

**A COMPARITIVE STUDY TO FIND THE EFFECTIVENESS OF
ULTRASOUND AND MYOFASCIAL RELEASE THERAPY
IN PLANTAR HEEL PAIN AND FOOT FUNCTION AMONG
MARATHON RUNNERS**

Dissertation

Submitted to

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In partial fulfillment for the degree of

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(SPORTS PHYSIOTHERAPY)



271650126

CHERRAAN'S COLLEGE OF PHYSIOTHERAPY

Cherraan's Institute of Health and Sciences

(Affiliated to the Tamilnadu Dr.MGR Medical University,Chennai 32)

Coimbatore, Tamilnadu, India.

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CERTIFICATE

The work embodied in the thesis entitled '**A COMPARITIVE STUDY TO FIND THE EFFECTIVENESS OF ULTRASOUND AND MYOFASCIAL RELEASE THERAPY IN PLANTAR HEEL PAIN AND FOOT FUNCTION AMONG MARATHON RUNNERS**' submitted to the **Tamilnadu Dr. MGR Medical University, Chennai** in the partial fulfillment for the degree of **Master of physiotherapy (sports physiotherapy)**, was carried out by candidate bearing register number of 271650126 at Cherran's college of physiotherapy, Coimbatore under my supervision. This is an original work done by her and has not been submitted in part or full for any other degree/diploma at this or any other university/institution. The thesis is fit to be considered for evaluation for award of the degree of Master of Physiotherapy.

.....

Signature of Supervisor

Mr.A.CHINNACHAMY MPT (Sports)

.....

Signature of principal

Mrs.E.SELVARANI, MPT (Neuro)

Date:.....

Date:.....

.....

Internal Examiner

.....

External Examiner

Project work evaluated on.....

DECLARATION

I hereby declare and present my project work entitled “**A COMPARITIVE STUDY TO FIND THE EFFECTIVENESS OF ULTRASOUND AND MYOFASCIAL RELEASE THERAPY IN PLANTAR HEEL PAIN AND FOOT FUNCTION AMONG MARATHON RUNNERS**” The outcome of the original research work undertaken and carried out by me, under the guidance of Professor. **Mr.Chinnachamy, MPT (Sports)**, Cherran’s college of physiotherapy, Coimbatore.

I also declare that the material of this project work has not formed in anyway the basis for the award of any other degree previously from the Tamilnadu Dr. MGR Medical University.

.....
Signature of Supervisor

Mr.A.Chinnachamy MPT (Sports)

.....
Signature of Student

S.PremKumar

Date:

Place:

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ABSTRACT

A COMPARITIVE STUDY TO FIND THE EFFECTIVENESS OF ULTRASOUND AND MYOFASCIAL RELEASE THERAPY IN PLANTAR HEEL PAIN AND FOOT FUNCTION AMONG MARATHON RUNNERS

OBJECTIVES:

To study the effects of ultrasound therapy and myofascial release in the management of pain and foot function on plantar heel pain in marathon runners

BACKGROUND:

Plantar fasciitis or plantar heel pain is one of the most common orthopaedic complaints, relating to foot. It is especially seen among older individuals between 40 and 60 years of age. This disease is more common in runners, volley ball players with symptoms of arch pain. Plantar fasciitis is defined as the inflammation to the plantar fascia on the medial process of the calcaneal tuberosity. The pain may be substantial, resulting in the alteration of the daily activities.

METHOD:

Ultrasound therapy is one of the most commonly used treatment modality in management of soft tissue lesion, Myofascial release is a soft tissue mobilization technique ,if the condition is treated in the acute stage then the symptoms will be aggravated, if treated in chronic stage the symptom will be alleviating.

CONCLUSION:

An experimental study was conducted to investigate the effectiveness of ultrasound therapy and myofascial therapy in the management of plantar heel pain in marathon runners.



CHAPTER I

INTRODUCTION

Plantar fasciitis or plantar heel pain is one of the most common orthopedic complaints, relating to foot. It is especially seen among older individuals between 40 and 60 years of age). This disease is more common in runners, volley ball players with symptom of arch pain. Plantar fasciitis is defined as the inflammation to the plantar fascia on the medial process of the calcaneal tuberosity. The pain may be substantial, resulting in the alteration of the daily activities. Various terms have been used to describe plantar fasciitis, including jogger's heel, policeman's heel, and even gonorrheal heel. Although a misnomer, this condition is sometimes referred to as heel spurs by the general public. Correctly pronounced it is "plantar fash-eee-eye-tiss" (Miller 2014).

Through overuse the fascia become inflamed and painful at its attachment to the heel bone or calcaneum. The condition is traditionally thought to be inflammation however this is now believed to be incorrect due to the absence of inflammatory cells within the fascia. The cause of pain is thought to be degeneration of the collagen fibers close to the attachment to the heel bone (Kwong 2013).

Plantar fascia has an important role in stability during gait cycle. During walking or running tension is placed through or painful the plantar fascia. When this tension is excessive or if it is too repetitive or forceful, damage to the plantar fascia can occur. Occasionally a heel spur develops in relation with plantar fasciitis. From this it is understood that plantar fasciitis mainly affects the persons ambulation mainly because of features of pain. So pain reduction is the main treatment which can improve the patient's functional activities. In most cases, plantar fasciitis does not require surgery or invasive procedure to stop pain and reverse damage. Conservative treatments are usually all that is required. However, every person's body responds to plantar fascitis treatment differently and recovery times may vary (Furey 2008).

Calcaneum is the largest of 26 bones in human foot which also has 33 joints & a network of more than 100 tendons, muscles & ligaments. Each foot contains 26 bones. 7 tarsal's (ankle bones), 5 metatarsals (instep bones) & 14 phalanges toe bones. The main arch of foot is called plantar arch. It runs lengthwise & touches the ground only at calcaneum & at the ball of the foot. The plantar arch is thickly padded at the

both ends. There is also a thick pad of fat under the heel of the out of the foot. Like all bones, it is subjected to external influence that can affect its integrity. The bones & joints of the foot& ankle are held together by a strong network of muscle & ligaments. The foot is connected to the ankle where one of the tarsal bones the talus, which meets the lower leg bones, the tibia & fibula. The ankle joints provides both great stability (keeping us standing up) & great mobility (walking, running, jumping). These 2 functions need to be kept in balance for proper functioning of the feet (**Miller 2014**).

Plantar fasciitis is one of the most common causes of heel & foot pain experienced by 10% of the population. Therefore individual suffering from what has traditionally referred as plantar fasciitis may be more accurately described as plantar heel pain. The plantar fascia acts as a bowstring to maintain & provide support to longitudinal arch of foot & to assist dynamic shock absorption. The plantar fascia plays a role in providing foot support & rigidity throughout the gait cycle (**Miller 2014**).

Recent studies have shown that the Incidence of plantar Fasciitis is on the rise affecting over 10% of the general population. Approximately 83% of those affected are active working adults between the ages of 25 and 65, approximately 22% are runners or active in a sports requiring running and 65-70% are overweight. There is no sex predilection (**Paul 2012**).

