

The Benefits of Laser Therapy and Hooking in the Treatment of Plantar Fasciitis: A Narrative Review

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Abstract: Plantar fasciitis is an inflammation that affects the plantar aponeurosis, causing pain. Although it is not a lethal injury, if left untreated, it can become a disabling condition. Laser therapy is a physiotherapy treatment that provides an analgesic effect, acting on acute or chronic bone and tendon injuries, increasing collagen synthesis and phagocytic activity, repair, and the release of cytokines that will reduce the inflammatory reaction. Hooking is a tool that has been widely used by physiotherapists due to its low cost, ease of use, non-invasive nature, and its indication for the treatment of numerous traumatic injuries and inflammations of the musculoskeletal system in general, as well as scar tissue adhesions. The aim of this study was to report the benefits of laser therapy and hooking in the treatment of plantar fasciitis. Here, Laser therapy demonstrated significant improvement in 2 of the 3 articles found for this review, potentially providing improvement in pain, healing process, among others. Therefore, more high-quality studies are needed to prove the efficacy of laser treatment in plantar fasciitis. The present study showed positive effects of both techniques. Reports show good results and efficacy in the treatment of plantar fasciitis.

Keywords: Plantar fasciitis; Treatment; Physiotherapy; Systematic review; Laser therapy; Hooking.

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1. Introduction

The foot, as a complex structure of the human body, is responsible for various functions such as posture, support, balance, among others [1]. The bones of the foot are positioned in a way that forms four arches on the sole of the foot: metatarsal, transverse, medial longitudinal, and lateral arches [2]. In contact with the ground, the foot is responsible for weight distribution and impact absorption, assisted by the arches. The sole of the foot does not maintain complete contact with the ground during walking, being distributed in three points: the posterior part of the calcaneus that serves as the support, the insertion of the plantar fascia, and two other supports in the anterior part of the foot [3].

During the walking phase, the body's weight is distributed between the front and back of the foot. When the foot touches the ground, the initial pressure is supported by the heel, passing along the arch which then flattens and transfers the pressure to the toes, and the hallux returns to the initial propulsion [4]. The plantar fascia is made up of fibrous, non-elastic tissue, located along the sole of the foot, from the heel to the toes [5]. Plantar fasciitis (PF) is characterized by inflammation of the plantar aponeurosis. This condition is located in the heel region or throughout the plantar fascia. PF causes pain and difficulty in walking, especially during the first steps in the morning, which can extend throughout the day, affecting the individual's functionality and becoming disabling [6, 7].

The joints of the foot and ankle play an important role in stability, being fundamental in the propulsion phase of walking, providing a stable base for body posture and being able to support the physiological loads imposed on them. This capacity is due to the anatomical arrangement of the bones, ligaments, and muscles, and the proper kinematics of the different joints [8]. The movements of the feet are responsible for absorbing impacts, maintaining balance, and distributing forces [8]. Some biomechanical considerations include excessive pronation, valgus foot, flat foot, Achilles tendon stiffness, calf muscle weakness, and discrepancies in the lower joints [9].

It is estimated that about 10% of the world's population has or will have foot pain at some point in their lives. In Brazil, there are no conclusive data on the incidence of the pathology due to insufficient epidemiological studies on the subject [7, 10]. The etiology of PF is divided into several factors such as excessively high or flat feet, reduced ankle dorsiflexion, as well as the natural advancement of age and increased body weight. The literature shows that women are more prone to developing PF, due to the physical structure of their feet and extrinsic factors such as wearing inappropriate footwear for long periods [11].

Although plantar fasciitis is generally associated with heel pain, only 5.2% of patients with PF have a heel spur, indicating that the pathology may not be directly linked to the pain syndrome; this association may be related to repeated traction at the origin of the plantar fascia [5]. The pain originates in the central portion of the plantar fascia, and when it becomes deeper, it may represent inflammation of the abductor nerve of the fifth toe. The causes of PF are diverse, and it may be directly related to biomechanical and/or anatomical changes, such as constant use of inappropriate footwear, excessive pronation of the subtalar joint, lack of flexibility of the longitudinal arch, muscle stiffness of the triceps surae, and differences in the length of the lower limbs [5, 10]. For approximately 20 years, low-power laser therapy has been used and investigated in clinical practice. Over time, therapists and researchers have questioned its clinical benefits due to the discrepancies found in studies addressing the topic. These researchers suggest a more cautious interpretation of the results to be reproduced clinically. Therefore, it is necessary to describe in detail all the parameters to be applied in its use: beam area, wavelength, energy density, energy delivered to the tissue, power density, and application time [12].

