Acute Effects of Three Soft Tissue Release Techniques In Improvement of Pain And Flexibility In Chronic Plantar Fasciitis In Runner

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Abstract- Purpose: *To find out the Acute effects of the soft tissue techniques in reduction of pain and increase in flexibility in chronic planter fasciitis in runners.*

Subjects and Method: *45 athletes (30 male and 15 female) with chronic planter fasciitis were included in this study. 45 athletes were assigned into three groups by inclusion and exclusion criteria (n=15 per group) Group A (experimental group) received transverse friction massage along with ultrasound and Group B (experimental group) received active release technique along with ultrasound whereas Group C (control group) received passive stretching technique along with ultrasound. To evaluate the range and flexibility of the ankle joint of the chronic planter fasciitis athletes were assessed for VAS and PFPS scale and ankle Dorsiflexion and planter flexion once immediately and later after 4 weeks.*

Result: *The study demonstrated significant reduction in pain, in all three group ($p<0.0001$). Ankle range of motion showed significant improvement in Group A (transverse friction massage). Group A (transverse friction massage) demonstrated significantly improvement as compare to Group B (active release technique) and Group C (passive stretching).*

Conclusion: *After analyzing the result it can be concluded that all the manual techniques with therapeutic ultrasound were effective in improving immediate relief of pain and improving the ROM in athletes with chronic planter fasciitis but more improvement was found in transverse friction massage technique. 4 weeks of transverse friction massage along with ultrasound shows greater improvement as compared to active release technique along with ultrasound and passive stretching along with ultrasound.*

Keywords- plantar fasciitis, transverse friction massage, active release technique, passive stretching, Therapeutic Ultrasound.

I. INTRODUCTION

Plantar heel pain is one of the most commonly occurring foot complaints treated by health care professionals [1]. Plantar heel pain is thought to be most commonly associated with the plantar fascia-when the term plantar fasciitis is commonly adopted. Plantar fasciitis is the most common cause of inferior heel pain. The word „fasciitis" assumes inflammation is an inherent component of this condition [2].

Plantar fasciitis can be defined as: An inflammation of the plantar fascia (also referred as Plantar heel pain syndrome, or Painful heel syndrome) The injury itself is an enthesopathy (an abnormality or injury at the site of attachment of a ligament or tendon to bone) of the origin of the plantar fascia at the medial tubercle of the calcaneous due to excess traction [3, 4, 5, 6, 7].

The plantar fascia is a thick, fibrous, relatively inelastic sheet of connective tissue originating from the medial heel, where it then passes over the superficial musculature of the foot and inserts onto the base of each toe. The plantar fascia is the main stabilizer of the medial longitudinal arch of the foot against ground reactive forces, and is instrumental in reconfiguring the foot into a rigid platform before toe-off [8, 9].

The chief initial complaint is typically a sharp pain in the inner aspect of the heel and arch of the foot with the first few steps in the morning or after long periods of non-weight bearing. Usually, after walking approximately ten to twelve steps the plantar fascia becomes stretched and the pain gradually diminishes. However, symptoms may resurface as throbbing, a dull ache, or a fatigue-like sensation in the medial arch of the foot after prolonged periods of standing, especially on unyielding cement surfaces. Generally, pain is most significant when weight bearing activities are involved [10, 11, 12, 13].

Under normal conditions, the plantar fascia performs this function appropriately without incurring injury. Some risk factors of plantar fasciitis include faulty mechanics of the foot due to structural abnormalities, age-related degenerative changes, overweight, training errors, and occupations

involving prolonged standing; athletes training for long distance running events. In the presence of these risk factors, excessive tensile forces may cause micro-tears in the plantar fascia. Repetitive trauma to the plantar fascia exceeding the fascia‟s ability to recover may lead to degenerative changes and an increased risk of injury [14].

According to kibler et al, deficits in flexibility of planter flexor muscles may contribute to greater fascia stretching [15]. cheung et al, content that intense muscle contraction of planter flexor muscles cause indirect stretching of the fascia, Increasing the risk of developing PF.[16] Some reports suggested that 81-86% of patient with PF have excessive pronation [17].

