

## **EFFECTIVENESS OF PLANTAR FASCIA STRETCHING Vs CONTRAST BATH COMBINED WITH ULTRASOUND IN PLANTAR FASCIITIS**

**V. RAJALAXMI<sup>1</sup>, G. MOHANKUMAR<sup>2</sup>, K. RAMANATHAN<sup>3</sup>,  
C. R. PRAVEEN KUMAR<sup>4</sup>, K. CHITRA<sup>5</sup> & K. ANUSIYA<sup>6</sup>**

<sup>1</sup>Vice Principal Faculty of Physiotherapy, Dr. M.G.R. Educational & Research Institute University,  
Velappanchavadi, Chennai, Tamil Nadu, India

<sup>2</sup>Professors, Faculty of Physiotherapy, Dr. M.G.R. Educational & Research Institute University,  
Velappanchavadi, Chennai, Tamil Nadu, India

<sup>3, 4</sup> Assistant Professor, Faculty of Physiotherapy, Dr. M.G.R. Educational & Research Institute University,  
Velappanchavadi, Chennai, Tamil Nadu, India

<sup>5, 6</sup> Physiotherapist, Dr. M.G.R. Educational & Research Institute University,  
Velappanchavadi, Chennai, Tamil Nadu, India

### **ABSTRACT**

#### **Objective of the Study**

To study the effectiveness of ultrasound with plantar fascia stretching technique in patients with plantar fasciitis. To study the effectiveness of ultrasound with contrast bath technique in patients with plantar fasciitis. To evaluate the comparative effectiveness of ultrasound with plantar fascia stretching and contrast bath technique in patients with plantar fasciitis.

#### **Methodology**

In the experimental study totally 30 subjects was taken, between the age group of 30 to 70 [15 individual in each group]. Group A treated with ultra sound therapy and contrast bath. Group B treated with ultra sound therapy, Active and Passive stretching of plantar fascia.

Study design: Experimental study, Study type; Pre and Post-test .Study setting: Out Patients Physiotherapy Department, ACS medical college and hospital. Sample size; 30 subjects, Study sample method; Simple random method, Study duration; 2 weeks of duration.

#### **Result**

On comparing the post -test mean values of group A (5.0) and B (3.53) on VAS score shows significant reduction in post test mean in both the group. Hence ultrasound is equally effective in both groups where group B shows a little lower value than group A at  $p > 0.05$ , hence the null hypothesis is accepted. On comparing mean values of group A & B on foot function index shows highly significant decrease in the post test means. stretching exercises (Group B) shows 17.66 lower mean value is more effective than contrast bath (group-A) (31.6) at  $p \leq 0.001$ , hence alternate hypothesis is accepted.

**KEYWORDS:** FFI, Active Stretching, Passive Stretching, Contrast Bath, Ultra Sound

## INTRODUCTION

Plantar fasciitis is a common painful disorder affecting the heel and plantar aspect of the foot. It is a disorder of the insertion site of tendon on the bone and is characterized by scarring, inflammation, or structural breakdown of the foot's plantar fascia. It is mostly caused due to overuse of the plantar fascia, increases in exercise, weight or age. Although plantar fasciitis was originally thought to be an inflammatory process, newer studies have demonstrated structural changes more consistent with a degenerative process<sup>(2,3)</sup>.

As a result of this new observation, many in the clinical community have stated the condition should be renamed plantar fasciitis. Plantar fasciitis is the most common injury of the plantar fascia and is the most common cause of heel pain<sup>(4)</sup>.

The overall incidence rate of plantar fasciitis was 10.5 per 1000 population. Compared with men, women had a significantly increased adjusted incidence rate ratio for plantar fasciitis of 1.96(95% confidence interval, 1.94 to 1.99). The adjusted incidence age between 30 to 70 years old. Increased body weight and body mass index have been shown to be significant risk factors for plantar fasciitis with a BMI more than 30kg/m<sup>2</sup> having an odds ratio of 5.6(95% confident interval ,1.9 to 16.6;p<0.01) compared with BMI of less than 25kg/M.<sup>(11)</sup>

Approximately 10% of people have plantar fasciitis at some point in their lifetime. It is commonly associated with prolonged weight bearing and is much more common in individuals with excessive internal rolling of the foot, which is seen in flat feet<sup>(14, 15)</sup>. Among non-athletic populations, plantar fasciitis is associated with obesity and lack of physical exercise<sup>(5, 6)</sup>.

The characteristic nature of plantar fasciitis is usually with pain felt on the bottom of the heel and is most intense with the first steps during day. Individuals with plantar fasciitis often have difficulty with dorsiflexion of the foot, an action in which the foot is brought toward the shin.

