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Effectiveness of Myofascial Release Versus Neural Mobilization in Pain, Range of Motion and Functional Activity in Patients with Plantar Fasciitis

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ABSTRACT

STUDY DESIGN: Experimental design (pretest – posttest design with comparative treatment)
BACKGROUND OF THE STUDY: Plantar fasciitis or plantar heel pain is a painful inflammatory condition that affects the posterior surface of the sole of the foot. It affects about 10% of the population in the life time. Incidence of the plantar fasciitis peaks between age of 40 to 60 years with no bias towards either sex. Myofascial release is a form of manual therapy approach that involves the application of a low load, long duration stretches to the myofascial complex intended to restore optimal length decrease pain and improve function. Neural mobilization or neurodynamics is a movement-based intervention aimed to restoring the homeostatic in and around the nervous system.
OBJECTIVES: This study is to compare the effectiveness of myofascial release versus neural mobilization in pain, range of motion and functional activity in patients with plantar fasciitis.
STUDY SETTING: Department of Orthopedics, PSG Hospitals, Coimbatore.
PARTICIPANTS: 28 patients with plantar fasciitis were participated in this study.
INTERVENTION: Included individuals were randomly assigned to receive 2 weeks treatment program on myofascial release and neural mobilization
MEASUREMENTS: Numeric pain rating scale for measuring plantar pain, Goniometer for measuring ankle dorsiflexion, plantar flexion and great toe extension, Functional Foot Index for measuring foot function.
RESULTS: Subjects receiving MFR shows that there is an improvement in pain, ROM except great toe extension and functional activity after 2 weeks of intervention compared with neural mobilization.
CONCLUSION: So, we conclude that the Myofascial release is effective in reducing pain, improving range of motion and functional activity in patients with plantar fasciitis compared to neural mobilization.

KEY WORDS: Plantar fasciitis (PF), Plantar Heel Pain (PHP), Self Myofascial Release (SMR), Myofascial Release (MFR), Numerical Pain Rating Scale (NPRS), Foot Function Index (FFI)

INTRODUCTION

Plantar fasciitis (PF) (or) Plantar Heel Pain (PHP)is the most commonly reported cause of inferior heel pain (1). It has been estimated that PHP affects as much as 10% of the general population over the course of lifetime (2). There is evidence that the condition may not be characterized by inflammation but, rather, by non-inflammatory degenerative changes in the plantar fascia. Biomechanical faults that cause abnormal pronation of foot. A tight gastrocnemius (with increased compensatory pronation) also predisposes patient to plantar fasciitis. cavus feet with relative rigidity have been noted to place more stress on plantar fasciitis. Obesity is also considered to be a cause in plantar fascia.

The deep fascia covering the sole is thick in the center and thin at the sides. This thick end part is known as the plantar fascia or the plantar aponeurosis. It represents the distal part of the plantaris, which has become separated from rest of the muscles because of the enlargement of the heel. The aponeurosis is triangular in shape. The apex forming the proximal which is attached to the attachment of the flexor digitorum brevis. Base, forms the distal part and it divides into five processes near the head of the metatarsal bones. Each processes splits into a superficial and deep slips. The superficial slip is attached to the skin. The deep slip further divides into two parts, which embrace the flexor tendons and blends with the deep transverse metatarsal ligaments. Fixes the skin of the sole. Protects deeper structures. Helps in maintaining the longitudinal arches of the foot. Gives origin to muscles of the first layer of the sole. The planter aponuerosis/ fascia runs nearly enter thin of the foot. It begins posteriorly on the calcaneus and continuous anteriorly to attach to the planter plates and then, via the plates, on to the proximal phalanx of each toes. When the toes are extended at the metatarso-phalangeal joints, the fascia is pulled increasing tight as the proximal phalanges glides dorsally in relation to the metatarsals. The large head act as a pulley around which the plantar fascia is tightened.

Muscles do not support the longitudinal arches of the foot; static arch support is maintained and provided by the truss mechanism that converts comprehensive forces to tensile forces. The plantar fascia is attached at the hind foot and forefoot and thus traverses the sole of the foot. During static weight bearing, the function of plantar fascia may be compared to that of the rod tying together the two beams namely the calcaneum and the metatarsals' truss is a triangular structures whose ends are connected by a tie rod that is the plantar fascia. The advantages of the truss are capability of withstanding significant compressive and tensile forces. The vertical compressive forces on the foot from the body weight are realized by the truss mechanism as tensile forces that distracts the forefoot from the hind foot. This increased tension of the plantar fascia resists the tensile forces and becomes progressively stiffer because of the ability of dense collagen to attenuate tensions. Increased tension along the tie rod is transmitted to both the lower ends of the truss and approximates the forefoot to the hind foot. Thus static arch support is maintained during standing, despite the vertical forces of the superincumbent body weight.

