Journal of Pharmaceutical Research International

33(44B): 532-539, 2021; Article no.JPRI.74562
ISSN: 2456-9119
(Past name: British Journal of Pharmaceutical Research, Past ISSN: 2231-2919, NLM ID: 101631759)

Efficacy of Percussive Massage versus Calf Stretching on Pain, Range of Motion, Muscle Strength and Functional Outcomes in Patients with Plantar Fasciitis – A Research Protocol

Madhu Lakhwani[1] and Pratik Phansopkar[1*]

[1]Department of Musculoskeletal Physiotherapy, Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences, Wardha, Maharashtra, India.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JPRI/2021/v33i44B32705
Editor(s):
(1) Dr. Vasudevan Mani, Qassim University, Saudi Arabia.
Reviewers:
(1) Banu kuran, Sisli Hamidiye Etfal Training Hostital, Turkey.
(2) Diker Dev Joshi, Rajiv Gandhi University of Health Sciences, India.
Complete Peer review History: https://www.sdiarticle4.com/review-history/74562

Study Protocol

Received 14 July 2021
Accepted 24 September 2021
Published 27September 2021

ABSTRACT

Introduction: Plantar fasciitis occurs with the deterioration of the plantar fascia and related surrounding tissues around the heel's medial calcaneal tuberosity. This illness usually causes tightness in the calf muscles. These tight muscles are thought to interfere with the normal biomechanics of ambulation. The invention of percussion massage guns intends to improve the usefulness and efficiency of self-myofascial release, following in the footsteps of vibrating foam rollers. Since there is limited research on muscle gun devices, despite their growing popularity, this study will look into their effects on range of motion, essential physiological or biomechanical factors that contribute to the disease, and their capacity to reduce muscular tightness.

Methodology: Subjects with Plantar Fasciitis (n = 48) will be recruited for a single-blind RCT. Participants will be assigned randomly to the experimental or control groups with a one-to-one allocation ratio. Participants in Group A will receive treatment via Theragun, Hot/cold immersion therapy, and a home exercise regimen during a one-week period immediately following baseline evaluations and randomization. Participants in GROUP B would only be subjected to Calf

**Corresponding author: E-mail: drpratik77@gmail.com;*

Stretching, a Contrast Bath, and a home exercise regimen. For a week, the calf muscles were treated for 5 minutes every day (7 sessions in all). As 1 week is completed, the efficacy of the approach for both groups is assessed using ankle flexibility tests, VAS, universal goniometers, Active Manual muscle testing, and the (PFPS) as outcome measures.

Discussion: The purpose of this study is to compare the benefits of the Hypervolt device vs calf stretching in individuals with plantar fasciitis. The outcomes of the study, which may include a newly designed rehabilitation technique, may assist patients experiencing Plantar +-Fasciitis.

Conclusion: Conclusion will be drawn based on the effect of both the techniques on Pain, Range of Motion, Muscle Strength, and Functional Outcomes in Patients with Plantar Fasciitis.

Keywords: Plantar fasciitis; percussive therapy; theragun; calf stretching; contrast bath; plantar fasciitis pain/disability scale (PFPS).

1. INTRODUCTION

Fascia is a sheet-like thin membrane that lies underneath the skin. These tissues are responsible for attaching, supporting, giving strength, separating muscles, and enclosing different organs [1].

Plantar fasciitis is caused by a progressive degenerative alteration in the matrix structure. It begins on the medial side of the calcaneus tubercle and inserts in three separate places in the front foot, resulting in three unique planes.The medial band, which connects to the base of the 5th metatarsal, protects the hallux muscles [2].

PF stiffens the arches while walking along with flattening the longitudinal arch and reducing the influence of GRF on metatarsal heads. When conjunction with the MTP joints, it acts as a bridge structure to secure the mid-tarsal bones in place during locomotion, known as the Windlass Mechanism [3].

Ten percent of the population may experience it at some point during their life [4].

Localized healing reactions promote the development of adhesions and because of formation of new connective tissue ,thickening of the plantar fascia happens in an unorganised manner.

