Acta Scientific Orthopaedics (ISSN: 2581-8635)

Volume 6 Issue 3 March 2023

Research Article

Comparison of Myofascial Release on Calf Versus Plantar Fascia in the Treatment of Plantar Fasciitis

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Received: December 01, 2022

Published: February 11, 2023

Abstract

Plantar fasciitis is a common cause of heel pain in adults. Plantar fasciitis has been experienced by 10% of the population. Plantar fasciitis leads to prolonged disability and functional limitation and hence needs to be addressed as soon as possible. MFR stimulates fibroblast proliferation leading to collagen synthesis that may promote healing of plantar fascia by replacing degenerated tissue with stronger and more functional tissue. By MFR there is a change in 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. Hence this technique is proposed to act as a catalyst in the resolution of plantar fasciitis.

Objective: To compare the effect of MFR on calf muscle and MFR on plantar fascia for the treatment of plantar fasciitis.

Method: 30 patients, 15 males and 15 females were included in this study and randomized into 2 groups. Group 1 received MFR on calf and group 2 received MFR on plantar fascia. Both the group received therapeutic US and strengthening exercises for foot and ankle. The primary outcome measure was VAS, PFPS and FFI. The obtained data was analyzed using independent t test for between groups and paired t test for within group analysis.

Result: There was a statistically significant difference in within group analysis for VAS, PFPS and FFI. And statistically significant difference in the post VAS scores between the two groups.

Conclusion: The study showed that MFR on calf and MFR on plantar fascia were both equally effective in relieving pain, reducing disability and improving functions in patients with plantar fasciitis.

However MFR on calf showed better improvement in terms of pain relief in lesser number of sessions when compared to MFR on plantar fascia group.

Keywords: Myofascial; Plantar Fascia; Plantar Fasciitis

Introduction

Plantar fasciitis is a common cause of heel pain in adults [1]. Plantar fasciitis has been experienced by 10% of the population [2].

The pain is usually caused by collagen degeneration (which is sometimes misnamed "chronic inflammation") at the origin of the plantar fascia at the medial tubercle of the calcaneus.[4] Degenerative changes cause acute and chronic inflammation of the plantar fascia and may cause calcification at the origin of plantar fascia [2].

As one walks, the heel makes contact with the ground. Just after this contact, the tibia turns inward and the foot pronates, stretching the plantar fascia and flattening the arch. This allows the foot to accommodate for irregularities in the walking surface and absorb shock [3].

Under normal condition fascia and connective tissue tends to move with minimal restriction. However due to repetitive stress there is a decrease in the fascial tissue length and elasticity resulting in fascial restriction. Shortening of plantar fascia leads to chronic bone traction in the heel and formation of heel spurs [4,5].

In the presence of aggravating factors, the repetitive movement of walking or running causes an excessive stretching of plantar fascia, which increases the tension in the fascia leading to micro tears in the plantar fascia. The affected site is frequently near the origin of the plantar fascia at the medial tuberosity of the calcaneus [3].

Individuals with pes planus (low arches or flat feet) or pes cavus (high arches) are at increased risk for developing plantar fasciitis. Other anatomic risks include overpronation, discrepancy in leg

length, excessive lateral tibial torsion and excessive femoral anteversion. Functional risk factors include tightness and weakness in the gastrocnemius, soleus, Achilles tendon and intrinsic foot muscles. However, overuse rather than anatomy is the most common cause of plantar fasciitis [1].

Plantar fasciitis also occurs in elderly adults. In these patients, the problem is usually more biomechanical, often related to poor intrinsic muscle strength and poor force attenuation secondary to acquired flat feet and compounded by a decrease in the body's healing capacity [1].

Plantar fasciitis leads to lateral weight bearing on the foot or forefoot during gait because of pain in the medial region of the calcaneus this leads to chronic shortening of the Achilles tendon and gastrocnemius and vice versa that is tight gastrocnemius muscles leads to plantar fasciitis [5].

