İstanbul Med J 2023; 24(2): 106–11
DOI: 10.4274/imj.galenos.2023.23356

Effectiveness of Low-Level Laser Therapy in Chronic Plantar Fasciitis Conservative Treatment

Bilge Gökçe[1], Ebru Aytekin[1], Yasemin Pekin Doğan[1], Didem İnceboy[1], Ertan Yüce[1], Fatma Ustabaşıoğlu[2]

[1]University of Health Sciences Turkey, İstanbul Training and Research Hospital, Clinic of Physical Medicine and Rehabilitation, İstanbul, Turkey
[2]Sultan 1. Murat State Hospital, Clinic of Physical Medicine and Rehabilitation, Edirne, Turkey

ABSTRACT

Introduction: This study aimed to evaluate the effectiveness of low-level laser treatment (LLLT) for treating chronic plantar fasciitis (PF).

Methods: The records of 60 patients with PF were retrospectively examined in this research. Thirty patients who have been applied LLLT and given exercise program constituted a treatment group. On the other side, 30 patients who have been given exercises but not applied LLLT was selected as a control group. Along with exercise, the treatment group underwent a 10-day continuous, 12-minute, 1.6 W, 808 nm wavelength diode laser treatment using galium-aluminum-arsenide. The American Orthopaedic Foot and Ankle Society (AOFAS) ankle-hindfoot scale and the Foot Function Index (FFI) were used to assess the patients' foot discomfort and functional condition while they were at rest, taking their first steps, and during activities. These assessments were all documented before, after, and after two months of treatment.

Results: In the treatment group, all VAS, FFI, and AOFAS scores except alignment score has been significantly improved both in the first and the second months compared to the initial state ($p<0.05$). The improvement in these scores was higher in the treatment group than in the control group in the first and the second months both ($p<0.05$).

Conclusion: These findings confirm that LLLT is an effective and reliable therapy choice in the conservative management of PF.

Keywords: Exercise, low-level laser therapy, pain, plantar fasciitis

Introduction

Adults who experience heel pain most frequently have plantar fasciitis (PF) (1). The degenerative condition known as PF is brought on by repeated stress to the area where the plantar fascia connects to the calcaneus (2). The etiology of PF is multifactorial; advanced age, pes planus, increased pronation, obesity, improper preference of shoe model, and decreased ankle dorsiflexion are the most common causes and result in biomechanical overload (3).

Clinical diagnosis is made substantially by anamnesis and physical examination. The typical clinical symptom is deep pain at the heel that begins after inactivity, notably with the initial steps in the morning, eases with activity, gradually worsens in response with weight-bearing toward the end of the day. The painful point with palpation is usually next to the anteromedial protrusion of the calcaneal tuberosity (4).

PF is usually a self-limiting clinical condition. Most of the patients recover conservative treatments.

Rest, adjusting activity levels, stretching exercises, resting splints, insoles, oral and topical medications, local injections, and physical therapy modalities are some of the conservative treatment choices (4-7).

Nowadays, a treatment procedure called low-level laser therapy (LLLT) is employed extensively, and new evidence has begun to emerge with the standardization of dosage recommendations according to diseases. Nowadays, LLLT is used for reducing pain and inflammation, wound healing, and increasing the speed of healing in musculoskeletal injury (8-15).

There are very few researches in the literature that examine how well LLLT works to cure PF (16). Evidence for LLLT's effectiveness in improving functional capacities in PF is still controversial. The fact that the studies were conducted with different laser devices and different treatment protocols affect these results. In this context, we need new studies that investigate different treatment protocols and dosages for finding the optimum LLLT method for PF therapy (16,17).

This study aimed to assess the effectiveness of LLLT in the management of chronic PF. Our LLLT treatment protocol in this study was distinct from previous suggested protocols that were applied in the literature. Cause no study had proved the best method for PF. For this reason, we gained to observe different kinds of treatment protocols's effects. Moreover, in our study, we use different scales that evaluate functional abilities and gait functions.

