TO STUDY THE PREVALENCE AND CORRELATION OF FLATFOOT WITH DYNAMIC BALANCE IN SCHOOL GOING CHILDREN IN KOTKAPURA CITY OF PUNJAB

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ABSTRACT

Background: Flatfoot is a condition in which the foot does not have a normal medial longitudinal arch when standing. Among children bilateral flatfoot has been found very common.

Aims & Objective: The main objective of this paper is to study the prevalence and correlation of flatfoot with dynamic balance in school going children in kotkapura city of Punjab.

Materials and Methods: This is a cross sectional study made on 892 school children between the ages of 8-14 years having flexible flatfoot from 6 government schools of Kotkapura city of Punjab. Three Foot print measurements – Arch Index, Staheli's Arch Index &ChippauxSmirak Index were taken for the diagnosis of flatfoot. Dynamic balance of subjects having flatfoot was measured with Star Excursion Balance Test.

Result: The prevalence of flatfoot was calculated by mean percentages of Foot Print Index Scores & the correlation of Flatfoot & Dynamic Balance was calculated with Karl Pearson Coefficient. Out of 892, 163 had unilateral flatfoot & 76 had bilateral flatfoot. Star Excursion Balance Test Score for dynamic balance showed negative correlation with Foot print Index Score of flatfoot.

Conclusion: The prevalence of bilateral flatfoot was 46.6%, and Girls were more affected as compare to boys. SEBT Score for dynamic balance was more in dominant side as compare to Non-dominant side. Thus results show negative correlation of flatfoot with dynamic balance in 8,11,13& 14 year of age group.

Keywords: Flatfoot; Prevalence; Children; Dynamic Balance; SEBT.

INTRODUCTION

Flatfoot is a condition in which the foot does not have a normal medial longitudinal arch when standing. Flat feet are considered normal in early childhood and the condition resolves spontaneously and most children become structurally normal when they are 12 or 13 years old[1].Flat footedness may be classified as pathological or physiological. The pathological or rigid flatfoot is characterized by a fixed arch that is not modified by the support or lack of support of weight. The physiological or flexible flatfoot characterized by normal arch without weight support and flattening of the arch during standing, is often noted during the first decade of life and can be symptomatic or asymptomatic[2].

Flatfoot in children is often a dynamic and restorable depression of the foot arch during weight bearing, also known as flexible flatfoot. However some of the children with flatfeet might not develop a good foot arch at skeletal maturity and inferior physical fitness was reported in children with flatfeet[3].

The prevalence for flatfeet diminishes significantly with age, being higher in children with ligament laxity and the early shoe wearing impairs longitudinal arch development. In 3 year old patients, the condition has been reported up to 54% and in the 6 year old group it has been reported at 24%[2].

Etiology of flexible flatfeet includes ligamentous laxity, neurologic disorders (Cerebral Palsy, Hypotonia), Muscular abnormalities (Muscular dystrophy), Genetic syndromes (osteogenesis), collagen disorders (ehlers-danlos). Etiology of Rigid flatfeet includes trauma, congenital vertical talus etc[4].

In normal feet, 61% of the weight is supported in the posterior area, 35% in the anterior area, and only 4% in the mid zone. In flat feet, between 17 and 30% is supported by the mid zone[2].

Balance is defined as the process that maintains the center of gravity within the body's support base. Balance needs constant adjustments with joint positioning and muscular activity. Many musculoskeletal and nervous system diseases can alter balance control. The literatures reveal controversy about the relation of flat-footedness and disability.Khodadadeh&Welton,1992 and Lin et al., 2001 stated that flat footedness was related to some kind of disability but Tudor et al. ,2009 confirmed that children with flatfeet and children with normal feet were equally successful at accomplishing all motor tests[5,6].

It is very hard to decide whether flatfoot is a physiologic adaptation or a pathologic

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condition. Therefore, it is believed that the decision to treat flexible flatfoot is often difficult[6]. In the light of literature available the purpose of the present study is to study the prevalence & correlation of flatfoot with dynamic balance in school going children.

AIMS AND OBJECTIVES

To study the Prevalence of flatfoot in school going children in kotkapura city of Punjab.

To find out the correlation of flatfoot with dynamic balance in school going children in kotkapura city of Punjab.

MATERIALS & METHODS

This was prevalence, cross-sectional study of school going children between 8-14 years of age, studying at 6 government schools in Kotkapura city of Punjab.

Inclusion criteria: age between 8-14 years, healthy subjects had bilateral flatfoot, asymptomatic flexible flatfoot.

Exclusion criteria: those have past history of any ankle surgery & acute ankle injury, musculoskeletal deformities, lower limb pathology, lower limb neurological condition, congenital flatfoot and those who did not want to participate and those who were absent in the class during the day of study.

