

# Plantar Fasciitis: A Case Review

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## Introduction

Most cases of inferior heel pain are diagnosed as plantar fasciitis.<sup>1</sup> Although the clinical presentations vary, the most common patient types that are affected are the obese female over 40 years of age and the athletic runner. Both types commonly complain of experiencing heel pain (which can be intense), during the first few minutes of a weight bearing stance. Most commonly this pain occurs after rising in the morning from bed and applying a compressive force on the heel. This pain is also repeated during the day once the patient has been seated for a prolonged period of time, and starts to ambulate. Pain eventually subsides as the foot or Achilles tendon stretches.<sup>2</sup> The patient usually describes the pain as “a bruised bone” that is specifically located to the center of the heel. In athletes, plantar fasciitis is usually a consequence of usually an overuse injury. One of the most common contributing factors to this condition is the use of ill-fitting running shoes which lack support in the base. With respect to the proper shoe the American Orthopedic Foot and Ankle Society has developed guidelines for patients who want to avoid foot problems.<sup>3</sup> Their advice with regard to the selection of shoes is very helpful in determining the right fit. Failure to stretch properly pre and post exercise is also a contributing factor with respect to the etiology of the condition.

## Case Report

A 62-year-old male presented to our office with a primary complaint of intense right heel pain. The pain was localized to the anatomical area corresponding to the medial calcaneal tubercle. The patient described that the pain is most intense while

engaging in weight bearing exercise (especially in the first few minutes of the exercise). Some of the aggravating factors described include ill fitting athletic shoes and pain upon compression activity of the heels, i.e., running, jogging. Relieving factors include ice therapy and taping of the area along with the incorporation of support footwear.

Upon physical examination the right foot revealed a normal longitudinal arch in the non-weight bearing position. The arch flattens considerably upon weight bearing activity. The patient has an over-pronated right foot while engaging a gait pattern in mid stance. The voluntary range of motion of the foot and ankle mortice are unremarkable. Motion palpation studies reveal an anterolateral talar position and a displaced navicular bone superiorly. Static palpation reveals a focal tenderness and inflammation in the region of the anteromedial calcaneal tubercle. The basic tenets of an acute inflammatory reaction are present (tumor, dolor, calor, rubor are *functio laesa*). Radiographic evaluation revealed a small boney growth representative of a calcaneal spur at the insertion site of the plantar fascia.

## Signs and Symptoms

The pain of plantar fasciitis is usually well localized in the area of the medial calcaneal tubercle; however, any area of the plantar fascia may be affected. The pain is described as “bruise-like”. It is often excruciating during the first few minutes of weight bearing initiated after a long period of rest. Although this condition rarely has a traumatic onset, a running injury can occur where the foot is twisted resulting in a sudden stretching of the plantar fascia. More commonly, the patient cannot recall a particular event leading to the condition. Aggravating factors include wearing poorly supporting footwear, running and the initial few minutes of weight bearing activity. Relieving factors include rest and wearing of proper footwear.

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Upon physical examination, a foot with a normal arch in the non-weight bearing position that flattens out with weight bearing is evident. Overpronation of the foot is usually pronounced. Gross ranges of motion of the foot and ankle are usually full and pain-free. Orthopedic and neurological testing of the foot usually reveals no abnormalities. Motion palpation of the foot and ankle commonly reveals an anterolateral talus and a superior navicular. Occasionally, superior cuboid and anterior calcaneal fixations are also found. Static palpation reveals a well-localized area of tenderness on the anteromedial calcaneal tubercle.

### Differential Diagnoses

There are a number of plausible diagnoses that need to be differentiated in determining the cause of the heel pain. Two of these conditions plantar fasciitis and Tarsal Tunnel Syndrome are the closest in their clinical presentation (see Table 1, below).

Other conditions that need to be differentially diagnosed are:

*Trauma.* If the heel is involved in a traumatic event, the following must be considered: fracture of the calcaneus, plantar arch strain, or rupture of the plantar fascia. Plain film radiography must be done in order to rule out fracture. Palpable swelling is normally seen in these conditions. A calcaneal fracture is the most common tarsal fracture. Comminuted fractures of the calcaneus may be noted on CT scan.<sup>5</sup>

*Stress Fracture of the Calcaneus.* This type of heel pain usually occurs in a patient who has recently increased their level of weight bearing activity. A radiographic regimen dealing with the initial presentation and followed up 10 days later may be used to assess the degree of the fracture. Usually a radiodense line traversing the posterior portion of the calcaneus is evident.<sup>6</sup> A CT scan may be necessary to locate a stress fracture.

