International Journal of Physiotherapy and Research,
Int J Physiother Res 2015, Vol 3(1):875-84. ISSN 2321-1822
DOI: 10.16965/ijpr.2015.101

Original Article

IMMEDIATE EFFECT OF THREE SOFT TISSUE MANIPULATION TECHNIQUES ON PAIN RESPONSE AND FLEXIBILITY IN CHRONIC PLANTAR FASCIITIS: A RANDOMIZED CLINICAL TRIAL

Renu B.Pattanshetty *[1], Amit S.Raikar [2].

[*1] Assistant Professor, KLEU Institute Of Physiotherapy, Belgaum, Karnataka, India.
[2] Post Graduate Student, KLEU Institute Of Physiotherapy, Belgaum, Karnataka, India.

ABSTRACT

Background and Objectives: Plantar fasciitis is a common foot disorder in which patients have pain and tenderness at the sole of the foot. Rest, exercises, orthotics, taping, cryotherapy, therapeutic ultrasound, electrical stimulation, whirlpool bath, and iontophoresis have been widely used to relieve plantar pain. Long term use of manual therapy techniques like myofascial release technique, positional release therapy and passive stretching have been used in the past to reduce pain and improve ankle range of motion. The present study aimed to evaluate and compare the immediate effectiveness of myofascial release technique, positional release therapy and passive stretching on pain response and ankle flexibility in chronic plantar fasciitis.
Material and methodology: A total of 60 participants with chronic plantar fasciitis were randomly allocated to Group A (myofascial release group) and Group B (positional release group) and Group C (passive stretching). Therapeutic ultrasound with intensity of 1W/cm^2 and frequency of 1MHz for 5 min was given for a single session to all the patients and then given the manual techniques. Visual analogue scale, range of motion of the ankle were outcome measures that were assessed pre- and immediately post-interventional.
Results: The study demonstrated statistical significant reduction in pain, in all three groups ($p<0.0001$). Ankle range of motion showed significant improvement in Group A (MFR). Group C (passive stretching) demonstrated significant improvement ($p=0.001$) as compared to Group B (PRT).
Conclusion: All three manual techniques with therapeutic ultrasound were effective in immediate relief of pain and improving ankle range of motion in subjects with chronic plantar fasciitis.
KEYWORDS: Plantar fasciitis, myofascial release, positional release therapy, passive stretching, therapeutic ultrasound.

Address for correspondence: Dr. Renu B. Pattanshetty, MPT; Ph.D. Assistant Professor, KLEU Institute Of Physiotherapy, Belgaum-590010, Karnataka, India. Contact No.: +919448482564
E-Mail: renu_kori@rediffmail.com

Access this Article online

Quick Response code

DOI: 10.16965/ijpr.2015.101

International Journal of Physiotherapy and Research
ISSN 2321- 1822
www.ijmhr.org/ijpr.html

Received: 07-01-2015	Accepted : 23-01-2015
Peer Review: 07-01-2015	Published (O): 11-02-2015
Revised: None	Published (P): 11-02-2015

INTRODUCTION

The human ankle/foot complex meet the stability demands of providing a stable base of support for the body in a variety of weight bearing postures without undue muscular activities and energy expenditure, and acting as a 'rigid' lever for the mobility demands by dampening of rotations imposed by the more proximal joints of the lower limb,being flexible to absorb the shock of the superimposed body weight as the foot hits the ground and allowing the foot to conform to the changing and varied terrain on which the foot is placed. Four of Cailliet's criteria for normal foot are absence of pain, normal muscle balance, central heel and straight and mobile

toes [1].

Plantar fascia called as plantar aponeurosis, lies superficial to the muscles of the plantar surface of the foot. It has thick central part which covers the central muscle of the 1st layer, Flexor digitorum brevis and is immediately deep to the superficial fascia of the plantar surface. It acts as a truss, maintaining the medical longitudinal arch of the foot, and assists during the gait cycle and facilities shock absorption during weight bearing activites[2].

Foot complaints are common in general practice and their incidence increases with age. Three out of four people complains of foot pain during the course of a life time [3], While approximately 20% of people aged 65 years or older complains of non traumatic foot problems [4]. Plantar fasciitis has been experienced by 10% of the population [5].

The foot is subjected to various types of injuries like laceration, contusion, ligaments sprains and rupture, fracture, penetrating wounds, etc In addition, pathologic changes are imposed on the foot by congenital abnormalities, bacterial and fungal infections and dermatologic lesions, ill fitting shoes,walking on hard surfaces [6].

Different authors have described heel pain as achilles spurs, retrocalcaneal bursitis, subcalcaneal pain, posterior heel pain, plantar fasciitis etc. Heel pain commonly occurs in weight bearing due to inflammation of thick tissue at the sole. Stress to plantar fascia may also result from injury, or a bruise incurred while walking, running, or jumping on hard surfaces; or being overweight [7]. Hence, causes of heel pain may be described as plantar, lateral, medial, posterior, and diffuse [8], and may either be caused due to injury to the soft tissue, bone, nerve or plantar fascia [9].

