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Effect Of Foot Strengthening Exercises With Kinesiotaping On Tibiofemoral Angle Amongst College Going Students With Flexible Flat Foot - An Experimental Study

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ABSTRACT

BACKGROUND: Pes planus is a lowering of the medial longitudinal arch of the foot, often known as flat foot because the navicular bone moving inwards and downwards from the subtalar joint .In genu varum (bow leg), the Tibiofemoral angle is increased where as in genu valgum (knock knee) this angle is decreased.

AIM: To study the effectiveness of foot strengthening exercises with kinesiotaping on tibiofemoral angle amongst college going students with flexible flat foot.

METHODOLOGY: Participants were briefed about the nature of the study and intervention. Their informed written consent was taken. 59 participants were selected based on the selection criteria. Prior and after the treatment the outcome measures that is NDT And TFA measurement were taken. The intervention protocol was given for 5 days in a week for total four weeks. Statical analysis was done and results were tabulated.

RESULT: Statistical analysis for group was done using by Wilcoxon test. kinesio taping along with strengthening exercises is having significant effects on NDT and TFA in flexible flat foot. The final analysis proves that it is clinically significant (p value is <0.05). It justifies the improvement in health outcome post intervention.

CONCLUSION : The study concluded that the kinesio taping along with strengthening exercises are effective in flat foot with genu valgum subjects. So, it can be implemented clinically as well**.**

Clinical Implication : Given the significant improvements in navicular drop and tibiofemoral angle measurements, clinicians can expect that implementing these interventions may lead to better alignment and function of the lower limbs, potentiall reducing the risk of knee and lower limb issues associated with pes planus,it may be beneficial for clinicians to incorporate this technique into rehabilitation programs.

INTRODUCTION

The arch is defined as a segmental elevation of the foot composed of several ligaments, muscles, and bone articulations. Pes planus is a lowering of the medial longitudinal arch of the foot, often known as flat foot because the navicular bone moving inwards and downwards from the subtalar joint [2,16]

Pes planus is classified into two types: flexible and rigid. A flexible pes planus has a normal arch in the non-weight bearing condition of the foot and a lowered arch in the weight bearing condition. Rigid pes planus, also known as structural pes planus, is a fixed lowering of the arch.[16]

The prevalence of flat foot in college students was 20% when the navicular drop test was used, and 5.61% when the medial longitudinal arch angle was measured.[3]

There is a functional connection between foot arches and lower limb biomechanics. Coronal plane abnormalities of the lower extremity include genu valgum, also known as knocked knees.[2]

Tibiofemoral angle is defined as the angle formed between both anatomical axes of femur and tibia. If the anatomical axis is between 5° and 7° valgus (approximately 6° valgus), it is deemed normal. Valgus deformity would be greater than 7°, while varus deformity would be less than 5° [16]

There is a biomechanical alteration in the state of the pes planus foot, which is foot alignment that shifts towards overpronation, putting greater strain on the vastus medialis than normal feet due to weakening plantar flexor muscles produce lateral ankle group muscular stiffness so that the lateral ankle will be pulled up with higher force in order to be transferred to the medial ankle, causing the tibia and the femur rotates to the medial region, resulting in hip adduction. Because of weakened plantar flexor muscles, which will cause tightness in the lateral angle group muscles so that the lateral ankle will be lifted up with greater pressure to be distributed to the medial ankle, causing the tibia and femur to rotate to the medial side. This condition causes the muscles surrounding the knees and legs to work harder in order to keep the body steady. As the foot arches flatten on the ground, the tibia and femur rotate inwards, putting strain on the knee.[2]

In genu varum (bow leg), the Tibiofemoral angle is increased where as in genu valgum (knock knee) this angle is decreased.[14] Toe Raising Test: A toe raising test was conducted under a physical examination of all the subjects. The purpose of this test to check the flexibility of Pes planus[17] Navicular drop test: which measures the navicular height from the ground to assess the flexible flat foot.[1]

The study found that kinematic tape on flexible flat feet had a good effect on lowering abnormally high foot pressure as well as tone and stiffness in the lower extremity muscles. To minimize further complications.[1]

KENZO KASE defined the mechanism of effects of kinesio taping as follows: it alters muscle function by acting on weakening muscles, it reduces pain by neurological suppression, and it repositions subluxed joints.[1] Kinesio tape is intended to imitate the mechanics of human skin. Kinesio tape is gentle on the skin's epidermis and can be stretched from its resting length. [1]

Hence,strengthening exercises with k-taping were effective on navicular drop height in functional flat foot.[1]

OBJECTIVES

1. To study the effect of k taping with foot strengthening exercises for flexible flat foot by using navicular drop test in college going students.
2. To study the effect of kinesio taping with foot strengthening exercises on tibiofemoral angle by using goniometry in college going students with flexible flat foot.
3. To differentiate the flexible flat foot and rigid flat foot by using toe raising test.

HYPOTHESIS

NULL HYPOTHESIS:

There will be no significant difference between foot strengthening exercises with kinesiotaping on tibiofemoral angle among college going students with flexible flat foot.

ALTERNATE HYPOTHESIS:

There will be significant differences between foot strengthening exercises with kinesiotaping on tibiofemoral angle among college going students with flexible flat foot.

