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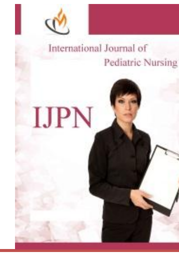

EFFECT OF WEIGHT BEARING AND NON WEIGHT BEARING EXERCISE ON MEDIAL LONGITUDNAL ARCH AND PLANTAR ARCH INDEX IN FLEXIBLE FLATFOOT CHILDREN WITH MEDIAL SHEO INSERT

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ABSTRACT

The aim of the study was to compare the effect of weight bearing and non weight bearing exercise on gait parameters in flexible flatfoot children with medial shoe insert. The sample consists of 180 children of both sexes age between 6-10 years diagnosed with flexible flatfoot, 60 samples in each group. Group 1 – received weight bearing exercise with foot orthotics, group 2 – received non weight bearing exercise with foot orthotics and group 3 received only foot orthotics the design of the study was pre-test, post test control group design. In this study subjects were randomized selected and allocated into any of the three groups by lottery method. Staheli's Planter Arch Index and medial longitudinal arch were the outcome measures. Outcome measures improved in all the three groups due to intervention and foot orthotics. At the same time. The Weight bearing group has shown better improvement than other groups.

INTRODUCTION

Flat foot as the most frequent condition seen in paediatric orthopaedic clinics [1, 2]. Flat feet have long been associated with pain and disability, and are a concern to parents from a preventative perspective as a part of their children's health and mobility [3, 4].There is copious literature addressing the paediatric flat foot, the methodological quality of the research realises a relative paucity from which clinical decisions about the management of paediatric flat foot can be derived. Indeed the summary from a Cochrane Library systematic review states that the evidence from randomised controlled trials is currently too limited to draw definitive conclusions about interventions (non-surgical) for paediatric flat foot [5]. The literature provides common views on conservative treatment to be prescribed for flexible flat foot in children Therapeutic exercises has been prescribed for a wide range of pediatric foot disorders and tipped as a potential treatment for flexible flat foot in children.

There is no doubt that some flat feet are associated with pain and disability and that orthotic therapy is beneficial is such cases [6]. There is much dispute regarding children with flat feet being potentially hindered [7-9]. There is even more disagreement about the use of foot orthoses in children, particularly when asymptomatic [10]. The notion of prevention has seen children with flat feet treated with foot orthoses in effort to rid them of future disability. However passionately espoused [11-13], this precept is not substantiated and

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clinicians continue to differ over the management of children with flat feet.

Current research does not seem to allow or promote exercise treatment to be used as an independent treatment option. However, the data from the published studies seem very promising indicating that the exercise could be very beneficial in helping to treat flexible flat foot in comparison to other treatments, but the available evidence is not sufficient regarding the effectiveness of weight bearing exercises in children with flexible flat foot. Therefore research is definitely needed that provides more insight into the effect of weight bearing exercises and its effect on gait parameters in flexible flat foot children. Hence the investigator felt it timely and to find effectiveness weight bearing exercises in children with flexible flat foot and provide an insight among health personnel's for effective management of flexible flat foot in children.

METHODOLOGY

Sampling size: a total number of 180 children of both sexes age between 6-10 years diagnosed with flexible flat foot participated in the study. Subjects were selected according to inclusion and exclusion criteria.

Inclusion Criteria

1. School Children diagnosed as flexible flat foot.
2. Age group from 6 -10 years of both sexes.
3. Present during the period of data collection.
4. No medical contradiction in exercises for foot.

Exclusion Criteria:

1. Congenital musculoskeletal deformities in lower limbs.
2. Children having other foot deformities.
3. Symptomatic and stiff (rigid) flat foot
4. Flexible flat foot with neuro-muscular involvement
5. Any past history of injury / treatment of the affected limb.
6. Other obvious clinical alignments abnormalities of that lower limb e.g. Genu varum / valgum etc.
7. Obesity.

Variables: Independent variables: Independent variables of this study were Weight-bearing Exercises, Non-weight Bearing Exercises and Orthotic Medial Shoe inserts. Dependent variables of this study were medial longitudinal arch and foot posture index

Materials & Methods: Data was collected from children of both sexes between the age group of 6-10 years attending Pediatric OPD Maxfort Hospital, Jamia Nagar, New Delhi and nearby schools in Delhi. All the subjects were undergoing a pretest measurement which include calculation of Staheli's Planter Arch Index and medial longitudinal arch.

