International Journal of Anatomy and Research,
Int J Anat Res 2014, Vol 2(1):187-90. ISSN 2321- 4287

Original Article

STUDY OF PLANTAR MEDIAL LONGITUDINAL ARCH AND ITS PATTERN OF DEVELOPMENT SUPPORTED THROUGH RADIOGRAPHIC EVALUATION IN WESTERN RAJASTHAN POPULATION

Pushpa Potaliya *[1], Dalpat Singh Chowdhary [2], Abhilasha Dadhich [3], Sushma Kushal Kataria [4].

*[1] Assistant Professor, Department of Anatomy, DR. S N Medical College, Jaipur, Rajasthan, India.
[2] Professor & Head, Department of Anatomy, Mahatma Gandhi Medical College, Jaipur, Rajasthan, India.
[3] Senior Demonstrator, Department of Anatomy, S M S Medical College, Jaipur, Rajasthan, India.
[4] Professor & Head, Department of Anatomy, DR. S N Medical College, Jaipur, Rajasthan, India.

ABSTRACT

This study had a purpose of enlarging the data on various parameters and pattern of development of plantar medial longitudinal arch in Western Rajasthan population. Fifty normal children of age between 0-7 years were selected. Subjects were divided in 5 groups according to ages(in months) beginning with 0-18 months,19-36 months and so on up to 90 months of age. Roentgenographs of foot were taken from Right lateral view for study of medial longitudinal arch. Parameters like Arch height, Forepart length, Hindpart length, Anterior and Posterior medial longitudinal arch angle were measured. The data obtained were statistically analyzed.

KEYWORDS: Plantar; Medial longitudinal arch; Roentgenographs; Right lateral view.

Address for Correspondence: Dr. Pushpa Potaliya, PhD, Assistant Professor, Department of Anatomy, 53, Abhay garh Scheme, Opp. K.V. No. 1 (A.F), Ratanada, Jodhpur, Rajasthan, India.
E-Mail: ppotaliyaa@gmail.com

Access this Article online

Quick Response code

Web site: International Journal of Anatomy and Research
ISSN 2321-4287
www.ijmhr.org/ijar.htm

Received: 02 Jan 2014
Peer Review: 02 Jan 2014 Published (O):31 Jan 2014
Accepted: 17 Jan 2014 Published (P):30 Mar 2014

BACKGROUND

The human foot is a highly evolved, specialized structure, uniquely suited to its considerable task of weight bearing and ambulation. The presence of arches especially longitudinal arches is consistent with the most advanced structural engineering principles regarding transmission of forces and absorption of shock. The medial longitudinal arch is the dynamic portion which undergoes some structural changes during normal gait. Regarding the development, human foot is a well-developed plantar-oriented, biconcave structure from end of the first trimester of gestation. Rose et al [1] advanced the concept of stability of the subtalar articulation and also stated that the critical age for development of plantar arch is 6 years. Mickel K J et al [2] stated that a structural collapse of longitudinal Arch can develop into a potentially "crippling" problem in later life, as proper functioning of it is critical to normal foot function.

The present work was planned to evaluate the subjects clinically and radiologically to study medial longitudinal arch.

MATERIALS AND METHODS

The present study of plantar arch development pattern especially medial longitudinal arch was done as it not only has clinical significance but

also helps in detection of any forthcoming abnormality which may severely affect the individual in later life.

50 normal children of age ranging between 0-7 years were selected from various schools and private sources with no bony deformity or pathology. The present study was carried out in the Department of Radio diagnosis, M.D.M. Hospital, DR. S. N. Medical College and associated group of hospitals, Jodhpur. Institutional ethical committee approval was taken prior and guidelines were followed throughout the study.

The roentgenographs of foot were taken from Right lateral view for studying medial longitudinal arch. Subjects were divided in 5 groups according to ages (in months) as

a. Age 0-18 months
b. Age 19-36 months
c. Age 37-54 months
d. Age 55-72 months
e. Age 73-90 months

Footprints of sole were also obtained for study of gross parameters.

Measurement of parameters : (figure 1)

1. Arch Height: Perpendicular distance (CD) from highest point of arch (i.e. C) to line joining two pillars of the arch (i.e. AB). This is point where unit of talus and calcaneus meets with unit of navicular, medial cuneiform and metatarsals.

