ORIGINAL RESEARCH

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EFFECTIVENESS OF INSTUMENTAL ASSISTED SOFT TISSUE MOBILIZATION TECHNIQUE WITH STATIC STRETCHING IN SUBJECTS WITH PLANTAR FASCIITIS

Vinod Babu. K[1]
Lisa Michael Pereira [2]
Sai Kumar. N[3]
Ayyappan. V.R[4]

ABSTRACT

Background: Instrumental assisted soft tissue mobilization and static stretching found to be effective in plantar fasciitis, however the combined effectiveness of these techniques were unknown. The purpose of this study is to find the effect of Instrumental assisted soft tissue mobilization technique for plantar fascia combined with static stretching of triceps surae for subjects with chronic stage of Plantar Fasciitis on pain intensity, ankle dorsiflexion range of motion and functional disability.

Methods: An experimental study design, selected subjects with chronic Plantar Fasciitis randomized subjects into each Study and Control group. Total of 40 subject's data who completed study, 20 in each group, was used for analysis. Control group received conventional exercise while Study group received conventional exercises with Instrumental assisted soft tissue mobilization combined with static stretching of triceps surae muscle. Outcome measurements such as Intensity of pain using Numerical Pain Rating Scale-101 (NPRS-101), function disability using Foot Function Index Pain Subscale (FFI) and ankle dorsiflexion active range of motion using Goniometer was measured before and after 2 weeks of intervention.

Results: There is statistically significant improvement in means of NRS-101, ankle dorsiflexion active range of motion and Foot Function Index Pain Subscale after intervention in both groups. When the post-intervention means were compared between Study and Control group after 2 weeks of treatment there is statistically significant difference in means between the groups whereas study group showed greater percentage of improvement than control group.

Conclusion: It is concluded that Instrumental assisted soft tissue mobilization technique combined with static stretching of triceps surae muscle is significantly effective than conventional exercises on reducing pain, improving ankle dorsiflexion range of motion and functional disability for subjects with chronic Plantar Fasciitis.

Key words: Plantar Fasciitis, Instrumental assisted soft tissue, soft tissue mobilization, Triceps Surae, Pain, Functional Disability, Range of motion, Static Stretching, Foot Function Index.

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CORRESPONDING AUTHOR

[1]Vinod Babu. K,
Assistant Professor in Physiotherapy,
K.T.G. College of Physiotherapy and
K.T.G. Hospital, Bangalore-560 091, India.
e-Mail: vinodbabupublications@gmail.com
dr.lisapereira@gmail.com

[2] MPT, Physiotherapist,
[3] Professor & Principal in Physiotherapy,
[4] Associate Professor in Physiotherapy.
K.T.G. College of Physiotherapy affiliated to Rajiv Gandhi University of Health Sciences, Karnataka, India.

INTRODUCTION

The term 'Plantar fasciitis' (PF) is defined as an inflammatory condition of the plantar fascia at its insertion on the medial calcaneal tubercle that occurs as a result of overstressing the plantar fascia.[1] Plantar fasciitis is usually seen as an overuse injury in athletes, runners in particular accounting for nearly 10% of running injuries, but is also seen in the general population.[2] The middle age people of 40 to 60 are more prone to plantar fasciitis.[3] Chronic PF is phase three in the soft tissue healing process where collagen is remodeled to increase functional capabilities of the tendon or ligament to withstand stresses imposed upon it, lasting on average from four weeks to 12 months.[4]

PF usually occurs unilaterally, and is worst upon arising in the morning or from getting up after prolonged sitting and eases with activity.[4,5] As a result of this PF has also been shown to limit range of motion of big toe dorsiflexion and ankle dorsiflexion. [4,5] The most causes of PF are due to poor biomechanics resulting in abnormal functional foot pronation which causes an increased tensile strain on the plantar fascia insertion that result in injury. [4,5,6] The complex of posterior musculature of leg that includes gastrocnemius and soleus muscle with the common attachment the achilles tendon together known as the triceps surae muscle[6] which is one of the cause for over-pronation of foot in symptomatic PF patients.[6] Therefore; it should always be looked for and treated with triceps surae stretches. Systemic review with five trials concluded that 5-30 minutes of calf muscle static stretching provides a small and statistically significant increase in ankle dorsiflexion compared with no stretching.[6,7,8]

