International Journal of Physical Medicine & Rehabilitation

Akkurt et al., Int J Phys Med Rehabil 2018, 6:5
DOI: 10.4172/2329-9096.1000484

Research Article Open Access

# Efficacy of High-Intensity Laser Therapy and Silicone Insole in Plantar Fasciitis

**Ferit Akkurt***, **Halil Ekrem Akkurt, Halim Yılmaz, Yücel Olgun and Zafer Sen**

*Department of Physical Medicine and Rehabilitation, Health Sciences University, Konya Training and Research Hospital, Turkey*

***Corresponding author:** Ferit Akkurt, Department of Physical Medicine and Rehabilitation, Health Sciences University, Konya Training and Research Hospital, Turkey, Tel: +905055762579; E-mail: akkurt_ferit@hotmail.com

**Received date:** July 17, 2018; **Accepted date:** September 04, 2018; **Published date:** September 08, 2018



## Abstract

Plantar fasciitis (PF), also known as plantar heel pain syndrome, heel spur syndrome, or painful heel syndrome, is an inflammatory disease of the plantar fascia. Many different methods have been used to treat it, but optimal treatment for this clinical condition is still unknown. 52 patients treated with (High-intensity laser therapy) HILT + insole and only insole was included in the study retrospectively. They had been assessed for the pain in the first steps in the morning, after 10 minute and 60 minute walk with 10 cm visual analogue scale (VAS) and Heel Tenderness Index (HTI), Foot and Ankle Outcome Score (FAOS), and measurement of plantar fascia thickness. Both groups showed a significant improvement regarding all parameters (pain scores, function and quality of life scores, and fat pad thickness) one month after treatment. When the pre and post-treatment percentage changes were compared, a significant difference was found between both groups regarding all VAS score parameters, FAOS foot and ankle related quality of life, FAOS pain, and HTI scores in HILT and insole group. HILT + insole therapy was considered to be more effective than only silicone insole with regard to decrease in pain and increase in quality of life.

**Keywords:** Plantar fasciitis; High-intensity laser therapy; Insole

## Introduction

Plantar fasciitis, also known as plantar heel pain syndrome, heel spur syndrome, or painful heel syndrome, (PF) is an inflammatory disease of the plantar fascia [1]. PF is the most common cause of heel pain in adults that approximately 10%-16% of adult population. The incidence is highest in people between the ages of 40 and 60 years without any bias toward either sex [2].

The exact cause is not known, but some risk factors such as age (middle age), obesity, excessive foot pronation, pes cavus, excessive running, reduced ankle dorsiflexion, tight achilles tendon and prolonged standing have been identified [2-4].

The basic condition causing PF is the tissue degeneration near the site of origin of the plantar fascia at the medial tuberosity of the calcaneus. Patients feel a gradual pain near the medial side of calcaneal tuberosity in the first steps in the morning or after prolonged rest. The pain increases with palpation of the medial plantar calcaneal region. Diagnosis of PF is primarily based on history and physical examination [5,6].

Many different methods have been used to treat PF including icing, extracorporeal shockwave and physical therapies, stretching, foot orthoses, night splints, cortisone injections, platelet-rich plasma injection and botulinum toxin A injection. However, there is scarce evidence about their long-term effects and an optimal management strategy has not been established yet [7-12].

In the last decade, High-intensity laser therapy (HILT) has gained importance for treatment of sports injuries (contusions, tendon injuries, muscle spasms, etc.) and other musculoskeletal disorders [13,14].

Different types of insoles have been prescribed to treat PF by physicians recently, and it has been found that it decreases rear foot pain and improve foot function, but there have not been enough studies to assess the efficacy of silicone insole [15].

To the best of our knowledge, there are no studies investigating the efficacy of HILT on PF treatment or comparing it with other well-known methods like silicone insole. In this study we aimed to investigate the short-term efficacy of HILT and silicone insole in the treatment of PF and to compare it with a full-length silicone insole alone.

## Materials and Methods

The files of PF diagnosed patients in the outpatient clinic of Physical Medicine and Rehabilitation Department of our hospital in 2015 and 2017 were retrospectively scanned.

