

Comparison of the Effectiveness of Radiofrequency Ablation and Steroid Injection in the Treatment of Plantar Fasciitis

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Abstract

Aim: The main goal of this research was to evaluate the effectiveness of steroid injections and radiofrequency ablation as treatments for refractory chronic plantar fasciitis.

Methods: Sixty patients with plantar fasciitis who had not responded to conservative treatment for at least 6 months were randomly divided into two groups. The first group received ultrasound-guided radiofrequency ablation (n=30) and the second group received steroid injection (n=30). Patients were evaluated with Visual Analogue Scale (VAS) and American Orthopaedic Foot and Ankle Society (AOFAS) scores before treatment, at 1 month and 6 months.

Results: At the sixth month follow-up, the VAS score was 2.8 in the radiofrequency group and 4.2 in the steroid group ($p<0.008$). AOFAS scores were 85.3 ± 6.8 in the radiofrequency group and 74.2 ± 8.4 in the steroid group ($p<0.003$). Treatment success was 83.3% in the radiofrequency group and 63.3% in the steroid group. The need for repeat treatment was observed with a rate of 10% in the radiofrequency group and 26.7% in the steroid group. No serious complications were observed in both groups.

Conclusions: Radiofrequency ablation proved superior to steroid injection as a treatment for chronic plantar fasciitis. The treatment achieved better results in pain management and functional improvement while requiring fewer follow-up procedures.

Keywords: Plantar fasciitis; radiofrequency ablation; steroid injection

1. Introduction

Plantar fasciitis is recognised as one of the most common causes of heel pain and can significantly limit the activities of daily living of individuals.¹ In the literature, it is reported that this condition affects approximately 10% of the population and millions of people are treated for this disease annually.² It has been reported that repetitive mechanical stress, especially on the plantar fascia, combined with factors such as obesity, limited dorsiflexion movement and prolonged standing, trigger this disease.³

Clinically, plantar fasciitis is characterised by intense pain, which is usually felt with the first steps in the morning. Although this pain decreases with activity, it may reappear during prolonged standing and walking.⁴ Treatment options include conservative methods such as NSAIDs, physical therapy, night splints and orthopaedic insoles, while surgical interventions or minimally invasive methods, especially radiofrequency ablation (RFA), come to the fore in resistant cases.^{1,4}

RFA is a method that does not involve surgery and which has drawn interest in treating plantar fasciitis in recent years. The method resolves symptoms well by inhibiting the pain signaling processes without damaging any of the neural tissue.^{2,5} In particular, pulsatile radiofrequency (PRFA) is considered as a strong alter-

native to traditional treatment methods with both its effectiveness and low complication rates.⁶

Although the existing literature evaluates the effectiveness of PRFA in the treatment of plantar fasciitis in terms of short-term pain control, there is limited data on the effects of this method on long-term functional recovery.^{1,7} For example, Hansen et al. suggest that PRFA is successful in short-term symptom management, with better long-term results in younger patients with low BMI.⁷ However, these findings have not been systematically analysed in larger patient groups. Furthermore, the study by Chou et al. states that PRFA is less invasive compared to surgical methods, but does not adequately explain the relationship between symptom duration and treatment success.⁶

For this investigation where the objective was to evaluate the effectiveness of radiofrequency ablation versus steroid injection methods towards managing chronic plantar fasciitis, we anticipated that both pain control and functional improvement would, as suspected, be superior with radiofrequency ablation. It was our hypothesis that radiofrequency ablation would be more beneficial than steroid injections in the long run as it would definitely reduce the chances of more procedures in the future. In this context, the

main aim of our study is to evaluate the 6-month follow-up results of radiofrequency ablation and steroid injection treatments in terms of pain, functional status, patient satisfaction and complications in patients with plantar fasciitis who have not responded to conservative treatment for at least 6 months. In addition, the secondary objectives of our study are to determine which patient profiles can achieve better results by analysing treatment responses in different patient subgroups (age, body mass index, symptom duration).