Instrumental assisted soft tissue Mobilization is thought to be an advanced form of soft tissue mobilization employs specially designed stainless steel instruments with bevelled edges that are specifically designed for various parts of the body contoured with concave and convex edges to target certain areas of the body that are convex and concave respectively. Technique is used to detect and release scar tissue, adhesions, fascial restrictions, soft tissue lesions, by using a variety of multidirectional stroke techniques applied to the skin at a 30°–60° angle over the involved soft tissue structure to augment a clinician's ability to perform soft tissue mobilization.[9,10,11]

From the literature Instrument-assisted soft tissue mobilization (IASTM) has been found to be useful in the treatment of chronic ankle fibrosis, Ankle Instability,[12] Patellar Tendinopathy and to loosen tight patellar retinaculum[13], trapezitis,[14] lateral epicondylopathy,[15] trigger thumb,[16] knee ligaments,[17,18] De Quervain's stenosing tenosynovitis,[19] myofascial Pain and Trigger Points,[20] lumbar compartment syndrome,[21] lumbar compression fracture in an osteoporotic case,[22] tibialis posterior strain,[23] carpal tunnel syndrome,[24] and this technique also found effective in rhomboid Inflammation, supraspinatus tendinosis, non-specific thoracic spine, mechanical low back pain. In Plantar fasciitis it is found to be effective in breakup of adhesions at the origin of the plantar fascia on the medial calcaneal tubercle in Plantar Fasciitis.[25,26,27]

IASTM delivers controlled micro trauma to the affected area, resulting in a local inflammatory response initiating the healing process. When used in combination with a stretching and therapeutic exercise protocol, IASTM has shown to correctly restore soft tissue structure and function.[28] However, it is vital that adaptive stress be used in combination with IASTM in order to properly restore normal function.

From the literature it is found that both Instrumental assisted soft tissue mobilization and static stretching found to be effective in plantar fasciitis; however the combined effectiveness of these techniques were unknown. Hence, this study with research question whether Instrumental assisted soft tissue mobilization for plantar fascia and static stretching of triceps surae does have an effect on pain, ankle dorsiflexion range of motion and functional disability for subjects with plantar fasciitis? Therefore, the purpose of this study with objective to find the effectiveness of Instrumental assisted soft tissue mobilization on plantar fascia with static stretching of the triceps surae muscle on improvement of pain, ankle dorsiflexion range of motion and functional disability. It was hypothesized that there will be a significant effect of these techniques on improvement of pain, ankle dorsiflexion range of motion and functional disability in subjects with plantar fasciitis.

METHODOLOGY

Pre to post test experimental study design with two group- Study and Control group. As this study involved human subjects the Ethical Clearance was obtained from the Ethical Committee of KTG College of Physiotherapy and K.T.G. Hospital, Bangalore as per the ethical guidelines for Bio-medical research on human subjects. This study was registered. The study was conducted at K.T.G Hospital, Bangalore. Subjects included both male and female subjects, clinically diagnosed as unilateral chronic plantar fasciitis with symptoms more than 6 weeks of duration[2-6], reduced ankle