Gastrocnemius tightness leads to an increase in Achilles tendon tension which causes an abnormality in the biomechanics of foot and changes in ground reaction forces. This flattens the arch of the foot which increases the tension in the plantar fascia.

In the presence of this aggravating factor, repetitive movements causes micro-tears in plantar fascia [6].

Patients with plantar heel pain usually report insidious sharp pain under the heel at the medial tuberosity of the calcaneus, upon weight bearing after a period of non-weight bearing. Occasionally the patient also complains of pain over the central band of the plantar fascia in the region of medial longitudinal arch. The pain is worse in the morning, with the first steps after getting out of bed, or after prolonged periods of inactivity (eg, sitting), or at the beginning of a workout. The pain typically lessens with increasing activity (eg, walking, running) but tends to worsen towards the end of the day. In some patients, these symptoms can induce considerable functional limitations and prolonged disability [1].

Different treatment options available are.

- Stretching And Strengthening
- Shoes
- Arch Supports and Orthotics
- Night Splints
- Anti-Inflammatory Agents
- Iontophoresis
- Corticosteriod Injections

Therapeutic Ultrasound

- Surgery
- Myofascial release is a soft tissue mobilization technique. MFR techniques stem from the foundation that fascia a connective tissue found throughout the body, reorganizes itself in response to physical stress and thickens along the lines of tension.[2]

MFR practitioner uses variety of techniques including gross or cross hand stretches, focused stretches, skin rolling, wind mill or J stretches, fascial glide, following fascia layers in their direction of ease. MFR consists of gentle form of stretching and manual compression to connective tissue and releasing bond between it and muscle [9].

There are two types of MFR technique.

- **The Direct MFR Technique:** Involves deep tissue manipulation to work with the restricted or tight myofascial tissue. Gentle, sustained force is applied until the tissue is released. Using their fingers, knuckles, elbows and other tools, the practitioner works to slowly stretch the tight fascia, applying a stretching force to the tissue. This purpose of this stretching force is to elongate the tightened fascia and release the 'stuck' fascial tissue.

Because the fascia is layered, the practitioner needs to work slowly through each layer to reach down to the deep tissue [9].

- **Indirect MFR Technique:** Involves gentle stretching of the fascia with light pressure. This allows the fascia to slowly 'unwind' until free movement is once again possible.

The gentle stretching that is applied to the tightened myofascial increases the heat and blood flow to the area. This process promotes the body's innate ability to heal itself. The healing eliminates the pain and restores the body to its optimum ability [9].

MFR stimulates fibroblast proliferation leading to collagen synthesis that may promote healing of plantar fascia by replacing degenerated tissue with stronger and more functional tissue. By myofascial release there is a change in 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. Hence this technique is proposed to act as a catalyst in the resolution of plantar fasciitis [2].

A study done by M.S Ajimsha., *et al.* 2014 to check the effectiveness of MFR in the management of plantar heel pain concluded

that MFR is more effective than a control intervention for plantar heel pain but the limitation of that study was that it was impossible to interpret weather MFR to gastrocnemius, soleus, planter fascia brought the improvement. Hence this study was designed to check which intervention was superior MFR on calf or MFR on plantar fascia in the management of plantar fasciitis.

Materials and Methods

- **Study design:** Comparative interventional study
- **Study population:** Patients diagnosed with plantar fasciitis
- **Type of samling:** Alternate sampling
- **Sample size:** 30
- **Duration of research work:** 6 months
- **Site of research work:** Outpatient physiotherapy center of tertiary care center

Inclusion criteria

- Adult male and female patients 18-60years of age having plantar heel pain
- Patients scoring a minimum of 35 on the plantar fasciitis pain scale
- Patients with tenderness over the heel specially on the medial calcaneal tuberosity and along the medial border of plantar fascia, post static dyskinesia especially morning first step pain