REVIEW OF LITERATURE

1. **Pooja patil et al (2019)** Flat feet are also referred to as pes planus or fallen arches. The medial longitudinal arch of the foot, which extends lengthwise along the sole, can be flattened due to intrinsic muscle weakness, ligmentous laxity, or other causes. The study's purpose is to assess the efficacy of kinesio taping as an adjuvant to strengthening activities in functioning flat feet aged 18 to 30 years. Methods: Thirty students were selected based on inclusion criteria and divided into two groups. Group A received strengthening exercises while Group B received kinesio taping along with the strengthening exercises for 4 weeks. The values of the navicular drop test were obtained before and after 4 weeks of treatment. Statistical analysis was conducted and findings were collected. Results: Both groups demonstrated improvement in navicular height post treatment, but the more statistically significant result was obtained in Group B persons treated with kinesio taping together with strengthening activities. Conclusion: The study indicated that kinesio taping combined with strengthening

exercises was more efficient in improving navicular height in functioning flat feet aged 18 to 30 years.

2. **Nagendrappa MS and Suchith Kumar NS et al (2021)** Pes planus deformity of the feet affects lower limb biomechanics and changes the tibiofemoral angle of the knee. There is limited evidence that connects pes planus to genu valgum in young adults, so this study focuses on the correlation between the two. The purpose of this study is to evaluate the relationship between pes planus and genu valgum in young people. Methodology: including inclusion and exclusion criteria. 40 patients with flat feet were assessed using the navicular drop test and tibiofemoral angle was measured with a 360-degree goniometer. Data was recorded in a data collecting form. Results: The correlation between ND[R] and TFA[R] is -0.07921204, indicating that the relationship is negatively weak, and that the variables are moving in opposite directions. The correlation between ND[L] and TFA[L] is 0.005061076, indicating that the relationship is positively weak; also, the variables are moving in the same direction. Conclusion: According to statistical analysis, increasing right pes planus causes a decrease in right genu valgum, while increasing left pes planus causes an increase in left genu valgum.

3. **Khadanga G B and kumar P et al (2022)** conducted a study to see the use of medial longitudinal arch angle and navicular drop evaluation techniques to determine the prevalence of flat feet in college going students between the ages of 18 and 25. Method:205 volunteers (116 male and 89 female) were assessed for flat foot using navicular drop test and medial longitudinal arch angle measurement with an age range of 18-25 years. The navicular drop of $\geq$ 10mm and medial longitudinal arch angle of $<$ 130° were considered flat feet. They Concluded that the prevalence of flat foot in college-going students was 20% when using the navicular drop test whereas 5.61% when using medial longitudinal arch angle measurement. 4) So-yeon Kim and Jung-eun Yoo et al (2019) conducted a study on intra-and inter-rater reliability of the navicular drop test in different postures. Methods: Forty healthy volunteers performed the navicular drop test in three different combinations of non-weight-bearing and weight-bearing postures (standing/standing, sitting/sitting, and sitting/standing. Therefore, the sitting/standing and sitting/sitting postures are recommended for use in navicular drop tests to diagnose flat feet.

4. **J.Karthikeyan and kshatrashal singh et al (2020)** Conducted a study to compare the effectiveness of taping and arch support on the flexible flat foot. method: Total of 30 participants of both the gender, age between 18 to 30 years, each 9 participant will undergo pre-test and post-test screening for an assessment of Body Mass Index (BMI), ROM, pain, physical examination, and Staheli Arch Index. Later the participants will be divided into two groups by a convenient sampling method. Group A participants will undergo exercises related to strengthening of foot muscles along with non-allergic taping technique while Group B participants will undergo exercises related to the strengthening of foot muscles along with medial arch support. conclusion: concluded that the application of Kinesio tape to flat feet was an effective intervention method for immediately reducing abnormally increased foot pressure and tone and stiffness in the lower extremities muscles and considered to be the most effective intervention for subjects with flat foot.

5. **Paramjeet Kaur, Ninderpreet Kaur et al (2018)** Conducted a study on effect of taping on flexible flat foot they state that there are Interventions to correct excessive pronation include taping, prescription of orthotics and corrective exercises programme. Therefore, the purpose of the study is to describe the outcome for a series of patient with Flexible Flat Foot who will be treated with Physical therapy treatment program, given by the researcher. Method: The Study sample included 50 subjects of age group18-28years. Subjects were then asked to sign the Consent form and gave their will regarding being enrolled in the study. During the assessment, subjects were assessed by the Staheli's Arch Index. Assessments were done as per the Assessment form. All the patients were received total intervention for 24 hrs. The patients were assessed at baseline and after 24 hrs. Conclusion: The present study has concluded that taping is effective for 24 hrs in the management of flexible flat foot.

METHODOLOGY

- Type of study: Experimental study
- Type of sampling: Purposive sampling
- Study design: pre and post experimental study
- Sample size: 59
- Study duration: 6 months
- Study setting: Colleges in Miraj.