Pain is made worse by activities such as, prolonged standing & walking wearing incorrect shoes chronic stress over use during activities, running on hard surface, excessive repetitive stresses applied to the foot; resulting in tension of plantar fascia, arthritis and diabetes among elderly people. It occurs in either sex, usually over the age of 40 except in active sportsmen when the patient, usually male, may be in his twenties. Other cause include rupture of plantar fascia, compression of nerve to abductor digiti (the first branch of lateral plantar nerve), tarsal tunnel syndrome, heel pad atrophy and stress fracture of calcaneum. (**Miller 2014**).

Plantar fascitis has been referred to as heel pain syndrome & heel spur syndrome because the pain is usually localized to the insertion of plantar aponeurosis at the medial tubercle of the calcaneum. The plantar fascia extends from the tubercle to the metatarsal heads forming longitudinal arch that provide support to the foot. Excessive load or tension on the aponeurosis leads to the condition commonly called

to as plantar fasciitis. Historically, plantar fascia has been considered as inflammatory process. However in recalcitrant cases it appears that a degenerative process affecting the collagen or degenerative fasciitis occur without evidence of inflammation. Histological examination of surgical biopsies reveals that, increased fibroblasts, ground substances,& the vascularity, not the expecting mediators. This improved understanding may impact the use of anti-inflammatory therapies for chronic plantar fasciitis (**Miller2014**).

Burning, stabbing or aching pain the heel of the foot. Pain usually decreases as the tissue warms up, but may easily return again after long periods of standing or weight bearing, physical activity, or after getting up after long periods of lethargy or sitting down. Pain may be present at night and is often present when first getting out of bed in the morning. It tends to be relieved by rest, i.e. when weight bearing is discontinued (**Kessler2003**).

During sleeping, the foot is in plantar flexed position causing shortening of the plantar structures. Sudden dorsiflexors in working up from night's sleep stretches the structures causing pain (**Ebenezer2010**)

Acetaminophen (Tylenol) or Ibuprofen (advil, motrin) are used to reduce inflammation. Numerous nonsurgical treatments have been used to relieve the symptoms associated with heel pain. These include rest, exercise (strengthening & stretching), orthotics (such as night splints), laser therapy & taping. Modalities like cryotherapy ultrasound with and without analgesic gel electrical stimulation administration of NSAIDS through iontophoresis or injection (**Ebenezer 2010**).

Ultrasound therapy is one of the most commonly used treatment modality in management of soft tissue lesion. Ultrasound consist of inaudible high- frequency mechanical vibrations created when a generator produce electrical energy that converted to acoustic energy through mechanical deformation of a piezo-electrical crystal located within the transducer, waves produced are transmitted by propagation through molecular collision and vibration, with a progressive loss of the intensity of the energy during passage through tissue (attenuation) due to absorption dispersion or scattering of wave. Although many laboratory – based research studies demonstrated a number of physiological effects of ultrasound upon living tissue, there is remarkably little evidence for benefit in treatment of soft tissue injuries (**Crawford 2007**).

Myofascial release is a soft tissue mobilization technique. If the condition is treated in the acute stage, then symptoms will be aggravated. If treated in chronic stage, the symptoms will be alleviating. Myofascial release techniques stem from the foundation that fascia, a connective tissue found throughout the body, reorganizes itself in response to physical stress and thickness along the lines of tension. By myofascial release there is a change in the viscosity of the ground substance to a more fluid state which eliminates the fascias excessive pressure on the pain sensitive structure and restores proper alignment (**Dubin 2008**). The present study was undertaken with the intension to find out the effectiveness of myofascial release in plantar heel pain in marathon runners, in conjunction with conventional treatment.

1.1 Statement of the study :

A study to find the effectiveness of ultrasound and myofascial release therapy on plantar heel pain and foot function in marathon runners .

1.2 Objectives of study :

- To study the effects of ultra sound therapy in the management of pain and foot function on plantar heel pain in marathon runners.
- To study the effects of myofascial release therapy in the management of pain and foot function on plantar heel pain in marathon runners.
- To compare the effects of ultra sound and myofascial release therapy in the management of pain and foot function on plantar heel pain in marathon runners.

1.3 Need of the study :

- The reason of the study is to popularize the effectiveness of ultra sound and myofascial release therapy as an useful intervention method to reduce pain and improve foot function in plantar heel pain marathon runners.

1.4 Hypothesis :

- It is hypothesized that there may be significant difference in pain and foot function following ultrasound therapy among plantar heel pain marathon runners.
- It is hypothesized that there may be significant difference in pain and foot function following myofascial release therapy among plantar heel pain marathon runners.
- It is hypothesized that there may be no significant difference between ultrasound therapy and myofascial release therapy in the management of pain and foot function among plantar heel pain marathon runners.

1.5 OPERATIONAL DEFINITION :

Plantar fasciitis

It is a foot condition caused by inflammation of plantar fascia, the thick ligamentous connective tissue that runs heel to the ball of the foot (**Ranga nathan2013**)

Pain

Pain is defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage (**Merskey & Bogduk 1994**).

Ultrasound

A form of acoustic vibration propagated in the form of longitudinal compression waves at frequency is too high to heard by human being (**Claytons 2011**).

Myofascial release

Myofascial release is a safe and very effective hands on technique that involves applying gentle sustained pressure into the myofascial connective tissue restrictions to eliminate pain and restore motion (**Kwong 2008**).

Foot function

The foot is an impressive architectural and functional design, able to act as both a flexible supportive base and a rigid lever, it is expected to work efficiently under excessive loads and demands, often in extreme conditions imposed on it by foot wear and the environment in which it had to work .however this complex structure's function depends heavily on having its correct functional angles and joints movements maintained (**Dubin 2007**)

CHAPTER II

REVIEW OF LITERATURE

Section A: Studies on general aspects of plantar fasciitis

Section B: Studies on the effect of ultrasound therapy on pain and foot function among plantar fasciitis subjects.

Section C: Studies on the effect of myofascial release on pain and foot function among plantar fasciitis subjects.

Section D: Studies on the reliability and validity of foot function index for foot function.

Section E: Studies on the reliability and validity of visual analogue scale for pain.

Section A: Studies on general aspects of plantar fasciitis.

Dubin (2000) stated that conservative care has been found to be successful in alleviating or controlling symptoms related to plantar fasciitis. If conservative care is not effective, a cortisone injection may be useful in decreasing pain symptoms. In recalcitrant cases of plantar fasciitis endoscopic conservative surgery is a viable option.

Young (1996) stated that enhanced release of growth factors from microphage following exposure to therapeutic ultrasound is observed. This may well account for the proliferation fibroblast.

Section B: Studies on the effect of ultrasound therapy on pain and foot function among plantar fasciitis subjects.

Chung *et al.*,(2007) did a study for the treatment of proximal plantar fasciitis with ultrasound - guided steroid injection. Proximal plantar fascia and heel pad were assessed with a 1 –MHz liner array ultrasound transducer. Pain intensity was quantified with a tenderness threshold (TT) and visual analog scale (VAS) and was concluded that ultrasound offers an objective measurement of the therapeutic effect on proximal plantar fasciitis. Accurate steroid injection under ultrasound guidance can effectively treat proximal plantar fasciitis.

