

VARIATION IN LIMITS OF STABILITY IN SINGLE LEG STANCE IN YOUNG INDIAN ADULTHOOD POPULATION



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This is certifying that Trishala Sharma, Reg no. 11211748 has selected the MPT Dissertation title “Variation in the limits of stability in single leg stance in young Indian adulthood population” for synopsis presentation under my guidance.

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DECLARATION

I hereby declare the dissertation title “Variation in the limits of stability in single leg stance in young Indian adulthood population” Submitted for MPT dissertation is entirely my original work.

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INTRODUCTION

Posture is maintaining the body alignment upright with respect to the environment. Postural orientation is defined as the ability to maintain an appropriate relationship between the body segments, and between the body and the environment for a task.(1)

Postural stability also called as balance, is ability to control the center of mass (COM) in relationship to the base of support (BOS)(2). Balance plays very important role in holding the body alignment against any external force, to maintain the proper body position and reduce the risk of fall. More is the balance less is the risk f fall.

It is reported in studies that patients after experiencing a stroke, head injury, non orthopedic poly trauma, or patients who are deconditioned generally, in acute inpatient rehabilitation had balance impairments (Juneja 1998). Balance is not only impaired in with patients with some disease, it is sometimes also disturbed in normal population, commonly seen in healthy old age citizens after a certain age.

Postural control is regulated by number of the body system working together, not just by a single system. Below mentioned are the components of the postural control (Motor Control, 2007, p.160)(2)

1. Musculoskeletal components
2. Neuromuscular synergies
3. Individual sensory systems
4. Sensory strategies
5. Anticipatory mechanism
6. Adaptive mechanism
7. Internal representation

Normally to measure postural control subject is made to stand n a force platform and ground reaction force and movements are measured. Any person having high velocity magnitude or velocity of COP excursion is supposed to have impaired postural control (Guskiewicz 1996).

Different people have different limits of stability depending upon their postural control components (mentioned above). Limit of stability is the maximum range of movement an individual purposefully covers in any direction against the risk of fall without disturbance in balance or stepping.

The timed unipedal stance test is a simple test for measuring static aspect of balance that can be used in a variety of setting and requires minimal equipment training (Barbara 2007)(3). The UPST is described as a method of quantifying static balance ability. It is a reliable measure. Jacobs et al recommended including the UPST with eyes open in conjunction with several tests for patients with Parkinson disease in order to evaluate postural stability because it correlated with balance confidence and a history of falls.

NEED OF STUDY

Studies have been done on stability and postural control throughout the world mostly these types of studies have been done on the population like adult, athletes, children, stroke, trauma injury, sports people, gym workers etc. Across the world people have done or are doing studies to check limits of postural control in different population. There are very few studies done on the normal healthy population taking single leg stance.

Considering the population of India the area of stability in single leg stance in healthy adults is yet to be explored. Evidence lack when it comes specifically about Indian population. Exclusively including Indian population we will conduct the study to check the variability in limits of stability in single leg stance.

SIGNIFICANCE OF STUDY

The study will provide field of physiotherapy with a new insight towards the unevenness of the limits of stability in young Indian. This will further also help researchers to conduct a study to rule out the cause of the discrepancy and plan the management accordingly.

This study will check the divergence of limits of stability in single limb stance in different individuals and we can rule out the causes in further studies to avoid the consequences at later stage of the life.

AIM OF STUDY

- To find limits of stability in single leg stance in young Indian adulthood population.

OBJECTIVES OF STUDY

- To generate the normative data for limits of stability in single leg stance for young Indian population.

HYPOTHESIS

NULL HYPOTHESIS H₀-

There exists no significant difference in limits of stability in single leg stance among young Indian population.

ALTERNATE HYPOTHESIS H₁-

There exists significant difference in limits of stability in single leg stance among young Indian population.

OPERATIONAL DEFINATION

Postural control: Posture is maintaining the body alignment upright with respect to the environment. It is of the two types static and dynamic.

Limits of stability: Limit of stability is the maximum range of movement an individual purposefully covers in any direction against the risk of fall without disturbance in balance or stepping.

COP: Centre of pressure reflects the centre of distribution of sum of applied force to the supporting surface. It depicts body movement to maintain COG over the base of support as COP continuously moves around the COM in order to maintain it within the base of support.

Single leg stance: Maintaining upright standing posture on single limb without falling against the external forces acting on the body.

KEY WORDS: Limits of stability, single leg stance, centre of pressure, dominance, perturbation, balance.

