

Effectiveness Of Structural Diagnosis And Management Approach And Myofascial Release Using Foam Roller In Patients With Plantar Heel Pain

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ABSTRACT

Plantar heel pain, affecting approximately 7.9% of the population, is a common and disabling lower limb condition characterized by pain in one or both feet. It often presents as intense pain after rest, reduced pain during activity, limited ankle movement, and tenderness at the heel. The primary cause is typically micro-tears and inflammation of the plantar fascia due to repetitive stress, exacerbated by biomechanical factors like altered foot arch mechanics and gait. This study investigates the effectiveness of a combined approach: the Structural Diagnosis and Management (SDM) Approach, which includes dorsiflexion mobilization, myofascial trigger point release in calf muscles, and hamstring flexibility improvement, alongside Myofascial Release (MFR) using a foam roller. **Methodology:** A quasi-experimental design was used with 30 participants (aged 30-40) diagnosed with unilateral plantar heel pain lasting over four weeks and exhibiting limited ankle dorsiflexion. Exclusions included recent trauma, fractures, osteoporosis, infections, cancer history, or phobias. The six-week intervention involved three to four sessions per week. Interventions included the SDM approach (dorsiflexion stretch, calf muscle trigger point release), MFR with a foam roller (plantar surface stripping, posterior leg stripping, lateral leg lengthening), and low-level laser therapy (LLLT) for 10 minutes. Outcome measures were the Foot Function Index (FFI), Foot and Ankle Disability Index (FADI), and ankle dorsiflexion/plantarflexion range of motion (ROM) measured with a universal goniometer. Paired t-tests analyzed pre- and post-intervention data. **Conclusion:** The study concluded that the combined SDM approach and MFR using a foam roller were effective in improving clinical and functional outcomes for patients with plantar heel pain. Within-group analysis showed significant improvements in all measured outcomes from pre-test to post-test, including reduced foot-related functional impairment, decreased ankle disability, and enhanced ankle range of motion.

Keywords: Plantar, Heel Pain, Myofascial Release, Foam Roller.

INTRODUCTION

Plantar heel pain, which affects approximately 7.9% of the population, is a disabling condition of the lower limb that presents as pain in one or both feet. [1] It is one of the most common musculoskeletal issues affecting the lower limb and can impact both individuals who are physically active and those who are sedentary. [2] The typical symptoms of plantar fasciitis include intense pain following a period of rest, reduced pain during activity, limited ankle movement, and tenderness on the inner side of the heel bone. [7] The underlying mechanism involves the stretching and tearing of the plantar fascia due to repeated micro-level stress at the point where the fascia meets the heel bone. This leads to continuous

breakdown of collagen, inflammation, and thickening of the fascia. [1] The plantar fascia runs from the back part of the heel bone to the base of the toes and is attached there. Risk factors for plantar fasciitis include obesity, excessive weight on the feet, long periods of standing, and wearing unsuitable footwear. [4]

The theory of biomechanical abnormalities that increase stress on the plantar fascia and surrounding tissues is widely accepted. [1] These abnormalities can include changes in the foot's arch, which alter normal movement. The deviations from normal motion needed to absorb forces from the ground. The inability to properly distribute the forces from the heel strike to the midstance phase It can increase the load

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on the plantar fascia and surrounding structures. The most widely accepted theory is described by Bolgia and Malone, who explain the biomechanical connection between the plantar fascia and the windlass mechanism. [1] The windlass mechanism is illustrated by an imaginary triangle formed by the heel bone, midtarsal joint, and metatarsal bones, creating a structure similar to a truss, with the plantar fascia acting like a 'Spanish windlass'. [1] Repetitive stress and damage to these soft tissues result in the clinical symptoms of plantar heel pain and related impairments. [1]

The Structural Diagnosis and Management (SDM) Approach is a newly designed hypothetical concept and needs to be examined through a systematic process. It includes the mobilization of dorsiflexion movement strain, the release of myofascial trigger points of gastrocnemius and soleus, improving flexibility of hamstring muscles. The theoretical concept of SDM for plantar heel pain are as follows,[1] Stretching to the gastrocnemius, and soleus muscles; Improves flexibility of Gastrocnemius and Soleus. Counterforce forefoot varus and prevents excessive pronation of the foot during gait Reduces and normalizes stress level to soft tissues of foot. Normalizes the stress to plantar fascia and to the perifascial structures. Release of local trigger points of calf muscles; Helps to improve flexibility of Gastrocnemius and Soleus. Enhance normal mobility required to absorb the ground reaction force through foot Promotes normal dissipation of the forces from heel strike to midstance Normalizes load to plantar fascia and perifascial structures.