The participants attended a preliminary screening session in which apart from checking for compliance with inclusion/exclusion criteria and granting informed consent, they became familiarized with the measurements. A standardized warm-up of 10 active and passive repetitions of plantar flexion, dorsiflexion, eversion, inversion and circumduction was conducted prior to testing. The order of measurements was randomized by side (left, right), weight bearing condition (non-weight bearing, weight bearing) and direction of motion (supination, pronation).

Each measurement were taken four times; at the baseline level (pretest), after 12th, 24th, & 36th week. A rest period of two minutes separated the sets of measurements.

For calculating Staheli's Planter Arch Index, subjects were asked to remove shoes and socks from both feet. This was necessary as the height of one shoe may affect the imprint of the other.

Footprints, in the present study, were obtained using a podograph with footprint mats. A non-slip material was placed under the podograph for safety reasons. The child was asked to take a step with the non-tested foot ontoone side of the podograph, followed by the placement of the tested foot onto the inked mat. The non-tested foot is then slightly raised from the supporting surface and placed back on the ground. The child walks off the podograph by clearing the tested foot first.

Calculation of the Staheli's Planter Arch Index: To maximize standardization, the method described by Hernandez et al.(2007) was used in my study. To obtain the measurement of the support width of the central region of the foot and of the heel region traces the following lines.

A line was drawn tangent to the medial forefoot edge (metatarsal width) and to the mid-heel region. The mean point of this line was calculated. From this point, a perpendicular line was drawn, crossing the footprint. This was the mid-foot region for the measurement of the arch width. This was measured in mm. The same procedure was repeated for the heel tangency point. This was the measurement of the mid-heel width. Staheli's Planter Arch Index = A/B.

Following the pretest measurement all the three groups (Group 1, 2 &3) had undergone the specific interventions

Group 1 (Weight-bearing Exercise & Orthotic (Medial shoe insert) group)

All subjects in this Weight-bearing Exercise & Orthotic (Medial shoe insert) groups 1 participated in 3 supervised half hour (30 minute) exercise sessions per week for the first three months and 2 supervised and 1 unsupervised exercise session per week for the next three months and 1 supervised and 2 unsupervised for last three months. Subjects in each exercise group were seen on alternating times to avoid cross contamination of treatment intervention. Repetitions of every exercise were 10 for first three months and 15 for next three month and 15 for last three months. Outcome of the treatment were measured on 12th week, 24th week and finally 36th week

Feet Exercises in Weight-bearing (Position)
1. **Walking** on the outer borders of the foot.
2. **Standing:** heel raising and lowering to the outer borders.
3. **Standing:** with the feet inverted.
4. **Standing** on a book: The toes are then flexed and extended.
5. **Standing:** foot shortening.
6. **Walking** along a straight line.
7. **Correct heel and toe walking:**
8. Standing on one leg: Big toe up.
9. Standing: calf muscles (Soleus and Gastrocnemius) strengthen and stretching.
10. Standing: towel exercise

Group 2(Non Weight-bearing Exercise & Orthotic (Medial shoe insert) group)

All subjects in this Non-weight Bearing Exercise & Orthotic(Medial shoe insert) groups 2 participated, as able, in 3 supervised half hour (30 minute) exercise sessions per week for the first three months and 2 supervised and 1 unsupervised exercise session per week for the next three months and 1 supervised and 2 unsupervised for last three months. Subjects in each exercise group were seen on alternating times to avoid cross contamination of treatment intervention. Repetitions of every exercise were 10 for first three months and 15 for next three month and 15 for last three months. Outcome of the treatment were measured on 12th week, 24th week and finally 36th week

Group 3 - Orthotic Group (control Group)

All subjects will be wearing medial shoe insert with the proper advice and guidelines given by Orthotist & Prosthotist. Outcome of the treatment were measured on 12th week, 24th week and finally 36th week

Data Analysis

The intra-rater reliability between the measures was calculated using the intra-class correlation coefficient (ICC) and the error between repeated measures was indicated by the 95% confidence intervals for the absolute difference between trials. The effect of the non-weight bearing and weight bearing measures on flat foot in children were calculated by comparing the changes in the selected dependent variables with a repeated measure ANOVA. All the analysis was done using SPSS 20 statistical software.

RESULT AND DISCUSSION

A total of 180 subjects were enrolled for this with mean age 7.48$\pm$1.44 ranging from 6-12 years of age. There were no significant differences in age, gender ratio, height, body weight, and body mass index (BMI) between all the groups.

Staheli's Planter Arch Index

An analysis of variance was done to find out the effect of intervention between the groups which has showed an improvement in the Arch indices after 36 weeks which was statistically significant Table 1.

