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Research Article

INFLUENCE OF LEG DOMINANCE ON SINGLE LEG STANCE TEST IN HEALTHY CHILDREN BETWEEN 12-14 YEARS

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ABSTRACT
There is no literature available to elaborated effect of limb dominance on static balance in children. Hence, we planned this study by keeping objectives as, to assess balance using single limb stance test with dominant and non dominant leg and to compare scores of both conditions. 224 healthy children between the ages of 12-14 years without any obvious motor, sensory or neurological problem were selected. They were assessed for single limb stance test (SLST) while standing on dominant and non dominant leg. Scores were compared with paired t test using SPSS 15.0. There was no significant difference in scores of single limb stance test while standing on dominant or non dominant leg. Thus, it can be concluded that, limb dominance does not affect SLST performance hence patient can be made to stand on either of limbs while performing single limb stance test.

Keywords: *Children, Limb Dominance, Balance, Single Limb Stance Test*

INTRODUCTION
Optimal control of upright stance is called as a good balance. It is result of chain of actions of sensory motor system. A harmonious interaction between visual, vestibular and somatosensory inputs along with appropriate torque production and motor reactions leas to a good balance. While sensory functioning includes continuous integration of visual, somatosensory, and vestibular afferents to monitor the biomechanical state of the body, motor functioning refers to the ability to initiate corrective neuromuscular responses to retain the body's center of mass (COM) within the base of support (Forth *et al.*, 2007). Deficiencies in any related sensory (e.g., vision loss, vestibular disorders) or motor system (e.g. lack of strength or asymmetry, lower body injuries) may increase spontaneous body sway and degrade balance performance (Baltaci *et al.*, 2003; Emrey *et al.*, 2003; Hahn *et al.*, 1999; Barker, 1997).
When one limb demonstrates increased dynamic control as a result of increase in muscle strength and recruitment patterns, the limb is said to be dominant over the other (Mutlu *et al.*, 2014; Cale *et al.*, 2005; Alonso *et al.*, 2011). This asymmetry in performance may lead to asymmetrical torque production leading to loss of harmony in postural system and thus impaired balance (Ford *et al.*, 2003; Hewhitt *et al.*, 2001; Kaplik *et al.*, 1991). Although concept of upper limb dominance is well accepted, lower limb dominance is still questionable and is being researched widely. Researchers and clinicians have tried to explore this asymmetry and effect of limb dominance using various tests of balance in sportsmen, elderly and healthy adults. They give a mixed review about performance, strength, fatigability in relation to dominance (Kejoenen *et al.*, 2003; Davlin, 2004; Cale and Mattacola, 2004; Eggen *et al.*, 2003; Dietz *et al.*, 1989; Hoffman *et al.*, 1998).
Although, children develop adult like balance by age of 7-10 years, their preferred limb is decided way before that. Their active life style and play keeps them prone for falls and injury. Ankle and knee injuries dramatically impair functional balance and are some of the most common lower body injuries not only among athletes but also the general population and children (Barker *et al.*, 1997; Bjordal *et al.*, 1997). The main goal of any successful rehabilitation is to optimize the functional recovery process and achieve the pre injury state of individuals by restoring damaged physical, neurological, and physiological capabilities (Knight, 1985). Under ideal conditions, this requires periodic monitoring of the pre injury state of the person. However, while athletes undergo various performance tests (strength, endurance, stability), there are no regular monitoring practices for sedentary individuals. Many times clinicians use unaffected limb for assessment, training, progress evaluation purposes in adults (Kejoenen *et al.*, 2003; Davlin, 2004). If

this rule of adults should be applied to adolescents remains unanswered. We could not find any literature on whether lower limb dominance plays in role in their balance. So this study was planned to find effect of limb dominance on static balance in children between 12-14 years.

MATERIALS AND METHODS

- Type of study: cross sectional
- Sampling technique: convenience
- Sample size: 224
- Study setting: community, schools for healthy children in Pune area
- Inclusion criteria: healthy children between 12 yrs-16 yrs, both genders, parents and children willing to participate in study
- Exclusion criteria: obvious motor, sensory, cognitive, neurological, deficits like CP, Polio, DMD, ligament injuries, lower limb deformities, amputations, visual disturbances etc. that would affect balance

Method

This was a preliminary part of another study details of which, will be published in future.

