

Bringing Forensic Science Aid To Paediatric Needs

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ABSTRACT

Advancement in foot posture assessment is a reliable identifier in forensic cases in children. It has been a goal for more than two decades to protect children from abuse and accidental trauma. Footprints has the possibility of identifying both the offender and the victim who can be a child in the age group upto 16 years as per the US Food and Drug Administration. In countries like India people in the rural area still walk barefooted. Therefore the collection, preservation and analysis of this valuable physical evidence can serve as an important tool in the law enforcement community. The foot print science is based on the principle that "footprints are unique to individuals like fingerprints."

The human foot is designed to provide a firm platform to support the body. This firm support is of crucial importance in the erect posture and bipedal locomotion of human. Anatomically a foot consists of 26 bones, 19 muscles and 107 ligaments; out of 26 bones, 7 are closely articulated, tarsal bones project at the front, 5 comparatively long metatarsal bones which carry the 14 phalanges of the free toes manage to balance and support the human body. The calcaneus is the largest of the tarsal bones and transmit the weight of the body to the ground forming the heel of the foot. The talus or the ankle bone connects the leg bones, the tibia and fibula to the rest of the foot. Foot arches are completely formed at around five years of age.

Researchers have proved before that foot print may be used to estimate stature, body weight and sex of an individual. In conclusion, forensic anthropologists can understand the utility of the foot bones in the forensic context with special emphasis on the pediatric age group.

Key words: foot-posture, footprint, foot-arches, paediatric, forensic.

Date of Submission: 13-12-2023

Date of Acceptance: 23-12-2023

I. INTRODUCTION:

Foot prints along with finger prints include the broad discipline of Dermatoglyphics. Dermatoglyphics pattern are completed after the fourth fetal month of the unborn baby and thereby constitute the unchanging record of an individual in the form of ridges on toes, soles, fingers and palms. Foot arches are completely formed around five years old (1).

The foot print science is based on the principle that "no two person will have similar footprints." i.e. footprints are unique to individuals (2). Therefore footprints bring forth the three basic scientific features of personal identification:

1. Individuality-> the papillary ridges on the plantar surface of the feet are unique for individuals.
2. Continuity->the structure of papillary ridges formed on the plantar portion of the feet and toes of a human being in fetal periods before birth remain unchanged in the entire lifetime of the individual.
3. Immutability->the characteristic features of the plantar ridges cannot be changed from birth to death (3).

The footprints of identical twins are different.

Foot- prints are important physical evidence for crime work and has scientific value in crime investigation.

Foot print impression evidence examination helps to establish the veracity of the case in the court of law.

Although Indian law scenario does not have much supporting evidence of foot print analysis in cases related to children, academic research are trying to establish the need and authenticity of research in foot print evidence (4).

II. MATERIALS AND METHODS:

A pilot study was conducted in the state of West Bengal among children in the age group of 3-6 years.

Objective: To compare the Foot arch pattern among the children of West Bengal aged between 3-6 years.

Place of Study:

The present study is conducted in urban areas in Howrah and rural areas of Bolpur. The study was carried out among 80 children (40 males, 40 females), aged 3-6 years, without any visible foot abnormalities or injuries. Time frame- 2018-2020

Measurements: Three measurements are normally used for foot print analysis-Clarke’s angle, Chippaux Smirak Index and Staheli index

Instruments used:

1. White A4 paper,
2. Chalk powder

III. RESULTS AND DISCUSSIONS:

The following measurements were taken on each foot print: The Staheli’s Plantar Arch Index and Chippaux-Smirak Index and Clarke’s Angle were calculated.

- a) Staheli’s Plantar Arch Index (SAPI/ SI) – Calculated as the ratio of the support width of the central region to the foot and of the heel region of the foot.
- b) Chippaux-Smirak Index (CSI) – Calculated as the ratio between the smallest length of mid-foot and the largest length of the metatarsal head region.
- c) Angular measurements include foot angle.
- d) Clarke’s Angle (CA) – Obtained by calculating the angle of the first medial tangential line that connects the medial adages of the first metatarsal head and the heel and the second line that connects the first metatarsal head and innermost point of longitudinal arch region on the footprint.