MATERIALS

- Consent form
- Goniometer
- Paper
- Measuring tap
- Kinesio tape

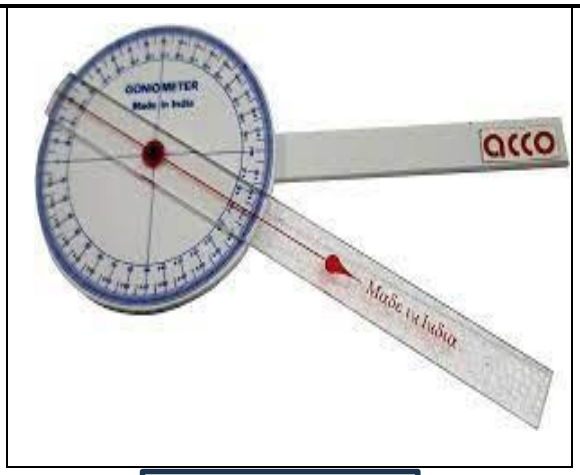


Figure No.1

Figure No. 2

Figure No. 3

INCLUSION AND EXCLUSION CRITERIA

INCLUSION CRITERIA

1. Age: 18-30 years
2. Both male and female
3. Flexible flat foot
4. Navicular drop test- >10 mm of drop
5. Unilateral and bilateral flat foot
6. Tibiofemoral angle- > 7˚

EXCLUSION CRITERIA

1. Any lower limb injury
2. Healing fracture of lower limb
3. Any neuromuscular disorders
4. Recent surgery
5. Any open wound
6. Skin infection

OUTCOME MEASURES

1. **Navicular drop test:**

Reliability- (ICC=0.83 to 0.95)

To measure the navicular height, navicular drop test was performed with the help of a thick white index card. It was placed parallel to the subject's feet (maintained in a subtalar neutral position) inner aspect of the hindfoot, with the card placed from the floor in a vertical position passing the navicular bone. The level of the most prominent point of the navicular tubercle was marked on the card and the floor was measured during sitting and standing. If navicular height is decreases by 10 mm in standing when compared to sitting position then individual is having functional flat feet and can be included in the study

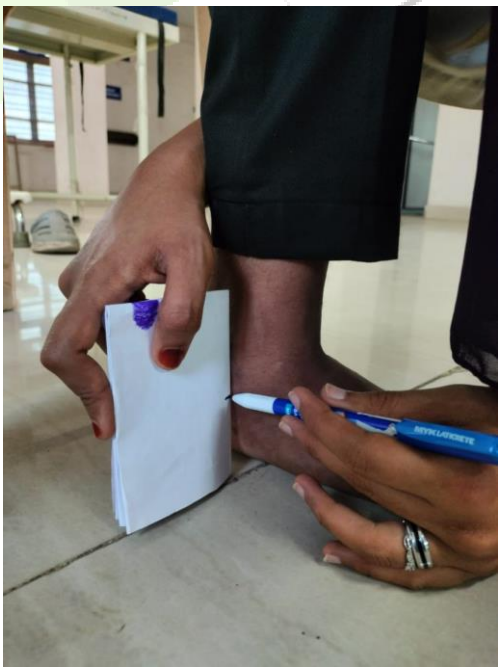


Figure No. 4

2. Tibiofemoral angle measurement:

Reliability- (ICC=0.87)

Tibiofemoral angle measurement (TFA): - Bilateral TFA were measured with subjects in supine position, the hips and knees were extended, the patella facing vertically upward, and limb positioned in straight line. One arm of the goniometer was aligned to an imaginary line drawn from the anterior superior iliac spine to the middle of the patella (femoral alignment). The second arm was aligned to a line joining the middle of the patella to the middle of the ankle (centre point between medial and lateral malleoli). The centre of patella served as fulcrum for the goniometer. The TFA recorded in degrees. If the anatomical axis is between 5° and 7° valgus (approximately 6° valgus), it is deemed normal.Valgus deformity would be greater than 7°, while varus deformity would be less than 5°.

Figure No. 5

3. Toe raising test:

The purpose of this test to check the flexibility of Pes planus. The test was performed with the patient weight-bearing, while the therapist dorsiflexes the hallux. Positive result: (arch formation) from the flat foot being flexible. Negative result: (lack of arch) from the flat foot being rigid.

PROCEDURE

ETHICAL COMMITEE CLEARANCE

⇩

SCREENING WAS DONE ACCORDING TO INCLUSION AND EXCLUSION CRITERIA

⇩

PARTICIPANTS INCLUDED AND EXPLANATION OF THE INTERVENTION IN VERNACULAR LANGUAGE

⇩

WRITTEN CONSENT WILL BE TAKEN FROM THE SUBJECTS

⇩

PRE INTERRVENTION AND POST INTEVENTION ASSESSMENT USING NAVICULAR DROP TEST AND TIBIOFEMORAL ANGLE.

⇩

K-TAPING FOR FLAT FOOT GIVEN FOR 4 CONSECUTIVE WEEKS (CHANGED EVERY 5 DAYS) AND FOOT STRENGTHENING EXERCISES FOR 20-25 MINS/DAY FOR 5 DAYS FOR 4 CONSECUTIVE WEEKS

⇩

1.Towel crawl	(for 1-2 mins)
2.Picking up small objects	(for 1-2 mins)
3.Abduction and adduction of digits	(10 reps with 3-5 sec hold , 2 sets)
4.Great toe press	(10 reps with 3-5 sec hold , 2 sets)
5.Small toe abduction	(10 reps with 3-5 sec hold , 2 sets)
6.Tapping the toes	(20-25 reps, 2 sets)
7.Key piano	(for 3-5 min, 2 sets)
8. Heel raises	(10 reps with 10 sec hold,1set)
9. Calf stretch	(2 reps with 30 sec hold,1set)

PROTOCOL

- **Procedure for application of kinesio tape:**

The subject's skin was checked for sensitivity one day prior to the application of taping. A part of the tape was applied over the lower leg posterior aspect and next day the area was examine for irritability, redness and blisters only those nonallergic individuals are included for the study.