Speed (1991) concluded that thermal effects of ultrasound increased blood flow, reduced pain, reduced muscle spasm and increased tissue extensibility.

Crawford et al.,(1995) conducted a study to evaluate the effectiveness of therapeutic ultrasound in the treatment of heel pain. The participants in that study were divided into two groups, one group were given true ultrasound, a dose of 0.5w/cm^2 , 3MHZ, pulsed 1.4 for 8 minutes, another group were given sham ultrasound for 8 sessions. It was seen that both the groups had reduction of pain. The true ultrasound had 30% pain reduction whereas the sham ultrasound had 25% reduction.

Section C: Studies on the effect of myofascial release on pain and foot function among plantar fasciitis subjects.

Kuhr et al.,(2007) performed a randomized control trial study to check out effectiveness in two groups. Group A received therapeutic ultrasound, contrast bath, foot intrinsic muscles strengthening exercise, plantar fascia stretching exercise and Group B received conventional treatment as group A, added with myofascial release for 15 minutes for 10 consecutive days and results concluded that myofascial release is an effective therapeutic option in the treatment of plantar fasciitis.

John (2007) in a study review of myofascial release as an effective massage therapy technique supports the usage of myofascial release techniques for the treatment of myofascial pain. Myofascial pain can present in clinical setting and can mimic other condition. Literature relies on palpation, symptomatology, and patient's history as keys to the diagnosis of this condition. According to the literature, applying an appropriate myofascial technique can be a very effective therapy for myofascial pain. Results have shown a decrease in pain, and an increase in range of motion for the joints acted on by the affected muscle.

Ordine et al.,(2005) conducted a randomized control trial study to check out effectiveness of myofascial release therapy for treating heel pain (plantar fasciitis), 4 treatment sessions given each week for total 4 weeks and results concluded that incorporation of myofascial technique before static stretching was superior to isolated stretching for improving function and decreasing pain in patients with plantar fasciitis.

Sucher (2004) stated that myofascial release by the physician combined with a self stretch reduced pain and numbness and improve electromyography results among carpal tunnel syndrome subjects. The manipulative approach released the transverse carpal ligaments, and “opened” or dilated the canal. The patients stretched the wrist, digits, and thumb, including myofascial components.

Section D: Studies on the reliability of foot function index for foot function.

Endnoj et al.,(2009) conducted a study to examine the test –retest reliability, internal consistency, construct and criterion validity of Foot Function Index. He found that the test –retest reliability of the foot function index total and sub – scale scores ranged from 0.87 to 0.69. The internal consistency ranged from 0.96 to 0.73 and the strong correlation between foot function index and subscale scores and clinical measures of foot pathology supported the criterion validity of the index, therefore concluded that Foot Function Index was useful for both clinical and research purpose.

Wu SH et al.,(2008) conducted a study to test the reliability and validity of the Taiwan Chinese version of the foot function index (FFI) among patients with plantar fasciitis and ankle /foot fracture where fifty plantar fasciitis patients and 29 ankle/foot fracture patients volunteered for the cross sectional survey and 24 were retested later and pain subscale and the activity limitation subscale were used and they concluded that the adapted Taiwan Chinese version of the FFI was reliable and valid and can be applied among traumatic and non traumatic foot disorders.

Agel et al.,(2005) performed a study on reliability of the Foot Function Index A report of the AOFAS outcomes Committee and the results concluded that The FFI appeared to be a reasonable tool for low functioning individuals with foot disorders.

Mak et al.,(2003) in a study The Foot Index : a measure of foot pain and disability concluded that test.,-retest reliability of the FFI total and sub –scale scores ranged from 0.87 to 0.69. Internal consistency ranged from 0.96 to 0.73with the exception of two items; factor analysis supported the construct validity of the total index and the sub-scales. Strong correlation between the FFI total and sub-scale scores and clinical measures of foot pathology supported the criterion validity of the index. The FFI should prove useful for both clinical and research purposes.

Seto et al.,(2000) in a study explained that FFI was done to examine the following measurement properties of the foot and Ankle disability Index (FFDI) and the FFDI Sport: intersession reliability during 1 and 6 week intervals .Sensitivity to differences between healthy subjects and subjects with chronic Ankle instability (CAI) and sensitivity to changes in those with CAI after rehabilitation. Fifty recreationally active subjects were taken. They took FADI and FADI sport as outcome methods .The result was intraclass correlation coefficients, for the FADI and FADI sport at 1 week were 0.89 and 0.84, respectively, for the involved limbs .Over 6 weeks, the ICC. Values for the involved limb of subjects who did not complete rehabilitation were 0.93 and 0.92, respectively for both surveys, Scores were significantly less for the involved limbs of subjects with CAI compared with their uninvolved limbs. No significant side to side differences were noted among the healthy subjects. Scores on both surveys increased significantly after rehabilitation. They concluded that the FADI and FADI sport appeared to be reliable in detecting functional limitations in subjects with CAI, sensitive to difference between healthy subjects and subjects with CAI and responsive to improvement in function after rehabilitation in subjects with CAI.

Section E: Studies on the reliability of visual analogue scale for pain.

Beijing et al.,(2008) concluded VAS as a reliable and valid instrument to assess pain intensity and selected the VAS as an outcome measure to detect immediate changes in pain.

Bijur et al., (2005) in a study reliability of the visual analogue scale for measurement of acute pain suggested that reliability of the VAS for acute pain measurement as assessed by the ICC appeared to be high. Ninety percent of the pain ratings were reproducible within 9 mm. These data suggested that the VAS is sufficiently reliable to be used to assess acute pain.

Carlsson (2004) did a study to evaluate the reliability and validity of the visual analogue scale in case of chronic pain. The visual analogue scale (VAS)was a simple and frequently used method for the assessment of variations in intensity of pain. In clinical practice the percentage of pain relief, assessed by VAS, is often considered as a measure of the efficacy of treatment. Two types of VAS, an absolute and a comparative scale, were compared with respect to factors influencing the reliability and validity of pain estimates. As shown in that study the absolute type of

VAS seemed to be less sensitive to bias than the comparative one was therefore preferable for general clinical use.

Seto *et al.*,(1997) explained in a study that VAS provided a simple technique for measuring subjective experience. VAS had been established as valid and reliable tool in a range of clinical research applications. Although there was also evidence of increased error and decreased sensitivity when using with some subject groups. Decisions concerned with the choice of scoring interval, experimental design, and statistical analysis for VAS had been in some instances bases on convention, assumption and convenience, highlighting the need for more comprehensive assessment of individual scales if that versatile and sensitive measurement techniques were to be used to full advantage.



CHAPTER III

MATERIALS AND METHODOLOGY

3.1 Study setting

The study was conducted in the outpatient department of Cherran's College of physiotherapy, Coimbatore.

3.2 Selection of subjects

20 subjects were selected randomly who fulfilled the inclusion and exclusion criteria were divided into 2 groups, Group A and Group B.

- GROUP A - Ultrasound therapy
- GROUP B - Myofascial release technique.

