

ORIGINAL ARTICLE

Comparison of Radiofrequency Ablation and Steroid Injection in the Treatment of Plantar Fasciitis; Short and Medium Term Results

Plantar Fasiit Tedavisinde Radyofrekans Ablasyon ve Steroid Enjeksiyonu Etkinliğinin Karşılaştırılması; Kısa ve Orta Dönem Sonuçları

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ABSTRACT**Objective:** Plantar fasciitis, commonly encountered in orthopaedic practice, can impede daily life activities and result in a loss of workforce. This study aimed to assess the short- and medium-term outcomes of radiofrequency ablation (RFA) and steroid injection treatments in patients with plantar fasciitis who did not benefit from conservative therapies, using pain and function scores.**Materials and Methods:** Between July 01, 2021, and January 01, 2023, patients diagnosed with plantar fasciitis at Hakkari State Hospital were examined. Those not responding to conservative treatments and underwent RFA or steroid injection were divided into two groups. Demographic information, Visual Analog Scale (VAS), and American Orthopedic Foot and Ankle Society (AOFAS) scores were analyzed, and both groups were compared.**Results:** The 6th-month post-treatment scores of 69 patients meeting inclusion criteria were examined (35 with RFA, 34 with steroid injections). Patients underwent RFA had a mean age of 43.89 ± 10.31 years, with 25 females and 10 males. Those receiving steroid injections had a mean age of 48.74 ± 5.00 years, with 23 females and 11 males. No significant difference was observed when comparing pre-intervention VAS and AOFAS values for both groups ($p=0.469$, $p=0.244$). There was no significant difference in the first-month VAS and AOFAS values between the two groups ($p=0.764$, $p=0.466$, respectively). However, a significant difference was observed in the post-6-month VAS and AOFAS values ($p=0.001$, $p=0.001$). Significant differences were found between VAS and AOFAS values in patients receiving RFA at both pre-intervention and 6 months ($p=0.001$, $p=0.001$). No significant difference was observed in pre-intervention and 6-month VAS and AOFAS values in steroid injections ($p=0.512$, $p=0.844$, respectively). No complications were observed in both groups during the follow-up period.**Conclusion:** In patients who did not benefit from conservative treatment, radiofrequency ablation has been found an effective, safe, and minimally invasive method for reducing pain severity in the short to medium term and improving daily activities.**Keywords:** Plantar Fasciitis, Radiofrequency Ablation, Steroid Injection, Calcaneal Spur**Öz****Amaç:** Ortopedik uygulamalarda yaygın olarak karşılaşılan plantar fasiit, günlük yaşam aktivitelerini kısıtlayabilir ve iş gücü kaybına neden olabilir. Bu çalışma, konservatif tedavilerden fayda görmeyen plantar fasiitli hastalarda radyofrekans ablasyon (RFA) ve steroid enjeksiyon tedavisinin kısa ve orta vadeli sonuçlarını, ağrı ve fonksiyon skorları kullanarak değerlendirmeyi amaçlamaktadır.**Materyal ve Metod:** 01 Temmuz 2021 ile 01 Ocak 2023 tarihleri arasında Hakkari Devlet Hastanesi'nde plantar fasiit tanısı alan hastalar incelendi. Konservatif tedavilere yanıt vermeyen ve RFA veya steroid enjeksiyonu uygulanan hastalar iki gruba ayrıldı. Hastaların demografik bilgileri, Görsel Analog Skala (VAS) ve Amerikan Ortopedik Ayak ve Ayak Bileği Derneği (AOFAS) skorları analiz edildi ve her iki grup karşılaştırıldı.**Bulgular:** Dahil etme kriterlerini karşılayan 69 hastanın 6. ay sonrası tedavi skorları incelendi (35 RFA, 34 steroid enjeksiyonu). RFA uygulanan hastaların yaş ortalaması 43.89 ± 10.31 yıl olup, 25'i kadın ve 10'u erkekti. Steroid enjeksiyonu alan hastaların yaş ortalaması ise 48.74 ± 5.00 yıl olup, 23'ü kadın ve 11'i erkekti. Her iki grup için müdahale öncesi VAS ve AOFAS değerleri karşılaştırıldığında anlamlı bir fark gözlenmedi (sırasıyla $p=0.469$, $p=0.244$). İlk ay VAS ve AOFAS değerleri arasında ise iki grup arasında anlamlı bir fark bulunmadı (sırasıyla $p=0.764$, $p=0.466$). Ancak, 6. ay sonrası VAS ve AOFAS değerleri arasında anlamlı bir fark gözlemlendi (sırasıyla $p=0.001$, $p=0.001$). RFA alan hastalarda, müdahale öncesi ve 6 ay sonrasında VAS ve AOFAS değerleri arasında anlamlı farklar bulundu (sırasıyla $p=0.001$, $p=0.001$). Steroid enjeksiyonu alan hastalarda ise müdahale öncesi ve 6 ay sonrasında VAS ve AOFAS değerleri arasında anlamlı bir fark gözlenmedi (sırasıyla $p=0.512$, $p=0.844$). Her iki grupta da takip süresinde komplikasyon gözlenmedi.**Sonuç:** Konservatif tedaviden fayda görmeyen hastalarda, radyofrekans ablasyonunun kısa ve orta vadeli ağrı şiddetini azaltma ve günlük aktiviteleri iyileştirme konusunda etkili, güvenli ve minimal invaziv bir yöntem olduğu bulunmuştur.**Anahtar Kelimeler:** Plantar Fasiit, Radyofrekans Ablasyon, Steroid Enjeksiyon, Kalkaneal Spur**Introduction**