Address for Correspondence: Ebru Aytekin MD, University of Health Sciences Turkey, İstanbul Training and Research Hospital, Clinic of Physical Medicine and Rehabilitation, İstanbul, Turkey
Phone: +90 212 459 61 24 **E-mail:** ebruaytekin@hotmail.com **ORCID ID:** orcid.org/0000-0002-9619-3374

Cite this article as: Gökçe B, Aytekin E, Pekin Doğan Y, İnceboy D, Yüce E, Ustabaşıoğlu F. Effectiveness of Low-Level Laser Therapy in Chronic Plantar Fasciitis Conservative Treatment. İstanbul Med J 2023; 24(2): 106-11.

Received: 25.11.2022
Accepted: 24.02.2023

Methods

In this retrospective investigation, the records of 60 individuals who were clinically diagnosed with PF and have been treated between May 2016 and October 2016 were included in the study. The files were retrospectively reviewed. 30 patients who have been applied LLLT and given exercise program constituted a treatment group. On the other side, 30 patients who have been given just exercises without any other therapy were selected as a control group.

The presence of chronic plantar heel pain symptoms that had persisted for at least three months and were resistant to first-step conservative treatment was the requirement for inclusion. By detecting discomfort to palpation and local pressure at the plantar fascia's origin on the medial tubercle of the calcaneus during the physical examination, the diagnosis was clinically verified. The participants who ranged in age from 18 to 75, were admitted if they had not use any anti-inflammatory medications throughout their treatment. The exclusion criteria included a history of trauma, surgery, skin lesions, malignancy, steroid injections within the preceding three months, radiculopathy, arthropathy, and pregnancy.

The University of Health Sciences Turkey, İstanbul Training and Research Hospital Ethics Committee gave its approval to the study (approval number: 2016/902). Each participant gave written consent. The research was based on a PhD thesis.

Interventions

Age, weight, height, body mass index (BMI), and daily standing time were among the demographic details of the patients that were recorded. The treatment group had 10 days continuous, once daily 12-minute LED galium-aluminium-arsenide (Ga-Al-As) 1.6 W, 808 nm wavelength diode laser treatment in addition to exercise treatment whereas control group had only exercise treatment. The plantar fascia's sensitive spots received LLLT treatment (four points), for a total dose of 4 J/cm^2 for 30 s each point periodically, with a total duration of 12 min. Figure 1 shows the locations of the LLLT applications.

The exercise regimen comprised achille tendon, gastrocnemius, plantar fascia stretching exercises, roll ball or roller exercise, toe-tap, and intrinsic muscle strengthening exercises (18,19). Achilles tendon stretching exercise is performed in a long sitting position by bringing the foot dorsiflexed and waiting for 10 seconds in this situation (20-22). Stretching the gastrocnemius muscle is done by leaning forward against the wall, keeping the legs straight, lowering the heels, and standing on the foot tip on the step (23,24). The affected side is positioned on the opposing leg in a sitting position while performing the plantar fascia stretching exercise. The foot is brought to dorsiflexion and toes to extension and held in this position for 10 seconds (25). For the rolling exercise, a cylindrical object is moved back and forth under the foot for 10 min (20). Towel curls, towel pickup, and toe-tap exercises were instructed to both groups to strengthen the intrinsic muscles of the foot. In the toe-tap exercise, all fingers are in the air while the heel is kept on the ground, and the big toe is repeatedly tapped on the ground and then the other four fingers are struck on the ground while the thumb is in the air (20,23,26). The participants were told that the exercises should be done ten times each, three times per day, for two weeks.

Outcome Measures

The patients' rest, the first step and activity pain levels were evaluated using a visual analogue scale (VAS), foot pain and functioning state was evaluated by the Foot Function Index (FFI) and American Orthopaedic Foot and Ankle Society (AOFAS) ankle-hindfoot scale. These assessments were all documented before, after, and after two months of treatment.

The level of subjective pain perception was assessed using VAS. Morning VAS, resting, and activity VAS were recorded separately. The patient selects a number describing his or her suffering levels between 0-10 (0: no pain, 10: the most severe pain). This number represents the intensity of the pain.