After getting the approval from institutional research and ethical committee of College of Physiotherapy, AdeshUniversity. Verbal as well as written approval was taken from Principal, College of Physiotherapy as well as from concerned Principals of 6 Government schools. Informed consent had been signed from parents and class in-charge of subject after explaining the study procedure and benefits to them. Subjects fulfilling the inclusion criteria were selected and Children who did not attend school on the day of clinical evaluation were excluded. There was no dropout during the study procedure.

For the prevalence total 892 subjects were screened from 6 schools after that assessment and Footprint measurements for the diagnosis of flatfoot were obtained with Independent Variable i.e. Foot Print Index. Three footprint measurements- the Arch Index, Staheli's Arch Index &ChippauxSmirak Index were obtained.

For foot print measurements stamp ink was applied to sole of the foot while subject was in sitting position. Foot prints were taken on A4 Sheet that was placed on Glass Base in standing position. Readings were measured in centimeters[3].

Arch Index= B/A+B+C

Chippaux-Smirak Index= B/A×100%

Staheli's Arch Index =B/C×100%

SEBT (Star Excursion Balance Test) was considered as Dependent Variable to find out the scores for dynamic balance of children had bilateral flatfoot. The SEBT involves having a participant maintain a base of support with one leg while maximally reaching in different directions with opposite leg, without compromising the base of support of the stance leg. Out of 892 subjects 76 subjects had bilateral flatfoot so the SEBT Score of 76 was calculated. The star excursion test layout consisted of four lines, applied to the floor with tape: two forming vertical and horizontal lines and two positioned perpendicular to each other and at 45° with respect to the vertical and horizontal lines. A rectangular representing the starting position of the feet was placed at the centre point. A standard tape measure was used to quantify the distance (cm) from the center point to the point that each subject reached along each diagonal using the distal part of the foot[7,8]. Star excursion balance test was performed with shoes off.

DATA ANALYSIS

The data was analyzed using Microsoft Excel 2007. To find out the prevalence Mean, Average& Standard Deviation of Plantar Index Score was calculated. To find out the correlation of flatfoot (Plantar Index Score) with dynamic balance (Star Excursion Balance test scores) Karl Pearson Coefficient Correlation (r) was calculated.

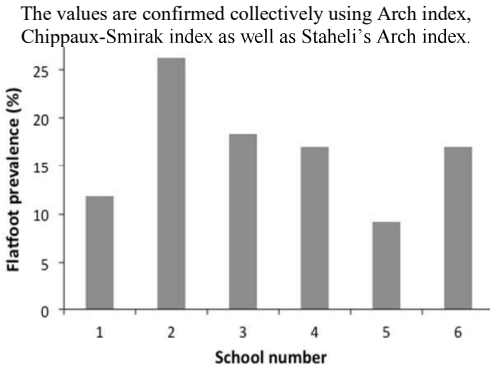
RESULTS

Out of 892 subjects 76 subjects had bilateral flatfoot. Out of 76 children 40 (52.6%) were girls and 36 (47.4%) were boys. Mean age was 11.1 for girls and 11.27 for boys.

First school 138 subjects had been screened for evaluation of bilateral flatfoot out of which 9 subjects were having bilateral flatfoot. 174 subjects had been screened from Second school from which 20 were having bilateral flatfoot. Third school consisted of 168 subjects from which 14 subjects were of bilateral flatfoot. Infourth school out of 96 subjects 13 were of bilateral flatfoot, fifth school out of 49 subjects 7 were having bilateral flatfoot and sixth school consisted 267 subjects from which 13 subjects had bilateral flatfoot.

Table 1: School Wise Percentage of Subjects having Flatfoot.

School 1	School 2	School 3	School 4	School 5	School 6
11.84%	26.31%	18.42%	17.1%	9.21%	17.1%



Graph 1: School wise Prevalence of Flatfoot.

