Types of Manual Therapy for the Treatment of Plantar Fasciitis
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Plantar fasciitis is a condition affecting the medial aspect of the dense connective fibrous aponeurosis on the sole of the foot. It is the most common cause of inferior heel pain, accounting for 11-15 percent of all foot symptoms requiring medical care among adults.[1,2,3]

Anatomical Characteristics

The plantar fascia consists of three bands; medial, central and lateral. The central portion is the primary component affected in plantar fasciitis and is functionally and structurally the most significant.[4]

The central band is triangular in shape, measuring 12 cm longitudinally from medial tubercle to metatarsal joints and 12-29 mm at its widest berth at the origin.[5,4] Originating at the medial tuberosity of the calcaneus, the fascia separates into five longitudinal bands inserting onto the metatarsals and phalangeal capsules of digits one through five.[4] These bands also connect to various osseous, ligamentous and muscular tissues at both the superficial and deep layers of the plantar foot.[4,5]

The plantar fascia is composed predominantly of Type I collagen fibers with some Type II and Type III. Within these fibers are hyaluronan, nerve endings, Ruffini and Pacini corpuscles.[5]

Biomechanical Function

The plantar fascia functions as both a supporter and stabilizer of the medial longitudinal arch during gait and weight bearing by acting as a windlass mechanism.[7]

The plantar fascia resists the combined downward compressive force of the body weight and the corresponding upward ground reaction force by virtue of its osseous connection.[7] The plantar fascia undergoes a stretch tension from these forces, preventing flattening of the medial longitudinal arch, thus elevating the arch.[7]

During the propulsive phase of gait, dorsiflexion of the toes wind the plantar fascia around the head of the metatarsal.[7] This winding shortens the plantar fascia and elevates the medial longitudinal arch while creating a varus position of the calcaneus that locks the talonavicular and calcaneocuboid joints into stabilizing the midfoot.[6,7]

Factors Contributing to Plantar fasciitis

The etiology of plantar fasciitis is unknown.[8] Multiple factors such as increased body mass index (BMI), pes planus, decreased dorsiflexion, pes cavus with a rigid high medial arch, tight gastrocnemius, shorten Achilles tendon, forefoot pronation, excessive tibial torsion, and shoes with stiff soles can contribute to this condition.[9,8]

The development of plantar fasciitis is believed to be from mechanical overload, creating repetitive microtrauma and excessive strain, resulting in failure at the calcaneal attachment.[10,2.11]

Histological studies have shown cellular and anatomical changes that correspond to a chronic degenerative process rather than inflammatory.[12,9] Changes include degeneration of collagen fibers, increase in fibroblasts, presence of vascularity and ground substance and lack of inflammatory mediators.[12,2,13] This myxoid degeneration replaces the normal cellular matrix but is mechanically inefficient. At night, with the foot in an equinus position, the plantar fascia contracts and with the first step in the morning, the fascia is stretched abruptly, thus causing pain and irritation.[9] Anatomically, the plantar fascia showed a thickening from the normal 3mm to 15 mm.[14]

Presentation of Plantar Fasciitis

The definitive presentation is medial heel pain that is most pronounced when taking the first step in the morning or after long periods of inactivity.[1,11,2,14] The pain is generally unilateral, sharp, and non-radiating. Increase in activity during the course of the day decreases the pain while prolonged weight bearing exacerbates the pain.[9,1,2] Paresthesia and nocturnal pain are rarely present.[15]

Clinically, there is tenderness and pain on palpation over the medial calcaneal tuberosity with possible extension along the plantar fascia.[2] Possible swelling over the medial calcaneus without signs of erythema or warmth.[9] Examination may reveal restricted active dorsiflexion of the foot, decreased dorsiflexion of hallux, tight Achilles tendon and gastrocnemius muscles.[9] Increased pain is noted with forced dorsiflexion of the foot and hallux and when walking on the toes.[15] Plantar Fasciitis is a self-limiting condition that generally resolves within one year.[16,1] Determination of plantar Fasciitis is self-evident based on clinical findings. Additional diagnostic evaluations are not essential for confirmation.[16,13]

Manual Therapy Options

Multiple treatment options exist ranging from conservative to surgical. However the efficacies of each treatment are variable without a strong evidence of its benefit.[15,8,17] Despite the limited evidence, many studies advocate initiating a conservative treatment approach.[8,16,11,10,18] Of the conservative treatments mentioned in the literature, the following were shown to be relevant and within the scope of practice for the osteopathic manual practitioner.