Functional ability was measured by AOFAS and FFI. AOFAS is a standardized evaluation of the clinical status of the ankle-hindfoot. It incorporates both subjective and objective information. Patients report their pain, and physicians assess alignment. AOFAS includes 9 items, distributed over 3 categories: pain (40 points), functional aspects (50 points), and alignment (10 points), for a total of 100 points with healthy ankles receiving 100 points (27). The FFI is a standard questionnaire used to assess foot diseases. Pain, disability, and activity restriction are among the three subscales of the FFI. The FFI consisted of 23 items. Patients take into account their foot issues from the previous week when filling out the FFI, scoring each item with a VAS. To obtain the subscales and the overall score, the scores for each item are added up (28-31).

Statistical Analysis

Descriptive information was shown using the following formats: number, percent, median, mean, ratio, frequency, and standard deviation. The Kolmogorov-Smirnov test was used to determine if the data were conformable to a normal distribution. The Independent Sample t-test and Mann-Whitney U test were used to assess quantitative independent data. Wilcoxon test results were used to assess the dependent data. The Pearson chi-square test was used to compare categorical variables. The cut-off for statistical significance was $p=0.05$. The Statistical Package for the Social Sciences program for Windows, version 22.00, was used for statistical analysis (SPSS Inc., Chicago, IL, USA).

Results

The trial involved 60 individuals in total. The baseline features and demographic data of the participants are listed in Table 1. The median age of the individuals was 45.4±12.3 years. The majority of participants were female (85%). Most individuals were overweight or obese. BMI values vary in range 19-40; the mean BMI of the participants was 28±5.7. The two groups did not substantially vary in terms of age, BMI, or daily standing time ($p>0.05$). Rest, activity, and first-step VAS scores in the treatment and control groups all significantly improved both in the first and second months compared to baseline. The improvement in these scores was better in the treatment group than in the control group in the first and the second month both ($p<0.05$) (Table 2).

In the treatment group, significant reduction has been observed in all FFI scores in the first and second months both ($p<0.05$). There has been no significant change in FFI pain subscale score in the control group

Table 1. Demographic and clinical characteristics by group

Characteristic		LLLT group (n=30)	Control group (n=30)	p	
		Mean ± SD	Mean ± SD		
Age		45.8±11.3	45.0±13.4	0.796	[m]
BMI		28.0±6.5	28.0±4.9	0.625	[m]
Standing time		6.1±1.6	6.1±1.9	0.934	[m]
		Number (%)	Number (%)		
Gender	Female	26 (86.7)	25 (83.3)	0.718	[x²]
	Male	4 (13.3)	5 (16.7)		

LLLT: Low-level laser treatment, SD: Standard deviation, n: Number, BMI body mass index

Table 2. Visual analog scale

	LLLT group (n=30)	Control group (n=30)	p	
	Mean ± SD	Mean ± SD		
VAS score resting				
Baseline	6.0±1.4	6.0±1.7	0.757	[m]
The first month after treatment	5.7±1.4	3.8±2.6	0.001	[m]
Second month after treatment	5.7±1.4	2.8±3.1	0.001	[m]
VAS score the first step in the morning				
Baseline	8.3±1.3	7.9±1.7	0.482	[m]
The first month after treatment	7.8±1.5	4.8±2.7	0.001	[m]
Second month after treatment	7.6±1.6	3.5±3.1	0.001	[m]
VAS score exercise				
Baseline	8.6±1.3	8.3±1.7	0.685	[m]
The first month after treatment	8.0±1.4	5.0±2.8	0.001	[m]
Second month after treatment	7.9±1.5	3.8±3.2	0.001	[m]

[m]Mann-Whitney U test/Wilcoxon test, LLLT: Low-level laser treatment, SD: Standard deviation, VAS: Visual analog scale

(p>0.05). Except this score, all other measurements has been improved both in the first and second months in the control group (p<0.05). The improvement in these scores was higher in the treatment group than in the control group in the first and the second months both. Just there has been no significant difference in the reduction ratio in the FFI activity limitation subscale score in the first month between the groups (Table 3).

In the treatment group, all measurements of AOFAS scores except alignment score has been significantly improved both in the first and the second months compared with to the initial state (p<0.05). The improvement in these scores was higher in the treatment group than in the control group in the first and the second months both. There has been no significant change in AOFAS pain and alignment scores compared to the initial state in the control group (p>0.05). Only the function score on the AOFAS scale in the control group showed a significant improvement (Table 4).