Various physiotherapy treatment protocols have been advocated in the past such as rest, taping, stretching, orthosis/ night splint, Silicon heel cups. Electrotherapy modalities in the form of ultrasound, phonophoresis, laser, microwavediatherm y, iontophoresis, cryotherapy, contrast bath have been given in past [18].

A treatment for plantar fasciitis is varied and research findings supporting their use are sometimes conflicting. Transverse friction massage (TFM) is a technique for pain and inflammation relief in musculoskeletal conditions. TFM may be part of a physiotherapy program offered in the treatment of various musculoskeletal conditions. TFM is a technique that attempts to reduce abnormal fibrous adhesions and makes scar tissue more mobile in sub-acute and chronic inflammatory conditions by realigning the normal soft tissue fibres (Schwellnus 1992 [19] Walker 1984) [20].

It has been indicated that TFM also enhances normal healing conditions by breaking cross bridges and preventing abnormal scarring. Its mechanical action causes hyperaemia, which results in increased blood flow to the area (Schwellnus 1992).

Active Release Techniques (ART) is a new and highly successful non invasive hands on technique, It is a patented state of the art soft tissue system/movement based massage technique method to address problems in the soft tissues of the body, including the muscles, ligaments, fascia, and nerves. Active Release Techniques treatment is a collection of soft tissue techniques for examination, diagnosis, and treatment of soft tissue disorders. It is designed to identify and treat scar tissue adhesions that are interfering with the normal function of the body. It allows the therapist to:

- ·Break-up restrictive adhesions,
- Restore normal sliding of the muscles and nerves, and
- More completely restore strength and flexibility to the foot [21].

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 [22].

Therapeutic Ultrasound has been used extensively to treat a variety of conditions because of its documented thermal effects. Ultrasound therapy helps in tissue repair and wound healing according to various clinical trials. It has been a treatment of chronic in soft tissue injuries. The high frequency sound stimulates the local tissues and increases the blood flow to the area alleviating inflammation [23].

II. REVIEW OF LITERATURE

1. **Anna Jacqueline et al (2017)** concluded that transverse friction massage with ultrasound therapy is more effective and benefiting the patient than giving only ultrasound therapy in decreasing pain and improving the functional ability. In this study it has found that when friction massage is given along with ultrasound for a patient with foot pain is reduces the foot pain and improve the activities of daily living for the patients suffering with planter fasciitis [24].
2. **Renu B. et al (2015)** concluded and evaluated the immediate effects of myofascial release technique, positional release technique and passive stretching on pain and flexibility in subjects with chronic plantar fasciitis along with therapeutic ultrasound. Passive stretching along with therapeutic ultrasound demonstrated marked reduction in pain and improve the range of motion [25].
3. **Muhammad khan et al (2014)** concluded that the use of the tissue-specific plantar fascia-stretching method as the key component of treatment for chronic plantar fasciitis. It includes obvious decrease in functional limitations and a higher satisfaction rate. An inexpensive, effective and straight forward treatment modality can be provided to the healthcare practitioner by this approach [26]
4. **Ameer A.Almubarak et al (2012)** concluded that exercise therapy is more effective than Control. combination of exercise therapy and either foot inserts or iontophoresis is more effective than exercise therapy alone. Long-term exercise therapy

is more effective than extracorporeal shock wave therapy [27].

5. **Paul Higgins et al (2012)** concluded that the effectiveness of treatment options available and to continue to promote physical therapy as an autonomous profession. As indicated by the survey results, physical theraists use a variety of methods and modalities to treat plantar fasciitis. While the common goal is to provide the best treatment approach for our patients diagnosed with plantar fasciitis, optimal treatment approaches need additional investigation [28].
6. **Geoff Formosa et al (2011)** concluded that to comparing the effect of TFM and HEP in six treatment session. The TFM will be more effective than the HEP [29].
7. **Romulo Renanordine et al (2011)** concluded that addition of TRP manual therapies to a self-stretching protocol is superior to the sole application of self-stretching in the treatment of individuals with plantar heel pain at short term. The magnitude of this benefit was clinically important for the main outcomes, physical function and bodily pain. In addition, significant increases in PPT levels within the TrP group were also found supporting antinociceptive effects of TRP therapy [30].
8. **Chakraborty MK et al (2011)** concluded that Tissue specific plantar fascia stretching exercise protocol alone can optimize tissue tension through control stretch of the plantar fascia by recreation of windlass mechanism(dorsiflexion of the first metatarsal and dorsiflexion of the ankle joint). It is noticed that high rate of satisfaction in regards pain and functional limitation [31].
9. **Adel Rashad Ahmad et al (2011)** concluded that the use of low frequency electrical stimulation as treatment tool, specific plantar friction massage, streching and strengthning exercise have effect in pain relief and improvement in foot fuctional activity [32]