The tension in the plantar fascia can contribute to supination of the foot as the heel is drawn towards the toes by its action. When the joints of hind foot and mid foot supinate and lock through a strong active plantar flexion force in the weight bearing, continuous force will cause the heel to lift and toes to extend at the metatarsal break. The plantar fascia will tighten as the metatarsal phalangeal joints extend, supporting the locked hind foot and the mid foot structures through which the body weight must pass to reach the toes. The tightened fascia will also resist excessive toe extension by creating a passive flexor force will assist the active toe musculature on pressing the toes into the ground to support

the body weight on the diminished base of support.

Windlass or winch was a powerful machine used as far back as twelfth century and utilized a rope or cable for hauling or hoisting. Based on the principle of lever that multiplies the force, a windlass pulls heavy object with less effort. Plantar fascia acts as a windlass and maintains dynamic arch support; the windlass action of the plantar fascia is essential in supination of subtalar joint, reconstitution of the longitudinal arches and reestablishment of the foot as a rigid lever during terminal stance phase of the gait. During ankle dorsiflexion and toe extension, the fascia winds around the metatarsal head causing tension on the fascia. The action occurs passively during late stance as toe extension occurs with the forward momentum of the body the primary origin of the plantar fascia is the medial aspect of the calcaneus, tension of the aponuerosis promotes calcaneal inversion and thereby irritates subtalar joint supination. It helps in arch reconstitution by pulling the calcaneus closer to the forefoot where the arch is elevated. Both surgical and non-surgical approaches have been proposed for the management of plantar heel pain (3,4). There has been limited evidence for low energy extra corporeal shock wave therapy and no evidence for therapeutic ultrasound (or) Low intensity laser, is reducing pain in individuals with plantar heel pain (5). Stretching of the gastrocnemii muscle and the plantar fascia have shown moderate evidence of effectiveness in the short term management of plantar heel pain (6).

Myofascial release is the application of a low load, long duration stretch to the myofascial complex, intended to restore optimal length, decrease pain, and improve function (6,7).

It has been hypothesized that fascial restriction in one part of the body cause under tension in other parts of the body due to fascial continuity. This may result in stress on any structures that are enveloped, divided, or supported by fascia (7,8). Myofascial practitioner believes that by restoring the length and health of restricted connective tissue, pressure can be relieved on pain sensitive structures such as nerves and blood vessels (9). MFR is being used to treat patients with plantar heal pain, but there are few formal reports of its efficacy. The MFR used in this study was the direct technique MFR, as promoted by Stanborough (7,9). The primary objective of the present study was to evaluate the efficiency of MFR on pain, disability and pressure pain threshold for the management of plantar heel pain (10).

Self Myofascial Release (SMR) works under the same principle as myofascial release and has been adapted to allow regular and frequent applications, without a therapist's intervention. The difference between the two techniques relates to the individual using their own body mass to exert pressure on the soft tissue as they rollover the dense foam roller or a tennis ball on the plantar aspect of the foot.

Neural Mobilization (or) neurodynamics is a movement based intervention aimed at restoring the homeostasis in and around the nervous system (11) neurodynamics refer to the communication between different parts of the nervous system and to the nervous system relationship to the musculoskeletal system. The nerve moves independently from other tissues. neurodynamics in the sense implied here in the mobilization of the nervous system as an approach to physical treatment of pain. The treatment relies on influencing pain physiology via the nervous system (12,13). Lack of evidence regarding effective care for patients seeking treatment for plantar heel pain and personal clinical observation described led to the proposal of a treatment procedure directed to the posterior calf muscle. The hypothesis was that deep, soft tissue massage to the posterior calf muscles with neural mobilization combined with stretching exercise would lead to increased pain relief

and improve function for patient with plantar heel pain (13). Several conditions such as plantar fasciopathy, hallux valgus and pes planus are associated with weakened or atrophied intrinsic foot muscles (14-20). Rehabilitation of these muscles used to treat these conditions and prohylatic exercise targeting the intrinsic foot muscle may aid in injury prevention (21,22). Several exercises that are currently prescribed for the rehabilitation of acute and chronic foot and lower extremity conditions are thought to improve intrinsic foot muscle function(23,24).

