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Original Research Article

# Holistic management of plantar fasciitis: An orthopaedic perspective

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## Abstract

**Background:** Majority of patients suffering from plantar fasciitis are either chronic recalcitrant or acute severe pain which hampered their daily activities and working capability therefore leading to psychological distress. There are very few challenging studies which show cased results of holistic conservative approach to guide a treating physician. The purpose of this study is to achieve the best possible outcome by managing plantar fasciitis in a holistically conservative manner like plantar fascia massaging, strengthening, footwear, foot roller and physiotherapy. Structured protocol study is the important aspect of this article.

**Materials and Methods:** Randomised control study of 100 patients presented to Orthopaedic Out-patient in MNR Medical College, Sangareddy. This study was performed on male and female patients aged between 25 and 70 years.

**Results:** Results were found to be encouraging in following a proper protocol of holistic approach to conservative management achieving an overall success rate of about 80%. We achieved favourable results through proper patient education and by gaining patients confidence. Regular stretching, strengthening exercises and using physiotherapy modalities showed better patient outcomes in terms of pain relief and functional outcome.

**Conclusion:** Holistic conservative treatment has a significant role in successfully treating plantar fasciitis in both acute and chronic cases. It is to be noted that continuing exercises regularly prevents recurrence.

**Keywords:** Acute, Heel pain, Foot roller, Conservative management, Holistic approach.

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## 1. Introduction

Plantar fasciitis is the most common cause of heel pain seen by Orthopaedicians in India. It is a painful and debilitating condition which affects both active and sedentary adults. Plantar fasciitis is used to describe heel pain caused by an inflammation of the plantar fascia. This could result from a tear in the plantar fascia or due to damage from repetitive micro-traumas.[1,2] Plantar fasciosis describes the degenerative, non-inflamed phase of plantar fasciopathy.[3] It is an enthesopathy that arises from degenerative processes affecting the junction between the periosteal- ligament attachment i.e between calcaneus and plantar fascia, respectively.[4]

Despite its name, “plantar fasciitis” which has been used generally for many years it is somewhat misleading, and not applicable for all plantar heel pain cases. The condition is more accurately described as a degenerative pathology rather than a primary inflammatory one. Comprehensive understanding of the disease reveals that its pathogenesis is more oriented to plantar fibre disorganisation and degenerative fibrosis rather than inflammatory pathology. Histological examinations rarely show inflammatory cells in biopsies from the involved fascias. Therefore, Lemont et al advocated the term “plantar fasciosis” to describe the syndrome characterised by pain along the proximal plantar fascia and its attachment in the area of the calcaneal tuberosity with impaired physical function, implying a more chronic degenerative process in comparison with acute heel pain.[5]

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*1.1. Anatomy*

Plantar fascia or plantar aponeurosis is a connective tissue structure in plantar region of foot. It distinctively has three parts:

1. Central band,
2. Lateral band and
3. Medial band;
   (i) The prominent central band attaches proximally to medial tubercle of calcaneum and distally to the subcutaneous tissue and joint capsules of second to fifth metatarsophalangeal joints and plantar bases of corresponding proximal phalanges.
   (ii) The lateral band takes its origin at lateral tubercle of calcaneum inserting to joint capsule of fifth metatarsophalangeal joint.
   (iii) Thinner medial band is a component of abductor hallucis fascial sheath.[6]

