Evaluation of children with flatfoot on the basis of clinical features, footprint analysis and imaging studies

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ABSTRACT:

Introduction: *There is no consensual agreement on the strict clinical or radiographic criteria for defining a flatfoot. Traditionally, a flatfoot has been defined subjectively as a weight-bearing foot with an abnormally low or absent longitudinal arch. This definition is based solely upon the static anatomic comparison of the height of the arch within a population. It fails to take into consideration the etiology of the flatfoot, the functional relationships between the bones, and the presence or evidence-based expectation of future pain or disability.*

Methodology: *All patients in the study were evaluated thoroughly using detailed history and complete physical examination with special emphasis on weight, family history, findings like tight tendoachilles, ligamentous laxity, intermalleolar distance and gait analysis. The examination included biomechanical examination of hip, knee, foot and ankle. Associated conditions were also given importance to rule out any syndromic flat foot.*

Results: *The younger the age group the better they respond to orthotic treatment. More severe the deformity the better they respond to orthotic treatment. Symptomatic fff have better results than asymptomatic fff. Early the orthotic treatment received better is the result. Arch support helps in relieving clinical features like pain and out toeing.*

Conclusion: *Arch index may help in improvement of radiographical angles like cp, tca and tma. There is no short term and long term complications related to using of arch support.*

Keywords: *Flatfoot, Arch index, Radiology, Tendoachilles*

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INTRODUCTION

Pes plano valgus is a condition characterized by flattening of the medial longitudinal arch, along with hind foot valgus. Foot and ankle specialists acknowledge that flatfoot deformity is a frequently encountered pathology in the pediatric population. Pes planovalgus (flatfoot) is a condition characterized by flattening of the medial longitudinal arch, and it is common in both pediatric and adult populations. Pediatric flatfoot comprises a group of conditions occurring in infants, children, and adolescents[1] that are distinguished by anatomy and etiologic factors[2]. Flat feet in infants, children and adolescents are so common that the lack of agreement about the natural history and pathophysiology of the condition is surprising. There is great controversy about the role that flat feet play in health, and disagreement on the indications for treatment. The frequent occurrence raises the question of whether many of the mild forms are really a part of normal development and not a sign of disease.

There are huge gaps in our knowledge about flatfoot. Terminology of foot movement is confusing. There is no agreement on a single name for this entity[3]. It is variously referred to as flatfoot, pes planus, pes valgoplanus, pes planovalgus, talipes valgus, and pronation syndrome. It is an anatomic lesion and not a diagnosis or even a single condition. It is a collection of clinical entities that are grouped together because they share similar features. It is unfortunate that the term flatfoot enjoy such universal usage. It is misleading because it concentrates only on the saggital plane component and the foot surface contact area, to the exclusion of other planes. Flatfoot is a triplane deformity. Although the deformity is on 3 planes, one plane often dominates. Newer additions to biomechanical theory call this planal dominance[4]. Flatfoot may exist as an isolated pathology or as part of a larger clinical entity. These entities include generalized ligamentous laxity, neurologic and muscular abnormalities, genetic conditions and syndromes, and collagen disorders.

Hence this study was carried out to evaluate all children with flatfoot on the basis of clinical features, footprint analysis and imaging studies

METHODOLOGY

In our study total of 30 cases were screened and further evaluated by foot print analysis. Further the children were assessed clinically and radiologically for the type and severity of flatfeet.

Inclusion Criteria:

a. written informed consent
b. 6month-16yearchildren.
c. Children with low or absent arch on weight bearing as documented by foot print analysis.

Exclusion Criteria:

a. Adult Patients with Flatfeet
b. Children Already Using Foot Orthosis for Flatfeet Deformity.

Pretreatment Analysis: All patients in the study were evaluated thoroughly using detailed history and complete physical examination with special emphasis on weight, family history, findings like tight tendoachilles, ligamentous laxity, intermalleolar distance and gait analysis. The examination included biomechanical examination of hip, knee, foot and ankle. Associated conditions were also given importance to rule out any syndromic flat foot.

The subjects were then evaluated for type based on clinical findings into flexible and rigid flatfoot severity using **Volpes Treatment Classification System** into mild, moderate and severe. Further subjects were analysed by calculating arch index from footprints and radiographic angles from standing ap and lateral Xrays.

Arch Index: It was calculated by dividing the width of the central region to the foot and of the heel in millimeters.
Normal range is 0.3 -1.

Radiographical Angles:
CP, TMA, TCA were calculated.

Angles	normal range
CP	35°-40°
TMA	20°-30°
TC	35°-40

Regardless of type and severity all cases were given arch support and followed up for 1 year at intervals of 3 months, 6 months and 1 year.
At the end of the treatment all cases were evaluated for any improvement either in clinical features, arch index and radiographical angles.

Patient Education and Counselling:

1. The nature of the condition.
2. The need of arch support.
3. The need of regular use of arch support
4. To bring patient for regular follow ups at 3 months, 6 months and 1 year.
5. To report immediately if there is any complications or even worsening of the condition regarding using arch support.