Plantar fasciitis an inflammation of the plantar fascia is one of the most common causes of foot pain in which pain and tenderness are located inferiorly at the plantar fascia origin [10]. It is more common in sports that involves running, long distance walking, dances, tennis players, basket ball players and non athletes whose occupation requires prolonged weight bearing [11]. Other causes are mechanical stress involving compressive forces making foots longitudinal arch flat [5]. Repeated micro traumas cause inflammation at the origin of the plantar fascia over the calcaneal medical tuberosity. Traction forces during the support phase on gait lead to an inflammatory process, resulting in fibrosis and degeneration [12]. There is a loss of flexibility as the disease progresses due to calcaneal tendon retraction, fatigue, fascial inextensibility, and poor mechanics [5].

Though etiology is unknown in approximately 85% of cases, plantar fasciitis can occur in association with various arthritides. In an athlete, plantar fasciitis appears to be associated with overuse, training errors, training on unyielding surfaces and improper or excessively worn foot wear. Sudden increase in weight bearing activity, particularly those involving running can cause micro-trauma to the plantar fascia. In elderly adults, plantar fasciitis is often attributable to poor intrinsic muscle strength and poor force attenuation secondary to acquired pesplanusand compounded by a decrease in the body's healing capacity [13].

Patients with plantar fasciitis typically present with inferior heel pain on weight bearing and pain often persist for months to years. Pain may be throbbing, searing or piercing, especially with the first few steps in the morning or after periods of inactivity. The discomfort often improves after further ambulation but worsens with continued activity, often limiting daily activities. The patient usually has tenderness around the medial calcaneal tuberosity at the plantar aponeurosis [14].

Medical and surgical management for plantar include non-steroidal anti inflammatory drugs, local cortisone injections, resection of the calcaneal spur or part of the plantar fascia near its origin, stripping off the soft tissue from the plantar surface of the calcaneus and excision of the medial inferior tubercle of the calcaneus. Other therapies include acupuncture, electron generating devices, insoles with magnetic foil, extracorporeal shock wave therapy [15].

Various physiotherapy treatment protocols have been advocated in the past such as rest, taping, orthotics,silicon heel cups, stretching, myo-fascial release and positional release therapy.

Electrotherapy modalities liketherape-utic ultrasound, phonophoresis, laser, microwave diathermy, iontophoresis, cryotherapy, contrast bath have been tried in past. Non weight-bearing stretching exercises have shown to helpful in reducing severe pain which occurs in the morning [16].

Therapeutic Ultrasound is a method of applying deep heat to connective tissue [15] which plays an important role in relieving plantar heel pain by both thermal and mechanical effect on target tissue resulting in increased local metabolism, circulation and extensibility of connective tissue and tissue regeneration. To obtain increase in the viscoelastic properties of collagen, an elevation in tissue temperature of greater than 3° to 4°C is indicated [17].

Stretching of the shortened and contracted plantar flexors may positively influence an individual's functional activities of daily living and decrease the risk of injury. Regardless of the type of fitness and rehabilitation program, the goal of stretching is to change the physical characteristics of connective tissue [18].

Myofascial release technique is a soft tissue mobilization technique mostly given in the chronic conditions that causes tightness and restriction in soft tissues. This technique has been proposed to act as a catalyst in the resolution of chronic plantar fasciitis [19].

Positional release therapy is an indirect myofascial technique focused on the neurologic component of the neuro-vascular myofascial somatic dysfunction.This technique is proposed to increase muscle flexibility by placing the muscle in a shortened position to promote-muscle relaxation in contrast to placing the muscle in a lengthened or stretched position [20].

Since there is dearth of literature to show the immediate effectiveness of myofascial release therapy, positional release technique and passive stretching, in chronic plantar fasciitis, the present study was proposed to evaluate and compare the three manual techniques on immediate response to pain and flexibility in chronic plantar fasciitis. It was hypothesized that there would be no difference in pain and flexibility with myofascial release, positional release therapy and passive stretching after a single session in chronic plantar fasciitis.

METHODOLOGY

Participants: Subjects between 18 and 60 years old with chronic plantar fasciitis with duration of more than three months and willing to participate in the study were recruited. The data was collected from the physiotherapy outpatient department at an Indian tertiary care set-up during the study period extending from nine months.Subjects were excluded if they had clinical disorder where therapeutic ultrasound is contraindicated such as infective conditions of foot, tumor, and calcaneal fracture, metal implant around ankle, Subjects with clinical disorder where myofascial release is contraindicated such as dermatitis, Ankle ankylosis, congenital foot deformities, corticosteroids injection in heel in past three months and subjects with referred pain due to sciatica and other neurological disorders were excluded.