dorsiflexion range of motion on the affected foot, maximal pain located at the antero-medial aspect of the plantar surface of the calcaneus, confirmation with at least 3 of the following findings: Aggravation of pain by passive dorsiflexion of the great toe, aggravation of pain when the patient stands on their toes, pain that is worse in the morning during the initial steps, but which decreases after walking continue, aggravation of pain during direct palpation of the antero-medial calcaneal tubercle during passive dorsiflexion of the great toe,[2-6] those who were willing to participate in the study. Subjects were excluded with impaired circulation to lower extremities,[1] referred pain due to sciatica, neurological disorders, Rheumatoid arthritis, taken corticosteroids injection to heel preceding 3 months. Patients with contra-indications to IASTM technique as stated by Carey-Loghmani [9-11] were also excluded, these include the following: Red flags and Yellow flags. Subjects recruited were randomized by Simple random sampling method, allocated to study group and control group by using closed marked pieces of folded paper. Proposed sample size was 40 and total 40 Subject (n = 40) who completed the study in both groups data was used for analysis. The study was conducted for 2 weeks, 3 sessions in a week. All the subjects fulfilling the inclusion criteria were informed about the study and a written informed consent was taken.

Procedure of intervention for Control Group:

Control group subjects were treated with conventional exercises for intrinsic muscles - Towel curl up: For towel curl ups participants sat with foot flat on the end of towel placed on a smooth surface small weight was kept at the other end of towel. Keeping the heel on the floor, the towel to be pulled towards the body by curling the towel with the toes, for 10 minutes.[2-6] Active ankle exercises: For active ankle such as dorsiflexion, plantar flexion, inversion and eversion in supine lying 10 times. Plantar fascia self-stretching: Plantar fascia stretching with tennis ball. Subject sitting on the chair rolling foot on the ball for 5 minutes.[7] In sitting, patient crossed the affected foot over the contralateral thigh. The patient places his/her fingers to grasp over the base of the toes and pull the toes back towards the shin, until a stretch felt in the plantar fascia. Other hand is used to stabilise the calcaneal region. Patients were instructed to start gently at first then work more aggressively as tolerated.[6]

Procedure of intervention for Study Group:

Study group subjects received conventional treatment as warm exercise same as given for Control group followed by Instrumental assisted soft tissue mobilization for plantar fascia combined with static stretching of triceps surae muscle.

Graston Technique: [26,27]

The treatment sequence employed was as suggested by Carey-Loghmani.[17] Patients were prone with their feet slightly off the end of the examination table, while the examiner was standing/sitting at the end of the table. The Zukatools the Scanner (IASTM-4) and Seahorse (IASTM-6) instruments were used. An emollient (consisting of a combination of mineral oil and bees-wax or coconut oil) was applied to the area being treated to decrease the friction between the skin surface and the beveled edge of the instruments. A two hand hold grip was used to ensure that the instruments at required 30-60˚ angle to the treatment surface. Plantar fascia Soft tissue dysfunctions in the foot was detected using scanner and treated when manually applied brush strokes to the affected area and proceeded to use 2 cycles of 15-20 series of strokes one cycle of stokes in proximal to distal direction and vice versa over the area of lesion using Seahorse instrument. The two strokes employed were those of Sweeping and Fanning: Sweeping stroke - characterized by the instrument contact points moving in one direction at the same rate in a linear or curvilinear path. Fanning stroke – instrument contact points move at different rates in an arched path. During application one end of the instrument was stabilized, serving as a fulcrum of motion while the other end is moving, with the resistance at the end of the instrument that is moving. Force was directed deep enough to detect any lesion that may exist, avoiding too much pressure to maintain subject coherence and treatment effectiveness. The treatment time totaled five minutes: four minutes for the tissue warm-up over the entire fascia, and one minute over the specific lesion which, depending on the participant, was at/near the medial calcaneal tubercle.[26,27]

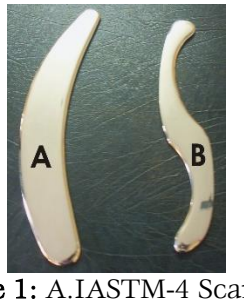


Figure 1: A.IASTM-4 Scanner;
B. IASTM-6 Seahorse.

Figure 2: Scanning using IASTM-4

Figure 3: Sweeping and Fanning using IASTM-6 Sea Horse

Static stretching of triceps surae muscle:

Gastrocnemius muscle stretch: The patient lies prone with the feet extended off the end of the examination table so that the knee remains straight as the examiner applies firm pressure to the ball of the foot to take up slack while dorsiflexing the foot at the ankle.