Subjects were made to lie in the prone position with knee flexed at 90 degrees. Foot was placed in subtalar neutral position, minimal inversion and neutral dorsiflexion. Taping was done in prone with 4 "I" tapes, 2 inches wide

The first piece of tape was applied on the plantar aspect starting from metatarsal head to calcaneum

Figure No. 6

The second piece of tape was anchored on the lateral midfoot and then diagonally under calcaneus and medially around posterior ankle. This piece of tape helped to maintain calcaneus in a more neutral position and limit calcaneal eversion.

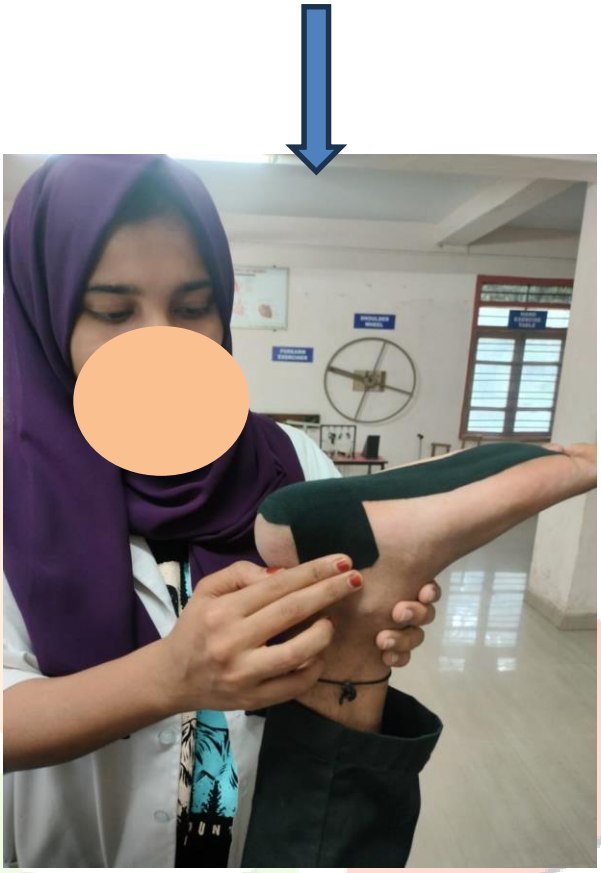


Figure No. 7

The third piece of tape was anchored on medial midfoot and brought diagonally under calcaneus and laterally around posterior ankle which assisted to “lock” calcaneus in position or “close the loop” for sensory input.

Figure No. 8

The fourth piece of tape extended from the lateral midfoot, over navicular and up the medial distal third of the lower leg, just above the malleolus which supported the midfoot.

Figure No. 9

➢ **Strengthening exercises with kinesiotaping**

Towel Crawl

Figure No. 10

Picking up small objects

Figure No. 11

Great toe press

Figure No.12

Small toe abduction

Figure No.13

Abduction of digits

Figure No.14

Adduction of digits

Figure No.15

Tapping the toes

Piano key

Figure No.13

Heel raises

Calf raises

STATISTICAL ANALYSIS

Shapiro-Wilk Tests of Normality

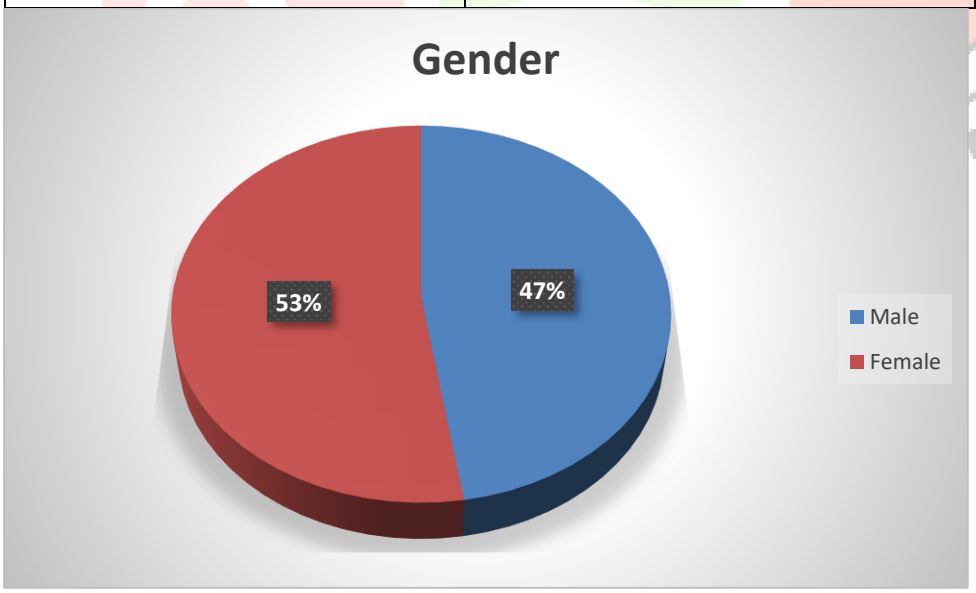
Table No.1

Variable	Time Frame	z-value	p-value
NAVICULAR DROP SCORE	Pre	0.867	0.000
	Post	0.917	0.001
TIBIOFEMORAL ANGLE MEASUREMENT	Pre	0.669	0.000
	Post	0.878	0.000

