EFFECTIVENESS OF SHORT FOOT EXERCISE ALONG WITH KINESIOTAPING VS SHORT FOOT EXERCISE ON MEDIAL LONGITUDINAL ANGULATION IN ACQUIRED FLAT FOOT - A COMPARATIUVE STUDY

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ABSTRACT:
BACKGROUND OF THE STUDY: Pes planus also known as flat foot is the loss of the medial longitudinal arch of the foot, abduction of the fore foot, internal rotation and plantar flexion of the talus and calcaneal eversion. The symptoms of flat foot are abnormal appearance of foot, pain beneath the medial malleolus, stiffness and restriction of ROM in hind foot. Flat foot is caused due to lower extremity injuries, increased intensity of low back pain, Talipes equinovarus deformity, ligamentous laxity, foot equinus deformity, tibial torsional deformity. Short foot exercise strengthens the intrinsic muscles and reduces the acquired flat foot. The application of kinesio taping has been suggested to improve the muscle contraction by supporting weakened muscle, decreasing inflammation and pain by increasing lymphatic flow and blood flow, and increasing the range of motion of the joint by adjusting the misalignment of muscle fibres, myofascia and joints. The purpose of the study is to find out the effectiveness of short foot exercises with kinesio taping to reduce acquired flat foot in adults.
METHODOLOGY: A comparative study design was used. Selection criterion based simple random toss method was used to recruit subjects (N=30) diagnosed with flat foot. They were randomized into two treatment groups. Group A Participants were given short foot exercises with kinesio taping and group B received short foot exercises alone. Both the groups received interventions for 6 days in a week for a period of 7 weeks. Total study duration was 4 months. This study was conducted at outpatient department of PPG College of physiotherapy. Prior the exercise program, angle of the foot was measured using Clark's method and Feiss line test.
RESULT: Pretest and post-test values for within group analysis were calculated by paired t test. The calculated t value was greater than table t value at 5% level of significance. In between group analysis calculated by unpaired t test pre-pre comparison values were less than table value. There was no significant difference. However post-post comparison value was greater than table t value at 5% level of significance. There is an improvement in both groups eventually. Group A have more significant, improvement than group B among patients with acquired flat foot at 5% level of significant
CONCLUSION: This study concluded that the short foot exercise along with kinesiotaping is more significant in improving medial longitudinal angulation in acquired flat foot using Clark's method and Feiss line test.
KEYWORDS: Pes Planus, Flat foot, Clark's method, Short foot exercise, Kinesio taping and Feiss line test.

INTRODUCTION:

PesPlanus also known as flat foot is the loss of the medial longitudinal arch of the foot, abduction of the forefoot, internal rotation and plantar flexion of the talus and the calcaneal eversion. (2) In lay term, it is a fallen arch of the foot that caused the whole foot to contact the surface the individual is standing on. The deformity is usually asymptomatic and resolves spontaneously in the first decade of life, or occasionally progresses into a painful rigid form which causes significant disability. All at birth has flat feet and noticeable foot arch are seen at around the age of 3 years. It is of two forms; flexible flatfoot and rigid flatfoot. When the arch of the foot is intact on heel elevation and non-bearing but disappears on full standing on the foot, it is termed flexible flat foot while rigid flat foot is when the arch is not present in both heel elevation and weight bearing.

Pesplanus is more frequent in female population with the male ratio of 2:1. The prevalence of flexible flatfoot among Indian adults is 13.6%. For male it is 12.8%and female it is 14.4%. According to 18 years of age were having 2.5% of bilateral flat foot, 22 years were having 3.75% bilateral flat foot, 24% years were having 3.75%bilateral flat foot, 24 years were having 1.25% bilateral flat foot.

Short foot exercise (SFE) is a widely used balance training intervention that has been developed recently to improve ankle proprioception and to strengthen the intrinsic foot muscles (IFM) so as to elevate and support the medial longitudinal arch (MLA) of the foot and improve dynamic standing balance.

