fashion. Data obtained from the Baropodometric Platform BTS were converted to Microsoft Excel, where the following parameters were analyzed i.e. anteroposterior oscillation (APO) and mediolateral oscillation (LO) directions, the Average speed of oscillation and displacement of Center of Pressure (COP) Descriptive statistics and T-test were used for the comparison in dominant foot and non dominant foot of volleyball players at 0.05 level of significance. The dominant foot also showed less oscillation in both aspect anterior posterior oscillation and lateral oscillation which shows more joint stability and also tells about the better functioning of propiroceptors ability. May be due to more laxity in joints of non dominant foot the speed of oscillation also showed significantly higher than dominant foot causes greater displacement in center of pressure.

Key Words: *Pressure, Dominant Foot and Oscillation*

INTRODUCTION:

Balance is the process of maintaining the projection of gravity center (GC) inside the body support base[(1)], which requires continuous adjustments of the muscular activity and joint positioning. The individual's pressure center (PC), the point in which the vector resulting from the vertical strength of ground reaction is located, representing the weighted average of all pressures of the surface area touching the ground, shall move continuously when compared to GC dislocations, according to the inverted pendulum model presented by Winter[(2)].

The three systems involved on balance control are: vision, vestibular system and somatosensorial system. The vestibular system in sensitive to linear and angular accelerations, while somatosensorial system is composed by many receptors that perceive the position and speed of all body segments, their contact with external objects, including the ground, and gravity direction[(2)]. Through vision, an individual can reasonably maintain balance, even after vestibular system is destroyed or after loosing the majority of proprioceptive information[(3)]

A Volleyball player needs better balance while in defensive position, reception position and also in the time of landing after spike as they have to ready for the next movement. It is not possible for the player to land on the both the feet every time because the attacker have to spike the ball often by adjusting his body position which requires adjustment of the body segment causing landing on one foot. Often right handed player landed on their left foot and left handed player landed on right foot first as during the moment of contact with the ball left leg comes up to counter the explosive movement of right hand as well as to prevent the excessive rotation of trunk which help him to control too much deviation of Center of gravity, after the attack movement recoiling of muscles takes place which forces left foot down for landing than the right foot.

So to check which foot is more dominant and balanced, oscillation of Left and right foot is to be measured with the help of Pressure plate and for this static balance is the best option. It will help the scholar to give statement about the dominant and non dominant foot that which foot has greater oscillation and which one requires more propiroceptive training to avoid injury and for the enhancement of performance.

The objective of this study was to observe postural control with single-foot support in Volleyball players with dominant foot and non dominant foot through variants derived from PC, measured by pressure sensors.

MATERIAL AND METHODS:

Ten male Inter University right handed volleyball players of LNIPE, Gwalior were selected as subjects for the study by employing purposive sampling.

The age level of the subjects ranged from seventeen to twenty four years. Players had represented national level. Nobody reported history of lower limb musculoskeletal or spine injuries, and no history of neurological, vestibular or uncorrected visual disorders; they didn't use drugs, alcohol or medicines that might compromise balance.

Players were asked to stand on Baropodometric Platform BTS with dominant foot and non dominant foot with a gap of 3 minutes in between so that fatigue will not affect the oscillation. Initially tested lower limb was alternated between right and left, following the order of the evaluations performed in a consecutive fashion. Data acquisition time was 10 seconds for each condition. Before the beginning of the tests, the individual tried the equipment and postures so he/ she could be familiar to them. Between evaluations, intervals between each acquisition were allowed, according to each subject's needs, in order to avoid fatigue effects.

Each condition was repeated three times, being considered for analysis the average of the three measures. The individual was asked to remain as steady as possible during test performance.Before test, a brief evaluation was performed in order to assure that the inclusion and exclusion criteria had been met.

Posture adopted for the test was: subject standing up with a single-foot support looking to horizon with trunk in an upright and comfortable position, with upper limbs positioned along the body, while the non-supported lower limb remained with the hip in a neutral position and knee flexed at 90º(Figure 1). Supported lower limb's hip and knee remained in neutral angle. All subjects performed the tests on bare feet.

Fig.1

Data obtained from the Baropodometric Platform BTS were converted to Microsoft Excel, where the following parameters were analyzed i.e. anteroposterior oscillation (APO) and mediolateral oscillation (LO) directions, the Average speed of oscillation and displacement of Center of Pressure (COP) Descriptive statistics and T-test were used for the comparison in dominant foot and non dominant foot of volleyball players at 0.05 level of significance.