The patients whose age range was 18-65 with unilateral plantar heel pain VAS score more than 4 in the first step in the morning were included. The value of the patients given silicone insole and HILT+ silicone insole were compared to each other pre and post-treatment. Those with previous surgical intervention, foot deformity, acute heel trauma, local corticosteroid injections or shock-wave treatment history, PF due to systemic rheumatic disease, radicular or neuropathic pain, local infections, coagulation disorders and pregnancy were excluded. Thus, 25 patients were incuded in HILT+ silicone and 27 patients in only insole group. Those patients whose pain in the first step in the morning, after walking 10 minutes and 1 hour were assessed with 10 cm visual analogue scale (VAS), Heel Tenderness Index (HTI) on palpation (0=no pain; 1=painful; 2=painful and winces; 3=painful, winces, and withdraws), foot and ankle outcome score (FAOS) before and after treatment had been recorded in their files were taken as subjects. The percentages of pre and post-treatment change in the

parameters of both treatment groups were calculated and compared statistically. The study was approved by the local Medical Ethics Committee.

## HILT protocol

Pulsed high power laser (Nd:YAG, λ1064nm, ASA Laser, Arcugnano, Italy) was applied as 10 sessions on alternate days with analgesic program, in manual scansion. This program consisted three phases: initial, intermediate and final. Every phase was articulated in sub-phases in which a total energy of 2000-3000 J was administered with increasing fluency (510-710 J/cm$^2$) and decreasing frequency (15-10 Hz). The total session duration was 15-20 min [14].

## Insole

All the patients involved in the study had been advised to wear a prefabricated full-length silicone insole in the daily life for 1 month. They had been allowed to sustain their normal daily activities without changing their usual diet and exercise habits.

## Outcome measures

The pain in the first steps in the morning, after walking 10 minutes and 1 hour were assessed with 10 cm visual analogue scale (VAS) and Heel Tenderness Index (HTI) on palpation (0=no pain; 1=painful; 2=painful and winces; 3=painful, winces, and withdraws).

FAOS is a 42-item questionnaire with five subscales: pain, other symptoms, daily living activities, sports and recreational function and foot and ankle-related quality of life [16]. The pain subscale contains 9 items, the other symptoms subscale contains 7 items, the activities of daily living subscale contains 17 items, the sports and recreational function subscale contains 5 items and the foot- and ankle-related quality of life subscale contains 4 items each of which can be scored on a 5-point Likert scale (from 0 to 4). Each of the five subscale scores is calculated as the sum of the items included. Raw scores are then transformed to a 0 to 100 scale, from the worst to the best.

All of the patients involved in the study had been evaluated with the above mentioned scoring systems both before and 1 month after the treatment.

## Statistical analysis

Statistical Package for the Social Sciences (SPSS) version 21.0 was used for statistical analysis. Descriptive parameters were represented as mean ± SD. Baseline characteristics were compared using chi-square and student's t-tests where appropriate. Comparison of pre and post-treatment results was done with paired sample t-tests. Percent change following treatment was evaluated by using student's t-test. Statistical significance and confidence intervals were determined as $p<0.05$ and 95% (95% CI), respectively.

# Results

Both groups were similar to each other in terms of age, body mass index (BMI), duration of complaint, work status and gender ($p>0.05$). Demographic data of both groups are given in Table 1.

| | **HILT+ Insole N=25** | **Only Insole N=27** | **P** |
|---|---|---|---|
| Age (years) | 47.32 ± 7.45 | 45.51 ± 6.88 | 0.923 |
| BMI (kg/m2) | 32,34 ± 3,80 | 31,53 ± 3,50 | 0.431 |
| Complaint duration (weeks) | 8.67 ± 12.6 | 7.14 ± 6.8 | 0.552 |
| Gender (M/F) | 2/23 | 4/23 | 0.372 |
| Work Status(housewife/ employ) | 22/3 | 19/8 | 0.253 |

**Table 1:** Demographic data of groups.

Both groups showed a significant improvement regarding all parameters (pain scores, function and quality of life scores, and fat pad thickness) one month after treatment (Table 2).