Statistical analysis were performed by using SPSS 23, and as the sample size is less than 2000 so Shapiro-Wilk test used to identify the normality and found data that do not follows normal distribution by ($P < 0.05$). Data set is not normally distributed as all the variables have not indicated p-value greater than 0.05 in the observation. The researcher shall use non-parametric test for data analysis purpose in the following sections. As the collected data is not normally distributed, to find out the effect within the group, paired sample Wilcoxon test is used. $P < 0.05$ considered as statistically significant in the study (CI 95%).

Table No.2

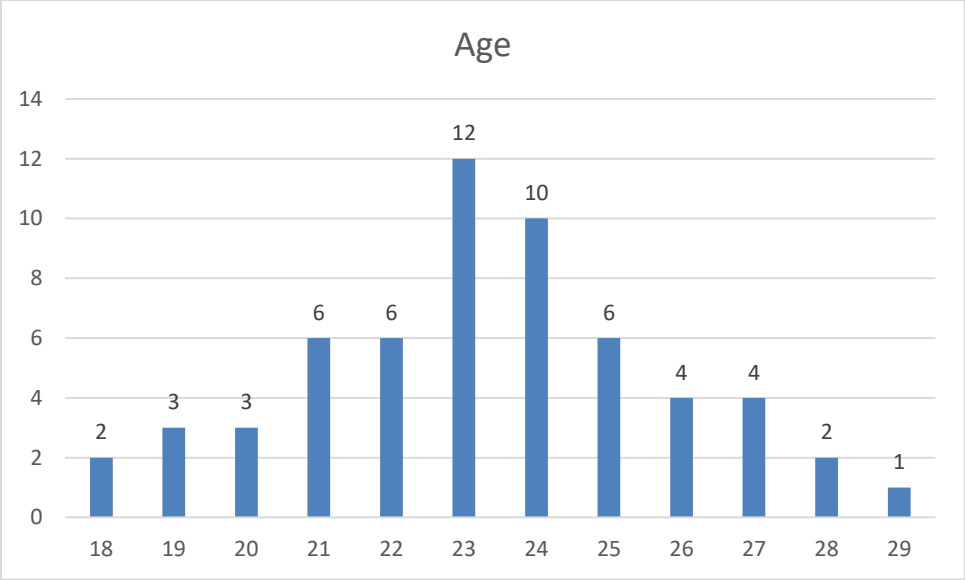
Gender	Frequency	Percent
Male	28	47
Female	31	53
Total	59	100.0



Graph 1**Age**	**Frequency**	**Percent**
18	2	3.4
19	3	5.1
20	3	5.1
21	6	10.2
22	6	10.2
23	12	20.3

