

## A Custom made Rigid foot orthosis for treatment of Plantar Fasciitis A Quasi- Experimental Study

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### Abstract

**Background:** Plantar fasciitis is a common cause of heel pain, classically presents with pain that is severe with the first few steps taken in the morning. In general, pain due to plantar fasciitis is mild to moderate but pain can be severe and affect one's life style. Many treatment options exist, including rest, exercises, footwear modification, orthotics and surgery. No single method is universally effective. Aim of this study is to asses' effectiveness of custom made rigid foot orthosis in plantar fasciitis.

**Materials and Methods:** 118 patients with plantar fasciitis treated with custom made rigid foot orthosis over period of 1year were included. All the patients were followed up to 1 year after completion of the orthotic treatment. No supplementary treatment was given. Results were analyzed using foot health status questionnaire forms for pain and function and comfort for wearing the orthotic within the shoe were graded from 0 to 10 on a Visual analogue Scale.

**Results:** 83(70.33%) patients had complete pain relief at 3 months and 23(19.49%) patients had complete relief by 4 months. 92% of patients had worn the insert up to 3 months. 87% patients rated the comfort to use within shoes from 8-10 on a visual analogue score (VAS). None of our patients had recurrence. Level of Evidence: Level 4

**Conclusion:** Management of plantar fasciitis with rigid foot orthosis alone is an effective treatment method. No recurrence was seen.

**Key words:** plantar fasciitis, rigid foot orthosis, polypropylene, calcaneal spurs.

### Introduction

Plantar fasciitis is a common musculoskeletal disorder characterized by pain involving the inferomedial aspect of the heel, seen mainly in the morning hours, pain relieves after walking few steps and exacerbates following periods of inactivity and prolonged walking or prolonged standing or climbing stairs[1]. 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[2]. The plantar fascia, or aponeurosis, is composed of central, lateral, and medial bands that originate along the medial tubercle of the calcaneus. The plantar fascia courses anteriorly along the arch of the foot, where the fascia divides into slips which eventually insert into the sides of the proximal phalanx in each toe [3]. At toe-off, hyperextension of the metatarso phalangeal joints results in tightening of the plantar fascia and assists with resupination of the foot. The plantar fascia functions through the "windlass mechanism" to depress the metatarsal heads and elevate and stabilize the longitudinal arch of the foot during gait. Therefore, with every step from heel rise to toe-off the plantar fascia is placed under tension[4]. The pain in plantar

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fasciitis is usually caused by collagen degeneration at the origin of the plantar fascia, cause of the degeneration is repetitive micro tears of the plantar fascia that overcome the body's ability to repair itself.

This degeneration is similar to the chronic necrosis of tendinosis, which features loss of collagen continuity, increases in ground substance (matrix of connective tissue) and vascularity, and the presence of fibroblasts rather than the inflammatory cells usually seen with the acute inflammation of tendinitis[4].

While numerous local and systemic factors may produce inferior heel pain [5,6] the diagnosis of plantar fasciitis is usually based on clinical criteria alone. Pain localized to the medial tubercle of the calcaneus is considered pathognomonic and is the most widely reported clinical sign[7,8,2]. The pain may be exacerbated by passive dorsiflexion of the toes or by having the patient stand on the tips of the toes.

Conservative therapy appears to be the mainstay of treatment, there is controversy regarding the most efficacious programme. Although all treatments have reputedly provided some level of relief, the final outcome, as well as the financial and personal burden imposed by each treatment, varies markedly across protocols[9, 10].

Treatment options are many including rest, stretching and strengthening exercises, tapping the plantar fascia and massaging over the plantar fascia, shoe modification, metatarsal pad, taping, arch support and orthotics, iontophoresis, corticosteroid injections, anti-inflammatory drugs[11,12] open plantar fascia release [13,14] and endoscopic plantar fasciotomy[15].

Limited research is available regarding the outcomes of plantar fasciitis treatment regimens. Martin et al [16] conducted a retrospective study in which all patients received a resting dorsiflexion night splint, a prescription for an oral nonsteroidal anti-inflammatory medicine, one physical therapy visit, and either a custom foot orthotic or a prefabricated heel cup. Pfeiffer et al[17] used stretching in conjunction with heel cups or rigid custom foot orthotics. A retrospective study by Wolgin et al [18] examined the long-term results of 100 patients who were provided a handout of conservative intervention options and allowed to choose their own treatment regimen.

Clinical experience indicates those custom foot orthotics are used commonly as an intervention for

plantar fasciitis; however, there is little information available on their mechanism of action and how they affect treatment outcomes. Two previous research reports may be helpful in regard to the mechanism of action of orthotics. Kogler et al<sup>(19,20)</sup> performed a cadaver study that compared the effects of five different foot orthotics and an oxford shoe on strain of the plantar fascia. Plantar fascia strain was lowest for loading conditions in which the foot orthotics provided a higher medial longitudinal arch. Kitaoka et al [21,22] also reported that two foot orthotic devices were effective in maintaining medial longitudinal arch height when axial loads were imposed on cadaveric foot specimens. The studies by Kogler et al[19,20] and Kitaoka et al[21,22] speak to the need for a custom-fitted orthotic that is both comfortable and provides sufficient medial longitudinal arch height to protect against excessive tensile strain of the plantar fascia. Even though various treatment modalities are available, no single method is proved one over other. Foot orthotics is being used in treatment of plantar fasciitis. Few studies have examined efficacy of foot orthotics for plantar fasciitis.