Soleus muscle stretch: The patient lies prone with the knee flexed and the ankle passively dorsiflexed. Increased pressure is gradually applied to dorsiflex the foot fully.[6]

The stretching for each muscle gastrocnemius and soleus was held with moderate pressure to feel stretch pressure without causing any stretch pain for 20 seconds with rest period of 30 seconds and 15 stretch was given.[1,6]

All the subjects were advised to use soft heel foot wear, not to stand for long time and not to walk bare foot. Subjects accepted into the study were asked not to change their lifestyle, daily activities, and exercise programs to avoid being excluded from the study.

Outcome measures:

Outcome measurements such as Intensity of pain using Numerical Pain Rating Scale-101 (NPRS-101), ankle dorsiflexion active range of motion using Goniometer and functional disability using Foot Function Index Pain Subscale (FFI) were measured pre and post intervention.

1. Numerical Pain Rating Scale-101(NPRS-101): [29] The NRS – 101 was chosen as it is easy to use, and it has been found to be a reliable and valid method to record subjective information relating to the patients' level of pain. The patients had to rate their pain as a percentage on two separate lines drawn from 0 (equivalent to no pain at all) to 101 (equivalent to pain as bad as it could be). The first number had to be their pain when it was at its worst was noted and used for analysis.

2. Measurement of Ankle active ROM:[28] The points of reference used to measure ankle dorsiflexion active ROM were the median line of the fixed arm of the goniometer on the line of the fibula and the external line of the movable arm positioned on the head of the fifth metatarsal. After the fixation of the arms of the goniometer, the fulcrum secondarily positioned on the inframalleolar region, so that the movable arm remained parallel to the fifth metatarsal line. The universal goniometer is positioned and then the subject was asked to perform the movement of active ankle dorsiflexion without any overpressure, while the examiner observe the movement until the final active ROM is achieved, at this level the range of motion in degrees was noted and used for analysis.

3. Foot Function Index Pain Subscale (FFI) for functional disability:[30,31] The FFI was used to obtain information on the impact of the patients' foot pain on their daily activities. It was found to be a valid and reliable scale for measuring foot pain, disability and activity restriction in orthopedic interventional trials and in patients with plantar fascitis. This instrument has been tested through time and adapted in its measures as it was frequently used in full scales or subscales to measure outcomes in various clinical practice or research studies. It consists of 9 questions that are scored from 0 (equivalent to no pain or difficulty at all) to 10 (equivalent to the worst pain imaginable or so difficult it required help) that best describes your foot over the past Week.

STATISTICAL METHODS

Descriptive statistical analysis was carried out in the present study. Out Come measurements analyzed are presented as mean ± SD. Significance is assessed at 5 % level of significance with p value was set at 0.05 less than this is considered as statistically significant difference. Paired 't' test as a parametric and Wilcoxon signed rank test as a non-parametric test have been used to analysis the variables pre-intervention to post-intervention with calculation of percentage of change. Independent't' test as a parametric and Mann Whitney U test as a non-parametric test have been used to compare the means of variables between two groups with calculation of percentage of difference between the means. Statistical software: The Statistical software namely SPSS 16.0, Stata 8.0, MedCalc 9.0.1 and Systat 11.0 were used for the

analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

RESULTS

Total 40 subjects data who completed the study were taken. In study Group there were 20 subjects with mean age 50.55 years and in control group there were 20 subjects with mean age 49.20 years (table-1). When means were analyzed from pre intervention to post intervention within the groups (table-2) there is a statistically significant ($p < 0.000$) change in means of NPRS-101 score, FFI Score and ankle dorsiflexion AROM within study and control group and there is no statistically significant difference in means of ankle dorsiflexion AROM in control group. There is also clinical significant improvement with large effect size in both the groups. However the study group has shown greater percentage of change in improvement than control group.