Ethical approval for the study was granted by the Institutional Ethical Committee and the procedures were conducted according to the declaration of Helsinki.

Study design: This study was pre post experimental design with random allocation of the subjects by envelope method to either of the three groups (myofascial group, positional release group and passive stretching group) using non probability sampling method. Total number of Sample size was calculated to be 60 participants (α error = 80 and level of significance = $p \leq 0.05$)

Procedure: Subjects were initially examined for assessing compliance with inclusion and exclusion criteria. In addition, demographic and anthropometry data of each subject were recorded. After this initial evaluation, they were randomly allocated to one of the three study groups A, B and C respectively.

Group A: Myofascial release group [19]

Participants were placed in prone lying position with foot placed outside the plinth. Then the part was cleaned and gel was applied to the involved site and then transducer head was moved in slow circular manner for 5 minutes. Subjects underwe-

nt myofascial release manually by using thumb and plantar cupping by using heel of hand and fingers technique for 10 min in supine lying for single session (photograph no. 2).

Group B: Positional release group [20]

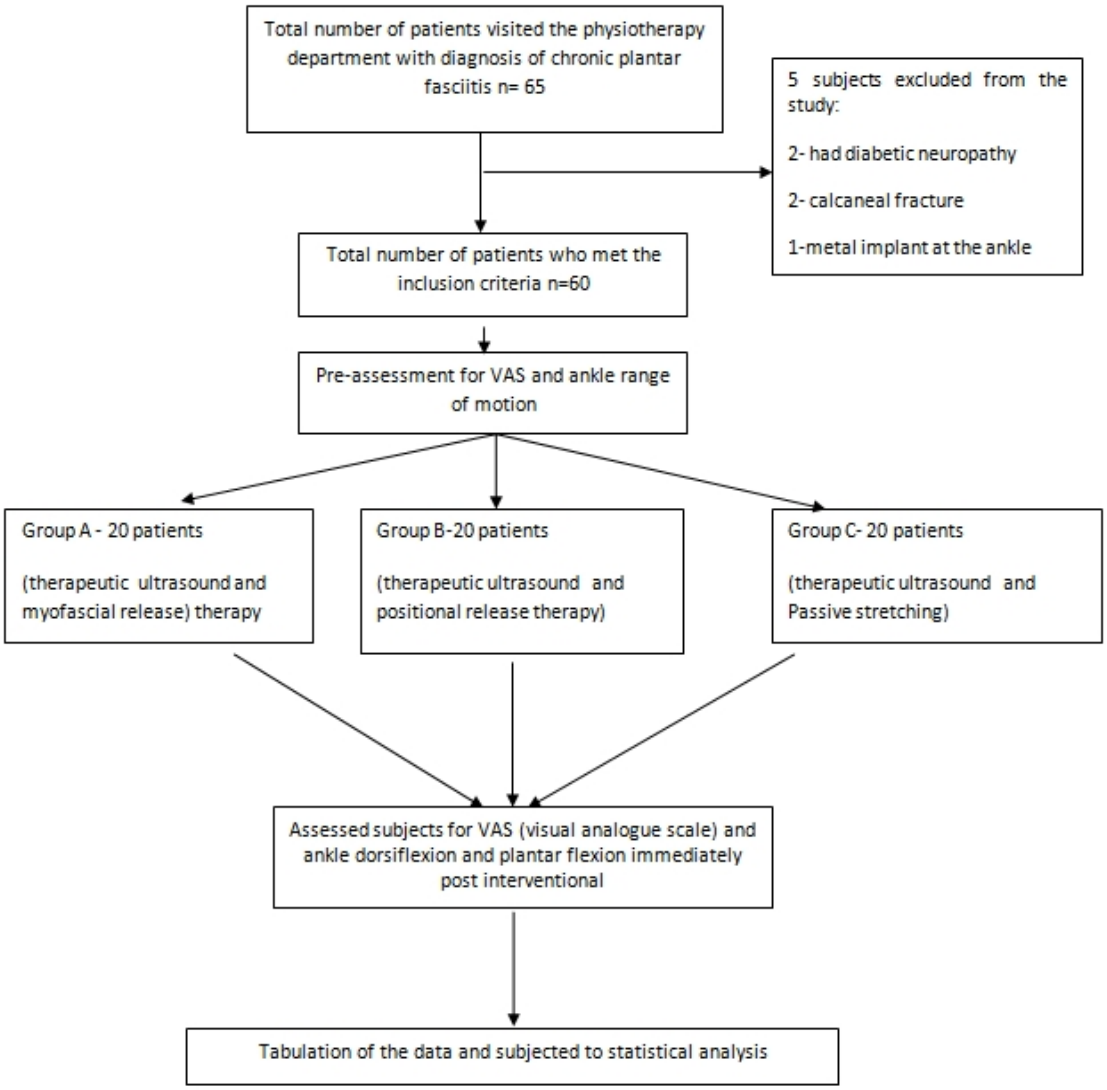
Subjects were given positional release technique manually by applying brief mechanical pressure on the tender point with one fingertip in order to determine tenderness. The foot was then positioned, into pure plantar flexion and gentle fine tuned by rotation, until the score in the tender point reduced to at least 70%. This position was held for 90 seconds following which slow release of pressure was applied and returned to neutral position; this was carried out in a single session (Photograph. 3).

