"THE LONG TERM EFFECT OF SELECTIVE EXERCISE AND TAPING ON NAVICULAR DROP HEIGHT IN SUBJECTS WITH ITBS"

A RANDOMIZED CONTROLLED TRIAL

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In

ORTHOPEDICS

By

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Bhubaneswar, Odisha

2021-2023

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation entitled **THE LONG TERM EFFECT OF SELECTIVE EXERCISE AND TAPING ON NAVICULAR DROP HEIGHT IN SUBJECTS WITH ITBS** is a bonafide and genuine research work carried out by me under the guidance of DR. CHINMAYA KUMAR PATRA PRINCIPAL, Abhinav Bindra Sports Medicine And Research Institute, Odisha

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LIST OF ABBREVIATIONS USED

ITBS- Iliotibial band syndrome

SE+KT- selective lower extremity exercises and kinesiotaping

LFE- Lateral femoral epicondyle

Gmed- Gluteus medius

GMax- Gluteus maximus

TP- Tibialis posterior

NDH- Navicular drop height

FPI- Foot posture index

FFI- Foot function index

MLA Medial longitudinal Arch

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ABSTRACT

Background: Iliotibial band syndrome (ITBS) is the second most common cause of knee pain in runners. It occurs as a result of excessive friction with the lateral femoral epicondyle (LFE) as the two structures collide while running. Excessive foot pronation has been associated with hip and knee injuries and may lead to ITBS. However, there are limited studies associated with ITBS and foot pronation. Therefore, the purpose of the study is to see the long term effectiveness of selective exercises and taping on navicular drop height in subjects with ITBS.

Methods: 20 subjects with pronated foot were recruited in the study and were randomly allocated into experimental group (Group A) and control group (Group B) where Group A performed selective lower extremity exercises and kinesiotaping and in control group only selective exercises was performed for a period of 6 weeks. Outcome measures were Nobel's compression test, Navicular drop height (NDH), foot posture index (FPI), foot function index (FFI). Pre and post intervention results were compared in both the groups.

Results: Group A improved significantly for NPRS, NDH, FPI, FFI- pain, disability ($p<0.04$, $p<0.01$, $p<0.01$, $p<0.00$, $p<0.002$, respectively). Group B also improved significantly for all variables ($p<0.04$, $p<0.004$, $p<0.01$, $p<0.00$, $p<0.03$). However, there was no difference between both the groups $P>0.05$.

Conclusion: The current study found both the treatment equally effective but the experimental group (SE+KT) showed slightly better improvement in reducing pain and improving function in subjects with ITBS.

INTRODUCTION

The iliotibial band (ITB) is a distal continuation of the fascia arising from tensor fascia lata (TFL), gluteus maximus, and gluteus medius muscle.[1] It spans from the iliac crest to the lateral proximal tibia and terminates at Gerdy's tubercle and fibular head and acts as important lateral stabilizer of the pelvis and knee.[2] With the prevalence of 1.6 to 12% of injuries connected to running and 22.2% of all lower extremity injuries, the ITB goes along the lateral thigh and knee and crosses over the lateral femoral epicondyle (LFE).[3,4] ITB and the patella have an important relationship that has been linked to patella-femoral maltracking and lateral knee discomfort in several studies.[5]

Iliotibial band syndrome (ITBS) is the primary cause of lateral knee pain and the second most frequent cause of knee pain in runners.[6] ITBS occurs when the ITB gets inflamed as a result of excessive friction with the LFE as the two structures collide while running.[3] Clinically, ITBS primarily manifests as an acute or intense pain near the lateral femoral epicondyle.[7] Compression and friction are essential to the pathophysiology of ITBS.[8] According to friction theory, inflammation and pain are caused by excessive friction. According to the notion of compression, pain is caused by the ITB's medial-lateral excursion compressing the blood vessels, nerves, and Pacinian corpuscles in the epicondylar region.[9] The ITB is anterior to the LFE when the knee is extended and posterior to the LFE when the knee is flexed more than 30 degrees. As a result, when the knee is flexed, the ITB comes into contact with the LFE at or just slightly less than 30 degrees of flexion.[10] The cause of ITBS is unclear, but it is thought to be a combination of internal and extrinsic causes.[7] Factors that are intrinsic, such as genu varum, a larger Q angle, lateral femoral condyles that are prominent, cavus feet, and severe pronation. Additionally, external variables such as excessive running and inappropriate footwear.[6,7] An increased risk of ITBS has been linked to abnormal kinematics of lower extremity.[11] It was also demonstrated that the shortening of the iliotibial band may cause abnormalities in the foot kinematics of people with pronated feet.[12]

Pes-planus, commonly known as 'flat foot', is a common pathomechanics condition characterized by a lowered medial longitudinal arch (MLA) with rear foot eversion and exaggerated pronation.[13] Foot pronation causes the tibia and femur to internally rotate

in the three planes of motion, which is associated with severe knee strain.[12,14] The joints in the lower extremities work together in a typical walking pattern to convert and lessen the forces. The foot supinates after pronating during the early phase of stance to allow the foot structure to become rigid enough for push-off while also absorbing ground reaction pressures and adapting to the uneven surface. However, people with flat feet rapidly pronate during heel contact and pronate for a long time in late stance, which increases the medial foot pressure.[15,16]

A previous study reported that tibialis posterior act as a rearfoot invertor and provides dynamic support around midfoot and maintain MLA and in addition, tightness of iliopsoas muscle result in malalignment at pelvis and lower extremity or in reverse muscular imbalance due to flat foot.[13,17] The intrinsic and extrinsic foot muscle act as support for MLA and have more important role in dynamic foot control and there are studies which support that strengthening the intrinsic foot muscles will result in maintaining the arch and thus reducing the pain.[18,19] There are various clinical treatments for flat feet, including physical therapy, taping, stretching, muscle strengthening, and the use of orthotics.[15]

Kinesotaping has recently gained popularity among practitioners for the management of musculoskeletal impairements as it help in reducing pain, reducing muscle soreness after exercise and thus help in enhancing the strength of fatigue muscle.[15] Kinesio taping is a non invasive therapy that uses elastic bands with specific textures to treat, modify, and prevent numerous musculoskeletal conditions.[15,20]According to studies, using Kinesio tape in accordance with muscle orientation can also alter the joint's kinematics, better static restraint, and improve force perception.[21]There is a dearth of evidence addressing the physical therapy rehabilitation for ITBS, despite studies explaining the connection between foot overpronation and ITBS. Numerous studies have been conducted on asymptomatic participants, but it is still necessary to determine whether strengthening and stretching exercises, as well as taping after an acceptable follow-up period in symptomatic patients, are effective·

NEED OF THE STUDY

- Foot exercises and foot taping has been shown to be effective in management of pronated foot, where as no study has investigated to see the long term effect of selective exercises and foot taping for subjects with pronated foot having IT band syndrome.
- Despite studies explaining the connection between overpronation and ITBS there is lack of evidence regarding the physical therapy intervention.
- Many studies have been done on asymptomatic subjects but the efficacy of strengthening and stretching exercises along with taping after adequate follow up period in symptomatic patient is needed**.**

AIM

- To see the long term effect of selective exercise and taping on navicular drop height in subject with ITBS

OBJECTIVES

1. To see the long term effect of selective exercise and taping on navicular drop height using navicular drop test (ND), foot posture index (FPI), foot function index (FFI) and Nobel's compression test.
2. To see the long term effect of selective exercise on navicular drop height using navicular drop test (ND), foot posture index (FPI), foot function index (FFI) and Nobel's compression test.
3. To compare the long term effect of selective exercise and taping vs selective exercise alone on navicular drop height using navicular drop test (ND), foot posture index (FPI), foot function index (FFI) and Nobel's compression test

HYPOTHESIS

NULL HYPOTHESIS

1. There will be no significant difference in long term effect of selective exercise on navicular drop height in subjects with ITBS.
2. There will be no significant difference in the long term effect of selective exercise and taping on navicular drop height in subjects with ITBS.
3. There will be no significant difference in the long term effect of selective exercise and taping vs selective exercise alone on navicular drop height in subjects with ITBS.