Short foot exercises (SFE), are exercise that involve trying to pull the first metatarsal head towards the calcaneus without flexing the toes. Previous researches demonstrated that SFE is effective in increasing the strength of intrinsic muscles in flexible pesplanus, enhancing foot posture and function, reducing acquired flat foot in healthy population**.**

Kinesiotaping (KT) is a air-permeable and water resistant and can be worm for several days without removal. The application of KT has been suggested to result in an improvement in muscle contractility by supporting weakened muscle, decreasing inflammation and pain by increasing lymph and blood flow, and increasing the range of motion of the joint by adjusting the misalignment of muscle fibres, myofascia and joints. KT may also assist in the management of ankle sprain by reducing pain, altering muscle function, improving circulation, enhancing proprioception and repositioning subluxed joints.

Kinesio taping is gaining increasing popularity and is being used as a tool of choice in the treatment of many clinical conditions**.** It can be used right from acute to chronic stages of rehabilitation. Conditions treated by the tape include but are not limited to acute ankle sprains, ac joint pain, Achilles tendinitis, shin splints, carpel tunnel syndrome, bursitis, lymphedema menstrual pain, pregnancy related back pain, headaches, malfunction of patella, ligament and meniscal injuries, sinus pain etc.

The angle of the foot was measured using Clark's Method. It determines the foot print angle between the line connecting the inner point of heel and the front part of the foot print (A-A), and the line connecting the most convex point of the inner edge of the foot print (A-B). In normal foot, the angle is over 42 degree, and in flat foot, the angle is less than 42 degree.

Feiss Line Test: Observe the medial side (inner side) of your foot and you would find that it's a little bit convex in shape (arch) with the apex facing upwards. This arch on the medial side of the foot is called the medial longitudinal arch.

NEED OF THE STUDY

Flatfoot is a postural deformity in which the arches of the foot collapse, with the entire sole of the foot coming into complete or near complete contact with ground. Flat foot causes several complications like inflammation of soft tissue, bunions, abnormal walking patterns and knee, hip and lower back pain.

The common symptoms of flat foot are lower extremity injuries, increased intensity of low back pain, Talipes equinovarus deformity, ligamentous laxity, foot equinus deformity, tibial torsional deformity.

Short foot exercise is a widely used balance training intervention that has been developed recently to improve ankle proprioception and to strengthen the intrinsic foot muscles so as to elevate and support the medial longitudinal arch of the foot and improve dynamic standing balance.

Kinesio tape to flat feet immediately reduces abnormally increased foot pressure and tone and stiffness in the lower extremity muscles

Hence, the need of the study was done to find a suitable conservative physiotherapeutic management of flat foot and determine the effect of short foot exercise along with kinesio taping

VS short foot exercise alone in the management of flat foot, towards acquired flat foot.

2. METHODOLOGY:

STUDY DESIGN: This study was comparative study.

SUBJECTS: In this study, Subjects with acquired flat foot were selected. Based on the selection criteria 30 subjects with acquired flat foot were selected for this study. Clear explanation and instructions were given to subjects regarding to the study procedure, merits and demerits of the intervention before starting the sessions. Then the written consent form was obtained from the selected acquired flat foot subjects to the pretest evaluation.

The pre-test and post-test were measured using Clark's method. Total treatment duration was 7 weeks. All the selected subjects receive short foot exercise along with kinesio taping.

The subjects were given short foot exercise along with kinesio tape for 20 minutes per session about 2 weeks and each day 2 sessions for 3 days totally 7 weeks for Group A and Group B received short foot exercises. The data were recorded and documented.

TREATMENT TECHNIQUE PROTOCOL:

SHORT FOOT EXERCISES PROTOCOL:

Duration of short foot exercise	20 minutes
Repetition	3 times
Rest period	30 seconds per exercise
Number of sessions/day	2 sessions/day
Number of days/weeks	3 days/ week for 7weeks

GROUP A AND GROUP B

SHORT FOOT EXERCISE:

TOWEL CURL EXERCISE

It is also known as toe curl. It is an excellent foot strengthening exercise. The towel curl exercise

stretches and flexes the foot to improve balance,to support the arches of the foot and increase the foot strength.

