



# Percutaneous Radio Frequency Nerve Ablation (RFNA) as an Alternative to ESWT for the Treatment of Plantar Fasciopathy



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## ABSTRACT

Percutaneous nerve ablation is a well-studied procedure which has been used to disrupt conduction in sensory nerves. In this study, the outcome from a recent clinical series in which 22 patients treated with percutaneous nerve ablation for pain associated with recalcitrant plantar fasciopathy was compared to the outcomes from a large, recently published meta analysis which examined the outcomes for heel pain treated with Extra Corporeal Shock Wave (ESWT) therapy. We found that Radiofrequency Nerve Ablation (RFNA) for the treatment of plantar fasciopathy was more likely to improve symptoms than ESWT. The additional benefits of decreased costs, increased convenience, and minimal risks make RFNA appear to be an excellent alternative to ESWT.

## INTRODUCTION

Radio Frequency Nerve Ablation (RFNA) is a technique which has been used for over 10 years for the treatment of chronic pain by pain management specialists in anesthesia and neurology to ablate compressed or damaged spinal nerves. Over the last few years, the technology has become more widely accessible, and has led to the current study.

The RF device consists of an electrode with an active tip, which generates a highly controlled heat source, resembling a microwave oven the size of a needle. In order to achieve pain relief, the active tip is brought in to contact with the nerve, and switched on. The tip is heated to 90°C, and causes damage to the myelin portion of the targeted nerve, or may transect it.

Because of the potential for injury from a misplaced electrode, it is important to be certain about the location of the nerve being targeted. For this reason, we utilize the NeuroTherm NT-250 radiofrequency generator (NeuroTherm, Inc., Wilmington, MA). It has a system whereby the sensory nerve can be directly stimulated prior to transection. It also has a separate stimulation mode to differentiate motor nerves. These redundant safety systems assures there is not an unintentional transection of an incorrect nerve.

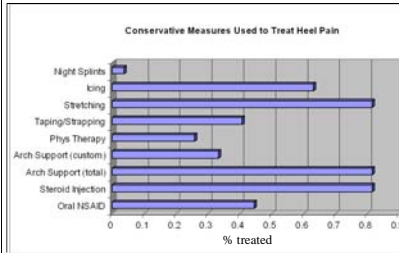
In this study, we compare our experiences with RFNA for the treatment of pain associated with plantar fasciopathy with outcomes using Extra-corporeal Shock Wave Therapy (ESWT). To gauge the outcomes associated with ESWT, we referred to a large meta analysis recently published on the topic

## HYPOTHESIS

We hypothesized that RFNA will produce superior clinical outcomes and less adverse events than ESWT for the treatment of plantar fasciopathy.

## MATERIALS AND METHODS

A group of 36 feet from 24 patients with classic symptoms of plantar fasciitis, including post-static dyskinesia and anterior medial heel pain were included in this study. All participants had pain for at least one month, and all participants failed treatment with non-surgical modalities as shown below.



RFNA patients were analyzed retrospectively, and all participants had at least 1 month follow-up, and most had 6 months follow-up. In order to participate in this study, all subjects had to meet the inclusion and exclusions criteria.

### INCLUSION CRITERIA

- ≥ 18 years old
- Heel pain present for at least 6 months
- Previously attempted at least 2 of the following conservative measures:

- Arch supports (custom or non-custom)
- Home stretching
- Physical Therapy
- Steroid injection
- Oral anti-inflammatory
- Icing
- Night Splint
- Taping/Strapping

### EXCLUSION CRITERIA

- Prior surgery to the affected heel
- History of trauma or fracture of the heel
- Pain related to peripheral neuropathy or ischemia
- Inability to tolerate injections to the heel region
- Allergy to local anesthetics or steroids
- Open wounds on the study foot.
- Local or systemic infection on the date when the procedure was to be performed

RFNA was performed using the NeuroTherm NT-250 radiofrequency generator. The procedure for nerve ablation was as follows. Area of maximum pain was identified at the anterior medial aspect of the heel. Next, a bolus of 1% plain Lidocaine was injected just beneath the skin. An RF grounding pad (antenna) is attached to the same limb, at a site remote from the treatment area.

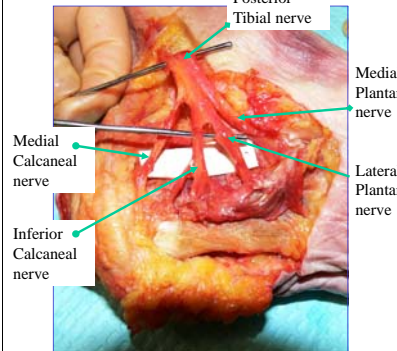
Following standard skin preparation, a cannula was advanced to the area of greatest pain, and the electrode was inserted. The patient was asked whether or not this location corresponded to their area of discomfort.