2. Materials and Methods

2.1. Study Design and Ethics Committee Approval

This research is a retrospective comparative clinical study conducted at special Osmaniye İbni Sina Hospital's Orthopedic Clinic. The research protocol was evaluated and approved by the Scientific Research Ethics Committee of Adana City Training and Research Hospital (Meeting No: 9, Decision No: 309, Date: 02.01.2025). The study was conducted in accordance with the principles of the Declaration of Helsinki. Our study covers the data of patients treated in our clinic between 1 January 2022 and 1 January 2024.

2.2. Patient Selection and Sampling

Patients diagnosed with plantar fasciitis who received conservative treatment for at least 6 months but did not have adequate response were included in our study. As a result of power analysis, a total of 60 patients were included in the study with at least 30 patients in each group. Patients were randomly divided into two groups, the first group received radiofrequency ablation (RFA) and the second group received steroid injection. Inclusion criteria were age between 18-65 years, no response to conservative treatment (NSAIDs, insoles, physiotherapy) for at least 6 months and consent for treatment. Exclusion criteria were defined as the presence of vascular disease, active infection, history of rheumatic disease, history of lower extremity surgery and body mass index above 30.

2.3. Treatment Protocols

Patients in the RFA group underwent radiofrequency ablation procedure under local anaesthesia under ultrasonography guidance. After skin antisepsis before the procedure, the radiofrequency probe was placed by targeting the area where the plantar fascia was thickest. In the steroid injection group, 40 mg methylprednisolone acetate was injected with local anaesthetic under ultrasonographic guidance. In both groups, ice application for 24 hours and oral analgesic use when necessary were recommended.

2.4. Evaluation Parameters

Demographic data (age, gender, body mass index, symptom duration, affected side) were recorded. Visual Analogue Scale (VAS) was used for pain assessment and scored between 0-10. American Orthopaedic Foot and Ankle Society (AOFAS) score was used for functional assessment. The evaluations were performed before treatment, 1 month and 6 months after treatment. Patient satisfaction was also evaluated with a scale of 0-10 and possible complications were recorded.^{8/9}

2.5. Statistical Analysis

SPSS 25.0 software was used for data analysis. Normality analysis was performed by Shapiro-Wilk test, Student t-test was used for normally distributed data and Mann-Whitney U test was used for non-normally distributed data. Chi-square test was used to compare categorical variables between groups, Friedman test and repeated measures ANOVA test were used to compare repeated measures within groups. Two-way ANOVA test was applied in subgroup analyses. Statistical significance level was accepted as $p < 0.05$.

Table 1

Demographic Data and Baseline Characteristics

Features	RFA Group (n=30)	Steroid Group (n=30)	p
Age (years)*	42.5 ± 8.3	43.2 ± 7.9	0.742†
Gender‡			0.598§
- Woman	18 (%60.0)	20 (%66.7)	
- Male	12 (%40.0)	10 (%33.3)	
Body Mass Index (kg/m ²)*	27.3 ± 2.1	26.9 ± 2.4	0.485†
Symptom duration (months)¶	8.5 (6-24)	9.0 (6-22)	0.678**
Affected side‡			0.432§
- Right	16 (%53.3)	18 (%60.0)	
- Left	14 (%46.7)	12 (%40.0)	
Duration of conservative treatment (months)¶	7.2 (6-12)	7.5 (6-13)	0.544**
Previous treatments‡			0.687§
- NSAID	30 (%100)	30 (%100)	
- Physiotherapy	25 (%83.3)	23 (%76.7)	
- Use of insoles	28 (%93.3)	27 (%90.0)	

Note: * Data are presented as mean ± standard deviation

Student t-test. ‡ Data are presented as n (%). § Chi-square test. ¶ Data are presented as median (min-max). ** Mann-Whitney U test. RFA = Radiofrequency Ablation, NSAID = Non-steroidal Anti-inflammatory Drugs