3.3 Variables

3.3.1 Dependent Variables

- Pain
- Foot function

3.3.2 Independent Variables

- Ultrasound therapy
- Myofascial release therapy

3.4 Measurement tools

Variables	Tool
Pain	Visual analogue scale
Foot function	Foot function index

3.5 Study design

The study design is was a pre test and post test experimental design.

3.6 Inclusion criteria

- Clinically diagnosed plantar fasciitis subjects
- Marathon runners
- Both sexes
- Age group-18 to 25
- Only unilateral involvement
- Subjects who were willing to participate
- Subjects who were clinically stable before the study
- Pain in the heel on the first step in the morning
- Heel pain felt maximally over plantar aspect of heel.

3.7 Exclusion criteria

Foot trauma with previous three months

Impaired circulation to lower extremities

Congenital deformities of foot and ankle

Referred pain due to sciatica and other neurological disorder

Arthritis

Recent fracture

3.8 Orientation to the subjects

Before collection of data, all the subjects were explained about the purpose of the study. The investigator had given a detail orientation to the various test procedures such as VAS for pain and FFI for foot function. The concern and full cooperation of each participant was sought after complete explanation of the condition and demonstration of the procedure involved in the study.

3.9 Materials used

- Ultrasound apparatus
- Ultrasound gel
- Couch
- Cotton
- Pillows

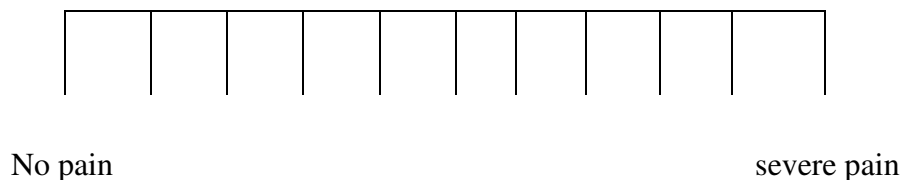
3.10 Test administration

Foot function index

This questionnaire was designed to give information to the therapist to find out how foot pain has affected the ability of the patient to manage in everyday life. The patients were asked to answer every question. For each of the questions, score was given based on a scale from 0 (no pain or difficulty) to 10 (worst pain imaginable or so difficult that required help) that best described patients foot over the past week.

Visual analog scale

Visual analog scale consists of 10cm horizontal line with 2 end points labeled respectively. One end is labeled as no pain and other is labeled as severe pain. The subjects were asked to place mark on the 10cm line at a point which corresponded to their level of pain intensity.



3.10 Treatment procedure

A brief explanation of the study was given to prepare the subjects after obtaining the informed consent

20 subjects were selected for this study, based on the inclusion and exclusion criteria. They were divided into 2 groups, Group A and Group B

- GROUP A- ultrasound therapy
- GROUP B – myofascial release therapy

Group A: Ultrasound therapy

Patient position: Prone lying - Patient was positioned in such a way that the foot was extended out of the couch while lying in prone.

Therapist position: Standing at the foot of the subjects

Procedure: The ultrasonic gel was taken on the treatment head and was moved continuously over the plantar surface while even the pressure was maintained in order to iron out the irregularities in the sonic field. The emitting surface were kept parallel to the skin surface to reduce reflection and pressed sufficiently firmly to exclude any series of air. The pattern of movements were overlapping parallel strokes.

Parameters

- Continuous mode
- Base of frequency of 1 MHz
- Intensity 1 W/cm
- 8 minute per session per day
- 2 weeks treatment

Figure 1: Shows ultrasound therapy



Group B: Myofascial release therapy

Patient position: Supine lying

Therapist position: Standing at the foot of the subjects

Procedure: Following some warm-up, the therapist glides the elbow, knuckles, wrist or thumbs from the foot pad to the heel. This helps the fascia to migrate backup against the calcaneus which can prevent heel spur development. Then gliding is done further on the lateral, medial and transverse arches of the foot contributing to relaxation of the plantar fascia.

Figure 2: Shows myofascial release therapy



3.12 Collection of Data

The selected subjects were divided into 2 groups:

- Group A- ultrasound therapy
- Group B- myofascial release therapy

Both the experimental groups were given treatment for continuous 2 weeks. Before and after the completion of 2 weeks treatment intervention, pain and foot functions were evaluated by VAS and FFI respectively and recorded.

3.13 Statistical technique

The collected data were analyzed by paired't' test to find out significance difference between pre and post -test values of experimental groups and further unpaired't' test was applied to find out the differences between groups.

CHAPTER IV

DATA ANALYSIS AND RESULTS

4.1 Data analysis

This chapter deals with the systematic presentation of the analyzed data followed by the interpretation of the data.

a) Paired 't' test

$$\bar{d} = \frac{\sum d}{n}$$
$$s = \frac{\sqrt{\sum d^2 - \frac{\sum(d)^2}{n}}}{n - 1}$$

$$t = \frac{\bar{d}\sqrt{n}}{s}$$

Where,

d – Difference between pre test and post test values

$\bar{d} = \frac{\sum d}{n}$ – Mean of difference between pre test and post test values

n – Total number of subjects

s – Standard deviation

b) Un paired t' test

$$S = \sqrt{\frac{\sum(x_1 - \bar{x}_2)^2 + \sum(x_2 - \bar{x}_2)^2}{n_1 + n_2 - 2}}$$

$$T = \frac{\bar{x}_1 - \bar{x}_2}{S} \sqrt{\frac{n_1 n_2}{n_1 + n_2}}$$

Where,

S = Standard deviation

n_1 = Number of subjects in Group A

n_2 = Number of subjects in Group B

\bar{x}_1 = Mean of the difference in values between pre-test and post-test in Group-A

\bar{x}_2 = Mean of the difference in values between pre-test and post-test in Group-B

Table 1

The table Shows mean value ,mean difference, standard deviation and paired ‘t ‘ value between pre and post test scores of pain among Group A

Measurement	Mean	Mean difference	Standard deviation	Paired‘t’ value
Pre- test	7.4	3.4	1.1832	8.8*
Post- test	4			

*0.005 level of significance

In Group A calculated paired ‘t’ value for pain is 8.8 and the ‘t’ table value is 3.250 at 0.005 level of significance .Since the calculated ‘t’ value is more than the ‘t’ table value above value shows that there is significant difference in pain following ultrasound therapy in plantar fasciitis subjects.

