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EVALUATION OF FOOT POSTURE AMONG SCHOOL TEACHERS OF MATHURA WITH REFERENCE TO AGE - AN EVALUATIVE STUDY

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ABSTRACT

The ankle and foot complex play a critical role in maintaining erect posture, as also in adaptation to supporting surfaces, in correcting postural sway in single limb stance, in shock absorption and in transition of ground reaction force (GRF) in order to aid the push off during normal gait1. Functional variance and minimal biomechanical alterations in the ankle and foot complex in turn alters the contact with the surface area and the peripheral sensory input in weight bearing posture2, 3. The effect of age on structural foot characteristics as well as on the plantar force and pressure distribution has been shown in previous studies. Aging affects also the risk of falling and adaptations strategies when walking4, 5. The analysis of different age groups revealed that the plantar pressure distribution pattern is the most distinct in toddlers, smaller differences were found between adults and seniors6. Elderly people tend to have more pronated and flatter feet, reduced range of motion of the ankle and first metatarsophalangeal joint, higher prevalence of hallux valgus, toe deformities, weaken toe plantar flexors and reduced tactile sensitivity7. **Review of Literature:** Hylton B. Menz; (2015) did a review study on biomechanics of aging of foot & ankle. This review study has provided an overview of changes in the structure & function of foot that are associated with aging & that have considerable implications for the well being of the older person with advancing age. The study concluded that there is general tendency for the foot to exhibit increased soft tissue stiffness, a decreased ROM, decreased strength & a more pronated posture with a reduced ROM & less efficient propulsion when walking14. Knowledge of normal foot posture in typically developing children helps to outline rehabilitation strategies most appropriate for the affected children as well as to monitor the progress with intervention8-10. Common methods available to measure foot posture in paediatric population are visual assessment, subjective clinical observations, radiographic appraisals, two dimensional video analysis, anthropometric values, footprint measures, arch index, valgus index, rear foot angle, navicular height, foot posture index etc11-12. **Material & Methodology:** Study Approval - The Maharaj Vinayak Global University (MVGU), Department of Research Committee (DRC) served as the approval board for this study. This study was submitted as a full board review, and the board members approved the study. 270 healthy teachers participated in the study & according to age were divided into four groups; Group A (21-30 years), Group B (31-40 years), Group C (41-50 years) & Group D (51-60 years). Total numbers of participants in each group were 103, 62, 75 & 30 respectively. The effect of age on foot posture was evaluated using Foot Posture Index – 6. **RESULTS:** In general, all the age groups - (21-30), (31-40), (41-50) & (51-60) showed significant changes in foot posture with advancing age in the form of either pronated or supinated foot. Paired sample't' test was used, the 'p' value is .001 (which is less than .05), so the study shows that there is significant effect on all the age groups on foot posture with reference to age.

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INTRODUCTION

The ankle and foot complex play a critical role in maintaining erect posture, as also in adaptation to supporting surfaces, in correcting postural sway in single limb stance, in shock absorption and in transition of ground reaction force (GRF) in order to aid the push off during normal gait (Mueller, 2005). Functional variance and minimal biomechanical alterations in the ankle and foot complex in turn alters the contact with the surface area and the peripheral sensory input in weight bearing posture (Franco, 1987). The effect of age on structural foot characteristics as well as on the plantar force and pressure distribution has been shown in previous studies. Aging affects also the risk of falling and adaptations strategies when walking (BRIDENBAUGH, 2011 and CHOI, 2014). The analysis of different age groups revealed that the plantar pressure distribution pattern is the most distinct in toddlers, smaller differences were found between adults and seniors (BOSCH, 2009). Elderly people tend to have more pronated and flatter feet, reduced range of motion of the ankle and first metatarsophalangeal joint, higher prevalence of hallux valgus,

Table 1. Foot posture with reference to age (Female)