Exclusion criteria

- History of pathologies around ankle/foot
- History of recent fractures around ankle/foot
- History of surgery ankle/foot
- Corticosteroids injection in heel preceding 3 months
- Subjects with clinical disorder where myofascial release is contraindicated such as dermatitis
- Metastatic calcaneal tumor
- Pregnancy

Outcome measures

- Visual analog scale
- Plantar fasciitis pain scale:
- Foot functional index:

Procedure

- Patients having plantar heel pain were selected to participate in the study having them evaluated as per the inclusion and exclusion criteria
- After the screening a signed informed consent was taken. They were informed that the identity as well as the photograph ill not be used in any part of the study
- They were explained in the language best understood, the details of the study namely, the procedure involved, the significance of regular attendance for the duration of the study, the probable beneficial outcomes and their right to withdraw from the study at any point of time
- They were further asked to answer the PFPS and FFI. Only those patients who scored a total of above 35 points in PFPS questionnaire, with medial calcaneal tuberosity tenderness and post static dyskinesia were included in the study
- A follow up of 10 sessions was required. The two protocols for group 1 and 2 were identical in terms of strengthening and ultrasound. Randomization was performed using alternate sampling and patients in group 1 received MFR on calf and group 2 received MFR on plantar fascia
- 38 patients were assessed for eligibility out of which 2 were excluded as they did not match the inclusion criteria, 4 declined to participate due to personal reasons, 2 could not attend all the 10 sessions

Intervention

- Ultrasound: continuous mode at frequency of 1.0Hz and an intensity of 1.2w/cm^2 for 5 minutes strengthening of ankle and foot muscles
- Ice application only if the patient feels any soreness after MFR.
- Patient will told a home program of hot water fomentation and all the exercises that he or she will be made to do in the hospital
- Self-stretches were taught to the patient and asked to do as home program.

Group 1: MFR on calf

- **Patient position:** Prone, with feet off the end of the bed to allow for easy dorsiflexion.
- **Therapist's position:** Facing toward head while standing at the foot end of the bed.
- **Technique 1:** Use an elbow flexed to 90 and take up a contact in the Tendo Achilles. Establish a line of tension in a superior direction and slowly engage the tissues while the patient dorsiflexes. Focus of the release will be at the junction of the tendon and the muscles.
- **Technique 2:** Use the index and middle fingers of each hand to take up a contact on the tendons of the gastrocnemii at the epicondyles of the femur. Put a line of tension in an inferior direction and slowly apply the pressure into the tendinous structures of the posterior knee. Continue this down into the superior portions of the fibrous part of the muscle.
- **Technique 3:** Use the index, middle and ring fingers of each hand get into the medial and lateral aspects of the calcaneus. Begin the release proximally, slowly establish a line of tension in inferior direction.

Figure 1: Technique number 1 for calf.

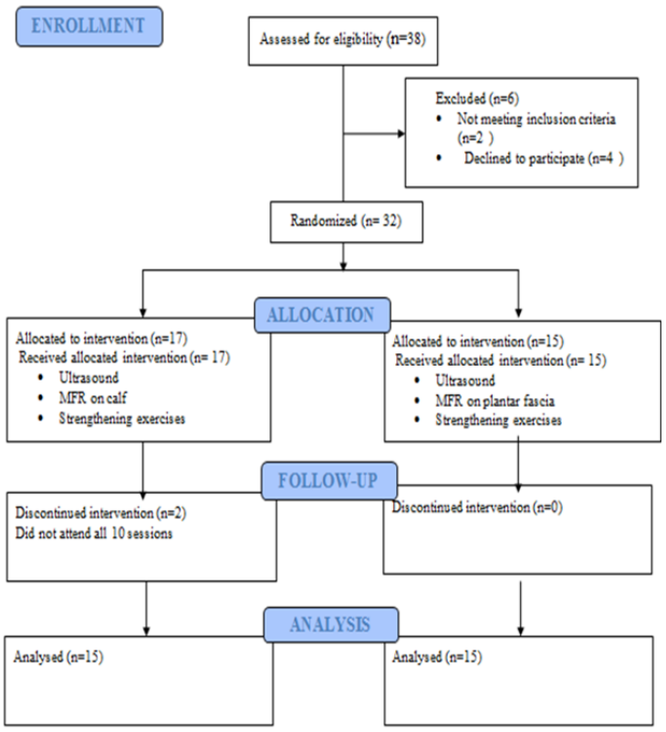
Figure 2: Technique number 2 for calf release.

