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Light-Emitting Diode Versus Sham in the Treatment of Plantar Fasciitis: A Randomized Trial

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Abstract

Objective: The purpose of this preliminary study was to compare the application of the light emitting diode (LED) to sham LED in the treatment of plantar fasciitis.

Methods: Eighteen subjects met the inclusion criteria and were randomly assigned into 2 groups: light emitting diode or sham LED. The subjects received either the LED at 12 J/cm^2 or sham LED along 2 points of the plantar fascia. Subjects in both groups received a 10 minute transverse friction massage and participated in 4 plantar fascia stretching exercises. All subjects received a total of 6 treatments over 3 weeks. Progress was assessed using the lower extremity functional and analog pain scale.

Results: No significant difference was found between treatment groups ($P = .845$). There was a significant difference in pain and outcome scores over time within both groups ($P < .35$).

Conclusion: Among patients with plantar fasciitis, the use of LED did not result in greater improvement in function or pain compared with sham treatment. The findings suggest that manual intervention and passive stretching activities may have provided significant pain relief and improvement in functional outcome scores.

Introduction

Plantar fasciitis affects more than 2 million people per year and is one of the most common foot pathologies diagnosed in the United States.[1–7] Clinicians commonly apply local modalities, manual treatments and stretching exercises in spite of a general lack of clinical evidence to prove the effectiveness of some of these methods. Authors performing a systematic review cited, "26 conservative treatments that have been recommended for the treatment of plantar heel pain."[6] These interventions included night splints, orthotic devices, shockwave therapy, stretching activities and local modalities.

The plantar fascia can be described as a fibrous layer of connective tissue that originates from the calcaneal tuberosity and extends as lateral slips to attach distally

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along the lateral border of the metatarsal heads.[3,8,9] Patients often report plantar heel pain that may originate just distal to the medial tubercle of the calcaneus. Their symptoms can occur while walking, or with the first few steps after a period of non-weight bearing. The fascia is typically tender to palpation over the medial aspect of the calcaneus and longitudinal arch, while passive stretching can increase pain. The term "fasciitis" implies localized inflammation, but recent literature suggests this pathology to be more of a degenerative process.[8,10] Degeneration of the plantar fascia can be the result of excessive loading, repetitive trauma, tears, or chronic inflammation.[2–8] Among the various treatment options, it appears that there is limited documented effectiveness. The most effective treatment involves gastrocnemius/soleus muscle stretching.[6]

Some authors have suggested that initial treatment for plantar fasciitis begin with a temporary custom foot orthosis (TCFO) for a short period of time followed by stretching. "Overall, findings suggest that a TCFO for 2 weeks, followed by a stretching program, decreases overall pain and increases foot and ankle function in subjects with plantar fasciitis".[3]

Recent evidence indicates that light therapy (phototherapy) may be beneficial in the treatment of musculoskeletal pathology.[11] One primary benefit of light therapy is the photobiotic effect, which has been shown to produce mitochondrion oxidative reactions. These reactions produce a single oxygenlet, a free radical, which in turn allows for a greater production of ATP for the healing tissue.[11]

Light therapy can be used for musculoskeletal pathology, neurologic and wound care applications.[11] Typical phototherapy devices include laser diodes, super luminous diodes, and light emitting diodes (LED). The benefit and application of the various diodes require a knowledge base/understanding of tissue response to wavelengths, frequency, power and treatment indications. The light emitting diode is a therapeutic modality that is thought to create similar physiological effects as laser therapy in the absorbing tissues. Several sources to this point, have expressed that appropriate parameters have not been established, yet that laser and/or light therapy devices appear to be safe for clinical use.[12–15]

The goal of this clinical trial was to determine if an application of the LED is more effective in the treatment of plantar fasciitis than a sham LED for patients receiving traditional methods of transverse friction massage and stretching of the plantar fascia.

Methods

This preliminary double blind, randomized controlled trial was performed with 18 subjects twice a week for three weeks. The protocol was reviewed and approved by the University of Hartford, Human Subjects Committee. Subjects were recruited using an electronic flyer posted in the University newsletter. A total of 26 subjects, 8 males and 18 females between the ages of 21 to 65 volunteered to participate in the study. Subjects were provided formal instruction regarding possible treatment outcomes, expected sensations from the applied modalities and a description of the soft tissue mobilization techniques used in this study. All subjects signed written consent.

Each subject presented with symptoms of plantar heel pain and was evaluated by a physical therapist to confirm the diagnosis of plantar fasciitis. Diagnosis was based on subjects reporting heel pain in the area of the medial calcaneal tubercle, general fascia pain and symptoms that increase in weight bearing especially the first few steps in the morning.[13] Six subjects withdrew from the study due to scheduling conflicts, while 2 did not meet the inclusion criteria.

Subjects were excluded from the study if their symptoms were the result of trauma within the last six months or those who reported having experienced foot fractures within the last four months. Subjects who presented with contraindications to light therapy which included: participation in radiation therapy within the last 6 months, acute swelling or inflammation, an undiagnosed mass or growth along the treatment area, those taking a prescribed anti-inflammatory medication at the time of the study, having had a steroidal injection within the last 3 weeks, or those who having a sensitivity to light.[16]

The remaining 18 subjects were randomly assigned into two treatment groups. All subjects received transverse friction massage and a plantar fascia stretching program along with either the LED or sham LED. Group 1 received LED at 12 J/cm^2 in two positions[16] along the fascia and Group 2 received sham modality in the same treatment positions. Sham LED was a light emitting diode treatment with an opaque cover over the diode to block transmission of the light to the tissue. Subjects were blinded as to whether they were receiving the real-time modality or sham. Clinicians who were involved in data collection and those who performed the transverse friction massage were also blinded to which modality the subjects had received. Subjects completed the analog pain scale and lower extremity functional scale (LEFS) at the initial visit, at the start of the fourth visit and at the