III. HYPOTHESIS NULL HYPOTHESIS

It states that there will be no significant difference in effect of Transverse friction massage and Active release technique and Passive stretching technique along with ultrasound in treatment of chronic plantar fasciitis amongst runners.

ALTERNATE HYPOTHESIS:

It state that there will be significant difference in effect of Transverse friction massage and Active release technique and Passive stretching technique with ultrasound in treatment of chronic plantar fasciitis amongst runners.

IV. AIMS AND OBJECTIVE AIMS

To compare the effects of three different soft tissue techniques in improving functional status and pain relief in planter fasciitis.

OBJECTIVE:

To identify the effectiveness of transverse friction massage, active release technique and passive stretching in patients with the chronic planter fasciitis in decreasing the pain and improving the range of motion in ankle joint.

V. MATERIAL AND METHOD STUDY DESIGN

Randomized control trial.

STUDY SETUP:-

All Participants were taken from, Green Park Cricket Club, C.S.J.M.U. University Kanpur IIT Kanpur, J.L.R.H.in Kanpur.

STUDY POPULATION:-

Study was conducted in subject with chronic plantar fasciitis.

SAMPLE SIZE:-

45 subject- Group A- 15 experimental group Group B- 15 experimental group Group C- 15 control group

SAMPLING METHOD:-

Total number of 45 participants was taken according to the inclusion and exclusion criteria. Participant who satisfy the criteria were allowed to participate in the study after explaining and filling the consent form.

STUDY DURATION:-4 week

SELECTION CRITERIA INCLUSION CRITERIA:

- Clinically diagnosed cases of chronic plantar fasciitis of not less than 3 months.
- Those who were willing to participate in the study and willing to take treatment for 4 weeks.
- Heel pain felt maximally over plantar aspect of heel

- Pain with first steps upon walking (Greater than or equal to 4 on a 0-to-10 VAS scale),
- Age group = 22 – 35 year
- Both genders male and female were included in the study

EXCLUSION CRITERIA:

- Previous surgical history for plantar fascia History of pathologies around ankle /foot/knee
- History of recent fractures around ankle/ foot/kne
- History of surgery ankle/ foot/knee
- History of auto immune or systemic inflammatory disorders
- Subjects with fixed deformities of foot/ ankle and knee joint.
- Subjects with impaired circulation to lower extremities, peripheral neuropathies, etc**.**
- Subjects with neurological disorders leading to impaired balance and coordination.
- Corticosteroids injection in heel preceding 3 months.

VARIABLES DEPENDENT VARIABLES:

1. ROM with universal goniometer.
2. Pain on VAS scale
3. PFPS Plantar Fasciitis Pain/Disability Scale

INDEPENDENT VARIABLES:

1. Transverse friction massage
2. Active release technique
3. Passive stretching

INSTRUMENTATION AND TOOLS

1. Couch/treatment table
2. Spirit
3. Cotton
4. Therapeutic Ultrasound
5. Ultrasound Gel
6. Towels
7. Universal goniometer

VI. PROCEDURE

Subjects who fulfil the inclusion and exclusion criteria were included in the study and an informed consent was taken from each of the subjects prior to participation. This was followed by Subjective as well as Objective assessment of the involved foot for tenderness, temperature, swelling, pain and its intensity in terms of the Visual Analog Scale (VAS). In addition to this functional assessment was carried out .Instructions were given to the subjects about techniques performed. After this participants were randomly allocated to three Groups, Group A, Group B and Group C. For this purpose randomization is done by allocating subjects with number of experimental group.