Heel pain is a common problem in society, approximately 10-15% of the adult population (1). One of the most common causes of heel pain is irritation of the plantar fascia (2). This irritation causes chronic inflammation in the proximal plantar fascia as a result of recurrent microtrauma, resulting in heels pain (3). In other words, plantar fasciitis is a pathology associated with inflammation of the plantar fascia at the site of

adhesion to the calcaneus anteromedial tuberculosis (4, 5). The vast majority of patients who complain chronic heel pain are accompanied by calcaneal spur (6). Besides, every patient with calcaneal spur has not heel pain. Of these patients with calcaneal spur, 15% are asymptomatic (7). Patients' pain complaints can often change over the course of the day, but in some patients the pain can become chronic, causing

limitation of activity and loss of workforce. Although a wide range of methods has been proposed for the treatment of plantar fasciitis, from stretch exercises to surgical intervention, there has been no consensus in choosing an effective treatment.

Recently, percutaneous procedures have been considered mini-invasive and are becoming more widely used (8). In recent years, radiofrequency ablation has been increasingly used in the treatment of many diseases (9). Good results have been achieved, especially with the help of radiological imaging in tumor surgeries and pain treatments (8). Recently, it has been used in cases of chronic inflammation, such as plantar fasciitis and lateral epicondylitis (10, 11). The general principle of radiofrequency ablation therapy is to produce heat through a low voltage, high frequency current through an electrode placed on the targeted lesion, causing thermal damage to the tissues and developing coagulation necrosis within a few days. Another effect is the disruption of covalent bonds maintaining the structure of the plantar fascia through the electrical activity generated by the RF electrode. This disruption leads to a reduction in the thickness of the plantar fascia and the elimination of sensory receptors that enable the occurrence and transmission of pain (12). However, there are no precise data and clear results on RFA treatment in patients with plantar fasciitis, the available literature has not fully clarified the issue. Our hypothesis is that the treatment of plantar fasciitis with RFA is more successful than the steroid injection, which is a conventional treatment. We conducted this study to demonstrate the effectiveness of steroid injection with RFA in patients who were treated with conservative treatments but whose symptoms did not recede.