PATIENT POSITION: standing or sitting.

THERAPIST POSITION: stride standing.

PROCEDURE: The patient was asked to place towel on the ground put the towel and uses their toes to scrunch towel or pull the towel. Repeat exercise 3-5 times daily.

HEEL RAISE

PATIENT POSITION: standing

THERAPIST POSITION: stride standing.

PROCEDURE: Asked the patient to stand patient weight evenly distributed over both feet. Hold onto the back of a chair or the wall for balance. Asked the patient to lift the both heel off the floor as high as they can.

SQUAT EXERCISE PATIENT

POSITION: Standing

THERAPIST POSITION: Stride standing.

PROCEDURE: Asked the patient to stand tall with patient feet hip distance apart. Patient hip, knees and toes should all be facing forwards. Bend patients knee and extend the buttocks backwards as the patient going to sit back into a chair make sure that the patient keep the knees behind toes and patient weight in their heels. Raise back up.

HAMSTRING CALF STRETCH

PATIENT POSITION: Long sitting

THERAPIST POSITION: Standing beside the patient

PROCEDURE: Asked the patient to extend their arms and reach forwards by bending at the waist as far as possible while keeping the knees straight. Hold the position for 15to 30 seconds. Relax back into the starting position**.**

KINESIOTAPING

After the short foot exercise, the kinesio taping is used. Kinesiotape is used for 3 days and it is changed after that and a new Kinesiotape is used.In the process of the application of Kinesiotaping, we require two pieces of short Y tape. One piece of I tape.

STEP 1:

Place two short Y tapes from the heel towards each toe while stretching the toes.

STEP 2:

Apply I tape from the outside of the little toe to inside the ankle with slight stretch. I tape is cyan in color.

The angle of the foot is measured before and after the exercise. That is the pre-test and post-test values are recorded. The foot print is taken as the criteria for the detection of flat foot using podograph. The Clark's method of foot print angle is used to measure the angle of the subject's foot prints.

Draw a line to represent the medial border of the foot between the points of the imprint at the base of the first metatarsal bone (base of the big toe) and calcaneus or heel bone Locate the point where this line first touches the inner side of the imprint at the base of the first metatarsal bone. Then, with a ruler held on this point, swing it down from the toe until it just touches the edge of the point on the inside of the arch, and draw a line from the point across the print. No white paper should show between this line and the print. Measure the angle at the junction of the two lines with a protractor.

An angle up to 13degree convex downward is referred to as normal foot. An angle between 15-30 degree convex downward is referred to as moderate flat foot. An angle greater than 30degree convex downward is referred to as Severe flat foot.

STATISTICAL ANAYLYSIS: The statistical tools used in the study are paired t-test and unpaired t-test. The paired t-test was used to find out the statistical significance between pre and post t-test values of short foot exercises and kinesiotaping before and after treatment for Group A and Group B. The unpaired t-test was used to compare the statistically significance difference of short foot exercises and kinesiotaping before and after treatment for Group A and Group B.

RESULTS:

Table-1: Demographic data:

S.NO	AGE	GENDER				TOTAL
		MALE		FEMALE		
		Group A	Group B	Group A	Group B	
1.	18-20	2	3	2	3	10
2.	21-23	3	2	2	2	9
3.	24-25	2	3	3	3	11

Table -2: PAIRED t TEST FOR CLARK'S METHOD– GROUP A

TEST	MEAN	S D	t- VALUE	Df	N	TABLE t- VALUE	P-VALUE
PRE TEST	12.7	3.6	28.5	14	15	2.145	p<0.05 SIGNIFICANT
POST TEST	39.4	1.0					

The results are enlisted in the above table. Pre test mean value is 12.7 and standard deviation value is 3.6. Post-test mean value is 39.4 and standard deviation value is 1.0. The calculated t value and table t values are 28.5 and 2.145. The obtained t value is greater than table 't' value at 5% level of significance for 14 degrees of freedom.