This difficulty is usually due to tightness of the calf muscle or Achilles tendon, the latter of which is connected to the back of the plantar fascia. Most individuals resolve on their own with time and respond well to conservative methods of treatment<sup>(9 10)</sup>.

Physical therapy management include various treatment modalities like Ultra Sound Therapy, Short Wave Diathermy, LASER Therapy and various manual therapy approaches like Foot Padding, Taping, Shoe Modification(steel shank and anterior rocker bottom), Arch Supports, Heel Cups, Custom Foot Orthoses.

Ultrasound is non - pharmacological management, refers to mechanical vibrations which are essentially the same as sound waves but of a higher frequency such waves are behind the range of human hearing and therefore also be called ultrasonic<sup>(12,13)</sup>

Therapeutic ultrasound has been used extensively to treat variety of conditions because of its documented thermal effect. It has repeatedly been shown to increase tissue temperature at depths up to 5cm with only minimal increase in skin temperature<sup>(17)</sup>.

Stretching of the plantar fascia and Achilles tendon is considered to be effective in the management of plantar fasciitis. The goal of a stretching program is to relieve the stress put on the plantar fascia by either the plantar fascia itself being tight or the fascia being tightened by a tight Achilles tendon, as both the plantar fascia and Achilles tendon insert

onto the calcaneus<sup>(7, 8)</sup>.

Porter et al. conducted a study comparing sustained with intermittent Achilles tendon stretching on dorsiflexion, pain and function over a four month period. This well-designed study randomized subjects into the two groups and a third group of asymptomatic controls was also recruited for comparison sake.

No significant differences were noted between the two stretching groups at any point in the study in any of the outcome measures. However, both groups did improve from baseline in pain and function scores, as well as in dorsiflexion and the results in both groups approached the scores of the asymptomatic controls. Increased Achilles tendon flexibility was found to correlate with decreased foot and ankle pain and increased foot and ankle function, an important point for consideration<sup>(19)</sup>.

The theory behind the use of contrast baths in physical therapy is that the rapid change from warm to cold helps to quickly open up and close the tiny capillaries in the body. Warmth causes these small arteries to open; cold causes them to close. The rapid opening and closing of the arteries near the site of your injury creates a pumping action. This pumping is thought to help decrease swelling and inflammation around the injured area. By decreasing the swelling and inflammation, pain can be reduced and improved mobility can be achieved.

Contrast bath therapy is a technique that your physical therapist may use to help you quickly and safely restore normal mobility and function after injury.

## METHODOLOGY

**Inclusion Criteria:** Participants with clinical diagnosis of plantar fasciitis, Chronic foot pain of duration more than 12 weeks, both male and female participants between the age 30-70years, those who were willing to participate in the study and willing to take treatment for 2 weeks, Pain in the heel on the first step in the morning.

**Exclusion Criteria:** Subjects with clinical disorder where therapeutic ultrasound is contraindicated such as infective conditions of foot, tumor, calcaneal fracture, metal implant around ankle, dermatitis, acute sepsis and anesthetic areas, Subject with impaired circulation to lower extremities, Subject with referred pain due to sciatica, Corticosteroids injection in heel preceding 3 month, Patient who cannot co-operate.

**Study Duration:** The study was conducted for 2weeks. Each week consist of 6 sessions. A total of 12 sessions were conducted.

**Materials Used:** Ultrasound , Assessment sheet, Consent form, Plinth, Visual analogue scale, Foot function index, Squeeze hand ball, Towel, Gel, Hot / cold water, Thermometer, Cotton, Tray, Rubber sheet, Scoring sheet.

## Outcome Measure

### Visual Analogue Scale

For measuring the intensity of pain, Visual Analogue Scale was used in the patients with low back pain by determining their current pain by making a mark on a 10cm visual analogue scale. The left end of the scale was labeled as “No Pain” and right end of the scale was labeled as “Worst Pain’ possible. The mark was then measured to the nearest millimeters from “No Pain’ end (Zero) of scale.

## Foot Function Index

Foot function index was designed to measure the impact of foot pathology on function in terms of pain, disability and movement restriction<sup>(18,21)</sup>.

## PROCEDURE

Once the study is approved by the institutional review board, 50 volunteers were recruited from the out-patient physiotherapy department with heel pain. Out of which 30 samples are selected based on the inclusion criteria, they were fully explained about the study and asked to fill the consent form in acceptance with participation of the study which is daily signed by the participant and the researcher.

Following this, a standardized history which consisted of demographic information such as Age, Gender and occupation was collected. Duration of the symptoms and the side affected was noted and initial evaluation of the pain profile is done using visual analogue scale (VAS) and functional disability is done using foot function index.

