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A CROSS-SECTIONAL STUDY ON EFFECT OF DURATION OF STANDING ON FOOT POSTURE IN HEALTH CARE PROFESSIONALS AT TERTIARY CARE HOSPITAL

Physiotherapy

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ABSTRACT

Introduction: Health care profession is known to be at high risk for work related musculoskeletal disorders. Postural control is altered because of prolonged standing on uneven weighing of limb, resulting in asymmetry of leg dominancy.
Material And Mathod: A cross sectional study was conducted at New Civil Hospital where foot posture was assessed in 186 healthcare professionals both males and females. Foot Posture Index, Navicular Drop Test, Planter Arch Index were used to assess foot posture. The ball kick test was used for limb dominance.
Result: Hours of standing had positively significant effect on non-dominant side foot posture measured by Krushkal Wallis one-way ANOVA by ranks analysis ($p < 0.05$) on non-dominant side and not on dominant side except for foot posture index.
Conclusion: There is effect of duration of standing on foot posture in health care professionals.

KEYWORDS

foot posture, foot dominance , standing, health care professionals

INTRODUCTION

The foot and ankle are a unique combination of flexibility with stability because of many bones, their shapes and attachments. The lower leg, ankle, and foot have two principal functions: propulsion and support. For propulsion they act like a flexible lever, for support they act like a rigid structure that they hold up entire body.[1]

When one stands normally, the weight of the body falls through the foot near the region of talonavicular joint.Normally the rear foot receives about twice the compressive load as the forefoot. The mean pressure under the forefoot is usually greatest in the region of the heads of the second and third metatarsal bones.[2]

Loading causes complex movements of the joints of the foot leading to a decrease in the arch height, As the normal response to loading produces a pronation moment on the foot. Arch deformities result from disruptions of the supporting ligaments as well as from muscle weakness or tightness leading to direct impairments of the arch. In some individuals, the foot position is the dynamic compensation for other bony malalignments.[3]

Many workers are required to stand for long periods of time without being able to walk or sit during the work shift. In operating rooms, for example, nurses and doctors must stand for many hours during surgical procedures. Similarly, direct care nurses, hairdressers, and store clerks spend large fractions of their working time standing. There are potential health consequences resulting from exposure to prolonged standing at work, they are increased risk of low back pain, cardiovascular problems, and pregnancy outcomes.[4]

Healthcare profession is known to be at high risk for work related musculoskeletal disorders. It is estimated that almost one-third of all cases of sick leave among healthcare workers are related to work related musculoskeletal disorders.[5]

Postural control is altered because of prolonged standing on uneven weighing of limb, resulting in asymmetry of leg dominancy and associated biomechanical changes causing low back pain, osteoarthritis and other musculoskeletal dysfunction. On an average 30-40% of muscular dysfunction results due to biomechanical changes such as limb asymmetry and postural sway. Early identification of these biomechanical markers helps us to correct attenuates and rehabilitate the changes which acclimates the musculoskeletal dysfunction. [6]

AIM OF THE STUDY

- To determine effect of duration of standing on foot posture in health care professionals.

METHODOLOGY

Study Design: Cross sectional study

Study Population: Subjects with Stroke of minimum 3 months of duration

Study Setting: New Civil Hospital, Surat.

Sample Size: Sample size was calculated from Open Epi software, version 3 at 95% confidence level on basis of prevalence 13.9 % and found 186 sample size.

Sampling Technique: Purposive Sampling

Inclusion Criteria:
A health care professional of
a) Age 20 to 30 years
b) Male and female
c) Occupation involving weight bearing postures

Exclusion Criteria:
a) History of congenital deformity in the lower extremity or foot;
b) Previous history of lower extremity or foot fractures;
c) Systemic diseases that could affect lower extremity or foot posture;
d) History of trauma or pain to either foot, lower extremity, or lumbosacral region at least 12 months prior to the start of the investigation.
e) Individual who refuse to give consent
f) Currently undergoing any rehabilitation program and individuals undergoing any physical training or sports
g) Person having generalized or local (in feet) skin disease.

Outcome Measure
- Ball kick test
- Navicular Drop Test
- Foot Posture Index
- Plantar Arch index

PROCEDURE

1. Ball Kick Test
Purpose: To determine the foot dominance
Tool: Ball
Procedure: Subject was asked to stand in front of a ball. Each subject was asked to kick that ball. The leg with which the ball was kicked will be noted as dominant leg.
Scoring: The leg which was used to kick ball noted as the dominant side.

2. Navicular Drop Test
Purpose: To measure the arch height
Equipment: Stool, pen and index card, measuring tape
Method: Here the height of the navicular tuberosity was measured in neutral and relaxed stance positions and the amount of excursion was measured. Participant was made to sit in the comfortable position in height matched stool with feet placed flat on the ground the subtalar joint neutral position was obtained with palpation method. The position of navicular tuberosity was marked on the index card. Subject was made to stand with the full weight bearing through the lower limbs equally and the subtalar joint neutral position was achieved during pronation and supination of subtalar joint as the

medial and lateral aspect of the head of the talus become prominent respectively. Then the position of the navicular tuberosity was marked on the same index card.
Scoring: The difference between mark of navicular tuberosity in sitting and standing was calculated by measuring tape and noted.