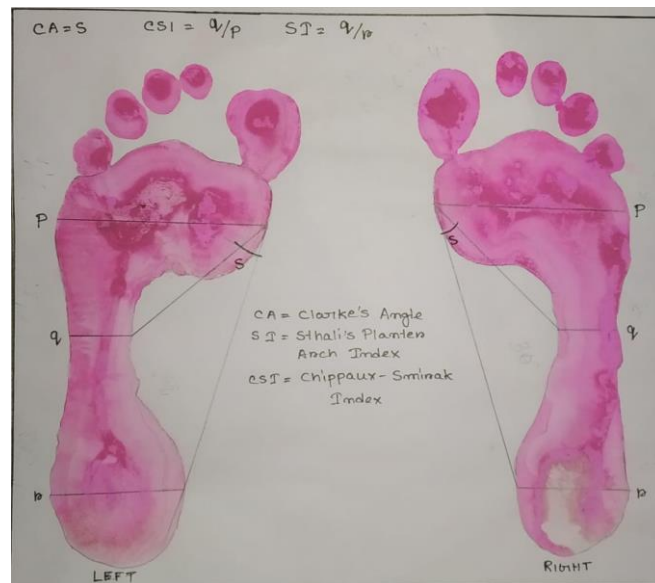


Figure1: Foot print showing CA, SI and CSI

Age Group	Clarke's Angle (CA) Mean		Staheli's Plantar Arch Index (SAPI/ SI) Mean		Chippaux-Smirak Index (CSI) Mean	
	Left	Right	Left	Right	Left	Right
3 Years old children	10°	11°	0.89	0.92	0.6	0.62
4 Years old children	20°	20°	0.64	0.65	0.42	0.41
5 Years old children	31°	31°	0.56	0.53	0.3	0.34
6 Years old children	28°	26°	0.55	0.58	0.31	0.34

Figure2: The measured angles

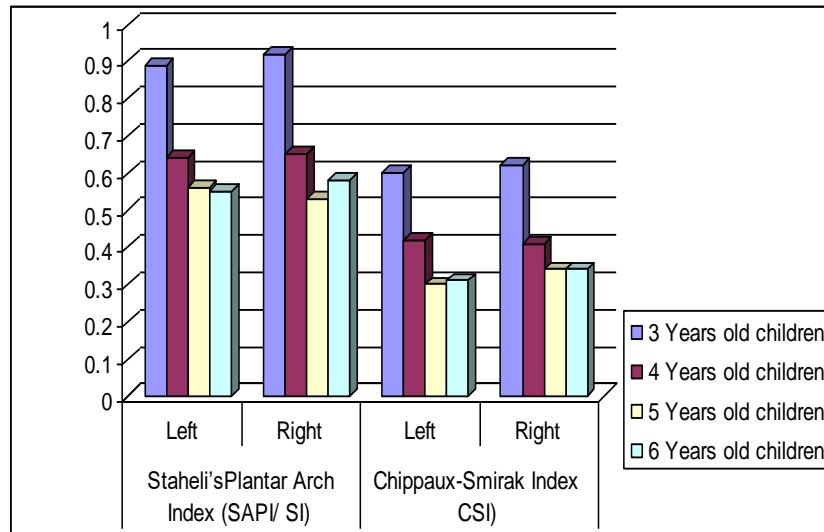


Figure3: Showing comparison between each age group and that the foot arch is formed around 5 years of age.

This study highlighted the facts:

- The human foot has three arches: two longitudinal arch (medial and lateral) and one anterior transverse arch.
- Traditionally, feet are classified as being high, normal, or low arched. A high arched foot is supposed to be at increased risk for injury to the bony structures on the lateral side of the foot, whereas a low arched foot can be a greater risk for soft tissue damage on the medial side of the foot.
- Arches do not develop upto about 2-3 years of age. Foot arches are completely formed around five years old.

IV. CONCLUSION:

There has been a growing interest in bare footprints in forensic investigations. Priorities for further research include the development of footprint databases to support footprint examiners in real-world practice. In children attention to foot print analysis may aid in identifying the trauma caused to a child either through assault or abuse, and even an idea of the assailant which will ensure effective investigation and prosecution(5).

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