| | HILT+ Insole | | | Only Insole | | | |
|---|---|---|---|---|---|---|---|
| | Pre-Treatment | Post-Treatment | p | Pre-Treatment | Post-Treatment | p | pα |
| VAS the first steps in the morning | 5.76 ± 2.42 | 1.56 ± 1.04 | <0.001 | 5.59 ± 1.80 | 3.29 ± 1.68 | <0.001 | <0.001 |
| VAS after a 10 minute walk | 7.52 ± 1.93 | 3.44 ± 1.26 | <0.001 | 7.48 ± 1.22 | 4.62 ± 1.71 | <0.001 | 0.01 |
| VAS after a 10 hour walk | 8.64 ± 0.86 | 4.36 ± 1.55 | <0.001 | 8.59 ± 0.50 | 5.48 ± 1.84 | <0.001 | 0.008 |
| FAOS pain | 46.22 ± 5.31 | 67.00 ± 10.94 | <0.001 | 44.54 ± 9.41 | 55.86 ± 10.65 | <0.001 | 0.001 |
| FAOS other symptoms | 62.42 ± 18.09 | 49.14 ± 12.34 | <0.001 | 50.52 ± 8.38 | 58.73 ± 16.22 | 0.007 | 0.243 |
| FAOS daily living activities | 42.58 ± 5.57 | 65.11 ± 12.97 | <0.001 | 45.75 ± 12.21 | 59.80 ± 13.66 | <0.001 | 0.080 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| FAOS sport and recreation function | 40.08 ± 24.40 | 61.20 ± 18.72 | <0.001 | 39.81 ± 16.66 | 52.77 ± 20.25 | 0.006 | 0.081 |
| FAOS foot and ankle related quality of life | 33.25 ± 8.40 | 66.75 ± 8.59 | 0.001 | 29.86 ± 11.00 | 40.97 ± 16.38 | <0.001 | 0.004 |
| HTI | 2.08 ± 0.75 | 0.88 ± 0.52 | <0.001 | 2.22 ± 1.01 | 1.37 ± 0.96 | <0.001 | 0.014 |

**Table 2:** VAS, FAOS, HTI, Pre and Post-Treatment in the Groups (HILT: High-intensity laser treatment. VAS: Visual Analog Scale; FAOS: Foot and Ankle Outcome Score; HTI: Heel Tenderness Index. pα: percentages of pre and post-treatment change P value).

When the pre and post-treatment percentage changes were compared, a significant difference was found between both groups regarding VAS score parameters (the first steps in the morning, after a 10- minute walk, after a 60-min walk), FAOS foot and ankle related quality of life, FAOS pain, and HTI scores in HILT + insole group (Table 2). Improvement in HILT + Insole group was more. No complications had been observed in either group.

## Discussion

In this retrospective study, the impact on treatment with full-length silicone insoles and HILT+ full-length silicone insoles in patients with PF were compared for the first time in the literature. In this study, significant improvements were seen in all parameters including pain scores, functionality and quality of life scores, and fat pad thickness in both groups when pre and post-treatment values were compared. Thus, both treatment methods were found to be effective and reliable to treat PF. HILT+ insole therapy was considered to be more effective than only silicone insoles with regard to decrease in pain and increase in quality of life.

Although PF is a common disease that affects the life quality, studies on its treatment have produced unsatisfactory evidences of optimal strategy and their long-term effects.

Laser treatment is a non-invasive and painless method that can be easily administered in therapy units for several musculoskeletal disorders, including muscle strains, epicondylitis, rheumatoid arthritis, osteoarthritis, and carpal tunnel syndrome [13]. The most commonly used laser treatment modalities for musculoskeletal disorders are low-intensity laser therapy (LILT) and HILT.

Although there are no studies showing the efficacy of HILT in PF, HILT is used for a wide range of disorders, including low back pain [17,18], knee osteoarthritis [19], facial paralysis [20], subacromial impingement syndrome [21] and lateral epicondylitis [14,22]. Higher-intensity laser irradiation is used in HILT, and it causes minor and slow light absorption by chromophores. Thus some thermal processes in the target tissue may be triggered by HILT [17,23]. In this study, it was found that HILT is an effective and reliable treatment method easily used in PF; however, further studies are needed for more satisfactory results.

The analgesic effect of HILT is based on multiple mechanisms of action, including its ability to slow transmission of the pain stimulus and to increase the production of morphine-mimetic substances in the body [24]. Furthermore, it may have the ability to block pain transmission through Aδ- and C-fiber, increases blood flow, vascular permeability, and cell metabolism [25,26].

HILT has been reported to reduce inflammation and pain. It uses a particular waveform with regular amplitude peaks; thus, the intervals prevent thermal accumulation phenomena. It rapidly induces photochemical and photothermic effects in the deep tissue. These effects stimulate collagen production within the tendons and increase blood flow, vascular permeability and cell metabolism; thus, promoting the repair of damaged tendons and removing painful stimuli [21].

Another method used to treat PF is foot orthoses. Its efficacy in patients with PF has been shown in previous studies. In recent studies, foot orthoses have been reported to reduce heel pain by relieving strain on the plantar fascia [27-29] and reducing pronation of the foot and collapse of the foot arch [30,31]. Total contact insoles can redistribute plantar pressure [32] and transfer pressure from the rearfoot to the midfoot region [33,34]. Scherer stated that the most important part of orthotic success was to mechanically control the midtarsal joint [35]. In this study, it was similarly decided that foot orthoses are easy and inexpensive treatment modality to relieve pain in PF.

## Conclusion

In conclusion, HILT and silicone insole are effective physical therapy modalities for patients with PF in reducing pain and increasing function and quality of life. The results of the present study are promising. Use of insole is a routine treatment for this disease. However, we have not found a study that used HILT in the treatment of this disease. Through the study in which HILT was used, we determined that HILT is a more effective treatment. So we think that placebo-controlled, multi-centered treatments in which HILT is used in more patients are needed to consider HILT therapy as a definite treatment method.

Recommending the patient silicone insoles will yield positive effects in increasing quality of life and recovery, but we think that HILT is more effective so it should also be recommended.

## Conflict of Interest

The authors report no conflict of interest.

## References

1. Dimou ES, Brantingham JW, Wood T (2004) A randomized controlled trial (with blinded observer) of chiropractic manipulation and Achilles stretching vs. orthotics for the treatment of plantar fasciitis. J Am Chiro Assoc 41: 32-42.
2. Rome K, Howe T, Haslock I (2001) Risk factors associated with the development of plantar heel pain in athletes. Foot 11: 119-125.
3. Taunton JE, Ryan MB, Clement DB, McKenzie DC, Lloyd-Smith DR, et al. (2002) A retrospective case-control analysis of 2002 running injuries. Brit J Sport Med 36: 95-101.
4. Irving DB, Cook JL, Menz HB (2006) Factors associated with chronic plantar heel pain: a systematic review. J Sci Med Sport 9: 11-22.