After this initial evaluation, they were allocated by lottery method to one of the two study Group A and Group B. 30 chit was drawn and every Odd number in group A and even numbers in group-B.

**Group A:** 15 patients were treated with ultra sound therapy and contrast bath.

**Group B:** 15 patients were treated with ultra sound therapy, active and passive stretching of plantar fascia.

## Application of Ultra Sound Therapy

Before the exposure of heat modality the therapist evaluated the patient from both Group- A and Group- B thoroughly and carried out necessary operating and safety checks of the ultrasound therapy. Patient's thermal sensation of the body part was recorded and local metal objects, synthetic material and electronic devices from the body part to be treated were removed (Low and reed, 2000). Patient is positioned prone lying with knee slightly flexed and pillow is kept under the leg to be treated. Ultrasound is given with continuous mode in concentric circles method using 1MHZ head 7 minutes one session / day prior to exercise for 6 days /week for 2 weeks.

## Contrast Bath (Group A)

The patient is instructed to sit on the stool or wooden chair. Instruct the patient to place both the leg in the tray containing hot water 42<sup>0</sup> C for 3minutes and cold water 15<sup>0</sup> C for 1mintues. The whole cycle is repeated for about 5 times. 2 session/day for 6 days /week for 2 weeks.

## Plantar Fascia Stretch (Group B)

### Active stretching

The patient sits with the knee flexed and heel rests on the plinth. The patient places the fingers over the plantar surface of the toes and gently extends toward the leg (dorsiflexion of the MTP joints).

The patient kneels with the toes curled up under the feet (MTP joint extension). The buttocks are gently lowered to the heels until a mild tension is felt in the bottom of the feet. Patient holds the position for 12-15 seconds and repeats 10 times.

**Passive stretching**

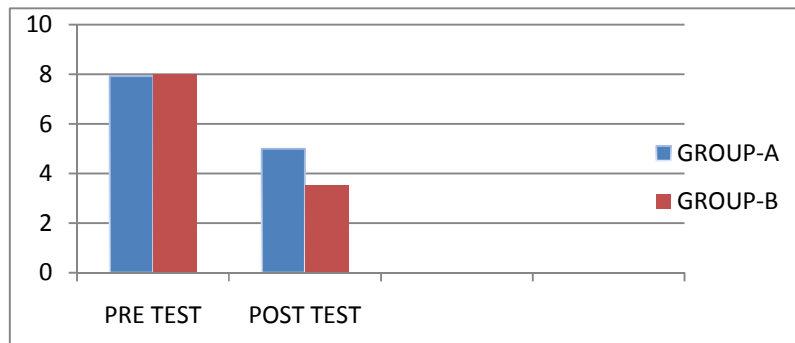
The patient is placed in supine position with the ankle joint out of the treatment plinth. Therapist places the fingers over the plantar aspect of the toes. The ankle joint may remain at neutral position. The therapist pushes the toes into extension. Hold the stretch for 12-15 second and repeat it 10 times for each foot. 2 session /day for 6 days/ week for 2 weeks.

**RESULTS**

**Table-1: Comparison of Visual Analogue Scale between Group – A and Group - B in Pre and Post Test**

Vas scale	*GROUP – A		*GROUP - B		t – TEST	SIGNIFICANCE
	Mean	S.D	Mean	S.D		
Pre test	7.93	.703	8	.755	.250	.804**
Post Test	5.0	.845	3.53	.516	573	.000**

\*GROUP A – Contrast Bath Group, GROUP B – Plantar Fascia Stretching Group.

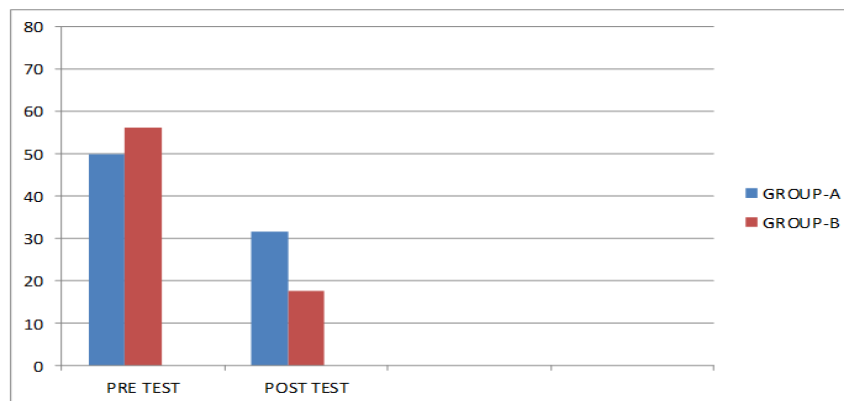


**Graph 1: Comparison of Visual Analogue Scale between Group-A and Group-B Pre and Post Test**

**Table 2: Comparison of Foot Functional Index (FFI) between Group-A &Group- B in Pre and Post Test**

FFI	*GROUP – A		*GROUP – B		t - TEST	SIGNIFICANCE
	Mean	S.D	Mean	S.D		
Pre test	49.86	4.48	56.2	7.25	2.37	.118**
Post Test	31.6	8.58	17.66	5.43	5.31	.000***

\*GROUP A – Contrast Bath Group, GROUP B – Plantar Fascia Stretching Group.