*Bursitis.* Infracalcaneal or subcalcaneal bursitis causes symptoms similar to plantar fasciitis. Posterior calcaneal bursitis gives pain in the posterior superior aspect of the heel.

Table 1: Differential Diagnosis of Plantar Fasciitis and Tarsal Tunnel Syndrome.<sup>4</sup>

	Plantar Fasciitis	Tarsal Tunnel Syndrome
Cause	Overuse Inflammation, inversion,	Trauma, space occupying lesion, pronation, valgus deformity
Pain	Plantar aspect of foot, anterior calcaneus Worse with walking, running, and in the morning (sometimes improves with activity)	Medial heel and medial longitudinal arch. Worse with standing, walking, and at night.
Electrodiagnosis	Normal	Prolonged motor and sensory Latencies
Active movements	Full range of motion	Full range of motion
Passive movements	Full range of motion	May have pain on pronation
Resisted isometric movements	Normal	weakness of foot intrinsics may be Present
Sensory deficits	No	Possible
Reflexes	Normal	Normal

*Plantar Fibromatosis.* This condition is usually due to a contracture of the plantar fascia. It produces a very localized heel pain somewhat similar to that seen in plantar fasciitis. In this condition a thickened plantar fascia is palpable.

*Arthritis.* Subtalar arthritis usually occurs after suffering a traumatic event. The pain is most prominent on subtalar motion and is constant on stress and weight bearing. Radiographs help to confirm the diagnosis.

*Calcaneal Apophysitis.* This is also called Sever's Disease. This is often the cause of heel pain in children 10–13 years of age. Examination reveals tenderness over the calcaneal apophysis. Radiographs usually reveal a fragmentation of the apophysis, and possible displacement.

*Painful Heel Pad.* The pain is similar to plantar fasciitis but is usually more generalized and involves the calcaneal fat pad.

*Metabolic Causes.* There are a lot of metabolic conditions that may lead to heel pain. Gout, pseudogout, and diabetes, are the more common ones. A full blood work up is needed, in order to differentially diagnose the condition.

## Diagnosis

In order to understand the underlying factors that can contribute to plantar fasciitis one must first take into account the anatomical structure of the area. The central part of the plantar fascia is greatly thickened to form the plantar aponeurosis. It consists of a strong, thick central part and weaker and thinner medial and lateral portions.<sup>7</sup>

The plantar aponeurosis consists of longitudinally arranged bands of dense fibrous connective tissue. These bands split to enclose the digital tendons and are attached to the margins of the fibrous digital sheaths and to the sesamoid bones in the great toe.<sup>8</sup> The plantar aponeurosis ultimately attaches to the bases of the proximal phalanges.

The primary function of plantar

aponeurosis is to support the longitudinal arch of the foot to help prevent over-pronation, and to hold the flexor tendons under the metatarsal heads during weight bearing. It takes up 60% of the stresses of weight bearing. A continually increased tension or pull of the plantar fascia on the calcaneus causes the periosteum to become inflamed (periostitis) and tear away from the enthesis. It is the inflammation that causes the pain.

Over-pronation at the subtalar joint unlocks the midtarsal joint causing the arch to sag and the foot to elongate. This stretches the plantar fascia at the center of the arch or at the origin on the heel eventually leading to inflammation and pain. In older people, the plantar fascia tends to lose much of the elasticity placing excessive strain on its calcaneal enthesis. A high arched, semiflexible or rigid foot also increases tension placed on the plantar fascia. Heel spurs form as a reaction to the increased stress at the calcaneal enthesis. These heel spurs themselves are not the cause of the pain.

Severe pain on weight bearing after rest is due to inflammatory edema which accumulates during rest in a site where there is very little space due to the tight compartmentalization of the tissues by strong connective tissue septa. That is, the increased fluid increases the pressure on the nerve endings within the tissue on weight bearing. The pain on weight bearing decreases rapidly within half an hour of weight bearing activity due to the improvement in drainage of both the venous and lymph systems servicing the area.

## Rehabilitative Therapy

The goal established early in the treatment phase is to reduce the surrounding inflammation. Once the inflammatory process has been arrested, resorption of fluid will occur around the site and therefore the patient will begin to experience various degrees

of pain relief. In order to reduce the inflammation, the practitioner must apply ice and ultrasound therapy very intensely for a 1–2 week period. Stabilizing the area is important and therefore taping of the foot may be beneficial in order to prevent further stress on the enthesis. Heel support in the form of a heel cushion and/or orthotic arch support may be used. In the second stage of rehabilitation Achilles tendons stretches and ice massage is recommended. In most cases the support for orthotics and arch support are maintained so as to redistribute the pressure of the weight bearing activity.