Figure 3: Technique number 3 for calf release.

Group 2: MFR on plantar fascia

- **Patient position:** Prone with feet off the end of the table to allow for easy dorsiflexion.
- **Therapist position:** Sitting on a stool at the end of the bed
- **Technique:** Use thumb of one hand at the metatarsal heads to dorsiflex the foot. Stretch down towards the heel with the thumb of the other hand proximal to the insertion on the calcaneus. Hold, wait for the release and stretch again by increasing dorsiflexion.

Figure 4: Mayofascial release on plantar fascia.



38 patients were assessed for eligibility out of which 2 were excluded as they did not match the inclusion criteria, 4 declined to participate due to personal reasons. 32 patients were randomized based on alternate sampling into group 1 and group 2.2 patients could not complete all the 10 exercise sessions

Statistical analysis

Statistical analysis was done by the statistical package of social science (SPSS) version 20. The results were concluded to be statistically significant with $p < 0.05$. Paired t test was used to compare within the group and Independent t test were used to compare between groups.

Demographic profile

Each group had 15 patients each. The mean age of the patients in group 1 was 44.40 ± 9.83 and the mean age of the patients in group 2 was 39.71 ± 12.96. The difference in mean age of 2 groups was not statistically significant ($p = 0.219$).

	Group 1	Group 2	P value
Age	44.40 ± 9.83	39.71 ± 12.96	0.219
Gender	F = 12 M = 3	F = 3 M a= 12	

Table 1: Baseline values.

The gender ratio of group 1 was 12:3 (12 = females and 3 = males) and group 2 was 3:12 (3 = females and 12 = females).

Therefore both the groups are matched with respect to age and gender.

Clinical parameters

Group 1

Group 1	VAS	PFPS	FFI
Pre	7.16 ± 1.382	58.10 ± 6.600	53.35% ± 9.324
Post	4.22 ± 1.242	32.16 ± 10.233	35.21% ± 15.202
P value	0.000	0.000	.000

Table 2: Within group scores for group 1.

- **VAS:** The mean VAS score on 1st day pre session was 7.16 ± 1.382 which was reduced to 4.22 ± 1.242 on post session

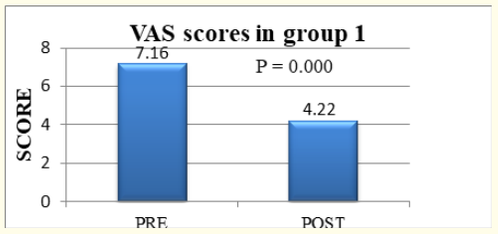
On comparing the pre session and post session values showed a statistical and clinical significant difference in pain ($p = 0.000$)

- **PFPS:** The mean PFPS score on 1st day pre session was 58.10±6.600 which was reduced to 32.16 ± 10.233 on post session.

There was a statistical and clinical significant difference in the pre and post session values ($p = 0.000$)

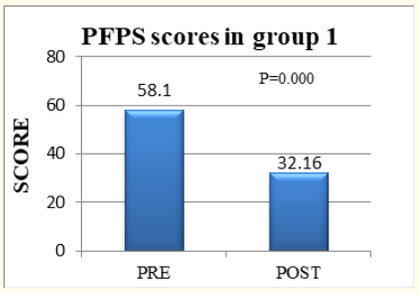
- **FFI:** The mean FFI score on 1st day pre session was 53.35% ± 9.324 which was reduced to 35.2% ± 15.202 on post session.