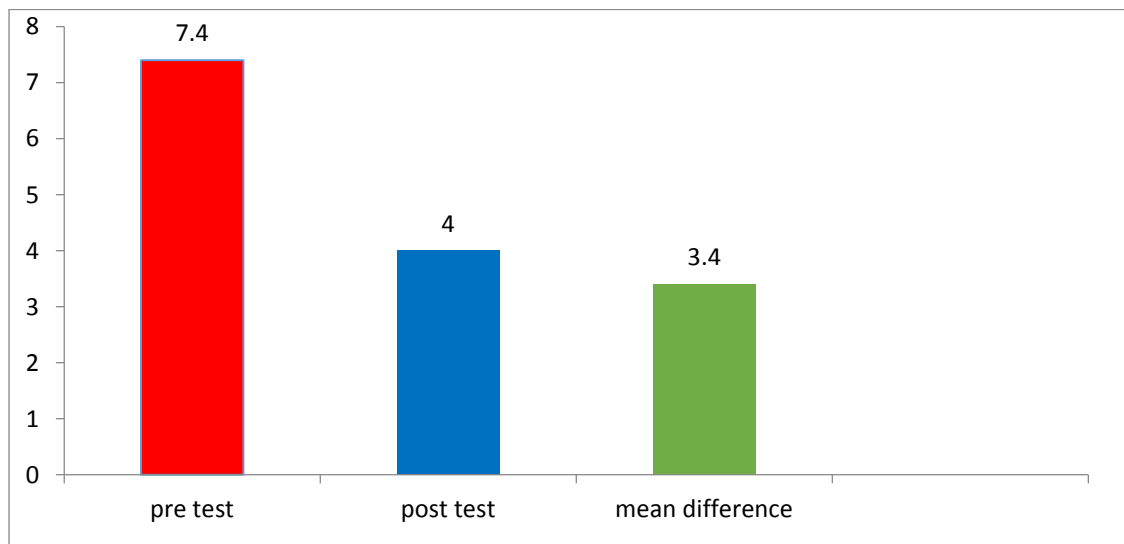


Figure 3: Shows the graphical representation of pre and post-test mean values of pain for Group A subject

Table 2

The table Shows mean value ,mean difference, standard deviation and paired ‘t’ value between pre and post test scores of pain among Group B

Measurement	Mean	Mean difference	Standard deviation	Paired ‘t’ value
Pre- test	8	6	3.898	4.86*
Post- test	2			

*0.005 level of significance

In Group B calculated paired ‘t’ value for pain is 4.86 and the ‘t’ table value is 3.250 at 0.005 level .Since the calculated ‘t’ value is more than the ‘t’ table value, the above value shows that there is significant difference in pain following myofascial release therapy in plantar fasciitis subjects.

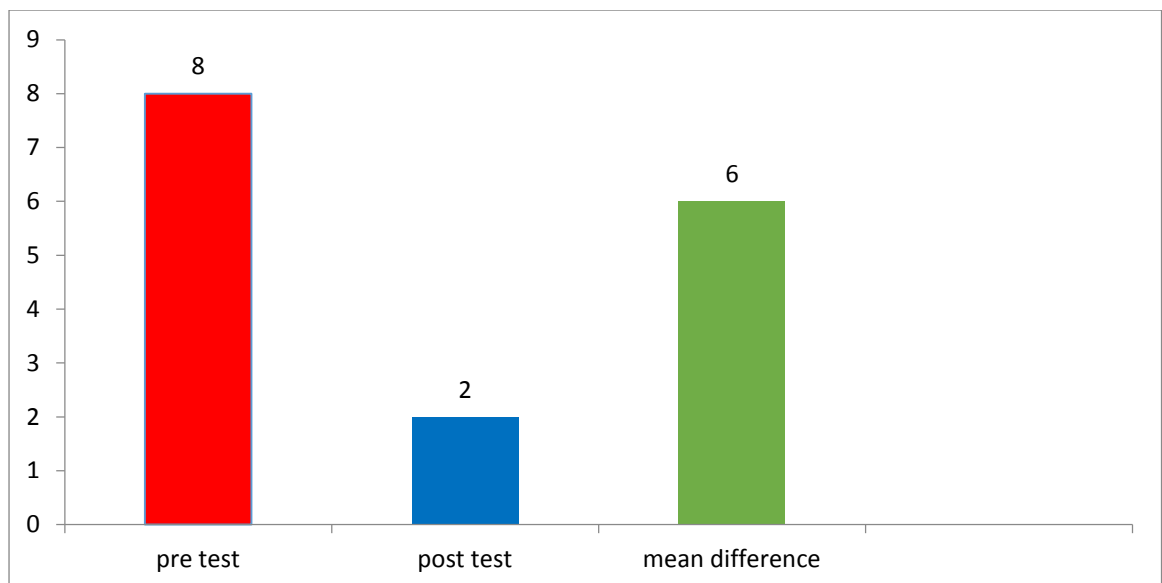


Figure 4 shows the graphical representation of pre and post-test mean values of pain for Group B subjects.

Table 3

The table shows mean value, mean difference, standard deviation, and unpaired 't' value of pain between Group A and Group B

Sl.no	Groups	Improvement		Standard deviation	Un paired 't' Test
		Mean	Mean Difference		
1	GROUP-A	3.4	2.6	7	5.4*
2	GROUP-B	6			

*0.005 level of significance

In Group A and B (for pain) calculated un paired 't' value is 5.4 and the 't' table value is 2.87 at 0.005 level since the calculated 't' value is more than the 't' table value above value shows that there is significant difference between ultrasound and myofascial release therapy in pain among plantar fasciitis subjects.

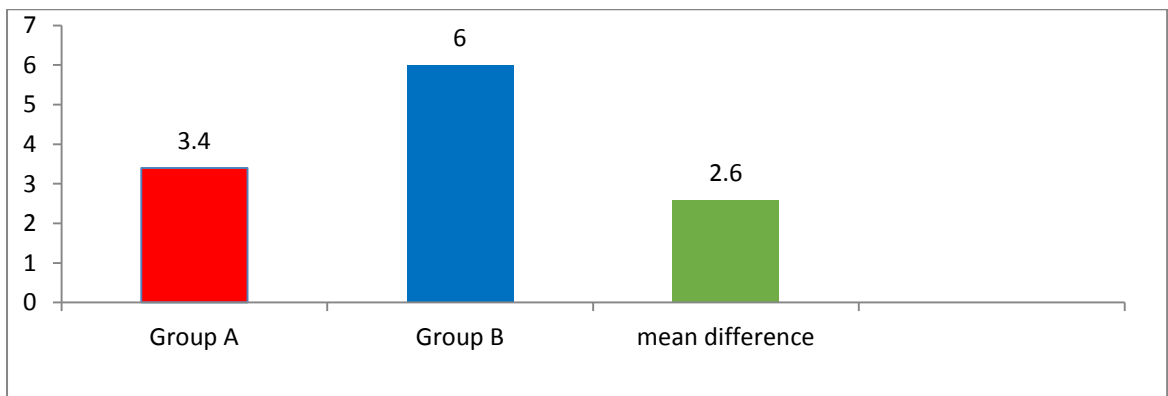


Figure 5 shows the graphical representation of pre and post-test mean values of pain in Group A and Group B

Table 4

The table 4 shows mean value, mean difference, standard deviation, and paired ‘t’ value between pre- test and post-test scores of foot function ability among Group A

Measurement	Mean	Mean difference	Standard deviation	Paired ‘t’ value
Pre- test	68.24	33.16	33.11	3.163*
Post- test	35.08			

*0.005 level of significance

In Group A for FFI calculated un paired ‘t’ value is 3.163 and ‘t’ table value is 2.87 at 0.005 level .Since the calculated ‘t’ value is more than ‘t’ table value above value shows that there is significant difference in foot function following ultrasound therapy in plantar fasciitis subjects.