- Ethics committee clearance was obtained from institutional ethics committee. Permission to conduct study and consent was obtained from the related school authorities and parents respectively.
- Subjects were selected according to the inclusion and exclusion criteria.
- Demographic data like limb dominance, height, weight, age, gender was recorded.
- Leg dominance was decided by asking them which leg they would prefer to kick a ball (Ford *et al.,* 2003).
- Chit method was used to decide the first test condition (i.e. dominant or non dominant leg standing)
- Participants were asked to perform SLST after the test procedure and purpose of the assessment was explained to them.
- SLST-This is the standard test used commonly for children and has reliability of 0.91 to 1.00 (Atwater *et al.,* 1990). Participants were made to stand barefoot and 2 ft away from the wall. They were asked to fixate gaze on given point at eye level and 20 ft away from standing point. They were made to have stance on one lower limb and the other lower limb flexed 90^0 at hip and knee with ankle in neutral, hands on hips. The time was noted from the moment of lifting the leg and stopped when the stance limb moved on the floor or foot touched down or participant's gaze moved away from target or participant kept the leg hooked at stance limb in spite of warning twice. 5 min of rest was given between each test. Mean of 3 readings was taken as final reading.
- Children were asked to perform the same test on same time for the other side, on next day.
- Data thus obtained was analyzed using paired t test on SPSS 17.0

RESULTS AND DISCUSSION

Table 1: Demographic data

Gender	Total number	Percentage
Male	36	16.07
Female	188	83.92

Table 2: Comparison of scores on dominant and non dominant legs (using paired t test)

	SLST duration (in seconds)		P value	Inference
Dominant leg	Mean	25.22	0.69	Not significant
	SD	2.84		
Non dominant leg	Mean	25.42		
	SD	3.84		

The results of this study suggest that, SLST duration was same for dominant and non dominant limb in healthy children of 12-14 years. There was no statically significant difference in scores (P=0.69). This finding is in line with the previous researches that examined single-leg stance performance in quiet standing tasks and functional hop task for adults and (Hoffman *et al.,* 1998; Bahamonde *et al.,* 2012).
Balance performance symmetry between the dominant and non dominant leg can be attributed to the physical activity patterns of the subjects in this study. For healthy children and healthy sedentary individuals, daily activities of the lower body mostly include walking, stair climbing, and sit-to-stand movements. One of the pervious researchers while studying effects of speed and limb dominance on knee muscle strength documented that; both the dominant and the non dominant leg are used synchronously during such cyclic movements (Hegeman *et al.*, 1988,) It is quite possible that, they contribute the same amount of torque production for generation of movements (Sadeghi *et al.,* 2000). While performing SLST the person has to stand on one leg maintaining balance. It requires a good torque production from calf, quadriceps, glutei (Clifford and Holder-Powell, 2010). While standing on one leg, the center of gravity moves towards the leg off the ground thus, shifting line of gravity towards that side making gluteus medius the most important muscle to maintain balance. It has shown that there was no difference in abductor strength in dominant or non dominant limb in adults (Cale *et al.,* 2005; Cale and Mattacola, 2004; Lashammar and Ribom, 2010) hamst to quadriceps ratio also has been similar in both legs in adults (Kong and Burns, 2010). Studies by Alonso et al found no difference in limb performance of healthy sedentary individuals and recreational foot ball players. Similar results were found by same authors in Judo players and sedentary individuals (Alonso *et al.*, 2008; Alonso *et al.,* 2011). Other scientists al used scan mat equipment, force plat form respectively and found similar limb performance in healthy adults (Tookuni *et al.*, 2005; McCurdy and Langford, 2006). Thus it shows that, adolescent show similar trend as that of an adult for balance performance with respect to dominance. On the other hand, overuse of one leg over another for certain athletic activities, such as shooting in soccer or kicks in combat sports may develop limb asymmetries in the athletic population (Barone *et al.*, 2011; Lanshammar *et al.,* 2011). Researchers have also found significant leg difference between dominant and non-dominant leg strength measured by the hamstring quadriceps(H:Q) ratio in healthy females of varied age group and recommended the adjustment of clinical tests based on leg dominance (Lanshammar *et al.,* 2011). Keeping these points in mind, we feel that, results obtained in this study might not be applicable for children involved in sports. To summaries, results of our study suggests that, clinicians can use any limb to assess static balance in typically developing children but, they should also consider the training pattern, sports and recreational activities while generalizing this information for adolescents involved in sports. We tried to minimize error by strict inclusion criteria. Since it's a known fact that, body mass index affects balance we included children with normal body mass index values only thus, eliminating effect of height and weight on SLST. The study had majority of female participant. It's known that, adolescent females have better postural balance capabilities than male (Dorneles *et al.,* 2013). Since the participants group was same for both conditions effect of gender on balance performance would be eliminated.