Material and Methods

Our study began after it was approved by the ethics board of Necmettin Erbakan University resolution 2023/4625 dated 03.11.2023. Patients who applied for heel pain to the Hakkari State Hospital between 01.07.2021-01.01.2023 were scanned. The data of those who received radiofrequency ablation and steroid injection and patients with plantar fasciitis who had previously received at least six months of non-invasive conservative treatments for plantar fasciitis (NSAI, shoe modification, weight loss, lifestyle changes, etc.) but stated that they did not benefit were examined retrospectively. Patients with the body mass index over 30, patients with a history of surgical intervention in the affected limb, patients with standing fungus or other infection, people with vascular pathology in the affected limb and patients with rheumatic disease were excluded. Patients with suitable criteria were divided into radiofrequency ablation (RFA) and steroid injection (SE). The age, gender, pain score and functional score of the patients were compared. The Visual Analog Scale (VAS) and the American Orthopaedic Foot Ankle Society (AOFAS) scores were examined as pain and functional scores respectively before, 1 month and 6 months after the procedure. VAS is a scale with a numerical rating between 0 and

10. (13). 0 = no pain, 10 = very severe pain (13). The American Orthopedic Foot and Ankle Society (AOFAS) score is rated on a scale of 0 to 100 points, where values below 70 indicate poor results, values between 70 and 79 indicate average results, values between 80 and 89 indicate good results, and values between 90 and 100 are considered excellent results.

Radiofrequency Ablation Procedure

Before the procedure began, the patient was placed in a prone position. A pedal electrode was attached to the limb where the procedure would not be performed. The ankle of the limb where RFA would be applied was brought to a neutral position. A sterile local anesthesia of 2 mg/kg Priloc %2 (VEM Pharmaceuticals, Çankaya/ ANKARA) was administered to the mid-edge of the heel. As shown in Figure 1, the radiofrequency rod was advanced to the medial limit of calcaneal tuberosity. Low-energy impulses were applied at 2 Hertz(Hz), and fasciculation or toe movements were checked to rule out that the prob was near the motor nerve. After making sure we were not close to the motor nerve, we gradually raised the voltage from 0 Volt(V) at 50 Hz until the patient felt numb to find the right position. Subsequently, the voltage was reduced and the prob was thought to be close to the sensory nerve, where the sensation of numbness continued at levels of <0.5 V. At this point, ablation was applied to the sensory nerve at 90°C for 90 seconds. The treatment was terminated by wrapping the patient with an elastic bandage. RFE2-A (BNS, China) model device was used for procedure.

Steroid Injection Procedure

Patient lay in the prone position before the procedure began. The ankle of the limb to be operated was taken to a neutral position. In sterile conditions, 2 mg/kg Priloc 2% (VEM Medicine, Çankaya/ANKARA) was administered to the treatment area. After local anesthesia, steroid injection was administered to the affected area (20 mg Depo-Medrol (PFIZER PFE Medicine, Ortaköy/Istanbul).The post-operative patients were elastically bandaged and followed for at least 30 minutes for the possibility of acute complications.

Statistical Assessment

The statistical analysis of the data was carried out with the IBM SPSS 22.0 Windows (SPSS Inc, Chicago, IL, USA) application. Demographic data and defining statistics of variables were given as average \pm standard deviation. Normality analysis was performed using the Shapiro-wilk test for independent variables. The Mann Whitney U test was used for independent variables that did not show normal distribution, while the Wilcoxon test for dependent variables. Values of $p < 0.05$ were considered statistically significant. In the power analysis, with a predicted type 1 error of 0.05 and an efficacy power of 0.80, a minimum of 30 patients were required in both groups to achieve statistical significance.



Figure 1: Application of RFA Treatment

Results

A total of 122 patients received steroid injections and/or radiofrequency ablation. Of these, 80 patients were found to meet the criteria, but 69 patients were included in the study because 11 patients did not comply with follow-up. 35 patients received radiofrequency ablation and 34 patients received steroid injections. The mean age of the patients who underwent RFA was 43.89 ± 10.31 years, 25 were female and 10 were male. The mean age of the patients who underwent steroid injection was 48.74 ± 5.00 years, 23 were female and 11 were male. Body mass index for the RFA group was 24.71 ± 3.61 while it was 24.23 ± 3.57 for the steroid group.