The table-3 shows that when pre-intervention means were compared between the groups there is no statistically significant ($p < 0.000$) difference in means of NPRS-101 Score, FFI Score and ankle dorsiflexion AROM. When post-intervention means were compared there is a statistically significant difference in means of NPRS-101, FFI score and ankle dorsiflexion AROM.

Table 1: Basic Characteristics of the subjects studied

Basic Characteristics of the subjects studied		Study Group	Control Group	Between the groups Significance[a]
Number of subjects studied (n)		20	20	--
Age in years (Mean ± SD)		50.55 ± 4.89 (42-59)	49.20 ± 4.40 (42-56)	p = 0.420 (NS)
Gender	Males	8	9	P = 0.794**
	Females	12	11	
	Within Group Significance	P = 0.000**	P = 0.000**	
Side	Right	10	10	P = 0.763**
	Left	10	10	
	Within Group Significance	P = 1.000	P = 1.000	

a - Pearson Chi-Square

Table 2: Analysis of NPRS-101, FFI, and Active Ankle Dorsiflexion ROM score within study and control Groups (Pre to posttest analysis)

	Pre intervention (Mean ± SD) min-max	Post intervention (Mean ± SD) min-max	Perecntage of change	Z value[b] (Non parametric significance)	t value a (Parametric)	Parametric Significance P value	95% Confidence interval of the difference		Effect Size (r)
							Lower	Upper	
	Study Group								
NPRS-101	85.45 ± 9.85 (66- 98)	24.30 ± 9.26 (8-39)	-71.56%	-3.923 p = 0.000**	43.627	P < 0.000**	58.21	64.08	+ 0.95 (Large)
FFI Score	58.84 ± 4.49 (50- 66.95)	17.73 ± 3.68 (11.30-22.61)	-69.86%	-3.922** p = 0.000**	62.648	P < 0.000**	39.73	42.48	+ 0.98 (Large)
AROM Ankle Dorsiflexion	8.35 ± 2.81 (4- 12)	17.25 ± 1.92 (10-15)	10.65%	-3.941** p = 0.000**	-12.829	P < 0.000**	-5.58	-4.01	+ 0.88 (Large)
	Control Group								
NPRS-101	83.10 ± 11.28 (57- 98)	64.40 ± 10.91 (47-84)	-22.50%	-3.924 p < 0.000**	17.219	P < 0.000**	16.42	20.97	+ 0.64 (Large)
FFI Score	61.10 ± 3.38 (56.09- 67.83)	46.23 ± 2.95 (41.74-51.74)	-24.33%	-3.928 p < 0.000**	40.779	P < 0.000**	14.10	15.63	+ 0.92 (Large)
AROM Ankle Dorsiflexion	8.35 ± 2.81 (4- 12)	8.50 ± 2.43 (5-12)	1.79%	*-0.183 p = 0.855(NS)*	-0.164	*P = 0.871(NS)*	-2.06	1.76	+ 0.02 (Small)

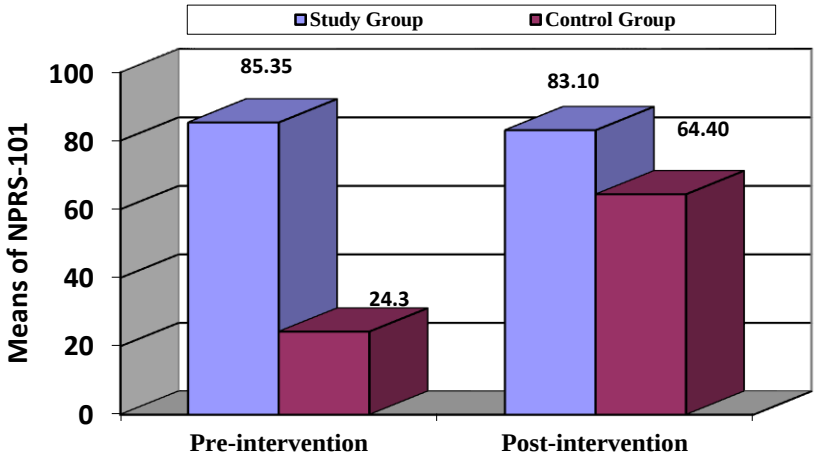
** Statistically Significant difference p < 0.05; NS- Not significant; a. Pared t test. b. Wilcoxon Signed Ranks Test