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REFERENCES
Alonso AC, Brech GC, Bourquin AM and Greve JMD (2011). The influence of lower-limb dominance on postural balance. *Sao Paulo Medical Journal* **129** 410-3.
Alonso AC, Bronzatto Filho E, Brech GC and Moscoli F (2008). Estudo comparativo do equilíbrio postural entre atletas de judô e indivíduos sedentários. *Brazilian Journal of Biomechanics* **9**(17)130-7.
Alonso AC, Brech GC, Bourquin AM and Greve JMD (2011). The influence of lower-limb dominance on postural balance. *Sao Paulo Medical Journal* **129**(6) 410-3.
Atwater SW, Crowe TK, Deitz JC and Richardson PK (1990). Interrater and test-retest reliability of two pediatric balance tests. *Physical Therapy* **70** 79-87.

Bahamonde R, Weyer J, Velotta J and Middleton A (2012). Effect of leg dominance on the single leg hop functional test in non injured adults. *30th Annual Conference of Biomechanics in Sports – Melbourne.*
Baltaci G and Kohl HW (2003). Does Proprioceptive Training During Knee and Ankle Rehabilitation Improve Outcome? *Physical Therapy Rev*iew **8** 5-16.
Barker HB, Beynnon BD and Renstrom PA (1997). Ankle injury risk factors in sports. *Sports Medicine* **23** 69-74.
Bjordal JM, Arnoy F, Hannestad B and Strand T (1997). Epidemiology of anterior cruciate ligament injuries in soccer. *American Journal of Sports Medicine* **25** 341- 5.
Cale AJ and Mattacola CG (2004). Eccentric hip strength and kinematic differences between the dominant and non-dominant legs of men and women during a hopping task. *Journal of Athletic Training* **39** 34-35.
Cale AJ, Timothy LU, Matt Seeley, Wes Sterling and Goodrich L (2005). Strength and Fatigability of the Dominant and Nondominant Hip Abductors. *Journal of Athletic Training* **40**(3) 203–206.
Clifford AM and Holder-Powell H (2010). Postural control in healthy individuals. *Clinical Biomechanics* **25** 546-51.
Davlin CD (2004). Dynamic balance in high level athletes. *Perceptual and Motor Skills* **98**(3) 1171-6.
Dorneles PP, Pranke IG and Mota CB (2013). Comparison of postural balance between female and male adolescents. *Fisioterapia e Pesquisa* **20**(3) 210-14.
Emery CA (2003). Is there a clinical standing balance measurement appropriate for use in sports medicine? A review of the literature. *Journal of Scientific Medicine and Sports* **6** 492-504.
Ford KR, Myer GD and Hewett TE (2003). Valgus knee motion during landing in high school female and male basketball players. *Medical Science and Sports Exercises* **35** 1745–1750.
Forth KE, Metter EJ and Paloski WH (2007). Age associated differences in postural equilibrium control: A comparison between EQ score and minimum time to contact (TTCmin). *Gait Posture* **25** 56-62.
Hahn T, Foldspang A, Vestergaard E and Ingemann-Hansen T (1997). One leg standing balance and sports activity. *Journal of Scientific Medicine and Sports* **9** 15-8.
Hegeman PA, Gillaspie DA and Hill LD (1988). Effects of Speed and Limb Dominance on Eccentric and Concentric lsokinetic Testing of the Knee. *The Journal of Orthopedic and Sports Physical Therapy* **10**(2) 59-65.
Knapik JJ, Bauman CL, Jones BH, Harris JM and Vaughan L (1991). Strength and flexibility imbalances associated with athletic injuries in female collegiate athletes. *American Journal of Sports Medicine* **19** 76–81.
Knight KL (1985). Guidelines for Rehabilitation of Sports Injuries. *Clinical Sports Medicine* **4** 405-16.
Kong PW and Burns SF (2010). Bilateral difference in hamstring to quadriceps ration in healthy males and females. *Physical Therapy in Sport* **11**(1) 7-12.
Lanshammar K and Ribom EL (2011). Difference in muscle strength in dominant and non-dominant leg in females aged 2—39 year- a population based study. *Physical Therapy in Sports* **12**(2) 76-9.
McCurdy K and Langford G (2006). The relationship between maximum unilateral squat strength and balance in young adult men and women. *Journal of Sports Science and Medicine* **5**(2) 282-8.
Mutlu CUĞ, Recep AO and Emre AK (2014). Influence of Leg Dominance on Single-Leg Stance Performance during Dynamic Conditions: An Investigation into the Validity of Symmetry Hypothesis for Dynamic Postural Control in Healthy Individuals. *Journal of Physical and Medicine and Rehabilitation* **60** 22-6.
Sadeghi H, Allard P, Prince F and Labelle H (2000). Symmetry and limb dominance in able-bodied gait: a review. *Gait and Posture* **12** 34-45.
Tookuni KS, Bolliger NR and Pereira CAM (2005). Comparative analysis of postural control in individuals with and without lesions on the anterior cruciate ligament of the knee *Acta Ortopedica Brasilias* **13**(3)115-9.