There was a statistical and clinical significant difference in the pre and post session values for FFI scores ($P = 0.000$).



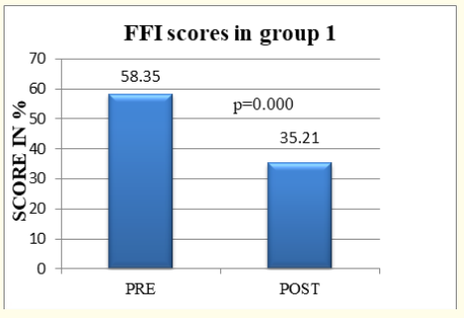
Graph 1: Pre and post vas scores in group 1.

Graph 1 shows pre and post VAS scores as per their means where significant difference between the levels can be noted (p = 0.000)



Graph 2: PRE and post PFPS scores in group 1.

Graph 2 shows pre and post PFPS scores as per their means. There is significant difference observed in PFPS within the group (p = 0.000)



Graph 3: PRE and post FFI scores in group 1.

Graph 3 shows pre and post FFI scores as per their means. There is a statistical difference observed in the FFI values post intervention.

Group 2

GROUP 2	VAS	PFPS	FFI
Pre	7.44 ± 1.057	59.32 ± 6.155	56.09% ± 9.497
Post	5.15 ± 1.023	36.51 ± 8.409	34.98% ± 10.195
P value	0.000	0.000	0.000

Table 3: Within group scores for group 2.

VAS: The mean VAS score on 1st day pre session was 7.44 ± 1.057 which was reduced to 5.15 ± 1.023 on post session.

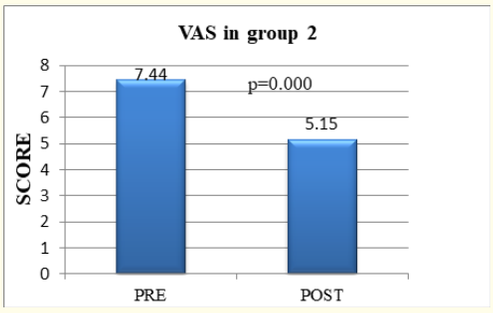
On comparing the pre session and post session values showed a statistical and clinical significant difference in pain (p = 0.000).

PFPS: The mean PFPS score on 1st day pre session was 59.32 ± 6.155 which was reduced to 36.51 ± 8.409on post session.

There was a statistical and clinical significant difference in the pre and post session values (p = 0.000)

FFI: The mean FFI score on 1st day pre session was 56.09% ± 9.497 which was reduced to 34.98% ± 18.195 on post session.

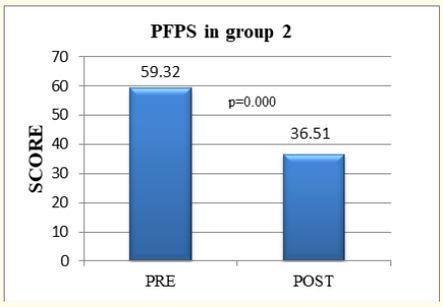
There was a statistical and clinical significant difference in the pre and post session values for FFI scores (P = 0.000).



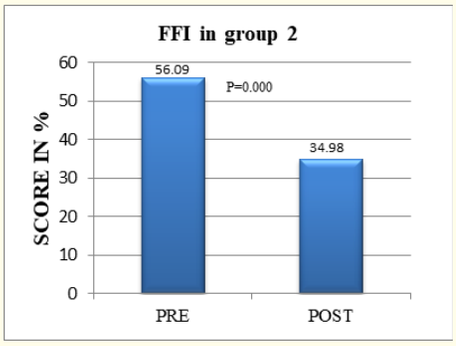
Graph 4: PRE and post vas values in group 2.