Table No.3

24	10	16.9
25	6	10.2
26	4	6.8
27	4	6.8
28	2	3.4
29	1	1.7
Total	**59**	**100**

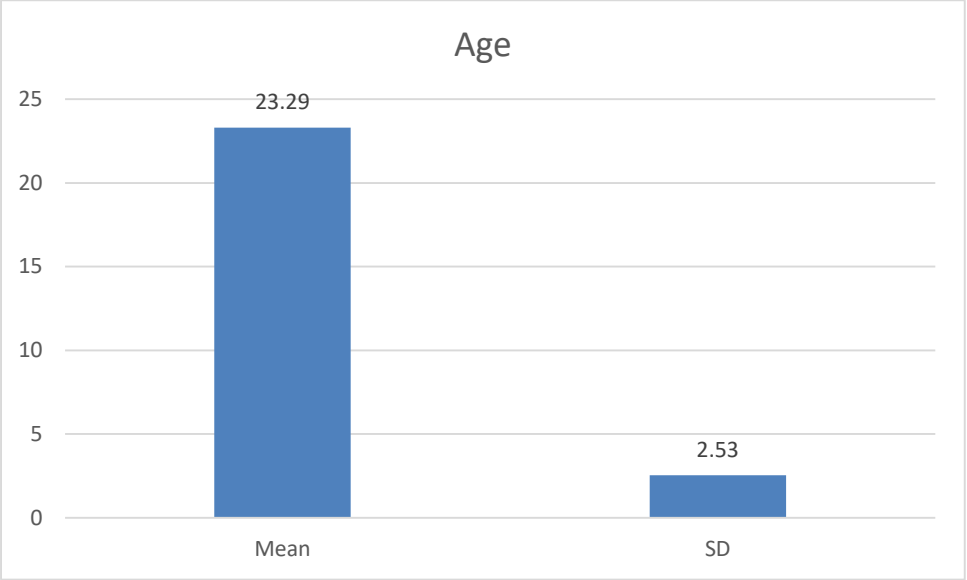


Graph 2

Descriptive Statistics

Table No.4

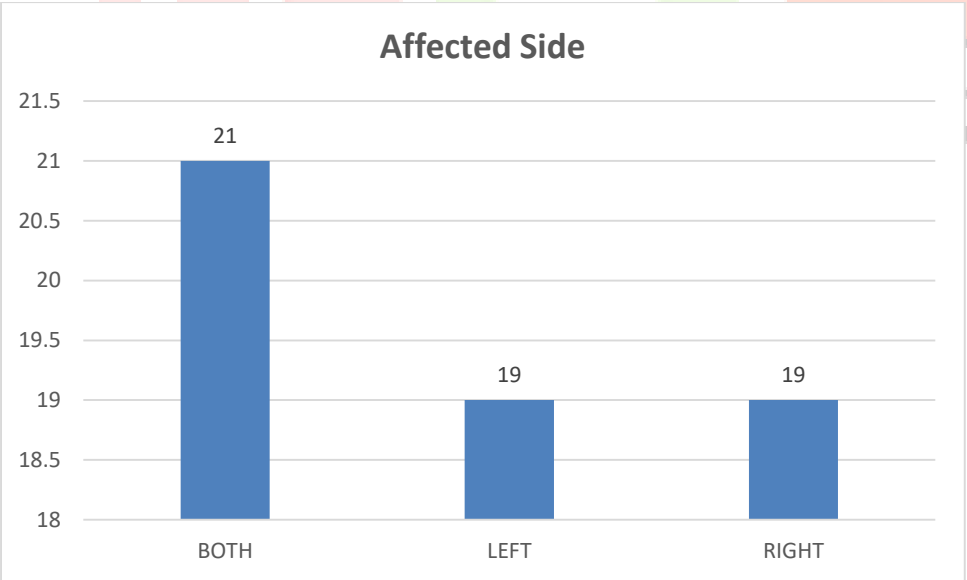
Variable	Minimum	Maximum	Mean	SD
Age	18.00	29.00	23.29	2.53



Graph 3

Table No.5

Affected Side	Frequency	Percent
BOTH	21	35.6
LEFT	19	32.2
RIGHT	19	32.2
Total	59	100.0



Graph 4

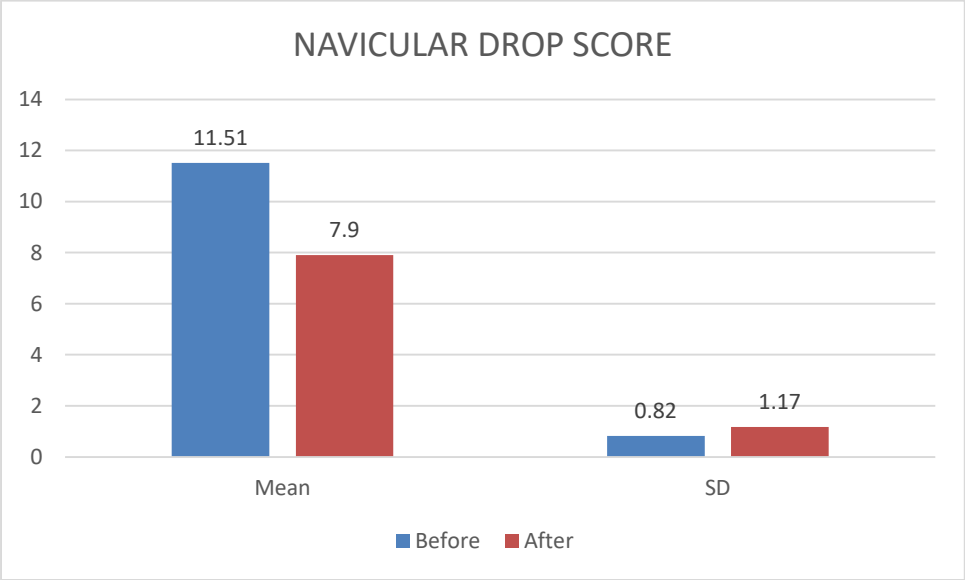
Within group Pre and post test

Comparison of pre-test and post-test of NAVICULAR DROP SCORE by paired sample Wilcoxon test

Table No.6

Times		Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Before		11.51	0.82	3.61	1.03	3.49	6.737	0.001*
After		7.90	1.17					

The mean value indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the limited consistency with post treatment value which is more to pre value. The effect size or Cohen's D indicates 3.49 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.