Preintervention VAS of the RFA group was 8.86 ± 0.77 while preintervention VAS of the steroid group was 8.70 ± 0.58 , and there was no significant difference between them ($p=0.469$). VAS at the end of the 1st month of the RFA group was 3.00 ± 1.33 while VAS at the end of the 1st month of the steroid group was 2.94 ± 1.61 , with no significant difference ($p=0.764$). VAS at the end of the 6th month of the RFA group was 5.71 ± 1.93 while VAS at the end of the 6th month of the steroid group was 8.52 ± 1.26 , and there was significant difference between them ($p=0.001$). Preintervention AOFAS of the RFA group was 42.80 ± 6.13 , while preintervention of the steroid group was 44.94 ± 7.35 and there was no significant difference ($p=0.244$). AOFAS at the end of the 1st month of the RFA group was 60.97 ± 13.67 while AOFAS at the end of the 1st month of the steroid group was 59.03 ± 12.15 and there was no significant difference between them ($p=0.466$). AOFAS at the end of the 6th month of the RFA group was 53.60 ± 9.49 while AOFAS at the end of the 6th month of the steroid group was 44.12 ± 7.05 and there was significant difference between them ($p=0.001$).

The patients were evaluated with the Wilcoxon test based on their preop state. In the RFA group, a statistically significant difference was observed between preintervention VAS value and at the end of 1st month VAS ($p=0.001$). In the RFA group, a statistically significant difference was observed between preintervention VAS value and at the end of 6th month VAS ($p=0.001$). In the steroid group, a statistically significant difference was observed between preintervention VAS and at the end of 1st month VAS ($p=0.001$). There was no statistically

significant difference between preintervention VAS and at the end of 6th month VAS in the steroid group ($p=0.512$). In the RFA group, a statistically significant difference was observed between the preintervention AOFAS value and at the end of 1st month AOFAS value ($p=0.001$). In the RFA group, a statistically significant difference was observed between the preintervention AOFAS value and at the end of 6th month AOFAS value ($p=0.001$). In the steroid group, a statistically significant difference was observed between the preintervention AOFAS value and at the end of 1st month AOFAS value ($p=0.001$). No statistically significant difference was observed between the preintervention AOFAS and at the end of 6th month AOFAS in the steroid group ($p=0.844$). Means of all scores, standard deviation and p values after statistical analysis are given in Table 1.

Table 1: Scores of patients who underwent radiofrequency ablation and steroid injection

		RFA (Mean \pm SD)	Steroid Injection (Mean \pm SD)	p value
	Preintervention VAS	8.86 ± 0.77	8.70 ± 0.58	0.469 ^a
	Postintervention 1st Month VAS	3.00 ± 1.33	2.94 ± 1.61	0.764 ^a
	Postintervention 6th Month VAS	5.71 ± 1.93	8.52 ± 1.26	0.001 ^a
	Preintervention AOFAS	42.80 ± 6.13	44.94 ± 7.35	0.244 ^a
	Postintervention 1st Month AOFAS	60.97 ± 13.67	59.03 ± 12.15	0.466 ^a
	Postintervention 6th Month AOFAS	53.60 ± 9.49	44.12 ± 7.05	0.001 ^a
RFA	VAS	Preintervention 8.86 ± 0.77	Postintervention 1st Month 3.00 ± 1.33	0.001 ^b
	AOFAS	Preintervention 42.80 ± 6.13	Postintervention 6th Month 60.97 ± 13.67	0.001 ^b
RFA	VAS	Preintervention 8.86 ± 0.77	Postintervention 6th Month 5.71 ± 1.93	0.001 ^b
	AOFAS	Preintervention 42.80 ± 6.13	Postintervention 1st Month 53.60 ± 9.49	0.464 ^b
Steroid	VAS	Preintervention 8.70 ± 0.58	Postintervention 1st Month 2.94 ± 1.61	0.001 ^b
	AOFAS	Preintervention 44.94 ± 7.35	Postintervention 6th Month 59.03 ± 12.15	0.001 ^b
Steroid	VAS	Preintervention 8.70 ± 0.58	Postintervention 6th Month 8.52 ± 1.26	0.512 ^b
	AOFAS	Preintervention 44.94 ± 7.35	Postintervention 1st Month 44.12 ± 7.05	0.844 ^b

