Relationship Between Hip Abductor Muscle Strength And Flatfoot Deformity Among Undergraduates At Faculty Of Allied Health Sciences, General Sir John Kotelawala Defence University

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Abstract: Numerous factors and many inter relationships between various anatomical deformities affect flatfoot. The objective of this study was to find the relationship between Arch Index and hip abductor muscle strength in both unilateral and bilateral flatfoot among undergraduates, at the Faculty of Allied Health Sciences (FAHS), General Sir John Kotelawala Defence University (KDU). A descriptive cross-sectional study was carried out including 510 students, aged between 19 - 40 years. Flat foot students were identified using the Arch index (AI) using modified Harris matt and AUTOCAD software. The hip abductor muscle strength was measured using modified Sphygmomanometer. The results indicated statistically significant relationships between unilateral and bilateral flatfoot with hip abductor muscle strength. A weak negative correlation was noted between left side hip abductor muscle strength and AI among the students with bilateral flatfoot ($p=0.04$, $r= -0.15$) and also between left side hip abductor muscle strength and left side AI in left unilateral flatfoot students ($p=0.04$, $r= -0.32$). However, no significant difference was noted between hip abductor muscle strength and the presence of flatfoot.

Keywords: Flatfoot, Hip abductors, Arch index

Introduction:

Flatfoot is any condition of the foot in which the medial longitudinal arch of the foot is lowered or lost. Therefore, the medial longitudinal arch is a main reference for the diagnosis of flatfoot (Villarroya et al., 2008). The foot typically is characterized as having three arches: medial and lateral longitudinal arches and the transverse arch, of which the medial longitudinal arch is the largest. These three arches fully integrated with one another to enhance the dynamic function of the foot (Levangie, Norkin and Lewek, 2019). A study done in India revealed 13.6% (for males-12.8%; for females-14.4%) prevalence of flat foot population (Aenumulapalli, 2017). Furthermore, no research had been conducted on prevalence of flatfoot among undergraduate students in Sri Lanka. A research was conducted among: 6-10-year-old children to find the flatfoot prevalence in the central province of Sri Lanka and to identify the associated factors of flatfoot. The prevalence was found to be: 16.06 %. (V. Senadheera, V., 2016). Objectives of the study were to determine the proportion of flatfoot among undergraduates of FAHS, KDU, to identify the hip abductor muscle strength in both flat foot and non-flatfoot group of students in FAHS, KDU and to identify the relationship between hip abductor muscle

strength and arch index in both bilateral and unilateral flatfoot.

Methodology:

Study design was descriptive cross-sectional study at the Faculty of Allied health sciences, General Sir John Kotelawala Defence University. All the undergraduates of Faculty of Allied Health Sciences, General Sir John Kotelawala Defence University, during the study period of July – August, 2019 were selected as the study population (n=510). Convenience sampling method was used.

Figure 1: Taking foot prints

Demographic characteristics including weight, height, age, and gender was noted prior to footprint analysis. Harris mat was used to take the flatfoot measurements. Harris mat is a noninvasive, sensitive and specific method in recording foot patterns in order to aid clinical diagnosis, decision making and follow-up of flatfoot (Welton, 1992). Researchers had created Modified Harris mat using locally available resources which gives similar foot print to Harris mat to obtain foot prints as the original Harris mat was expensive and difficult to find. (Kilmartin et al., 1994).

Figure 2: Foot print

Flatfoot measurements were taken according to the arch index. The normal Foot arch index is 0.21- 0.26. Flatfoot is diagnosed when AI Ratio is >0.26, and high arch foot is when arch index is <0.21. While taking hip abductor muscle strength measurements, test limb is kept at 0° flexion and 0° abduction at the hip and full knee extension. The contralateral hip and knee was flexed to 90° to provide stability. A pillow was placed in between the two lower limbs to maintain neutral position of hip and prevent abduction or adduction of the test limb. The center of the device was placed 5 cm proximal to the lateral malleolus (Steffen et al. 2008). The participant was instructed to maximally push upward into the device for 5 seconds that was stabilized by the rater's hands to create a make test procedure, which has been demonstrated to be more accurate than a break test for hip abduction assessment. A rest period of 60 seconds was provided between each maximal contraction of both tests, allowing adequate time for muscle restoration (Hébert et al. 2011).