A post hoc Bonferroni test has showed at week 12 at baseline till 24 weeks of treatment, though there was improvement in the arch index was shown by all the groups it was statistically insignificant. But after 36th week there was a statistically significant difference was seen between Control, Non weight bearing & Weight Bearing Groups. The Weight bearing group has shown better improvement than other groups (Table 2)

Medial Longitudinal Arch

An analysis of variance was done to find out the effect of intervention between the groups which has showed an improvement in the Medial Longitudinal Arch after 12 weeks onwards which was statistically significant Table 4. A post hoc Bonferroni test has showed at baseline all the groups were similar, after 12 weeks of treatment the subjects in NWBG and WBG showed improvement in MLI height which was statistically significant. The Weight bearing group has shown better improvement than other groups (Table 5).

A representative clinical population with flexible flat feet was used in this study; participants were included according to clinical signs and symptoms rather than diagnostic imaging. The sample would have been reduced to a specific subgroup of children with flat foot if a single imaging modality had been used as the inclusion criteria. Furthermore, diagnostic imaging is not always necessary for the diagnosis of flat foot, and many health professionals who frequently treat the condition (such as podiatrists and physiotherapists) rely on clinical criteria. We therefore believe that the use of a clinical diagnosis for inclusion into the flat foot group provides results that can be generalised to the broader population of children seeking treatment for flat foot [14].

A final limitation is that the overall effect size was relatively low, which indicates that there may be other variables of importance that were not included in our test battery. Further research is required to determine whether the inclusion of other postulated tests can improve the classification accuracy of the multivariate

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model.

Fig 1. Line graph demonstrating the mean value Staheli's Plantar Arch Index of the three groups during baseline, 12th, 24th, & 36th week treatment.

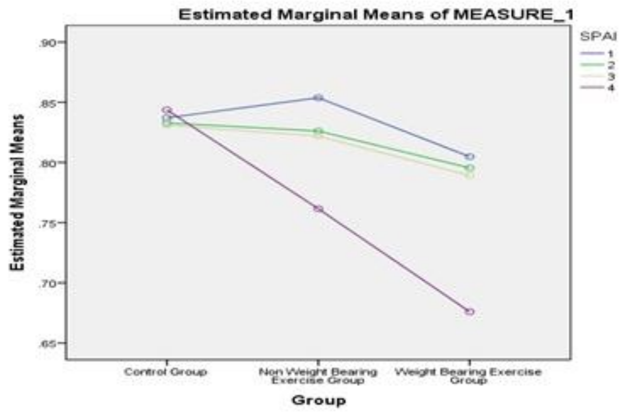

Fig 1. Line graph demonstrating the mean value Medial Longitudinal Arch of the three groups during baseline, 12th, 24th, & 36th week treatment.

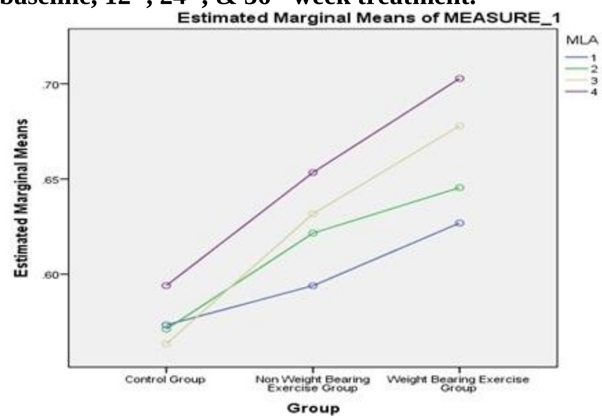

Table 1. ANOVA to find the effect different techniques on Staheli's Planter Arch Index.

Staheli's Planter Arch Index		Sum of Squares	df	Mean Square	F	Sig.
Baseline	Between Groups	.055	2	.028	2.508	.184
	Within Groups	1.889	171	.011		
	Total	1.945	173			
Week 12	Between Groups	.046	2	.023	4.296	.075
	Within Groups	.906	171	.005		
	Total	.951	173			
Week 24	Between Groups	.072	2	.036	6.236	.062
	Within Groups	.983	171	.006		
	Total	1.055	173			
Week 36	Between Groups	.808	2	.404	35.779	.000*
	Within Groups	1.931	171	.011		
	Total	2.739	173			