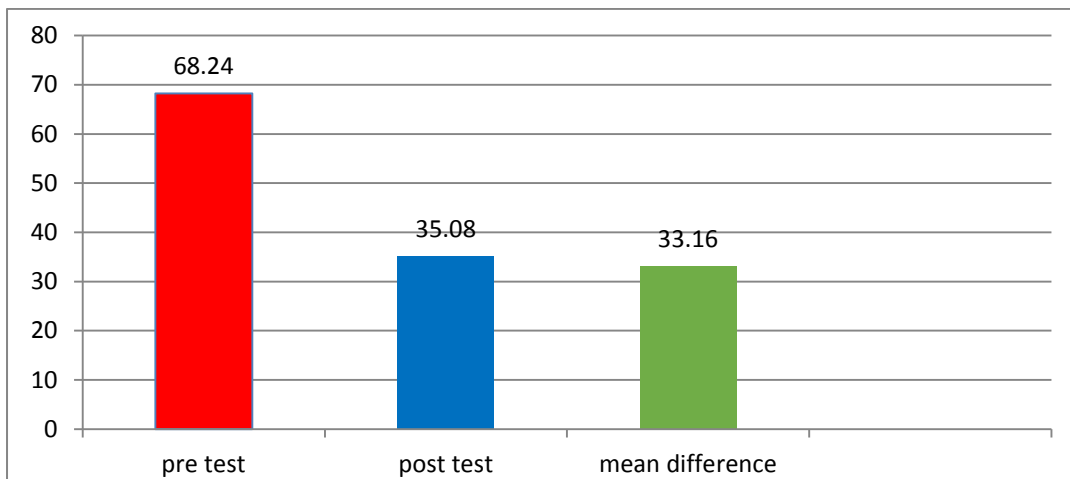


Figure 6 shows the graphical representation of pre and post-test mean values of FFI among Group B

Table 5

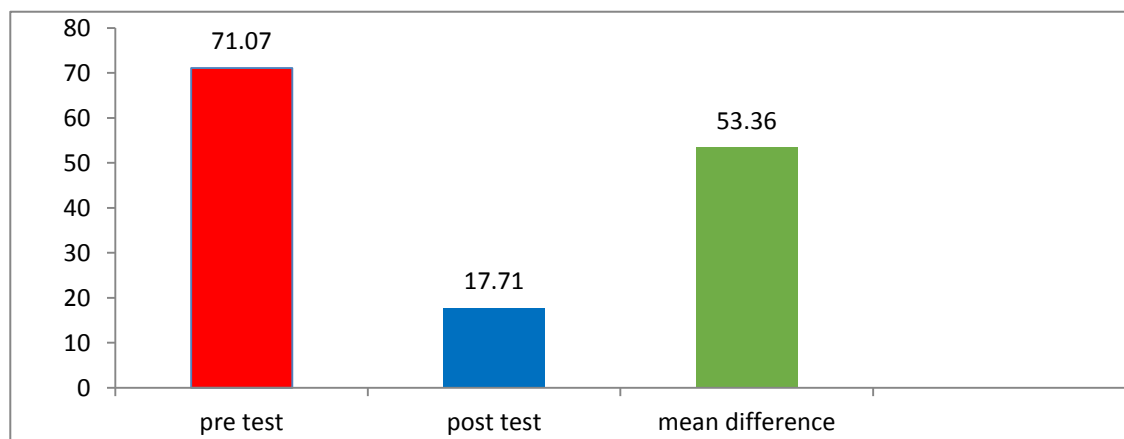
The table shows mean value, mean difference, standard deviation, and paired ‘t’ value between pre- test and post-test scores of foot functional ability among Group B

Measurement	Mean	Mean difference	Standard deviation	Paired ‘t’ value
Pre- test	71.07	53.36	53.63	3.14
Post- test	17.71			

*0.005 level of significance

In Group B for FFI calculated paired ‘t’ table value is 3.14 and ‘t’ table value is 2.87 at 0.005 level .Since the calculated ‘t’ value is more than the ‘t’ table value above value shows that there is significant difference in foot function following myofascial release therapy in plantar fasciitis subjects.

Figure 7 shows the graphical representation of pre and post-test mean values of



FFI Group B

Table 6

The table shows mean value, mean difference, standard deviation, and Un paired ‘t’ value of foot functional ability between Group A and Group B

Sl.no	Groups	Improvement		Standard Deviation	Un paired ‘t’ Test
		Mean	Mean Difference		
1	GROUP-A	33.16	20.2	1.24	36.30*
2	GROUP-B	53.36			

*0.005 level of significance

In Group A and B for FFI calculated un paired ‘t’ value is 36.30 and the ‘t’ table value is 2.87 at 0.005 level .Since the calculated ‘t’ value is more than the ‘t’ table value above value shows that there is significant difference between ultrasound therapy and myofascial release therapy in the management of foot function among plantar fasciitis subjects.

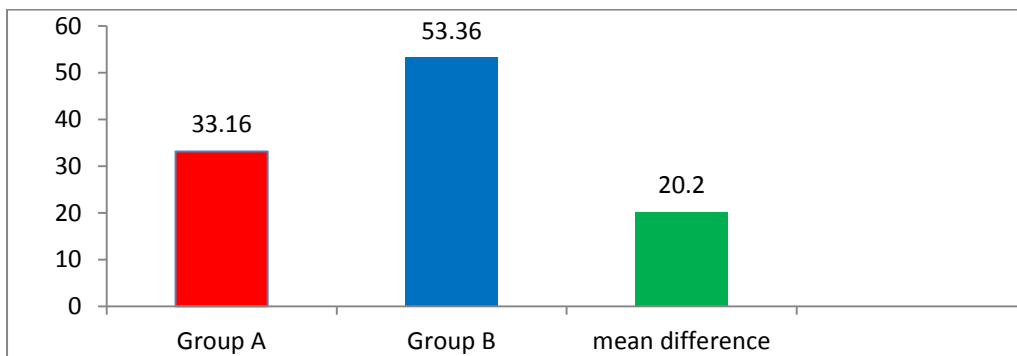


Figure 8 shows the graphical representation of pre and post-test mean values of FFI Group A and Group B

4.2 Results

20 marathon runners with plantar heel pain were selected for the study. The subjects were randomly divided into two groups.

Group A subjects was treated with ultrasound therapy.

Group B subjects was treated with myofascial release therapy.

Analysis of dependent variable pain in Group A: The calculated Paired 't' value is 8.8 and the table 't' value is 3.25 at 0.005 level of significance. Hence, the calculated 't' value is greater than the Table 't' value. There is significant difference in pain following ultrasound therapy among plantar fasciitis subjects.

Analysis of dependent variable pain in Group B: The calculated paired 't' value is 4.86 and the table 't' value is 3.25 at 0.005 level of significance. Hence, the calculated 't' value is greater than the table 't' value there is significant difference in pain following myofascial release technique.

Dependent variable pain between Group A and Group B: The calculated unpaired 't' value is 5.44 and the table 't' value is 3.250 at 0.005 level of significance. Hence, the calculated 't' value is greater than table 't' value there is significant difference between conventional therapy and myofascial release techniques in reducing plantar heel pain in marathon runners .