Stretching

Stretching of the plantar fascia and Achilles-gastroc-soleus complex has shown to decrease pain and improve recovery time.[8,11,17,16,12,19] Plantar fascia specific stretch was cited to have the most effect in reducing morning pain.[11]

For the plantar fascia stretch, the affected foot is crossed over onto the contralateral knee. The hallux is pulled into dorsiflexion until a stretch is felt at the plantar fascia insertion. The stretch is held for 10 seconds and repeated for three sets of 10 daily.[11] The wall stretch for the Achilles-gastroc-soleus complex is performed with straight knee to isolate the gastrocnemius muscle and bent knee for the soleus and Achilles tendon.[17] (Figs 1 and 2 in Appendix 1)

Manual Trigger Points and Deep Tissue Massage

Tight myofascial bands and trigger points in the gastrocnemius muscle can contribute to plantar fasciitis pain.[20,21,22] Trigger point and deep massage therapies were directed at both the

lateral and medial gastrocnemius. Trigger point technique involved application of pressure to the trigger points until an increase in muscle resistance was felt by the practitioner. The pressure was maintained until the practitioner perceived release of the taut band. The pressure was then increased to return to previous trigger point tension. The process was repeated for 90 seconds.[22] For the deep massage therapy, painful areas were palpated and a forceful soft tissue massage mobilization technique was applied to the affected area. The technique was applied across the muscle fibers with sufficient sweep and depth until the pain response was obtained. [22]

Myofascial Release

In studies comparing myofascial release therapy to ultrasound therapy, myofascial therapy showed greater effectiveness in reducing pain, decreasing mobility and improving function than ultrasound therapy.[23,24] In these studies, the direct technique of applying direct pressure on the restricted fascia were used.

Ajimsha et al.,[24] treated the gastrocnemius at three different sites. At the Achilles tendon portion, the practitioner contacts the tendon and establishes a line of tension in a superior direction and slowly engages the tissue while the client dorsiflexes the foot. The focus of release is at the junction of the tendon and muscles, performed for 5 minutes, one repetition. At the epicondyles of the femur, the tendons of the gastrocnemii are contacted with an inferiorly directed line of tension. Pressure is applied slowly into the tendinous structures of the posterior knee and continued to the superior portions of the fibrous part of the muscle while the client dorsiflexes, performed for 5 minutes, one repetition. At the medial and lateral aspects of the calcaneus, an inferiorly directed line of tension is established and a slow release proximally is initiated while the client performs three repetitions of dorsiflexon from plantar flexion, for 5 minutes, 1 repetition.

For the soleus muscle, the client's knee is flexed 10-15 degrees, the Achilles tendon is contacted and pressure is gradually applied through the tendon into the investing fascial layer between the soleus and gastrocnemius. A line of tension is placed in a superior direction with the tissue engaged and the client dorsiflexes, for 5 minutes and repeated once.[24]

For the plantar fascia, the client's foot is off the end of the table. Using a knuckle contact on the soft tissue anterior to the calcaneus, a line of tension is placed in an anterior direction towards the ball of the foot and into the deep layers while the client flexes and extends the toe, for 5 minutes with two repetitions.[24]

In Shah's study,[23] the practitioner stabilizes the ankle with one hand, with the knuckle of the other hand contacting the fascia, pressure is applied to the restricted fascia while exerting tension on the fascia. Tension is maintained for 90 seconds. Total treatment time for 15 minutes.

Counterstrain

Urse[11] listed the Heinking counterstrain method for treatment of tender points. With patient in supine position, ipsilateral knee flexed, the practitioner places one thumb on the tender point at the plantar fascia insertion. While monitoring the tender point with the thumb, the toes and ankle are plantar flexed, curving around the tender point until symptomatic relief of the tenderness is felt by the monitoring thumb. If required, supination or pronation of the foot can be added. The position of ease is held for approximately 90 seconds or until there is softening of the tissues below the monitoring thumb. The foot is then returned to neutral position without moving the thumb and the tender point re-assessed.