FINDINGS:

Descriptive statistics of anteroposterior oscillation (APO) and mediolateral oscillation (LO) directions, the Average speed of oscillation and displacement of Center of Pressure (COP) presented in Table-1 and Table-2 respectively

Table-1

Descriptive Statistics of Anteroposterior, Mediolateral Oscillation, Average Speed of Oscillation and displacement of Center of Pressure in Dominant Foot and Non Dominat Foot

S.No	Variables	Non dominant Foot(Mean ± S.D)	Dominant foot (Mean ± S.D)
1	Antero-posterior Oscillation	11.48±1.90	15.38±1.80
2	Mediolateral Oscillation	12.75±1.03	14.05±1.97
3	Average Speed	15.7±2.25	18.67±2.92
4	Center of Pressure	73.11±9.76	87.88±14.66

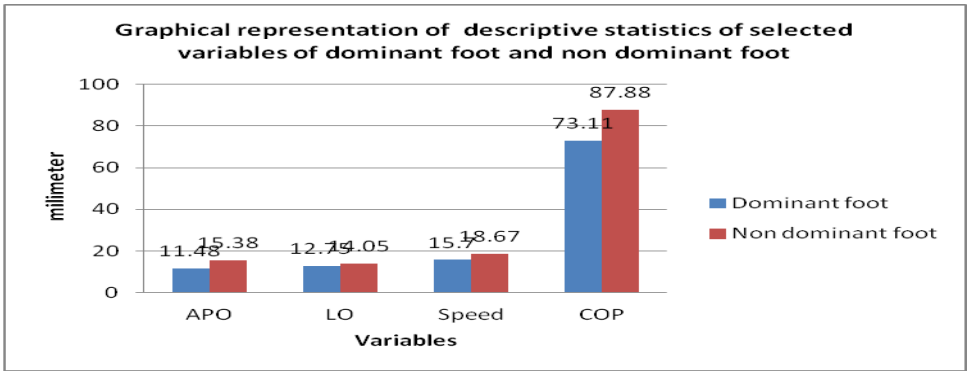

Figure Of Static Pressure Analysis Of Left Foot

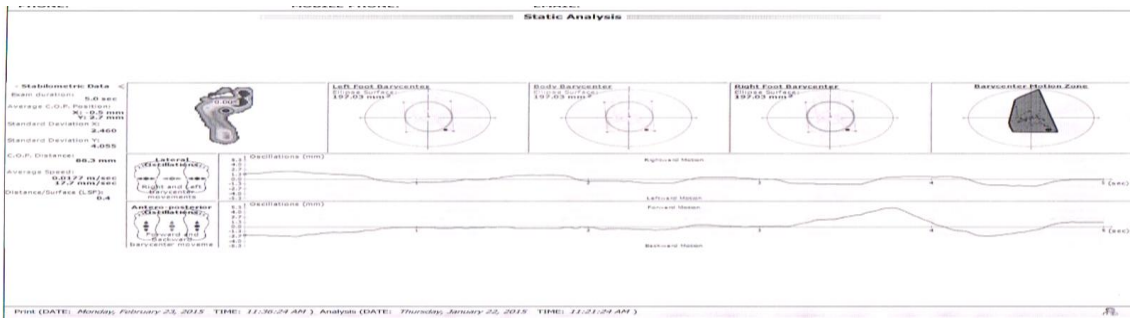

Fig-2

Table-2

T-Test Between Dominant Foot and Non Dominant Foot of Volleyball Players in Selected Variables

S.No	Variables		t- test
1	Antero-posterior Oscillation	foot	4.771*
		Left foot	
2	Mediolateral Oscillation	Right foot	1.850
		Left foot	
3	Average Speed	Right foot	2.548*
		Left foot	
4	Center of Pressure	Right foot	2.653*
		Left foot	

*significant at 0.05 level t (18)

DISCUSSION:

It is revealed from the study that there is more oscillation in the non dominant foot than the dominant foot in anteroposterior oscillation, average speed of oscillation and in center of pressure. As volleyball players didn't get ideal conditions to attack the ball during match rallies, due to that maximum number of times they land on the dominant foot, where chances of oscillation is less and leads to prevention of injury. Volleyball players have to control his or her body towards anterior direction after landing from spiking position not in lateral side due to this medial lateral oscillation didn't show any significant difference in dominant foot and non dominant foot. The dominant foot also showed less oscillation in both aspect anterior posterior oscillation and lateral oscillation which shows more joint stability and also tells about the better functioning of propiroceptors ability. May be due to more laxity in joints of non dominant foot the speed of oscillation also showed significantly higher than dominant foot causes greater displacement in center of pressure.

Balance deficit found in this study could be explained by biomechanical factors, such as muscle laxity or atrophy, as well as by proprioceptive deficiency found in individuals with slight ACL injuries. Zätterström et al.[(19)]concluded that the isolated improvement of muscular strength is not able to fully restore balance in individuals with ACL injuries. Whereas Henriksson et al. noticed that, even in individuals with laxity on the injured side compared to the non-injured side, there is no difference on postural oscillation between limbs.

RECOMMENDATIONS:

The influence degree of biomechanical and proprioceptive factors was not evaluated in this study. It may be included in future studies to find the specific reason for more oscillation. The evaluation of other musculoskeletal disorders on lower limbs or of other conditions leading to a balance change is also of great value. The use of the test might not be limited only to an evaluation of the treatment provided, but might also be used as a preventive or prognostic means, if, for example, it correlates a poorer postural control to a predisposition to injuries and falls.

There is, also, a lack of studies correlating balance to the influence degree of muscle strength, proprioception, joint laxity, and response time to stimulus.

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