MATERIALS & METHODS

It is a, Experimental study Pretest – posttest design with comparative treatment.

The study was conducted in the Department of Orthopedics, PSG hospitals, Coimbatore during the period of June 2019- December 2019. The study was reviewed and approved by Institutional Human Ethics Committee at PSG IMSR, Coimbatore. Ethical Register no:

PSG/IHEC/2019/Appr/FB/034.28Individuals with plantar fasciitis, age group ranging from 35--60 years were participated. Based on the selection criteria individuals were randomly assigned into two groups by simple random sampling method by computer software generated random.

Group A: Myofascial Release for Gastrocnemius, soleus, plantar my fasciae, self myofascial release and intrinsic foot muscle exercise.

Group B: Neural mobilization, self-neural mobilization and intrinsic foot muscle.

Simple random sampling computer software generate random version 4.0.

The Inclusion criteria: Both male and female subjects with 35-60 age, Plantar heel pain with increased on initial weight bearing after a period of rest, relieving with continued activity, Insidious onset of sharp pain under the plantar heel surface upon weight bearing after a period of non-weight bearing, Symptoms decreasing with first levels of activity such as walking. The exclusion criteria Red flags to manual therapy, Bilateral plantar heel pain, Prior surgery or facture in the lower extremity, Inflammatory conditions causing plantar pain. (e.g.: rheumatoid arthritis. Ankylosis spondylitis), Subject with referred pain due to sciatica and other neurological symptoms, Severe vascular disease, Prior manual therapy interventions to the foot. The Total duration of 10 months was adopted for this study.

Treatment Duration: 45 minutes /session Totally 6 session (3 session /week for 2 weeks).

GROUP-A

Direct myofascial release for gastrocnemius, soleus, plantar myofasciae

Self myofascial release for plantar myofasciae

Intrinsic foot muscle exercises

GROUP-B

Passive neural mobilization

Self-neural mobilization

Intrinsic foot muscle exercises.

INSTRUMENT & TOOL FOR DATA COLLECTION:

Numerical Pain Rating Scale for measuring plantar pain.

Goniometer for measuring ankle dorsiflexion, plantar flexion and great toe extension.

Foot Function Index for measuring foot function.

TECHNIQUE OF DATA COLLECTION:

Initial assessment was taken on the first day of intervention by using outcome measures. After obtaining the informed consent form, the Interventions was given to each group separately for 2 weeks. Final assessment was taken after the 2 weeks of treatment using same outcome measures. Comparison of pretest and posttest values within the group and between the groups was done finally to find out the results of the study.

TECHNIQUE OF DATA ANALYSIS &INTERPRETATION:

Data collected from subjects were analyzed using paired 't' test to measure changes between pretest and posttest values of outcome measures within the group. Independent 't' test was used to measure the changes between the groups.

After obtaining the informed consent Initial assessment was taken on the first day of intervention by using outcome measures. The Intervention was given to each group separately for 2 weeks. Final assessment was taken after 2 weeks of treatment using same outcome measures.

DATA ANALYSIS AND INTERPRETATION

Data analysis is the systemic organization and synthesis of research data and testing of research hypothesis using these data. Interpretation is the process of making sense of the results of a study and examining the implication (Polit & Beck, 2004).

The pretest and posttest values for Groups A and B were obtained before and after intervention. The pain reduction and improvement in disability was measured using Numerical Pain Rating Scale (NPRS), Ankle Dorsiflexion, Ankle Plantar Flexion, Great toe extension & Foot Function Index (FFI). The mean, standard deviation and Paired 't' test values were used to find out whether there was any significant difference between pretest and posttest values within the groups. Statistical analysis for the present study was done using SPSS (version 16.0).

Independent 't' tests are used to find the significant differences between the groups after intervention.

TABLE: 1. Mean, Mean Difference, Standard Deviation and Paired 't' Test Values of NPRS (in cms) for Groups A & B

Groups		Mean (in cms)	Mean Difference	Standard Deviation	't' Value	'p' Value
Group A	Pre-test	6.79	4.21	1.19	15.0	p<0.05
	Post-test	2.57		0.85		
Group B	Pre-test	7	2.71	1.24	13.99	p<0.05
	Post-test	4.29		1.07		

Based on Table 1, the mean difference of group A was found to be 4.21, Standard deviation was 1.19 in pretest and 0.85 in posttest for Group A, the 't' value using the paired 't' test was 15.0 which was greater than the table value of 2.160 at p<0.05. In Group B the mean difference was 2.71, standard deviation was 1.24 in pretest and 1.07 in posttest for Group, the 't' value using the paired test was 13.99 which was greater than the table value of 2.160 at p<0.05. This shows there is a significant reduction in pain for NPRS in both groups. The result shows that pretest and posttest mean difference of NPRS for group A and group B have statistically significant difference.