When comparing the mean values of Group A and Group B, Group B subjects treated with myofascial release therapy showed more difference than Group A. hence it is concluded that myofascial release therapy is more effective than ultrasound therapy in reducing pain among plantar heel marathon runners.

Analysis of dependent variable foot function in Group A: The calculated paired 't' value is 3.163 and the table 't' value is 3.250 at 0.005 level of significance. Hence, the calculated 't' value is greater than the table 't' value there is significant difference in foot function following conventional therapy among plantar heel pain marathon runners .

Analysis of dependent variable foot function in Group B: The calculated paired 't' value is 3.142 and the table 't' value is 3.250 at 0.005 level of significance. Hence, the calculated 't' value is greater than the table 't' value there is significant difference in foot function following myofascial release technique among plantar heel pain marathon runners .

Dependent variable foot function between Group A and Group B: The calculated unpaired 't' value is 36.3 and the table 't' value is 3.25 at 0.005 level of significance. Hence, the calculated 't' value is greater than table 't' value, there is significant difference between conventional therapy and myofascial release technique in improving foot function among plantar heel pain marathon runners .

When comparing the mean values of Group A and Group B, Group B subjects treated with myofascial release therapy showed more difference than Group A. Hence it is concluded that myofascial release therapy is more effective than ultrasound therapy in improving foot function among plantar heel pain marathon runners.

CHAPTER V

DISCUSSION

Plantar heel pain is one of the conditions, which can be treated by a wide variety of physiotherapy methods. It is still difficult to formulate all proof guidelines for the management of plantar fasciitis. Various methods of treatment exist with own claims of success without any attempts of comparing the maximal methods. The objective of this study was to find out the effectiveness of myofascial release in treatment of plantar fasciitis.

The study was conducted on 20 subjects. The subjects were divided into two groups, Group A and Group B.

Group A received ultrasound therapy

Group B received myofascial release therapy

The aim of the study was to find out effect and compare the effectiveness of ultrasound therapy and myofascial release therapy on reduction of pain and improving the foot function among plantar fasciitis subjects.

Results of the present study shows that there is significant difference in pain and foot function following myofascial release therapy and ultrasound therapy among plantar fasciitis subjects.

This results was supported Chung *et al.*, (2007) they concluded in their study that treatment of proximal plantar fasciitis with ultrasound - guided steroid injection. Proximal plantar fascia and heel pad were assessed with a 10 –MHz liner array ultrasound transducer. Pain intensity was quantified with a tenderness threshold (TT) and visual analog scale (VAS) and was concluded that ultrasound offered an objective measurement of therapeutic effect on proximal plantar fasciitis. Accurate steroid injection under ultrasound guidance can effectively treat proximal plantar fasciitis. This results was supported

This results was supported by Speed (1991) concluded that thermal effects of ultrasound increased blood flow, reduced pain , reduced muscle spasm and increased tissue extensibility.

This results was supported Kuhr *et al.*, (2007) performed a randomized control trail study to check out effectiveness in two groups. Group A received therapeutic ultrasound , contrast bath , foot intrinsic muscles strengthening exercise , plantar fascia stretching exercise and Group B received conversional treatment as group A added with myofascial release for 15 minutes for 10 consecutive days and results concluded that myofascial release is an effective therapeutic option in the treatment of plantar fasciitis.

This results was supported John (2007) in a study review of myofascial release as an effective massage therapy technique supports the usage of myofascial release techniques for the treatment of myofascial pain. Myofascial pain can present in clinical setting and can mimic other condition. Literature relies on palpation, symptomatology, and patient's history as keys to the diagnosis of this condition. According to the literature, applying an appropriate myofascial technique can be a very effective therapy for myofascial pain. Results have shown a decrease pain, and an increase in range of motion for the joints acted on by the affected muscle.

Hence the hypothesis first and second are accepted third is rejected.

Heel Pain



CHAPTER VI

CONCLUSION

An experimental study was conducted to investigate the effectiveness of ultrasound therapy and myofascial release therapy in the management of plantar heel pain in marathon runners.

20 subjects with plantar heel pain were included in this study and randomly divided into two groups A and B each group consist of 10 subjects. Group A was treated with ultrasound therapy. Group B was treated with myofascial release therapy. Pain and foot function were assessed before and after intervention by VAS and FFI.

The statistical result shows that there is improvement in both the groups. But when comparing both its found that myofascial release technique is more effective than ultrasound therapy in reducing pain and improving foot function among plantar heel pain runners.

6.1 Limitations

- The study was limited with an age group of 18-25 years.
- The study was limited to assess only the pain intensity and foot function index
- This study couldn't be generalized to every one, as the sample size was small.

6.2 Suggestion

- As this study was done only with sub acute plantar fasciitis patients, further studies are suggested to detect the progress in patients with other problem of ankle.
- In this study subjects were tested for pain intensity and foot function index, similar studies could also be done to detect the strength of foot and ankle ability measure.
- Further studies should have multiple age group, as this study was considered for only 18-25 years.
- As the study was done for a short period, a long –term study also can be done.
- Further studies can be done with functional outcome measures as a parameters.
- Further studies can be done with newer method of electrotherapy modalities.

CHAPTER VII

BIBILOGRAPY

Books

Benedict (2006) Factors associated with chronic plantar heel pain : a systemic review, *JSciMedSport*.2006;9:11-22;discussion23-24.<http://dx.doi.org/10.1016/j.jsams.2006.02.004>

Bijur (2001) *AcadEmrg Med*, 2001Dec;8(12):1153-7

Crowford (1996) How effective is therapeutic ultrasound in the treatment of heel pain? *Ann Rheum Dis.*, 1996;55:265-7.

DiGiovanni (2003) Tissue specific plantar fascia-stretching exercise enhance outcomes in patients with chronic heel pain. A prospective , randomizd study. *J Bone Joint Surge Am*.2003;85-A:1270-1277

Dubin (2007) Evidense based treatment for plantar fasciitis .

Elliot (2005) News –Line for Physical Therapist & PT Assists.

Furey (1975) plantar fasciitis :the painful heel syndrome.

Geppert (1988) Management of heel pain in the inflammatory arthritis. *ClinOrthopRelat Res*.1998;93-99

Gill (1987) Conservative treatment for painful heel syndrome. Proceeding of the third annual summer meeting. *Foot Ankle*.1987;8:122.

Lehman (1999) arthritis, and heel pain. *J Am Podiatr Med Assoc*.1999;89:18-19

Journals

1.**Bijur (2013)** Journal of foot ankle research. *AcadEmerg Med*, 2013 Dec;8(120):1153-7

2.**Riddle (2013)** Journal of the American podiatric association 2013. Risk factors for plantar fasciitis: a matched case-control study. J Bone Joint Surg Am.2013;85-A:872-877.

