ORIGINAL RESEARCH PAPER

Volume-8 | Issue-7 | July - 2019 | PRINT ISSN No. 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

EFFECT OF INTRINSIC MUSCLE STRENGTHENING EXERCISES ALONE VERSUS FARADIC FOOT BATH AND INTRINSIC MUSCLE STRENGTHENING EXERCISES ON YOUNG INDIVIDUALS WITH PES PLANUS.

Physiotherapy

Khushboo A Patel Intern, Dr. A.P.J. Abdul Kalam College of Physiotherapy, PIMS(DU), Loni, India.

Nupoor Kulkarni* Asst professor, Dr. A.P.J. Abdul Kalam College of Physiotherapy, PIMS(DU), Loni, India. *Corresponding Author

ABSTRACT

BACKGROUND: The aim of the study was to determine the effect of intrinsic muscle strengthening exercises alone versus faradic foot bath and intrinsic muscle strengthening exercises on Foot Posture Index in young individuals with pes planus.

METHODOLOGY: 30 participants with mean age 20.13±0.97 years having pes planus were selected and allocated to two groups. All the participants were assessed with Foot Posture Index(FPI) before and after the intervention; undertaken for 3 weeks. Group A received intrinsic muscle strengthening exercises; Group B received faradic foot bath and intrinsic muscle strengthening exercises given to participants in group A.

RESULT: The pre and post-intervention FPI mean score for Group A was 8.8±0.86 and 4.26±1.03 respectively ($p<0.0001$, $t=27.43$). The mean value of FPI score for Group B, before the intervention was 9.26±0.88 and after the intervention it was 4.13±0.91 ($p<0.0001$, $t=15.957$). The post-intervention FPI mean score for Group A and Group B were 4.53±0.63 and 5.13±1.24 respectively. There was no statistically significant difference found between the groups, which showed both were beneficial.($p=0.1$,$t=1.659$)

CONCLUSION: The study concluded that, intrinsic muscle strengthening exercises alone was equally effective as intrinsic muscle strengthening exercises with faradic foot bath. Hence, there was no additional effect of faradic foot bath when combined with intrinsic muscle strengthening exercises.

KEYWORDS

Pes planus, intrinsic muscle strengthening exercises, faradic foot bath, FPI.

1.INTRODUCTION:

Pes planus also called as flat feet or fallen arches is a postural deformity that occurs due to reduction in the Medial Longitudinal Arch(MLA)[1]. A cross sectional study done in Indian population showed that the prevalence of flat feet in 18-25 year old adults was 11.25% in participants with bilateral flat feet[2].Another cross sectional study for prevalence of flexible flat feet in Indian young adults was found to be 13.6%, for males it was 12.8% and for females it was 14.4%[3].The ankle is a complex joint with 26 bones in each foot constructed such that they form the medial longitudinal, lateral longitudinal and the transverse arch[4]**.** The arch of the foot is primarily supported by the ligaments, bony alignments, intrinsic muscle strengthening exercises and by the additional support from the extrinsic foot muscles[5].

The medial longitudinal arch aids in walking by protecting against pressure through the concavity of the arch and acts as the energy store while walking. It also helps in producing strength to push off, adjust balance and absorb shock[6]. Normally, while weight bearing the MLA is raised from the ground[1].While weight bearing the deformity of pes planus induces the talus bone in flexion with adduction and the calcaneus bone in valgus position creating excessive pronation of the foot [7]. The two most common types of pes planus found are rigid and flexible pes planus. In rigid pes planus the MLA is reduced while weight bearing as well as while non-weight bearing activities. On the other hand, in flexible pes planus the MLA is reduced only while weight bearing activities, and it is raised while non-weight bearing activities [8]. The causes of the pes planus can be congenital or acquired. The congenital causes are physiological or infantile, congenital vertical talus. The acquired causes are obesity, occupational, postural, secondary to anatomical defect elsewhere. The other common causes are flaccid flat feet or pronated foot, peroneal spasm, rheumatoid arthritis, fracture calcaneum, muscle weakness, ligament laxity and dropping of the talar head [9]. The various factors contributing to acquired pes planus are sitting positions, sleeping position, footwear, compensation of other abnormalities or tight Achilles tendon, or severe rupture of tendons or ligaments of the foot, or malalignment of the foot[6,10,11,12].The most common cause for pes planus in young individuals is posterior tibial tendon dysfunction, which forms the main tendon of the medial arch [13].