Among the benefits resulting from laser therapy are the analgesic effect on acute or chronic bone, muscle, and tendon injuries, increased collagen synthesis and phagocytic activity, which will accelerate the repair process, as well as the release of cytokines that will reduce the inflammatory reaction [13]. The hooking technique is a tool that has been widely used by physiotherapists due to its low cost, ease of use, non-invasive nature, and, when used correctly, it does not pose risks to patients. It is indicated for the treatment of numerous pathologies of traumatic origin and inflammations of the musculoskeletal system in general, as well as scar tissue adhesions [14]. This technique was created in the 1970s and was proposed by a Swedish physiotherapist named Kurt Ekman. He realized that the size of his fingers did not allow him to precisely reach certain anatomical elements. So, he had the idea of using various material instruments (wood, horn, turtle shell) to mobilize them [15]. The present study aimed to show the benefits of laser therapy and hooking in the treatment of plantar fasciitis.

2. Material and Methods

This is literature review, through a bibliographic survey with a qualitative approach, relatively current, addressing the physiotherapeutic treatment of plantar fasciitis using laser and hooking. Scientific articles on the mentioned topic were examined, focusing on publications from the last 13 years, written in Portuguese, French, and English. For this study, research was conducted in different databases: Medline (via PubMed), Lilacs, Science Direct, Google Scholar, and Scielo. The descriptors used were: Plantar fasciitis; Plantar fascia; Physiotherapeutic treatment; Physiotherapy; Laser therapy; Hooking, combined with the Boolean (logical) operators OR and AND..

3. Revision

3.1 Anatomy

The structure of the foot is formed by twenty-six bones, divided into three parts: the tarsus, the metatarsus, and the phalanges. The tarsus is composed of seven strong and closely articulated bones, which function to support the body's weight. These bones are short but well-distributed in two rows: anteriorly, the cuboid, the navicular, and the three cuneiforms, and posteriorly, the talus and the calcaneus. The metatarsus consists of five bones located between the tarsal bones and the phalanges, forming the semi-movable tarsometatarsal and metatarsophalangeal joints. The bones that make up the toes are the phalanges, composed of 14 bones, divided into proximal, medial, and distal phalanges, with the hallux having only proximal and distal phalanges [9].

The foot is formed by ligamentous and bony arrangements, thus forming the arches. There are four arches: metatarsal, transverse, medial longitudinal, and lateral longitudinal. The metatarsal arch extends from the first to the fifth metatarsal, having a semi-ovoid aspect. The transverse arch aims to protect the soft tissues and increase foot mobility. It extends from the transverse tarsal bones, mainly the cuboid and the internal cuneiform. The medial longitudinal arch is formed by the talus, navicular, calcaneus, first cuneiform, and first metatarsal bones. The lateral longitudinal arch consists of the calcaneus, cuboid, and fifth metatarsal bones [2].

The classification of the foot and ankle muscles can be divided into intrinsic and extrinsic. The intrinsic foot muscles are mainly responsible for maintaining the plantar arches, and their weakness can alter the foot's structure, creating areas of hyperpressure and predisposing to the appearance of plantar ulcers [16]. The extrinsic musculature originates below the knee and inserts into the foot. These muscles are responsible for plantar flexion, dorsiflexion, inversion, and eversion movements, as well as acting simultaneously with the movements of the toes (phalanges) [17].

The plantar fascia is a fibrous tissue that covers the plantar surface of the foot. Also known as the plantar aponeurosis, it originates at the medial tuberosity of the calcaneus and extends along the sole of the foot. Along with the ligaments, the plantar fascia supports the downward forces of the foot. Its main objective is to provide stability to the plantar arch during walking, giving the necessary force for foot propulsion [18, 19].

3.2 Biomechanics of the Ankle and Foot

The biomechanics of the foot and ankle are complex and intrinsically associated with each other. The foot is an integral mechanical part of the lower extremity necessary for smooth and stable walking. The foot-ankle complex must adjust to different ground surfaces and varying speeds of locomotion. Any pathological change in the structure or movement of the foot or ankle can profoundly impact their shock-absorbing, propulsive, and stabilizing functions [20]. Excessive pronation is responsible for absorbing and distributing the forces that arise from the heel's contact with the ground. The valgus foot has scant pronation and a rigid plantar arch, specifically a hard plantar fascia, which does not absorb the reaction forces derived from running. On the other hand, flat feet, determined by the fragility of the foot's capsuloligamentous structures, favor plantar fascia tension. A rigid Achilles tendon limits ankle dorsiflexion, which can create or contribute to the onset of plantar fasciitis. Calf muscle weakness and joint limitation reduce the foot's ability to absorb ground reaction forces and propel the body forward. A discrepancy in the lower joints can contribute to the development of plantar fasciitis [9].

3.3 Etiology

The phenomenon known as heel pain affects both athletes and non-athletes, and its etiological factors include various pathologies such as heel spur, microtraumas in the plantar fascia region, among others [2]. Tension on the plantar fascia develops from toe

extension as a result of weight bearing from the heel. When the weight is shifted to the front of the foot, the plantar fascia is tensioned, causing microlesions at the site [2]. Inadequate footwear is one of the main extrinsic causes of plantar fasciitis, combined with Achilles tendon shortening, which as an intrinsic cause, is also an important factor in the pathology's development [9].