Chiropractic treatment for this condition really depends on making the precise diagnosis as to the subluxation and fixations. Graded mobilization and manipulation are helpful in restoring normal biomechanics. A number of different manipulations may be required. These manipulative procedures include the navicular override adjustment for the superior navicular, the triangular thrust adjustment of an anterolateral talus, the superior cuboid adjustment and the anterior calcaneal adjustment.

Medical management often includes cortisone and local anaesthetic injection at the site of pain. This will immediately resolve the pain for 6–12 weeks, however, the cause must be corrected or the pain will reoccur. Although very effective at initially reducing the pain, the side effects of anti-inflammatories must be considered when treating the patient for this condition. Cortisone treatment may be used in severe causes of plantar fasciitis.

### The Nutritional Approach to Plantar Fasciitis

Nutritional data is limited regarding the treatment of plantar fasciitis. An extensive search on MEDLINE (via PubMed) and alternative medical databases (Alt-HealthWatch & AMED) provided little, if any, information regarding specific nutritional treatments for plantar fasciitis. In the book, *A System of Orthopedic Medicine*, the histological description of fascia points to

many possible nutritional interventions.<sup>9</sup> Fascia is a highly fibrous tissue composed of primarily collagen. The collagen consists of a dense network of fibers arranged in a regular pattern according to the stresses placed on them. Fibroblasts are cells that produce collagen, and are also responsible for the non-fibrous ground substance. The non-fibrous ground substance is composed of proteoglycans, which are polysaccharide molecules (glycosamino-glycans or GAGs) bound to a central protein core. Fibroblastic activity is modulated by the partial pressure of oxygen, steroid hormone levels, and nutrition.

Despite the apparent lack of nutritional treatments for plantar fasciitis, the astute clinician could help the patient by utilizing certain nutrients to address some of the factors known to modulate fibroblastic activity.

Useful nutritional interventions could be employed to: (1) improve oxygen transport to the plantar fascia; (2) modify fibroblastic activity in order to “soften” the plantar fascia; and (3) support the structural (histological) composition of the plantar fascia.

*Improving Oxygen Transport to the Plantar Fascia.* To improve the delivery of oxygen to the plantar fascia, the flush-free form of niacin, inositol hexaniacinate (IHN) could be employed. IHN has been shown to be helpful in the treatment of intermittent claudication (IC) and other peripheral vascular diseases.<sup>10,11</sup> The postulated mechanism of action of IHN is arterial dilation, reduction in fibrinogen, improvement in blood viscosity, and resultant improvement in oxygen transport.

Even though the plantar fascia is poorly supplied with blood vessels, IHN supplementation may increase blood flow and oxygen transport to the medial and lateral plantar arteries, and the deep plantar arch, resulting in improved nutrition to the plantar fascia. These benefits may hasten recovery from plantar fasciitis.

The therapeutic dosages used for peripheral vascular diseases have been 2 grams twice daily for at least 3 months. Using the same dosages and treatment duration would be reasonable for the treatment of plantar fasciitis. It would be wise to have liver enzymes checked at three month intervals due to the rare possibility of hepatotoxicity with IHN supplementation. Considering IHN has a fibrinolytic effect, the use of this nutrient with blood-thinning medications should be monitored closely.

*Modifying Fibroblastic Activity in order to "Soften" The Plantar Fascia.* Another reasonable approach to the treatment of plantar fasciitis is to use the potassium salt of para-aminobenzoic acid (Potaba, Glenwood) or para-aminobenzoic acid (PABA). Potaba is a very expensive prescription drug whereas PABA is an inexpensive over-the-counter nutrient that can be found in health food stores and pharmacies. They are almost identical except that Potaba is the potassium salt of PABA. Potaba is an "anti-fibrotic" agent that has been shown to inhibit the accumulation of abnormal fibrous tissue in patients with scleroderma. Potaba can inhibit *in vitro* the growth and macromolecule synthesis of cultured fibroblasts from scleroderma patients.<sup>12</sup> Human studies utilizing Potaba have consistently shown positive benefits on the skin and survival.<sup>13,14</sup> In a retrospective study assessing the skin response to Potaba among 390 patients with scleroderma, 90% of 224 treated patients demonstrated mild, moderate, or marked skin softening.<sup>14</sup> By contrast, less than 20% of a parallel group of 96 patients who did not receive Potaba showed mild or moderate skin improvement at the end of follow-up. The difference in skin softening between the two groups was significant ( $p < 0.0001$ ).