2. Forepart Length: Length from anterior pillar (i.e. point A) to the lower point of arch height (i. e. point D)

3. Hindpart Length: Length from posterior pillar(i.e. point B) to the lower point of arch height (i.e. point D)

4. Anterior Medial Longitudinal Arch Angle (i.e. angle ACD) and Posterior Medial Longitudinal Arch Angle (i.e. angle BCD)

Radiological study of the measurements of height in case of medial longitudinal arch revealed that there is gradual increase in average height with the advancement of age up to 90 months ranging from 0.92-3.56 cm (table 1). Also in case of Anterior and Posterior segment length a gradual in increase in length was observed but comparatively Anterior segment length was more in all age groups (ranging from 2.90-8.10 cm) to Posterior segment length (ranging from 1.21-4.90 cm) (table 2).Correlation coefficient values were calculated for both these lengths (table 3).In study of Anterior Medial Longitudinal Arch Angle which ranged from 61.20°-65.80°,highest degree of angle was reported in age group of 19-36 months (around 67.70°) (table 4).In Posterior medial longitudinal arch angle which ranged from 38.90°-54.20°,the highest angle was reported in age group of 73-90 months (ie.54.20°) (table 4). Correlation coefficients for both these values were also calculated.

Table 1: Showing Height of Medial Longitudinal Arch (in cms).

AGE GROUP	RANGE	AVERAGE
0 – 18	0.5 – 1.1	0.92
19 – 36	1.3 – 2.8	2.05
37 – 54	2.5 - 3.3	2.82
55 – 72	2.6 – 3.5	3
73 - 90	3.0 - 4.0	3.56

Fig. 1: Showing Points for Various Measurements.

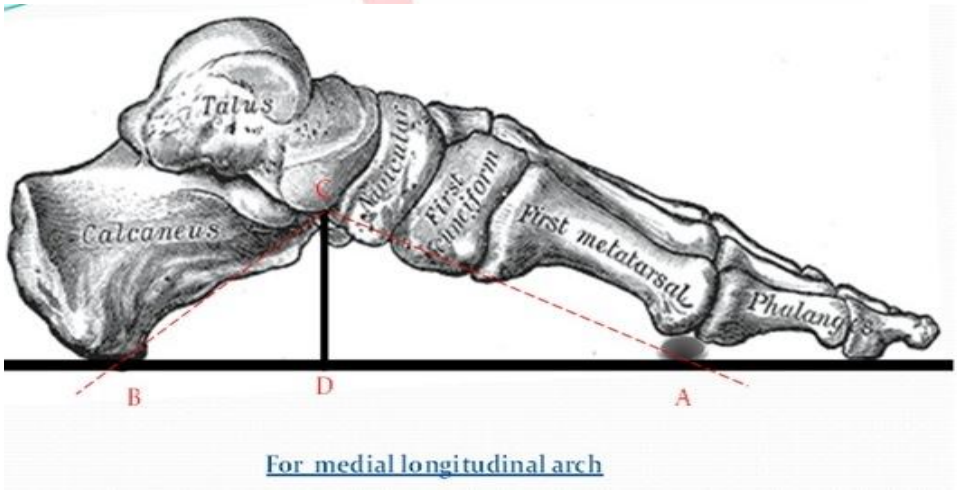

Table 2: Showing Anterior and Posterior segment length of Medial Longitudinal Arch (in cms).

AGE GROUP (in months)	ANTERIOR SEGMENT LENGTH (in cms)		POST. SEGMENT LENGTH (in cms)	
	RANGE	AVERAGE	RANGE	AVERAGE
0-18	0.8-3.4	2.9	0.6-1.7	1.21
18-36	4.3-6.5	5.06	2.0-3.6	2.82
37-54	5.6-6.6	6.01	2.9-4.1	3.5
55-72	5.3-7.8	6.96	2.8-4.5	3.7
73-90	7.1-9.0	8.1	4.1-5.8	4.9

Table 3: Correlation coefficient of anterior and Posterior segment length of Medial Longitudinal Arch.

S.NO.	AGE GROUP (in months)	Correlation coefficient
1	0-18	0.835
2	19-36	0.657
3	37-54	0.3211
4	55-72	0.3943
5	73-90	0.9675

Table 4: Showing Anterior and posterior Medial longitudinal arch angle (in degrees).

AGE GROUPS (in months)	Ant. Medial Arch Angle (in degrees)		Post. Medial Arch Angle (in degrees)	
	RANGE	AVERAGE	RANGE	AVERAGE
0-18	50-66	61.2	29-43	38.9
19-36	59-74	67.7	45-63	48.8
37-54	62-67	65	45-54	50.4
55-72	60-70	59.5	45-53	50.3
73-90	62-70	65.8	50-58	54.2

Table 5: Correlation coefficient of Anterior and Posterior Medial longitudinal arch angle for Medial longitudinal arch angle.