Figure 1

Visual Analogue Scale (VAS) Scores Over Time

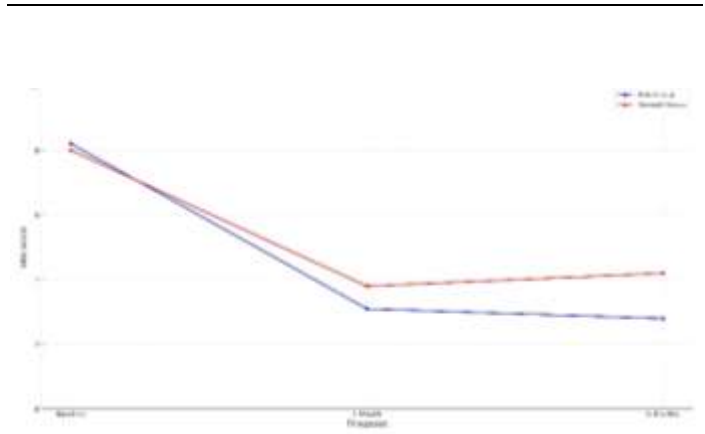


Table 2

Comparison of VAS Scores Between Groups

VAS Score	RFA Group (n=30)	Steroid Group (n=30)	p value*
Before treatment†	8.2 (7-10)	8.0 (7-9)	0.645
1st month†	3.1 (2-5)	3.8 (2-6)	0.032
6th month†	2.8 (1-5)	4.2 (2-7)	0.008
p value‡	<0.001	<0.001	

Note: † Data are presented as median (min-max). * Mann-Whitney U test was used for comparison between groups. ‡ Friedman test was used for within-group comparison. VAS = Visual Analogue Scale (0-10, 0: no pain, 10: excruciating pain), RFA = Radiofrequency Ablation

3. Results

When the baseline characteristics of the radiofrequency ablation (RFA) and steroid injection groups were compared, no significant difference was found between the two groups. The groups were similar in terms of age, gender distribution, body mass index, symptom duration, affected side and previous treatment modalities. Previous NSAID use, physiotherapy applications and use of insoles were commonly reported in both groups. These results indicate that there was a homogeneous distribution between the groups at the beginning and the effects of the treatments applied can be evaluated more objectively (Table 1).

Analysis of post-treatment Visual Analogue Scale (VAS) scores showed a significant decrease in both groups compared to pretreatment values. However, this decrease was more pronounced in the RFA group and significantly lower VAS scores were found in the 1st and 6th month measurements compared to the steroid group. Especially at the 6th month, the median VAS score of the RFA group was 2.8, while it was 4.2 in the steroid group. These findings suggest that RFA treatment is more effective in pain management (Table 2) (Figure 1).

Table 3

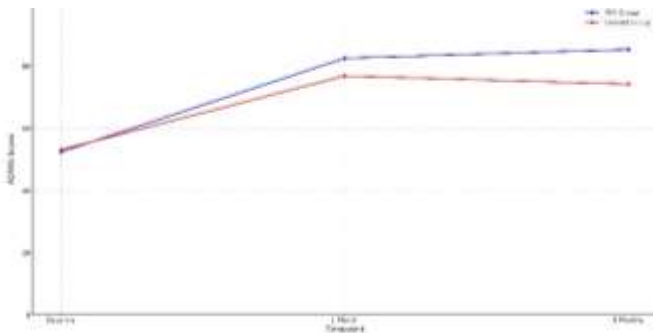
Comparison of AOFAS Scores Between Groups

AOFAS Score	RFA Group (n=30)	Steroid Group (n=30)	p value*
Before treatment†	52.4 ± 8.6	53.1 ± 8.2	0.745
1st month†	82.5 ± 7.3	76.8 ± 7.9	0.028
6th month†	85.3 ± 6.8	74.2 ± 8.4	0.003
p value‡	<0.001	<0.001	

Note: † Data are presented as mean ± standard deviation. * Student's t-test was used for comparison between groups. ‡ Repeated measures ANOVA test was used for within-group comparison. AOFAS = American Orthopaedic Foot and Ankle Society Score (0-100, higher scores indicate better functional status), RFA = Radiofrequency Ablation

Figure 2

AOFAS Scores Over Time



When analysed in terms of AOFAS scores used for functional evaluation, a significant improvement was recorded in both groups after treatment. However, it was observed that the AOFAS scores of the RFA group were significantly higher than the steroid group at the 1st and 6th months. At the end of the 6th month, the mean score was 85.3 in the RFA group and 74.2 in the steroid group.