Table 2. Post Hoc Multiple Comparison for SPAI

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Baseline	CG	NWBEG	-.01666	.01402	.709	-.0506	.0172
		WBEG	.03233	.01414	.070	-.0019	.0665
	NWBEG	CG	.01666	.01402	.709	-.0172	.0506
		WBEG	.04899*	.01408	.082	.0149	.0830
	WBEG	CG	-.03233	.01414	.070	-.0665	.0019
		NWBEG	-.04899*	.01408	.082	-.0830	-.0149
Week 12	CG	NWBEG	.00666	.01346	1.000	-.0259	.0392
		WBEG	.03732*	.01357	.120	.0045	.0701
	NWBEG	CG	-.00666	.01346	1.000	-.0392	.0259
		WBEG	.03066	.01352	.074	-.0020	.0633
	WBEG	CG	-.03732*	.01357	.120	-.0701	-.0045
		NWBEG	-.03066	.01352	.074	-.0633	.0020
Week 24	CG	NWBEG	.00900	.01944	1.000	-.0380	.0560
		WBEG	.04174	.01960	.104	-.0057	.0891
	NWBEG	CG	-.00900	.01944	1.000	-.0560	.0380
		WBEG	.03274	.01952	.286	-.0145	.0799

	WBEG	CG	-.04174	.01960	.104	-.0891	.0057
		NWBEG	-.03274	.01952	.286	-.0799	.0145
Week 36	Control Group	NWBEG	.08210*	.01965	.000*	.0346	.1296
		WBEG	.16766*	.01982	.000*	.1197	.2156
	NWBEG	CG	-.08210*	.01965	.000*	-.1296	-.0346
		WBEG	.08556*	.01974	.000*	.0378	.1333
	WBEG	CG	-.16766*	.01982	.000*	-.2156	-.1197
		NWBEG	-.08556*	.01974	.000*	-.1333	-.0378

Table 3. ANOVA to find the effect different techniques on Medial Longitudinal Arch

		Sum of Squares	Df	Mean Square	F	Sig.
Baseline	Between Groups	.084	2	.042	3.292	.068
	Within Groups	2.178	171	.013		
	Total	2.262	173			
Week 12	Between Groups	.166	2	.083	9.353	.000
	Within Groups	1.521	171	.009		
	Total	1.687	173			
Week 24	Between Groups	.383	2	.191	23.845	.000
	Within Groups	1.373	171	.008		
	Total	1.756	173			
Week 36	Between Groups	.342	2	.171	24.078	.000
	Within Groups	1.213	171	.007		
	Total	1.555	173			

Table 4. Post Hoc Multiple Comparison

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Baseline	CG	NWBEG	-.02062	.02087	.973	-.0711	.0298
		WBEG	-.05357	.02105	.135	-.1045	-.0027
	NWBEG	CG	.02062	.02087	.973	-.0298	.0711
		WBEG	-.03294	.02096	.354	-.0836	.0177
	WBEG	CG	.05357	.02105	.135	.0027	.1045
		NWBEG	.03294	.02096	.354	-.0177	.0836
Week 12	CG	NWBEG	-.05049	.01744	.013*	-.0927	-.0083
		WBEG	-.07440	.01759	.000*	-.1169	-.0319
	NWBEG	CG	.05049	.01744	.013*	.0083	.0927
		WBEG	-.02391	.01752	.522	-.0663	.0184
	WBEG	CG	.07440	.01759	.000*	.0319	.1169
		NWBEG	.02391	.01752	.522	-.0184	.0663
Week 24	CG	NWBEG	-.06842	.01657	.000*	-.1085	-.0284
		WBEG	-.11462	.01671	.000*	-.1550	-.0742
	NWBEG	CG	.06842	.01657	.000*	.0284	.1085
		WBEG	-.04620	.01664	.018*	-.0864	-.0060
	WBEG	CG	.11462	.01671	.000*	.0742	.1550
		NWBEG	.04620	.01664	.018*	.0060	.0864
Week 36	CG	NWBEG	-.05942	.01558	.001*	-.0971	-.0218
		WBEG	-.10884	.01571	.000*	-.1468	-.0709
	NWBEG	CG	.05942	.01558	.001*	.0218	.0971
		WBEG	-.02062	.02087	.973	-.0711	.0298
	WBEG	CG	-.05357	.02105	.035*	-.1045	-.0027
		NWBEG	.02062	.02087	.973	-.0298	.0711

CONCLUSION

The study was the first study to evaluate the relationship between flexible flat foot in children and effect of weight bearing exercises. Our study has demonstrated that the weight bearing exercises have beneficial effects and has improved various factors associated with ankle function, thereby improving the child's functional activity. Inconsistent findings between the experimental and control groups indicate that pathology may play a role in the relationship between flexible flat foot and dynamic function. However, prospective studies are required to determine whether this relationship is causal

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