Group C: passive stretching group [18]

For stretching ankle plantar flexors , firstly the soleus muscle was stretched with knee flexed and then gastrocnemius muscle was stretched with knee extended, over pressure was placed up on the bottom of the foot while the ankle was held in dorsi-flexion in supine lying. Passive plantar fascia stretching was performed in supine lying by application of force distal to the metatarsophalangeal joints on the affected side, pulling the toes upward towards the shin until a stretch was felt in the sole of the foot. Stretchings were performed for three repetitions each held for count of 30 sec for a single session in supine lying (Photograph no. 3).

Therapeutic ultrasound with intensity of 1W/cm^2 and frequency of 1MHz for 5 min was given for a single session to all the patients. (Photograph no. 1)

Fig. 1: Consort Study Flow Chart.



Outcome measures:

1. Pain: This was recorded by 10 cm horizontal visual analogue scale (VAS), the participants were asked to mark their intensity of pain on a 10 cm long line in the data collection sheet with numbers 0 to 10 where 0 symbolized no pain and 10 was severe pain.
2. Ankle Range Of Motion (ROM): Ankle plantar and dorsi flexion ROM was measured by Universal Goniometer. They were measured with subjects in high sitting position with ankle placed in 90º as the starting position, this reading was transposed and recorded as 0º.The Fulcrum was centered over the lateral aspect of the lateral malleolus, the proximal arm aligned with the lateral midline of the fibula, using the head of fibula as the reference and the digital arm parallel to the lateral aspect of the 5th metatarsal. The average of the three readings was recorded.

VAS score and ROM for each group were measured pre and immediately post intervention, in all the 3 groups.

Data analysis:

Analysis of raw data was done using SPSS windows version 13.0 version. Descriptive statistics were used to define the demographic characteristics of the sample. Various statistical measures such as mean, standard deviation and tests of significance such as Chi-Square test, student paired 't' test, one-way Analysis of Variance (ANOVA) and multiple comparison Scheffe test were utilized for this purpose. Nominal data using 'F' test , ANOVA and Chi-Square test was done. Intra group comparison of the pre interventional and post interventional outcome measures was done by using student paired 't' test whereas one way ANOVA and multiple comparison Scheffe test was used to measure the inter group difference. Probability values less than 0.05 were considered statistically significant ($p \leq 0.05$).

RESULTS

A total of 60 subjects with chronic plantar fasciitis accepted to participate in the study out of which 30 were males and 30 were females. There were 11 males and 9 females in group A, 9 males and 11 females in group B, 10 males and 10 females in group C. ($c^2 = 0.40$, p=0.8187). The average age of the subjects in group A was 34.25 ± 13.89 years, group B subjects was 36.60 ± 14.58 years and group C subjects mean age was 37.85 ± 13.78 years. Age was well matched in all three groups (F= 0.3367, p= 0.7155). There was no significant difference between the mean BMI values of the subjects in three the groups. (F= 0.4794,p= 0.6216)

The pre-interventional values of Visual analogue score within the group was 7.92 ± 0.98, 7.30 ± 1.68, and 7.13 ± 1.56 in group A, B and C respectively whereas post-interventional values of Visual analogue score was 3.68 ± 1.71, 3.13 ± 1.85, and 3.78 ± 2.03, in group A, B, and C respectively. VAS scores were statistically significant post interventional for all the three groups ($p < 0.0001$). The inter group analysis for VAS showed no significant difference in the reduction of pain when compared between all the three groups.

Values of pre-interventional ankle active dorsiflexion range of motion in group A was 16.60 ± 1.10 degrees, group B was 16.60 ± 1.64 degrees, and group C was 16.80 ± 1.54 degrees whereas post-interventional ankle dorsiflexion range in group A was 20.00 ± 1.03 degrees, group B was 17.65 ± 1.57 degrees, and group C was 20.30 ± 1.13 degrees. Comparing pre- and post-interventional valuesof ankle active dorsiflexion range of motion, values in all the three groups had shown statistical significant difference ($p<0.0001$). The inter group analysis for active dorsiflexion range of motion showed statistically significant difference between group A versus group B ($p<0.0001$), group A verses group C showed no statistically significant difference (p=0.754), group B verses group C showed statistically significant difference ($p<0.0001$).

Comparison of pre-interventional versus post-interventional values, all the three groups showed statistical significant difference ($p<0.0001$) in improving ankle plantarflexion range of motion. The inter group analysis for the same showed statistically significant difference between group A and group B (p=0.0025). comparison of Group B and group C showed statistically significant difference (p=0.0263). However, group A verses group C showed no statistically significant difference (p=0.6912).