Table 4

Treatment Success and Complications

Parameters	RFA Group (n=30)	Steroid Group (n=30)	p value
Successful treatment† (>50% reduction in VAS)*	25 (%83.3)	19 (%63.3)	0.024‡
Patient satisfaction score§	8.4 (6-10)	7.2 (5-9)	0.018¶
Complications*			
- Injection site pain	4 (%13.3)	6 (%20.0)	0.488**
- Transient paresthesia	3 (%10.0)	1 (%3.3)	0.612**
- Skin changes	1 (%3.3)	2 (%6.7)	0.554**
- Infection	0 (%0)	0 (%0)	-
Need for retreatment at 6 months*	3 (%10.0)	8 (%26.7)	0.042‡

Note: Evaluation at the end of the 6th month. * Data are presented as n (%). ‡ Chi-square test

§ Data presented as median (min-max), scoring from 0-10 (0: not at all satisfied, 10: very satisfied). Mann-Whitney U test. ** Fisher's exact test. RFA = Radiofrequency Ablation, VAS = Visual Analogue Scale

Table 5

Subgroup Analyses (According to 6th Month VAS Scores)

Subgroups	RFA Group (n=30)	Steroid Group (n=30)	p value*
Age Groups			
<50 years†	2.6 ± 0.8 (n=19)	3.9 ± 1.1 (n=18)	0.012
>50 years†	3.1 ± 0.9 (n=11)	4.5 ± 1.2 (n=12)	0.023
p value‡	0.038	0.041	
Body Mass Index			
<25 kg/m ² †	2.4 ± 0.7 (n=8)	3.7 ± 0.9 (n=9)	0.015
25-30 kg/m ² †	3.0 ± 0.8 (n=22)	4.4 ± 1.0 (n=21)	0.028
p value‡	0.042	0.039	
Symptom Duration			
<12 months†	2.5 ± 0.6 (n=21)	3.8 ± 0.9 (n=20)	0.008
>12 months†	3.4 ± 0.9 (n=9)	4.7 ± 1.1 (n=10)	0.019
p value‡	0.035	0.029	

Note: † Data are presented as mean ± standard deviation. * Student's t-test for comparison between groups. ‡ Two-way ANOVA for comparison between subgroups. RFA = Radiofrequency Ablation, VAS = Visual Analogue Scale (0-10, 0: no pain, 10: excruciating pain)

These results show that RFA treatment is also superior in terms of functional improvement (Table 3) (Figure 2).

RFA group was found to have higher success rates in treatment success and patient satisfaction parameters. Treatment success, which is evaluated with a reduction of more than 50% in VAS scores, was reported as 83.3% in the RFA group and 63.3% in the steroid group. In terms of patient satisfaction score, the RFA group showed a higher satisfaction level than the steroid group with a median score of 8.4. However, complication rates were low in both

treatment modalities and no serious complications were reported (Table 4).

In subgroup analyses, variables such as age, body mass index and symptom duration were examined. RFA treatment was found to be superior to steroid treatment in different subgroups in terms of 6-month VAS scores. In particular, younger patients (<50 years), individuals with low body mass index and patients with symptom duration less than 12 months benefited more from RFA treatment. These findings suggest that treatment selection should be optimised according to the individual characteristics of patients (Table 5).