REVIEW OF LITERATURE

Rahul Goel et al (2017)(4) conducted a study with 14 normal healthy adults to assess somatosensory utilization while carrying out a functional motor task of single limb postural control using gravity bed. Single limb stance was tested in supine position with eyes open and closed, loaded with 60% of body weight. There was significant difference in single limb stance time across the two conditions. Eyes closed condition challenged the postural control system as compared to eyes open condition.

Nam G. Lee et al (2015)(5) evaluated the effects of the abdominal drawing in maneuver on static core and unipedal postural control in normal population with core instability among 19 individuals. Main outcome measure used in the study was a prone formal test, centre of pressure sway. They also checked electromyographic activity in external oblique, erector spinae, gluteus medius, vastus medialis oblique, tibialis anterior and medial gastronemius muscles. All the participants had to go through pretest followed by ADIM and after that post test. Pretest and post test showed changes in unipedal postural stability. This study provided the first evidence to focus the effects of ADIM training for individuals with core instability improving core and postural stability in normal population.

Sheree Reed et al (2015)(6) conducted a study to evaluate whether the stance leg determined after ball kicking test results in a longer duration of unipedal stance time. Author included 42 participants in the study and made them to kick a ball placed in front of them and the leg used for kicking was recorded and then participants were made to stand on a single leg with arms crossed and eyes open. He found that 50% of the participants maintained longer single leg stance on the leg determined after ball kicking test. It showed that stance limb determined after ball kicking test is more adept as compared to the kicking limb.

J.G Ponce-Gonzalez et al (2014)(7) did a study to develop a UPST for assessing balance using forced platform taking 23 participants in the study. He checked single leg balance test in standard positioning where the motion of arm and same leg was limited. Total of 6 attempts both with jumping leg and contralateral leg were asked to perform with eyes open, eyes closed and eyes open and executing a precision task. Taking the mean of the best result of six attempts performed each day author got the result that the CP-speed had better reliability with the "best result" than

the” mean result”. Author concludes that single leg stance test is a reliable method for the assessment of balance in static position with eyes open.

Lara Allet et al (2012)(8) explored the relationship between unipedal stance test and lower extremity musculature capacities relevant to frontal plane postural control in older individuals having a spectrum of neuromuscular function. Author tested UST, quantitative measured thresholds of frontal plane ankle proprioception and ankle and hip motor functions in 41 participants with spectrum of lower limb sensorimotor functions and identified composite ankle proprioceptive threshold and age to be only predictors of UST.

Etienne J. Bisson et al (2010)(9) conducted a study to assess the influence of ankle and hip muscle fatigue on postural sway and reaction time while single leg stance among 28 participants. Participants were made to stand on their dominant leg for 30 seconds before and after the fatigue of muscles of flexors and extensors of hip and ankle. Centre of pressure data was used to calculate the sway area, sway variability and velocity in antero-posterior and medio-lateral planes. Results revealed that antero-posterior sway variability was influenced by fatigue but reaction time was not influenced by fatigue.

Alex J.Y. Lee et al (2007)(10) investigated somatotype and gender influencing the single leg upright posture in 709 children. Author measured the BMI, height weight ratio and skinfold thickness. Postural stability was checked by using force platform. The study revealed that girls have significantly smaller mean radius of centre of pressure as compared to boys in eyes open and eyes closed conditions and mesomorphic children have significantly smaller mean radius of centre pressure in comparison to the endomorphics. It showed that gender and somatotype are the influencing factors of postural stability in children.

Barbara et al (2007)(3) gathered normative values for repeated trials of the UPST with eyes open and closed across age group and gender using the method prospective, mixed model design taking 549 subjects 18 years or older, performed the UPST with eyes open and closed. Mean and best of 3 UPST times for males and females of 6 age groups (18-39, 40-49, 50-59, 60-69, 70-79, and 80+) she found that there was a significant age dependent decrease in UPST time during both conditions. Performance is age-specific and not related to gender.

Karen P. Cote et al (2005)(11)conducted study to find out the influence of supinated and pronated foot types on static and dynamic balance. 48 participants with pronated, supinated and neutral foot type participated in the study. Chattecx balance system was used for measuring centre of balance, stability index and sway during static balance with eyes open and eyes closed conditions, for dynamic balance star excursion balance test was used . Results showed no such difference in centre of balance as a function of foot type, postural stability is affected in pronator and supinated foot types in comparison to the neutral foot type.

Jay Hertel et al (2002)(12) conducted a study to identify difference in postural control among healthy participants having different foot types.15 male and 15 female were included in the study with cavus foot, rectus foot and planus foot. Subjects underwent three 10 seconds trial of single leg stance with open eyes, standing on a forced platform. COP, excursion area and velocity were measured. He concluded that COP excursion velocities were not significantly different in people with different foot types.