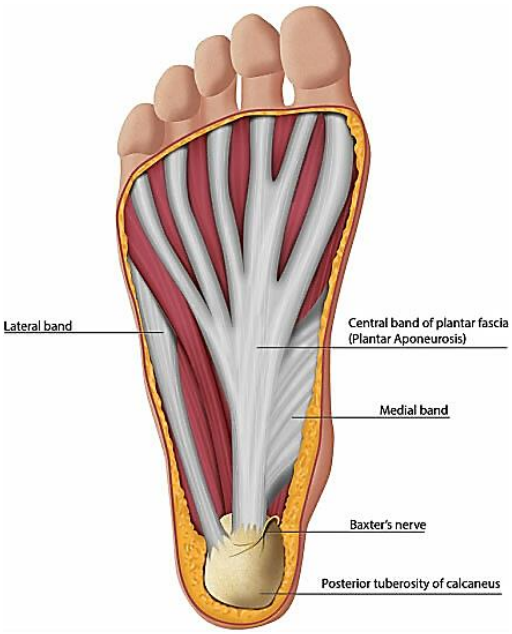


**Figure 1:** Anatomy of plantar fascia showing lateral, central, and medial bands[16]

*1.2. Biomechanics*

The anatomical plantar aponeurosis - longitudinal arch relationship is used to describe two main biomechanical mechanisms for human foot function.

1. Windlass mechanism: the plantar fascia wraps around the metatarsal heads like a cable wrapping around a drum to insert onto proximal phalanges of toes. During dorsiflexion of toes there is tension created in plantar fascia which in turn pulls the calcaneus towards the metatarsal heads and raises the longitudinal arch. The windlass mechanism is believed to be activated during push off in walking and running when the toes are dorsiflexed.[6]
2. Energy storing: when the foot is loaded in stance phase, the longitudinal arch compresses and the foot elongates causing plantar fascia to stretch and store energy, the plate aponeurosis then recoils during unloading phase and most of this elastic energy is returned to foot to aid during push-off phase thereby reducing the metabolic energy required for running.[6]

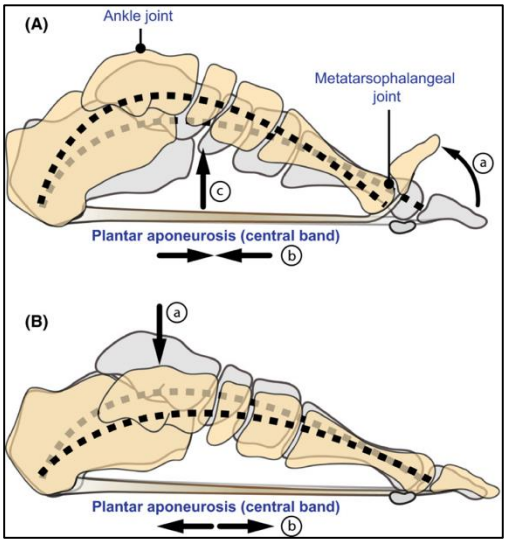


**Figure 2:** Explains about windlass mechanism of plantar fascia: when the toes are dorsiflexed, tension creates in plantar fascia which pulls the calcaneus toward the metatarsal heads and raises the longitudinal arch

Plantar fasciitis is multifactorial; no particular cause for the onset of plantar fasciitis; rather, it may result from daily activities, lifestyle changes, anatomic, biomechanics factors of foot, obesity, inappropriate footwear, environmental factors and sometimes even a combination of these can lead to plantar fasciitis (**Table 1**).[7,8]

**Table 1:** Risk factors of plantar fascitis

| S. No. | Intrinsic Factors | |
|---|---|---|
| 1. | **Anatomy** | a) Pes Planus-flat foot |
| | | b) Pes Caves-high arched foot |
| | | c)Tight Tendoachilles |
| | | d) Calcaneal spur |
| | | e) Limb length discrepancy |
| | | |

| *Table 1 Continued…* | | |
|---|---|---|
| 2. | **Biochemical** | a) Excessive pronation of foot |
| | | b) Limited ankle dorsiflexion |
| | | c) Weak intrinsic foot muscles |
| | | d) Weak Plantar flexors |
| | | |
| 3. | **Environmental** | a) Obesity |
| | | b) Sedentary lifestyle |
| | | c) Walking on hard surfaces |
| | | d) Prolonged standing |
| | | e) Improper footwear |
| | | f) Age related degenerative changes |

One cannot term all cases of plantar heel pain under plantar fasciitis/ plantar fasciosis, there are other causes of heel pain which can be demarcated from each other based on clinical history and examination. (**Table 2**)[7,9,10]