Graph 4 shows pre and post VAS scores as per their means where significant difference between the levels can be noted (p = 0.000).

Graph 5 shows pre and post PFPS scores as per their means. There is significant difference observed in PFPS within the group (p = 0.000)



Graph 5: PRE and post PFPS values in group 2.



Graph 6: PRE and Post FFI Values in Group 2.

Graph 6 shows pre and post FFI scores as per their means. There is a statistical difference observed in the FFI values post intervention.

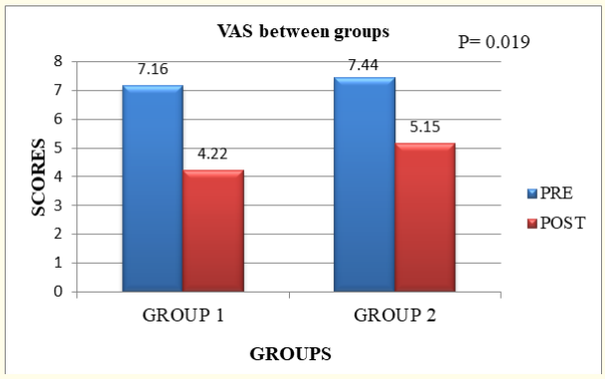
Between groups

		Group 1	Group 2
VAS	Pre	7.16 ± 1.382	7.44 ± 1.057
	Post	4.22 ± 1.242	5.15 ± 1.023
	P value	0.019	
PFPS	Pre	58.10 ± 6.660	59.32 ± 6.155
	Post	32.16 ± 10.233	36.51 ± 8.409
	P value	0.172	
FFI	Pre	53.35% ± 9.324	56.09% ± 9.497
	Post	35.21% ± 15.202	34.98% ± 10.195
	P value	0.958	

Table 4: Between group scores.

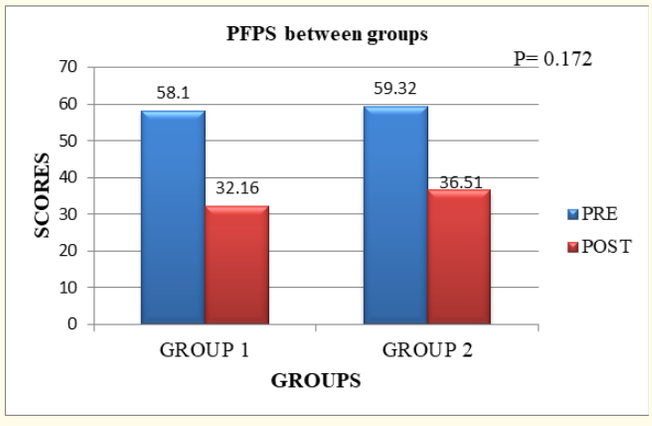
VAS: both groups showed statistical and clinical significant difference in pain although group 1 shows better result over group 2 (p = 0.019).

PFPS AND FFI: on comparing the pre session and post session values revealed that there was no statistically significant difference seen with p values 0.172 and 0.958 but clinically both grouped showed improvement.



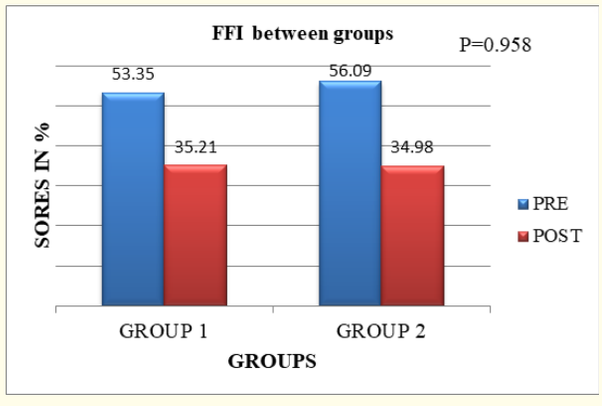
Graph 7: Vas scores between groups.

