

EFFECTIVENESS OF SHORT FOOT EXERCISES ALONG WITH KINESIOTAPING ON MEDIAL LONGITUDINAL ANGULATION IN ACQUIRED FLAT FOOT SUBJECTS

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ABSTRACT

Background of the Study

Flat foot is a deformity that is becoming common nowadays. *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 prevalence of flexible flatfoot among Indian adults is 13.6%. For males it is 12.8% and females it is 14.4%. Thus, flatfoot is a common deformity in adults. 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

This study design is a simple experimental study, 15 subjects with acquired flat-foot were selected for this study. It is a Convenient sampling and sample size; subjects with the age range between 18-25 years were enrolled for this study. Participants were given short foot exercises with kinesio taping. The group will receive intervention 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.

Result

The mean and standard deviation of short foot exercise pre-test values are 11.06 and 3.83 and post-test values are 30.93 and 2.73 respectively. The calculated *t* value and table value were 3.75 and 2.145. The obtained *t* value is greater than table value at 0.05 level of significance for 14 degrees of freedom.

Conclusion

This study concluded that the short foot exercise along with kinesio taping seemed to be beneficial for improving acquired flat foot.

KEYWORDS: *Pes Planus, Flat Foot, Clark's Method, Short Foot Exercise, Kinesio Taping*

Article History

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INTRODUCTION

In the process of man's evolution, changes in the use of the hands and feet began when original homo-sapiens adopted ground life as an upright biped position and the function of locomotion were gradually transferred from the arms and hands to the legs and feet. The biped position with the consequent freeing of the front paws to be used in prehensile activities was a preliminary condition to the development of the brain and its mental processes.⁽¹⁾

Vertical terrestrial biped position has made the human body not only more vulnerable to the forces of gravity in maintaining the balance, but also to other possible weakness such as poor circulation leading eventually to heart failure, varicose veins, hernia, defective feet, back pain, sinus trouble, excessive curvature of the spine.⁽²⁾

There are various types of postural defects which may vary from mild to severe in degree. Some of the defects affect the spine and others involve the lower extremities. The most common postural defects of the lower extremities are knock knees, bow leg and flat feet. In the lower extremity deformities, flat foot is common deformity in adults.

The human foot is a complex, multi-joint system which determines the critical interaction between the lower limbs and the ground during locomotion. Human feet are a specialized structure. It is the base of human body and support all the body weight like a foundation. It is a unique structure composed of bone supported by muscle with tendons and ligaments arranged in specialized form. The foot has three such arches, which are present at birth: the medial longitudinal, the lateral longitudinal arch is the largest and clinically the most important.⁽³⁾

In the process of man's evolution, changes in the use of the hands and feet began when original homo-sapiens adopted ground life as an upright biped position and the function of locomotion were gradually transferred from the arms and hands to the legs and feet. The biped position with the consequent freeing of the front paws to be used in prehensile activities was a preliminary condition to the development of the brain and its mental processes.

Pes Planus 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.⁽⁴⁾ In lay term, it is a fallen arch of the foot that caused the whole foot to make contact with 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.⁽⁵⁾ 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.⁽⁶⁾

METHODOLOGY

Study Design

All those patients with acquired flat foot visiting the department of physiotherapy and outpatient department of PPG college of physiotherapy were selected for this study. 15 subjects with acquired flat foot were selected. The criteria adopted to include the subjects with acquired flat foot consist of: Age group between 18-25 years, Gender- both male and female, Clinical diagnosed acquired flat foot patients were selected, Patient who has positive sign in Jack test is positive. Exclusion criteria: Those who have history of any surgery or fracture in the foot People with rigid or congenital flat foot, People with deep vein thrombosis, People with severe intolerance to exercise.

METHODS

This study design is a simple experimental study, 15 subjects with acquired flat-foot were selected for this study. It is a Convenient sampling and sample size; subjects with the age range between 18-25 years were enrolled for this study. Participants were given short foot exercises with kinesio taping. The group will receive intervention 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.

Treatment duration was 7 weeks

Number of sessions/day: 2 sessions/day for 3 days

Number of day/ weeks: 3 days/week for 7 weeks

1 session: 20 minutes

DESCRIPTION OF TECHNICAL INTERVENTION

Short Foot Exercise

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 pes planus, enhancing foot posture and function, reducing acquired flat foot in healthy population.⁽²²⁾

Kinesio Taping

Kinesio taping (KT) is a air-permeable and water resistant and can be worn 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.

Mechanism of action-Kinesio tape 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. Application and different tape tensions there after change to modulate the body healing mechanisms while still giving it a protected environment to avoid further damage and enhance tissue healing and correct function. Kinesio taping is gaining increasing popularity and is being used as a tool of choice in the treatment of many clinical conditions.⁽²³⁾ 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, carpal tunnel syndrome, bursitis, lymphedema menstrual pain, pregnancy related back pain, headaches, malfunction of patella, ligament and meniscal injuries, sinus pain etc

RESULT

The mean and standard deviation of short foot exercise pre-test values are 11.06 and 3.83 and post-test values are 30.93 and 2.73 respectively. The calculated t value and tablet value were 3.75 and 2.145. The obtained t value is greater than tablet value at 0.05 level of significance for 14 degrees of freedom.