Myofascial Release (MFR) is a type of soft tissue mobilization used to treat chronic conditions that cause tightness and restrictions in soft tissues. It helps to reduce the pressure on pain-sensitive structures caused by the fascia and restores proper alignment. MFR uses various techniques to decrease the tension on the plantar fascia at its attachment point. [1] This technique involves applying a low-load, prolonged stretch to the myofascial complex with the goal of restoring optimal length, reducing pain, and improving function. [22] Common soft tissue management techniques in MFR include deep stripping along the plantar surface of the foot towards the calcaneus, or using friction on the plantar fascia

away from the calcaneus. Applying MFR over the pressure points of the fascia, the calcaneus, and the gastrocnemius and soleus muscles has been found to be effective in reducing pain and improving function. [1] Laser therapy is a non-invasive and painless treatment option for patients suffering from plantar heel pain. [24] Low-level laser therapy (LLLT), also referred to as photo-bio-modulation therapy, is a quick and non-invasive treatment with no harmful side effects. Currently, LLLT is used to reduce pain and inflammation, promote wound healing, and accelerate the healing process in musculoskeletal injuries. [28] Therefore, using a foam roller for myofascial release can provide effective results in managing plantar heel pain and reducing ankle disability, thereby improving the range of motion of the ankle.

DESIGN & METHODOLOGY:

METHOD OF COLLECTION OF DATA:

Primary data will be collected from the sample and 30 subjects were included in the study. Age group between 30-40 (30 subjects). The subjects were included on the basis of Diagnosis with Unilateral Plantar Heel Pain, Heel Pain lasting more than 4 weeks, Limited Ankle Dorsiflexion Range of Motion (ROM). SOURCE OF DATA: For the study, 30 subjects between the age group of 30 and 40 were recruited with moderate to severe heel pain with limited ankle dorsiflexion range of motion. The subjects were screened for eligibility to participate in the study and regarding the study. The subjects explained the purpose of study and their role in the study. SAMPLE DESIGN: The study is based on Quasi Experimental study design. SAMPLING TECHNIQUE: Randomized Sampling Technique. SAMPLE SIZE: This study includes 30 subjects. STUDY SETTING: Jaya College of Physiotherapy, Thiruninravur, Chennai. STUDY DURATION: 6 weeks of duration with 3-4 sessions per week(alternative days). INCLUSION CRITERIA: Subjects with diagnosis of Unilateral Plantar Heel Pain. Limited Ankle Dorsiflexion ROM. Age Group: 30-40 years. Sex: Both Males and Females. Pain Intensity: Heel pain for more than 4 weeks. EXCLUSION CRITERIA: Recent trauma or injury to the foot. Past History of Fracture of Foot/Lower Tibia. Osteoporosis. Co-morbidity associated with an

infectious conditions of foot. Previous History of Cancer. Pre-existing Phobia to Physiotherapy or Manipulative Therapy.

PROCEDURE:

INTERVENTION 1: STRUCTURAL DIAGNOSIS AND MANAGEMENT(SDM) APPROACH

PHASE 1- (Dorsiflexion Stretch to Gastrocnemii and Soleus Muscles)

In supine lying, stabilize the tibia with a hand, and with another hand applies a gentle stretch to the gastrocnemii and soleus muscles. The maneuver has three stages namely, Stage 1 - Constitutes the first one-third of ankle dorsiflexion range. Stage 2 - Constitutes stretching up to middle one-third range. Stage 3 - Refers to stretching to the full range. This procedure can be performed and repeated for 3 times.