ALTERNATE HYPOTHESIS

1. There will be significant difference in long term effect of selective exercise on navicular drop height in subjects with ITBS.
2. There will be significant difference in the long term effect of selective exercise and taping on navicular drop height in subjects with ITBS.
3. There will be significant difference in the long term effect of selective exercise and taping vs selective exercise alone on navicular drop height in subjects with ITBS.

REVIEW OF LITERATURE

1. Tahmasbi, Alireza et al. *Sport sciences for health* vol. 19,1 (2023) conducted a study on “Comparison between the effects of tibialis posterior versus fibularis longus Kinesio taping on foot posture, physical performance, and dynamic balance in young women with flexible flatfoot.” 24 participants were recruited in the study and were randomly allocated in tibialis posterior kinesio taping and fibularis longus kinesio taping. Navicular drop height, foot posture index, balance test and timed up and go test were used as an outcome measure. Results showed that kinesiotaping of tibialis posterior muscle can improve foot posture and physical performance.
2. **Wani, S.S. & Pradhan** et.al Muscle Ligaments and Tendons Journal (2023) June;14(6) 13. 267. Conducted a study on “Iliotibial Band Trigger Points and Plantar Heel Pain: A Cross-Sectional Study”. In this study a total of 30 participants were recruited. The purpose was to examine the relationship between iliotibial trigger point and plantar heel pain. Foot posture index was used as an outcome measure. Iliotibial trigger point was palpated manually. They found that there is association between existence iliotibial trigger point and plantar heel pain so addressing iliotibial trigger point may help in reducing pain in patients with plantar heel pain
3. **Kim HJ, Cho J** et al. BMC Musculoskelet Disord. 2022 Feb 15;23(1):150. Conducted a study on “Talonavicular joint mobilization and foot core strengthening in patellofemoral pain syndrome: a single-blind, three-armed randomized controlled trial”. A total of 48 participants were randomly divided into talonavicular joint mobilization, foot core strengthening and blended intervention for a period of 4 weeks. They

reported that foot intervention including talonavicular mobilization and foot core strengthening is effective for reducing pain and improving functions in patients with patellofemoral pain syndrome.

4. Alam, F., Raza, S., Moiz, J. A., etal. *Phys Sportsmed*. 2019;47(3):301-311- conducted a study on “Effects of selective strengthening of tibialis posterior and stretching of iliopsoas on navicular drop, dynamic balance, and lower limb muscle activity in pronated feet”- A RCT study was done on 28 asymptomatic collegiate student with bilateral pronated foot and concluded that inclusion of selective TP strengthening and IP stretching seems to be a prominent adjunct to the conventional exercise program for improved clinical outcomes of patients with pronated feet.
5. **Unver B, Erdem EU**, et al. J Sport Rehabil. 2019 Oct 18;29(4):436-440. Conducted a study on “Effects of Short-Foot Exercises on Foot Posture, Pain, Disability, and Plantar Pressure in Pes Planus”- A Quasi experimental study was done on 41 participants with pesplanus and were randomly divided into experimental and control group. Experimental group performed short foot exercises daily for 6 weeks. Result- after 6 weeks of intervention the navicular drop height significantly in experimental group.
6. Dodelin, D., Tourny, C., Menez, C., etal *Clinical research on foot & ankle, 06(2018):* 1-8.- conducted a case series on “Reduction of Foot Over-pronation to Improve Iliotibial Band Syndrome in Runners” and they suggest that using orthotic insoles may be an effective treatment for ITBS in runners who have over pronated foot.

7. **Lee J, Yoon J, Cynn H**. J Bodyw Mov Ther. 2017 Jan;21(1):216-222**-** conducted a study on “Foot Exercise and Taping in Patients with Patello-femoral Pain and Pronated Foot”- In this study a total of 18 subjects with PFPS and pronated foot were included and they compared the effect of foot in three conditions (untreated, short foot exercise and taping) on knee and ankle during forward descending of stairs and the result showed that the SF exercise was the most effective of the three foot conditions for increasing AbdH muscle activity during FDS in subjects with PFPS and a pronated foot

8. **Lee, Dain and Jong-duk Choi** Phys Ther Korea 2016;23(4):27-37**-** conducted a study on “The Effects of Foot Intrinsic Muscle and Tibialis Posterior Strengthening Exercise on Plantar Pressure and Dynamic Balance in Adults Flexible Pes Planus”- A cross sectional study was done on 7 males and 9 females and were randomized into two groups in which experimental group performed foot intrinsic muscle and tibialis posterior strengthening whereas control group performed only foot intrinsic exercise for 6 weeksand the experimental group showed significant improvement than control group.

9. **Goo, Young-Mi et al**. *Journal of physical therapy science* vol. 28,3 (2016): 911-5. conducted a study on “The effects of gluteus maximus and abductor hallucis strengthening exercises for four weeks on navicular drop and lower extremity muscle activity during gait with flatfoot”- A total 18 healthy adults were included and were divided into two groups and performed their respective exercise for 3 times per week in laboratory and 2 times per week at home for 4 weeks and they found that strengthening both the group is consider more effective for correction of medial longitudinal arch

10. Luque-Suarez, Alejandro et al. *Physiotherapy* vol. 100,1 (2014): 36-40 conducted a study on “Effects of kinesiotaping on foot posture in participants with pronated foot: a quasi-randomised, double-blind study.” A total of 68 participants were enrolled in the study and were allocated into experimental kinesiotaping and sham taping groups respectively. Foot posture index was used as an outcome measure and measure were taken at baseline, 1 min, 10 min, 60 min and 24 hours after taping. However the study reported no significant improvement in both the groups.

METHODOLOGY

DESIGN: A randomized control trial was conducted inside the Abhinav Bindra Sports Medicine and Research Institute in BBSR. The study was accepted by the institutional ethical committee and signed consent form was taken from the participants.

PARTICIPANTS AND SAMPLE SIZE: A total of 48 subjects were included in the study and sample size was determined using G. power software based on an effect size of 0.9, a alpha level of 0.05, and a power (1–β) of 0.90. Participants were recruited through purposive sampling by word of mouth. Collegiate students 18-26 years were included in the study having pronated foot based on navicular drop test (ND>10mm), ITBS based on positive Nobel's compression test, and pain evaluation (NPRS 4/10). Participants using foot orthosis within one year and having any lower limb injury within one year were excluded from the study.

RANDOMIZATION: Block randomization method was used. 48 subjects were equally allocated into groups (A OR B). 4 blocks was made which will contain 12 sealed envelopes inscribed with the either the letter A or B. The subjects were unaware of the group allocation until the time of the intervention.

SAMPLE SIZE ESTIMATION:

Sample size calculation was done using G.power 3.1.9.4

Type of power analysis: A priori

Effect size of 0.9, a alpha level of 0.05, and a power (1–β) of 0.90

STUDY PROCEDURE:

This study was reviewed and approved by the institutional ethical committee. Subjects were recruited by word of mouth. The interventions were carried out in the exercise therapy laboratory inside the college campus itself. The participants were thoroughly explained about the purpose of the study and its methods. All participants were screened to match into the inclusion criteria mentioned above. If participants met with the inclusion criteria, they were asked to sign an informed consent form.