Photograph1: Patient receiving therapeutic ultrasound.

Photograph 2: Patient receiving myofascial release therapy.

Photograph 3: Patient receiving positional release therapy.

Photograph 4: Passive stretching of soleus.

Photograph 5: Stretching of plantar fascia.

Photograph 6: Passive stretching of gastrocnemius.

Table 1: Age distribution & Anthropometric variables.

Groups	Mean Age (Years)	Mean BMI
Group A	34.25 ± 13.89	24.13 ± 2.21
Group B	36.60 ± 14.58	23.60 ± 2.99
Group C	37.85 ± 13.78	23.37 ± 2.25

Table 2: Gender Distribution in all the three groups.

Gender	Group A	Group B	Group C
Males	11	9	10
Females	9	11	10
Total	20	20	20

Table 3: Mean changes in Visual Analogue Scale Scores (cms) in all the three groups.

Groups	Visual Analogue Scale (cms)	
	Pre Treatment	Post Treatment
Group A	7.92 ± 0.98	3.68 ± 1.71
Group B	7.30 ± 1.68	3.13 ± 1.85
Group C	7.13 ± 1.56	3.48 ± 2.03

Table 4: Mean differences in ankle Range of Motion (ROM in degrees) in all the three groups.

Groups	DORSI FLEXION ROM		PLANTAR FLEXION ROM	
	Pre Treatment	Post Treatment	Pre Treatment	Post Treatment
Group A	16.60º ± 1.10º	20.00º ± 1.03º	41.35º ± 1.87º	44.05º ± 1.76º
Group B	16.60º ± 1.64º	17.65º ± 1.57º	40.85º ± 3.07º	41.30º ± 2.90º
Group C	16.80º ± 1.54º	20.30º ± 1.13º	40.85º ± 2.98º	43.40º ± 2.35º

Table 5: Comparison of VAS and ankle range of motion in all the three groups.

Groups	Value	Visual Analogue Scale	Dorsiflexion ROM	Plantar-flexion ROM
		Pre Treatment Vs. Post Treatment	Pre Treatment Vs. Post Treatment	Pre Treatment Vs. Post Treatment
Group A	p	<0.0001 Significant	<0.0001 Significant	<0.0001 Significant
Group B	p	<0.0001 Significant	<0.0001 Significant	0.00043 Significant
Group C	p	<0.0001 Significant	<0.0001 Significant	<0.0001 Significant

Table 6: Comparison of visual analogue scale score (VAS) in all the three groups (pre and post interventional)

Visual Analogue Scale						
VAS Score	Source of variance	SS	DF	MS	F	'p'
Pre Interventional	Between group	6.9803	2	3.4902	1.6872	0.1941
	Within group	117.909	57	2.0686		
Post Interventional	Between group	3.1103	2	1.5552	0.4466	0.642
	Within group	198.487	57	3.4822		

Table 7: Comparison of ankle dorsi-flexion ROM in all the three groups.

DORSIFLEXION (ROM)						
Active ROM	Source of variance	SS	DF	MS	F	'p'
Pre Interventional	Between group	0.5333	2	0.2667	0.1279	0.8802
	Within group	118.8	57	2.0842		
Post Interventional	Between group	84.233	2	42.116	26.453	7.468
	Within group	90.75	57	1.5921		

Table 8: Comparison of ankle plantar-flexion range of motion in all the three groups.

PLANTARFLEXION (ROM)						
Passive ROM	Source of variance	SS	DF	MS	F	p
Pre Interventional	Between group	3.3333	2	1.6667	0.2297	0.7955
	Within group	413.65	57	7.257		
Post Interventional	Between group	82.633	2	41.316	7.2698	0.0015
	Within group	323.95	57	5.6833		

Table 9: Comparison of ankle ROM post- treatment in all the three groups.

GROUPS	'p' value	
	Dorsiflexion(ROM)	Plantarflexion(ROM)
Group A Vs. Group B	<0.0001	0.0025
	Significant	Significant
Group A Vs. Group C	0.75483	0.6912
	Not Significant	Not Significant
Group B Vs.	<0.0001	0.0263
	Significant	Significant

DISCUSSION AND CONCLUSION

This clinical trial was conducted to evaluate and compare the immediate effectiveness of myofascial release technique, positional release technique and passive stretching on pain and flexibility in subjects with chronic plantar fasciitis along with therapeutic ultrasound. (Figure: 1)

All the three groups had equal number of participants and were well matched in term of gender distribution. Age group of subjects ranged between 18 to 65 years. Majority of the patients afflicted with subcalcaneal heel pain are between 40 to 60 years of age, although the range has been reported to be 8 to 80 years of age [21]. A similar study reported that subcalcaneal pain is a common orthopedic problem that generally occurs in persons ranging from 30 to 70 years of age [22].