**Table 2**: Clinical history and examination of plantar heel pain

| S. No | Etiology | Disorder | Clinical cues |
|---|---|---|---|
| 1. | **Traumatic** | Acute calcaneal fracture | h/o hard landing on heel |
| | | Calcaneal stress fracture | Progressive worsening of heel pain after incr. in activity or change to hard surface |
| | | Fat pad contusion | h/o hard landing on heel |
| | | Plantar fascia tear/ rupture | Constant pain over foot arches, diffficulty in weight bearing. |
| 2. | **Degenerative** | Fat pad atrophy | Elderly, central calcaneal pain |
| | | Plantar fasciitis | Medial calcaneal tubercle pain with initial steps |
| 3. | **Inflammatory** | Rheumatoid Arthritis | associated with systemic involvement |
| | | Reactive Arthritis | |
| | | Psoriatic Arthritis | |
| | | Seronegative Spondyloarthropathy | |
| | | Gout | 1st Metatarsal involvement |
| 4. | **Neurologic** | Peripheral Neuropathy | Associated with paraesthesia |
| | | Lumbar radiculopathy/ Lumbar canal stenosis | Radiating pain associated with tingling and numbness |
| | | Tarsal tunnel syndrome | Numbness, tingling, heel pain worsened with dorsiflexion, standing and activity. |
| | | Baxter's Neuropathy | Heel pain with Abductor digiti minimi weakness |
| | | Neuroma | Heel pain with tingling, painful lump on palpation |
| 5. | **Soft Tissue** | Achilles tendinitis | Posterior calcaneal tenderness and achilles tendon pain |
| | | Tendinopathies of:<br>1. Tibialis posterior<br>2. Flexor hallucis longus<br>3. Flexor digitorum longus | Pain along tendon length and its insertion point |
| | | Retrocalcaneal bursitis/ Haglund deformity | Retrocalcaneal pain |
| | | Sinus tarsi syndrome | Pain along lateral border of heel and foot,<br>Feeling of ankle instability h/o repeated ankle sprains |
| 6. | **Infections** | Diabetic ulcer | Non- healing ulcer in diabetic population |
| | | Osteomyelitis | Fever associated with discharging sinus |
| 7. | **Paediatric** | Sever's disease/ Calcaneal apophysitis | Adolescent; heel pain which worsens with increased activity |
| 8. | **Tumours** (Rare) | Ewing's sarcoma | Intermittent pain and swelling, mainly differentiated on radiologic features |

Labovitz et al described that hamstring tightness also plays a significant role in plantar fasciitis.[11] Koukamis et al studied the prevalence of heel pain in spondyloarthritic patients where this type of heel pain is recurrent and resistant to NSAID's.[9] Hence, while evaluating heel pain patients, it is important to enquire about previous enthesopathies and multiple joint involvement. Obtaining clinical history and evaluating accordingly is more appropriate. According to Hafner et al 25% of recalcitrant heel pain is neoplastic in origin significant with plantar fibroma.[12]

Classical plantar fasciitis symptoms include severe early morning heel pain i.e 'first step pain' or pain after prolonged periods of rest which improves with walking. Physical examination includes examination of gait, range of motion of ankle and foot, focusing on limited ankle dorsiflexion, assessment of forefoot, mid-foot, hind foot alignment.[5] Tenderness along the antero-medial aspect of plantar calcaneus which is exacerbated by windlass test. Windlass test: by stabilising the ankle, the first metatarsophalangeal joint is passively dorsiflexed to maximum leads to discomfort along the plantar fascia. According to De garceau et al the windlass test is highly specific but low sensitive hence its usage is limited. Tightness of calf muscles are considered to be a contributory factor in developing plantar fasciitis.