It is a condition that affects the preponderance of those who participate in sports or work for lengthy periods of time while standing. It causes discomfort, which causes the thick band to become inflamed.The plantar fascia is a rope that extends from the sole, connecting the toes and the heel bone. Prolonged standing, adiposity, excessive foot internal rotation, jogging, and reduced ankle dorsiflexion are all major risk factors. Plantar fasciitis causes searing pain as you take your first steps in the morning. The discomfort generally subsides after the foot is on the move and walking [5].

The most prevalent cause of discomfort is where plantar fascia originates but in distal PF along the length of central band ,soreness occurs typically.It is acute injury resolving easily with supports from the arch and stretchings. Ankle dorsiflexion ROM should be evaluated with the knees either flexed or extended [2].

Plantar fasciopathy, or soreness at the plantar fascia's calcaneal connection, is a prevalent reason of chronic heel ache. Pain where there is insertion on the calcaneus is a defining characteristic. This implies that people with the condition have greater sensitivity to local discomfort [6].

Burning or electric-shock-like heel pain is frequently caused by a neurologic condition, such as peripheral neuropathy or compression neuropathy. Compression of the peripheral nerves that give feeling to the heel can happen in a variety of places. The history and physical examination might provide clues as to the location of the compression.

According to the hypothesis, individuals are prone to the disease due to chronic tensile stress of the plantar fascia. Extrinsic variables are environmental and situational effects that affect on an individual, and they include extended standing, incorrect shoe fit, past injury, pace, periodicity, and distance per week [7].

It is considered to be a deteriorating tissue condition or perhaps an inflammation of the calcaneus tuberosity, according to several

research. Collagen denaturation occurs in these lesions as a result of an unhealed small tear in the fascia. Because the norma fascia and underlying structures have been replaced by angiofibroblastic hyperplastic tissue, one of the histological characteristics of PF, the lesion sites lack inflammatory cell infiltration [8].

Stretchings and exercises, which are part of physiotherapeutic treatment, can be an effective way to provide targeted and gradual amounts of strain to damaged soft tissue, which may aid proper remodelling [9].

Stretching is commonly used to return shortened or tight muscles to their normal length or tension. Increased muscular flexibility is attributable to sensory change rather than increased muscle length, according to the sensory theory. To address this issue and increase the therapeutic impact of stretching, a variety of therapeutic instruments have been widely employed. In the realm of rehabilitation and sports, the use of vibrating devices to improve flexibility of muscle tissue has grown in recent years. Recently, LV treatment devices have been utilised to enhance musculoskeletal recovery and athletic performance.[10].

2. METHODOLOGY

2.1 Study Design and Sample Size

The individuals will be randomised into two groups by simple random selection using the envelope technique of randomization in this randomised controlled single-blinded experiment. Percussive therapy will be given to Group A, while Calf Stretching will be given to Group B.

2.2 Participants

2.2.1 Inclusion criteria

1. Untreated discomfort of heel due to inflamed plantar fasci for less than 6 months
2. Those who have previously undergone therapy and have a history of heel pain during the first few steps in the morning or after prolonged non-weight bearing activities
3. Calcaneal medial tubercle pain with sensitivity on palpation
4. Subjects ranging between the age of 20 to 50 years

2.2.2 Exclusion criteria

1. Individuals with complications such as lower limb neurovasculopathy
2. arthrosis of the ankle, knee, and hip
3. Anatomical foot/lower limb abnormalities, as well as any other disorders that interfere with complete ambulation,

2.3 Recruitment Procedure

Patients who come to the OPD of RNPC and AVBRH who will meet the eligibility requirements according to the inclusion criteria and willing to participate will be engaged in the RCT.

2.4 Sample Size Consideration

The prevalence was taken from the referenced article no.21 In power calculation ,sample size determination is 44.17 in number and considering the drop outs, sample size has been estimated 24 in each group. In each group, the total minimum sample size with a 90% confidence interval is 24. Total sample size calculated to be 48 considering two groups.