TABLE: 2. Mean, Mean Difference, Standard Deviation and Paired 't' Test Values of Ankle Dorsiflexion (Degree) for Groups A & B

Groups		Mean (Degree)	Mean Difference	Standard Deviation	't' Value	'p' Value
Group A	Pre-test	12.79	-3.71	1.76	13.98	P<0.05
	Post-test	16.5		1.61		
Group B	Pre-test	13.21	-4.93	2.29	11.96	P<0.05
	Post-test	18.14		1.35		

Based on Table 2, the mean difference of group A was found to be -3.71, Standard deviation was 1.76 in pretest and 1.61 in posttest for Group A, the 't' value using the paired 't' test was 13.98 which was greater than the table value of 2.160 at p<0.05. In Group B the mean difference was -4.93, standard deviation was 2.29 in pretest and

1.35 in posttest for Group, the 't' value using the paired test was 11.96 which was greater than the table value of 2.160 at $p<0.05$. This shows there is a significant reduction in pain for ankle dorsiflexion in both groups. The result shows that pretest and posttest mean difference of ankle dorsiflexion for group A and group B have statistically significant difference.

TABLE: 3. Mean, Mean Difference, Standard Deviation and Paired 't' Test Values of Ankle Plantar Flexion (Degree) for Groups A & B

Groups		Mean (Degree)	Mean Difference	Standard Deviation	't' Value	'p' Value
Group A	Pre-test	37.36	-8.35	3.52	15.17	p<0.05
	Post-test	45.71		2.73		
Group B	Pre-test	36.79	-5.14	3.70	13.18	p<0.05
	Post-test	41.93		4.03		

Based on Table 3, the mean difference of group A was found to be -8.35, Standard deviation was 3.52 in pretest and 2.73 in posttest for Group A, the 't' value using the paired 't' test was 15.17 which was greater than the table value of 2.160 at $p<0.05$. In Group B the mean difference was -5.14, standard deviation was3.70 in pretest and 4.03 in posttest for Group, the 't' value using the paired test was 13.18 which was greater than the table value of 2.160 at $p<0.05$. This shows there is a significant reduction in pain for ankle plantar Flexion of in both groups. The result shows that pretest and posttest mean difference of ankle plantar Flexion for group A and group B have statistically significant difference.

TABLE: 4. Mean, Mean Difference, Standard Deviation and Paired 't' Test Values of Great Toe Extension for (Degree) Groups A & B

Groups		Mean (Degree)	Mean Difference	Standard Deviation	't' Value	'p' Value
Group A	Pre-test	36.50	-14.86	4.35	21.40	p<0.05
	Post-test	51.36		2.82		
Group B	Pre-test	36.14	-10.79	5.07	7.18	p<0.05
	Post-test	46.93		7.90		

Based on Table 4, the mean difference of group A was found to be -14.86, Standard deviation was 4.35 in pretest and 2.82 in posttest for Group A, the 't' value using the paired 't' test was 21.40 which was greater than the table value of 2.160 at $p<0.05$. In Group B the mean difference was -10.79, standard deviation was 5.07 in pretest and 7.90 in posttest for Group, the 't' value using the paired test was 7.18 which was greater than the table value of 2.160 at $p<0.05$. This shows there is a significant reduction in pain for Great Toe Extension in both groups. The result shows that pretest and posttest mean difference of Great Toe Extension for group A and group B have statistically significant difference.

TABLE: 5. Mean, Mean Difference, Standard Deviation and Paired 't' Test Values of Foot Function Index (%) for Groups A & B

Groups		Mean (%)	Mean Difference	Standard Deviation	't' Value	'p' Value
Group A	Pre-test	49.92	26.35	6.00	19.33	p<0.05
	Post-test	23.57		4.27		
Group B	Pre-test	48.74	15.16	3.07	14.52	p<0.05
	Post-test	33.58		5.25		

Based on Table 5, the mean difference of group A was found to be 26.35, Standard deviation was 6.00 in pretest and 4.27 in post test for Group A, the 't' value using the paired 't' test was 19.33 which was greater than the table value of 2.160 at $p<0.05$. In

Group B the mean difference was 15.16, standard deviation was 3.07 in pretest and 5.25 in post test for Group, the 't' value using the paired test was 14.52 which was greater than the table value of 2.160 at $p<0.05$. This shows there is a significant reduction in pain for FFI in both groups. The result shows that pretest and posttest mean difference of FFI for group A and group B have statistically significant difference.