Age (yrs)	t	df	Sig (2 tailed)	Mean difference	95% confidence interval of the difference	
					lower	lower
31-40	74.359	26	.001	36.81481	35.7971	37.8325
41-50	91.515	40	.001	44.87805	43.8869	45.8692

Age (yrs)	t	df	Sig (2 tailed)	Mean difference	95% confidence interval of the difference	
					lower	upper
41-50	91.515	40	.001	44.87805	43.8869	45.8692
51-60	46.016	7	.001	55.0010	52.1737	57.8263

Age (yrs0	t	df	Sig (2 tailed)	Mean difference	95 % confidence interval of the difference	
					lower	upper
21-30	81.187	82	.001	24.37349	23.7763	24.9707
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By using paired sample 't' test the 'p' value is .001 (which is less than .05). So there is significant effect on foot posture with reference to age.

toe deformities, weaken toe plantar flexors and reduced tactile sensitivity (SCOTT, 2007). Knowledge of normal foot posture in typically developing children helps to outline rehabilitation strategies most appropriate for the affected children as well as to monitor the progress with intervention (MENZ H, 2005; MENZ, 2006 and MICKLE, 2010). Common methods available to measure foot posture in paediatric population are visual assessment, subjective clinical observations, radiographic appraisals, two dimensional video analysis, anthropometric values, footprint measures, arch index, valgus index, rear foot angle, navicular height, foot posture index etc (MILANOVIĆ, 2013 and MURPHY, 2005). The Foot Posture Index (FPI), which was developed by Redmond AC (NIX, 2010) in 1998, provides quantitative measurements of the typical deviations of foot posture and is sensitive enough to detect any structural dysfunction in the forefoot, midfoot and rearfoot in the frontal, sagittal and transverse planes. It can be used as a screening tool for different inclusion and exclusion criteria in clinical research. This clinical tool can also be used to monitor the outcome of different rehabilitation strategies.

Review of Literature: Hylton B. Menz; (2015) did a review study on biomechanics of aging of foot & ankle. This review study has provided an overview of changes in the structure & function of foot that are associated with aging & that have considerable implications for the well being of the older person with advancing age. The study concluded that there is general tendency for the foot to exhibit increased soft tissue stiffness, a decreased ROM, decreased strength & a more pronated posture with a reduced ROM & less efficient propulsion when walking (Hylton, 2015). Marta Gimunova, Martin Zvonar, OndrejMikeska; (2018) conducted a study on structural foot characteristics as well as on the planter pressure distribution. The study was done to compare dynamic gait characteristics in younger & older elderly. The results suggest that the effect of aging on planter pressure distribution during the gait is affected by gender & should be considered when evaluating the gait in elderly (Marta Gimunova, 2018). Heba H. Hazzaa, Gehan H., El-Meniawy& Mohamed B. Bedier; (2015) conducted a study on 150 children to detect the correlation between age & gender with flat foot deformity in obese children. Foot Posture Index – 6 was used to assess the foot posture, while the foot print was used to measure plantar arch index. The study concluded that there was significant correlation between gender & incidence of flat foot, while there was no significant correlation between age & incidence of flat foot (Heba, 2015). Alessandra Paiva de Castro, Jose Rubens Rebelatto& Thais RabiattiAurichio; (2011) conducted a study on 154 older women & 131 older men to identify differences between the anthropometric foot variables. Foot variables comprised of the Arch index (AI) & the foot function index (FPI). The study showed no differences between men & women with respect to AI & FPI. Study also concluded that anthropometric foot variables of older men & women must be taken into account for the manufacture of shoes for older adults (Alessandra Paiva de Castro, 2011).

MATERIAL AND METHODS

Study Approval: The Maharaj Vinayak Global University (MVGU), Department of Research Committee (DRC) served as the approval board for this study. This study was submitted as a full board review, and the board members approved the study. 270 healthy teachers participated in the study & according to age were divided into four groups; Group A (21-30 years), Group B (31-40 years), Group C (41-50 years) &

Group D (51-60 years). Total numbers of participants in each group were 103, 62, 75 & 30 respectively. The effect of age on foot posture was evaluated using Foot Posture Index – 6.