Arch of feet were classified as follows:
0-5 mm - high arch
5-10 mm -normal arch
>10 mm- low arch.

As per these values foot arches were classified.


Figure 1


Figure 2


Figure 3

Figure1: Palpation for navicular tuberosity and determination of subtalar neutral position
Figure 2: Measuring navicular tuberosity in sitting
Figure 3: Measuring navicular height in standing

3. The Foot Posture Index (FPI-6)

Purpose: To measure foot posture
Method: The FPI consists of six validated, criterion-based observations of the rear foot and forefoot of a subject standing in a relaxed position. The rear foot was assessed via palpation of the head of the talus, observation of the curves above and below the lateral malleoli and the extent of the inversion/eversion of the calcaneus. The observations of the forefoot consist of assessing the bulge in the region of the talonavicular joint, the congruence of the medial longitudinal arch and the extent of abduction/adduction of the forefoot on the rear foot. Each of these parts was rated on a scale from -2 to +2. The negative values indicated supination, while the positive values indicated pronation. The neutral position of the foot was categorized as 0. The total FPI-6 result classified the foot into the following categories:
(i)from -12 to -5: increased foot supination,
(ii)from -4 to -1: slight foot supination,
(iii)from 0 to +5: neutral foot,
(iv)from +6 to +9: slight foot pronation,
(v)from +10 to +12: increased foot pronation.
Scoring: The method for scoring had taken from reference sheet and for scoring each category, then noted in FPI scoresheet.

4. Plantar Arch Index (PAI)

Purpose: to measure foot posture
Equipment: Ink, sponge, plastic tray, graph papers
Method: Plantar arch index was obtained using simple ink print method. A thin (1–2 cm width), large piece of sponge about 30 cm (larger than the foot size) was placed on tray, and diluted ink was poured and wetted. The sponge absorbed all the ink and when the foot was placed, the ink stuck on the surface of the feet with subject in sitting position. Then subject was asked to stand and feet were then placed on a clean graph paper to obtain the print.

Scoring: The presence of flat feet was diagnosed, by calculating the PAI. For calculating PAI, a tangential line was drawn connecting the edges of the medial forefoot and heel region. The mid-point of this straight line was calculated. From this marked point, a perpendicular line was drawn crossing the footprint. The same procedure was repeated at the heel region for heel tangency point. The width of the central region of the footprint was considered as "A," and the width of the heel region is considered as "B." PAI was obtained by dividing the A value by B value.

Plantar arch index (PAI) = A/B.
If the PAI is >1.15, then it is considered as a flat foot.

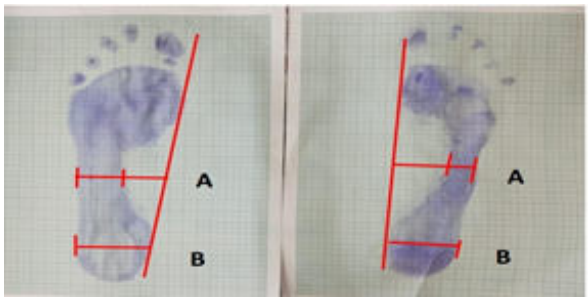


Figure 4: Measurement Of PAI From Foot Print

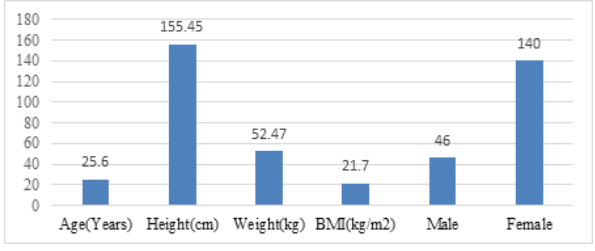
ETHICAL CONSIDERATION

Ethical clearance has given by Human Research Ethics Committee, Government Medical College, Surat.

Statistical Analysis

The availed were tabulated in Microsoft Excel. The statistical analysis was done using SPSS - version 15 software. Collected data was first analyzed using Kolmogorov-Smirnov test for the normality before applying any statistical test. According to the result of the test, the data was not following normal distribution so non-parametric tests were applied on the data. Kruskal Wallis one-way ANOVA by rank was used to analyze how standing affects foot posture. Level of significance was set at $p < 0.05$.