Table 1: Descriptive Statistics of Demographical Data

S. NO.	AGE GROUP	GENDER		TOTAL
		MALE	FEMALE	
1.	18-20	2	2	4
2.	21-23	3	2	5
3.	24-25	2	4	6

Table 2: Within the Group Analysis of Short Foot Exercise with Kinesio Taping

TEST	MEAN	STANDARD DEVIATION	t- VALUE	TABLE t- VALUE	P-VALUE
PRE TEST	11.06	3.83	3.75	>2.145 significant	p<0.05 SIGNIFICANT
POST TEST	30.93	2.73			

The results are enlisted in the above table. The mean and standard deviation of short foot exercise with kinesio taping: pre-test mean values 11.06 and 3.83 and post-test mean values are 30.93 and 2.73 respectively. The calculated t value and tablet value were 3.75 and 2.145. The obtained t value is greater than tablet value at 0.05 level of significance for 14 degrees of freedom.

The null hypothesis is rejected and alternate hypothesis is accepted. Hence, the statistical report states that there were significant improvements in angle of the foot after short foot Exercises with kinesio taping.

DISCUSSION

The human foot is a complex, multi-joint system which determines the critical interaction between the lower limbs and the ground during locomotion. Human feet is a specialized structure. It is the base of human body and supports all the body weight like a foundation. It is unique structure composed of bone supported by muscles with tendons and ligaments arranged in specialized form. The foot has three such arches, which are present at birth: the medial longitudinal, the lateral longitudinal and the transverse arches. Among the three arches, the medial longitudinal arch is the largest and clinically the most important.

Pes planus also known as flat foot is the loss of the medial longitudinal arch of the foot, heel valgus deformity, and medial talar prominence. In lay terms, it is a fallen arch of the foot that caused the whole foot to make contact with 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 flat foot and rigid flat foot. 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.

The aim of the study was determine the effectiveness of short foot exercise along with kinesio taping on improving medial longitudinal arch among people with acquired flat foot.

Mechanism of Short foot exercise: 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 pes planus, enhancing foot posture and function, reducing acquired flat foot in healthy population.

Mechanism of kinesio taping: Kinesio taping (KT) is a air-permeable and water resistant and can be worn 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.

Mechanism of action-Kinesio tape 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. Application and different tape tensions there after change to modulate the body healing mechanisms while still giving it a protected environment to avoid further damage and enhance tissue healing and correct function. 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, carpal tunnel syndrome, bursitis, lymphedema menstrual pain, pregnancy related back pain, headaches, malfunction of patella, ligament and meniscal injuries, sinus pain etc...

According to EUN-KYUNG KIM, et al., (November 2022): He conducted study on The effects of short foot exercise and arch support insole on improvement in the medial longitudinal arch and dynamic balance of flexible flat foot patient The 14 university students with flexible flat foot were selected by conducting randomly assigned to a short foot exercise group of seven subject and an arch support group of seven subject. His result concluded that to improve flat foot applying short foot exercise was more effective then applying arch support insole in terms of medial longitudinal arch improvement and dynamic balance ability according to DA-BEE LEE, et al., (2021):He did study on The 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.

According to WAYNE JOHNSON, et al.,(2021) He did study on The 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 2.380 mm ($p < .028$). There was also a statistically significant increase in SAH in the foot strengthening group compared to the control group ($p = .013$)

This present study states that in 7 weeks of short foot exercise program, there was improvement in alignment of weight shift and muscle structure which help in movement and to recover from flat foot.

Due to the inward twisting of the tibia and femur, there will be stress on the knee. Which causes hyperextension of the knee. The Medial Longitudinal Arch was collapsed. Degeneration of Posterior Tibialis Tendon, tightening of calf muscles, tendon dysfunction leads to secondary damage of the spring ligament and talocalcaneo ligament. During walking or running, the balance and stability decrease which leads to the reduced endurance. The reduced lateral core endurance could be explained by the weakness of hip abductors observed in flatfoot subjects. The hip abductors act to stabilize the pelvis, so that prevent pelvic drop during single stance (Trendelenburg sign). Hip abduction weakness could result in an increased firing of the lateral trunk stabilizer. The increased firing could probably cause muscle fatigue over time.

Thus, the resultant of the study showed that the pre-test and post-test values of subjects of Flat foot accepted the alternative hypothesis. Short foot exercise with kinesio taping shows significant improvement on acquired flat foot. Statistical analysis is also evidence for significant improvement.

LIMITATIONS

- Size of the sample was very small.
- The study duration was short duration.
- Patient was no instructed to do home exercise in this study.
- The outcome was measured by Clark's method.

CONCLUSION

Study concludes that short foot exercises along with kinesio taping improves the condition of flat foot. Thus, the study accepts the alternate hypothesis and rejects the null hypothesis.

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AUTHOR'S CONTRIBUTION

I understand my agreement to participation in this study and I am not waiving any of my legal rights. I confirm that Ms. JIBINA BENNY/MRS.G.KARTHIKA, MPT ASSOCIATED PROFESSOR have explained me the purpose of study, the study procedure and possible risk that I may experience. I have read and I have understood this concern to participate as a subject in this study.

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