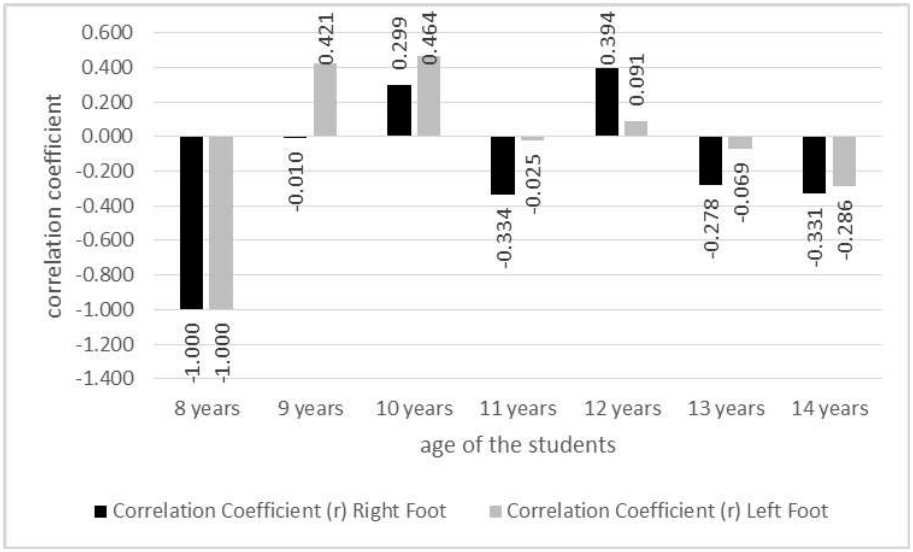
The results show that there is strong negative correlation of flatfoot and dynamic balance in 8 year school going children and in the age group of 11, 13 and 14 year the relationship is also negative.

There is weak positive correlation of flatfoot and dynamic balance in left foot in 9, 10 and 12 year age group. Also there is weak positive correlation of flatfoot and dynamic balance in right foot in 10 and 12year age group. Interestingly 8 years age group showed absolute negative correlation of -1 of flatfoot and dynamic balance in right as well as left foot. Since it is rare to get such absolute negative correlation, repeated analysis using various other tools revealed similar results, though the exact reasons are unclear.

Table 2: Correlation of flatfoot with dynamic balance.

		8 years	9 years	10 years	11 years	12 years	13 years	14 years
Correlation Coefficient (r)	Right Foot	-1*	-0.0104*	0.298945*	-0.33417*	0.393728*	-0.27783*	-0.33062*
	Left Foot	-1*	0.421011*	0.4641224*	-0.02455*	0.090837*	-0.06892*	-0.28562*

The significant correlations (p-value < 0.05) are denoted with * in individual values in the table.



Graph 2: Correlation of Right and Left foot with Dynamic Balance.

DISCUSSION

This study found a prevalence of 46.6% for the population analyzed. The present study shows the negative correlation of Independent Variable (Plantar Index Score) & Dependent Variable (SEBT) in 8 year, 11 year,13 year & 14 year of age group. This could be due to loss of stability mechanism or dysfunction of the tibialis posterior tendon which can alter balance control[6]. These results agreed with Lin et.al., 2001 who showed poorer performance in children with flexible flatfoot[5]& with Khodadadeh& Welton,1992 who stated that for some reason, traditionally, flat footedness is related to some kind of disability: "Children who have flexible flatfoot are often noted to be slow in running or in performing athletic skills" or "people with low-arch feet were often assumed to be inefficient in foot skills and to be predisposed to injuries of the lower limbs. The results of study byRahnamaet al., 2010 are accordance with present study. He concluded that subjects with foot ankle instability demonstrated poorer postural stability when tested at level 5 0n the Biodex stability system[9].

In contrast to the findings of this study HedayatiRozitaet al.,2014 conducted a study on the relation between clinical measurements of

plantar characteristics and static and dynamic balance. He confirmed that foot structure changes do not have much effect on the indicators of static and dynamic balance[10]. The study done by Tudor et al., 2009 confirmed that there were no disadvantages in sport performance originating from flat-footedness. Children with "flat" and children with "normal" feet were equally successful at accomplishing all motor tests; thus, they suggested that there was no need for treatment of flexible flatfeet with the sole purpose of improving athletic performance, as traditionally advised by many[11].

No single study can solve the controversy of flat-footedness and its relation to Balance. The findings of study just make an access for the complete understanding of the functionality of flexible flat-foot and its correlation with Dynamic balance.

LIMITATIONS OF THE STUDY

There exist several limitations that may have affected the results:

- Area of population was confined.
- 8-14 years children have been included and data holds the results for this age only.
- More than two measuring tools can be used to evaluate Plantar Index and Dynamic balance to make the data statistically more significant.
- Navicular drop was not observed and any Modern technique was not used to diagnose the flatfoot or asses the dynamic balance.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

CONCLUSION

It has been found that there was strong negative correlation of Plantar Index & Star Excursion Balance Score in the age group of 8, 11,13 and 14 year. On the basis of results we will accept the Alternative Hypothesis that means the Independent Variable (PI) & Dependent Variable (SEBT) were negatively related with each other.

However this study doesn't show the comparison of Flatfoot and Dynamic Balance in Dominant & Non-Dominant Side. Type of footwear and socioeconomic status of the subjects were not taken into consideration during the study. The literature shows that plantar arches start to develop at the age of 5-6 years and upto12 years these get matured. So for the better analysis of flatfoot follow up study from 6 to 12 years can be performed.

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