Pes planus not only contributes to foot problems but also to some serious other complications like shin splints, hammer toes, plantar fasciitis, bunions, heel pain and commonly the knee and low back pain [14]. The process of maintaining the center of gravity within the body's base of support is termed as balance [15]. An excessive pronation of the foot can affect the static and dynamic postural stability [16]. Previous studies have shown that short foot exercises have immediate effect in improving the dynamic balance in patients with excessively pronated feet [17]. The treatment of pes planus deformity can be: conservative and surgical treatment. The conventional treatments used for pes planus over the years include taping, orthosis, shoe corrections, mobilization of foot bones, foot muscle exercises including intrinsic and extrinsic both [1,5,7,8,9,17].The flexible pes planus is usually painless, but if signs of inflammation are seen than pharmacological treatment is started by prescribing non-steroidal anti-inflammatory drugs(NSAIDS) [9]. Severe flat feet are surgically treated to reduce pain and foot alignment by Arthrodesis, Arthroresis and reconstructive procedures [1,5,9].

The purpose of this study was to compare the effect of intrinsic muscle strengthening exercises alone versus faradic foot bath and intrinsic muscle strengthening exercises in young individuals with pes planus and to find the significant difference of the same on Foot Posture Index(FPI). Very few studies have been done to find the effect of intrinsic muscle strengthening exercises and the effect of faradic foot bath on FPI. Therefore, a comparative study of the above treatments on Foot Posture Index was done to find out which one is superior.

2.MATERIALS AND METHODS:

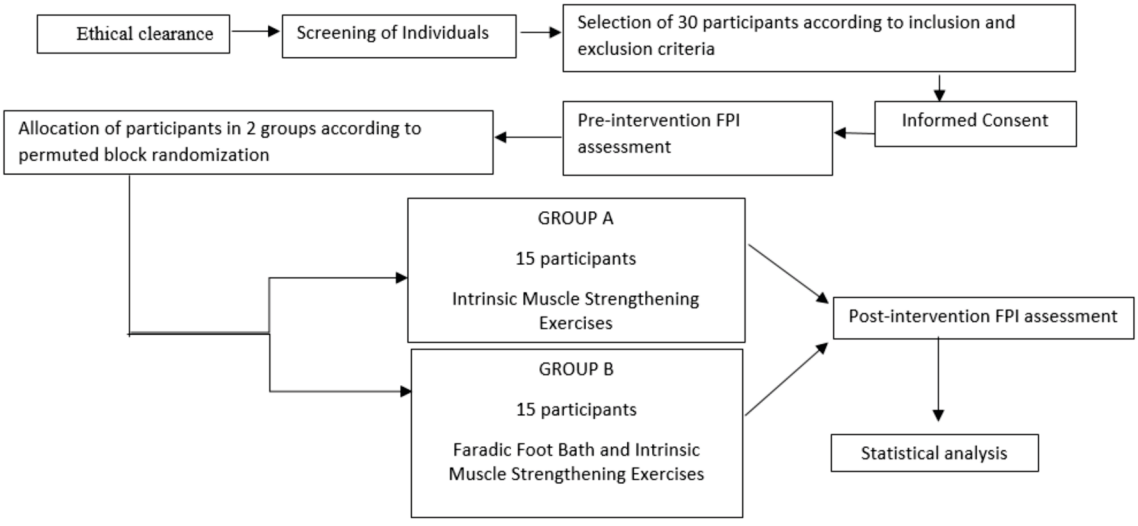
2.1 Participants: An approval for the study was obtained from the Institutional Ethical Committee(Ref no- PIMS/CPT/IEC/2018/577). The study was conducted in OPD setting of Dr. APJ Abdul Kalam College of Physiotherapy.30 participants aged between 18-25 years, both males and females, with pes planus, willing to participate were included. Exclusion consisted of history of any lower limb surgery, lower limb pathology, any neurological condition of lower limb, traumatic injury of foot and leg, soft tissue injury of lower limb, individuals who have received any medical or conservative treatment for arch management. The written consent was obtained prior to the study.30 participants were than allocated to two groups-Group A(intrinsic muscle strengthening exercises) and Group B(faradic foot bath and intrinsic muscle strengthening exercises), according to permuted block randomization.