Groups allocation was done by using Block Randomization. 4 boxes (6 for males and 6 for females) with each box containing 12 sealed envelopes encoded with the group allocation

After recruiting subjects, their demographic and anthropometric data were recorded and outcome measure such as NPRS, Navicular drop height, foot posture index and positive Nobel's compression test data were recorded pre and post the 6 weeks of intervention

OUTCOME MEASURES:

NAVICULAR DROP TEST (NDT):-

The Navicular Drop Test, as described by Brody (1982), is used to evaluate the medial longitudinal arch and excessive pronation. To test the ND, the subjects were asked to sit on a chair with hip and knees at 90 degrees and foot resting on the floor with subtalar in the neutral position. At approximately 2.5cm anteroinferior to the tip of medial malleolus navicular tuberosity was palpated. The distance from the floor to navicular tuberosity was measured both in sitting and standing and the difference value was recorded. The intrareliabilty value was 0.94, which shows a good reliability for the test.

NOBEL'S COMPRESSION TEST

The Nobel's compression test is the only diagnostic test used in clinical examination for the diagnosis of ITBS. Lateral knee pain is the most common symptom for ITBS. The test is conducted by applying direct pressure over lateral condyle of femur and knee is passively extended through a range from 60 degree to full extension. Reproduction of

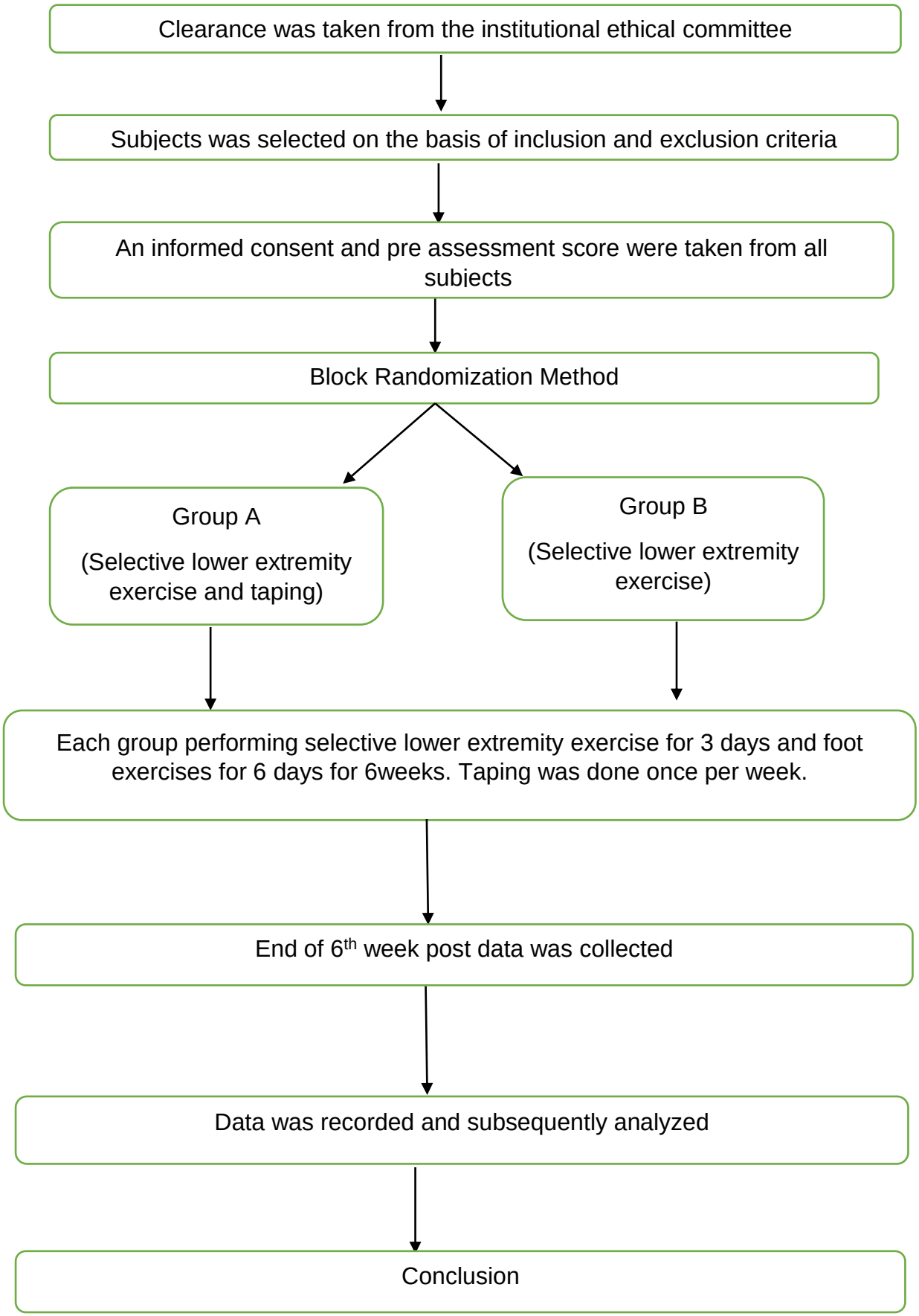
lateral knee pain at approximately 30 degree of knee flexion is considered a positive Nobel's compression test.

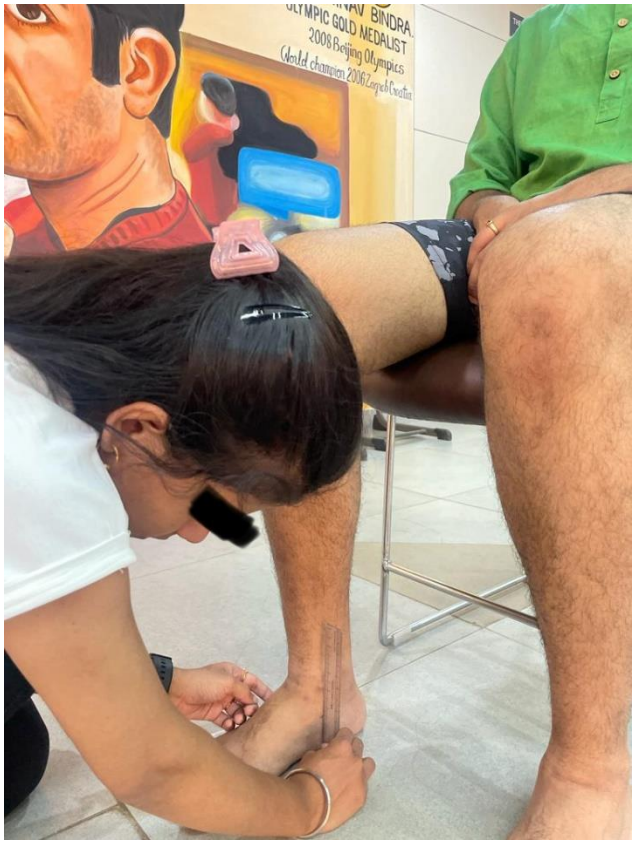
FOOT POSTURE INDEX (FPI-6)

FPI is a simple scale and a quick, reliable diagnostic tool to quantify the degree to which a foot is pronated, neutral or supinated. Both feet of each participant were assessed for the six FPI criteria. The inter rater reliability for FPI was good (Kw = 0.88) and construct validity was confirmed (PSI=0.88).

FOOT FUNCTION INDEX (FFI)

A Foot Function Index (FFI) was developed to measure the impact of foot pathology on function in terms of pain, disability and activity restriction. The FFI is a self-administered index consisting of 23 items divided into 3 sub-scales. Test-retest reliability of the FFI total and sub-scale scores ranged from 0.87 to 0.69. Internal consistency ranged from 0.96 to 0.73.


Clearance was taken from the institutional ethical committee
Subjects was selected on the basis of inclusion and exclusion criteria
An informed consent and pre assessment score were taken from all subjects
Block Randomization Method
Group A
(Selective lower extremity exercise and taping)
Group B
(Selective lower extremity exercise)
Each group performing selective lower extremity exercise for 3 days and foot exercises for 6 days for 6weeks. Taping was done once per week.
End of 6th week post data was collected
Data was recorded and subsequently analyzed
Conclusion



NDH IN SITTING

NDH IN STANDING

NOBEL COMPRESSION TEST

ITB STRETCH

STRENGTHENING OF FOOT

SIDE LYING HIP ABDUCTION

I**NTERVENTION:**

The study participants were divided into two groups:

Group A: Selective lower extremity exercises along with Kinesio-taping.