2.5 Randomization

Following the baseline examination, individuals who meet the inclusion criteria will be allocated to one of two groups at random (GROUP A or GROUP B). A computer-generated randomisation schedule in randomized permuted blocks will be prepared by an independent statistician, to ensure the number of subjects undergoing the two treatments within each group are closely balanced and the allocation numbers will be placed in invisible sealed envelopes. These envelopes will be made available to the player after signing the consent form.

2.6 Implementation

Research coordinator and principal investigator will supervise randomization. Participants will be asked to manually select from the envelope, sealed group allocation for the recruitment into either group.

2.7 Blinding

Tester(s) will be blinded to assign the subjects to the group. To ensure binding, subjects will be mandated not to reveal any details of their treatment to the tester

2.8 Study Procedure

At first, the patient will be extensively assessed. If the patient meets the eligibility requirements, he or she will be included in the study. The patient will give his or her consent after being fully informed. This will be accomplished through the use of a pre and post experimental design.The randomised controlled trial study design will be employed for this investigation.
Division will be done into Two groups:

GROUP A:

A percussive massage treatment using Theragun will be delivered to this group.
Lying on Stomach and foot out of bed will be the patient's position.
Therapist position: The therapist will stand at the foot end of the patient's afflicted side.
The soft attachment head will be used to massage the user, with a frequency of Fifty-Three Heartz for a week, the treatment will be used on the Gastrosoleus muscles for 5 minutes each day (Seven sessions in all) [11].
The first 2.5 minutes of the massage therapy will be focused on the gastrocnemius muscle medially, while the second 2.5 minutes laterally.
The unit will be moved in a straight line starting from distal to proximal and again moving back to distal within twenty seconds at the extreme medial aspect of the muscle to be treated [12].

GROUP B:

Gastrosoleus stretching:

Patient will be asked to lie in supine position with legs straight out in front and a little wrapped up towel beneath the knee to widen the leg.
This is done to keep the knee safe during stretching.
By hand or body weight, will be pushing the patient's ankle up towards the therapist.
A calf muscle stretch will be felt by the patient.
It will be done 10 times with a 10 seconds hold in between each iteraction.
The stretch will be held till the time mild discomfort is experienced by the patient.
The therapy will take a week to complete.

A pre and post examination will be performed before and after a week of intervention.

A Home Exercise Routine will also be provided to the participants, which they must follow twice a day.
For both groups, the home exercise programme will include:

Active ankle exercises: lying (10 reps)

Plantar fascia stretching moving the arch over a cylibdrical can are also useful [13].

Towel curl up: One foot will be flat on the end of a towel as the patient sits. The towel will be brought towards the body by curling it with the toes while keeping the heel on the floor.
Contrast Bath: The patient will be instructed to sit comfortably on a stool.
We will instruct them to immerse both lower extremities in warm (about forty two Degree) water for 4 mins and cold (fifteen Degree Celcius) water for a min
The process will be done about five times [one session a day for a week] [14].

2.9 Outcome Measures

2.9.1 The primary outcome measure

2.9.1.1 Knee to wall test, ankle flexibility test

Standing front of a wall with the testing feet close to the wall.

Centre of calcaneus, and patella perpendicular to the wall and in the plane throughout the test.

The patient positions their non-testing leg behind them to avoid obscuring the findings, with their hands on the wall ahead.

Lunging forward till the front knee comes into contact with the wall.

The heel must remain in touch with the floor at all times.

From the most recent successful effort, a measurement is obtained from the larger toe to the wall [15].

2.9.2 The secondary outcome measures

Visual Analogue Scale (VAS): with verbal descriptors at both ends to depict the extremes

of a sensation , it is a horizontal line with the length of 100 millimeter . patients indicate the point on the line that best matches to the intensity of their symptoms . To that purpose, they are told to draw a cross on the straight line at the place that best indicates their level of agreement VAS enables the determination of clinically important variations in distributions. When compared to categorical scales, this form of scale is thought to be more accurate and sensitive, as well as less prone to distortion and prejudice[16,17]

ROM: For measuring the range of motion of extremity joints, goniometers are considered legitimate and trustworthy clinical equipment. With the patient's leg is supine on the treatment table and the fulcrum at the lateral malleolus, goniometric measurements of the ankle are collected while maintaining the goniometer's bottom rod parallel to the tibia and fibula.The opposing arm went parallel to the fifth metatarsal in a straight line.Angle measurements were obtained at each point of dorsiflexion and plantar flexion while the patient was instructed to perform active dorsiflexion and plantarflexion at the ankle from a starting position with the foot relaxed (called the zero neutral position). If feasible, the subject was requested not to dorsiflex or plantarflex his or her toes. After dorsiflexion, the neutral starting position was restored before beginning plantarflexion[18,19]

Muscle strength: Active Manual muscle testing will be assessed Ankle dorsiflexors, plantar flexors [20].