Even though scleroderma is an extremely serious connective-tissue disease, the ability of Potaba to reduce skin fibrosis may mean that its use in plantar fasciitis (a much lesser medical condition) may

prove to be very valuable therapeutically. The fact that fibrosis of the plantar fascia occurs is a very good reason to try a therapeutic trial of Potaba or PABA. Potaba is better tolerated than PABA at high doses. A good approach would be to slowly increase the amount of PABA over 3-4 weeks until 4-6 grams per day has been achieved. High doses are necessary in order to achieve the "anti-fibrotic" effects. Potaba (or PABA) also has the ability to potentiate cortisol by inhibiting its breakdown in the liver.<sup>15</sup> This action may help to reduce the pain associated with plantar fasciitis, may enhance the therapeutic benefits of an injectable corticosteroid derivative (e.g., triamcinolone), or may be able to reduce the amount of injectable corticosteroid derivative required. At 300-400 mg per day, no serious side effects have been reported with Potaba (or PABA).<sup>17</sup> When high doses (such as 8 grams or more per day) have been utilized, nausea, fever, hypoglycemia, leukopenia, and rash have occurred.<sup>15</sup>

*Supporting the Structural (Histological) Composition of the Plantar Fascia.* The plantar fascia is composed of primarily collagen. Vitamin C is involved in two hydroxylation reactions necessary for collagen formation. Two enzymes, prolyl-hydroxylase and lysyl hydroxylase, serve to hydroxylate lysine and are required for the hydroxylysine cross-links in collagen.<sup>18</sup> By acting as a reducing agent, vitamin C is able to keep these enzymes active, and improve the ability of fibroblasts to synthesize collagen. Therapeutic doses of vitamin C range from 500-3000 mg per day. The possible toxicities or contra-indications of vitamin C therapy have been well elucidated.<sup>19</sup>

Another nutrient that supports the structural framework of the plantar fascia is the trace mineral, copper. Copper is a cofactor for the enzyme, lysyl oxidase. This enzyme catalyzes the removal of the epsilon amino group of lysyl residues of a polypeptide and the oxidation of the terminal carbon atom of an aldehyde.<sup>20</sup> In

other words, an intake of copper that satisfies the RDA is necessary for proper collagen cross-linking. An observational study pertaining to dietary intakes of copper demonstrated that 75% of daily diets in the United States fail to contain the RDA of 2-3 mg/day.<sup>21</sup> Optimal daily doses should be between 2-4 mg/day. This amount is safe for long-term use. It is imperative that copper levels be monitored regularly since large doses of vitamin C can cause copper depletion, and copper treatment may induce a zinc deficiency due to the reciprocal relationship of these minerals in the body.<sup>22</sup>

Supporting the integrity of the fascia by supplying copper and vitamin C may re-regulate disordered fibroblastic activity by promoting healthy connective tissue formation. Improving fibroblastic activity may be a factor in alleviating fibrosis formation and/or the pain associated with plantar fasciitis.

#### Theoretical Model Linking Repetitive Microtrauma and Nutrition in the Treatment of Plantar Fasciitis

In plantar fasciitis, the heel pain and other symptoms are the result of repetitive microtrauma overload injury at the attachment of the plantar fascia to the inferior aspect of the calcaneus.<sup>23</sup> The author's belief that the resulting fibrosis and tension along the plantar fascia compromises blood flow (i.e., diminishes oxygen supply and nutrition), leading to disordered fibroblastic activity, and further pain, inflammation, and fibrosis formation.

To break this vicious cycle, biomechanical interventions and nutritional measures should be instituted immediately. In addition to biomechanical treatments, We suggest the following nutritional plan: (1) IHN supplementation at 2 grams twice daily for 3 months or longer to improve blood flow, oxygen transport, and nutrition; (2) PABA supplementation, beginning gradually, and working up to 2-3 grams twice daily for 8 weeks to soften the plantar fascia (i.e., reducing fibroblastic activity and

fibrosis formation); (3) Taper PABA to 500-1000 mg daily for 4 weeks or longer once softening of the plantar fascia has occurred; and (4) Once PABA supplementation has been tapered down, 2 mg of copper daily and 1500 mg of vitamin C twice daily in order to support "normal" fibroblastic activity within the plantar fascia.

#### Conclusion

This article presents a case report of plantar fasciitis. It is imperative to correctly differentially diagnose this condition in order to treat it effectively. A plausible treatment regimen that incorporates the strengthening and repair of vital histological structures has been presented. Further studies should be directed towards the strengthening of the structural components of the plantar fascia. It may be through the use of an orthomolecular medical approach that both correction and prevention of this condition can come about.

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