For Wynne et al.,[25] counterstrain treatments were applied to tender points in the foot, ankle and lower leg. Brief mechanical pressure was applied on each tender point with one finger tip to determine tenderness and tissue tension. The appropriate joint was then moved into various positions of ease until 70% to 80% of relief was achieved when the same pressure was reintroduced. The position was maintained for 90 seconds, the joint was then slowly returned to neutral position and the tender points re-examined.

References

1. Buchbinder R. Plantar fasciitis. N Engl J Med. 2004;350:2159-66.

2. Lareau CR, Sawyer GA, Wang JH, et al. Plantar and medial heel pain:diagnosis and management. J. Am Acad Orthop Surg; 2014:22:372-380.

3. Irving DB, Cook JL, Menz HB. Factors associated with chronic plantar heel pain: a systematic review. J Sci Med Sport; 2006:9:11-22.

4. Wearing SC, Smeathers JE, Urry SR et al. The pathomechanics of plantar fasciitis. Sports Med.2006; 36 (7): 585-611.

5. Stecco C, Corradin M, Macchi V et al. Plantar fascia anatomy and its relationship with Achilles tendon and paratenon J. Anat. 2013;223, pp665-676.

6. Daniels T. Plantar fasciitis (heel pain). Discussion paper prepared for The Workplace Safety and Insurance Appeals Tribunal. 2003.

7. Bolgla L, Malone TR. Plantar fasciitis and the windlass mechanism: a biomechanical link to clinical practice. J Athletic Training. 2006;39:77-82 .

8. Covey CJ, Mulder M. Plantar fasciitis: how best to treat? J Family Practice. 2013;62:466-471.

9. Babcock M. Plantar fasciitis. In Cooper G,(ed.) Therapeutic uses of botulinum toxin. New Jersey:Humana Press Inc.:2007:75-89.

10. Puttaswamaiah R, Chandran P. Degenerative plantar fasciitis: A review of current concepts. The Foot;2007:17:3-9.

11. Urse GN. Plantar fasciitis: a review. Osteopathic Family Physician ;2012: 4: 68-71.

12. Dyck D Jr, Boyajian-O'Neill LA. Plantar fasciitis. Clin J Sport Med 2004;14:305–309.

13. Karagounis P, Tsironi M, Prionas G, et al. Treatment of plantar fasciitis in recreational athletes two different therapeutic protocols. Foot Ankle Spec; 2011:4:226-34.

14. Singh D, Angel J, Bentley G, et al. Fortnightly review: plantar fasciitis. BMJ;1997:315:172-175.

15. Guijosa AL, O'Mullony Muñoz I, Escribá de La Fuente M, et al. Plantar fasciitis: evidence-based review of treatment . Reumatol Clin. 2007;3:159-65.

16. Tahririan MA, Motififard M, Tahmasebi MN, Siavashi B. Plantar fasciitis. J Res Med Sci. 2012;17:799-804.

17. Feinblatt JS. Plantar fasciitis/faciosis. In Philbin T.M.(ed.), Sports injuries of the foot: evolving diagnosis and treatment. New York: Springer Science+Business Media: 2014: 129-150.

18. Rosenbaum AJ, DiPreta JA, Misener D. Plantar heel pain. J Bone Joint Surg Am; 2010;92;2514-22.

19. Rompe JD, Cacchio A, Weil L Jr, Furia JP et al. Plantar fascia-specific stretching versus radial shock-wave therapy as initial treatment of plantar fasciopathy. J Bone Joint Surg Am;. 2010;92:2514-22.

20. Renan-Ordine R, Alburquerque-Sendín F, de Souza DP, et al. Effectiveness of myofascial trigger point manual therapy combined with a self-stretching protocol for the management of plantar heel pain: a randomized controlled trial. J Orthop Sports Phys Ther; 2011:41:43-50.