Table 3: Comparison of means of NPRS-101, FFI, and AROM Dorsiflexion score between the Groups (Pre and Post Intervention Comparison)

	Percentage of difference	Z value[b] (Non parametric)	t value [a] (Parametric)	Parametric Significance p value	95% Confidence interval of the difference		Effect Size (r)
					Lower	Upper	
	PREINTERVENTION						
NPRS-101	-2.78%	Z = -0.569; P = 0.569	0.702	p = 0.487 (NS)	-4.43	9.13	+ 0.11 (Small)
FFI Score	3.76%	Z = -1.624; P = 0.104	-1.796	p = 0.080 (NS)	-4.80	0.28	+ 0.27 (Small)
AROM Ankle Dorsiflexion	0.00%	Z = 0.000; P = 1.000	0.000	p = 1.000 (NS)	-1.80	1.80	+ 0.00 (Small)
	POST INTERVENTION						
NPRS-101	90.41%	Z = -5.412; P = 0.000**	-12.528	p = 0.000**	-46.58	-33.62	+ 0.89 (Large)
FFI Score	89.11%	Z = -4.135; P = 0.000**	-26.987	p = 0.000**	-30.63	-26.36	+ 0.97 (Large)
AROM Ankle Dorsiflexion	-67.96%	Z = -4.739; P = 0.000**	6.691	p = 0.000**	3.24	6.05	+ 0.89 (Large)

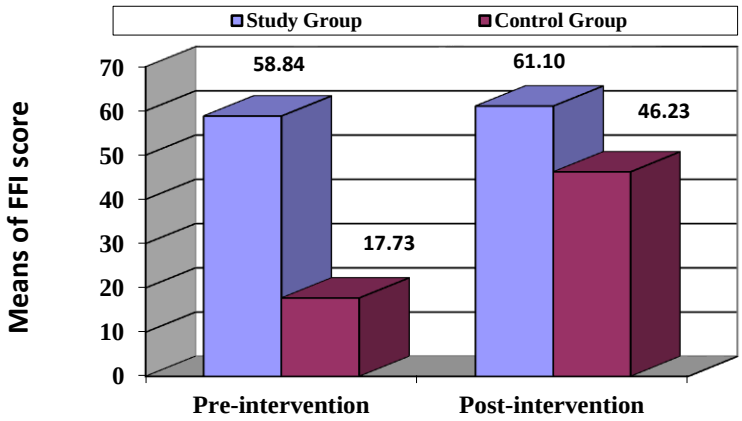
** Statistically Significant difference p < 0.05; NS- Not significant a. Independent t test b. Mann-Whitney Test

Graph1: Comparison of means of NPRS-101 between Study and Control Groups



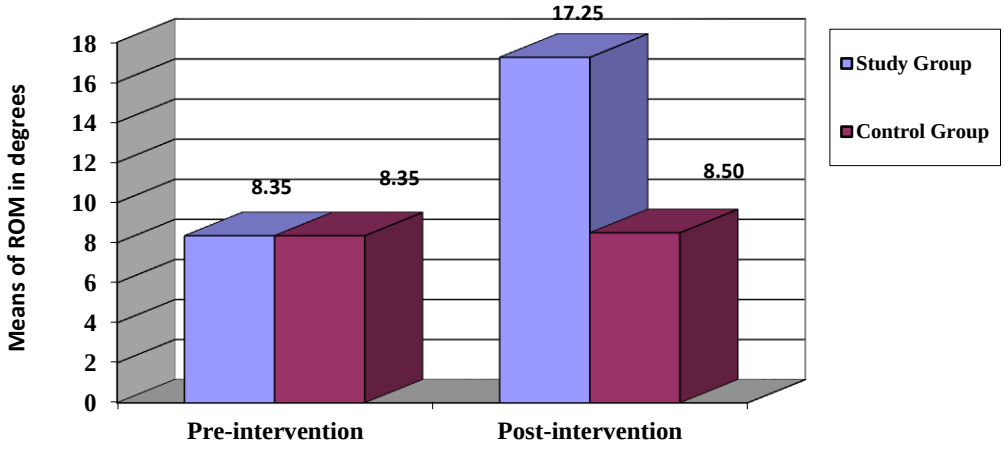
The above graph shows that there is no statistically significant difference in means of NPRS-101 score for pain when pre intervention means were compared between study and control groups. There is a statistically significant difference when post-intervention NPRS-101 score means were compared between the groups.

