



**ORIGINAL RESEARCH PAPER**

**Physiotherapy**

**A STUDY OF SHORT FOOT EXERCISE AND CRYO BALL THERAPY IN YOUNG INDIVIDUAL WITH FLEXIBLE FLAT FOOT: A CASE STUDY**

**KEY WORDS:** Flexible flat foot, short foot exercise, cryotherapy, pain, foot function.

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**ABSTRACT**

Flatfoot, pes planus, or fallen arch is a common disorder that arises from a decrease of the medial longitudinal arch and it is commonly observed in clinical practice which causes pain and difficulty during physical activities. It is the result of the weakness of intrinsic and extrinsic foot muscles. In particular, the tibialis posterior muscle plays an essential role in maintaining the Medial Longitudinal Arch during dynamic weight bearing and balance. In addition, this muscle acts longer than other supination muscles during the stance phase in the gait cycle. So, the strengthening exercises of the tibialis posterior and cryotherapy improves pain and foot function among young adults with flat foot.

**INTRODUCTION**

Many terms have been used to describe the flat foot. Some of the more common ones are pes planus, Plano valgus, calcanei-valgus, and fallen arches. Flat foot describes the common endpoint of any abnormality that causes the medial longitudinal arch to collapse. It can cause severe symptoms or be asymptomatic. [1]

Flat foot, pes planus, or fallen arch is a common disorder that arises from a decrease of the medial longitudinal arch. This deformity includes calcaneus bone in the valgus position and talus bone in plantar flexion with adduction producing excessive pronation of the foot when bearing weight. During the walking cycle, a normal foot changes from a supple (early stance phase) to a rigid position (late stance phase) while the concavity of the sole is maintained. A flatfoot remains in a supple position and does not convert to a rigid position for push-off, and the concavity of the sole is lost during the stance phase. The degree of non-conversion to a rigid position depends on the degree of flatfoot. [5]

Short-foot exercises (SFE), which are often recommended to strengthen intrinsic foot muscles activate the abductor hallucis muscle and prevent an excessive decrease of Medial Longitudinal Arch (MLA) height. It is effective in increasing the cross-sectional area of the Abductor hallucis muscle and the strength of the flexor hallucis muscle in a flat foot, enhancing foot posture and function, reducing navicular drop, and improving dynamic balance in healthy populations. [30]

The role of cryotherapy in the treatment of pain has been known since the Egyptians. For fifty years, techniques initially dedicated to the whole body have evolved into more specific approaches by targeting nerve structures.

**CASE PRESENTATION**

Miss.R.Poojaa was a 22-year-old female. She was a student. She was a classical dancer.

She has a flat foot pain for over 4years. Previously, she took on and off treatment for a flat foot. She came with a complaint of foot pain during a dance session. She had difficulty in stair climbing and long-standing.

She had difficulty climbing stairs. She had difficulty in dancer practicing due to foot pain. She should be able to practice well for dance competitions. She wants to climb stairs as normal. She practices short foot exercises and cryotherapy for 8 weeks as home exercises.

**Physical Examination**

Present history: there is foot pain, while practicing classical

dance. Pain history: worsen during weight-bearing activities. Date of onset symptoms: dance competition days. Onset of pain: toes & heels. Duration of symptoms: 3-4 hours of pain. Type of pain: sharp pain. Aggravating factors: dancing, long-standing, climbing ramps. Relieving factors: stretching the foot, squeezing the foot. Built: endomorphic. Type of gait: compensated rear foot. Deformity: hind foot valgus, forefoot abduction, & supination. External appliances: there are no splints and orthotic. Tenderness: there is no tenderness on the site of the foot.

**Measurement Of Clarke's Angle Using Footprints**

Bilateral footprints were obtained from the study participants using an ink stamp pad. After cleansing their feet, the participant was requested to step their soles on the inkpad with minimal pressure, and then the inked foot was transferred onto a plain white A4 size paper kept aside on a flat surface.

Clarke's angle is obtained by calculating the angle of the first medial tangential line that connects the medial edges of the first metatarsal head and the heel, and the second line that connects the first metatarsal head and the acme of the medial longitudinal arch and concavity.

**CLARKE'S ANGLE**



**UNIPEDAL TOE TEST**

**Patient position:** Single limb standing

**Procedure:** The subject is asked to stand on his/her toe. If the foot moves into eversion, the tibialis posterior muscle is involved. Short foot exercise (Intrinsic and Extrinsic foot muscles -Tibialis posterior) strengthening and cryotherapy.

**Special Test**

Hubscher maneuver (or Jack's test):

The test is performed with the patient weight bearing, with the foot flat on the ground, while the therapist passively dorsiflexes the hallux and notes for an increasing concavity of the arches of the foot.

