Review article

Plantar fasciitis - an update

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Abstract:
Plantar fasciitis is one of the most common causes of inferior heel pain managed by many physical therapists in variety of clinical settings and wildly treated conservatively. It is usually caused by a biomechanical imbalance resulting in tension along the plantar fascia. It is estimated that 11% to 15% of all foot complaints requiring medical attention can be attributed to this condition. The patient typically presents with inferior heel pain on weight bearing. Pain associated with plantar fasciitis may be throbbing, searing, or piercing, especially with the first few steps in the morning or after periods of inactivity. This article present on overview of the current knowledge on plantar fasciitis and focuses on biomechanics, etiology, diagnosis and treatment strategies, conservative treatment including the physical therapy management are discussed. This information should assist health care practitioners who treat patients with this disorder

Key words: heel pain; micro trauma; biomechanical imbalance

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Introduction

Plantar fasciitis is a degenerative syndrome of plantar fascia resulting from repeated trauma at its origin on the calcaneus[1]. Although a misnomer, this condition is sometimes referred to as heel spurs by the general public. There are many diagnoses within the differential of heel pain. [2] The typical presentation is sharp pain localized at the anterior aspect of the calcaneus. Plantar fasciitis is often associated with a heel spur; however, many asymptomatic individuals have bony heel spurs, whereas many patients with plantar fasciitis do not have a spur.[3]Plantar fasciitis can be a difficult problem to treat, with no panacea available. Fortunately, most patients with this condition eventually have satisfactory outcomes with nonsurgical treatment.[4] Therefore, management of patient expectations minimizes frustration for both the patient and the provider. Plantar fasciitis is a common cause of heel pain, affecting10% of the general population. Men, usually between ages 40-70, are affected more than woman[5]. The pain is worst early in the morning and often improves with activity. Patient complains of pain in the sole or heel during weight bearing and is relieved once it is discontinued[6]. On examination, there is tenderness over the medial side of the calcaneum. It is characterized by pain at the insertion of the plantar fascia. Diagnosis is based on the patient history and on the result of the physical examination. The patient typically presents with inferior heel pain on weight bearing. Pain associated with plantar fasciitis may be throbbing, searing, or piercing, especially with the first few steps in the morning or after periods of inactivity.[7]Planterfascitis is usually treated conservatively. Conservative treatment includes medical therapy and physical therapy. Medical therapy includes NSAIDs, injecting local steroids etc[8]. Physiotherapy includes taping, stretching,

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night splints, shoe insert, thermal modalities, ultrasound therapy, laser therapy and custom foot orthosis etc. Conservative treatment is almost always successful, most patients respond and are better within 9 months of physiotherapy treatment.

Biomechanics

The plantar aponeurosis is a dense fascia that runs nearly the entire length of the foot. Although other passive structures contribute to arch support, the role of the plantar aponeurosis (plantar fascia) is particularly important. It begins posteriorly on the medial tubercle of the calcaneus and continues anteriorly to attach by digits to the plantar plates and then, via the plates, the proximal phalanx of each toe[9]. From the beginning to the end of the stance phase of gait, the tension of the plantar aponeurosis increases shows that the plantar fascia deforms 9% to 12% on stretching during this time.[10] The plantar fascia, primarily as a result of its anatomical position, great mechanical and biomechanical properties. Rupture and partial or complete surgical sectioning of the plantar fascia, may lead to progressive pes planus with associated.[11] The plantar aponeurosis, as the tie-rod, holds together the anterior and posterior struts when body weight is loaded on the triangle. This structural design is efficient for the weight-bearing foot because the struts (bone) are subjected to compression forces; whereas the tie-rod (aponeurosis) is subjected to tension forces. Bending moments of the bone that can cause injury are minimized. The fibrocartilaginous plantar plates of the MTP joints are organized not only to resist compressive forces from weight bearing on the metatarsal heads but also to resist tensile stresses .Plantar aponeurosis , as the tie-rod , holds together the anterior and posterior struts when the body weight is loaded on the triangle. This structural design is efficient for the weight-bearing foot because the struts (bone) are subjected to compression forces; whereas the tie-rod (aponeurosis) is subjected to tension forces. Bending moments of the bone that can cause injury are minimized[12]. The fibrocartilaginous plantar plates of the MTP joints are organized not only to resist compressive forces of weight bearing on the metatarsal heads but also to resist tensile stresses presumably applied through the tensed plantar aponeurosis.