3.**Roberts (2012)** International journal on exercise science. Management of heel pain in the inflammatory arthritides.ClinOrthopRelat Res.2012;93-99

Website

1.www.pudmed.com

2.www.medline.com

3.www.studentsttest.com

4.www.grapgpad.com

CHAPTER VIII

ANNEXURES

ANNEXURE -I

ASSESSMENT CHART

D) Subjective Examination:-

- a) **Name** :
- b) **Age** :
- c) **Sex** :
- d) **Occupation** :
- e) **Chief complaints** :

Dislocation of Ankle Joint Yes /No

Hyper mobility Yes/ No

Recent fracture around the feet Yes/ No

Neurological disorders Yes/ No

Hypomobility Yes/ No

f) **Weight** : **kgs**

g) **Height** : **cms**

(ii) History collection:-

a) **Present Medical history**

Any fracture or dislocation of Ankle or foot - Yes/No

b) **Past Medical history:-**

Fracture complication of the Ankle and foot -Yes/No

(iii) OBJECTIVE EXAMINATION:

(a) On Observation:

- General body built
- Musculature
- Deformity
- Tropic changes
- External appliances

(b) On Palpation:

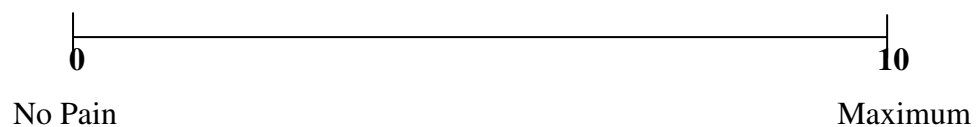
- Temperature
- Swelling
- Bony prominence
- Local tenderness
- Oedema or effusion
- Nodules
- Scar tissue
- Muscle spasm

(h) On Examination:

PAIN ASSESSMENT (USING VAS)

- On set -
- Duration -
- Site of pain -
- Type of pain -
- Nature of pain -
- Aggravating factors -
- Relieving factors -

USING VAS



SENSORY EXAMINATION:

- ❖ Temperature
- ❖ Pressure

MOTOR EXAMINATION:

- Muscle power assessment – Calf Muscles, Intrinsic Muscles -
- Joint range of motion - Ankle dorsiflexion -
- 1st MTP Joint extension

(vi) DIAGNOSIS

- X – Ray
- Medical Imaging
- Special Tests

- | | | | |
|----|-------------------|-------------------------------|-------------------------------|
| a) | Point tenderness | <input type="checkbox"/> + ve | <input type="checkbox"/> - ve |
| b) | Self stretch Test | <input type="checkbox"/> + ve | <input type="checkbox"/> - ve |
| c) | Haglund syndrome | <input type="checkbox"/> + ve | <input type="checkbox"/> - ve |

(v) AIMS :

(vi) Means :

(vii) Home Program :

ANNEXURE -II

Foot and Ankle Ability Measure (FAAM) Activity of daily living

S.No		NO DIFFICULTY	MODERATE DIFFICULTY	EXTREME DIFFICULTY	UNABLE TO DO	N/A
1	Standing					
2	Walking on even Ground					
3	Walking on even ground without shoes					
4	Walking up hills					
5	Walking down hills					
6	Going down stairs					
7	Walking on uneven ground					
8	Steeping up and down curbs					
9	Stepping up and down curbs					
10	Squatting					
11	Coming up on your toes					
12	Walking initially		35			

13	Walking 5 minutes or less					
14	Walking approximately 10 minutes					
15	Walking 15 minutes or greater					
16	Home responsibility					
17	Activities of daily living					
18	Personal care					
19	Light to moderate work (standing, walking)					
20	Heavy work (push/pulling, climbing, carrying)					
21	Recreational activities					

ANNEXURE-III

Foot Function Index

Section 1: To be completed by patient

Name: _____ Age: ____ Date: _____

Occupation: _____ Number of days of foot

Pain: _____ (this episode)

Section 2: To be completed by patient

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. For the following questions, we would like you to score each question on a scale from 0 (no pain) to 10 (worst pain imaginable) 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 0 1 2 3 4 5 6 7 8 9 10 Worst pain imaginable

1. In the morning upon taking your first step?
2. When walking?
3. When standing?
4. How is your pain at the end of the day?
5. How severe is your pain at its worst?

Answer all of the following questions related to your pain and activities over the past week, how much difficulty did you have?

Disability scale

No Difficulty 0 1 2 3 4 5 6 7 8 9 10 So Difficult unable to do

- 6. When walking in the house?
- 7. When walking outside?
- 8. When walking four blocks?
- 9. When climbing stairs?
- 10. When descending stairs?
- 11. When standing tip toe?
- 12. When getting up from a chair?
- 13. When climbing curbs?
- 14. When running or fast walking?

Answer all the following questions related to your pain and activities over the past week. How much of the time did you have?

Disability Scale

None of the time 0 1 2 3 4 5 6 7 8 9 10 All of the time

- 15. Use an assistive device (cane,walker,crutches,etc) indoors?
- 16. Use an assistive device (cane,walker,crutches,etc) outdoors?
- 17. Limit physical activities?

Section 3: To be completed by physical therapist

SCORE: _____/170×100= _____%(SEM 5,MDC 7)

SCORE:Initial _____ Subsequent _____ Subsequent _____ Discharge _____

Number of treatment sessions: _____

Diagnosis/ICD-9 Code: _____

ANNEXURE IV

RAW DATAS OF PAIN AND FOOT FUNCTION

Table: 7 Pre and post-test values of pain in Group A.

SL.NO	PRE TEST	POST TEST
1	9	5
2	6	3
3	9	4
4	8	4
5	6	3
6	6	4
7	7	4
8	8	5
9	8	4
10	7	4

Table: 8 Pre and post-test values of pain in Group B.

SL.NO	PRE TEST	POST TEST
1	8	2
2	9	3
3	9	2
4	8	2
5	7	1
6	8	2
7	9	3
8	7	2
9	7	1
10	8	2

Table: 9 Pre and post-test values of Foot Function Index in Group A.

SL.NO	PRE TEST	POST TEST
1	78.25	38.54
2	61.35	33.25
3	76.25	37.55
4	71.54	35.24
5	60.14	32.87
6	63.21	35.24
7	65.58	37.41
8	72.36	35.21
9	70.45	33.21
10	63.24	32.33

Table: 10 Pre and post-test values of Foot Function Index Group B.

SL.NO	PRE TEST	POST TEST
1	72.12	18.32
2	75.24	20.25
3	77.1	19.56
4	70.95	16.32
5	65.24	15.24
6	74.17	18.41
7	80.25	19.35
8	61.43	16.52
9	60.52	16.2
10	73.75	16.95

ANNEXURE V

PATIENT CONSENT FORM

I.....Voluntarily consent to participate in the research named on **“A COMPARATIVE STUDY ON EFFECTIVENESS OF ULTRASOUND THERAPY AND MYOFASCIAL RELEASE THERAPY IN REDUCING PAIN AND IMPROVING FOOT FUNCTION AMONG PLANTAR FASCITIS PATIENTS”**.

The researcher has explained me the treatment approach in brief, risk of participation and has answered the questions related to the study to my satisfaction.

Signature of patient

Signature of researcher

Signature of witness

Place:

Date: