

# Photobiomodulation a Promising Therapeutic Modality in Plantar Fasciitis

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## ABSTRACT

Plantar fascia is inflammation of the connective tissues in the foot, a common cause of heel pain in adults. The currently available treatment protocol may require 6–12 months of therapy to get an individual to pain-free. Photobiomodulation (PBM) a type of laser therapy, which elicits biological changes in tissues resulting in beneficial therapeutic effects. Evidence supports the use of PBM for the degenerative conditions like tendinopathy and epicondylitis, osteoarthritis, peripheral nerve degeneration. Similarly, the use of PBM in plantar fasciitis (PF) shows a promising result.

**Keywords:** Foot, Pain, Photobiomodulation therapy, Plantar fasciitis.

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## NEW PRODUCTS AND PROCESSES

Plantar fascia is a thin fibrous band on the plantar surface of the foot and forms a strong mechanical link between the calcaneus and the toes. Its inflammation termed plantar fasciitis (PF) is the most common cause of heel pain in adults.<sup>1</sup> Risk factors include middle age, obesity, activities involving excessive foot pronation, running and prolonged standing.<sup>2,3</sup>

Clinically, most patients complain of pain on the initial few steps in the mornings or getting up after prolonged rest. Pain gradually improves, but stiffness intensifies during the day, often with prolonged standing or climbing stairs. A pathognomonic feature is the tenderness at the insertion of plantar fascia on the medial calcaneal tubercle.<sup>4</sup>

Conservative therapy in the form of anti-inflammatory drugs, stretching exercises, corticosteroids, foot orthoses, night splints, and extracorporeal shockwave therapy provides significant relief in the majority of patients with PF.<sup>5</sup> Rarely, surgery is done, including spur resection and fascial band release.<sup>6</sup> Newer modalities like platelet-rich plasma and photobiomodulation (PBM) have gained prominence, the latter coming up as a noninvasive useful method.

## PHOTOBIMODULATION

Photobiomodulation has been reported as a possible treatment option in acute and chronic pain in patients of osteoarthritis, lymphedema, peripheral nerve degeneration, and ligament or tendon injury.<sup>7</sup> This therapy is usually done over short sessions for 2–3 weeks.<sup>7</sup>

The effect of PBM depends on the specific wavelength and dosing parameter used. The available options are low-level laser therapy (LLLT) or high-intensity laser therapy (HILT).<sup>7</sup> The efficacy of the method is determined by optimal tissue penetration of the light and specific wavelength absorbed by the photo-acceptors.<sup>8</sup> For effective penetration, the optimal wavelength ranges from ~650 nm to 1,200 nm, and hence infrared spectrum of light is most commonly used.<sup>7,8</sup>

## Mechanism of Action

Low-level laser therapy leads to an increase in cell proliferation, enhanced microcirculation, increased vascular formation, with

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production of collagen, leading to decrease inflammatory degeneration of the soft tissues, including fascia, ligament, and muscles.<sup>7</sup> Additional anti-inflammatory action suppresses the pro-inflammatory factors.<sup>9,10</sup>

The effects of LLLT are enhanced with HILT as it can penetrate and stimulate larger and deeper areas of the fascia. Additionally, a HILT session involves a significantly greater amount of energy transfer into the issue as compared to LLLT.<sup>5</sup>

## Alleviation of Pain

The pain relief could be due to a combination of one or more effects; increased endogenous opioid neurotransmitter production, raised threshold to thermal pain and enhanced local blood circulation, increased oxygen consumption due to accelerated redox reaction rate of the electron respiratory chain of mitochondria, increased cellular adenosine triphosphate (ATP) production, and increased production of anti-inflammatory cytokines.<sup>11</sup>

Ordahan et al. showed that HILT is a more effective option than LLLT in PF.<sup>5</sup> The high-intensity laser radiation leads to less wastage as there is only a minor and slow absorption by melanin and chromophores, and there is an increase in the mitochondrial oxidative reaction and ATP, RNA, and DNA production resulting in tissue stimulation, which repairs damaged tissue and removes the pain stimulus.<sup>12</sup>

Being noninvasive, PBM avoids the side effects associated with use of nonsteroidal anti-inflammatory drugs (NSAIDs) and patient discomfort with injectable steroids or PRP. Besides pain, it also

reportedly improves foot function and the plantar fascia thickness.<sup>11</sup> Cinar et al. reported that LLLT significantly improves the functional score at 3 weeks and also improves the walking distance in patients of PF.<sup>13</sup> Kiritsi et al. reported decrease in plantar fascia thickness after intervention with LLLT.<sup>14</sup> Ordahan et al. reported significant improvement with both LLLT and HILT for PF in terms of pain, function, and quality of life.<sup>5</sup> However, the dosage needs to be adequate, as a low insufficient dosage has been shown to be ineffective.<sup>15</sup>

## CONCLUSION

Photobiomodulation is a useful modality for PF with no side effects and effective results. However, further studies are still needed to establish an effective protocol with defined optimal frequency, dose, and wavelength of the light used.

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