- **GROUP A-EXPERIMENTAL GROUP** Ultrasound with Transverse friction massage.
- **GROUP B- EXPERIMENTAL GROUP** Ultrasound with Active release technique
- **GROUP C- CONTROL GROUP** Ultrasound with passive stretching technique

Subjects were initially examined for assessing compliance with inclusion and exclusion criteria. In addition, demographic 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.

Range of motion for ankle Dorsiflexion and plantar flexion:

Position of the patient- Sitting in the end of the couch and the legs are kept hanging.

Axis– Tip of the medial malleolus is taken as the axis.

Stable arm– It is placed over the midline of the medial aspect of the leg and is holding by the therapist left hand.

Movable arm– Movable arm is placed 90degree to the movable arm and is holding by the therapist right hand.

Procedure– Therapist right hand is performing the plantar and Dorsiflexion movement of the hip with the goniometer and measuring the angle to see the ROM.

GROUP A- TRANSVERSE FRICTION MASSAGE

Treated anatomical area- Mid sole of the foot.

Treatment duration- 10 minute.

Position of patient- Patient in supine lying and the great toe kept in dorsiflexion.

Pressure- Constantpressure such that the discomfort experienced would not cause severe pain was applied.

Technique- Pressure were applied with index finger, thumb provided that brisk motion would be initiating from shoulder and wrist flexible with hand stiff.

Concurrent treatment- 4 wks

Ultrasound- 1 MHz, 1 w/cm2continuous 5 min

GROUP B- ACTIVE RELEASE TECHNIQUE:

Treated anatomical area- Mid sole of the foot. Treatment duration- 10 minute.

Position of patient- Patient in long sitting position Pressure- pressure is given accordingly, also patient tolerance is considered.

Technique- Therapist were first start by shortening the muscle or fascia of affected limb then apply very specific pressure with hand as with hand stretch the tissue is lengthened. Active movement is done whenever possible like the patient actively shortened or lengthened the fascia according to the instructions given by therapist.

Concurrent treatment- 4 wks Ultrasound with the output of 1W/cm2 for 5 minutes continuous with frequency of 1MHz

GROUP C- PASSIVE STRECHING:

Planter fascia stretching: Position of patient- Supine lying
Treatment duration- Three repetitions each held for count of 30 sec

Technique- Support the posterior aspect of the distal tibia with one hand Grasp the foot along the tarsal and metatarsal areas Apply the stretch force to the anterior aspect of the foot, and planter flex the foot as far as possible.

Soleus Muscle Stretching: Position of patient- Supine lying
Treatment duration- Three repetitions each held for count of 30 sec

Technique- Grasp the patient heel with one hand, maintain the subtalar joint in a neutral position, place forearm along the planter surface of the foot. Stabilized the anterior aspect of the tibia with other hand. The knee should be flexed.

Dorsiflex the talocrural joint of the ankle by pulling the calcaneus in an inferior direction with thumb and finger gently applying pressure in a superior direction just proximal to the head of the metatarsals with the therapist forearm..

Stretching of the Gastronomies: Position of patient- Supine lying

Treatment duration- Three repetitions each held for count of 30 sec

Technique- Grasp the patient heel with one hand, maintain the subtalar joint in a neutral position, place forearm along the planter surface of the foot. Stabilized the anterior aspect of the tibia with other hand Dorsiflex the talocrural joint of the ankle by pulling the calcaneus in an inferior direction with thumb and finger gently applying pressure in a superior direction just proximal to the head of the metatarsals with the therapist forearm.

Therapeutic ultrasound with intensity of 1W/cm2 and frequency of 1MHz for 5 min given for all the patients.

VII. DATA ANALYSIS

Analysis of raw data was done using SPSS window 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 test of significance such as Chi-Square test, student paired „t" test, one way analysis of variance (ANOVA) and multiple comparision scheffe test were utilized for this purpose. Nominal data using „F" test, ANOVA and Chi- Squre 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 comparision Scheffe test was used to measure the inter group difference.