Group B: Selective lower extremity exercises alone.

For selective lower extremity, exercises were performed for 3 days per week with progression up-to 6 weeks and short foot exercises and towel curl was performed for 6 days per week with progression up-to 6 weeks, twice daily for 6 weeks.

Selective Lower extremity exercises	Duration in weeks 0-2 week	2-4 week	4-6 week
Trunk side bend IT band stretch	30s x 2sets	30s x 2	40 x 3
Trunk side bend with ITB reach	30s x 2	30s x 2	40s x 3
ITB stretch	30s x 2	30s x 2	40s x 3
ITB hip abductor stretch	30s x 2	30s x 2	40s x 3
Iliopsoas stretch	30s x 2	30s x 2	40s x 3
Side lying hip abduction	30s x 2	30s x 2	40s x 3
Gluteus Maximus Strengthening	6 x 2	6 x 3	10 x 2

Tibialis posterior strengthening	10 x 2	10 x 3	10 x 4
Towel curl exercise	10 x 2	10 x 3	10 x 4
Short foot exercise	10 x 2 (sitting and standing)	10 x 2 (standing on one leg)	10 x 2 (standing on unstable surface)

Kinesotaping-

The tape was stretched fully and applied directly to the skin.
The strap will start from posterior tibia and end around the navicular to facilitate tibialis posterior muscle in everted position with 30% tension and the second tape will start from navicular and end around the fifth metatarsal bone in inversion and dorsiflexion position with 75% stretch.

DATA ANALYSIS:

The data analysis was done using SPSS software. Shapiro-wilk test was used to assess the normality of data. Wilcoxin test or Mann Whitney was used if the data is not normally distributed. Independent unpaired t-test was used to compare the data between the groups. Paired t-test was used to compare the data within the groups.

RESULTS

A total of 20 participants were enrolled in the study and were randomly divided into 2 groups. The overview of study procedure is given in figure 1.

Table 1 shows demographic and baseline characteristics of both the groups. Shapiro-wilk test was used to assess for the normality of data and the test showed that the distribution of the FPI values and FFI for activity limitation was not normal $p<0.05$, hence non parametric tests were applied. Also, the test showed that age, BMI, NDH and FFI for pain and disability was normally distributed $p>0.05$, hence the parametric test was applied.

Navicular drop:

There was a significant difference (within group) in pre and post values of Group A and Group B ($p<0.01$) and ($p<0.04$) respectively. (Figure 2) (Table 2)

There was no statistically significant difference between Group A and Group B for navicular drop height($p=0.10$).

Nobel's compression test (NPRS):

There was a significant difference (within group) in pre and post values of Group A and Group B ($p<0.004$). (Figure3) (Table 3)

However, there was no statistically significant difference between Group A and Group B ($p=0.73$).

Foot posture index (FPI):

There was a significant difference (within group) in pre and post values of Group A and Group B ($p<0.01$) and ($p<0.01$) respectively. (Figure 4) (Table 4)

There was no significant difference between Group A and Group B ($p=0.06$).

Foot function index (FFI):

For pain:

There was a significant difference (within group) in pre and post values of Group A and Group B ($p<0.00$). (Figure 5) (Table 5)

However, there was no statistically significant difference between Group A and Group B ($p=0.29$).

For disability:

There was a significant difference (within group) in pre and post values of Group A and Group B ($p<0.002$ and $p<0.03$ respectively). (Figure 6) (Table 6)

However, there was no statistically significant difference between Group A and Group B ($p=0.91$).

For activity limitation:

There was no statistical significant difference (within group) in pre and post values of Group A and Group B ($p=0.06$ and $p=0.10$ respectively). (Figure 7) (Table 7)

There was no statistically significant difference between Group A and Group B ($p=0.68$).

Any variables have not shown a significant difference between groups. (Figure 8) (Table 8)

TABLE 1. DEMOGRAPHIC DATA AND BASELINE CHARACTERISTICS

	GROUP A	GROUP B	P
AGE	23±3.26	23±3.29	0.84
MALE/FEMALE	3/7	1/9	
BMI	23.36±3.69	25.10±4.04	0.32
PRE NOBEL COMPRESSION TEST	5(2)	5(1)	0.21
PRE NDH	10mm	10mm	
PRE FPI LEFT	7.5(2)	9(1.75)	0.06
PRE FPI RIGHT	7.50(2)	9(1.75)	0.06
PAIN	19.30±9.11	17.100±3.77	0.64
DISABILITY	9.7±6.7	8.0±4.47	0.51
ACTIVITY LIMITATION	0(2.5)	0(2.5)	0.63

TABLE 2: PRE AND POST NAVICULAR DROP HEIGHT (NDH) GROUP A VERSUS GROUP B

GROUPS	PRE NDH	POST NDH	DIFFERENCE	P
	MEAN±SD	MEAN±SD	MEAN±SD	
GROUP A	10±0	9.1±0.99	0.9±0.99	0.01
GROUP B	10±0	9.3±0.94	0.7±0.94	0.04

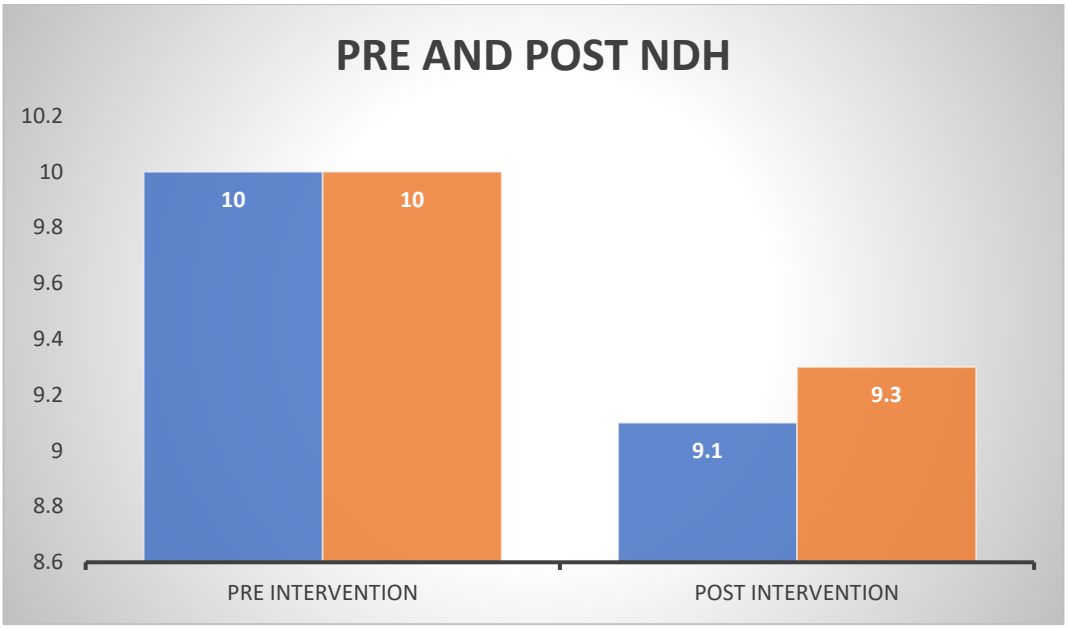


FIG 1 COMPARISON OF PRE AND POST VALUES FOR NDH (GROUP A VERSUS GROUP B) ($p<0.01$ and $p<0.04$ RESPECTIVELY).