Table -3: PAIRED t TEST FOR CLARK'S METHOD– GROUP B

TEST	MEAN	S D	t- VALUE	Df	N	TABLE t- VALUE	P-VALUE
PRE TEST	12.7	3.6	30.2	14	15	2.145	p<0.05 SIGNIFICANT
POST TEST	30.93	2.73					

The results are enlisted in the above table. Pretest mean value is 12.7 and standard deviation value is 3.83 and post-test mean value is 30.93 and standard deviation value is 2.73. The calculated t value and table t values were 30.2 and 2.145. The obtained t value is greater than table 't' value at 5% level of significance for 14 degrees of freedom.

Table -4 : PAIRED t TEST FOR FEISS LINE TEST– GROUP A

TEST	MEAN	S D	t- VALUE	Df	N	TABLE t- VALUE	P-VALUE
PRE TEST	3	0	12.3	14	15	2.145	p<0.05 SIGNIFICANT
POST TEST	1.4	0.4					

The results are enlisted in the above table. pre test mean value is 3 and standard deviation value is 0 and post-test mean value is 1.4 and standard deviation value is 0.4. The calculated t value and tablet value were 12.3 and 2.145. The obtained t value is greater than tablet value at 5% level of significance for 14 degrees of freedom.

Table – 5: PAIRED t TEST FOR FEISS LINE TEST– GROUP B

TEST	MEAN	S D	t- VALUE	Df	N	TABLE t- VALUE	P-VALUE
PRE TEST	3	0	7.7	14	15	2.145	p<0.05 SIGNIFICANT
POST TEST	1.8	0.4					

The results are enlisted in the above table. The mean and standard deviation of short foot exercise: pre-test mean value is 3 and standard deviation value is 0 and post-test mean value is 1.8 and standard deviation value is 0.4. The calculated t value and tablet value were 7.7 and 2.145. The obtained t value is greater than table 't' value at 5% level of significance for 14 degrees of freedom.

Table – 6: UNPAIRED t TEST USED FOR BETWEEN GROUP ANALYSIS – CLARK'S METHOD.

TEST	MEAN	S D	t-VALUE	Df	N	TABLE t- VALUE	P-VALUE
PRE TEST GROUP A	12.7	3.6	0	28	30	2.048	p>0.05 NOT SIGNIFICANT
PRE TEST GROUP B	12.7	0.4					
POST TEST GROUP A	39.4	3.6	6.5	28	30	2.048	P<0.05 SIGNIFICANT
POST TEST GROUP A	30.9	2.7					

The results are enlisted in the above table. Pre-pre comparisons mean values were 12.7 and 12.7 and post-post comparison mean values were 39.4 and 30.9 respectively. The calculated t value and tablet value were 0 for pre-pre comparison. The obtained t value is lesser than tablet value at 5% level of significance for 14 degrees of freedom. Calculated t value was 6.5 for post-post comparison. The obtained t value is greater than tablet value at 5% level of significance for 14 degrees of freedom.

Table -7: UNPAIRED t TEST USED FOR BETWEEN GROUP ANALYSIS – FEISS LINE TEST:

TEST	MEAN	S D	t-VALUE	Df	N	TABLE t- VALUE	P-VALUE

PRE TEST GROUP A	3	0	0	28	30	2.048	p>0.05 NOT SIGNIFICANT
PRE TEST GROUP B	3	0					
POST TEST GROUP A	1.4	0.4	2.5	28	30	2.048	P<0.05 SIGNIFICANT
POST TEST GROUP A	1.7	0.4					

The results are enlisted in the above table. Pre-pre comparisons mean values were 3 and 3 and post-post comparison mean values were 1.4 and 1.7 respectively. The calculated t value and tablet value were 0 for pre-pre comparison. The obtained t value is lesser than tablet value at 5% level of significance for 14 degrees of freedom. Calculated t value was 2.5 for post-post comparison. The obtained t value is greater than tablet value at 5% level of significance for 14 degrees of freedom.