**Graph 2: Comparison of Foot Function Index between Group-A Group-B in Pre and Post Test**

On comparing the post test mean values of group A (5.0) and B (3.53) on VAS shows significant reduction in post test mean in both the group. Hence ultrasound is equally effective in both groups where group B shows a little lower value than group A at  $p > 0.05$ , hence the null hypothesis is accepted. On comparing mean values of group A & B on foot function index shows highly. Significant decrease in the post test means. stretching exercises (Group B) shows 17.66 lower mean value is more effective than contrast bath (group-A)(31.6) at  $p \leq 0.001$ , hence null hypothesis is rejected and alternate hypothesis is accepted

## DISCUSSIONS

The present study was conducted to compare the effectiveness of contrast bath with plantar fascia stretching with a common treatment of Ultrasound therapy to both the groups in the treatment of plantar fasciitis for two weeks in terms of pain on Visual Analogue Scale (VAS) and functional disability with foot functional index (FFI). It was noticed that there was improvement in all the above parameters in both the Groups. Group A- received ultrasound and contrast bath and Group B – received ultrasound and plantar fascia stretching. Both the groups had equal number of participants and showed no statistical significance with respect to their gender distribution, which could have altered the results of the study and were well matched.

The overall incidence rate of plantar fasciitis was 10.5 per 1000 population. Compared with men, women had a significantly increased incidence rate ratio for plantar fasciitis of 1.96(95% confidence interval, 1.94 to 1.99). The adjusted incidence age between 30 to 70 years old. Increased body weight and body mass index have been shown to be significant risk factors for plantar fasciitis with a BMI more than 30kg/m<sup>2</sup> having an odds ratio of 5.6(95% confident interval ,1.9 to 16.6;p<0.01) compared with BMI of less than 25kg/M.

When the intra-group (paired t- test) mean values of VAS was analyzed (Table 3 & Table 4) Group A pre test mean VAS (7.93) and post test mean VAS (5). The mean values of Group B pre test mean VAS (8.0) and post test mean VAS (3.53) from the data analysis: it shows that there was statistically significant decrease in Pain (VAS) within Group A and Group B at (**P ≤ 0.001**).

When the intra-group (paired t- test) mean values of FFI was analyzed (Table 3 & Table 4) Group A pre test mean FFI (49.86) and post test mean FFI (31.6). The mean values of Group B pre test mean FFI (56.2) and post test mean FFI (17.66) from the data analysis: it shows that there was statistically significant decrease in Pain (VAS) within Group A and Group B at (**P ≤ 0.001**).

When the inter-group (student t- test) means values of VAS was analyzed (Table 1). Group A shows post test mean VAS (5.0) and Group B shows post test mean VAS (3.53) clearly indicated that there was equal reduction in pain intensity (VAS) at **P > 0.05**. By analyzing (Table 2) Group A shows post test mean FFI (31.6) and Group B shows post test mean FFI (17.66) statistically significant improvement in physical functions between Group A and Group B following exercise interventions. The FFI results were found to be statistically significant difference at **P ≤ 0.001**.

## CONCLUSIONS

The Present study concluded that 2-weeks treatment program performed on subjects with plantar fasciitis demonstrated that both contrast bath and plantar fascia stretching exercises combined with ultrasound were effective in reducing pain intensity and improving functional activities. Further it was observed that plantar fascia stretching combined

with ultrasound therapy was more effective in improving functional activities and equally effective in reducing pain intensity compared with contrast bath in subjects with plantar fasciitis. Hence findings of this study suggest that plantar fascia stretching exercises if added to conventional physiotherapy in the treatment of plantar fasciitis is more beneficial.

## ETHICAL CONSIDERATIONS

The manuscript is approved by the Institutional Review board of faculty of physiotherapy. All the procedures were performed in accordance with the ethical standards of the responsible ethics committee both (Institutional and national) on human experimentation and the Helsinki Declaration of 1964 (as revised in 2008).

**Conflict of Interest:** 'Conflicts of interest: none'

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