TABLE: 6. Comparison between the post test values of Group A&B

Outcome Measures	Group	Mean	Mean Difference	Standard Deviation	"t" Value	"p" Value
Numeric Pain Rating Scale	Group A	2.57	-1.72	0.85	4.69	p<0.05
	Group B	4.29		1.07		
Ankle Dorsi flexion	Group A	18.14	1.64	1.35	2.93	P<0.05
	Group B	16.14		1.61		
Ankle Plantar Flexion	Group A	45.71	3.79	2.73	2.91	P<0.05
	Group B	41.93		4.03		
Great Toe Extension	Group A	54.00	4.43	2.82	1.97	p>0.05
	Group B	44.07		7.90		
Foot Function Index	Group A	23.57	-10.01	4.27	5.54	p<0.05
	Group B	33.58		5.25		

The Numerical Pain Rating Scale (NPRS) between the groups were calculated using independent 't' test & the 't' value was 4.69 which was greater than the table value of 2.056 at $p<0.05$.

The Ankle Dorsiflexion between the groups were calculated using independent 't' test & the 't' value was 2.93 which was greater than the table value of 2.056 at $p<0.05$.

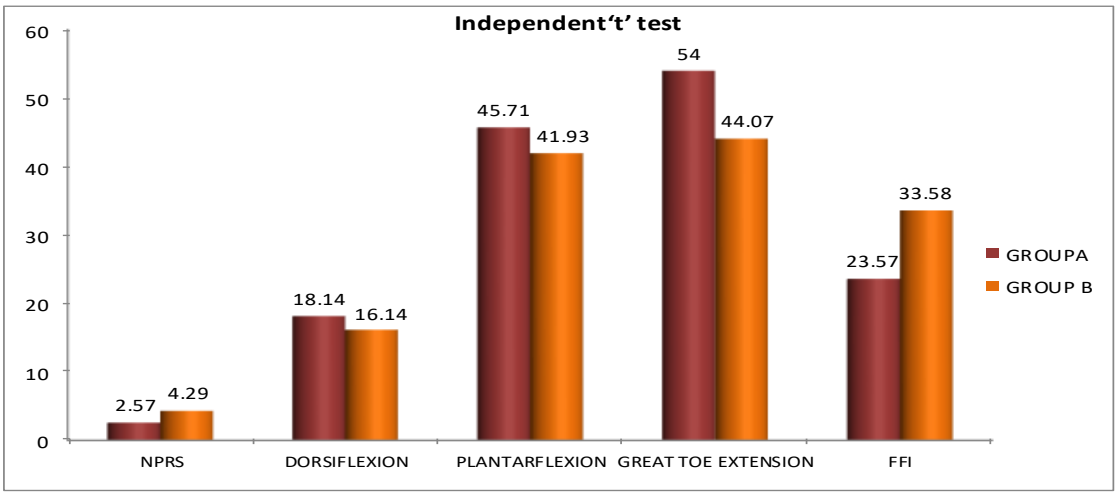
The Ankle Plantar Flexion between the groups were calculated using independent 't' test & the 't' value was 2.91 which was greater than the table value of 2.056 at $p<0.05$.

The Great Toe Extension between the groups were calculated using independent 't' test & the 't' value was 1.976 which was lesser than the table value of 2.056 at $p>0.05$.

The Foot Function Index (FFI) between the groups were calculated using independent 't' test & the 't' value was 5.54 which was greater than the table value of 2.056 at $p<0.05$

Therefore, the results of these statistical analyzes showed that the Group A is effective on improving the NPRS, FFI, Ankle Dorsiflexion & Ankle Plantar Flexion compared to Group B and there is no significant difference in both groups on Great Toe Extension.

GRAPH: 1. Comparison between the post test values of Group A&B



RESULT AND DISCUSSION

The data from group A (MFR) and B (NM) for NPRS were analyzed using paired 't' test and independent 't' test. The calculated value of paired 't' test for group A is 15.0 (MFR) and for group B (NM)is 13.99 which is greater than the table value indicating there is a significant difference within the groups. The value of independent 't' test for both groups is 4.69 which is greater than the table value indicating there is a significant difference between the groups.