**Intervention:**

**Exercise Protocol:** Five exercises were selected. Each exercise was performed barefoot and had both a concentric and an eccentric phase. **EXERCISE 1:** Toe Curls This exercise builds up the flexor muscles of the feet and toes, improving your foot strength. **EXERCISE 2:** resisted foot adduction Patient position: Sitting with their knees maintained at a forearm's length apart and flexed approximately 80degree, with feet on the ground. **EXERCISE 3:** toe splays Patient position: Sitting in the chair & foot placed on the ground. **EXERCISE 4:** unilateral heel raise (calf raise)

**Foot Function Index**

**Patient Name:** Miss. R. Poojaa Date: 11/08/2022

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: Is foot pain at its worst?	7	Pain standing with shoes?	7
Foot pain in the morning?	5	Pain walking with orthotics?	2
Is pain walking barefoot?	5	Pain standing with orthotics?	2
Pain standing barefoot?	6	Foot pain at end of the day?	8
Pain walking with shoes?	6		48

**Disability Subscale: How much difficulty did you have?**

Difficulty walking in the house?	4	Difficulty standing on tiptoe?	6
Is difficulty walking outside?	5	Is difficulty getting up from the chair?	7
Difficulty walking 4 blocks?	6	Difficulty climbing curbs?	9
Difficulty climbing stairs?	5	Is difficulty walking fast?	9
Difficulty descending stairs?	5	56	

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

Stay inside all day because of feet?	5	Use assistive devices indoors?	1
Stay in bed because of feet?	8	Use assistive devices outdoors?	1
Limit activities because of feet?	4	19	

**Total Score: 123/230 x 100 = 53.47%**

FOOT FUNCTION INDEX	PRE-TEST VALUE	POST-TEST VALUE
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PAIN SUBSCALE	48/90	34/90
DISABILITY SUBSCALE	56/90	39/90
ACTIVITY LIMITATION SUBSCALE	19/50	13/50
TOTAL SCORE	123/230	86/230

**5.1.1 FOOT FUNCTION INDEX**

**OUTCOME MEASURES**

OUTCOME MEASURES: FOOT FUNCTION INDEX	PRETEST VALUE	PERCENTAGE OF PRE-TEST	POST-TEST VALUE	PERCENTAGE OF POST-TEST
PAIN SUBSCALE	48/90	53.33%	34/90	37.77%
DISABILITY SUBSCALE	56/90	62.22%	39/90	43.33%
ACTIVITY LIMITATION SUBSCALE	19/50	38%	13/50	26%
TOTAL SCORE	123/230	53.47%	86/230	37.39%

**Assessment Findings**

**Pain scale:** the pre-test pain subscale value was 48(53.33%) & the post-test pain subscale value was 34(37.77%) the pain level is comparatively reduced in after offering cryotherapy. **Disability subscale:** the pre-test disability subscale value was 56(62.22%) & the post-test disability subscale value was 39(43.33%) the disability level is comparatively reduced after offering short foot exercise & cryotherapy. **Activity limitation subscale:** the pre-test activity limitation subscale value was 19(38%) & the post-test activity limitation subscale value was 13(26%) the activity limitation level was comparatively reduced after offering the short foot exercise & cryotherapy.

**DISCUSSION**

The purpose of this study is to investigate the effect of the intrinsic and extrinsic foot muscles (tibialis posterior) strengthening and cryotherapy on pain and foot function among young adults with flexible flat foot.

Flat feet are a relatively common foot deformity and are defined by the loss of the medial longitudinal arch of the foot where it contacts or nearly contacts the ground. The arch of the foot is a tough, elastic connection of ligaments, tendons, and fascia between the forefoot and the hindfoot. The arch serves as an adaptive and flexible base for the entire body. It functions to dissipate the forces of weight-bearing and acts to store mechanical energy within the stretched elastic ligaments during the gait cycle.

The protocol consists of resisted foot adduction, toe curls (towel crunches, toe extension exercises (toe splay), unilateral heel raise, and calf stretches. This increases the strength of the muscle which acts as a better dynamic stabilizer of the arch than it was before the intervention so that the pain and difficulty were much reduced during physical activities like walking".

Intermittent cryotherapy (10 minutes application and 10 minutes rest and then applied for another 10 minutes results in reducing pain. In this study, cryotherapy is applied in the form of a ball under the plantar surface which acts as a myofascial release. Cryotherapy lowers cellular metabolism, thus helping to shorten the healing time after injury. It also causes vasoconstriction followed by vasodilation of the blood vessels (hunting response). It plays a major role in the destruction of the pain-spasm-pain cycle and also reduces inflammation.

The subject was asked to fill the pain and disability subscale of the foot function index before and after the intervention. They experienced less pain and difficulty during and other activities after 8 weeks of extrinsic and intrinsic muscle strengthening training and cryotherapy.

So, extrinsic and intrinsic muscle strengthening training and cryotherapy relieve pain and improve foot function among individuals with flexible flat feet.

### CONCLUSION

The study concluded that there was a significant improvement in pain and difficulty in subjects with flexible flat foot. It was concluded that intrinsic and extrinsic foot muscle strengthening and cryotherapy were efficient in reducing pain and difficulty and thereby improving the foot function in flexible flat foot.

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