21. Cleland JA, Abbott JH, Kidd MO Manual physical therapy and exercise versus electrophysical agents and exercise in the management of plantar heel pain: a multicenter randomized clinical trial. J Orthop Sports Phys Ther;2009:39:573-85.

22. Saban B, Deutscher D, Ziv T. Deep massage to posterior calf muscles in combination with neural mobilization exercises as a treatment for heel pain: a pilot randomized clinical trial. Man Ther; 2014: 19:102-8.

23. Shah H. A study on effect of myofascial release in plantar fasciitis. IJPOT;2014:21:261-66.

24. Ajimsha MS, Binsu D, Chithra S. Effectiveness of myofascial release in the management of plantar heel pain: a randomized controlled trial. Foot (Edinb).; 2014: 24:66-71.

25. Wynne MM, Burns JM, Eland DC et al. Effect of counterstrain on stretch reflexes, hoffmann reflexes, and clinical outcomes in subjects with plantar fasciitis. J Am Osteopath Assoc; 2006:106:547-56.

APPENDIX 1

Fig. 1 Plantar Fascia Stretch. Grasp the hallux and pull it into dorsiflexion until a stretch is felt in the arch of the foot. Taken from Wearing SC, Smeathers JE, Urry SR et al. The pathomechanics of plantar fasciitis. Sports Med.2006; 36 (7): 585-611.

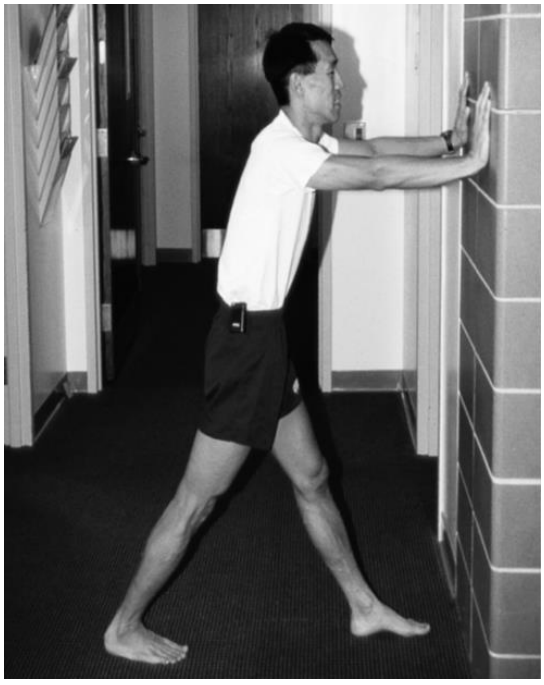
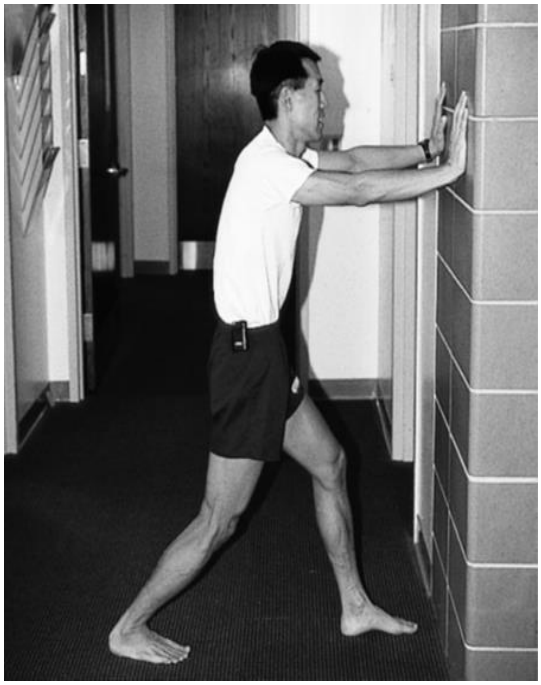
a)  b) 

Fig 2: Wall stretches for right a) Achilles and soleus and b) gastrocnemius muscles. Taken from Young CC, Rutherford DS, Niedfeldt MW. Treatment of plantar fasciitis. Am Fam Physician; 2001:63:467-74.