Graph 7 shows pre and post VAS scores in both the groups. There is significant difference observed in VAS between the group (p = 0.019).



Graph 8: PFPS scores between groups.

Graph 8 shows pre and post PFPS scores in both the groups. There is no significant difference observed in PFPS scores between the group (p = 0.172).



Graph 9: FFI scores between groups.

Graph 9 shows pre and post FFI scores in both the groups. There is no significant difference observed in FFI scores between the group (p = 0.958).

Discussion

The present clinical trial was conducted to compare the effectiveness of MFR on calf versus plantar fascia in the treatment of plantar fasciitis with a conventional treatment of therapeutic ultrasound and strengthening exercises to both the groups.

A total of 30 patients with the mean age 44.40 ± 9.83 in group 1 and 39.71 ± 12.96 in group 2 were included in this study and statistical analysis was carried out using statistical package of social science (SPSS) version 20.

VAS

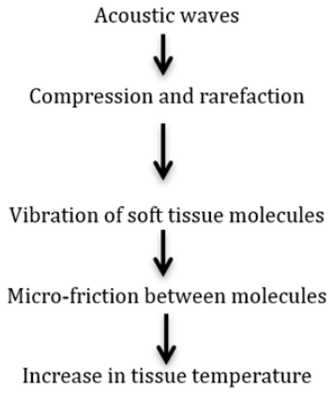
The mean VAS score in the baseline data of group 1(7.16 ± 1.382) and that of group 2(7.44 ± 1.057) is statistically insignificant. This shows that both the groups had similarity between the initial score of pain.

The mean VAS score reduced to 4.22 ± 1.242 in group 1 and 5.15 ± 1.023 in group 2 which showed a statistical significant difference in pain(p = 0.000) in both groups.

This change in post session VAS can be attributed to the following reasons.

Ultrasound

Ultrasound reduces localized tenderness by increasing the blood circulation and has a micro massaging effect which reduces the inflammation and accelerates the regeneration of tissues [5]



Thermal effects of ultrasound

- Increased collagen extensibility
- Increased nerve conduction velocity
- Increased enzymatic activity'
- Increased nociceptive threshold [18].

MFR

According to Schleip under normative conditions fascia and connective tissue tend to move with minimal restrictions. However injuries resulting from physical trauma, repetitive strain injury, inflammation are thought to decrease fascial tissue length and elasticity resulting in fascial restriction. MFR results in returning the fascial tissue to its normative length by collagen reorganization [4].

MFR can also be attributable to the stimulation of afferent pathways and the excitation of afferent Aδ fibers which can cause segmental pain modulation as well as modulation through the activation of descending pain inhibiting system [4].

MFR suppresses pain and restores the mechanical function of the plantar fascia.

Both the groups have shown improvement in reducing pain although group 1 has shown better results than group 2 statistically as well as clinically with p value 0.019.

Patients have shown improvement in symptoms within 3-4 days in group 1 as compared to group 2 and this can be attributed to the following reasons.

MFR treats the taut bands in the calf muscle by releasing the uneven tightness in the injured fascia covering the calf muscle.

MFR utilizes the stretching of fascia and muscle and helps to increase the ROM and decrease pain by breaking the adhesions in the fascia [16].

MFR supplies mechanical and thermal energy which converts ground substance into gel state again which facilitates sliding movement of collagen and elastin fibers which releases muscle tension [16].

Plantar fasciitis leads to lateral body weight support on the foot or forefoot during gait because of pain in the medial region of the calcaneus or at the proximal insertion of the plantar fascia. This leads to chronic shortening of the Achilles tendon and pain in the medial portion of gastronemius [5].

Patients with plantar fasciitis who have gastrocnemius tightness will have an increased Achilles tendon tension.