Discussion

For adults, PF is the most typical source of heel discomfort. Although this condition can be self-limiting, there are many conservative treatment options (32). However, their effectiveness is still uncertain, and the optimal treatment has not been defined (33).

Literature contains a insignificant number of publications examining LLLT's efficacy in the management of PF. It has been reported that there are a number of disputed cases about the LLLT treatment for PF, which may be caused by variations in the treatment protocols and kinds of LLLT. Numerous factors, including frequency, dose, and locations, are taken into account in LLLT's therapeutic use. Consequently, future research should concentrate on identifying the best treatment parameters to enhance the clinical effectiveness of the treatment (34).

The purpose of this research was to asses the efficacy of LLLT in the management of persistent PF. Our LLLT treatment protocol in this study was distinct from the other protocols described in the literature. We observed different kinds of therapy protocols's effects. Moreover, in our study, we used different scales that evaluate functional abilities and gait function.

We retrospectively examined 60 patient files diagnosed with PF. Because of our study, VAS, FFI, and AOFAS values significantly improved in both the treatment and control groups, according to our findings, which were significantly better in the treatment group compared with the control group. These results demonstrate that LLLT can be a viable therapy option for PF.

LLLT in the treatment of PF was first investigated in 1998 by Basford et al. (35). They applied LLLT at a wavelength of 830 nm at a dose of

Table 3. Foot function index

	LLLT group (n=30)	Control group (n=30)	p	
	Mean ± SD	Mean ± SD		
Pain subscale				
Baseline	7.7±1.2	7.6±1.9	0.882	[m]
The first month after treatment	7.6±1.3	4.8±2.7	**0.001**	[m]
Second month after treatment	7.4±1.3	3.5±3.0	**0.001**	[m]
Disability subscale				
Baseline	7.0±1.6	6.2±2.2	0.135	[m]
The first month after treatment	6.8±1.6	4.7±3.2	**0.006**	[m]
Second month after treatment	6.6±1.7	3.1±3.1	**0.001**	[m]
Activity limitation subscale				
Baseline	4.6±2.9	4.5±2.8	0.853	[m]
The first month after treatment	4.4±2.8	3.8±2.8	0.344	[m]
Second month after treatment	4.2±2.7	2.2±2.7	**0.002**	[m]
Total FFI score				
Baseline	6.6±1.0	6.5±1.9	0.589	[m]
The first month after treatment	6.4±0.9	4.8±2.9	**0.021**	[m]
Second month after treatment	6.3±1.0	3.3±3.0	**0.001**	[m]

[m]Mann-Whitney U test/Wilcoxon test, LLLT: Low-level laser treatment, SD: Standard deviation, FFI: Foot function index

Table 4. American orthopaedic foot and ankle society

	LLLT group (n=30)	Control group (n=30)	p	
	Mean ± SD	Mean ± SD		
Pain subscale				
Baseline	21.7±25.2	23.3±25.4	0.797	[m]
The first month after treatment	21.7±25.2	61.7±28.4	**0.001**	[m]
Second month after treatment	21.7±25.2	67.5±30.2	**0.001**	[m]
Function subscale				
Baseline	43.5±17.4	58.7±20.3	**0.001**	[m]
The first month after treatment	46.1±17.4	68.5±24.2	**0.001**	[m]
Second month after treatment	48.2±17.8	77.5±25.3	**0.001**	[m]
Alignment subscale				
Baseline	75.0±31.5	78.3±31.3	0.632	[m]
The first month after treatment	75.0±31.5	78.3±31.3	0.632	[m]
Second month after treatment	75.0±31.5	78.3±31.3	0.632	[m]
Total AOFAS				
Baseline	37.9±14.7	46.5±19.8	0.052	[m]
The first month after treatment	39.2±15.1	66.8±24.9	**0.001**	[m]
Second month after treatment	40.3±14.7	73.6±26.5	**0.001**	[m]

[m]Mann-Whitney U test/Wilcoxon test, LLLT: Low-level laser treatment, SD: Standard deviation, AOFAS: American Orthopaedic Foot and Ankle Society

1 J to the to the plantar fascia's starting point and a dose of 2 J along the medial fascial edge for 12 sessions and found no significant clinical difference with the placebo group in the first month after treatment. However, the reason for this result is likely to be due to the low dose of treatment administered. In our study, unlike this study, a higher dose of LLLT was applied to the patients. In contrast to this study, our treatment group showed a significant improvement in comparison to the control group on the VAS, FFI, and AOFAS scales for all criteria of pain, function, and activity limitation.