RESULTS



Graph1: Demographic Data Of Population

Table 1 : Statistics Of Effect Hours Of Standing On Foot Posture

Outcome variable	*Hours of standing*	*N*	*Mean*	*Std. Deviation*	*Chi square*	*Df*	*p-value*
NDT D	*Less than 2*	63	4.57	2.51	4.001369	2	0.135243
	2 to 4	75	5.18	2.45			
	more than 4	48	5.19	2.28			
	Total	186	4.98	2.43			
NDT ND	*Less than 2*	63	4.88	2.80	8.995415*	2	0.011134
	2 to 4	75	5.93	2.51			
	more than 4	48	6.17	2.52			
	Total	186	5.64	2.66			
FPI D	*Less than 2*	63	4.02	2.45	7.237696*	2	0.026814
	2 to 4	75	4.30	2.37			
	more than 4	48	5.48	2.81			
	Total	186	4.51	2.57			
FPI ND	*Less than 2*	63	4.08	2.30	9.295051*	2	0.009585
	2 to 4	75	4.38	2.38			
	more than 4	48	5.76	3.03			
	Total	186	4.64	2.61			
PAI D	*Less than 2*	63	0.96	0.33	3.56583	2	0.168147
	2 to 4	75	0.96	0.25			
	more than 4	48	1.09	0.33			
	Total	186	0.99	0.30			
PAI ND	*Less than 2*	63	0.94	0.29	8.162074*	2	0.01689
	2 to 4	75	0.98	0.28			
	more than 4	48	1.13	0.31			
	Total	186	1.0	0.30			

* Significant at p value < 0.05
**Significant at p value < 0.01

DISCUSSION

The percentage distribution of population according to profession in which 32% were nurses, 26% were of medical internes, 16% were

physiotherapy internes, 15% were nursing students posted on duty and 11% were medical post graduates from different branches.

The frequency distribution of foot posture of study population according to Foot Posture Index were 60.21% on dominant foot and 46.77% on non-dominant foot. The number of subjects having pronated feet were 531.18% for dominant side and 77(41.39%) on non-dominant side. The number of subjects having highly pronated foot posture were 11(5.9%) on dominant side and 16(8.6%) on non-dominant side. The number of people having supinated foot posture were 5(2.6%) on dominant side and 6(3.22%) on non-dominant side.

A study conducted by **Chandan S et al**[7] to study the foot posture in 100 healthy young Kathak dancers. They found from the results of Foot Posture Index, 3 % of the population had supinated foot, 7% of the population had normal foot, 25% of the population had pronated foot and 65% of the population had excessive pronated foot.As result of study, they concluded that there was deviation in the foot posture of Kathak dancers.

The effect of foot posture and duration of standing was analysed by Krushkal Wallis one-way ANOVA by ranks test. The table 1 compares the mean within 3 groups according to hours of standing which were less than 2 hours, 2 to 4 hours and more than 4 hours per day. The distribution of participants according to the hours of standing: the number of participants for 2 hours of standing were 63, for 2 to 4 hours were 75 and for more than 4 hours were 48. The results of the test show that as the hours were increasing, the mean values of the outcome measures were increasing, which were significantly different on non-dominant side and not significant for dominant side ($p < 0.05$) except for data of Foot Posture Index. This shows that duration of standing affects foot posture. As hours of standing increases the mean values increase for both dominant and non-dominant side, and statistically significant on non-dominant side for each variable at p value < 0.05. Thus it can be concluded that hours of standing have effect on foot posture.

A review of literature had been done by **Waters Thomas et al**[4] with purpose to study effect prolonged standing at work and its association with potentially serious health outcomes, such as lower back and leg pain, cardiovascular problems, fatigue, discomfort, and pregnancy-related health outcomes. Based on their review of the literature, there seemed to be ample evidence showing that prolonged standing at work leads to adverse health outcomes. Review of the literature also supported the conclusion that certain interventions are effective in reducing the hazards associated with prolonged standing. They concluded that use of interventions and following suggested guidelines on hours of standing from governmental and professional organizations should reduce the health risks from prolonged standing. The guidelines were as following: (1) Prolonged standing of ≦1 hour and a total per day of ≦4 hours is considered a safe zone according to Dutch ergonomic guidelines. (2) Workplaces should not be static, but allow for mobility and use of various postures. (3) Interventions such as floor mats, shoe inserts, adjustable chairs, sit–stand workstations, and compression stockings can be effective in reducing subjective effects (e.g., pain, discomfort, fatigue) from prolonged standing.

A study conducted by **Susan Dsouza et al**[8] to identify the occurrence of flat feet in chronic low back subjects, determine the factors associated with occurrence of flat feet and to state the relationship between flat feet and chronic low back pain. They concluded that presence of flat foot is a common phenomenon among the population with chronic low back pain and hence, need for treatment of low back pain to be directed towards the biomechanical corrections of the lower extremity kinetic chain.

LIMITATION OF STUDY

- Purposive sampling was done.
- Age criteria was 20 to 30 years.
- Study had not considered kinematic components acting on lower limb.
- Study had not done specified to a health care profession.

FUTURE SCOPE OF THE STUDY

- Study should be carried out specific to a profession with classifying their ergonomic need with lower limb dominance and kinematic components taken in consideration.

CONCLUSION

The results of present study have given the valuable perspective to the prevention and also in management of the musculoskeletal disorders by correcting the kinematic chain from foot. The result of the study concludes that standing have significant effect on foot posture in health care professionals.

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