2.2 Measurements and outcome measures: Demographic data was collected, and the participants were evaluated with Foot Posture Index(FPI) before and after the 3 weeks of intervention.

Foot Posture Index: The participants were asked to attain standing position and were viewed in anterior, posterior, and lateral view. The foot posture index was assessed under following headings:1) Talar head palpation, 2) Observation of the curves above and below the lateral malleoli, 3)The extent of the inversion/eversion of the calcaneus, 4)The bulge in the region of the talonavicular joint(TNJ, 5)The congruence of the medial longitudinal arch, 6)The extent of abduction/adduction of the forefoot on the rearfoot. A score of more than +5 was a pronated foot [18].

2.3 Intervention: 15 participants in Group A were given intrinsic muscle strengthening exercises twice in a day for 5 days per week for 3 weeks. The exercise session was conducted for 20-25 minutes. The intrinsic muscle strengthening exercises included:-1.Toe clawing 2.Toe spreading 3.Foot rolling 4.Picking up small logs 5.Toe flexion and extension 6.Standing on lateral border of foot 7.Tandem walking 8.Walking on lateral border of feet.

15 participants in Group B received faradic foot bath for one session each day for 5 days in a week for 3 weeks along with intrinsic muscle strengthening exercises as given to participants in Group A. The participants were asked to attain sitting position and put their feet in a tray immersed in water. The two plate electrodes were covered with cotton and placed at the forefoot and hindfoot region. The faradic current was given for 30 contractions per set and 3 sets in each session. The intensity of the faradic current contractions was decided according to the patient's tolerance. The surge duration was 1 and surge interval was kept 3 for all participants. The faradic bath tray was properly cleaned and sterilized after each use. The cotton was properly disposed after the use [1,9]



3.Data Analysis and Result

3.1 Data Analysis:

TABLE 1 : Demographic Data, Comparison of Group A and Group B using Paired t test.

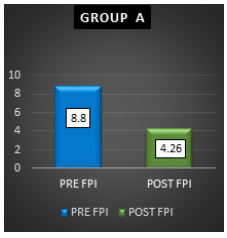
GROUPS			GROUP A (Intrinsic muscle strengthening exercises) n-15	GROUP B (Faradic foot bath and intrinsic muscle strengthening exercises) n-15
Age	P value 0.31T value-1.01	(mean±sd)	20.6±0.91	21±0.81
BMI	P value-0.19T value-1.92	Normal	6	10
		Underweight	3	1
		Overweight	6	4
Gender			2 males, 13 females	0 males, 15 females
FPI (mean±sd)		Pre-intervention	8.8±0.86	9.26±0.88
		Post-intervention	4.26±1.03	4.13±0.91
		P value	<0.0001	p<0.0001
		T value	27.43	15.957

TABLE 2: Comparison of Post-intervention FPI scores in Group A and Group B using unpaired t test.

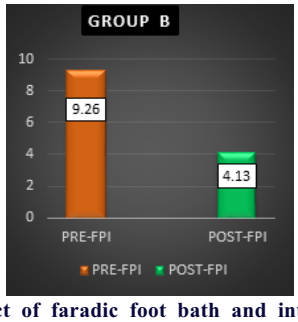
GROUP	MEAN	SD	P value	T value	Degree of freedom(df)	Result
GROUP A	4.53	0.63	0.1083	1.659	28	Not Significant
GROUP B	5.13	1.24				

3.2 RESULTS:-

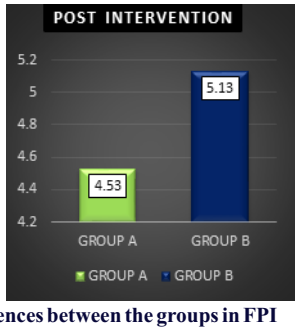
The baseline demographic data of all participants were comparable in both the groups. The mean value of FPI scores before the intervention was 8.8±0.86 and after the intervention it was 4.26±1.03 in Group A (p<0.0001, t=27.43). (table 1, graph 1). The mean value of FPI score before the intervention was 9.26±0.88 and after the intervention it was 4.13±0.91 in Group B (p<0.0001, t=15.957), (table 1, graph 2). On comparison of the difference of Post-intervention FPI scores between Group A and Group B; using unpaired t test, it was observed that this difference is statistically not significant. (p=0.1083,t=1.659 with df=28) (table 2, graph 3).