In their 2009 investigation, Kiritsi et al. (8) used a Ga-As laser with an infrared wavelength of 904 nm to perform LLLT. The active treatment dose was 8.4 J over the tendon insertion point, followed by 8.4 J along the medial fascial boundary. They evaluated the clinic of the patients with VAS pain scores and the plantar fascia thickness ultrasonographically.

After treatment, the LLLT group showed a substantial reduction in pain levels, although both groups also showed an increase in plantar fascia thickness. Fascia thicknesses, on the other hand, were unchanged in comparison to the placebo group.

Jastifer et al. (34) performed a total of 6 sessions of 635 nm, 17-mW dose, 10 min, 2 times a week, 3 weeks. They evaluated their patients with FFI and VAS scales before treatment, at 2 weeks, 6 months, and 12 months after treatment. They found that there was a significant difference in all evaluations compared to pretreatment values. However, in our study, we were unable to evaluate the long-term effects of treatment. Similar to this study, we also used the FFI scale and a significant change was found in the FFI scale scores in terms of both the amount of pain reduction and the improvement in functions at the 1st and 2nd months after the treatment.

Randomized placebo-controlled study in 2015, Macias et al. (36) applied LLLT at a dose of 17 mw with a wavelength of 635 nm for 10 min, twice a week, for 3 weeks. They showed that the LLLT group was significantly superior to the placebo group in both decreasing VAS pain scores and decreasing fascia thickness. They also achieved significant improvement in all FFI scores in both the LLLT and the placebo groups, but they didnot detect a difference between the groups. The limitation of our study, according to the study by Macias et al. (36) and Kiritsi et al. (8) is that the plantar fascia thickness was not evaluated by ultrasound (US) and the placebo group was excluded in our study.

In their investigation in 2017, Ulusoy et al. (16) used the AOFAS test to assess the efficacy of LLLT in PF. They applied a Ga-Al-As laser device at 830 nm, 50 mW output power, 8 j/cm^2 dose for a total of 3 weeks 5 times a week. They compared the efficacy of LLLT with extracorporeal shock wave therapy (ESWT) and therapeutic US therapy. AOFAS ratings in the LLLT group improved more than in the ESWT and US groups, according to the study.

In a randomized prospective study by Cinar et al. (37) both treatment and control groups were given insoles and a home exercise program, and LLLT was also applied to the treatment group. They used the AOFAS function scale for functional evaluation and the VAS scale for pain after the 12-minute walk test. They performed LLLT in the 5 most painful points at a dose of 5.6 j/cm^2 for 80 seconds. While both groups showed a substantial improvement in their AOFAS function scores in the third week following treatment, only the group that received LLLT in the third month showed a meaningful improvement. Although there was a significant improvement in the measurement of activity-related pain in both groups at the 3rd month, the amount of improvement was greater in the treatment group. In our study, in parallel with this study, a significant increase was observed in all groups of AOFAS scores compared with the pre-treatment scores, except the alignment score in the treatment group. This is a result consistent with previous studies. This supports that LLLT is an effective treatment. The different aspects of our study according to the study by Cinar et al. (37) is that the LLLT was applied at a lower dose and with a different application method.

The positive sides of our study; in accordance with previous studies, no adverse effects were seen in the patients throughout the study. This finding supports that LLLT is a safe treatment. The fact that the treatment responses of the patients included in our study was evaluated using the FFI and AOFAS scales also enabled us to investigate the correlation of these two scales. And the results obtained from the two scales were correlated with each other.

Study Limitations

The limitations of our study are that the evaluation process was short, retrospective, and there was no placebo group.