PHASE 2-(Release of Local Triggers of Calf Muscles)

In prone lying, apply pressure throughout the calf with medial to lateral, superior and inferior directions on the pillow. The maneuver has three stages namely, Stage 1 - Constitutes gentle pressure. Stage 2 - Firm pressure. Stage 3 - Deep pressure. This procedure can be performed and repeated for 3 times.

INTERVENTION 2: MYOFASCIAL RELEASE USING FOAM ROLLER

PHASE 1: In prone lying, the patient foot must be place at the end of the couch with no restrictions in ankle movements. Using foam roller, deep stripping is done over the plantar surface of the foot towards the calcaneus.

PHASE 2: In prone lying, the patient foot must be placed at the end of the couch/bed with no restrictions in ankle movements. Using foam roller, deep stripping is done over the posterior aspect of leg.

PHASE 3: In prone lying, the patient foot must be place at the end of the couch with no restrictions in ankle movements. Using foam roller, active engagement lengthening to lateral aspect of leg.

INTERVENTION 3: LASER THERAPY TECHNIQUE:

The patients lies in prone lying, the foot is slightly flexed and placed at the end of the couch. Then, the parameters of the laser has been set. The low-level laser therapy is applied over the affected area. The duration of Laser Therapy is about 10 minutes. After the treatment, the heel is observed if there any presence of redness over the treated area.

DATA ANALYSIS:

Paired t-test Output:

t-Test: Paired Two Sample for Means		
	<i>FFI Pre</i>	<i>FFI Post</i>
Mean	66.83	41.70
SD	4.02	4.24
Observations	30.00	30.00
t Stat	240.94	
P-value	0.000	

Paired t-test Output:

t-Test: Paired Two Sample for Means		
	<i>FADI Pre</i>	<i>FADI Post</i>
Mean	61.37	79.90
SD	3.01	2.66
Observations	30.00	30.00
t Stat	-123.90	
P-value	0.000	

Paired t-test Output:

t-Test: Paired Two Sample for Means		
	<i>DF Pre</i>	<i>DF Post</i>
Mean	7.47	14.93
SD	1.14	1.39
Observations	30.00	30.00
t Stat	-80.60	
P-value	0.000	

Paired t-test Output:

t-Test: Paired Two Sample for Means		
	<i>PF Pre</i>	<i>PF Post</i>
Mean	28.93	37.13
SD	1.28	1.87
Observations	30.00	30.00
t Stat	-38.83	
P-value	0.000	

DISCUSSION:

Plantar heel pain is one of the most common musculoskeletal conditions affecting the lower limb, and is known to affect both physically active and sedentary individuals. The classical signs of plantar fasciitis are severe pain after a period of rest, decrease in pain with activity, restriction in ankle range of motion (ROM) and tenderness over medial aspect of calcaneus. The pathophysiology is caused by stretching and rupture of plantar fascia due to repetitive micro-stress that happens at the location where plantar fascia meets the calcaneus that produce repetitive collagen breakdown, inflammation, and fascia thickening. Plantar Fascia running from the posterior tuberosity of the calcaneus to the base of the proximal phalanges and attached over it. It is essential to accurately evaluate the pain and disability using Foot Function Index and Foot and Ankle Disability Index, the range of motion using Goniometer.

For the study, 30 subjects between the age group of 30 and 40 were recruited with moderate to severe heel pain with limited ankle dorsiflexion range of motion. The subjects were screened for eligibility to participate in the study and regarding the study. All participants received a clear explanation regarding the treatment procedure. The outcome measures were documented by using, **FOOT FUNCTION INDEX:** The Foot Function Index (FFI) is a 23 item questionnaire, with 9 items on Pain, 9 items on Disability and 9 items on painful Activities. **UNIVERSAL GONIOMETER:** The Range of Motion of Ankle Dorsiflexion and Plantarflexion was measured by using a Universal Goniometer. **FOOT ANKLE DISABILITY INDEX:** The Foot Ankle Disability Index (FADI) is a 26-item questionnaire containing 22 functional difficulty-related questions and 4 pain-related questions. This study focused on improving functional outcome in patients with plantar heel pain. Statistic report confirms the improvement at various level of impairment and disability using evidence based exercise approach.

