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EFFECT OF TALO-NAVICULAR MOBILIZATION ALONG WITH INTRINSIC FOOT MUSCLE STRENGTHENING ON NAVICULAR DROP AND DYNAMIC BALANCE IN INDIVIDUALS WITH FLAT FOOT

Physiotherapy

Arun Kumar. S* — Assistant Professor, KG College of Physiotherapy (Affiliated to The Tamil Nadu Dr. MGR Medical University), Coimbatore, Tamil Nadu, India *Corresponding Author

Manoj Abraham. M — Professor/Principal, KG College of Physiotherapy (Affiliated to The Tamil Nadu Dr. MGR Medical University), Coimbatore, Tamil Nadu, India

Aleena Jose Paul — BPT- INTERN, KG College of Physiotherapy (Affiliated to The Tamil Nadu Dr. MGR Medical University), Coimbatore, Tamil Nadu, India

ABSTRACT

Flat foot is a common musculoskeletal condition characterized by a reduced medial longitudinal arch, leading to excessive pronation, increased navicular drop, and impaired dynamic balance. Weakness of the intrinsic foot muscles and reduced mobility of the talo-navicular joint may contribute to these problems. This study aimed to determine the effect of talo-navicular mobilization combined with intrinsic foot muscle strengthening on navicular drop and dynamic balance in individuals with flat foot. Thirty participants aged 18–24 years with flat foot were randomly assigned into two groups. Group A received talo-navicular mobilization along with intrinsic foot muscle strengthening exercises, while Group B received only intrinsic foot muscle strengthening exercises for 6 weeks. Navicular Drop Test and Y-Balance Test were used to assess the outcomes before and after the intervention. Both groups showed improvement following treatment; however, Group A demonstrated significantly greater reduction in navicular drop and better improvement in dynamic balance compared to Group B, with statistically significant differences ($p < 0.05$). The findings suggest that combining talo-navicular mobilization with intrinsic foot muscle strengthening is more effective than strengthening exercises alone in improving foot posture and dynamic balance in individuals with flat foot.

KEYWORDS

Flat Foot, Talo-Navicular Mobilization, Intrinsic Foot Muscle Strengthening, Navicular Drop, Dynamic Balance.

INTRODUCTION

Pes planus, or flatfoot, is a common musculoskeletal condition characterized by collapse of the foot's arches, leading to postural deformity and functional impairment. Key features include reduction of the medial longitudinal arch, forefoot deviation, talar plantarflexion with medial rotation, and calcaneal eversion. The foot's dual role in stance and propulsion depends on intrinsic muscles for stability, adaptability, and shock absorption; dysfunction results in excessive pronation and impaired mechanics.

Severity of flatfoot is determined by medial arch height, which influences shock attenuation and locomotor efficiency. Acquired flatfoot may arise from injury, obesity, illness, or faulty biomechanics. Prevalence varies: 21–57% in children aged 2–6, declining to 13–27% in school children, and 13–26% in adults. Though higher in overweight individuals, flatfoot also occurs in those with normal BMI, indicating multifactorial etiology.

Clinical features include plantar fascia and Achilles pain, ligament laxity, instability, and secondary musculoskeletal issues in knees, hips, and spine. Two types exist: flexible flatfoot, where the arch collapses under weight but reappears on tiptoe, and rigid flatfoot, with permanent arch absence. The talo-navicular joint plays a pivotal role in pronation mechanics, and dysfunction may strain surrounding tissues. Strengthening intrinsic foot muscles—such as abductor hallucis and flexor digitorum brevis—via exercises like toe curls and short foot training improves arch support, balance, and dynamic stability.

Untreated flatfoot may progress to hallux valgus, plantar fasciitis, metatarsalgia, knee pain, or Achilles tendinitis. Navicular drop measurement serves as an indicator of pronation, though influenced by anatomical and neuromuscular factors beyond static alignment. Balance, both static and dynamic, integrates sensory and motor systems to maintain posture. Dynamic balance is commonly assessed using the Y Balance Test, a reliable variation of the Star Excursion Balance Test, measuring anterior, posterolateral, and posteromedial reach with composite scoring

Objectives of the Study

- To determine whether the integration of Maitland mobilization with intrinsic muscle strengthening leads to a greater reduction in navicular drop compared to intrinsic muscle strengthening alone.
- To evaluate the effectiveness of the combined intervention in enhancing dynamic balance among individuals with flat foot.

METHODOLOGY

Study Design

Pre-test and Post-test experimental study design.

Study Setting

The study was conducted in KG Physiotherapy and Rehabilitation centre Saravanampatti, Coimbatore.

Study Duration

The study was conducted over a period of 6 months, 3 sessions per week for total of 6 weeks.

Study Sampling

30 subjects who fulfilled the predetermined inclusion criteria were selected and divided into 2 groups by random sampling method. Each group consists of 15 subjects. Group were named as A and B.

Group A: This group received Talo-Navicular Mobilization and intrinsic foot muscle strengthening

Group B: This group received intrinsic foot muscle strengthening alone.

Inclusion Criteria

Age group of 18-24 years**,** Both Males and Females Functional Flat foot**,** Navicular drop more than 10 mm**,** Normal BMI-18.5-24.9**,** Subjects who were willing to participate in the study were included.

Exclusion Criteria

Foot or Ankle surgery, Subjects with neurological dysfunction, musculoskeletal dysfunction, psychiatric conditions were excluded, Any previous history of musculoskeletal injury like fracture or dislocation, Foot deformity other than pes planus, Congenital foot deformities.