Mean body mass index (BMI) of the subjects in all the groups were 24.13 ± 2.21 for Group A and 23.60 ± 2.99 in Group B and 23.37 ± 2.25 in Group C. According to WHO standard ideal BMI is in the range of 18.5 - 24.9 [23]. The BMI in all the three groups were well matched.

Therapeutic ultra sound has shown to relieve pain in plantar fasciitis, the results of which are similar to the present study. Therapeutic Ultrasound refers to mechanical vibrations which are essentially the same as sound waves but of a higher frequency. Therapeutic frequencies of ultrasound range from 0.5 to 5 MHz. It has been estimated that for an output of 1W/cm^2 there is a temperature rise of 0.8°C/ min [24]. If local temperature is raised between 40°C to 45°C hyperaemia will result [25]**.** To achieve a useful therapeutic effect the tissue temperature has tobe maintained between thesevalues for at least 5 mins [26]**.** Also heating fibrous tissue structures such as joint capsules, ligaments, tendons and scar tissue may cause a temporary increase in their extensibility, and hence a decrease in joint stiffness. Mild heating can also have the effect of reducing pain and muscle spasm and promoting healing process [27]**.** Pain relief may also occur due to the non thermal effects of pulsed ultrasound in the form of stimulation of histamine release from mast cells and factors released from macrophages that accelerate the normal resolution of inflammation [26]. Therapeutic ultrasound has the potential to accelerate normal resolution of inflammation provided that the inflammatory stimulus is removed [28]**.** The dosage for therapeutic ultrasound used in the present study was based on the evidence suggested by Hana Hronkova et al [29]. Which has caused complete disappearance of pain in 50% of the subjects Pulsed Ultrasound was preferred for soft tissue repair and 1 MHz frequency was chosen as it is capable of reaching to deeper tissues [25].

Myofascial release has also shown to decreasepain and improve functional foot index in subjects with plantar fasciitis [30], the results of which are similar to the present study. Myofascial release technique and passive stretching with therapeutic ultrasound has shown to relieve pain and normalize the connective tissue by softening, lengthening and realigns the fascia [31]. Patients with plantar fasciitis present with reduced ankle range of motion and great toe dorsiflexion due to pain and a concomitant tight achilles.[32] Restricted movement in ankle may also be due to hyperactivity of the myotatic reflex arc which is caused by excessive gamma gain [33]. The goal of MFR is to release fascia restriction and restore its tissue. This technique is used to ease pressure in the fibrous bands of the connective tissue function, or fascia. Gentle and sustained

stretching of myofascial release is believed to free adhesions and softens and lengthens the fascia. By freeing up fascia that may be impending blood vessels or nerves, myofascial release helps in improving circulation and nervous system transmission. This technique has been widely used in physical therapy treatments in the chronic conditions causing tightness and restriction in soft tissues. It helps in change of the viscosity of the ground substance to a more fluid state which eliminates the fascia's excessive pressure on the pain sensitive structure and restores proper alignment. There is sufficient evidence to support the effectiveness of deep tissue procedures in treating strain/sprain injuries [34,35]. It has also shown to stimulate fibroblast proliferation, leading to collagen synthesis that may promote healing of plantar fasciitis by replacing degenerated tissue with a stronger and more functional tissue [36.37]. The reasons mentioned above may explain the reason for relieving pain, improvement range of motion in myofascial release therapy group similar to the study [30]. Direct MFR is a highly effective technique for subjects with plantar fasciitis who need to recover quickly. All the treatment methods were equally beneficial in relieving pain and improving ROM.

Positional release therapy is a technique proposed to increase muscle flexibility by placing the muscle in a shortened position to promote muscle relaxation in contrast to placing the muscle in a lengthened or stretched position [20]. Also called as counter-strain therapy, it is an indirect myofascial technique focusing on the neurologic component of the neuro-vascular myofascial somatic dysfunction. The use of body positioning, tender points to identify the lesion and to monitor the therapeutic intervention are some of the Positional release therapy indirect approaches with respect to tissue resistance [31]**.** The neurophysiologic rationale underlying the therapy is based on the fact that alteration in afferent neurons affect somatic joint dysfunction. Restricted movement may be due to hyperactivity of the myotatic reflex arc, which is caused by excessive gamma gain. By positioning the patient's muscle in the position of ease for a short period of time, the gamma gain decreases, thereby allowing the hyperactive reflex arc to return to its original state and range of motion to increase. This technique has been proposed for resolving dysfunction in chronic, subacute and acute condition [38]. The treatment duration (90 sec) for Positional release therapy selected for this study produced immediate significant pain relief which further suggests that this time duration may be used in similar clinical set-ups in alleviating pain in chronic plantar fasciitis [33]. Pain relief may also occur due to decrease in the intrafusal and extrafusal fiber disparity and reset of the inappropriate proprioceptive activity. Korr has provided a conceptual model how different manipulative techniques like isometrics and stretching may be effective in treatment of somatic dysfunction [39]. Wynne MM et al demonstrated reduction in pain and improvement in functional ability using positional release therapy results of which are similar to the present study [23]. Use of positional release therapy normalizes myotatic reflex arc thus producing movement gains, which may explain the reason for improvement in ankle ROM in the present study. But when compared to MFR and Passive Stretching ROM gains were to a lesser extent. Stretching is a term used to describe any therapeutic maneuver designed to increase mobility of soft tissue and subsequently improve ROM by elongating structures that have adaptively shortened and have become hypomobile over time. When a muscle is stretched and elongated, the stretch force is transmitted to the muscle fibers via the connective tissue (endomysium and perimysium) in and around the fibers. It is hypothesized that molecular interactions link these noncontractile elements to the contractile unit of muscle, the sarcomere. During passive stretch both longitudinal and lateral force transduction occurs [40]. Since stretching is an integral part of treatment component of physical fitness and rehabilitation programmes, it is thought to positively influence performance and injury prevention especially in the athletes. Shortening and contracture of the plantar flexors may cause limitations in ROM that restrict the normal action of muscle. This condition may be managed with a stretching program, which may decrease the risk of injury. Regardless of the type of program, the goal of stretching is to change the physical