TABLE 3 PRE AND POST NPRS GROUP A VERSUS GROUP B

GROUPS	PRE NPRS	POST NPRS	WITHIN GROUP DIFFERENCE	P
	MEDIAN(IQ)	MEDIAN(IQ)	MEDIAN	
GROUP A	5(2)	2(1)	3.5(1)	0.004
GROUP B	5(1)	1(1)	3.0(1)	0.004

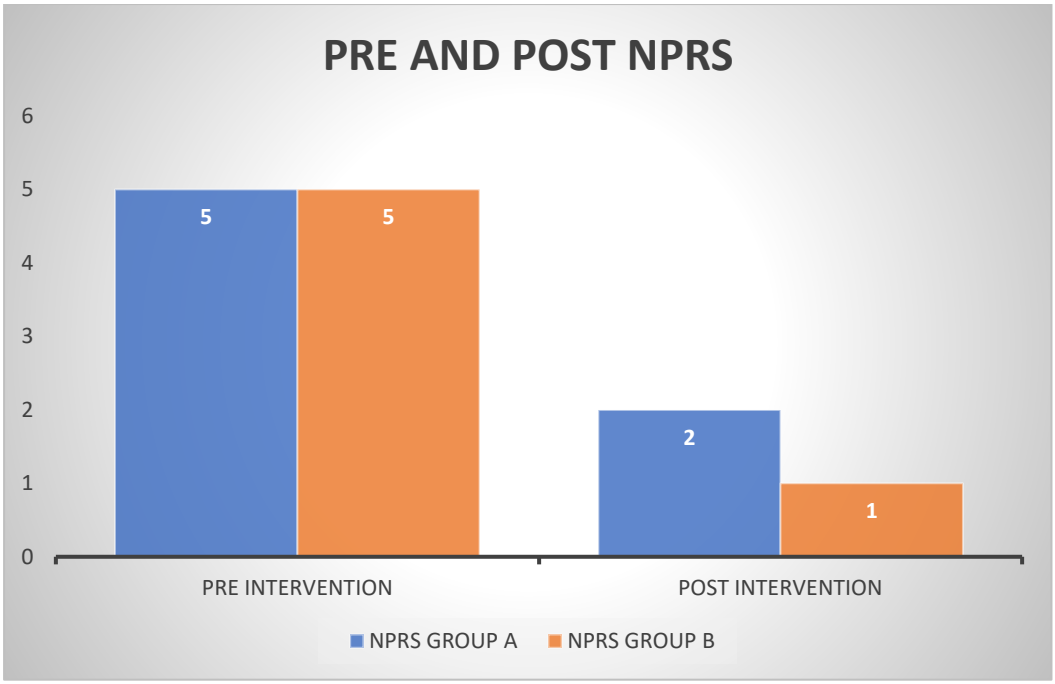


FIG 2 COMPARISON OF PRE AND POST NPRS FOR GROUP A VERSUS GROUP B. IT SHOWS SIGNIFICANT DIFFERENCE p<0.004

TABLE 4 PRE AND POST FPI OF GROUP A AND GROUP B

GROUPS	PRE FPI	POST FPI	DIFFERENCE	P
	MEDIAN(IQ)	MEDIAN(IQ)	MEDIAN(IQ)	
GROUP A	7.5(2)	6(0.25)	1.5(1.25)	0.01
GROUP B	9(1.75)	8(1.5)	1.0(1)	0.014

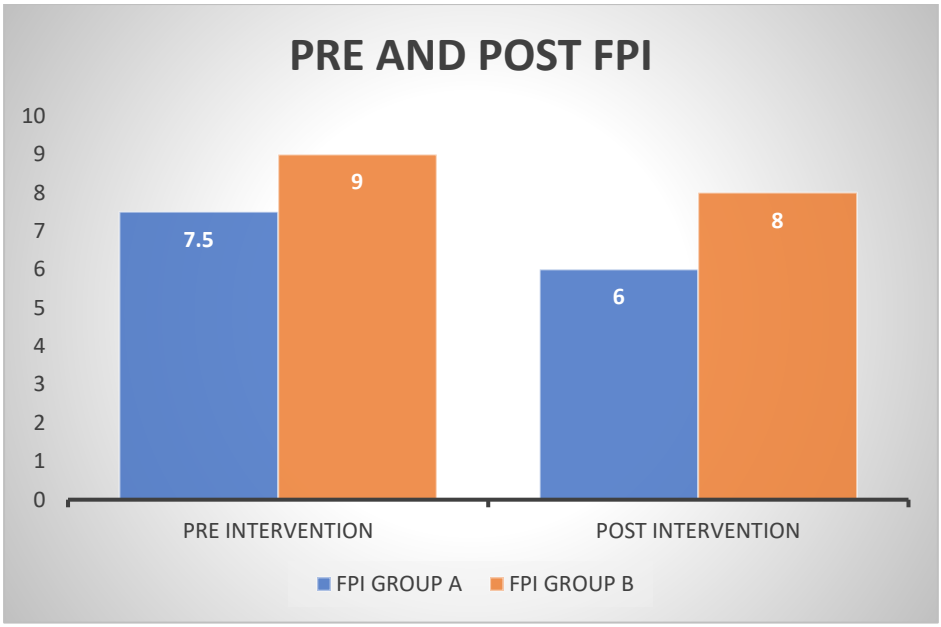


FIG 3: COMPARISON OF PRE AND POST FOOT POSTURE INDEX (FPI) FOR GROUP A VERSUS GROUP B.

TABLE 5: PRE AND POST FFI (PAIN) OF GROUP A AND GROUP B

GROUPS	PRE FFI PAIN	POST FFI PAIN	WITHIN GROUP DIFFERENCE	P
	MEAN±SD	MEAN±SD	MEAN±SD	
GROUP A	19.3±9.11	9±6.2	10.3±6.07	0
GROUP B	17.1±11.9	9.3±10.1	7.8±4.13	0

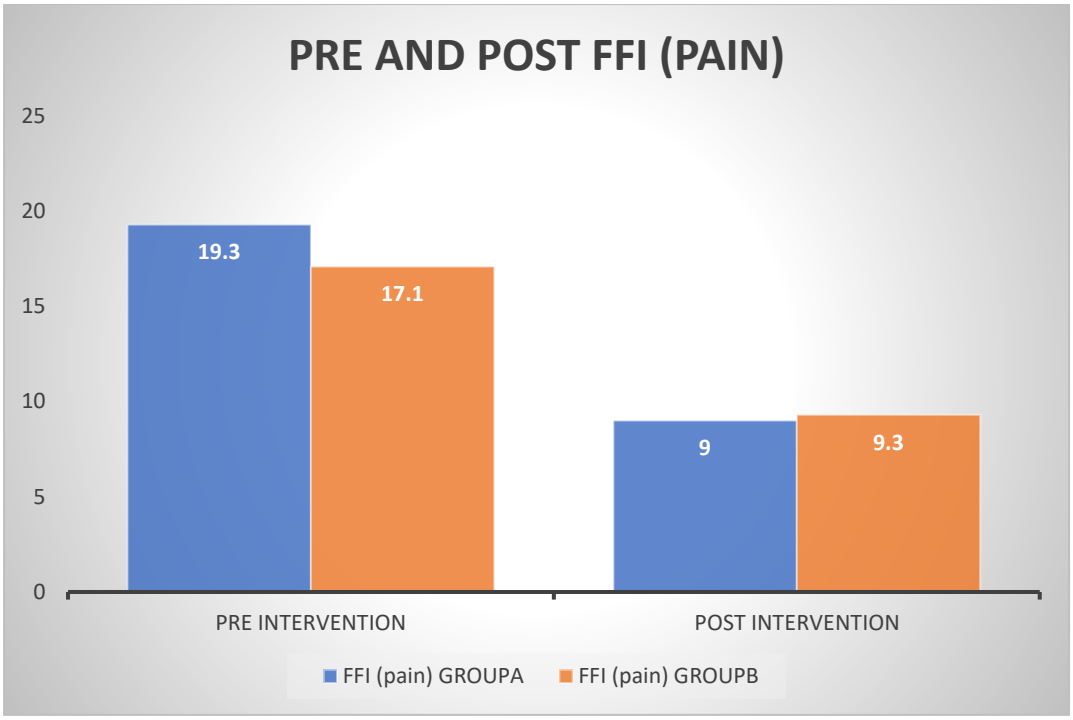


FIG 4: COMPARISON OF PRE AND POST FOOT FUNCTION INDEX OF PAIN (FFI) FOR GROUP A AND GROUP B (P<0.00)