2.10 Plantar Fasciitis Pain/Disability Scale (PFPS)

uses unique symptomatic questions to distinguish between PF and control questions, making 0 and 100 point ratings meaningless.This includes a number of important questions concerning plantar fasciitis symptoms and treatment choices [21].

2.11 Data Collection and Management

2.11.1 Data collection

Information about study given at time of recruitment (elaborating the purpose, nature, procedure, benefits and after effects of the intervention) with all baseline tests and assessment will be reported.

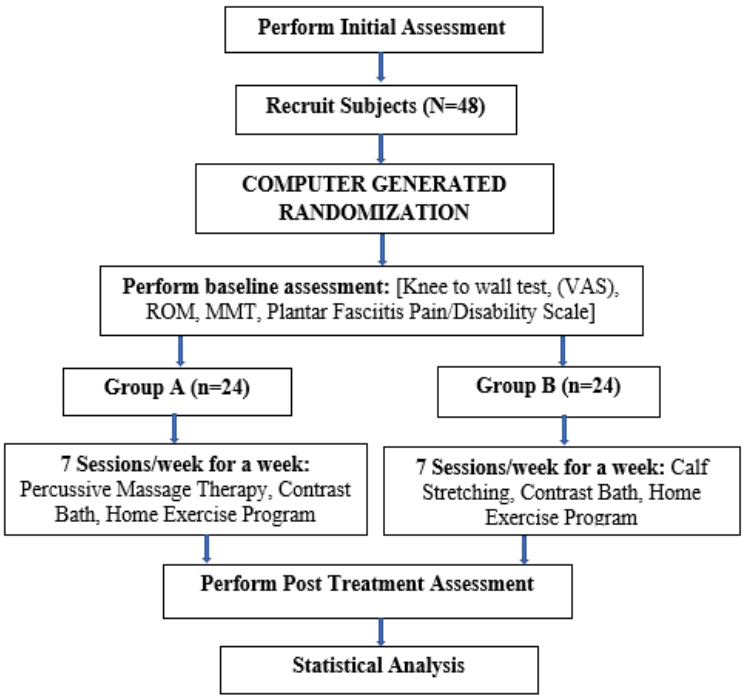

Fig. 1. Study procedure flow chart

3. DISCUSSION

The primary goal of this research is to see how Theragun works as an addition to traditional strategy in decreasing pain and increasing functional abilities in Plantar fasciitis population.

When the muscle's internal milieu is disrupted, it loses its ability to create maximum force or to sustain moderate intensity contractions for lengthy periods of time. As a result, in such circumstances, any mechanism that returns the disrupted organizational conditions to homeostatic levels would restore performance capacity.Vibratory massage has been proposed as one such method. Massage after a strenuous workout is designed to recover a muscle's performance capability more rapidly than recuperation merely.[22].

The tonic vibration reflex, which is mediated by the muscle spindles, is a fundamental response of the neuromuscular system to mechanical stimuli. Due to the percussive impact, the muscle is periodically stretched during application, and the response is for the muscle to contract, supposedly to relieve the stretch.[23].

Nitric oxide is produced by friction which occurs between the endothelial structures of vessels and moving blood, which are caused by laminar shear stress. This type of shear stress may be seen when blood flows through arteries during moderate exercise. When applied externally, low-frequency vibration generates enough endothelial shear stress to promote NO generation and improve blood flow[24].