We have used rigid orthosis made of polypropylene custom made in the Department of Artificial Limb Centre, M.S. Ramaiah Medical College, Bangalore. The orthosis is prepared after taking a well moulded plaster of paris (pop) cast impression of the individual foot and polypropylene is treated in hot oven at 180 degree centigrade for 2hrs as it melts it is placed over negative shaped mould and shaped as per the design of the mould and trimmed, our orthosis extends from posterior aspect of the heel to head of the metacarpals sparing the toes. It should be worn in the shoes.

The purpose of this study is to determine the effectiveness of custom made rigid foot orthotic on pain and disability in plantar fasciitis.

## Materials and Methods

A prospective study of 118 patients with plantar fasciitis treated with custom made rigid foot orthotic over a period of 1 year from April 2008 to May 2009. All patients were informed about nature of treatment and all patients signed a written consent.

Twelve out of 130 patients did not use the orthotic for more than 6 weeks; so they were excluded the morning hours which relieves after walking few steps and aggravates after prolonged walking or climbing stairs, palpation elicits tenderness over

inferomedial aspect of the heel. Radiographs were taken in all patients to see any calcaneal spurs, no diagnostic ultrasonography or MRI was done. Duration of symptoms in this study ranges from 2 months to 1.5 years. 15 patients were treated with analgesics and 10 patients had received corticosteroid injection into the plantar fascia before 4 to 5 months of prescribing orthotic, none of these patients had any relief. Radiographs showed calcaneal spur in 22 patients. All patients were advised to use the orthotic within the shoes, through out the day for 3-4 months. No supplementary analgesics or any other mode of pain relief was given. Patients were followed up at 6 weeks, 3 months, 6 months and 1 year.

All patients have filled foot health status questionnaire [FHSQ] forms for pain and function before treatment and 1 year after completion of treatment. Foot health status questionnaire has four domains the foot pain, foot function, foot wear, general foot health. Only foot pain and foot function are taken into account in our study. Foot pain questionnaire evaluates type of pain, severity and duration of pain, score ranges from 0-100, Acute & extreme pain is score zero and No pain or discomfort is score 100. Similarly, foot function is evaluated in terms of impact on physical activities, score zero corresponds to severely limited activities like walking, working and moving about and score 100 when some can perform all desired activities with ease. Visual Analogue Scale [VAS] for pain and comfort for use of orthotic within the shoes from 0-10, zero being worst and 10 being the best.

## Results

All patients were in the age group of 36 -57 years, 50 males and 68 females, average height was 5.33feet (range 4.9 to 6.1feet), average weight was 71.2kgs(range 48 to 92kgs). Average foot health status questionnaire score for pain before treatment was 56.78 (Range 28-72), Average foot health status questionnaire score for function before treatment was 46.18 (Range 23-57) . Average VAS for pain was 6.1 range (6-9).

Complete pain relief was achieved in 3 months in 83 patients (70.33%) and 23 (19.49%) patients had relief in 4 months and 12 patients (10.16%) had no relief at all. Out of 12 patients who did not have any relief 4 were bilateral and 8 were unilateral, 3 patients had calcaneal spur on radiographs. No further investigation was done in these patients to find out the cause for persistence of pain.

Foot health status questionnaire at final follow-up improved for both pain and function, FHSQ for pain was 96.22 (Range 89-91) and FHSQ for function was 94.64 (Range 91-97), VAS for pain was 3.12 (Range 4-1). VAS for comfort of using the orthotic within the shoe ranged from 7-9 (average 8-80). There is no difference in relief of pain between male and female patients and in patients with normal body mass index, over weight, and obesity. None of our patients had recurrence of symptoms.

## Discussion

Orthoses are commonly used in the conservative treatment of plantar fasciitis. It is thought that foot orthoses reduce the symptoms of plantar fasciitis by reducing strain in the fascia during standing and ambulation [20,21]. Cadaveric research shows that orthoses reduce foot pronation, collapse of the longitudinal arch, and associated elongation of the foot [22]. There are many different types of orthotic devices prefabricated orthoses and customized orthoses. Two important characteristics for successful treatment of plantar fasciitis with orthotics are the need to control overpronation and metatarsal head motion, especially of the first metatarsal head [4,23]. In one study orthotics were cited by 27 percent of patients as the best treatment [19].

Landorf, Keenan et al [24] compared effectiveness of prefabricated orthosis, custom made orthosis and sham orthosis, they found that prefabricated orthosis and custom made orthosis in comparison with sham orthosis had only short term benefits but long term benefits were negligible. None of the series have follow up after discontinuation of orthotic, our patients were followed upto 1 year after treatment, no recurrence observed. In our study all the patients who had relief of symptoms had no recurrence. Relief of symptoms in our opinion may be due to redistribution of weight into uniform area over whole of the foot, there by promoting uniform blood perfusion into calcaneal attachment of plantar fascia. Further studies involving a Doppler scan both before and after orthotic treatment to check any change in vascular pattern is needed to confirm this hypothesis. Large randomized clinical study involving different modalities in similar population group are necessary to check efficacy of one modality over the other.

## Conclusion

Custom made rigid foot orthosis is cost effective method in management of plantar fasciitis. No supplementary analgesics or local corticosteroids are necessary. Very comfortable to use in the shoes, no recurrence of pain is seen.

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