

Staheli`s plantar arch index measured by simple footprint method is an effective diagnostic tool for flat foot as other radiological methods- A comparative study



Medical Science

KEYWORDS : flat foot, plantar arch, talus, calcaneum, talo- first metatarsal angle, subarch angle, Medial and lateral longitudinal arch

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ABSTRACT

Aim- To know whether the diagnosis of flat foot by simple ink footprint method is as reliable as radiological method or not.

Material & Methods -100 children aged between 5-11 yrs having flat foot were selected from the department of orthopedic of M.Y. hospital Indore. Footprint was taken by the help of ink method then Staheli`s plantar arch index calculated. Radiograph was taken in lateral view of both foot in standing position. Talo first metatarsal (TFM) angle were assessed by radiological expert. Data of both study are compared. Correlation between TFM angle and planter arch index value is established statistically.

Results- Observation shows that correlation between TFM radiological angle and planter arch index is significant (p value <0.05) with correlation value 0.33 for right foot and 0.49 for left foot.

Conclusion- Flat foot can be diagnosed by simple ink footprint method and it is as reliable as other radiological methods.

INTRODUCTION-

Some part of foot is not seen in footprint because of presence of arches which makes sole concave. An arched foot is most distinctive feature of man (fig no.1). These arches maintain proportional distribution of the body weight. Concavity of the arches protects the plantar vessels and nerves from compression. When foot is on the ground the arches flatten somewhat but when off the ground they restore the original contour. So it works like spring to help in jolting and jumping from the height. Flat foot (Pes planus) is a condition in which the arches are collapsed and the entire sole touches the ground (figure no. 2).

The arches present right from birth, although they are masked by excessive amount of fat in their sole, an apparent flat foot (fat foot) is present in many children up to the age of 2 years. In weight bearing areas of foot fat pad atrophies and normal arches appear. Most people with flat feet remains asymptomatic they do not suffer. In some cases, flat feet can cause pain, swelling, or sore foot as well as shin splints, Achilles tendinitis, and planter fasciitis. Present study is to know how easily flat foot can be diagnosed by simple foot print method. This is very effective, easily applicable and comparatively cheaper than other diagnostic method likes X ray, CT scan or MRI scan.

MATERIAL AND METHODS-

Present study was conducted on 100 children aged between 5-11 years having flat foot. The 100 children were selected from the department of orthopedic M.Y. hospital Indore. Children below 5 year and above 11 years, having orthopedic surgeries or serious traumas on limbs and having palsy, congenital anomalies were excluded. History taking and careful clinical examination was done and Signs were recorded. For obtaining the foot print by ink method following material was used :-

- Stamp ink
- Roller
- plane paper
- Plastic platform
- Clips
- Ink dropper.
- measuring scale

A plastic platform with a plane paper which is immobilized with the help of clips is kept on smooth surface. The child is seated in front of the platform and the foot to be studied is equally impregnated with stamp ink with the help of roller and requested

the child to put this foot on to the platform but opposite foot out of platform, now child is asked to stand up and perform a small flexion of the ipsilateral knee and then go back to initial position removing the foot from the platform. Measurement is taken by measuring scale. By using foot print Staheli`s planter arch index (SPAI) was calculated as a line drawn tangent to the medial forefoot edge and at heel region. The mean point of this line is calculated. From this point a perpendicular line is drawn crossing the footprint. At the heel perpendicular line is drawn at maximum width of foot print thereby obtain them measurement of the width of central region (A), and of the heel region (B) in millimeters (figure no.3).

Staheli`s plantar arch index (SPAI) was obtained by dividing the A value with the B value.

$$SPAI = A / B.$$

According to the pediatric orthopedic society normal plantar arch index is the one comprises within 2 standard deviations (SD) of the population average. Thus planter arch index values equal or above the sum of 2 SD with the average were considered as indicative of flat foot and named as threshold index for this condition.

Radiographs were taken in lateral view of both feet separately in standing weight bearing position. Talo- first meta tarsal angle (TFM angle) was measured by radiological expert.TFM angle is formed between the long axis of talus and long axis of first metatarsal on weight bearing lateral view (fig no. 4 &5). In normal weight bearing foot, the midline axis of talus is in line with midline axis of first metatarsal.

- An angle >4 degree convex downward is considered flat foot.
- 15-30 degree is moderate flat foot.
- > 30 degree is severe flat foot.

Foot print studies and radiological findings were carefully analyzed statistically in all children.

RESULTS -

Observation shows that correlation between plantar arch index and TMF radiological angle is significant (p value <0.05) for both feet with correlation value 0.33 for right foot and 0.49 for left foot (Table no.1).