Massage can help to relieve tension in the muscle tendon unit, which influences the visco-elastic component of the tissue, increasing muscle competence and improving muscular flexibility. boosting blood flow while decreasing muscular stiffness [25]. Type 1a sensory afferent excitation takes place when applied high frequency vibration which decreases golgi tendon organ type 1b sensory afferent fibres with type 2 afferent (static muscle spindle afferent) stimulation. Reciprocal Inhibition of antagonist muscle with induction of the tonic vibration reflex has been demonstrated . H-reflex sensitivity is significantly reduced by local vibration. Major influence on movement control and muscle activation is by Pacinian Sensory receptors having sensitivity towards vibration.Patients' joint mobility is thought to have improved following vibration therapy because local vibration reduced muscle tension and sensitivity to changes in muscle elongation. When treating a region with limited joint mobility and soft tissue shortness, it is expected that employing joint mobilisation or stretching after first administering local vibration will have a high success rate.[10,26].

Despite the fact that LV is not a naturally occurring phenomena, it may be employed as a functional study technique to modify the operation of the muscle spindle reflex arc in motor and reflex investigations. The neural mechanisms that support vibratory pain modulation appear to originate in the spinal cord and go to the cortex [27].

Finally, this study aims to investigate how a 5-minute calf muscle percussion technique impacts the range of motion (ROM), discomfort, muscular strength, and functional outcomes of Plantar Fasciitis patients.

4. CONCLUSION

Samples will be collected , statistical analysis will be done and the conclusion will be drawn based on the data collected.

CONSENT

Principal Investigators will obtain the written informed consent from the participant on a printed form (local language) with signatures and give the proof of confidentiality.

ETHICAL APPROVAL

Prior to the start of the study, approval from the institutional ethical committee will be acquired. The participant individuals of the study and DMIMSU who will fund it will be able to retrieve findings of study. After completion of study and publication of results data will be stored in the DMIMSU data repository.

CONFIDENTIALITY

The study program will be explained to the participant, the principal investigator will take subjective information. The consent form will include the confidentiality statement and signatures of the principal investigator, patient and a witnesses. If required to disclose some information for the study, consent will be taken