5. Thomas JL, Christensen JC, Kravitz SR, Mendicino RW, Schuberth JM, et al. (2010) American College of Foot and Ankle Surgeons Heel Pain Committee. The diagnosis and treatment of heel pain: a clinical practice guideline-revision 2010. J Foot Ankle Surg 49: 1-19.
6. Neufeld SK, Cerrato R (2008) Plantar fasciitis: evaluation and treatment. J Am Acad Orthop Surg 16: 338-346.
7. Roos E, Engström M, Söderberg B (2006) Foot orthoses for the treatment of plantar fasciitis. Foot Ankle Int 27: 606-611.
8. Kalaci A, Cakici H, Hapa O, Yanat AN, Dogramaci Y, et al. (2009) Treatment of plantar fasciitis using four different local injection modalities: a randomized prospective clinical trial. J Am Podiatr Med Assoc 99: 108-113.
9. Peerbooms JC, van Laar W, Faber F, Schuller HM, van der Hoeven H, et al. (2010) Use of platelet rich plasma to treat plantar fasciitis: design of a multi centre randomized controlled trial. BMC Musculoskelet Disord 11: 69.
10. Placzek R, Deuretzbacher G, Buttgereit F, Meiss AL (2005) Treatment of chronic plantar fasciitis with botulinum toxin A: an open case series with a 1 year follow up. Ann Rheum Dis 64: 1659-1661.
11. Thomson CE, Crawford F, Murray GD (2005) The effectiveness of extra corporeal shock wave therapy for plantar heel pain: a systematic review and meta-analysis. BMC Musculoskelet Disord 6: 19.
12. League AC (2008) Current concepts review: plantar fasciitis. Foot Ankle Int 29: 358-366.
13. Brown AW, Weber DC Physical agent modalities (2000) In: Braddom RL (ed) Physical medicine and rehabilitation. WB Saunders, Harcourt Health Sciences Company, London; pp 440-458.
14. Dundar U, Turkmen U, Toktas H, Ulasli AM, Solak O (2015) Effectiveness of high-intensity laser therapy and splinting in lateral epicondylitis; a prospective, randomized, controlled study. Lasers Med 30: 1097-1107.
15. Lee SY, McKeon P, Hertel J (2009) Does the use of orthoses improve self-reported pain and function measures in patients with plantar fasciitis? A meta-analysis. Phys Ther Sport 10: 12-18.
16. Roos EM, Brandsson MD, Karlsson J (2001) Validation of the foot and ankle outcome score. Foot Ankle Int 22: 788-794.
17. Fiore P, Panza F, Cassatella G, Russo A, Frisardi V, et al. (2011) Shortterm effects of high-intensity laser therapy versus ultrasound therapy in the treatment of low back pain: a randomized controlled trial. Eur J Phys Rehab Med 47: 367-73.
18. Alayat MSM, Atya AM, Ali MME, Shosha TM (2014) Long-term effect of high-intensity laser therapy in the treatment of patients with chronic low back pain: a randomized blinded placebo-controlled trial. Lasers Med Sci 29:1065-1073.
19. Kheshie AR, Alayat MSM, Ali MME (2014) High-intensity versus low-level laser therapy in the treatment of patients with knee osteoarthritis: a randomized controlled trial. Lasers Med Sci 29: 1371-1376.
20. Alayat MS, Elsodany AM, El Fiky AA (2014) Efficacy of high and low level laser therapy in the treatment of Bell's palsy: a randomized double blind placebo-controlled trial. Lasers Med Sci 29: 335-342.
21. Santamato A, Solfrizzi V, Panza F, Tondi G, Frisardi V, et al. (2009) Short-term effects of high-intensity laser therapy versus ultrasound therapy in the treatment of people with subacromial impingement syndrome: a randomized clinical trial. PhysTher 89: 643-652.
22. Akkurt E, Kucuksen S, Yılmaz H, Parlak S, Sallı A, et al. (2016) Long term effects of high intensity laser therapy in lateral epicondylitis patients. Lasers Med Sci 31: 249-253.
23. Ohshiro T, Calderhead R (1991) Development of low reactive-level laser therapy and its present status. J Clin Laser Med Surg 9: 267-275.
24. Zati A, Valent A (2006) Laser therapy in Medicine. In: Medica M (ed) Terapia Elsica: Nuove Tecnologie in Medicina Riabilitatiya p: 162-185.
25. Chow R, Armati P, Laakso EL, Bjordal JM, Baxter GD (2011) Inhibitory effects of laser irradiation on peripheral mammalian nerves and relevance to analgesic effects: a systematic review. Photomed Laser Surg 29: 365-381.
26. Kujawa J, Zavodnik L, Zavodnik I, Buko V, Lapshyna A, et al. (2004) Effect of low-intensity (3.75-25 J/cm2) near-infrared (810 nm) laser radiation on red blood cell ATPase activities and membrane structure. J Clin Laser Med Surg 22: 111-117.
27. Kogler GF, Solomonidis SE, Paul JP (1996) Biomechanics of longitudinal arch support mechanisms in foot orthoses and their effect on plantar aponeurosis strain. Clin Biomech 11: 243-252.
28. Landorf KB, Keenan AM, Herbert RD (2006) Effectiveness of foot orthoses to treat plantar fasciitis: a randomized trial. Arch Intern Med 166: 1305-1310.
29. Yucel U, Kucuksen S, Cingoz HT, Anliacik E, Ozbek O, et al. (2013) Full-length silicone insoles versus ultrasound-guided corticosteroid injection in the management of plantar fasciitis: a randomized clinical trial. Prosthet Orthot Int 37: 471-476.
30. Kitaoka HB, Luo ZP, AnK-N (1997) Analysis of longitudinal arch supports in stabilizing the arch of the foot. Clin Orthop Relat Res 341: 250-256.
31. Kitaoka HB, Luo ZP, Kura H, An KN (2002) Effect of foot orthoses on 3-dimensional kinematics of flatfoot: a cadaveric study. Arch Phys Med Rehabil 83: 876-879.
32. Goske S, Erdemir A, Petre M, Budhabhatti S, Cavanagh PR (2006) Reduction of plantar heel pressures: insole design using finite element analysis. J Biomech 39: 2363-2370.
33. Chen WP, Ju CW, Tang FT (2003) Effects of total contact insoles on the plantar stress redistribution: a finite element analysis. Clin Biomech 18: 17-24.
34. Seligman DA, Dawson DR (2003) Customized heel pads and soft orthotics to treat heel pain and plantar fasciitis. Arch Phys Med Rehabil 84: 1564-1567.
35. Scherer PR (1991) Heel spur syndrome. Pathomechanics and nonsurgical treatment. J Am Podiatr Med Assoc 81: 68-72.