Graph 2: Comparison of means of FFI score between study and control Groups



The above graph shows that there is no statistically significant difference in means of FFI score when pre intervention means were compared between study and control groups. There is a statistically significant difference when post-intervention FFI score means were compared between the groups.

Graph 3: Comparison of means of Ankle Dorsiflexion AROM score between study and control Groups



The above graph shows that there is no statistically significant difference in means of AROM when pre intervention means were compared between study and control groups. There is a statistically significant difference when post-intervention AROM means were compared between the groups.

DISCUSSION

It is found that for subjects with plantar fasciitis in study group following two weeks of Instrumental assisted soft tissue mobilization technique combined with static stretching of triceps surae with conventional exercises shown statistically significant greater percentage of change in improvement in pain, ankle dorsiflexion AROM and functional disability than the control group who received only conventional exercises and in this there is no significant improvement in ROM in control group.

In study group the improvements could be because of Instrumental assisted soft tissue mobilization technique for plantar fascia with static stretching of triceps surae muscle along with conventional exercises. Studies have addressed the physiological and clinical benefits of IASTM technique. [32,33] At the cellular level, [32,33] the IASTM technique found to be effective in increasing blood flow, break up of soft tissue restrictions/ adhesions, tissue heating to the area, mast cell production and phagocytes, promote the restoration of normal tissue texture, enhance the proliferation of extracellular matrix fibroblasts, improve ion transport, decrease cell matrix adhesions, increase vascular response, and the remodeling of unorganized collagen fiber matrix following IASTM application which is much like the effect hypothesized in cross frictions by Cyriax (1984).[32,33]

The application of the IASTM initiates the controlled microtrauma created by the instruments is hypothesised to create a localised inflammatory response, which allows for healing and scar tissue remodeling to take place. The remodeling of the collagen increases the elasticity of the scar tissue, breaks down fibrotic adhesions and increases functional capability or pliability of the tissue.

The deep pressure by IASM inhibits the incoming sensory input of pain; in addition it is thought that the pressure may also causes the release of the body's natural pain killers, i.e. endorphins. In addition it decreases pain levels explained by the "Gate Control Theory" proposed by Melzack and Wall (1965). The mechanism of pain reduction in the treatment of the IASTM may influence the larger fibers to close the "gate" and decrease the sensation of pain experienced. [32,33]

The research that does exist regarding IASTM is largely made up of case studies and small-scale experiments. Burke et al evaluated the efficacy of IASTM on carpal tunnel syndrome and determined that it was in fact effective. Hammer et al investigated the use of IASTM on patients with plantar fasciitis and related heel pain, the treatment aimed at the triceps surae and other lower leg musculature. Therefore similar improvements from IASTM technique might have obtained in the present study.

