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Role of orthosis among children with flatfoot

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Abstract

Introduction: Various studies have concluded that the prevalence of flatfoot is influenced by multiple factors; age, height, weight, gender, genu valgum and joint laxity **Methodology:** One year 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 **Results:** The mean value of arch index of right foot was 0.977 and of left foot was 0.963. There was 63.33% of improvement. The difference was found to be significant **Conclusion:** There is significant improvement in arch index by using arch support

Keywords: flatfoot, orthosis, arch index

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. It also ignores normal anatomic variations in arch height among adults, between children and adults, and between racial groups. It is well recognized that there is a higher incidence of flatfeet in blacks ^[1, 2, 3, 4] than Caucasians, and that these flatfeet, like those in Caucasians, rarely cause disability. Morley ^[1] evaluated the heel-to-arch width ratio on the footprints of children in the first decade of life and found that nearly 100% of 2-year-olds were flatfooted, while the same pattern was seen in only 4% of 10-year-old children. Though he and other authors ^[2, 3] believed that many of these flatfeet actually had an arch that was obscured by a fat pad, Gould *et al.* ^[4] and others ^[5, 6] refuted the fat pad theory with radiographic evidence of actual flattening of the medial longitudinal arch.

Various studies have concluded that the prevalence of flatfoot is influenced by multiple factors; age, height, weight, gender, genu valgum and joint laxity ^[7, 8, 9]. Pheffer and colleagues reported a decrease in prevalence with increasing age and a higher prevalence of flatfeet in boys (59%) than in girls (36%) when evaluating a group of 3 to 6 year old child

Despite the lack of a strict definition, it is believed that most children and at least 20% of adults have flatfeet, most of which are flexible. Harris and Beath ^[10] using their own anatomic criteria, identified flatfeet in approximately 23% of their adult study subjects. They subdivided flatfeet into three types: flexible flatfoot (FFF), flexible flatfoot with short tendo-Achilles (FFF-STA), and peroneal spastic or rigid flatfoot. They found that flexible flatfoot accounted for approximately two-thirds of all flatfeet and, in contrast to the latter two types, rarely caused disability. They emphasized that the flatness of the arch in weight-bearing was of less importance than the mobility of the joints and tendons ^[10]. They identified contracture of the Achilles tendon in association with flexible flatfoot in 25% of the total number of subjects with FFF and noted that this type was often accompanied by pain and functional disability ^[10].

Methodology

Study Design: Prospective randomized single blinded clinical case series study.

Study Period: One year 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.

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Inclusion Criteria

1. written informed consent
2. 6 month-16 year children.
3. Children with low or absent arch on weight bearing as documented by foot print analysis.

Exclusion Criteria

1. Adult Patients with Flatfeet
2. 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.

Results**Table 1: Age Distribution**

		Frequency	age grouping	Valid Percent	Cumulative Percent
Valid	0-4	10	33.33%	33.3	33.3
	12-16	3	10.00%	10.0	43.3
	4-8	11	36.67%	36.7	80.0
	8-12	6	20.00%	20.0	100.0
	Total	30	100.0	100.0	

Table 2: Birth h/o

		Frequency	birth h/o	Valid Percent	Cumulative Percent
Valid	LSCS	5	16.67%	16.7	16.7
	normal	25	83.33%	83.3	100.0
	Total	30	100.0	100.0	

Table 3: Socio Economic Status

		Frequency	Ses	Valid Percent	Cumulative Percent
Valid	Lower middle	15	50.00%	50.0	50.0
	Middle	12	40.00%	40.0	90.0
	Upper middle	3	10.00%	10.0	100.0
	Total	30	100.0	100.0	

Table 4: Out toeing gait

		Frequency	out-toeing gait	Valid Percent	Cumulative Percent
Valid	absent	2	6.67%	6.7	6.7
	present	28	93.33%	93.3	100.0
	Total	30	100.0	100.0	

Table 5: Deformity of foot

		Frequency	deformity of foot	Valid Percent	Cumulative Percent
Valid	absent	11	36.67%	36.7	36.7
	present	19	63.33%	63.3	100.0
	Total	30	100.0	100.0	

Table 6: Degree of improvement

		Frequency	Degree of improvement	Valid Percent	Cumulative Percent
Valid	30-50	8	27.59%	27.6	27.6
	50-70	8	27.59%	27.6	55.2
	70-90	13	44.83%	44.8	100.0
	Total	29	100.0	100.0	