Plain weight bearing radiograph of the ankle showing both AP and lateral views is helpful for excluding other causes of heel pain. Ultrasonography can be used to assess plantar fascia thickness. Normal plantar fascia is isoechoic and hyper-echoic with adjacent fat, fascia thickness ranges from 2-4mm. In plantar fasciosis the fascia is usually hypo-echoic, and thickness is greater than 4mm, with disorganisation of plantar fascia fibres and peri-insertional oedema.[5,13,14] (**Figure 3**)

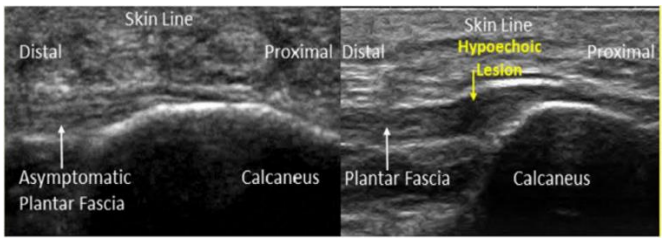


**Figure 3**: Demonstration of Normal Ultrasonography of plantar fascia in the first image, the second image demonstrates the appearance of hypo-echoic nature of plantar fasciitis. {khammas}

Current treatments focused more on reduction of pain, is it beneficial in the long run?

## 2. Materials and Methods

This is a prospective study of randomised study conducted on 100 pts, who have presented to MNR Medical College and Hospital, Sangareddy, Telangana with Plantar fasciitis between September 2023 to September 2024. The subjects were assessed for pain relief and functional outcome.

All male and female patients in the age group of 25-70yrs presenting with heel pain, confirmed by complete clinical evaluation, suggesting features of plantar fasciitis were involved in the study. Patients with calcaneal stress fractures, Achilles tendinitis, Retrocalcaneal bursitis were excluded.

Patients with history of early morning heel pain immediately after getting up from bed and pain during initial steps after periods of inactivity, clinical diagnosis was made based on history, medial calcaneal tubercle tenderness, Windlass test (passive dorsiflexion of great toe leading to pain at origin of plantar fascia; i.e medial calcaneal tubercle).[15]

Blood investigations like CBP, ESR, CRP, RA factor, ANA if RA factor is positive), and Ultrasonography were done for Recalcitrant cases.

Then patients are initially managed with Rest, Ice, NSAID's, MCR slippers, and plantar fascia massaging, stretching and strengthening exercises, Gastrocnemius stretching exercises. Follow up after 2 wks.

These exercises began with plantar fascia massaging (**Figure 4**), followed by stretching using a towel first thing in the morning before placing feet on the ground.(**Figure 5**) This is followed by rolling ice water bottles under their feet.

**Figure 4**: Plantar fascia massaging at the point of origin at medial calcaneal tuberosity

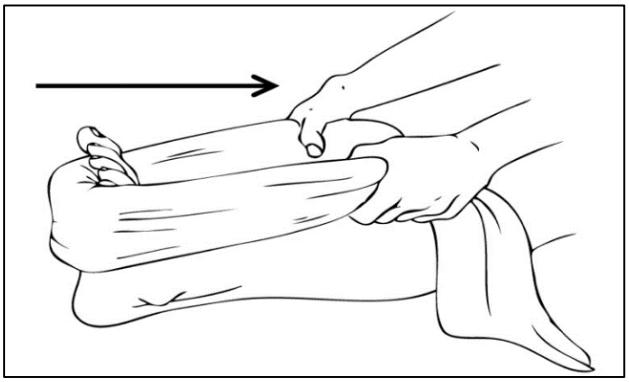

**Figure 5:** Plantar fascia stretching exercise using a towel under feet

In the evening or when the patient is at rest, we recommended that they roll their feet over a foot roller and the patients with weak intrinsic muscles of foot were recommended to do intrinsic foot muscle strengthening exercise using a towel.(**Figure 6**)