3.4 Treatment

3.4.1 Laser

In the field of physiotherapy, the application of low-power laser therapy has shown significant growth, being used to promote inflammation control and pain reduction, as well as to favor the healing process, reduce edema, and preserve tissues and nerves [21]. The radiation emitted by low-power laser has demonstrated analgesic, anti-inflammatory, and healing effects, being widely used in tissue repair processes due to the low energy densities used and wavelengths capable of penetrating tissues [22]. Such effects can be achieved with wavelengths between 600 and 1000 nm and powers of 1 mW to 5 W/cm² [21]. Among the benefits described in the literature, the stimulation of collagen and fibroblast production, increased local blood flow, and improved mitochondrial function, increasing ATP production, can be highlighted [23].

In a study by Matos et al. [23] involving 32 patients with a diagnosis of PF, most of the complaints were unilateral (75%). The initial average pain level was 7, with 23 patients having a pain level equal to or greater than seven. Of the 32 patients, 6 abandoned the treatment for professional reasons. Of the 26 treated patients, 24 reported improvement, and 2 did not improve. At the end of the treatment using low-power laser monotherapy, 23 patients ended with a pain level equal to or less than 1. The improvement represented an average reduction of 89.7% of the initial pain value. There was no record of symptomatic recurrence in the patients' process at the data analysis date (which was about 12 months after the study period).

In a literature review by Pontin et al. [24], the effectiveness of physiotherapeutic treatment modalities in patients with PF was verified. Only one study was found, which is a randomized clinical trial that evaluated the application of low-intensity laser versus placebo (treatment with the laser turned off), and there was no difference between the two treatment groups. There is no evidence to support the use of therapeutic laser in the treatment of patients with PF.

Silva et al. [25] used low-intensity laser therapy, with the treatment consisting of continuous laser irradiation on the origin of the plantar fascia. Pain was assessed by VAS in situations such as nighttime rest and daily activities. Six weeks after laser therapy, pain decreased by 59%. Thus, laser therapy may contribute to the healing of PF and pain reduction. In another cited study, low-intensity laser therapy was also investigated with 69 patients to evaluate its clinical utility for unilateral PF treatment. The voluntary participants were treated twice a week for three weeks for a total of six treatments, being evaluated at five moments: before the procedure and in weeks 1, 2, 3, 6, and 8. The pain rate was recorded using a visual analog scale. At the final visit, participants showed improvement in heel pain, with a visual analog scale score decreasing from 69.1 to 39.7, demonstrating that low-intensity laser therapy is a promising treatment for PF.

3.4.2 Hooking

Hooking is a manual, external, and painless therapeutic technique used complementarily with other techniques. It is usually employed by physiotherapists and has been used effectively in treating locomotor apparatus problems, typically of inflammatory or traumatic origin, which tend to cause intense pain [14]. The treatment is performed using a tool similar to a crochet needle placed on the skin to release adhesions or fibroses pre-

sent in the musculoskeletal system. It is usually used with other techniques to avoid loss of mobility in the locomotor apparatus [14]. The contraindications of the technique are few and similar to those of massage, such as in rheumatological pathologies in the inflammatory phase, on the tendon sheath in cases of tenosynovitis, skin problems, burns, etc., and on recent traumatic tissue injuries (strain, contusion, sprain) [15].

In a literature review by Barbosa [14], the application of the Physiotherapeutic Hooking technique in a patient with a clinical diagnosis of bilateral plantar fasciitis demonstrated a satisfactory increase in the range of motion and pain reduction. Vanderwalle [15] discusses only the hooking method, its applications, and effects but does not mention the method in treating plantar fasciitis, thus requiring further studies to prove its efficacy in the mentioned pathology.

5. Conclusion

Plantar fasciitis is typically a limiting condition for individuals, showing that in most cases, seeking appropriate and specific treatment reduces the percentage of pain evolution in patients. Laser therapy demonstrated significant improvement in 2 of the 3 articles found for this review, potentially providing improvement in pain, healing process, among others. Therefore, more high-quality studies are needed to prove the efficacy of laser treatment in plantar fasciitis. Despite the almost nonexistent reference to hooking in the treatment of plantar fasciitis, which would allow better grounding, this study showed some positive effects of the technique. More studies are needed, with a larger sample on this treatment in the mentioned pathology, to validate its benefits.

This narrative review demonstrated the agreement of some authors on the improvement of functionality and quality of life of the population, showing the effectiveness in treating plantar fasciitis. The cited techniques demonstrate that physiotherapeutic resources obtained great satisfactory results when applied correctly.

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