S.NO.	AGE GROUP (in months)	Correlation coefficient
1	0-18	0.8094
2	19-36	0.6123
3	37-54	0.4522
4	55-72	0.244
5	73-90	0.9455

RESULTS AND DISCUSSION

The present radiological study for height of medial longitudinal arch reveals its average value to be 2.47 cm. Dowling A.M. et al [3] found that the arch height on an average for young normal children is 2.89 cm (approx.). Obese children were found to have low plantar arch height. It is known that a fat pad is present underneath the medial longitudinal arch of the infant foot while the arch develops, although this fat pad is thought to resolve by the age of 5-8 years as the arch of the foot is formed as reported by Hefti & Brunner [4]. In our study also increasing pattern in arch height is observed ranging between 0. 9cm-3.56 cm. Riddiford-Harland et al. [5] speculated that the midfoot plantar fat pad might remain in the feet of obese children as a protective adaptation to cushion the loads associated with their excess mass, in turn, causing their characteristic flatter feet relative to their leaner counterparts.

Schilling F. W.[6] found that when standing on both feet the mean height of the arch at the tangent to the medial plantar imprint is 5 mm at the age of 4 years. The “critical limit” is approx. 2 mm. The height of the medial longitudinal arch increases each year. The increase is greater at the age of three than at six years, and should be at least 1 mm between the third and fourth years of life. At initial examination Gould N. et al [7] observed that all of the apparently normal toddlers had pes planus by all clinical, roentgenographic, and photographic measurements. There were no cavus feet at that time or at 5 years of age.

The average anterior and posterior segment length of medial longitudinal arch was found to be 5.80 cm and 3.26 cm respectively. Blais M.M. [8] found that 15%. of normal children have some leg aching or fatigue with growth and strenuous activity with a small percentage having coincidental flat feet which results in lower arch height and increased foot length. Correlation coefficient between anterior and posterior segment length in our study stated the two data to be significantly correlated with an average value of 0.9375.

The lowest value of anterior medial longitudinal arch angle is found to be 59.50° in children with age 4.5-6years .In prior group it is greater, approx.65.00 and also in latter group it is higher 65.80 approx. The posterior medial longitudinal arch angle was observed with an average of 48.52° ranging from 38.90°-54.20°. Values shows moderate correlation ranging from 0.2440-0.9455 with an average of 0.6934.

CONCLUSION

We have found that plain X-ray study of developing medial longitudinal arch can be clinically very important for evaluation and treatment of functional disorders and deformities associated with biomechanics of foot.

Conflicts of Interests: None

REFERENCES

[1]. Rose GK, Welton EA, Marshall T: The diagnosis of flat foot in the child. J Bone Joint Surg (br)1985, 67-B: 71-8.

[2]. Mickle K J, Steele J R, Munro B J: The Feet of Overweight and Obese Young Children: Are They Flat or Fat? Obesity 2006;14:1949–1953; doi: 10.1038/oby.2006.227.

[3]. Dowling, A. M., Steele, J. R., Baur, LA: Does obesity influence foot structure and plantar pressure patterns in prepubescent children? Int J Obes Relat Metab Disord. 2001;25: 845–852.

[4]. Hefti F, Brunner R: Flexible arch of the foot. Orthopade. 1999;28:159–172.

[5]. Riddiford-Harland DL, Steele JR, Storlein LH: Does obesity influence foot structure in prepubescent children? Int J Obes Relat Metab Disord. 2000;24:541–544.

[6]. Schilling F W: The medial longitudinal arch of the foot in young children. Z Orthop Ihre Grenzgeb. 1985 May-Jun;123(3):296-9.

[7]. Gould N, Moreland M, Alvarez R, Trevino S, Fenwick J. Development of the child's arch. Foot Ankle 1989 Apr;9(5):241-5.

[8]. Blais MM, Green WT, Anderson M. Lengths of the growing foot. J Bone Joint Surg Am 1956;38A:998–1006.

How to cite this article:

Pushpa Potaliya, Dalpat Singh Chowdhary, Abhilasha Dadhich, Sushma Kushal Kataria. STUDY OF PLANTAR MEDIAL LONGITUDINAL ARCH AND ITS PATTERN OF DEVELOPMENT SUPPORTED THROUGH RADIOGRAPHIC EVALUATION IN WESTERN RAJASTHAN POPULATION. Int J Anat Res 2014;2(1):187-90.