The tension in the plantar aponeurosis (the tie-rod) in the loaded foot in evident if active or passive MTP extension is attempted while the triangle is flattened (i.e., when the subtalar and transverse tarsal joints are pronated). The range of MTP extension will be limited .

Through the pulley effect of the MTP joints on the plantar aponeurosis , the plantar aponeurosis , acts interpedently with the joints of the hindfoot to contribute to increasing the longitudinal arch (supination of the foot) as the heel rises during the metatarsal break, thus

contributing to converting the foot to a rigid lever for effective push-off . The tightened plantar fascia at the MTP joints, prevents excessive toe extension that might stress the MTP joints or allow the LOG to move anterior to the toes[13].

Etiology

The cause of plantar fasciitis is often unclear and may be multifactorial. Because of the high incidence in runners, it is best postulated to be caused by repetitive microtrauma. Possible risk factors include obesity, occupations requiring prolonged standing and weight-bearing, and heel spurs.[14] Other risk factors may be broadly classified as either extrinsic (training errors and equipment) or intrinsic (functional, structural, or degenerative) . Training errors are among the major causes of plantar fasciitis. Athletes usually have a history of an increase in distance, intensity, or duration of activity. The addition of speed workouts, plyometrics , and hill workouts are particularly high-risk behaviors for the development of plantar fasciitis. Running indoors on poorly cushioned surfaces is also a risk factor . Appropriate equipment is important. Athletes and others who spend prolonged time on their feet should wear an appropriate shoe type for their foot type and activity (see Treatment).[15] Athletic shoes rapidly lose cushioning properties.[16] Athletes who use shoe-sole repair materials are especially at risk if they do not change shoes often. Athletes who train in lightweight and minimally cushioned shoes (instead of heavier training flats) are also at higher risk of developing plantar fasciitis .

Risk factors

Structural risk factors include pes planus, overpronation, pes cavus, leg-length discrepancy, excessive lateral tibial torsion, and excessive femoral anteversion.[17]

Athletes with pes planus (low-arched) or pes cavus (high-arched) feet have increased stress placed on the plantar fascia with foot strike.[18] Pronation is a normal motion during walking and running, provid-

ing foot-to-ground surface accommodation and impact absorption by allowing the foot to unlock and become a flexible structure. In athletes, Planterfascitis appears to be associated with overuse, training errors, training on unyielding surfaces and wearing improper footwear. Sudden increases in weight bearing activity, particularly those involving running, can cause micro trauma to the planter fascia at a rate that exceeds the body's ability to recover[19]. In athletes, Planterfascitis appears to be associated with overuse, training errors, training on unyielding surfaces and wearing improper footwear. Sudden increases in weight bearing activity, particularly those involving running, can cause micro trauma. Leg-length discrepancy, excessive lateral tibial torsion, and excessive femoral anteversion can lead to an alteration of running biomechanics, which may increase plantar fascia stress. As regards functional risk factors, tightness in the Gastrocnemius and Soleus muscles are mainly involved. Achilles tendon is considered a risk factor for plantar fasciitis. Reduced dorsiflexion has been shown to be an important risk factor for this condition.[20] Weakness of the gastrocnemius, soleus, and the intrinsic foot muscles is also considered a risk factor for plantar fasciitis.

Pathophysiology

A Subcalcaneal pain syndrome in athletes is thought to be brought on by an overload of the plantar fascia. However, the mechanism of this overload is debated. Overload causes micro-tears at the fascia bone interface of the calcaneum or within the substances of the plantar fascia alone[21] The central band of the plantar fascia is primarily affected where a hyper-cellular, an inflammatory response occurs within the fibres of the fascia, leading to degenerative changes.