VIII. RESULT

Table 1.1: Distribution of study subjects according to gender

Gender	Group A	Group B	Group C	Significance
Male	2	6	7	Chi Square =0.122 p=0.10
Female	13	9	8	

Table 1- depicts the gender wise distribution of study subjects. The table shows that study subjects were selected as per gender matched distribution (Chi Square =0.122,p=0.10).

Table 1.2: Age of study subjects

	Group A	Group B	Group C	Significance
Age (in years)	26.47± 2.97	27.40 ±3.13	27.33 ±2.71	F=0.468 p=0.62

Table 2- represents the age of study subjects. The mean age of study subjects is 26.47(±2.97), 27.40(±3.13) & 27.33(±2.71).The mean age among three groups were almost same I.e. mean age difference among groups is statistically insignificant (F=0.468, p=0.62).

Table 1.3: Weight of Study subjects

	Group A	Group B	Group C	Significance
Weight (kg)	68.47 ±10.23	63.53 ±8.41	65.40 ±11.05	F=0.941 p=0.9

Table 3- represents the weight of study subjects. The mean weight of study subjects is 68.47(±10.23), 63.53(±8.41) & 65.53(±11.05).The mean weight among three groups were almost same I.e. mean age difference among groups is statistically insignificant (F=0.941,p=0.9).groups is statistically insignificant (F=0.468, p=0.62).

Table 1.4: BMI of study subjects

	Group A	Group B	Group C	Significance
BMI	23.47 ±3.05	22.23 ±2.22	21.54 ±2.27	F=2.21, p=0.12

Table 4- represents the BMI of study subjects. The mean BMI of study subjects is 23.47(±3.05), 22.23(±2.22) & 21.54(±2.27) in group A, group B & group C respectively. The mean BMI among three groups were almost same I.e. mean BMI difference among groups is statistically insignificant (F=2.21,p=0.12).

Table 1.5: Pre & Post Active PF ROM score among three groups

ROM	Group A	Group B	Group C	Significance
Pre day 0 Activa PF	23.20 ±7.31	24.93 ±7.61	23.20 ±7.33	F=1.09 p=0.34
Post day 30 active PF	33.60 ±6.45	30.07 ±6.81	28.67 ±6.49	F=2.23 p=0.12
Significance	t=-4.13 p=0.000	t=-11.24 p=0.000	t=2.16 p=0.000	Significance

Table 5- shows Pre & Post Active PF ROM score among three groups. One way ANOVA (analysis of variance) shows that at pre 0 day ,active PF ROM is almost same (F=1.09,p=0.34) & similarly at post 30 day active PF ROM is same among three groups (F=2.23,p=0.12). Whereas the student t – test (paired) shows that there is significant improvement in each groups in active PF ROM between pre – post test (p<0.0001).The maximum improvement of active PF ROM is seen in group A (pre –post difference =-10.4)

Table1.6: Pre & Post Passive PF ROM score among three groups

ROM	Group A	Group B	Group C	Significance
Pre day 0 Passive PF	29.00 ±6.83	30.27 ±6.99	29.60 ±7.22	F=1.01 p=0.37
Post day 30 Passive PF	38.93 ±6.91	35.00 ±6.83	33.80 ±7.14	F=2.24 p=0.12
Significance	T=-3.95, p=0.000	T=-6.82, p=0.000	T=-1.60 p=0.000	

Table 6 shows Pre & Post Passive PF ROM score among three groups. One way ANOVA (analysis of variance) shows that at pre 0 day ,passive PF ROM is almost same (F=1.01,p=0.37) & similarly at post 30 day, passive PF ROM is same among three groups (F=2.24,p=0.12).

Whereas the student t – test (paired) shows that there is significant improvement in each groups in passive PF ROM between pre –post test (p<0.0001).The maximum improvement of passive PF ROM is seen in group A (pre –post difference =-9.93)

Table 1.7: Pre & Post Active DF ROM score among three groups

ROM	Group A	Group B	Group C	Significance
Pre day 0 Active DF	14.73 ±2.54	15.27 ±2.01	15.27 ±2..05	F=0.28 p=0.75
Post day 30 active DF	18.40 ±1.59	18.13 ±1.76	17.60 ±2.09	F=0.74 p=0.48
Significance	T=4.78 p=0.000	T=8.52 p=0.000	T=3.08 p=0.000	

Table 7 shows Pre & Post active DF ROM score among three groups. One way ANOVA (analysis of variance) shows that at pre 0 day ,active DF ROM is almost same (F=0.28,p=0.75) & similarly at post 30 day, active DF ROM is same among three groups (F=0.74,p=0.48).