characteristics of connective tissue. Passive stretching along with therapeutic ultrasound demonstrated marked reduction in pain and improvement in range of motion in the present study and it correlates well with the results of study by CA Knight et al. The author suggested stretching of the Achilles tendon and plantar fascia, performed 3-5 times daily, showed significant decrease in pain in plantar fascia [18].

However, the present study aimed to evaluate the immediate effectiveness of stretching rather than a long term study. To conclude, the present study is the first to report the immediate effectiveness of myofascial release technique, positional release therapy and passive stretching on pain response and flexibility in chronic plantar fasciitis in all three groups. Future research should consider using a larger sample size in different populations like athletes and elderly population along with different electrical modalities, more number of treatment sessions and a follow-up.

CLINICAL MESSAGE:

Use of manual techniques like myofascial release therapy, positional release therapy or passive stretching may be used along with therapeutic ultrasound in the treatment of chronic of plantar fasciitis instead of using therapeutic ultrasound in achieving immediate relief of pain and improving ankle range of motion.

ACKNOWLEDGEMENTS:

We would like to mention a special thanks to M.D. Mallapur, Lecturer, Dept. of community medicine, JN Medical College, Belgaum, Karnataka for helping us with the analysis of the data and also like to thank all the individuals who participated in the study.

Conflicts of interest: None

REFERENCES

[1]. Caillet R: Textbook of Foot and Ankle Pain. 2nd Ed. Philadelphia: FA Davis Company;1968.

[2]. S J. Bartold, Plantar heel pain syndrome: Overview and management: Journal of Bodywork and movement Therapies, 2004; 8: 214-226.

[3]. Footpain : A general description of the causes, http://www.docpods.com/foot pain.htm/Aug 16th 2005.

[4]. Gorter K, De.Poels, De.Melker R, Kuyvenhoven M: Variation in diagnosis and management of common foot problems by GP's. FamPract 2001; 18(06):569-573.

[5]. Whiting W.C, Zernicke R F, Roxas M; Plantar Fasciitis : Diagnosis and Therapeutic Considerations. Alt. Med Rev.2005; 10:83-93.

[6]. Kent K. Wu: Surgery of the foot. 3rd Ed. Philadelphia: Lea &Febiger; 1986.

[7]. American Podiatric Medical Association USA, cited in www.apma.org./topics/heel.htm / Nov 1st 2009.

[8]. Reid C. David: Sports Injury Assessment and Rehabilitation. 1st Ed. New York: Churchill Livington; 1992.

[9]. Singh D. , Angel J,. Trevino Bently Saul G. Forthrightly Review: Plantar Fasciitis, BMJ,1997; 212-216.

[10]. Roberts Scott :Text Book on Plantar fasciitis, heel spurs and heel pain 8-25-2004, www.heel spurs .com/intro.html(Google) page 2 and 5/21st Aug2009.

[11]. Brotzman S.B, , Kevin M.D, Wilk E,: Text Book of Clinical Orthopaedic Rehabilitation; 2nd Ed. New York: Churchill Living stone; 2001.

[12]. Rutherford Y.C , Niedfelat M.W: treatment of Chronic Plantar fasciitis. Am Fam pain. J. Foot Ankle Surg 2001; 40:329-400.

[13]. American College of Foot and Ankle Surgeons: The diagnosis and treatment of heel pain. J Foot Ankle Surg 2001; 40:329-40.

[14]. Hurtling D, Kessler RM: Management of Common Musculoskeletal disorder. The lower leg, Ankle and Foot. 3rdEd. Philadelphia: Lippincott; 1995.