a: Mann Whitney U test, b: Wilcoxon test, SD: Standard Deviation

Discussion

The study's most significant findings indicated that patients underwent RFA had significantly lower Visual Analog Scale (VAS) scores and significantly higher American Orthopedic Foot and Ankle Society (AOFAS) scores compared to those who received steroid injections. No gold standard method has been revealed in the literature for the treatment of plantar fasciitis, which is frequently seen in patients presenting with heel pain and is frequently encountered in the routine practice of physicians of the relevant branches (Orthopaedics, physical therapy and rehabilitation, family medicine). In this study, we compared the effectiveness of RFA, A method that has been increasingly used in recent years, and steroid injection, which is a conventional method. As a result of our study, while there was no significant difference between the two groups in the first month after the procedure. A significant improvement was observed in the pain and functional scores of the patients who received RFA compared to those who received steroid injection at the end of the sixth month.

Yürük et al. evaluated the effectiveness of radiofrequency ablation in 20 patients with plantar fasciitis and stated that this method was safe and effective(12). However, the presence of patients with and without pes planus deformity in this study disrupts standardization. As it is known, the incidence of plantar fasciitis increases in pes planus deformity(7).

In symptomatic patients with plantar fasciitis who do not benefit from conservative treatments, steroid injections are usually performed in the second stage to reduce plantar fascia inflammation and edema in the adjacent area. However, the long-term effectiveness of steroid injection is limited compared to other treatments. In a randomized clinical study, Rastegar et al. revealed that steroid injection could quickly relieve plantar heel pain, but dry needling might provide more satisfactory results in the long term in patients with plantar fasciitis (14). In addition, it has been stated that platelet rich plasma (PRP) injection has more positive results in pain and function scores during the 3-month follow-up period compared to corticosteroid injections (15, 16). Some studies have also stated that steroid injection treatment has an effect similar to placebo and improves symptoms for up to 1-2 months (17). This finding correlates with the fact that in our study there was no significant difference between the two groups in the 1st month after the procedure. The scores of plantar fasciitis patients who received steroid injection in the sixth month after the procedure were close to the preoperative scores, indicating that this treatment is not a definitive treatment. Therefore, RFA treatment may be an alternative treatment in patients who do not benefit from conservative treatment.

Surgical intervention may be considered in patients with persistent plantar fasciitis who have failed at least 6 months of conservative treatment. Open plantar fascia release is the traditional operation method. According to reports, the postoperative satisfaction

rate of fascia release is 50-95% (18, 19). However, the disadvantages of surgery include the larger wound, longer postoperative recovery time, and the possibility of complex regional pain syndrome occurring after surgery. We think that it is necessary to develop less invasive techniques rather than such a surgical procedure, which is prone to so many complications and has a relatively low chance of success. Since RFA treatment is a minimally invasive method compared to surgical intervention, it does not cause complications occurred in open surgery. Yapıcı et al. underscored the utility of radiofrequency ablation therapy in patients with plantar fasciitis who exhibited resistance to various treatment modalities, such as steroid injections or Extracorporeal Shock Wave Therapy, as it was evidenced by their study evaluating a substantial patient cohort of 229 individuals(20). In our study, no complications related to RFA treatment were observed in the six-month follow-up of patients who received RFA treatment. For this reason, we think that RFA can be safely applied instead of limited long-term effectiveness treatment, such as steroid injection.

Conclusion

Our study has several limiting factors. The most important of these is that it is a retrospective study. The second limiting factor is our current knowledge of patients' short- and medium-term clinical outcomes; Unfortunately, we do not have data on long-term outcomes. Another limiting factor may be that radiological evaluation of the plantar fascia cannot be performed with x-ray or tomography and requires magnetic resonance imaging. We did not use magnetic resonance imaging because it is expensive and radiological imaging for the patient who feels relieved after the treatment creates ethical concerns.

According to the results of our research, radiofrequency ablation is an effective, safe and minimally invasive method in reducing pain severity and improving daily activities in short-term (0-3 months) and medium-term (3-6 months) perspectives. Radiofrequency ablation therapy can be considered as an effective option in patients who have received conservative treatment but have not benefited from it.

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Treatment Method Is Better in the Treatment of Chronic Plantar Fasciitis: Corticosteroid Injection, Extracorporeal Shock Wave Therapy, or Radiofrequency Thermal Lesioning? *J Am Podiatr Med Assoc.* 2023;113(5).

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