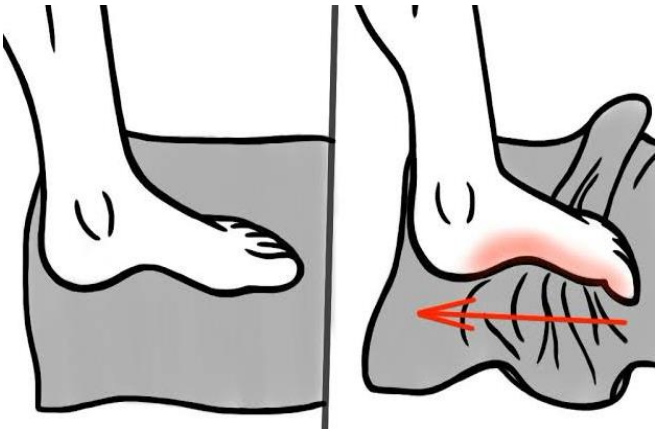

**Figure 6:** Towel crunches: Intrinsic foot muscle

We made sure that patients understand the need for regular exercise and introduced the foot roller alongside the regular exercise.(**Figure 7**)

**Figure 7:** Foot roller

We added another exercise in the evening foot rotation exercise- where the affected foot is crossed over the other leg, then the patient is asked to hold the feet and slowly rotate the foot. Palm of hand should touch the heel with fingers and toes interlocked.(**Figure 8**)

**Figure 8:** Foot rotation exercise

Even after these initial steps if the pain doesn't subside then we continued with physiotherapy modalities including Interferential therapy for the next three weeks alongside other recommended treatments. For acute cases, we recommended footwear modifications (Medial arch, Heel rise, Supination) as well as foot roller. For chronic cases additional interventions may include plantar fascia taping and Corticosteroid injection as the last resort.

First-step pain, foot pain, functional outcome and Quality of life were assessed at 2wks; 6wks and 3 months. Revisit if symptoms reoccur

Even after these initial steps if the pain doesn't subside then we continued with foot roller, physiotherapy modality like Interferential therapy for the next three weeks plantar fascia taping and Corticosteroid injection as the last resort.

## 3. Results

A total of 100 patients (47 males, mean age: 48±16 years; 53 females, mean age: 46±13 years) were studied. Significant differences were noted among participants in terms of height, weight, educational status, and occupation. All patients were subjected to initial treatment which included Rest, Ice, Microcellular rubber footwear, NSAID's and patient specific plantar fascia exercises. Patients who had partial pain relief or no pain relief after 2-week follow-up were subjected to additional foot roller exercises, taping, Interferential therapy along with patient specific plantar fascia stretching exercises for 6 weeks. (**Figure 9**)

Outcome

1. Complete relief: 78 patients after initial and next interventions.
   a. NSAID's: 3patients
   b. Plantar fascia exercises and foot roller: 36
   c. Plantar fascia taping: 4 patients
   d. Interferential therapy: 35 patients
   e. MCR slipper use and exercises: most patients

2. Partial pain relief or no relief: 49 patients who had partial relief or no pain relief after initial treatment for 2 weeks were later subjected to Interferential therapy and regular exercise. 45 out of these 49 patients achieved good outcomes.
3. No pain relief: 4 patients had no improvement with the above treatment and were administered with Intralesional corticosteroid injection.
4. Lost to follow-up: 18 patients.