METHODS

1. To undergo the study an informed consent was taken from the patients parents with the consequences of the study being explained.
2. The patients having flatfoot of any type and severity were chosen from outpatient department and flatfoot clinic of CIO, VMMC and SJH, New Delhi.
3. A detailed history and general physical examination was performed to rule out other associated illnesses. e.g. neurological illnesses, duchenne muscular dystrophy etc
4. Every flatfoot under orthotic management were classified accordingly, given arch support and followed up.
5. At the end of each follow up any improvement was observed by calculating arch index and radiographical angles and comparing to previous follow ups.
6. The child was also kept under observation for any arch support related complications during and after the treatment.

RESULTS

Table1: Relation between age group and Tendoachilies tightness

Crosstab				
Count				
		tight tendoachilles		
		absent	Present	Total
age grouping	0-4	8	2	10
	12-16	3	0	3
	4-8	11	0	11
	8-12	4	2	6
Total		26	4	30

Test of significance; Pearson Chi Square P value; 0.202 Statistical significance; not present

Table2: Relation between age group and Diagnosis

Count				
		diagnosis		
		asymptomatic fff	symptomatic fff	Total
age grouping	0-4	4	7	11
	12-16	3	0	3
	4-8	4	6	10
	8-12	3	3	6
Total		15	16	30

Test of significance: Pearson chi square
P value: 0.322
Statistical significance: not present

Table 3: Relation between age group and volpe's classification

Count				
		volpe's classification		
		moderate	severe	Total
age grouping	0-4	2	8	10
	12-16	2	1	3
	4-8	3	8	11
	8-12	3	3	6
Total		10	20	30

Test of significance: Pearson chi square
P value: 0.357
Statistical significance: not present

Table4: Relation between age group and degree of improvement with foot orthoses follow up in 1 year

Count					
		degree of improvement with foot orthoses follow up in 1 year			
		30-50	50-70	70-90	Total
age grouping	0-4	1	3	6	10
	12-16	1	2	0	3
	4-8	3	3	5	11
	8-12	3	1	2	6
Total		8	9	13	30

Statistical significance: not present
Test of significance: Pearson chi square.
P value: 0.408

Table5: Correlation of Radiographic Angles after 1 Year

		cprt after 1 year	cplt after 1 year	tcart after 1 year	tcalt after 1 year	tmart after 1 year	tmalt after 1 year	degree of improvement with foot orthoses follow up in 1 year
cprt in degree	Pearson Correlation	.771**	.748**	-.386*	-.397*	.557**	.546**	-.051
	Sig. (2-tailed)	.000	.000	.035	.030	.001	.002	.788
	N	30	30	30	30	30	30	30
cplt in degree	Pearson Correlation	.767**	.754**	-.400*	-.412*	.547**	.539**	-.037
	Sig. (2-tailed)	.000	.000	.028	.024	.002	.002	.844
	N	30	30	30	30	30	30	30
tcart in degree	Pearson Correlation	-.442*	-.464**	.887**	.892**	-.501**	-.496**	-.044
	Sig. (2-tailed)	.015	.010	.000	.000	.005	.005	.817
	N	30	30	30	30	30	30	30
tcalt in	Pearson	-.447*	-.471**	.885**	.889**	-.491**	-.488**	-.067

degree	**Correlation**							
	Sig. (2-tailed)	.013	.009	.000	.000	.006	.006	.725
	N	30	30	30	30	30	30	30
tmart in degree	**Pearson Correlation**	.449*	.502**	-.463**	-.472**	.877**	.870**	-.088
	Sig. (2-tailed)	.013	.005	.010	.008	.000	.000	.642
	N	30	30	30	30	30	30	30
tmalt in degree	**Pearson Correlation**	.450*	.504**	-.459*	-.466**	.885**	.881**	-.092
	Sig. (2-tailed)	.013	.005	.011	.009	.000	.000	.627
	N	30	30	30	30	30	30	30
cprt after 3 months	**Pearson Correlation**	.814**	.791**	-.424*	-.435*	.570**	.557**	-.004
	Sig. (2-tailed)	.000	.000	.020	.016	.001	.001	.984
	N	30	30	30	30	30	30	30
cplt after 3 months	**Pearson Correlation**	.790**	.774**	-.435*	-.447*	.560**	.551**	-.021
	Sig. (2-tailed)	.000	.000	.016	.013	.001	.002	.911
	N	30	30	30	30	30	30	30
tcart after 3 months	**Pearson Correlation**	-.441*	-.462*	.886**	.891**	-.514**	-.509**	-.036
	Sig. (2-tailed)	.015	.010	.000	.000	.004	.004	.850
	N	30	30	30	30	30	30	30
tcalt after 3 months	**Pearson Correlation**	-.446*	-.471**	.880**	.884**	-.515**	-.513**	-.030
	Sig. (2-tailed)	.013	.009	.000	.000	.004	.004	.874
	N	30	30	30	30	30	30	30
tmart after 3 months	**Pearson Correlation**	.449*	.502**	-.463**	-.472**	.877**	.870**	-.088
	Sig. (2-tailed)	.013	.005	.010	.008	.000	.000	.642
	N	30	30	30	30	30	30	30
tmalt after 3 months	**Pearson Correlation**	.431*	.487**	-.452*	-.460*	.879**	.875**	-.102
	Sig. (2-tailed)	.017	.006	.012	.011	.000	.000	.593
	N	30	30	30	30	30	30	30
cprt after 6 months	**Pearson Correlation**	.871**	.833**	-.357	-.374*	.527**	.511**	.080
	Sig. (2-tailed)	.000	.000	.053	.042	.003	.004	.673
	N	30	30	30	30	30	30	30
cplt after 6 months	**Pearson Correlation**	.871**	.837**	-.372*	-.389*	.517**	.502**	.083