GRAPH 1:- Effect of intrinsic muscle strengthening exercises on FPI



Graph 2:- Effect of faradic foot bath and intrinsic muscle strengthening exercises on FPI



Graph 3:- Differences between the groups in FPI

4. DISCUSSION:

The present study aimed at comparing the effect of intrinsic muscle strengthening exercises (Group A) and faradic foot bath along with intrinsic muscle strengthening exercises(Group B) in young individuals with pes planus. In this study the Foot Posture Index (FPI-6) was used to assess the foot posture; assessing the six elements of forefoot and rearfoot. Using this made it possible to determine the severity of pronation of the foot as supported by Anthony C Redmond et al (2008) who conducted a study on normative values of Foot Posture Index and concluded that the normative values identified may assist in classifying foot type for the purpose of research and decision making in clinical settings[19]. The participants were assessed with Foot Posture Index on 1st day i.e. pre-intervention and after 3 weeks i.e. post-intervention. The intervention was given for 3 weeks to both the groups and data was collected in the data sheets.

In the present study, when pre-intervention and post-intervention mean FPI score was compared using paired t test, the mean pre-intervention FPI score was 8.8 and post-intervention mean FPI score was 4.26, which is highly significant as the strengthening exercises may improve the muscle power and improve the endurance of the muscle in accordance with Dee-bee Lee et al (2016) who conducted a study on effect of intrinsic foot muscle and tibialis posterior strengthening on flat feet. The study concluded that plantar pressure distribution and dynamic balance ability in adults with flexible pes planus may improve with the intrinsic foot muscle and tibialis posterior muscle strengthening exercises [8]. Other study conducted by Takayuki Hashimoto et al (2014) study the effect of strength training for the intrinsic flexor muscles of the foot on effects on muscle strength, the foot arch, and dynamic parameters before and after the training. The study concluded that muscle strength training exercises significantly improved muscle strength scores, foot arch shape, and movement performance[20]. Another study supporting this result was conducted by Iwona Sulowska et al (2017) on influence of plantar short foot muscle exercises on foot posture and gait parameters in long distance runners. The study concluded that strengthening exercises of short foot muscles have beneficial effects on foot alignment by change of foot posture from slight pronation towards a neutral foot. The change in gait parameters may indicate improvement of motor control and shifting natural and comfortable walking speed towards lower values [11].

The present study showed highly significant improvement in participants who received Faradic foot bath and intrinsic muscle strengthening exercises in FPI post intervention. One explanation for this may be that effect of faradic foot bath decreases the foot pronation by improving the contractility of the muscle and helps in maintaining the medial longitudinal arch as supported by Veerpreet Kaur et al (2017) who conducted a study aimed at finding the effectiveness of faradic foot bath on flexible flat feet. The study concluded that level of improvement is significantly high, and the faradic foot bath can be effective after 3 weeks of intervention [9]. In addition to this Santosh Metgud et al (2017) conducted a randomised clinical trial to evaluate and compare the effect of low dye taping and faradic foot bath in subjects with flat foot, using navicular drop test and arch index. The study showed that faradic foot bath and low dye taping were equally effective in reducing the navicular drop height and arch index in individuals with flat feet. The researchers revealed that faradic foot bath was more effective but there was no statically any difference seen between the groups [21].

The post-intervention comparison of mean FPI score in Groups A and B; using unpaired t test showed that it was not significant, and both the groups were equally effective in treating pes planus in young individuals. This revealed that intrinsic muscle strengthening exercises alone can be used to treat the pes planus. The review of literature had revealed that faradic foot bath is useful and can be used to treat pes planus [9,21]. The overall result of the present study revealed that intrinsic muscle strengthening exercises are the most beneficial and faradic foot bath has no additional effect. However, these result may be difficult in generalizing to the global population as the sample size was small and taken from an area.