Sign and Symptoms

Acute diffuse swelling of digits, Pain at the medial calcaneal tuberosity, Swelling over Achillis insertion, Enthesopathy, Periostitis. The classical presentation of PF in pain in the sole of the foot at the inferior region of the heel. Patient report the pain to be particularly bad with the first few steps taken on rising in the morning or after an extended refrain from weight- bearing activity. The pain can be so severe the patient limps or hobbles around with the affected heel off the ground. After a few steps and through the course of the day, the heel pain diminishes, but returns if intense or prolonged weight-bearing activity is undertaken. Generally, the pain is more significant when weight bearing activities are involved, and can often be correlated to increased amount or intensity of physical activity prior to the onset of symptoms. Some patients may also secondarily develop lower back pain.

Diagnosis

Diagnosis of Planterfascitis is usually made on the basis of history and physical examination.Pain on first rising in the morning is typical of Planterfascitis, and may be helpful in distinguishing it from other forms of heel pain. For example, in the case of a calcaneal stress fracture or nerve entrapment; the pain would actually increase with more walking rather than diminish after the first few steps. Associated paraesthesia is not a common characteristic of Planterfascitis. Nocturnal pain should raise suspicion of other causes of heel pain, such as tumors, infections, and neuralgia (including tarsal tunnel syndrome). Planterfascitis is usually unilateral, but up to 30% of cases have a bilateral presentation. Bilateral disease in young patients may indicate Reiter's syndrome. The diagnosis of plantar fasciitis is made with a reasonable level of certainty on the basis of a clinical assessment alone[22] Patients should be questioned about other features of Seronegative arthritidities.[23] Patients typically report an insidious onset of pain under the plantar surface of the heel upon weight bearing after a period of non-weight bearing. This pain in the plantar heel region is most noticeable in the morning with the first few steps after walking or after a period of inactivity. In some cases, the pain is so severe that it results in an antalgic gait. The patient will usually report that the heel pain becomes less with increasing levels of activity (i.e. walking, running), but will tend to worsen toward the end of the day[54]

Differential diagnosis

The following differential diagnoses have been suggested for plantar heel pain.

Calcaneal stress
Bone bruise
Fat pad atrophy
Tarsal tunnel syndrome
Soft-tissue, primary or metastatic bone tumors
Paget disease of bone
Saver's disease
Referred pain as a result of an S I radiculopathy.

Management

Non-operative Management

Conservative treatment for plantar fascitis should

focus on decreasing pain, promoting healing, restoring range of motion and strength, correcting training errors, limiting biochemical deviations caused by structural abnormalities and improving the nutrition.[24]

Orthosis: Foot orthosis is used to decrease abnormal foot pronation that is thought to cause increased stress on the medial band of the plantar fascia. Foot orthosis can reduce the strain in the plantar fascia during static loading, reduce the collapse of the medial longitudinal arch and reduce elongation of the foot associated with pronation[25].

The primary objects in using heel pad and orthotic were

To promote proper biomechanical alignment of the foot (neutral)

To achieve maximum comfort by using materials that absorb shock.

To provide cushioning and comfort exactly to the contour of the foot.

To attain time and cost efficiency.

This device should be considered as a first line of treatment for older persons with Planterfascitis.

Night Splints: Posterior tension night splint maintains ankle dorsiflexion and extension, creating a constant mild stretch of the plantar fascia that allows it to heal at a functional length. Physicians can make custom splints in the office or purchase prefabricated splints. One Cochrane review found limited evidence to support the use of night splints to treat patients with pain lasting more than six months. Patients treated with custom made night splints improved , but patients treated with prefabricated night splints did not. The purpose of night splinting is to keep the patient's ankle an a neutral position overnight, passively stretching the calf and plantar fascia during sleep. The intent is to allow the fascia to heel. Clinically study of night splinting has yielded mixed reviews. Some reports claim improvement in approximately 80 % of patients. In contrast, one study 116-120 patients showed no benefits after three months compared to no treatment.[26] Shoes should have adequate arch support and cushioned heels. For individuals with pes planus, a shoe with longitudinal arch support can help decrease pain associated with long periods of standing. A change in footwear was cited by 14% Planterfascitis patients as the treatment that worked best.[27]