4. Discussion

Our research evaluated how radiofrequency ablation compared to steroid injection as treatments for chronic plantar fasciitis. The radiofrequency ablation procedure produced superior pain reduction effects than steroid injection procedures when measuring patient outcomes at the six-month follow-up point. The radiofrequency ablation procedure's ability to minimize plantar fascia tissue density and disrupt pain-transmitting nerve endings seems to explain the observed difference in pain reduction between the two treatments. The long-term follow-up results showed that pain measurements for patients who received steroid injections returned to near their original levels.

This research investigated the effectiveness of treating plantar fasciitis through Radiofrequency ablation (RFA) against steroid injections. The research showed that RFA treatment and steroid injections both reduced pain levels effectively from baseline measures yet RFA demonstrated greater pain reduction (VAS: 2.8) after six months. The VAS score for the steroid injection group reached 4.2 at 6 months which showed a lower level of pain improvement. Bupivacaine injections into the joint space deliver rapid and substantial pain reduction according to research that supports this method following ACL surgical procedures. Menekşe et al. (2024) demonstrated that bupivacaine injections into the joint space effectively reduced VAS scores during postoperative recovery. The results indicate that steroid injections work well for short-term pain relief yet their effectiveness fades in comparison to RFA and other permanent pain management approaches.¹⁰ Research indicates that RFA offers enduring pain relief through two main processes that include plantar fascial thickness reduction and the elimination of pain receptors.¹¹ Yalçın Turhan and Arıcan (2019) studied that RFA achieved superior results than steroid injection and extracorporeal shock wave therapy with lower VAS scores at week 6 but the distinction reduced during the long term.¹² The short-term benefits of steroid injections remain limited to symptom relief while their effectiveness decreases over time. Our research results confirmed that the VAS scores from the steroid injection group maintained proximity to initial values during the 6-month period. The research conducted by Zheng et al. (2024) demonstrated that RFA and steroid injection therapy used together delivered better pain management results during both short and long-term periods than steroid injection therapy used alone.¹³ The findings demonstrate how RFA works effectively as a supplementary treatment approach. A study conducted by Yuan et al. (2020) showed that RFA outperformed traditional open plantar fascial release by providing both shorter surgical duration and faster postoperative recovery as well as superior patient contentment.¹⁴ The results support expanding the clinical use of RFA because of its minimally invasive nature.

The AOFAS score at 6 months reached 85.3 in the RFA group but 74.2 in the steroid group. The data showed both groups experienced substantial improvement over their starting points and RFA

delivered greater functional improvement. The medical literature shows that RFA reduces symptoms through its ability to use heat energy and target nerve functions in the plantar fascia area.^{15/16} Sean et al. (2010) documented that RFA application resulted in a substantial increase of AOFAS scores while demonstrating this procedure as an effective treatment approach.¹⁵ Research by Orhurhu et al. (2019) demonstrated that RFA stands as a both safe and effective treatment for plantar fasciitis patients while achieving high patient satisfaction rates at 6-month follow-up.¹⁶ Research in other studies indicates that steroid injections create brief pain relief but RFA stands out as the better long-term solution.^{17/18} Studies in the literature demonstrate that combined surgical methods lead to beneficial results regarding both pain management and functional recovery. Research has demonstrated that open bursectomy together with tendon capsule release produces major improvements in patient satisfaction and range of motion.¹⁹ Research findings indicate RFA stands as a robust therapeutic choice for enduring plantar fasciitis patients who want to improve their functionality.