TABLE 6: PRE AND POST FFI DISABILITY OF GROUP A AND GROUP B

GROUPS	PRE FFI DISABILITY	POST FFI DISABILITY	WITHIN GROUP DIFFERENCE	P
	MEAN±SD	MEAN±SD	MEAN±SD	
GROUP A	8.6±4.81	2.8±2.04	5.8±4.15	0.002
GROUP B	8.0±4.47	3.6±4.9	6.0±3.7	0.03

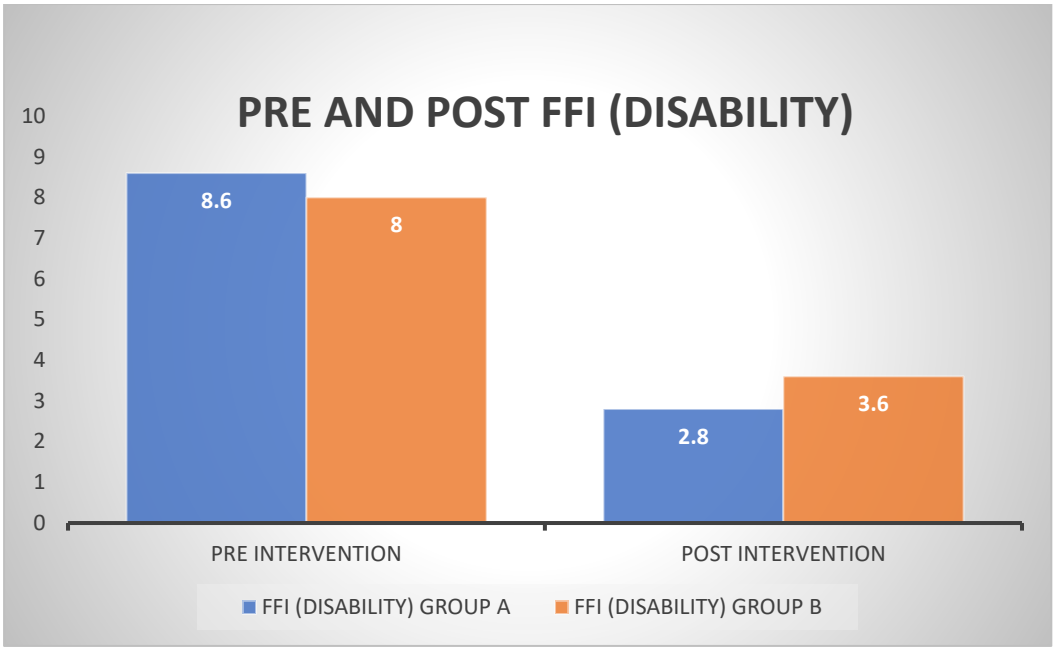


FIG 5: COMPARISON OF PRE AND POST FOOT FUNCTION INDEX OF DISABILITY (FFI) OF GROUP A (EXPERIMENTAL) AND GROUP B (CONTROL)

TABLE 7: PRE AND POST FFI ACTIVITY LIMITATION OF GROUP A AND GROUP B

GROUPS	PRE FFI ACTIVITY LIMITATION	POST FFI ACTIVITY LIMITATION	WITHIN GROUP DIFFERENCE	P
	MEDIAN (IQ)	MEDIAN (IQ)	MEDIAN (IQ)	
GROUP A	0(2)	0(0)	0(2)	0.06
GROUP B	0(1.5)	0(0)	0(1)	0.1

TABLE 8: SHOWS THE MEAN DIFFERENCE COMPARISON OF PRE AND POST MEAN DIFFERENCE FOR ALL OUTCOME MEASURE BETWEEN GROUP A AND GROUP B

DIFFERENCE	GROUP A	GROUP B	P
NDH	0.9±0.99	0.7±0.94	0.65
NPRS	3.5(1)	3(1)	0.7
FPI	1.5(1.25)	1(1)	0.06
FFI PAIN	10.3±6.07	7.8±4.13	0.2
FFI DISABILITY	5.8±4.15	6.0±3.7	0.91
FFI ACTIVITY LIMITATION	0(2)	0(1)	0.68

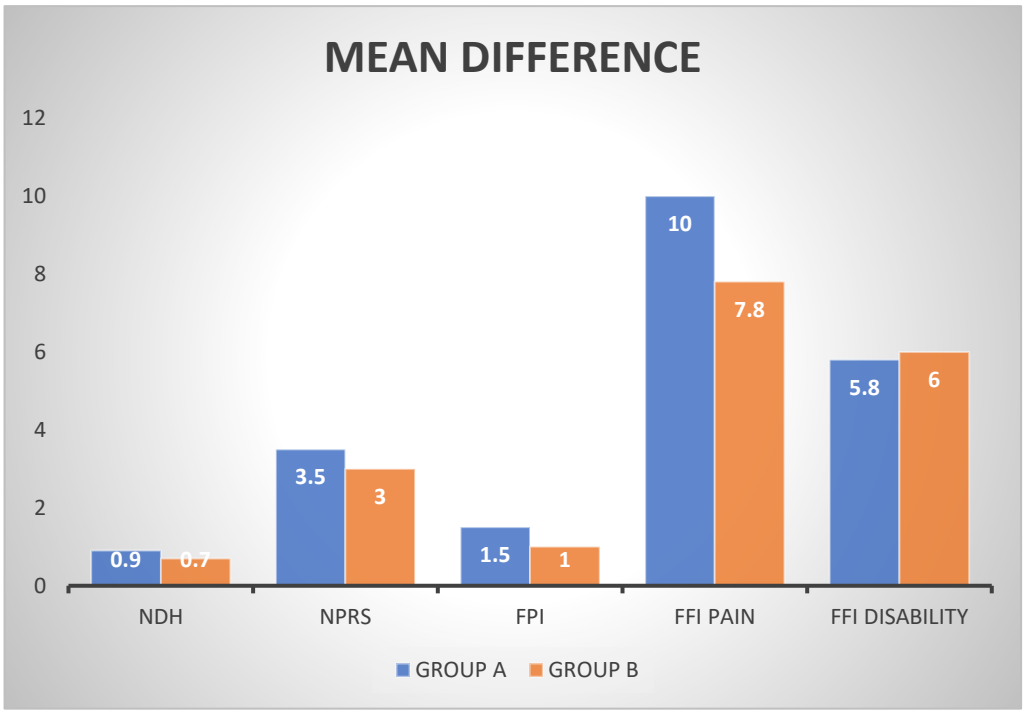


FIGURE 6: SHOWS THE COMPARISON OF THE PRE AND POST MEAN DIFFERENCE BETWEEN GROUP A AND GROUP B FOR ALL OUTCOME MEASURES

DISCUSSION

The purpose of this study was to evaluate the long-term effects of selective lower extremity exercises and kinesio-taping on navicular drop height in subjects with ITBS. The result showed that after 6 weeks of intervention the NPRS on nobel compression test reduced significantly in both the group, but there was no statistically significant difference between the groups. However, the experimental group (SE+ KT) shows slightly better improvement in pain than control group (SE). Therefore, for the pain outcome (NPRS) the null hypothesis was accepted.