The data from group A (MFR) and B (NM) for Ankle dorsiflexion were analyzed using paired 't' test and independent 't' test. The calculated value of paired 't' test for group A (MFR) is13.98 and for group B (NM) is 11.96 which is greater than the table value indicating there is a significant difference within the groups. The value of independent t test for both groups is 2.93 which is greater than the table value indicating there is significant difference between the groups.

The data from group A (MFR) and B (NM) for Ankle plantarflexion were analyzed using paired 't' test and independent 't' test. The calculated value of paired 't' test for group A (MFR) is 15.17 and for group B (NM) is 13.18 which is greater than the table value indicating there is a significant difference within the groups. The value of independent t test for both groups is 2.91 which is greater than the table value indicating there is significant difference between the groups.

The data from group A (MFR) and B (NM) for great toe extension were analyzed using paired 't' test and independent 't' test. The calculated value of paired 't' test for group A (MFR) is 21.40 and for group B(NM) is 7.18 which is greater than the table value indicating there is a significant difference within the groups. The value of independent t test for both groups is 1.976 which is lesser than the table value indicating there is no significant difference between the groups.

The data from group A (MFR) and B (NM) for Foot function Index were analyzed using paired't' test and independent 't' test. The calculated value of paired't' test for group A (MFR) is 19.33 and for group B (NM) is 14.52 which is greater than the table value indicating there is a significant difference within the groups. The value of independent 't' test for both groups is 5.54 which is greater than the table value indicating there is significant difference between the groups.

DISCUSSION

The aim of this study was to compare the effectiveness of MFR versus Neural mobilization in patients with Plantar fasciitis.

A total of 28 patients diagnosed with plantar fasciitis in the age group of 35-60 years participated in this study. The participants who satisfied the selection criteria were randomly assigned into two groups by simple random sampling. Baseline measurements were taken using the Numerical Pain Rating Scale (NPRS), Range Of Motion (ROM) and Foot Function Index (FFI) for both groups. One group received Myofascial release (MFR) and the other group received Neural Mobilization for 2 weeks. At the end of 2 weeks, participants were again evaluated and measurements were taken using same outcome measures. Statistical analysis for the present study was done using SPSS (version 16.0)

Both males and females are affected equally. There is none of them have similar impairment and functional limitation with Plantar Fasciitis. Participants were selected cautiously not to generalize these results to younger or older patients. All participants in this study were between 35 and 60 years.

MFR is a widely employed direct manual treatment, which utilizes specifically guided mechanical forces to manipulate and reduce myofascial restriction of various somatic dysfunction. MFR is effective to provide immediate relief of pain and increase ROM of affected joints[25]. Neural mobilization focused on restoring soft tissue mobility and restoring the foot and ankle flexibility of involved structures originating from the medial tubercle of the calcaneus tissue[26]. This study showed significant improvement

in ankle dorsiflexion and plantar flexion and there is minimal level of significant changes in great toe extension.

The FFI score item related to pain, disability and activity restriction were the major issue for the patient and this was addressed and found significant improvement after the treatment. It is one of the easiest and quickest tool available to assess disability and an excellent way to monitor individual patient progress and its acquired five to six minutes to complete the test.

Our results suggest that complete resolution of symptoms may not be expected within 2 weeks of MFR versus neural mobilization. The anatomical and functional complexity of the foot may require a more diversified rehabilitation program involving other muscles, and/or a longer treatment period.

Myofascial release is effective on reducing pain, improving ROM and functional activity in patients with plantar fasciitis compared to neural mobilization.

Limitations of the Study:

- There was no control group without intervention, so it is difficult to exclude effects of the natural recovery process of plantar fasciitis.
- No blinding was done.
- There was a lack of long term follow up of patients to find out the carry over effects of the intervention.

Suggestions for Future Research:

- In future studies long term follow-up can be done to determine the effect of intervention.
- The study can be conducted with control group to rule out that the natural maturation of the syndrome which would influence the results.
- The future studies can be done in large samples because if more the sample size used, greater would be the significance.
- The future studies compare the effect of MFR versus Neural mobilization along with short foot exercise over the other interventions like iontophoresis, ultrasound, orthosis.

CONCLUSION

On the basis of the statistical analysis this study shows that there is improvement in pain, range of motion except great toe extension and functional activity on application of myofascial release versus neural mobilization in patients with plantar fasciitis.

So, we conclude that the myofascial release is effective in reducing pain, improving range of motion and functional activity in patients with plantar fasciitis compared to neural mobilization.

Declaration by Authors

Ethical Approval: Approved

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Conflict of Interest: The authors declare no conflict of interest.

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