DISCUSSION

The age of the study group was taken from 6 months- 16 years. For our convenience the study group was divided into 4 groups of 6 months-4years, 4-8 years, 8-12 years and 12-16 years. Total cases of 30 were evaluated and follow up made for 1 year.

In previous studies flatfoot was considered as a universal condition and comprises a group of conditions occurring in infants, children and adolescents[1]. Because of spontaneous resolution there was controversy whether to call it as pathologic or physiologic.

In our study there was 10 cases (33.33%) in age group 6 months -4years, 11 cases (36.67%) in age group 4-8 years, 6 cases (20%) in age group 8-12 years and 3 cases(10%) in age group 12-16 years suggesting decreasing prevalence with age. Morley in his previous studies suggested the 100% occurrence of flatfeet in 2 year old and only 4% in 10 year old children[5].Pheffer and colleagues also reported a decrease in prevalence with increasing age[6].

AGE GROUPING VERSUS DIAGNOSIS.

In our study all were diagnosed to be flexible flatfoot. They were further divided into symptomatic and asymptomatic. 16 cases were symptomatic in which 10 were severe and 6 were moderate and 14 cases were asymptomatic in which 10 were severe and 4 were moderate.

The difference in groups was found to be not statistically significant.
P value; 0.322

Morley AJ(1957) et al[7], in their study showed that most of the flatfoot are flexible type, accounting two thirds of all flatfeet and rigid footfoot approximately 9%.

AGE GROUPING VERSUS VOLPES CLASSIFICATION

Based on VOLPES TREATMENT CLASSIFICATION cases were classified into mild, moderate and severe. Out of 10 in age group 0-4 years 2 were moderate and 8 were severe, out of 11 in age group 4-8 years 3 were moderate and 8 were severe, out of 6 in age group 8-12 years 3 were moderate and 3 were severe, out of 3 in age group 12-16 years 2 were moderate and 1 was severe. Among asymptomatic fff 4were moderate and 11 were severe and among symptomatic fff 6 were moderate and 9 were severe.

The difference in groups was found to be not statistically significant.

P value: 0.357

ARCH INDEX

Arch index of bilateral feet of every patient is calculated and assessed. According to Staheli[8] et al., the normal values of arch index have broad values from 0.3 to 1.0. In our study in the initial evaluation it was found that mean value of arch index of right foot was found to be 1.140 and that of left foot to be 1.139 not much difference was found between the right and left feet.

The difference in both feet was found to be not statistically significant.

P value: 0.058

RADIOGRAPHIC ANGLES

In our study, cases were evaluated radiographically by obtaining standing antero-posterior and lateral x-rays and calculating angles like cacaneal pitch, talocalcaneal angle, talo 1st metatarsal angle. The normal angles are cp= 43.5°± 8.9°, talo first metatarsal angle= 28.9°± 6.22 and talocalcaneal angle 14.1°± 4.19. Simons GW. And vanderwilde R. Staheli LT, Chew DE, et al demonstrated that TCA decreases when there is equines or varus angulation and increases when there is calcaneus or valgus angulation oh the hindfoot[9].

Bordelon RL, Rose GK et al and Viladot A. demonstrated that TMA shows the inclination degree of the talus and it increases in flatfoot[10].Tachdjian MO, in his study showed that CP decreases in flatfoot[11]. Initially it was found in all cases of our study that calcaneal pitch was below and talo first metatarsal angle and talocalcaneal angles above the normal range.It was found in our study that there was no difference (p>0.05) in paired samples t test of both arch index and radiographically measured angles calculated for each childs left and right feet. After thorough initial evaluation patient was classified into type and severity based on VOLPESTREATMENT CLASSIFICATION and was treated with arch support.

CONCLUSION

Most of the flexible flatfoot were severe type and the next being moderate type based on VOLPES CLASSIFICATION. There was no mild type. Maximum no of severe type was seen in age group between 6months and 8years. The younger the age group, more was the severity.

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