This result is consistent with similar research in the past on runners with ITBS[10,22]. They showed that experimental exercises such as stretching and strengthening of hip musculature could be more beneficial for patient with ITBS compared with conventional treatment. Hip abductors should be strengthened as part of ITBS treatment because research indicates that excessive hip adduction may be a risk factor for the development of ITBS[23,24]. The explanation for strengthening the hip abductor muscles is based on Janda's classification of muscular imbalance, which states that G.Med weakening may cause a compensatory increase in TFL activity, which results in increased tensile pressures acting on the ITB and may also cause a lower extremity dysfunction. The rehabilitation of ITBS, however, has not received enough research[1.7,25].

ITB tension is increased as a result of the varying length-tension relationships of the intrinsic and extrinsic foot muscles. Higher foot pronation also correlates with higher tibial and femoral internal rotation, which tilts the pelvis anteriorly and shortens the iliopsoas muscle, creating an internal rotation moment at the knee. Recent investigations have also shown that foot pronation can alter hip kinematics, putting strain on the ITB through its proximal attachment[6,12,17].

We hypothesized that SE+KT will be better compared to SE alone on navicular drop height in subjects with ITBS. We found that NDH and FPI improved significantly in both the groups. Even though there was no statistically significant between the two groups, SE+KT showed slightly better improvement. FFI (pain and disability) improved in both the groups. Therefore, for NDH and FPI the null hypothesis was accepted.

Our results are consistent with those of earlier research by Goo et al. and Alam et al. in subjects with pronated feet. They reported that individuals with pronated feet benefit more from targeted strengthening of the TP, iliopsoas, and GMax combined with strengthening of intrinsic foot muscles than from traditional treatment alone[14,25,26,27]. Therefore, in order to address the pathomechanics of flat feet, specialized lower limb muscle strengthening may need to be taken into account when developing rehabilitation programs for individuals with pronated feet[25].

Reduced MLA is linked to weakness and dysfunction in the intrinsic foot muscles and posterior tibialis[15]. The major dynamic stabilizer for MLA is TP[14]. Taping enhances blood flow through the autonomic system, facilitates muscular activation by enhancing sensory inputs from skin and joint receptors, and modifies the length-tension relationship and force-generating ability of muscles. Alireza et al. reported that kinesotaping of TP muscle and transverse arch could improve the foot posture and physical performance in people with flexible flat feet[20]. In our study, kinesiotaping was applied in order to facilitate the TP muscle with 30-35%% tension and transverse arch with 75% tension because they are essential for raising the MLA.

A previous biomechanical study reported that excessive internal rotation of tibia and femur due to over pronation of foot may contribute to ITBS[6]. The addition of kinesiotaping appears to be helpful in reducing foot pronation. Furthermore, because the navicular bone is covered by the TP Kinesio taping technique, it's likely that it will provide mechanical support for both the navicular bone and the MLA, reducing stress on ITBS in the process. Therefore, this might be the cause of why participants with ITBS in our experimental group improved slightly more than those in the control group in terms of pain and function.

LIMITATIONS OF THE STUDY

1. The study has several limitations. First due to lack of funding the sample size was restricted to 20 subjects and gender distribution in our study was not equal therefore our results cannot be generalized.
2. Second EMG analysis could have been done to see the changes post intervention.
3. Third biomechanical analysis while running could have been done.

FUTURE SCOPE

Future studies should incorporate the EMG analysis and force plate analysis for foot pressure distribution on running biomechanics on pronated foot in subjects with ITBS

CONCLUSION

The result of this study concluded that selective lower extremity exercises are equally effective to selective exercises and taping on navicular drop height in subjects with ITBS.

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FORMAT OF CONSENT FORM

TITLE-LONG TERM EFFECT OF SELECTIVE EXERCISE AND TAPING ON NAVICULAT DROP HEIGHT IN SUBJECTS WITH ITBS.

I have been informed by Ms. MADHURI RAI; pursuing MPT (ortho)conducting the above-mentioned study under the guidance of, Dr.Chinmaya Kumar Patra, PRINCIPAL, Department of Physiotherapy ABHINAV BINDRA SPORTS MEDICINEAND RESEARCH INSTITUTE (ABSMARI), BHUBANESWAR.

I have no objection and will be a part of that group. I also understand that the studydoes not have any negative implication on my health. I understand that theinformation produced by the study will become a part of the institute's record and willbe utilized, as per confidentiality regulations of the institute. I am also aware that thedata might be used for medical literature and teaching purposes, but all my personaldetails will be kept confidential.

I am well informed to ask as many questions as I can to Ms. Madhuri Rai either during the study or later.I understand that my assent is voluntary and I reserve the right to withdraw ordiscontinue the participation from the study at any point of time during the study.

I have explained to MR/MISS/MRS the purpose of theresearch, the procedure required in the language he/she could understand to the best ofmy ability.

_____

(Signature of the Investigator) (Date)

I confirm that Ms. Madhuri Rai (investigator) has explained to me in thelanguage I can understand, the purpose of the study and the procedure. Therefore, Iagree to give my assent for the participation as a subject in this study and I will beaccountable for the decisions.

_____

(Signature of participant) (Date)

CASE RECORD SHEET

DEMOGRAPHIC DATA:

Name:

Age:

Gender:

Height:

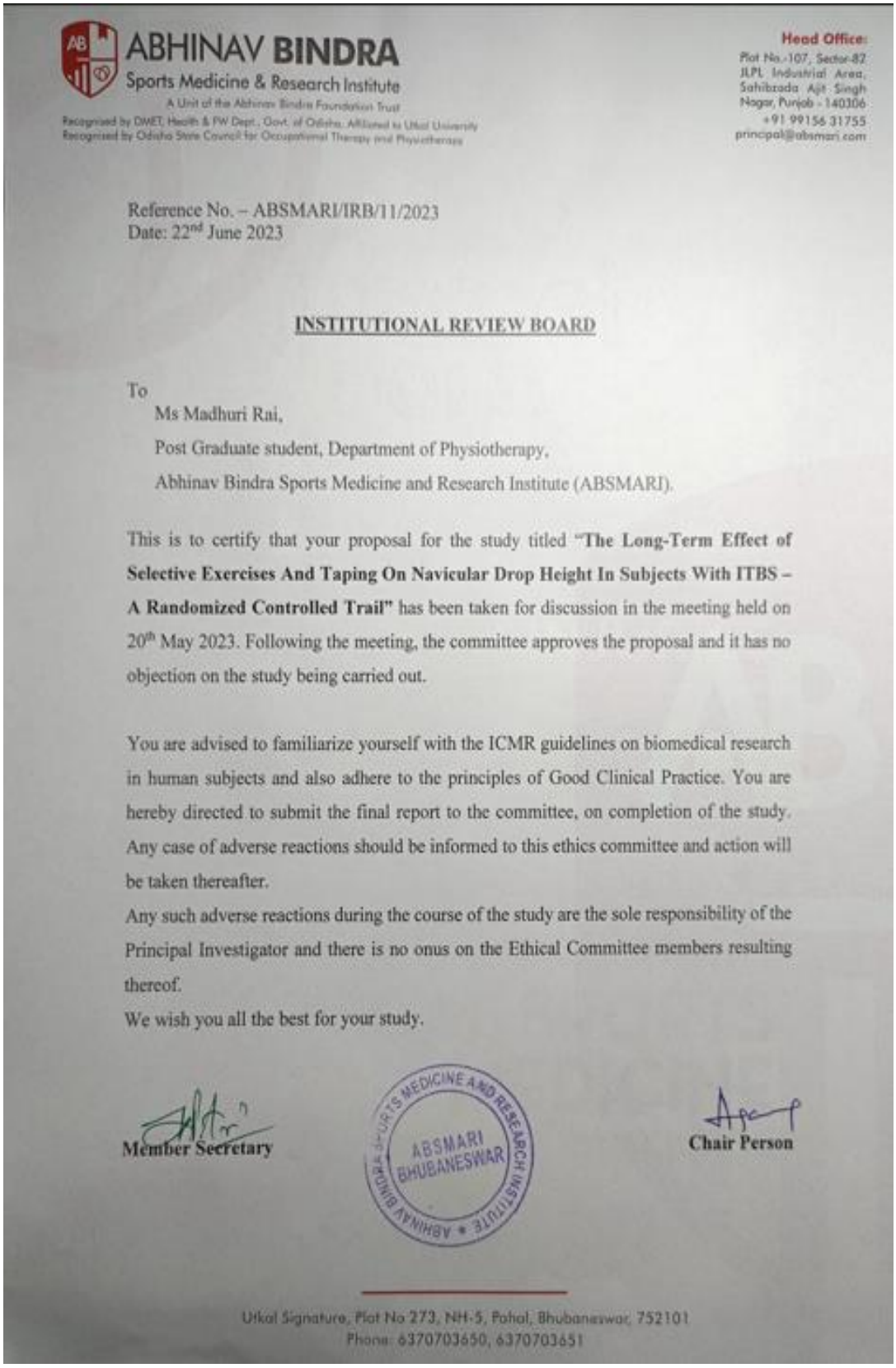
Weight:

Body mass index:

Adverse events (if any):

OUTCOMES	PRE -TEST	POST -TEST
NAVICULAR DROP HEIGHT: SITTING STANDING		
NOBEL'S COMPRESSION TEST		
FOOT POSTURE INDEX		
FOOT FUNCTION INDEX PAIN DISABILITY ACTIVITY LIMITATION		

COPY OF ETHICAL COMMITTEE CLERANCE CERTIFICATE



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Reference No. – ABSMARI/IRB/11/2023
Date: 22nd June 2023

INSTITUTIONAL REVIEW BOARD

To
Ms Madhuri Rai,
Post Graduate student, Department of Physiotherapy,
Abhinav Bindra Sports Medicine and Research Institute (ABSMARI).

This is to certify that your proposal for the study titled **"The Long-Term Effect of Selective Exercises And Taping On Navicular Drop Height In Subjects With ITBS – A Randomized Controlled Trail"** has been taken for discussion in the meeting held on 20th May 2023. Following the meeting, the committee approves the proposal and it has no objection on the study being carried out.

You are advised to familiarize yourself with the ICMR guidelines on biomedical research in human subjects and also adhere to the principles of Good Clinical Practice. You are hereby directed to submit the final report to the committee, on completion of the study. Any case of adverse reactions should be informed to this ethics committee and action will be taken thereafter.

Any such adverse reactions during the course of the study are the sole responsibility of the Principal Investigator and there is no onus on the Ethical Committee members resulting thereof.

We wish you all the best for your study.

Member Secretary

ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE
ABSMARI BHUBANESWAR

Chair Person

Utkal Signature, Plot No 273, NH-5, Pahal, Bhubaneswar, 752101
Phone: 6370703650, 6370703651

ANNEXURES 1

SAPPHIRE PHYSICAL THERAPY

Foot Function Index

Patient Name: _____ Date:_____

This questionnaire has been designed to give your therapist information as to how your foot pain has affected your ability to manage in everyday life. Please answer every question. For each of the following questions, we would like you to score each question on a scale from 0 (no pain or difficulty) to 10 (worst pain imaginable or so difficult it required help) that best describes your foot over the past WEEK. Please read each question and place a number from 0-10 in the corresponding box.

No Pain 1 2 3 4 5 6 7 8 9 10 Worst Pain Imaginable

Pain Subscale: How severe is your foot pain:

Foot pain at its worst?		Pain standing with shoes?	
Foot pain in morning?		Pain walking with orthotics?	
Pain walking barefoot?		Pain standing with orthotics?	
Pain standing barefoot?		Foot pain at end of day?	
Pain walking with shoes?			

Disability Subscale: How much difficulty did you have:

Difficulty walking in house?		Difficulty standing tip toe?	
Difficulty walking outside?		Difficulty getting up from chair?	
Difficulty walking 4 blocks?		Difficulty climbing curbs?	
Difficulty climbing stairs?		Difficulty walking fast?	
Difficulty descending stairs?			

Activity Limitation Subscale: How much of the time do you:

Stay inside all day because of feet?		Use assistive device indoors?	
Stay in bed because of feet?		Use assistive device outdoors?	
Limit activities because of feet?			

Office Use Only: Score: ____/230 points (MDC: 7 points; No Disability "0")
Number of PT Sessions: _____ Gender: M F Age: _____
ICD-9 Code: _____ PT Initials: _____

ANNEXURES 2

THE FOOT POSTURE INDEX©
FPI-6

Reference Sheet

The patient should stand in their relaxed stance position with double limb support. The patient should be instructed to stand still, with their arms by the side and looking straight ahead. It may be helpful to ask the patient to take several steps, marching on the spot, prior to settling into a comfortable stance position. During the assessment, it is important to ensure that the patient does not swivel to try to see what is happening for themself, as this will significantly affect the foot posture. The patient will need to stand still for approximately two minutes in total in order for the assessment to be conducted. The assessor needs to be able to move around the patient during the assessment and to have uninterrupted access to the posterior aspect of the leg and foot.

If an observation cannot be made (e.g. because of soft tissue swelling) simply miss it out and indicate on the datasheet that the item was not scored.

If there is genuine doubt about how high or low to score an item always use the more conservative score.

Rearfoot Score	**-2**	**-1**	**0**	**1**	**2**
Talar head palpation	Talar head palpable on lateral side/but not on medial side	Talar head palpable on lateral side/slightly palpable on medial side	Talar head equally palpable on lateral and medial side	Talar head slightly palpable on lateral side/ palpable on medial side	Talar head not palpable on lateral side/ but palpable on medial side
Curves above and below the malleoli	Curve below the malleolus either straight or convex	Curve below the malleolus concave, but flatter/ more shallow than the curve above the malleolus	Both infra and supra malleolar curves roughly equal	Curve below malleolus more concave than curve above malleolus	Curve below malleolus markedly more concave than curve above malleolus
Calcaneal inversion/eversion	More than an estimated 5° inverted (varus)	Between vertical and an estimated 5° inverted (varus)	Vertical	Between vertical and an estimated 5° everted (valgus)	More than an estimated 5° everted (valgus)
Forefoot Score	**-2**	**-1**	**0**	**1**	**2**
Talo-navicular congruence	Area of TNJ markedly concave	Area of TNJ slightly, but definitely concave	Area of TNJ flat	Area of TNJ bulging slightly	Area of TNJ bulging markedly
Medial arch height	Arch high and acutely angled towards the posterior end of the medial arch	Arch moderately high and slightly acute posteriorly	Arch height normal and concentrically curved	Arch lowered with some flattening in the central portion	Arch very low with severe flattening in the central portion – arch making ground contact
Forefoot abd/adduction	No lateral toes visible. Medial toes clearly visible	Medial toes clearly more visible than lateral	Medial and lateral toes equally visible	Lateral toes clearly more visible than medial	No medial toes visible. Lateral toes clearly visible

Foot Posture Index Datasheet

Patient name	***ID number***

	FACTOR	***PLANE***	**SCORE 1** Date_____ Comment_____		**SCORE 2** Date_____ Comment_____		**SCORE 3** Date_____ Comment_____	
			Left *-2 to +2*	***Right*** *-2 to +2*	***Left*** *-2 to +2*	***Right*** *-2 to +2*	***Left*** *-2 to +2*	***Right*** *-2 to +2*
Rearfoot	Talar head palpation	*Transverse*						
	Curves above and below the lateral malleolus	*Frontal/ transverse*						
	Inversion/eversion of the calcaneus	*Frontal*						
Forefoot	Prominence in the region of the TNJ	*Transverse*						
	Congruence of the medial longitudinal arch	*Sagittal*						
	Abd/adduction forefoot on rearfoot	*Transverse*						
	TOTAL							

Reference values
Normal = 0 to +5
Pronated = +6 to +9, Highly pronated 10+
Supinated = -1 to –4, Highly supinated –5 to -12

MASTER CHART