Graph 5

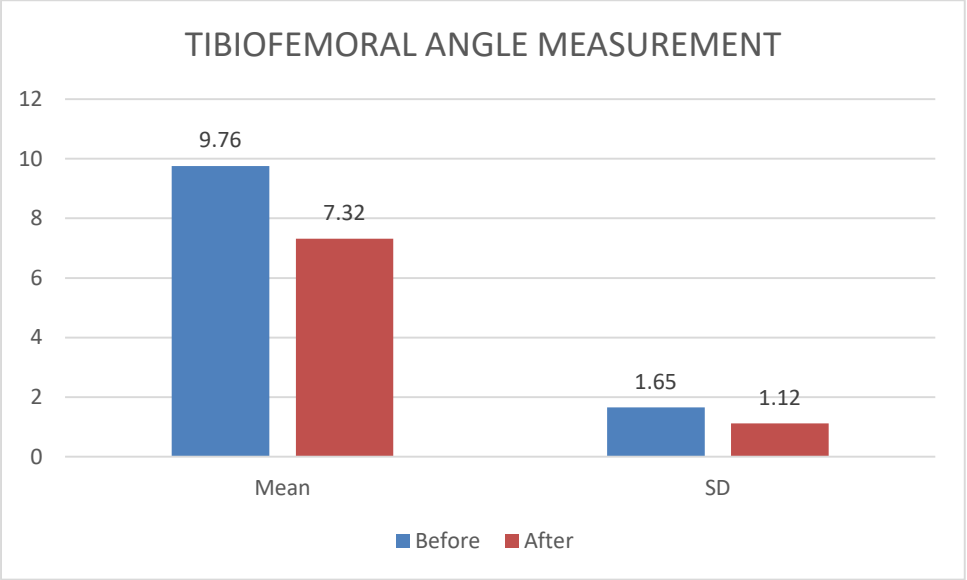
Within group Pre and post test

Comparison of pre-test and post-test of TIBIOFEMORAL ANGLE MEASUREMENT by paired sample Wilcoxon test

Table No.7

Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Before	9.76	1.65	2.44	1.92	1.27	6.146	0.001*
After	7.32	1.12					

The mean value indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less to pre value. The effect size or Cohen's D indicates 1.27 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention



Graph 6

DISCUSSION

The present study aimed to evaluate the effectiveness of foot strengthening exercises combined with kinesiotaping on the tibiofemoral angle in college students with flexible flat foot.

In this study individual were selected in age group of 18-30 years with an aim to provide them the best treatment to avoid further complications like plantar facitis, metatarsalgia, hallux valgus, achilis tendinopathy ,balance impairement.

59 subjects were taken according to inclusion and exclusion criteria**,** k-taping is given for 4 consecutive weeks (changed every 5 days) And Foot strengthening exercises for 20-25 mins/day for 5 days for 4 consecutive weeks. The outcome measures were navicular drop test to assess flat foot ,tibiofemoral angle for genu valgum and toe raising test to differentiate flexible flat foot. outcome measure were assessed pre-treatment, immediately after 1st session, after 1 week and after 4 weeks post treatment sessions.

There is only 1 group in this study by comparing pre and post test values of navicular drop subjects by paired t test showed that there was a significant difference with p value being 0.001 <0.05> and mean being 3.61 and z value is 6.737. And tibiofemoral angle of comparing of pre and post test values of subjects by paired t test showed a significant difference with p value being 0.001 <0.05> and mean being 2.44 and z value is 6.146.

The findings revealed significant improvements in both the navicular drop scores and the tibiofemoral angle measurements after the intervention, indicating that these combined approaches can positively impact foot and lower limb alignment.

corroborating findings from studies by **Patil et al.** and **Kaur et al.,** who noted similar improvements in navicular height and overall foot function when kinesiotaping was applied alongside strengthening exercises. In our study, the participants who received kinesiotaping in conjunction with foot strengthening exercises exhibited more pronounced improvements compared to those who did not receive kinesiotaping.

Moreover, the changes in tibiofemoral angle measurements suggest that enhancing the strength and stability of the foot can influence knee alignment. This is particularly relevant given that an increased tibiofemoral angle is associated with a higher risk of developing knee-related issues, such as pain and instability. The reduction in angle post-intervention indicates that targeted strengthening can mitigate some of the adverse effects associated with flat foot. This suggests that kinesiotaping may not only provide mechanical support but also enhance proprioception and muscle activation, further stabilizing the foot and ankle during weight-bearing activities.

The significant reduction in the tibiofemoral angle observed post-intervention indicates a direct correlation between foot alignment and knee positioning. An increased tibiofemoral angle is commonly associated with knee-related complications, including pain and instability. The results suggest that strengthening exercises focused on the intrinsic muscles of the foot, combined with kinesiotaping, can lead to better alignment and function of the knee joint. This aligns with findings from **Nagendrappa et al.,** who noted a connection between pes planus and genu valgum in young adults, underscoring the importance of addressing foot mechanics to improve knee alignment.

This study reinforces the effectiveness of combining foot strengthening exercises with kinesiotaping in managing flexible flat foot and its associated tibiofemoral angle issues. The results advocate for targeted rehabilitation strategies that enhance foot function and alignment, thereby preventing complications in individuals with pes planus. This approach not only improves immediate outcomes but also contributes to long-term musculoskeletal health, underscoring the importance of comprehensive interventions in the prevention and management of lower limb disorders.

CONCLUSION

The present study concluded that strengthening exercises with kinesiotaping is statistically effective in improving genu valgum in subject with flat foot. In conclusion, this study highlights the effectiveness of combining foot strengthening exercises with kinesiotaping in improving navicular drop and tibiofemoral angle amongt college students with flexible flat foot. The findings indicate that these interventions can enhance foot biomechanics and lower limb alignment, potentially reducing the risk of related musculoskeletal issues. This approach not only supports better patient outcomes but also underscores the need for further research to refine treatment strategies for flexible flat foot conditions.