INTERVENTION 1 - STRUCTURAL DIAGNOSIS AND MANAGEMENT (SDM) APPROACH:

The mean Foot Function Index (FFI) score at pre-test was 66.83 ± 4.02 , which reduced to 41.70 ± 4.24 at post-test, indicating an improvement in foot-related functional status. With regard to ankle range of motion, the mean dorsiflexion (DF) value increased from 7.47 ± 1.14 at pre-test to 14.93 ± 1.39 at post-test, reflecting an improvement in ankle dorsiflexion mobility. Similarly, the mean plantar flexion (PF) value improved from 28.93 ± 1.28 at pre-test to 37.13 ± 1.87 at post-test, indicating enhanced plantar flexion range of motion following the intervention. Hence, the evidence is sufficient to conclude the treatment “SDM APPROACH” is significantly effective in decreasing the pain values. **Sapia Akter et. al., 2023** - Comparison of SDM approach and MFR for improving plantar heel pain - This study conducted over 4 to 6 weeks of intervention period and reveals the prevalence of plantar heel pain affects 7.9% population and it is a disabling condition of lower limbs and concludes that the MFR can be effective in treating the plantar heel pain.

INTERVENTION 2 - MYOFASCIAL RELEASE USING FOAM ROLLER:

The mean Foot and Ankle Disability Index (FADI) score increased from 61.37 ± 3.01 during the pre-test to 79.90 ± 2.66 in the post-test, suggesting improved functional ability of the foot and ankle. With regard to ankle range of motion, the mean dorsiflexion (DF) value increased from 7.47 ± 1.14 at pre-test to 14.93 ± 1.39 at post-test, reflecting an improvement in ankle dorsiflexion mobility. Similarly, the mean plantar flexion (PF) value improved from 28.93 ± 1.28 at pre-test to 37.13 ± 1.87 at post-test, indicating enhanced plantar flexion range of motion following the intervention. Hence, the evidence is sufficient to conclude the treatment “MYOFASCIAL RELEASE USING FOAM ROLLER” is significantly effective in decreasing the pain and disability values. **Yadav S et. al., 2022** - Effect of foam rolling with self-stretching on plantar heel pain - Within group analysis has shown that there was a statistically significant difference in all the outcome measures in both the groups. The present study proved that both self-stretching and foam rolling with self-stretching showed significant improvement on pain and increasing ROM in plantar fasciitis. However, effectiveness of foam rolling with self-stretching was superior to self-stretching.

ANALYSIS OF OUTCOME MEASURES: FFI:

The mean Foot Function Index (FFI) score at pre-test was 66.83 ± 4.02 , which reduced to 41.70 ± 4.24 at post-test, indicating an improvement in foot-related functional status. **FADI:** The mean Foot and Ankle Disability Index (FADI) score increased from 61.37 ± 3.01 during the pre-test to 79.90 ± 2.66 in the post-test, suggesting improved functional ability of the foot and ankle. **ANKLE DF:** The mean dorsiflexion (DF) value increased from 7.47 ± 1.14 at pre-test to 14.93 ± 1.39 at post-test, reflecting an improvement in ankle dorsiflexion mobility. **ANKLE PF:** The mean plantar flexion (PF) value improved from 28.93 ± 1.28 at pre-test to 37.13 ± 1.87 at post-test, indicating enhanced plantar flexion range of motion following the intervention.

CONCLUSION

The findings of the present quasi-experimental study indicate that the structural diagnosis and management

approach combined with myofascial release using a foam roller was effective in improving clinical and functional outcomes in patients with plantar heel pain. The within-group analysis revealed significant improvements from pre-test to post-test across all outcome measures, demonstrating a reduction in foot-related functional impairment and ankle disability, along with improvements in ankle range of motion.

LIMITATIONS AND RECOMMENDATIONS:

The subjects are taken between the age group of 30 - 40 years. This study is about shorter period of duration. No control group is there in this study. **RECOMMENDATIONS:** Increase the sample size for this study. Include multiple age groups for this study. Add a control group and give standard physiotherapy program.

CONFLICT OF INTEREST:NIL

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