



Magnetic Resonance Imaging and Clinical Outcomes of Laser Therapy, Ultrasound Therapy, and Extracorporeal Shock Wave Therapy for Treatment of Plantar Fasciitis: A Randomized Controlled Trial

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ABSTRACT

We determined and compared the effectiveness of low-level laser therapy (LLLT), therapeutic ultrasound (US) therapy, and extracorporeal shock wave therapy (ESWT) using magnetic resonance imaging (MRI). We performed a randomized, prospective, comparative clinical study. A total of 60 patients with a diagnosis of chronic plantar fasciitis were divided randomly into 3 treatment groups: group 1 underwent 15 sessions of LLLT (8 J/cm²; 830 nm); group 2 underwent 15 sessions of continuous US (1 mHz; 2 W/cm²); and group 3 underwent 3 sessions of ESWT (2000 shocks). All patients were assessed using the visual analog scale (VAS), heel tenderness index (HTI), American Orthopaedic Foot and Ankle Society (AOFAS) ankle-hindfoot scale, Roles-Maudsley score, and MRI before and 1 month after treatment. The primary efficacy success criterion was the percentage of decrease in heel pain of >60% from baseline at 1 month after treatment for ≥2 of the 3 heel pain (VAS) measurements. Significant improvement was measured using the mean VAS, AOFAS scale, and HTI scores for all 3 groups. The thickness of the plantar fascia had decreased significantly on MRI in all 3 groups. The treatment success rate was 70.6% in the LLLT group, 65% in the ESWT group, and 23.5% in the US group. LLLT and ESWT proved significantly superior to US therapy using the primary efficacy criterion ($p = .006$ and $p = .012$, respectively), with no significant difference between the LLLT and ESWT groups ($p > .05$). The treatment of chronic plantar fasciitis with LLLT and ESWT resulted in similar outcomes and both were more successful than US therapy in pain improvement and functional outcomes.

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Plantar fasciitis is the most common diagnosis (10% to 15%) for patients with foot and ankle pain (1). Plantar fasciitis has a multifactorial etiology. It was previously thought to be an inflammatory syndrome; however, recent studies have emphasized that a degenerative process is more dominant (2–4). The factors thought to be associated with the disease include biomechanical dysfunction, mechanical overload, obesity, overuse, Achilles tendon strain, decreased ankle dorsiflexion, atrophy of the intrinsic muscles, and a pronated foot type (5,6). The patient's history and physical examination findings are usually sufficient to diagnose plantar fasciitis. Patients

typically present with a throbbing, burning, or piercing type of inferior heel pain, especially with the first few steps in the morning. However, the pain will decrease after a few steps but will return during the day with prolonged weightbearing activity. Sometimes, the pain will persist for months or even years (4).

Although not routinely necessary, imaging can be used to verify recalcitrant plantar fasciitis or to rule out other foot pathology. Magnetic resonance imaging (MRI), although expensive, is very sensitive and has been accepted as the standard imaging method to evaluate plantar fascia morphology and bone marrow edema. The MRI findings of plantar fasciitis include thickening of the plantar fascia, perifascial and intrafascial edema pattern at T₂-weighted images, intrafascial T₁-weighted signal enhancement, and a limited bone marrow edema pattern at the calcaneal tuberosity (7,8).

The treatment options include numerous methods focusing on the anatomic and biomechanical problems and pain management. The recommended first-tier treatment options are nonsteroidal anti-inflammatory drugs, therapeutic orthotic insoles, limitations of extended physical activities, and Achilles and plantar fascia stretching

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