from the patient with complete assurance of his confidentiality

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Gatt A, Agarwal S, Zito PM. Anatomy, Fascia Layers. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021 [cited 2021 Jul 28]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK526038/
2. Latt LD, Jaffe DE, Tang Y, Taljanovic MS. Evaluation and Treatment of Chronic Plantar Fasciitis. Foot Ankle Orthop. 2020;5(1):2473011419896763.
3. Guo J, Liu X, Ding X, Wang L, Fan Y. Biomechanical and mechanical behavior of the plantar fascia in macro and micro structures. J Biomech. 2018;76:160–6.
4. Naik V, Singh M. Effects of matrix rhythm therapy (MaRhyThe) in plantar fasciitis – An experimental study. Indian J Phys Ther Res. 2019;1(2):105.
5. Assad S, Ahmad A, Kiani I, Ghani U, Wadhera V, Tom TN. Novel and Conservative Approaches Towards Effective Management of Plantar Fasciitis. Cureus. 8(12):e913.
6. Ostermann S, Olesen JL, Holden S, Riel H. Stretching and relaxing the plantar fascia may change plantar fascia thickness but not pressure pain thresholds: a cross-sectional study of patients with plantar fasciopathy. BMC Musculoskelet Disord. 2020;21(1):804.
7. Irving DB, Cook JL, Young MA, Menz HB. Obesity and pronated foot type may increase the risk of chronic plantar heel pain: a matched case-control study. BMC Musculoskelet Disord. 2007;8(1):41.
8. Yang W, Han Y, Cao X, Pan J, Zeng L, Lin J, et al. Platelet-rich plasma as a treatment for plantar fasciitis. Medicine (Baltimore). 2017;96(44):e8475.
9. Eun SS, Chachan S, Lee SH. Effectiveness of a Double Air-Cushioned Shoe Compared with Physiotherapy in the Treatment of Plantar Fasciitis. BioMed Res Int. 2020;2020:e9468302.
10. Jung S, Ha S. Effects of Local Vibration on Shoulder Horizontal Adduction and Internal Rotation Range of Motion in Subject with Posterior Shoulder Tightness. J Musculoskelet Sci Technol. 2020;4(2):66–9.
11. Efficacy of Percussive massage Versus Calf Stretching on Pain, Range of Motion, Muscle Strength and Functional Outcomes in Patients with Plantar Fasciitis – A Randomized Control Trial. [Internet]. 2021 [cited 2021 Jun 8]. Available:https://www.researchsquare.com
12. Konrad A, Glashüttner C, Reiner MM, Bernsteiner D, Tilp M. The Acute Effects of a Percussive Massage Treatment with a Hypervolt Device on Plantar Flexor Muscles' Range of Motion and Performance. J Sports Sci Med. 2020;19(4):690–4.
13. Lim AT, How CH, Tan B. Management of plantar fasciitis in the outpatient setting. Singapore Med J. 2016 Apr;57(4):168–71.
14. Jasoliya DrV, Tailor DrH, Moradiya DrN. Results of rest, soft sole slippers, contrast bath and plantar stretches physiotherapy in case of plantar fasciitis. Int J Orthop Sci. 2019;5(2.3):253–6.
15. Howe L. Restricted ankle dorsiflexion: methods to assess and improve joint function. Strength Cond; 2015.
16. Klimek L, Bergmann K-C, Biedermann T, Bousquet J, Hellings P, Jung K, et al. Visual analogue scales (VAS): Measuring instruments for the documentation of symptoms and therapy monitoring in cases of allergic rhinitis in everyday health care. Allergo J Int. 2017;26(1):16–24.
17. Effectiveness of hamstring stretching on plantar... - Google Scholar [Internet]. [cited 2021]. Available:https://scholar.google.co.in/scholar?q=Effectiveness+of+hamstring+stretching+on+plantar+fasciitis:+A+pilot+study&hl=en&as_sdt=0&as_vis=1&oi=scholart
18. Tavares P, Landsman V, Wiltshire L. Intra-examiner reliability of measurements of ankle range of motion using a modified inclinometer: a pilot study. J Can Chiropr Assoc. 2017;61(2):121–7.
19. Konor Mm, Morton S, Eckerson Jm, Grindstaff Tl. Reliability Of Three Measures Of Ankle Dorsiflexion Range Of Motion. Int J Sports Phys Ther. 2012;7(3):279–87.

20. Sillevis R, Shamus E, Mouttet B. The Management Of Plantar Fasciitis With A Musculoskeletal Ultrasound Imaging Guided Approach For Instrument Assisted Soft Tissue Mobilization In A Runner: A Case Report. Int J Sports Phys Ther. 2020;15(2):274–86.
21. Ratna St, Dowle P, Prasad Dvbn, Paruchuri Drk. Effect Of Kinesio Taping In Adjunct To Conventional Therapy In Reducing Pain And Improving Functional Ability In Individuals With Plantar Fasciitis A Randomized Controlled Trial. Int J Physiother. 2015;587–93.
22. Cafarelli E, Sim J, Carolan B, Liebesman J. Vibratory massage and short-term recovery from muscular fatigue. Int J Sports Med. 1990;11(6):474–8.
23. Carlsöö S. The effect of vibration on the skeleton, joints and muscles: A review of the literature. Appl Ergon. 1982;13(4):251–8.
24. Johnson PK, Feland JB, Johnson AW, Mack GW, Mitchell UH. Effect of Whole Body Vibration on Skin Blood Flow and Nitric Oxide Production. J Diabetes Sci Technol. 2014;8(4):889–94.
25. Imtiyaz S, Veqar Z, Shareef MY. To Compare the Effect of Vibration Therapy and Massage in Prevention of Delayed Onset Muscle Soreness (DOMS). J Clin Diagn Res JCDR. 2014;8(1):133–6.
26. Pope ZK, DeFreitas JM. The effects of acute and prolonged muscle vibration on the function of the muscle spindle's reflex arc. Somatosens Mot Res. 2015;32 (4):254–61.
27. Hollins M, Corsi C, Sloan P. Pacinian Signals Determine the Direction and Magnitude of the Effect of Vibration on Pain. Perception. 2017;46(8):987–99.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle4.com/review-history/74562