CLINICAL IMPLICATION

The study highlights the effectiveness of combining kinesiotaping with foot strengthening exercises for managing flexible flat foot. This suggests that clinicians should consider integrating kinesiotaping into rehabilitation programs for patients with flexible flat foot to enhance treatment outcomes.

Given the significant improvements in navicular drop and tibiofemoral angle measurements, clinicians can expect that implementing these interventions may lead to better alignment and function of the lower limbs, potential reducing the risk of knee and lower limb issues associated with pes planus.

The study provides valuable insights that can enhance clinical practice for managing flexible flat foot, improving patient outcomes, and fostering a comprehensive understanding of the condition's implications on lower limb biomechanics.

LIMITATIONS AND SUGGESTIONS

➢ Limitations

1. **Sample Size:** The study involved a relatively small sample size of 59 participants, which may limit the generalizability of the findings. A larger cohort could provide more robust data and insights.
2. **Short Intervention Duration:** The intervention lasted for only four weeks. While significant improvements were observed, longer follow-up periods may be necessary to assess the sustainability of these changes over time.
3. **Lack of Control Group:** The absence of a control group limits the ability to attribute changes solely to the intervention. Future studies could benefit from a randomized controlled trial design to better isolate the effects of kinesiotaping and strengthening exercises.
4. **Limited Assessment of Other Variables:** Factors such as body mass index (BMI), previous injuries, or activity levels were not controlled or assessed, which might influence the outcomes. Future research should consider these variables to provide a more nuanced analysis.

➢ Suggestions for Future Research

1. **Larger Sample Size:** Future studies should aim for larger sample sizes to improve statistical power and generalizability. Multi-center studies could also enhance diversity in participant characteristics.
2. **Long-term Follow-up:** Implementing longer follow-up periods (e.g., 6 months to a year) would help determine the longevity of the effects of kinesiotaping and strengthening exercises on foot and knee alignment.
3. **Exploration of Additional Interventions:** Investigating the effects of combining kinesiotaping and strengthening exercises with other interventions (such as orthotics or physical therapy modalities) could provide a broader understanding of effective treatment strategies for flexible flat foot.

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MASTERCHART

SR.NO.	AGE	GENDER	AFFECTED SIDE	NAVICULAR DROP SCORE		TIBIOFEMORAL MEASUREMENT		ANGLE
				PRE	POST	PRE	POST	
1	25	F	BOTH	13	9	10	7	
2	22	M	BOTH	10	7	11	10	
3	23	M	LEFT	12	9	8	6	
4	21	F	RIGHT	12	8	9	7	
5	19	F	BOTH	11	7	9	7	
6	24	M	LEFT	10	6	11	7	
7	21	F	LEFT	11	6	11	6	
8	23	F	RIGHT	11	9	12	10	
9	26	F	BOTH	12	8	10	7	
10	28	M	LEFT	13	10	9	7	
11	24	F	LEFT	12	8	9	7	
12	22	F	LEFT	12	8	10	6	
13	18	M	RIGHT	11	8	12	8	
14	25	F	BOTH	11	7	10	7	
15	24	M	BOTH	11	7	11	8	
16	24	F	BOTH	13	9	10	8	
17	27	M	BOTH	12	9	11	6	
18	29	F	RIGHT	12	8	10	8	
19	25	F	LEFT	11	7	10	6	
20	23	F	LEFT	12	7	9	6	
21	21	M	BOTH	11	8	10	8	
22	20	M	BOTH	11	10	12	10	
23	22	M	RIGHT	12	9	9	6	
24	24	M	RIGHT	10	7	10	7	
25	23	F	LEFT	13	10	12	9	
26	20	F	BOTH	12	8	10	7	
27	19	M	RIGHT	12	9	10	7	
28	26	F	RIGHT	12	8	11	9	
29	27	M	BOTH	12	8	10	9	
30	23	M	BOTH	11	7	10	6	
31	21	F	BOTH	11	6	11	5	
32	19	M	LEFT	12	9	11	7	
33	25	F	LEFT	12	7	9	7	
34	22	M	LEFT	10	6	10	7	
35	20	F	RIGHT	11	8	8	8	
36	18	M	LEFT	13	10	10	8	
37	22	F	BOTH	12	8	9	7	
38	25	M	RIGHT	11	7	10	8	
39	23	F	LEFT	11	6	12	7	
40	24	F	BOTH	11	8	9	10	
41	24	M	BOTH	12	8	10	6	
42	25	M	LEFT	12	7	10	7	
43	27	F	BOTH	13	9	12	6	
44	28	M	RIGHT	10	6	8	7	
45	23	M	RIGHT	11	6	9	7	
46	21	F	LEFT	11	7	9	7	
47	24	M	BOTH	12	7	10	7	
48	23	M	RIGHT	12	8	10	8	
49	27	F	RIGHT	12	8	9	6	
50	23	M	RIGHT	12	7	9	8	
51	21	F	BOTH	11	9	10	7	
52	23	F	LEFT	10	10	9	7	
53	26	F	RIGHT	11	10	9	9	

54	22	F	LEFT	11	9	9	7
55	24	M	RIGHT	12	9	10	8
56	23	M	RIGHT	11	8	10	7
57	26	F	LEFT	11	7	9	7
58	24	M	BOTH	12	8	10	7
59	23	F	RIGHT	11	7	9	8