DISCUSSION-

Result of the study is supported by the studies of Kanatli U, Yetkin H, et al [1] compared Footprint and radiographic analysis of the feet in march 2001. This study was to investigate the relationship between radiologically measured angles and the arch index obtained from footprint analyses in 38 children with flat foot. A positive correlation of arch index was found between lateral talo-horizontal and lateral talo-first metatarsal angles ($p < 0.05$). These angles have been used by some authors to describe the height of the medial longitudinal arch of the foot. So footprint analysis could be used effectively for screening studies and at individual office examinations. Chen [HYPERLINK "http://www.ncbi.nlm.nih.gov/pubmed?term=%22Chen%20CH%22%5BAuthor%5D"](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Chen%20CH%22%5BAuthor%5D) [HYPERLINK "http://www.ncbi.nlm.nih.gov/pubmed?term=%22Chen%20CH%22%5BAutCH,HuangHYPERLINK"](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Chen%20CH%22%5BAutCH,HuangHYPERLINK) [HYPERLINK "http://www.ncbi.nlm.nih.gov/pubmed?term=%22Huang%20MH%22%5BAuthor%5D"](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Huang%20MH%22%5BAuthor%5D) [MH, et al \[2\]](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Huang%20MH%22%5BAuthor%5D) observed in 2006 the correlation between selected measurements from footprint and radiograph of flatfoot. They did study on 32 children age range 7-13 years they obtained sub-arch angle from electronic footprints and to compare the results with radiographic measurements. They found significant Correlations between the subarch angle from electronic foot print and the talo-first metatarsal angle. Arnold José Hernandez et al [3] did calculation of the Staheli's planter arch index and prevalence of flat feet on 100 children aged 5-9 years in 2007. Flat feet were evaluated by means of foot print and planter arch index. Correlation between X ray studies and foot print shows that foot print is effective for individual studies and population based investigations.

CONCLUSION -

Study concluded that there is significant correlation between planter arch index and TFM angle ($P < 0.05$) as indicated by correlation values (for right foot it is 0.33 and for left foot it is 0.49). Hence we can conclude that for diagnostic tool foot print method is as effective as radiological method. It is also simple, cost effective, easy to apply and satisfactory for routine clinical examination. This method is non invasive and does not use radiation as well. It can be used as a feasible method for application on follow up cases taking physiotherapy or other treatment.

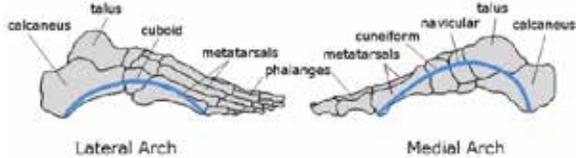


Figure no.1 –medial and lateral arches of foot

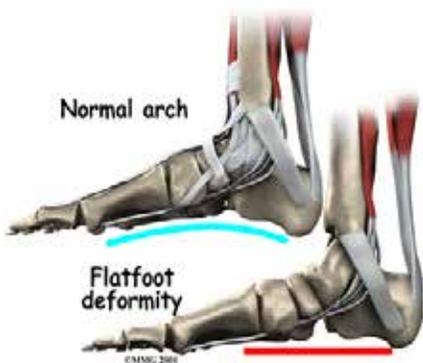


Figure no. 2 - Normal and flat foot



Figure 3- Measurement of the width of the central region (A) and heel region (B) of the foot, in millimeters, on a footprint. The plantar arch index is obtained by dividing A value by B value



Figure no. 4- TFM (talo-first metatarsal) angle on weight-bearing lateral foot radiograph

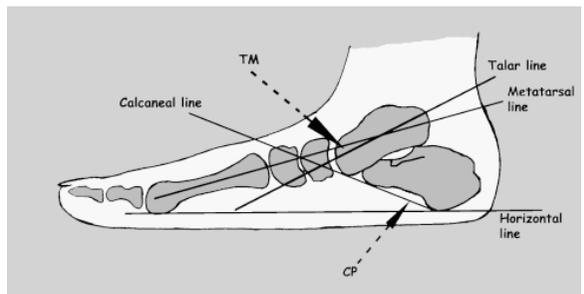


Figure no. 5 - Schematic illustration of TFM (talo-first metatarsal) angle

Table No.1 Correlation between TFM angle and plantar arch index value :-

	Correlation value	P value	Significant level
Rt. Feet	0.33	$P < 0.05$	Significant
Lt. feet	0.49	$P < 0.05$	Significant

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