RESULTS

In general, all the age groups - (21-30), (31-40), (41-50) & (51-60) showed significant changes in foot posture with advancing age in the form of either pronated or supinated foot. Paired sample't' test was used, the 'p' value is .001 (which is less than .05), so the study shows that there is significant effect on all the age groups on foot posture with reference to age.

Table. 2 Foot posture with reference to age (Male)

Age	t	df	Sig (2 tailed)	Mean difference	95% confidence interval of the difference	
					lower	upper
21-30	42.702	30	.001	24.48387	23.3129	25.6549
31-40	62.848	32	.001	35.24242	34.1002	36.3847

Age	t	df	Sig (2 tailed)	Mean difference	95% confidence interval of the difference	
					lower	upper
21-30	42.702	30	.001	24.48387	23.3129	25.6549
41-50	66.048	24	.001	45.60000	44.1757	47.0249

Age	t	df	Sig (2 tailed)	Mean difference	95% confidence interval of the difference	
					lower	upper
21-30	42.702	30	.001	24.48387	23.3129	25.6549
51-60	69.443	10	.001	52.81818	51.1235	54.5729

Age	t	df	Sig (2 tailed)	Mean difference	95% confidence interval of the difference	
					lower	upper
31-40	62.848	32	.001	35.24242	34.1002	36.3847
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By using paired sample 't' test the 'p' value is .001 (which is less than .05). So there is significant effect on foot posture with reference to age.

DISCUSSION

There are very less studies which are done on effect of posture with reference to age. Only limited studies are conducted on foot posture & age but are on children, which shows foot posture are not affected by age in children, very few of the studies are done on adults & olds to study the effect of age on foot posture. In our study four groups were made Group A (21-30 years), Group B (31-40 years), Group C (41-50 years) & Group D (51-60 years). The study showed significant effect of age on foot posture in all the age group in the form of foot supination & pronation.

A study finding, reduced force and pressures under the heel, lateral forefoot and hallux was observed in healthy older people (approximately 68 years old) by Scott et al. (SCOTT, 2007) and explained mainly by the reduced step length and different foot characteristics in their older age group of elderly. A previous study done by Rosenbaumfound that foot progression angle increased significantly with age in the female group. Out-toeing was observed to increase the load on the medial aspect of the mid-foot and forefoot, observed in this group by increased plantar pressures in MH1 region (ROSENBAUM, 2013). In a study done by Marta Gimunova et al. the effect of age was observed by decreased mean plantar pressures. However, in males, higher mean pressure was observed in the older age group (70–79), compared to 60–69 age group in region MH4, MH5 and mid-foot, suggesting a greater weight-bearing by the lateral side of the foot and decreased longitudinal arch of the foot (HESSERT, 2005 and SCOTT, 2007).

Conclusions

Age-Related Changes in Joint Range of Motion: Ageing is associated with several changes in joint physiology, including a reduction in the water content of the cartilage, the synovial fluid volume and the proteoglycans. The collagen fibres in the cartilage undergo a crosslinking process, resulting in increased stiffness[21]. These changes may contribute to the reduced range of motion in lower extremity joints observed in older people. Several studies have shown that ankle dorsiflexion, plantarflexion and subtalar joint inversion-eversion range of motion are 12–30% lower in older people (James, 1989; Nigg, 1992 and Nitz, 2004).

Age-Related Changes in Foot Posture and Dynamic Foot Function: The medial longitudinal arch of the foot plays an important role in shock attenuation and in generating sufficient power for propulsion when walking. From middle age, there is a trend towards a gradual lowering of the arch, as evidenced by

greater medial contact of the midfoot, observed from footprints (Staheli, 1987), and higher scores (indicative of a more pronated foot posture) on the triplanar Foot Posture Index measurement tool (Redmond, 2008). It is likely that age related lowering of the arch is an early stage in the continuum of the physiological process.

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