DISCUSSION:

Pesplanus also known as flat foot is the loss of the medial longitudinal arch of the foot, heel valgus deformity, and medial talar prominence. The aim of the study was to determine the effectiveness of short foot exercise along with kinesio taping on improving medial longitudinal arch among people with acquired flat foot.

The following studies also supports the resultant of this present study. DA-BEE LEE, et al. (2021) did study on Effects of Foot Intrinsic Muscle and Tibialis Posterior Strengthening Exercise on Plantar Pressure and Dynamic Balance in Adults Flexible PesPlanus. 16 young flexible pesplanus adults (7 males, 9 females) were recruited and were randomized into two groups. The experimental group performed foot intrinsic muscle and tibialis posterior muscle strengthening training, the control group performed only foot intrinsic muscle strengthening training. All groups received strengthening training for 30 minutes five times a week for six weeks. The results of this study provide evidence to suggest that foot intrinsic muscle and tibialis posterior muscle of extrinsic muscle strengthening exercises may improve plantar

pressure distribution and dynamic balance ability in adults with flexible pes planus.

WAYNE JOHNSON, et al., (2021) did study on Effect of Foot Strengthening Exercise on Dynamic Function of the Medial Longitudinal Arch in Runners. Thirty-four recreational runners (17 males, 17 females) have completed this ongoing study (age 24.06 +3.61 years, body mass 68.63 +12.95 kg, and height 173.34 ± 9.54 cm). To date, 22 subjects have been assigned to the control group (8 weeks of normal running) and 12 to the foot strengthening group (8 weeks of foot strengthening, along with normal running). His results concluded that the foot strengthening group with an initial DAD of 2 3.80 mm ($p < .028$). There was also a statistically significant increase in SAH in the foot strengthening group compared to the control group ($p = .013$)

The resultant of these studies might be due to the following mechanism of short foot exercise and kinesiotaping. Short foot exercises involve trying to pull the first metatarsal head towards the calcaneus without flexing the toes. Previous researches demonstrated that SFE is effective in increasing the strength of intrinsic muscles in flexible pesplanus, enhancing foot posture and function, reducing aquid flat foot in healthy population.

The application of KT has been suggested to result in an improvement in muscle contractility by supporting weakened muscle, decreasing inflammation and pain by increasing lymph and blood flow, and increasing the range of motion of the joint by adjusting the misalignment of muscle fibres, myofascia and joints. Kinesiotaping when applied to the skin with minimal tension creates convolutions under the skin which in turn increase the space under the skin to promote healing and channelize the flow of fluids away from and into the affected area to promote healing of an injured tissue. This forms the basis of healing process in the acute phases of rehab.

LIMITATIONS:

- Size of the sample was very small.
- The study duration was short duration.
- Patient was not instructed to do home exercise in this study.
- Follow up study was not done

SUGGESTIONS:

- Greater number of subjects can be included in the study
- Further studies can be done with long treatment duration.

- A larger sample size is required to establish the effect of treatment.
- Congenital Flatfoot can also be included.
- Further study needed with comparison on other intervention in pesplanus patient to show higher effect.

CONCLUSION:

The pre- test and post-test values were evaluated by Clark's method and Fiess line test. Paired t test used for with group analysis. The obtained t value is greater than tablet value at 5% level of significance in Group A and B. un paired t test used for between group analysis. In pre-comparison. The obtained t value is lesser than tablet value at 5% level of significance for 14 degrees of freedom. In post-post comparison. The obtained t value is greater than tablet value at 5% level of significance for 14 degrees of freedom. The study concludes both groups were significantly improved but compared that short foot exercises along with kinesiotaping significant improvement in the group A than group B.

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