REFERENCES:-

1. Tendulkar S, Naik V, Yeole U. Effect of faradic stimulation vs. intrinsic muscle strengthening of foot in young individuals with flat feet. International Journal of Physical Education, Sports and Health 2018; 5(1): 135-138.
2. Bhoir T, Anap DB, Diwate A. Prevalence of flat foot among 18-25 years old physiotherapy students: cross sectional study. Indian Journal of Basic and Applied Medical Research. 2014 Sep;3(4):272-8.
3. Aenumulapalli A, Kulkarni MM, Gandotra AR. Prevalence of Flexible Flat Foot in Adults: A Cross-sectional Study. Journal of clinical and diagnostic research: JCDR. 2017 Jun;11(6):AC17.
4. Cheryl L, Riegger et al.; anatomy of ankle and foot, 1988.
5. D'silva C. Comparative Effect of Mobilization, Low Dye Taping and Faradic Foot Bath in Subjects with Flat Foot–A Randomised Clinical Trial (Doctoral dissertation, KLE University, Belagavi, Karnataka).
6. Talati D, Patil R, Malwade M. Influence of leg dominance on flat foot in healthy adults. Global Journal for Research Analysis. 2018 Apr 14;7(2).
7. Panichawit C, Bovonsunthonchai S, Vachalathiti R, Limpasutirachata K. Effects of Foot Muscles Training on Plantar Pressure Distribution during Gait, Foot Muscle Strength, and Foot Function in Persons with Flexible Flatfoot. Journal of the Medical Association of Thailand Chotmaihet thangphaet. 2015 Jun;98:S12-7.
8. Lee DB, Choi JD. The Effects of Foot Intrinsic Muscle and Tibialis Posterior Strengthening Exercise on Plantar Pressure and Dynamic Balance in Adults Flexible Pes Planus. Physical Therapy Korea. 2016 Nov;23(4):27-37.
9. Kaur V, Kaur P, Kaushal K. Effect of Faradic Foot Bath on Flexible Flat Foot. International Journal of Science and Research (IJSR) 2018 July; ISSN Volume 7 Issue 7.
10. Stovitz SD, Coetzee JC. Hyperpronation and foot pain: steps toward pain-free feet. The physician and sportsmedicine. 2004 Aug 1;32(8):19-26.
11. Sulowska I, Oleksy Ł, Mika A, Bylina D, Sołtan J. The influence of plantar short foot muscle exercises on foot posture and fundamental movement patterns in long-distance runners, a non-randomized, non-blinded clinical trial. PloS one. 2016 Jun 23;11(6):e0157917.
12. Mickle KJ, Steele JR, Munro BJ. The feet of overweight and obese young children: are they flat or fat? Obesity. 2006 Nov;14(11):1949-53.
13. Erol K, Karahan AY, Kerimoğlu Ü, Ordahan B, Tekin L, Şahin M, Kaydok E. An important cause of pes planus: the posterior tibial tendon dysfunction. Clinics and practice. 2015 Jan 28;5(1).
14. Fatima S, Arsh A, Rahman N, Ullah A. Frequency and Associated Factors of Knee and Low Back Pain among Adults with Pes Planus. Journal of Dow University of Health Sciences. 2018 Dec 19;12(3).
15. Guskiewicz KM, Perrin DH et al. Research and clinical applications of assessing balance, 1996.
16. Cote KP, Brunet ME, II BM, Shultz SJ. Effects of pronated and supinated foot postures on static and dynamic postural stability. Journal of athletic training. 2005 Jan;40(1):41.
17. Moon DC, Kim K, Lee SK. Immediate effect of short-foot exercise on dynamic balance of subjects with excessively pronated feet. Journal of physical therapy science. 2014;26(1):117-9.
18. Redmond AC, Crane YZ, Menz HB. Normative values for the foot posture index. Journal of Foot and Ankle research. 2008 Dec;1(1):6.
19. Redmond AC, Crane YZ, Menz HB. Normative values for the foot posture index. Journal of Foot and Ankle research. 2008 Dec;1(1):6.
20. Hashimoto T, Sakuraba K. Strength training for the intrinsic flexor muscles of the foot: effects on muscle strength, the foot arch, and dynamic parameters before and after the training. Journal of physical therapy science. 2014;26(3):373-6.
21. Metgud S, D'silva C, Hegannavar A. Effect of low dye taping and faradic foot bath in subjects with flat foot: A randomised clinical trial. International Journal of Multidisciplinary Research and Development. 2017 Jul;4(7):467-471.