Conclusion

According to this study, LLLT is useful in PF conventional treatment with regard to pain, functional activities, and quality of life. It has been concluded that LLLT is a reliable and effective application in the physical treatment of PF. To investigate the effects of LLLT on PF treatment, placebo-controlled studies with longer follow-ups are needed for more patients.

Ethics Committee Approval: The University of Health Sciences Turkey, İstanbul Training and Research Hospital Ethics Committee gave its approval to the study (approval number: 2016/902).

Informed Consent: Each participant gave written consent.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions: Surgical and Medical Practices - B.G., Y.P.D., E.Y.; Concept - B.G., E.A., D.İ., E.Y.; Design - B.G., Y.P.D., D.İ., E.Y.; Data Collection or Processing - B.G., E.A., Y.P.D., D.İ., E.Y., F.U.; Analysis or Interpretation - B.G., E.A., Y.P.D., D.İ., F.U.; Literature Search - B.G., E.A., Y.P.D., F.U.; Writing - B.G., E.A., F.U.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. Rompe JD, Furia J, Weil L, Maffulli N. Shock wave therapy for chronic plantar fasciopathy. Br Med Bull 2007; 81-82: 183-208.
2. Cornwall MW, McPoil TG. Plantar fasciitis: etiology and treatment. J Orthop Sports Phys Ther 1999; 29: 756-60.
3. Martinelli N, Bonifacini C, Romeo G. Current therapeutic approaches for plantar fasciitis. Clin Cosmet Investig Dent 2014; 6: 45-56.
4. Buchbinder R. Clinical practice. Plantar fasciitis. N Engl J Med 2004; 350: 2159-66.
5. Pasquina PF, Foster LS. Plantar fasciitis. In: Musculoskeletal Disorders: Foot and Ankle, edited by WR Frontera, JK Silver, TD Rizzo Jr, WB Saunders, Philadelphia; 2008. p.469-73.
6. Goff JD, Crawford R. Diagnosis and treatment of plantar fasciitis. Am Fam Physician 2011; 84: 676-82.
7. Chacko K. Heel pain: diagnosis and treatment. Primary Care Case Rev 2003; 6: 50-6.
8. Kiritsi O, Tsitas K, Malliaropoulos N, Mikroulis G. Ultrasonographic evaluation of plantar fasciitis after low-level laser therapy: results of a double-blind, randomized, placebo-controlled trial. Lasers Med Sci 2010; 25: 275-81.
9. Rola P, Doroszko A, Derkacz A. The Use of Low-Level Energy Laser Radiation in Basic and Clinical Research. Adv Clin Exp Med 2014; 23: 835-42.

10. Chow RT, Barnsley L. Systematic review of the literature of low-level laser therapy (LLLT) in the management of neck pain. Lasers Surg Med 2005; 37: 46-52.

11. Djavid GE, Mortazavi SMJ, Basirnia A. Low level laser therapy in musculoskeletal pain syndromes: Pain relief and disability reduction. Lasers Surg Med 2003; 152: 43.

12. Gam AN, Thorsen H, Lønnberg F. The effect of low-level laser therapy on musculoskeletal pain: a meta-analysis. Pain 1993; 52: 63-6.

13. Jacobsen FM, Couppé C, Hilden J. Comments on the use of low-level laser therapy (LLLT) in painful musculo-skeletal disorders. Pain 1997; 73: 110-1.

14. Reddy GK, Stehno-Bittel L, Enwemeka CS. Laser photostimulation of collagen production in healing rabbit Achilles tendons. Lasers Surg Med 1998; 22: 281-7.

15. Walker J. Relief from chronic pain by low power laser irradiation. Neurosci Lett 1983; 43: 339-44.

16. Ulusoy A, Cerrahoglu L, Orguc S. 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. J Foot Ankle Surg 2017; 56: 762-7.

17. Maskill JD, Bohay DR, Anderson JG. Gastrocnemius recession to treat isolated foot pain. Foot Ankle Int 2010; 31: 19-23.

18. Celik D, Kuş G, Sırma SÖ. Joint Mobilization and Stretching Exercise vs Steroid Injection in the Treatment of Plantar Fasciitis: A Randomized Controlled Study. Foot Ankle Int 2016; 37: 150-6.