Body weight and height was measured on a stadiometer with a weighing scale (China, 2018) and measurements were taken in same room temperature and time frame. Height was measured to the nearest centimeter and weight was measured to the nearest kilogram. Each measurement was taken thrice and mean value was recorded.

Height, weight, hip abductor muscle strength measurement and flatfoot analysis was performed by different examiners throughout the data collection procedures. This eliminated the subjective human errors that could occur during the process of obtaining measurement. All the data collected was analyzed using the IBM SPSS Statistics software version 20. $P<0.05$ will be considered statistically significant among the obtained parameters.

Results, discussion and conclusion:

To determine the proportion of flat foot among undergraduates of Faculty of Allied

Health Science, Sir John Kotelawala Defense University

When measuring the arch index (AI); the foot prints were taken by using Harris mat and AI were calculated by using AutoCAD software (version 20). Among the students 201(39.4%) were bilateral flatfoot, 47(9.2%) were right sided flatfoot, 45(8.8%) were left sided flatfoot, 184(36.1%) were normal footed, 8(1.6%) were right sided high arched, 11(2.2%) were left sided high arched, 14(2.7%) were bilaterally high arched. The flatfoot prevalence of the study is high compared to other related studies. This could be due to the increased sample size in our research compared to these studies and the other reason would be due to the different age ranges compared to these studies. As in our study the age ranges from 19 to 40 years while other studies could be stated as; (Bhoir,Anap and Diwate,2014) 18 – 25 years,(Porghasam,2016) 6 - 18 years, (Aneumulapalli,2017)18 - 21 years.

To identify the hip abductor muscle strength in both flat foot and non-flat foot groups of students in Faculty of Allied Health Science, Kotelawela Defense University

The mean hip abductor muscle strength in right and left sides of both flat-foot and non-flat foot groups respectively was 69.15 (SD 21.845) and 67.73 (SD 22.919). In the flat foot population; right side mean hip abductor muscle strength was 67.63 and left side mean hip abductor muscle strength was 17.64. In non-flatfoot population; right side mean hip abductor muscle strength was 71.2 and left side mean hip abductor muscle strength was 15.45. Independent sample t test was used to analyze data. Comparing hip abductor muscle strength in males and females, in male population; right side mean hip abductor muscle strength was 76.17 and left side mean hip abductor muscle strength was 73.12. In female population; right side mean hip abductor muscle strength was 66.06 and left side mean hip abductor muscle strength was 65.36. Independent sample t test was used to analyze data. The significance value of right side and left side hip abductor muscle strength in males and females are 0.00. When considering the hip abductor muscle strength of both flat foot and non-flat foot group of students; we found a significant difference in hip abductor muscle strength of males and females. Similar results were reported by Elisabath, Coombs and Daielsvy, 2018 where male's hip abductor strength was higher than females. Considering the muscle mass to body mass ratio, this ratio is more in males compared to females as male's fiber mass is considerably higher compared to females and males exert more force compared to females.

To identify the relationship between hip abductor muscle strength and arch index in bilateral and unilateral flatfoot

Pearson correlation test was used to find the relationship between hip abductor muscle strength and arch index in bilateral and unilateral flatfoot students. In bilateral flatfoot, considering the left side hip abductor muscle strength and AI index; right side dominant had a significance value of 0.04 and Pearson correlation coefficient of -0.15. In left unilateral flatfoot, considering the left side hip abductor muscle strength and AI index; left side dominant had a significance value of 0.05 and Pearson correlation coefficient of -0.32. According to our study we found a significant relationship between hip abductor muscle strength and AI index; increased arch index causes reduction in hip abductor muscle strength. A similar finding was suggested in a study done by Noorollah and Yashar, 2015. This could be due to a neuromuscular compensation of the body resulting from over loading of the medial longitudinal arch and changes in medial longitudinal arch.

In conclusion, a significant difference in hip abductor muscle strength between males and females was identified. A weak negative

relationship between hip abductor muscle strength and arch index in unilateral and bilateral flatfoot individuals was also found in our study.

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