Anti-inflammatory Agents: Anti-inflammatory agents, whether administered orally, topically or through an injection, have been a cornerstone in the treatment of plantar fasciitis. There is limited evidence to support the use of steroid injection to provide short-term pain relief[28].

Physiotherapy Treatment

Ultrasound Therapy: Ultrasound may control pain by its transmission on perception or by modifying the underlying condition causing the pain. These effects may be the result of stimulation of the cutaneous thermal receptors on increased soft tissue extensibility due to increased tissue temperature. The result of change in nerve conduction due to increased tissue temperature is the non-thermal effect of ultrasound. The modulation of inflammation is due to the non-thermal effects of ultra-sound. Continuous ultrasound of 0.5 to 2.0 w/cm^2 intensity and 1.5 MHz frequency has also been reported to be more effective than superficial heating with paraffin or deep heating with short wave diathermy for relieving the pain from soft tissue injuries when applied within 48 hours of injury

LASER Therapy: Low- intensity LASER therapy or low level LASER therapy is a generic term that defines the therapeutic application of relatively low out putt (<500)LASER and monochromatic super luminous diodes for the treatment of disease and injury at a dosage (usually<35/cm^2) generally considered to be too low to affect any detectable heating of the irradiated tissue.. The radiation generated by therapeutic LASER device differs from that produced by other sources in three respects.

Stretching and strengthening: Stretching and strengthening programs are valuable because they can help correct functional risk factors, such as tightness of the Achilles tendon and weakness of intrinsic muscles of the foot. Commonly used stretches are curls or stair stretches, which focus on stretching the gastrocnemius and soleus muscles. Stretching of the plantar fascia can be conducted similarly like the self myofascial release technique[29]

The dosage for calf stretching can be either 3 times a day or 2 times a day utilizing either a sustained (3 minutes) or intermittent (20 seconds) stretching time, as both are shown to produce similar effects.

Taping: Studies indicate that taping causes improvement in function of planter fascia in Planterfascitis. Calcaneal or low-Dye taping can be used to provide short-term (7 to 10 days) pain relief. Low Dye taping of the foot has been shown to be effective in limiting pronation

Extra corporeal shock waves therapy: Extra corporeal shock waves have been applied since 1990, principally in Europe for treatment of numerous musculoskeletal disorders.Proponents of extra corporeal shock wave therapy (ESWT) also referred to as orthotripsy, claim it offers an effective means of treatment for chronic plantar fasciitis among the non-surgical treatments. It uses pulses of high- pressure sound waves to bombard damaged tissue to relieve pain associated with PF. It is non-invasive and has a relatively short recovery time.[30]

Operative Treatment

Isolated partial or complete release of the plantar fascia or a fascia release combined with resection of the plantar calcaneal spur and excision of the spur are surgical treatment options for recalcitrant planter fascitis[31] An open procedure requires a 3-6 mm plantar medical incision to release the fascia never decompression and /or resection of calcaneal spur may also be performed at this time. Devise et at reported that 50% of patients with heel pain were totally satisfied with the results of surgical intervention. Although Confetti and Tarquinii noted a high satisfaction rate, only 57% of their patients had functional recovery postoperatively. Consequently, it is believed that it is important to further optimize imperative treatments prior to considering surgical options.

Conclusion

Plantar Fasciitis is considered to be one of the most common cause of inferior heel pain in both athletic and non athletic population. The diagnosis is typically based on the history and the finding of localized tenderness. Many treatment options exist, including rest, stretching, change of footwear, low dye taping, ultra sound therapy, orthotics, night splints, anti-inflammatory agents and surgery.

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