↓

This produces a plantar flexion moment at the hind foot and decrease in ground reaction force in the calcaneus (hindfoot)

↓

Displaces the center of pressure of the foot anteriorly to the forefoot.

↓

Increase in ground reaction force and increased ankle joint dorsiflexion moment at the forefoot.

↓

Hindfoot plantar flexion moment plus forefoot dorsiflexion moment

↓

Flattens the arch of the foot.

↓

Flattening forces on the arch is counteracted by the tension of the plantar fascia.

↓

So release of the gastrocnemius muscle will reduce the Achilles tendon tension which in turn will reduce the tension produced in the plantar fascia thereby causing a relief in patients with plantar fasciitis [6].

Patel and DiGiovanni found that, in a sample of 254 patients with plantar fasciitis, 83% had a limitation of ankle joint dorsiflexion because of gastrocnemius and/or gastrocnemius-soleus tightness. Only 17% of plantar fasciitis patients had normal ankle dorsiflexion range of motion.

This connection would explain the beneficial effect of calf release over plantar fascia release in the treatment of plantar fasciitis [6].

PFPS AND FFI

Both these scales measures the difficulties the patients suffers in plantar fasciitis in terms of pain and function and the amount of activities limited due to pain.

The mean PFPS score in the baseline data of group 1(58.10 ± 6.660) and that of group 2(59.32 ± 6.155) which is statistically insignificant. This shows that both groups had similarity between the initial scores

The mean PFPS score reduced to 32.16 ± 10.233 in group 1 and 36.51 ± 8.409 in group 2 post treatment which a statistical significant difference of p value 0.000.

The mean FFI scores in the baseline data of group 1(53.35% ± 9.324) and that of group 2(56.09% ± 9.497) which is statistically insignificant. This shows that both groups had similarity between the initial scores

The mean PFPS score reduced to 35.21% ± 15.202 in group 1 and 34.98% ± 10.195 in group 2 post treatment which a statistical significant difference of p value 0.000.

The scores of PFPS and FFI improved post treatment showing improvement in functional activities such as stair climbing, descending, standing on toes, getting up from chair, running, fast walking, driving, riding a bike.

The change in the PFPS and FFI scores post treatment is attributed to the following reasons

Strengthening exercises

Strengthening exercises regains the protective mechanism of the muscles and prevents the excess load of the body weight, even the overuse with long standing, running or wrong footwear causing stress on the plantar fascia and preventing it from micro trauma [17].

Strengthening exercises improves gait of the patient, better gripping on uneven surfaces, corrects the abnormal bio-mechanics of foot due to muscle imbalance, picking up objects from the floor using toes

US and MFR

Pain arising due to plantar fasciitis leads to avoidance of activity. Decrease in pain by US and MFR improves function in individuals

Gastrocnemius tightness

↓

Increased Achilles tendon tension

↓

Abnormal biomechanics of foot and changes in ground reaction forces

↓

Flattens the arch of the foot.

↓

Increased tension in the plantar fascia

↓

Pain and avoidance of activity

↓

MFR and strengthening exercises correct the abnormal biomechanics of the foot and calf tightness and reduces pain and to improve function [6].

The PFPS and FFI scores in both the groups post treatment showed improvement within the group and between the groups shows better result clinically however the p value for group 1 (p = 0.172) and group 2 (p = 0.958) showed no statistical difference between the groups.

Conclusion

The study showed that MFR on calf and MFR on plantar fascia were both equally effective in relieving pain, reducing disability and improving functions in patients with plantar fasciitis.

However MFR on calf showed better improvement in terms of pain relief in lesser number of sessions when compared to MFR on plantar fascia group.

Limitations of the Study

- The study only assessed the short-term effects. We do not know if these effects would be maintained at a long term follow up.
- Small sample size.

Suggestions

- The study can be carried out on a large sample group.
- Long term follows up to check the effectiveness of the treatment on long term basis.

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