Our assessment revealed RFA patients experienced an 83.3 percent success rate while achieving 8.4/10 patient satisfaction compared to the steroid group which achieved a 63.3 percent success rate with 7.2 patient satisfaction score. Research findings demonstrate that RFA produces better results than RFA compared to steroid group outcomes. Kanesen et al. conducted a retrospective study which demonstrated RFA achieved better pain control and functional outcomes for patients receiving the procedure. The study demonstrated that patients achieved substantial improvements in VAS and AOFAS scores during the 6-month evaluation which verified RFA effectiveness.²⁰ The contrast between open and arthroscopic methods reveals how the degree of invasiveness affects treatment outcomes including complication rates and patient satisfaction.²¹ Erken et al. identified RFA as an effective treatment option particularly for patients who do not benefit from conservative treatments. The study confirmed that RFA delivers immediate pain relief and patients reported excellent satisfaction rates.²² This outcome could explain why patients showed greater satisfaction after receiving RFA treatment. Research shows that steroid injections deliver effective short-term pain management yet their impact on pain and function becomes minimal after the short-term period.²³ Studies indicate that steroid injections have become less popular because of side effects and the requirement for repeat injections.²⁴ Our research confirms RFA stands as the most effective treatment approach because it provides both the best success rates and patient satisfaction levels when compared to alternative methods supported by scientific literature. RFA delivers a long-term solution to symptoms while steroid therapy provides brief symptom management.

We evaluated the effectiveness of Radiofrequency ablation (RFA) and steroid injection treatments during follow-up care and re-treatment regression analysis and found both methods to be effective. The re-treatment rate was 10% in the RFA group and 26.7% in the steroid group. Research on the long-term effects of RFA has established that this treatment provides strong success rates for pain management.²⁵ The short-term benefits of steroid injections require more frequent re-treatment sessions.²⁶ The treatment produces minimal adverse effects that include temporary discomfort at the injection site and numbness sensations. Serious complications were absent for both treatment modalities. Research published in the literature demonstrates that RFA and steroid injections have similar safety profiles as shown by studies.²⁷ RFA stands out because of its minimally invasive approach and low complication rate which enhances patient satisfaction according to.²⁸ The findings support previous research in the literature by

demonstrating that RFA reduces the need for further treatments. More extensive randomized controlled trials are required to enhance the practical application of these findings.

The research indicates that better treatment results occur in patients under 50 years old and those with low body mass index and brief symptom duration of less than 12 months. The research supports previous studies which demonstrate that younger patients achieve better plantar fasciitis treatment results.^{5,7} The healing potential of tissues and biomechanical adaptability of younger patients enables them to recover better according to research.²⁹ Research shows that patients with lower BMI experience reduced plantar fascia mechanical stress which promotes better healing outcomes.⁵ Patients who receive treatment early in their condition tend to achieve better results because pathological changes remain reversible.⁷ Treatment success and complication prevention can be enhanced through personalized approaches which consider patient-specific characteristics.

The research contains both positive aspects and negative aspects. The patients received thorough follow-up care and appropriate scales were used for evaluation while specific criteria existed for patient enrollment. The primary drawbacks of our research include its single-center design and short observation duration and small participant sample size. The lack of assessment regarding patient daily activities and footwear preferences could have affected our research findings. The research would benefit from future studies that implement multicenter investigations with extended follow-up periods and larger participant numbers. Research should conduct comparative studies to evaluate radiofrequency ablation treatment effectiveness based on patient age groups and body mass indexes. The evaluation of sustained quality of life and work capability after treatment should become the focus of extensive research.

5. Conclusion

Radiofrequency ablation produced superior results for both long-term pain management and functional enhancement. Radiofrequency ablation provided better results than corticosteroid injections because patients needed fewer repeat procedures. The analysis indicates that patients who start treatment early and are younger tend to achieve better results. The selection of appropriate patients for correct interventions at suitable times represents a crucial factor in plantar fasciitis treatment. Radiofrequency ablation stands as a safe treatment option for patients with chronic plantar fasciitis who do not respond to conservative care. The findings need verification through studies that include larger participant groups and extended observation periods.

Statement of ethics

The study protocol was approved by the Adana City Training and Research Hospital (Meeting No: 9, Decision No: 309, Date: 02.01.2025). All participants were informed in detail about the study's purpose and procedures, and written informed consent was obtained from each participant in accordance with the Declaration of Helsinki.

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Conflict of interest statement

The authors declare that they have no conflict of interest.

Availability of data and materials

Data used in this study can be provided on reasonable request.

This manuscript has not been presented at any scientific meeting or conference.

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