Whereas the student t – test (paired) shows that there is significant improvement in each groups in active DF ROM

between pre –post test (p<0.0001).The maximum improvement of active DF ROM is seen in group A (pre –post difference =-3.67)

Table 1.8: Pre & Post passive DF ROM score among three groups

ROM	Group A	Group B	Group C	Significan
Pre day 0 Active DF	18.27 ±2.08	18.73 ±1.62	18.20 ±1.08	F=1.20 p=0.31
Post day 30 active DF	19.01 ±0.01	19.87 ±0.51	19.60 ±0.82	F=1.96 p=0.15
Significance	T=1.35 p=0.000	T=-3.01 p=0.000	T3.99 p=0.000	

Table 8 shows Pre & Post passive DF ROM score among three groups. One way ANOVA (analysis of variance) shows that at pre 0 day ,passive DF ROM is almost same (F=1.20,p=0.31) & similarly at post 30 day, passive DF ROM is same among three groups (F=1.96,p=0.15).

Whereas the student t – test (paired) shows that there is significant improvement in each groups in passive DF ROM between pre –post test (p<0.0001).The maximum improvement of passive DF ROM is seen in group A (pre – post difference =-0.73)

Table 1.9: Pre & Post VAS score among three groups

VAS	Group A	Group B	Group C	Significanc e
VAS 0	4.87 ±1.18	4.87 ±0.74	4.80 ±1.14	F=0.02 p=0.98
VAS 30	2.47 ±1.06	2.87±0.8 3	2.53±0.9 1	F=0.77 p=0.46
Significanc e	T=7.85 p=0.000	T=9.16 p=0.000	T=12.4 p=0.000	

Table 9 depicts the VAS after &before treatment among three groups. VAS at 0 day is almost same between group B & C with respect to group A three (F=0.02,p=0.98) and also same among three groups after 30 day (F=0.77,p=0.46).Moreover, the pair t-test shows that there is highly significantly reduction VAS in all three groups between pre & post VAS score but group A has maximum changes in VAS between pre-post test(2.4)

Table 1.10: Pre & Post PFPS score among three groups

VAS	Group A	Group B	Group C	Significanc e
PFPS	4.87 ±1.18	4.87 ±0.74	4.80 ±1.14	F=0.02 p=0.98
PFPS 0	2.47 ±1.06	2.87±0.8 3	2.53±0.9 1	F=0.77 p=0.46
Significanc e	T=7.64 p=0.000	T=7.00 p=0.000	T=9.84 p=0.000	

Table 10 depicts the PFPS after &before treatment among three groups. PFPS at 0 day is almost same between group B & C with respect to group A three (F=0.01,p=0.98) and PFPS decreases sharply in group A compare to group B & C ,after 30 day (F=5.81,p=0.006).Moreover, the pair t- test shows that there is highly significantly reduction PFPS in all three groups between pre & post PFPS score but group A has maximum changes in PFPS between pre-post test(9.79)

IX. DISCUSSION

Planter fasciitis is an overuse injury that involves an inflammatory reaction of the planter fascia at its origin on the calcaneus. In the plantar fasciitis, the fascia under goes degeneration and become tight thereby leading to hypomobility within the ankle-foot compiles, especially talocrural, subtalar and 1st tasrometatarsal joints.

This study was designed to see the acute effects of transverse friction massage, active release technique and passive stretching in improvement of pain and flexibility in chronic planter fasciitis in runners.

In this we examined the effect of group A i.e transverse friction massage to group B i.e Active release technique to group C i.e passive stretching along with therapeutic ultrasound.

All the three group had equal number of participants and were well matched in term of gender distribution (Chi Square =0.122,p=0.10). Age group of the subject ranged between 18- 35 years. The mean BMI of study subjects was 23.47(±3.05), 22.23(±2.22) & 21.54(±2.27) in group A ,group B & group C respectively. According to WHO standard ideal BMI is in the range of 18.5 – 24.9. [54]. The BMI in all the three group was well matched.