[15].Ravindra P, Prakash C: Degenerative Plantar fasciitis: A review of Current concepts. The Foot, vol17, issue 1, March 2007:3- 9.

[16]. Wapher K, Sharkey P: The use of right splints for treatment of recalcitrant plantar fasciitis .Foot Ankle; 1991; 12(3):135 - 137.

[17]. Draper DO, Castel JC, Castle D: Rate of temperature increase in human muscle during 1 MHz and 3 MHz continuous ultrasound. J Orthop Sports Phys. Ther.1995; 22:142-150.

[18]. CA Knight et al: Effect of Superficial heat, Deep heat, and Active Exercise, Warm up on the Extensibility of the Plantar Flexors, PhysTher: Vol.81, No.6, June 2001:1206 - 1214.

[19]. Carol M. 2001: The Myofascial release manual. 3rd ed. Slack Inc 67.Walkier JM. Deep transverse frictions in ligament healing. J. Orthop Sports Physther 1984; 6(2):89-94.

[20]. D'Ambrogio K J, Roth G B.: Text Book of Positional Release Therapy, Assessment and treatment of musculoskeletal Dysfuntion. Ed 2nd. Philadelphia: Mosby; 2002.

[21]. Gill LH: Conservative treatment for painful heel syndrome. Proceedings of the third annual summer meeting. Foot ankle. 1987:8:122.

[22]. Lapidus P.W., Guidotti F.P., Painful heel: Report on 232 patients with 364 painful heels. Clin Ortho.1965; 39:178.

[23]. Wynne M M. et al. Effect of Counterstrain on Stretch Reflexes, Hoffmann Reflexes, and Clinical Outcomes in subjects with plantar fasciitis. JAOA, January 17, 2006; 106(9): 547-556.
[24]. Evans P. (1980): The healing process at cellular level: a review. Physiotherapy, 66, pg: 256-9.
[25]. Hronkova H, Navrtil L, , Skopek J and Kymplova J, Possibilities of the Analgesic therapy of Ultra sound and Non-Invasive therapy 19.02.2000, www.laserpartner.org. pg: 2.
[26]. Lehman J. F., De Lateur B. J: In Therapeutic Heat and Cold, 3rd Ed, Baltimore: Williams & Wilkins;1982.
[27]. Young, S. 'Ultrasound therapy' in: Kitchen, S and Bazin, S (eds) Claytons'sElectrotherapy, WB Saunders, Philadephia, 10th Ed, 1996,243-267.
[28].Young SR and Dyson: M. 'Macrophages responsiveness to Therapeutic Ultrasound'. Ultrasound in medicine and Biology, 1990, (16) 261-269.
[29]. Evans P. The healing process at cellular level: a review. Physiotherapy, 1980: 66,: 256-259.
[30]. Leadhetter W. Cell matrix response in tendon injury. Clin Sports Med 1997; 11(3) ; 533-579.
[31]. Meseguer AA, et al. Immediate effects of the Strain/ counterstrain technique in local pain evoked by tender points in the upper trapezius muscle. 2006; 9(3):112-118.
[32]. Racette SB et al. Obesity: Overview of Prevalence, Etiology and Treatment. Physical therapy 2003; 83: 276-288.
[33]. De Deyne, PG: Application of passive stretch and its implication for muscle fibres .Phys Ther. 2001: 81(2): 819-827.
[34]. Richie D , AAPSM (2003-2004), your podiatric sports Physician Talks about Plantar Fasciitis Treatment Pearls., www.aapsm.org (Pub Med)/ 4th Aug 2006.
[35]. Walkier JM. Deep transverse frictions in ligament healing. J. Orthop Sports Phys Ther 1984; 6(2): 89-94.
[36]. Kvist M, Jarvinen M. Clinical histochemical and biomechanical features in repair of muscle and tendon injuries. Int J Sports Med 1982; (3Suppl1): 12-14.
[37]. Dyck DD Jr, Boyajian-O'Neil LA. Plantarfasciitis. Clin J Sports Med 2004; 14(5) : 305-309.
[38]. Travor B, Julie Kramer et al: Effect of a Positional release therapy technique on Hamstring flexibility. PhysTher Can; 2004; 56:165-170.
[39]. Jones LH: Spontaneous release by positioning. The DO. 1964; 4: 109-116.
[40]. Wayne Pugh, The efficacy of foot or those in the treatment of plantar fasciitis: - A systemic review, Physical Therapy 2000; 43: 276-188.

How to cite this article:

Renu B.Pattanshetty, Amit S.Raikar. IMMEDIATE EFFECT OF THREE SOFT TISSUE MANIPULATION TECHNIQUES ON PAIN RESPONSE AND FLEXIBILITY IN CHRONIC PLANTAR FASCIITIS: A RANDOMIZED CLINICAL TRIAL. Int J Physiother Res 2015;3(1):875-884. **DOI:** 10.16965/ijpr.2015.101