Variables

Independent Variables:

- Talo-Navicular mobilization
- Intrinsic foot muscle strengthening exercises

Dependent Variables

- Navicular drop
- Dynamic balance

Outcome Measure

- Navicular drop test
- Y balance test

Procedure

Participants were informed about the study protocol, risks, and rights before providing written consent. Thirty subjects who met the inclusion criteria were randomly assigned into two groups of 15 each. Group A received talo-navicular mobilization combined with intrinsic foot muscle strengthening, while Group B performed intrinsic foot muscle strengthening alone.

The mobilization consisted of a plantar glide applied to the navicular (20 repetitions × 3 sets) with the patient supine and knee relaxed, stabilizing the talar neck to increase medial arch height. Strengthening exercises included short foot, toe curls, toe spread out, first toe extension, second–fifth toe extension, and marble pickup. Both groups followed a structured program of 3 sets of 15 repetitions, 3 sessions per week for 6 weeks. Each 30-minute session incorporated a 5-minute warm-up, intervention phase, and 5-minute cool-down, ensuring consistency across participants.

Talo-navicular Mobilization

Plantar Glide

Intrinsic Foot Muscle Strengthening Exercises

Toe Curls **Short Foot Exercise**

Table- I Age Group Classification

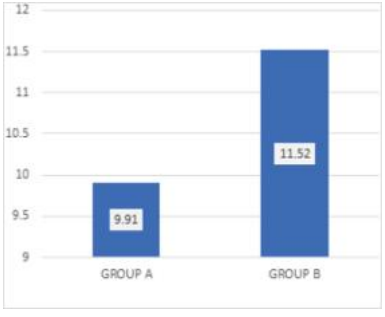
S. NO	AGE	TOTAL	GROUP-A	GROUP-B
1	18-21	16 (53.33%)	7	8
2	22-24	14 (46.66%)	8	7

Table – II Comparison of Pre & Post Test Values of Group A & B

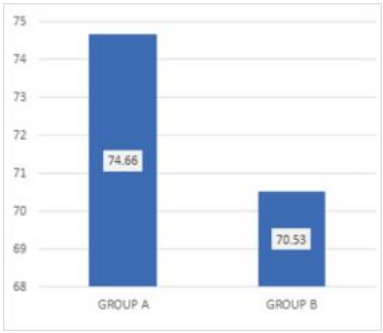
Outcome Measure	Group	Pre – Test Mean ± SD	Post – Test Mean ± SD	Mean Difference	T-Value
Navicular Drop Test	A	13.03 ± 1.01	9.91 ± 1.22	3.12	16.09
	B	13.01 ± 0.94	11.52 ± 1.23	1.49	9.77
Y- Balance Test	A	69.26 ± 3.11	74.66 ± 2.29	5.40	19.81
	B	67.39 ± 1.50	70.53 ± 2.09	3.14	11.72

Table – III Comparison of Post – Test Values of Navicular Drop Test & Y- Balance Test of Group A & B

Outcome Measure	Group A (Mean ± SD)	Group B (Mean ± SD)	Mean Differnce	T - Value
Navicular Drop Test	9.91 ± 1.22	11.52 ± 1.23	1.61	3.61
Y- Balance Test	74.66 ± 2.29	70.53 ± 2.09	4.13	5.14



Graph I Unpaired 't' Test Navicular Drop Test For Group-A & Group-B (Post-test Values)



Graph II Unpaired 't' Test Y- Balance Test- Group- A & Group- B (Post-test Values)

RESULTS

Tables I summarize the age characteristics of participants in Groups A and B. Within-group analysis using paired t-tests revealed statistically significant improvements in navicular drop (Group A t=16.09, Group B t=9.77) and Y-Balance test scores also improved (Group A t=19.81, Group B t=11.72) following the intervention. Between-group comparison using unpaired t-tests identified significant differences in post-intervention scores for the navicular drop test (t=3.61) and Y-balance test (t=5.14). These findings confirm that while intrinsic foot muscle strengthening alone is beneficial, the addition of talo-navicular mobilization produces superior improvements in medial arch function, dynamic balance, and overall foot stability, thereby supporting the study's alternative hypothesis.

DISCUSSION

This study explored how combining talo-navicular joint mobilization with intrinsic foot muscle strengthening affects navicular drop and dynamic balance in people with flat foot. Flat foot alters the medial longitudinal arch, often leading to pronation, instability, and reduced balance. Addressing both joint mobility and muscle strength is therefore important in treatment. Thirty participants were randomly assigned to two groups: Group A received mobilization plus strengthening, while Group B performed strengthening alone. Outcomes were measured using the navicular drop test and Y-Balance test.

Both groups showed significant improvement, confirming that intrinsic muscle strengthening helps enhance arch stability and posture. However, Group A achieved greater reductions in navicular drop and better gains in dynamic balance. These superior results likely stem from improved talo-navicular joint mobility, proprioceptive input, and neuromuscular control when mobilization was added. The findings support earlier research showing that talo-navicular joint mobilization and intrinsic foot muscle training together provide stronger benefits than strengthening alone.

CONCLUSION

This study investigated the effect of talo-navicular mobilization combined with intrinsic foot muscle strengthening on navicular drop and dynamic balance in individuals with flat foot. Thirty participants were randomly divided into two groups: Group A received mobilization plus strengthening, while Group B performed strengthening alone for six weeks. Navicular drop and Y-Balance tests were used for pre- and post-assessment.

Both groups showed improvement, confirming the benefit of intrinsic muscle strengthening. However, Group A demonstrated significantly greater gains in medial arch stability and dynamic balance, supporting the alternative hypothesis that combined intervention is more effective than strengthening alone.

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