Edward A. Hurvitz et al (2001)(13) conducted a study to find the correlation between peripheral neuropathy and unipedal stance testing. 92 participants were recruited in the study who underwent electrodiagnostic studies and 3 trials of unipedal stance testing and found that participants having peripheral neuropathy had significantly shorter unipedal stance than normal participants.

MATERIALS AND METHODOLOGY

STUDY DESIGN – The design for the present study is observational and cross sectional study design. Observational studies can identify important associations. The main advantage of this method is that subjective bias is eliminated, if observation is done accurately. Information gathered under this process related to what is currently happening. In cross-sectional type of the study the data analysis of the specific population is done for the one point of the time.

So the present study comes under observational category as we are collecting samples and analyzing them to see the variations in the limits of stability. This study aims to generate a

normative data for the limits of stability among different gender with prolong sitting hours and prolong standing hours and to check the relation between limits of stability and preference of footwear type among university students population.

STUDY SETTING – The study will be conducted in the Neurology Laboratory in the School Of Physiotherapy and Paramedical Sciences, Block 3A, Lovely Professional University, Phagwara, Punjab.

POPULATION AND SAMPLING:

Healthy indian population of Lovely Professional University, Phagwara, Punjab.

SAMPLING – Sampling method taken is stratified sampling. This method would be easy to select the particular number of the participants required from the selected block numbers of the university, it will reduce the effort by targeting equal number of subjects randomly from each strata.

SELECTION CRITERIA

INCLUSION CRITERIA –

- Young adults of age >18.
- Indian nationality.
- MMT grade >3 for ankle dorsiflexors, invertors and evertors.
- Ambulatory.
- Normal blood pressure during the time of evaluation.

EXCLUSION CRITERIA –

- No any neurological and orthopedic impairment.
- No lower limb pathology.
- No vestibular disorders. Known history of balance impairments.
- No known history of diabetes.
- Peripheral neuropathy.
- Any lower limb fracture within the 6 months.

- Pregnant women.
- Limb length discrepancy.
- Musculoskeletal disease.
- Balance disorders.
- Arthritis.
- Plantar fasciitis.
- Kyphotic posture
- Forward head posture
- Foot deformities
- Poor vision

PARAMETERS

- Posture sway
- Center of pressure displacement – Anterio-posterior displacement , latero-lateral displacement

TOOLS

- **Win Tack analyzer medicapteurs, France.**

The Win Track analyzer is an instrument used to measure balance, gait parameters and postural sway. The dimensions of the platform are 1610 millimeter X 30 millimeter. The thickness of platform is 9 millimeter and it comprises of 12288 sensors that are of resistive sort. The sensors are having dimensions of 7.8 X 7.8 millimeter² and recording acquisition frequency of the instrument is 200images/sec. The data of various variables or parameter is recorded via computer and are calculated automatically

- Win track – To assess the postural sway or center of pressure displacement using various sensory inputs and during different tasks.
- Weight machine- Weight machine is used before the postural assessment.
- Measuring tape – Height should be measured for all the participants

PROCEDURE

Subjects will be chosen in view of Inclusion and Exclusion Criteria. Subject will be depicted procedural subtle elements to be followed in this Study and there after Consent Form will be gotten subjects will undergo the measure of their height, weight and foot size. Physically manual muscle testing of each individual for the ankle dorsiflexors, evertors and invertors will be done. After all the examination the subject will be asked to stand barefoot on a win-tract on single limb (preferred limb first) with arms crossed over the chest, then readings will be taken for the balance, posture sway and centre of pressure displacement in antero-posterior and medio-lateral plane. Similarly the readings would be done for the other limb as well with eyes open and eyes closed condition. Participant will be made to stand on the win track for 30 sec to get the readings of a limb.

STATISTICAL TOOL:

Data analysis will be carried out using SPSS software after collecting all the outcome measures. The following are the statistical formulas and tools which will be used for the data analysis.

- Mean
- Standard deviation

Arithmetic mean: It is the average of the given set of numbers.

Mean= (Sum of observations)/(Number of observations)

$$\bar{x} = \frac{\sum x}{n}$$

where x = each observation and n = number of observations.

Standard deviation: It measures the absolute variability of distribution. The greater the amount of variability, the greater is the standard deviation. It can be calculated by using the formula

$$s = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (x_i - \bar{x})^2}$$

EXPECTED OUTCOME:

After the completion of the study we will get the normative data for the limits of stability in single limb stance in younger population.

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