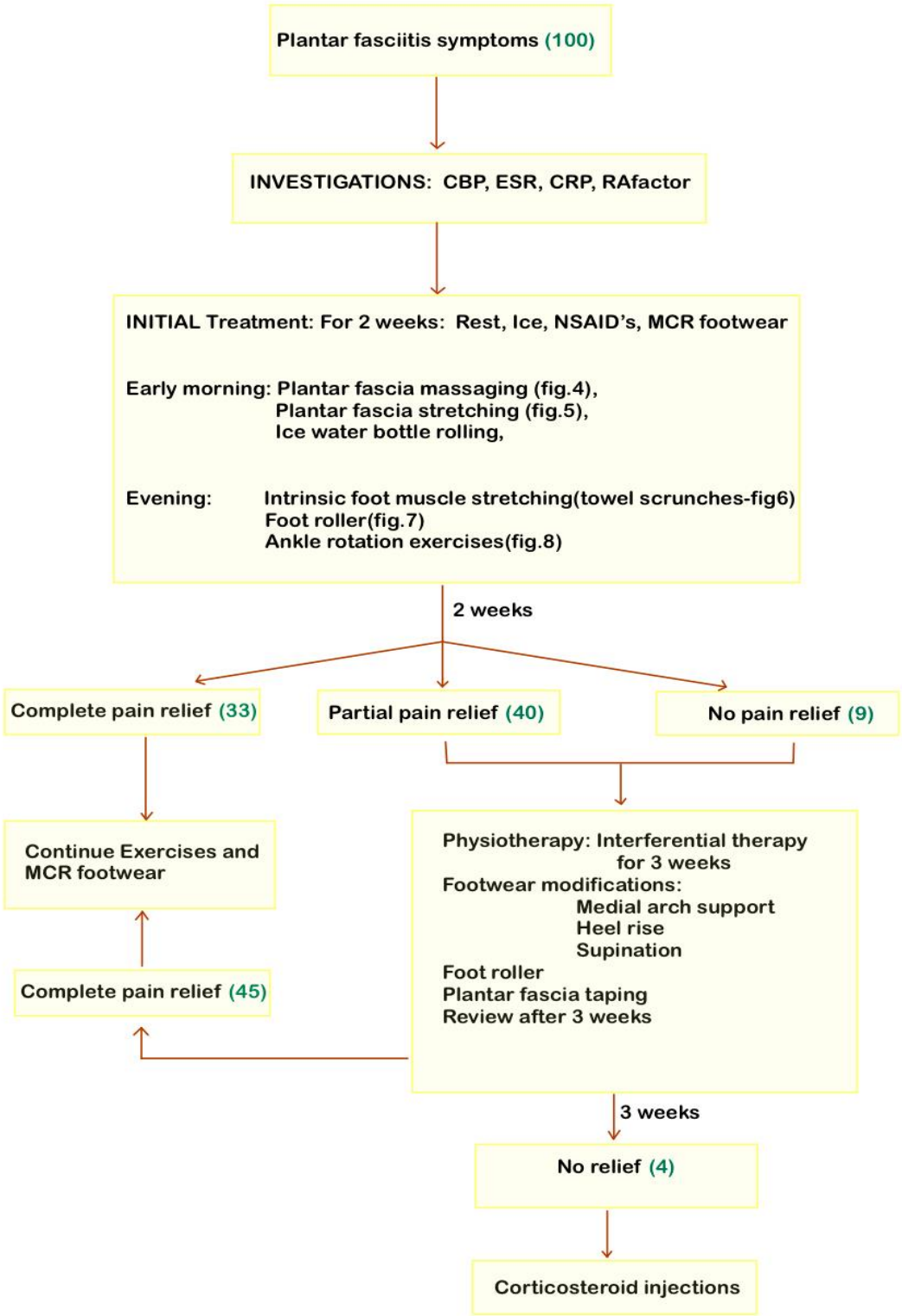


**Figure 9:**

## 4. Discussion

The results demonstrate that patients using microcellular rubber footwear with (Medial arch support, Heel rise, Supination) combined with regular stretching, strengthening exercises and physiotherapy modalities like Interferential therapy for a minimum of 3 months showed better outcome in terms of quality of life and was effective for prolonged periods. In regard to functional outcome and pain relief after subsequent followup at 2 weeks and 6 weeks, there were satisfactory results in patients on Interferential therapy, foot roller those using microcellular rubber footwear with regular plantar fascia exercises. Patient specific treatment modality is advised based on the underlying cause for their pain. The plantar fascia is the main stabiliser of the medial longitudinal arch of the foot against ground reaction forces and is instrumental in reconfiguring the foot into a rigid platform before toe-off.[2] The multiple risk factors lead to micro-tears in plantar fascia, repeated trauma to the plantar fascia which exceeds the tissue's ability to recover can result in degenerative changes and a heightened risk of injury. The increased fascial load is sensed by gap junctions between the fibrocytes leading to Extracellular matrix changes high in turn causing myxoid degeneration and fragmentation of plantar fascia.[16] This can be counteracted by MCR slippers. Some explain that overload on plantar fascia causes mild inflammation at cellular level where the fibroblasts produce collagen to repair, continuous repetitive stress limits the body's ability to heal. This inflammation diminishes over months and collagen starts to unwind and gets fragmented. New immature blood vessels form over time to heal and improve flow to the area. Factors like enlarged fibroblasts, poor blood flow, disorganised new collagen, old collagen unraveling lead to thickening of plantar fascia which creates tension around it therefore leading to pain.[17] During sleep the plantar fascia is relaxed due to plantar flexion of foot. In initial steps the tense plantar fascia is getting stretched leading to pain, with further steps the pain reduces, due to gradual relaxation of plantar fascia, supporting muscles and ligaments. Over time this thickened inflamed plantar fascia develops into scar tissue. More recently, the term 'plantar fasciosis' has been introduced to de-emphasise the idea that inflammation is the cause of pain.[18]