Table 7: Arch index vs degree of improvement with foot orthosis

	degree of improvement with foot orthoses
follow up 3 months	0
follow up in 6 months	45
follow up in 1 year	67.33333
	arch index rightfoot
Initially	1.140667
follow up 3 months	1.142

follow up in 6 months	1.133667
follow up in 1 year	0.977333
	arch index left foot
Initially	1.139333
follow up 3 months	1.142
follow up in 6 months	1.130333
follow up in 1 year	0.963333

Table 8: Radiographic angles vs degree of improvement

	cplt
Initially	24.86667
follow up 3 months	25.1
follow up in 6 months	27.26667
follow up in 1 year	34.6
	tcalt
Initially	28.16667
follow up 3 months	28.3
follow up in 6 months	26.73333
follow up in 1 year	22.4
	tmalt
Initially	21.63333
follow up 3 months	21.6
follow up in 6 months	21.26667
follow up in 1 year	19.3

Discussion

Pheffer and colleagues reported higher incidence among boys (59%) than girls (36%). In our study, males outnumbered the females in all the age groups. The ratio was close to 3:1. There were 20 males and 10 females with males being 66.67% and females being 33.33%.

Birth history and Milestones

Previous studies have shown greater incidence and severity of flatfoot among children who had difficult labour and cesarean section and delayed milestones.

In our study, out of total 30, 25 were normal deliveries and 5 were cesarean section. That is 83.3% were normal deliveries.

In our study 28 had normal milestones and 2 had delayed milestones. That is 93.33% had normal milestones.

Family History

Harris E *et al.*, Herring JA *et al.*, and Abosoa A *et al.* in there studies showed flatfoot may be associated with family history and presence of similar issues in other family members. [6, 7]

In our study, out of 30, 9 had similar features in their family members. That is 30% had significant family history.

Previous studies have shown that flatfoot may be associated with comorbidities such as obesity, neuromuscular disorders, trauma and structural abnormalities above the level of the ankle (eg, ankle valgus, tibia varum, genu valgum, tibial torsion, femoral anteversion, limb-length discrepancy) [11, 12, 13] None of the cases in our study had any associated conditions.

Clinical Features

In our study 28(93.33%) out of 30 had out-toeing gait and 19(63.33%) out of 30 had deformity of foot. Others had features like pain, frequent falls etc.

Tight Tendoachilles

2 out of 10 in age group 0 -4 years and 2 out 6 in age group 8-12 years had tight tendoachilles and no-one in age groups between 4-8 years and 12-16years had tight tendoachilles.

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

P value: 0.202

Harris RI, Beath T (1947 and 1948) identified contracture of the Achilles tendon in association with flexible flatfoot in 25% of the total number of subjects with FFF and noted that this type was often accompanied by pain and functional disability [14, 15].

Ligamentous Laxity

1 out of 6 in between 8-12 years and 1 out of 3 between 12-16 years had ligamentous laxity. Whereas no-one in age groups between 0 to 8 years had ligamentous laxity.

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

P value: 0.117

Arch Index

3 MONTHS

Mean value of arch index of right foot was 1.140 and that of left foot was 1.139

The difference was found to be significant in each foot.

P value: <0.0001

6 Months

The mean value of arch index of right foot was 1.133 and of left foot was 1.130. There was 45% improvement.

The difference was found to be significant in each foot.

P value; < 0.0001

1 year

The mean value of arch index of right foot was 0.977 and of left foot was 0.963. There was 63.33% of improvement.

The difference was found to be significant. [p value <0.0001]

Engel and Staheli [16] found a strong reduction up to the age of 4, because medial longitudinal arch development happens primarily through that age, thus, higher plantar arch indexes are expected in younger children, while these indexes are lower in older children. Other authors admit that major variations on plantar arch happen until the age of 7 [17, 18].

In our study there was regression of arch index in all age groups in 1 year follow up in both males and females. In the age group between 6months and 8 years 6 cases had improvement between 50-70% and 11 cases had improvement between 70-90%. In age group of 8-16, 3 had 50-70% and 2 had 70-90% of improvement.

The difference was not statistically significant with p value 0.408

But in our study males had more severe deformity and had better improvement than females. 12 males and 10 females had 50-90% of improvement.

The difference was statistically significant with p value 0.010.

The correlation between X-ray studies and footprint shows that the footprint is effective for individual studies and population-based investigations.

Conclusion

These symptomatic flexible flatfoot responds favourably with orthotic treatment (UCBL), which provides symptomatic relief.

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