Total of 45 subject were taken as per inclusion and exclusion criteria, all 45 subject those who satisfied the criteria were included in the study. Each group had 15 subjects. The treatment protocol was for 4 week in which

ankle planter flexion and dorsiflexion ROM and pain on VAS was measured, the transverse friction massage(10 minute) [33], active release technique (10 minute) [34], passive stretching (three repetition 30 second) [35] both group given ultrasound (1w/cm2 1mhz for 5 min) [36]. Was given once in a day. The measurement that was taken on day 0 i.e pre treatment and on the 30 day i.e post treatment.

The mean improvement in pain and intensity and flexibility (ROM) was found to be greater in group A that is transverse friction massage in comparison to group B that is active release technique and group C passive stretching.

The result of present study indicated that is group A transverse friction massage with ultrasound is more effective ($p<0.0001$) than group B that is active release technique and group C that is passive stretching.

Geoff Formosa, Gordon Smith concluded in their study that the friction massage applied by the using the thumb of one hand to impart the frictions while stretching the planter fascia with the other hand by maintaining the toe dorsiflexion [37].

Struijs et al and sevier et al reported that TFM is to stretch and mobilize fibrous adhesions and tight scar tissue and increase in flexibility might have coincided with an increase in pain felt on first step following sleep.

The movement is to stimulating proteoglycan synthesis, which lubricate the fascia and maintains the distance between the fibers, orientation the laying down of new collagen fibers through mechanical stress so fibers can resist tensile forces and preventing intermolecular cross-linking from occurring [38].

Anna Jacqueline Abigail et al (2017) also reported that transverse friction massage is given along with ultrasound therapy is to reduce the pain and improve the activity for the patient suffering from planter fasciitis [39].

ART is a method for treating the soft tissues such as the tendon, nerve, and myofascia, and is performed for repetitive strain injury, acute injury, and functional fixation damage due to abnormal posture maintained over the long term. Furthermore, ART is an effective at resolving adhesion of scar tissue and the soft tissue that causes pain, spasm, muscle weakness, tingling, and other symptoms [40].

Stretching is term used to describe any therapeutic manoeuvre designed to increase mobility of the soft tissue and subsequently improve ROM by elongating structures that have become hypomobile over time. When a muscle is stretched and elongated the stretch force is transmitted to the muscle fiber via the connective tissue in and around the fiber During passive stretch both longitudinal and lateral force transaction occur [41].

It is thought to positivity influence performance and injury prevention especially in the athletes. Shortening and contracture of the planter flexors may cause limitation in ROM that restrict the normal action of muscle. Passive stretching along with therapeutic ultrasound demonstrated marked reduction of pain and improvement of ROM in present study and it correlated well with the results of study by CA knight et al. The author suggested stretching of the Achilles tendon and planter fascia, performed 3-5 times daily, showed significant decrease pain in planter fascia [42].

Therapeutic ultrasound has shown to relive pain in the planter fasciitis. Therapeutic ultrasound refers to mechanical vibrations which are essential the same as sound waves but of a higher frequency. Therapeutic ultrasound frequencies of ultrasound range from 0.5 to 5 MHZ. it has been estimated that for an output of 1w/cm2 there is a temperature rise of 0.8c /40c to 45c hyperemia will result [43].

The dosage for therapeutic ultrasound used in the present study was based on the evidence suggested by Hana Hronkova et al. which has caused complete disappearance of pain in 50% of the subject continuous ultrasound was preferred for soft tissue repair and 1MHZ frequency was chosen as it is capable of reaching to deeper tissues [44].

X. LIMITATION OF STUDY

- The duration of the study small The sample size was small The elderly population was not included in study
- Follow up was not included

XI. FUTURE STUDY

- Similar studies should consider using a large sample size
- Similar study can be carried out with the Athletes in different sports
- Similar studies can be carried out in obese patient along with different electrical modalities
- Similar studies can be performed with more number of treatment sessions and a follow-up.

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