There are many differential diagnoses for heel pain and the clinician must be able to differentiate plantar fasciitis from other causes of heel pain. **(Table 2)** [18]

Previous studies have emphasised more on other management methods like anti-inflammatory medications,[17,19,20] plantar fascia stretching, night splints, [custom made orthosis, taping, Corticosteroid injections,[21,22] platelet rich plasma injections, Botulinum toxin injections, Extra corporeal shockwave therapy.[23,24] Iontophoresis, Fasciotomy (open and endoscopic) which showed variable inconclusive results. Night splints are cumbersome and have poor patient compliance. Reinstein studied the effect of barefoot walking versus footwear walking for 4 weeks, which showed that the barefoot walking group showed significant improvement in pain, physical function. Chen et al, have studied the effect of various modalities like injecting corticosteroid which proved to be better in an acute setting and relief of pain for a period of 2-3 months. Fasciotomy is mainly done for recalcitrant cases which shows reliable results.[21] Iontophoresis and extra corporeal shockwave therapy are advanced modalities which are not available in most hospitals. There is still scope of study for these modalities which were theoretically proven to have better results but inconclusive clinically.

Patients must be made aware that it will take at least 3-6 months for complete pain relief, and they must have patience and review with the treating doctor at regular intervals. It is recommended to start with soft sole slippers, foot roller exercises and personal risk factor assessment and recommending specific plantar fascia exercises, in patients having no relief and partial relief it is better to go for Interferential therapy followed with regular exercises and soft slippers. As stated by Stratton, usage of low frequency electrical stimulation for the treatment of plantar fasciitis is beneficial as it increases blood flow locally by eliciting muscle contractions.

In chronic cases where there is scar tissue formation, scar massage proved helpful during the proliferation stage. Scar massage has proven to show beneficial role in collagen synthesis as it prevents adhesions leading to collagen production. Static and dynamic splinting in preliminary stages can alter the visco-elastic properties of tissues thus elongating and stretching tissues over time. Botox injections provide tissue relief and silicone gel provides hydration and cushioning effect.

It is better to be called plantar fasciosis rather than plantar fasciitis which summarises the whole concept of treating it. Patient education and compliance are main factors to treat this condition and prevent the recurrence.

As per our observations, patients who followed regular exercises and used MCR slippers have good outcomes, and those who have did not achieve pain relief were further subjected to physiotherapy modalities like Interferential therapy. Very few patients needed corticosteroid injections. There were patients who did not achieve complete pain relief with any of the above modalities.

## 5. Conclusion

Plantar fasciitis is a common cause of heel pain resulting from inflammatory micro tears due to repetitive stress and a non inflammatory degenerative condition. Conservative management including Rest, NSAID's, exercises, Footwear modifications and adjunct therapies like Taping, Interferential therapy of calf muscle proved to be effective in most cases. Long term management and prevention of

recurrence is achieved with further regular exercises, footwear modifications (Medial arch, heel rise, supination) patient compliance, and education.

## 6. Source of Funding

None.

## 7. Conflict of Interest

None.

## 8. Ethical Approval

Ethical No.: MNR EC-BHR-18/23.

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