Stretching and Strengthening exercises programs are focused on the intrinsic muscles of the foot because they can help correct functional risk factors, such as tightness of the Achilles tendon and weakness of intrinsic muscles of the foot. The goal of a stretching program is to relieve the stress put on the plantar fascia by either the plantar fascia itself being tight or the fascia being tightened by a tight Achilles tendon, as both the plantar fascia and Achilles tendon insert onto the calcaneus. It is generally accepted that soft tissue treatments such as massage and stretching do not enact acute plastic tissue modifications. Instead, it has been proposed that there may be a change in neurophysiological properties that occurs as a result of these types of treatment. In general, previous literature has observed an acute decrease in reflex activity and muscle stiffness that allows for a greater range of motion following stretching activity. Similar changes in range of motion have also been documented with the implementation of massage to the hamstring and triceps surae muscle groups. It is proposed that this increase in range of motion is due to an increase in stretch tolerance, as opposed to an increase in the physical properties of the tissue.[34]

Strengthening exercises for the intrinsic muscles of the foot are designed to improve longitudinal arch support and decrease stress on the plantar fascia.[34] Martin et al[35] reported that strengthening exercises provide the greatest decrease in pain in 34.9% of patients with plantar fasciitis.

However, both the groups found statistically significant improvement from pre to post within group analysis, the improvement in control group could be because of the effect of conventional exercises such as intrinsic muscle exercises and plantar fascia self-stretching exercises but this group is lack with improvement in ROM this could be because there is no triceps surae stretching and Graston technique received by this group.

Pre intervention comparison of means of pain, ROM and Foot function between control group and study group found no statistically significant difference in the baseline parameters. When the Post intervention means were compared there is a statistically significant difference in means of NPRS-101, FFI and ROM.

Subjects in Study group showed reduced pain level by NPRS-101 of -71.56% and in Control group -22.50%. The functional disability was improved

with FFI score by -69.86% in Study group and -24.33% in Control group. The ankle dorsiflexion AROM was significantly improved to 10.65% in study group and 1.79% with no significant improvement in control group. The results show that greater percentage of change in all three variables was found in Study group. There is a clinical significant improvement in post intervention values with large effect size in study groups with NPRS-101 +0.89, FFI Score +0.97 and AROM dorsiflexion +0.89 than the control group. These findings shows that Instrumental assisted soft tissue mobilization technique and static stretching of triceps surae along with conventional exercises produced significantly greater percentage of improvement than conventional exercises.

In this study the subjects in both the groups were not completely recovered from the plantar fascia symptoms this could be because of the short duration and frequency of Instrumental assisted technique used in the study. The average treatment time for PF ranges from a few weeks to months. Many studies have shown time frame estimated less than the natural history of PF healing and the time period allocated in this study was 2 weeks consist of six sessions. Therefore in present study when treated with 6 sessions the improvement was found statistically and clinically significant in study group but follow-up might have help to know the completely recovery.

The results from the study shows significant difference in improvement of pain, ROM and functional ability in the group who received Instrumental assisted soft tissue mobilization and static stretching along with conventional exercises in subjects with Plantar Fasciitis. Therefore, the present study rejects null hypothesis.

Limitations of the Study:

A larger sample size would have strengthened the finding of the study. No follow-up sessions were kept after the final treatment due to which the maintenance of the improved outcome or reoccurrence of the condition could not be assessed. The IASTM shall be given as IASTM + exercises. However, for the purposes of research, participants did not received full protocol. GTISTM should be used in conjunction with a cardio warm-up, targeted stretching and strengthening exercises and post treatment cryotherapy. In order to determine the effectiveness of the IASTM with stretching in the present study the above components of the GT protocol were modified.

Further Study Recommendation:

Further long term follow-up studies are needed to find the effect of IASTM technique with triceps surae stretching in chronic plantar fasciitis with large sample size. Future studies can be carried with other specific population with plantar fasciitis caused by cumulative stress such as flat foot and long-distance runners.

CONCLUSION

It is concluded that Instrumental assisted soft tissue mobilization technique combined with static stretching of triceps surae muscle is significantly effective than conventional exercises on reducing pain, improving ankle dorsiflexion range of motion and functional disability for subjects with chronic Plantar Fascitis. It is recommended that implementation of Instrumental assisted soft tissue mobilization technique combined with static stretching of triceps surae muscle is clinically beneficial in the treatment chronic plantar fascitis.

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Conflicts of interest: None

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