19. Chew KT, Leong D, Lin CY, Lim KK, Tan B. Comparison of autologous conditioned plasma injection, extracorporeal shockwave therapy, and conventional treatment for plantar fasciitis: a randomized trial. PM R 2013; 5: 1035-43.

20. Young CC, Rutherford DS, Niedfeldt MW. Treatment of plantar fasciitis. Am Fam Physician 2001; 63: 467-74, 477-8. Erratum in: Am Fam Physician 2001; 64: 570.

21. Bartold SJ. The plantar fascia as a source of pain—biomechanics, presentation and treatment. Journal of bodywork and movement therapies. J Bodyw Mov 2004; 8: 214-26.

22. Covey CJ, Mulder MD. Plantar fasciitis: How best to treat? J Fam Pract 2013; 62: 466-71.

23. Dyck DD Jr, Boyajian-O'Neill LA. Plantar fasciitis. Clin J Sport Med 2004; 14: 305-9.

24. Tisdel CL, Donley BG, Sferra JJ. Diagnosing and treating plantar fasciitis: a conservative approach to plantar heel pain. Cleve Clin J Med 1999; 66: 231-5.

25. Digiovanni BF, Nawoczenski DA, Malay DP, Graci PA, Williams TT, Wilding GE, et al. Plantar fascia-specific stretching exercise improves outcomes in patients with chronic plantar fasciitis. A prospective clinical trial with two-year follow-up. J Bone Joint Surg Am 2006; 88: 1775-81.

26. DiGiovanni BF, Nawoczenski DA, Lintal ME, Moore EA, Murray JC, Wilding GE, et al. Tissue-specific plantar fascia-stretching exercise enhances outcomes in patients with chronic heel pain. A prospective, randomized study. J Bone Joint Surg Am 2003; 85: 1270-7.

27. Analay Akbaba Y, Celik D, Ogut RT. Translation, Cross-Cultural Adaptation, Reliability, and Validity of Turkish Version of the American Orthopaedic Foot and Ankle Society Ankle-Hindfoot Scale. J Foot Ankle Surg 2016; 55: 1139-42.

28. Yaliman A, Sen E, Eskiyurt N, Budiman-Mak E. Turkish translation and adaptation of foot function index in patients with plantar fasciitis. Turkish J Phys Med Rehab 2014; 60: 212-23.

29. Kitaoka HB, Alexander IJ, Adelaar RS, Nunley JA, Myerson MS, Sanders M. Clinical rating systems for the ankle-hindfoot, midfoot, hallux, and lesser toes. Foot Ankle Int 1994; 15: 349-53.

30. Budiman-Mak E, Conrad KJ, Roach KE. The Foot Function Index: a measure of foot pain and disability. J Clin Epidemiol 1991; 44: 561-70.

31. Trevethan R. Evaluation of two self-referent foot health instruments. Foot (Edinb) 2010; 20: 101-8.

32. Haake M, Buch M, Schoellner C, Goebel F, Vogel M, Mueller I, et al. Extracorporeal shock wave therapy for plantar fasciitis: randomised controlled multicentre trial. BMJ 2003; 327: 75.

33. Rome K, Howe T, Haslock I. Risk factors associated with the development of plantar heel pain in athletes. The Foot 2001; 11: 119-25.

34. Jastifer JR, Catena F, Doty JF, Stevens F, Coughlin MJ. Low-Level Laser Therapy for the Treatment of Chronic Plantar Fasciitis: A Prospective Study. Foot Ankle Int 2014; 35: 566-71.

35. Basford JR, Malanga GA, Krause DA, Harmsen WS. A randomized controlled evaluation of low-intensity laser therapy: plantar fasciitis. Arch Phys Med Rehabil 1998; 79: 249-54.

36. Macias DM, Coughlin MJ, Zang K, Stevens FR, Jastifer JR, Doty JF. Low-Level Laser Therapy at 635 nm for Treatment of Chronic Plantar Fasciitis: A Placebo-Controlled, Randomized Study. J Foot Ankle Surg 2015; 54: 768-72.

37. Cinar E, Saxena S, Uygur F. Low-level laser therapy in the management of plantar fasciitis: a randomized controlled trial. Lasers Med Sci 2018; 33: 949-58.