## MATERIALS AND METHODS (CONTINUED)

The RFNA probe is advanced to the area of greatest discomfort prior to nerve ablation.



The objective here was to target the medial calcaneal nerve, just after it branches off from posterior tibial nerve. In some cases, the inferior calcaneal nerve was also targeted, if the pain was more anterior.



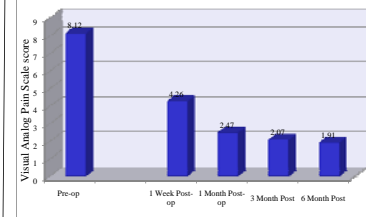
Once positioned, the sensory and motor stimulation functions are used to confirm that the proper nerve is at the tip of the electrode. Ablation is performed at 90°C, for 90 seconds. The probe is then slightly repositioned and the procedure is repeated two more times. Following treatment, patients are free



to resume normal activities immediately. There is no bandages given other than a simple Band-aid. All patients were asked to rate

their pain at its worst, just prior to treatment, and at each follow-up visit, for up to 6 months. A standardized visual analog pain scale was utilized to rate their symptoms. Statistical analysis included student's t-test to determine relative changes in symptoms, and ANOVA to determine the influence of co-factors.

## RESULTS



We found that the average VAS score dropped from 8.12 (SD=1.61) prior to treatment, to 4.26 (SD=1.97) after 1 week, 2.47 (SD=1.76) after 1 month, 2.07 (SD=0.39) after 3 months, and 1.91 (SD=0.42) after 6 months.  $p < 0.05$  for all time points when compared to baseline. Adverse events were also recorded, and are listed below.

Adverse Event	Number of Occurrences and Outcome
Bruising at Injection Site	2 (5.6%) - Resolved w/o treatment
Swelling at Injection Site	1 (2.8%) - Resolved in 2 days w/o tx
Peroneal Tendinitis	1 (2.8%) - Resolved w/ NSAID in 2 wks
Lateral Calf Pain	1 (2.8%) - Resolved with ambulation and NSAIDs after 2 weeks
Sensation of Walking on a "Wad of Tissue"	1 (2.8%) - Resolved w/o treatment Completely gone after 1 month.
Persistent post-static dyskinesia	2 (5.6%) - Unchanged after 6 months
One foot improved more than the other (bilateral cases only)	3 (33.3% of the bilateral cases) - Both feet improved significantly, but 1 felt slightly better than the other by at least 1 point, even 6 months after the procedure.

The outcomes from this retrospective study were compared to data from a comprehensive meta-analysis published in the British Medical Journal, in 2007, (Rompe, JD, et al; Shock Wave Therapy for chronic plantar fasciopathy, Br. Med J, 2007, v 354:183-208.) which examined the outcomes from 17 ESWT studies. They found that in high quality, placebo controlled studies, involving a total of 909 patients, 60% of the patients had a favorable response to low energy ESWT after 12 weeks, and 50% showed a favorable response to high energy ESWT. In uncontrolled studies, success rates of 75% or more were reported. It was also noted that in many cases, it may take up to 12 weeks to appreciate a measurable improvement. The adverse events associated with ESWT increased with the energy level and number of pulses, but were mostly limited to hematoma, reversible edema, and reversible erythema. In addition, there was potentially significant pain associated with ESWT administration, which frequently required sedation and local anesthetics.

## DISCUSSION

Although most cases of plantar fasciopathy respond to conservative measures, 20% will ultimately require some more invasive treatment. The emergence of ESWT has provided the surgeon with an additional option before considering partial plantar fascia releases and heel spur resections. Using even the most conservative measures, it appears that at least 50% of those receiving ESWT will show some improvement. In this study, we observed significant improvement in 88.9% of the cases with RFNA. The magnitude of improvement was also much stronger with RFNA. We observed a decrease in the magnitude of pain by 47.5% during the first week, 69.6% after 1 month, and 74.5% after 3 months.

In general, ESWT is a hospital-based procedure, due in part to the cost of the equipment, and the need for intravenous sedation. Furthermore, it may take up to 3 months for patients to show a measurable improvement. In the current study, RFNA was performed in the office under local anesthetic. The cost of the machine is dramatically less than the cost of ESWT, and we observed positive results in 88.9% of the cases within 1 week of treatment.

In part, the success garnered with RFNA may be the result of the precision whereby the source of the heel pain is treated. Depending on the device, ESWT is administered over a relatively wide area, in order to capture the area of pain. Conversely, RFNA specifically targets the region of electrode pain prior to treatment. The placement of the is very precise with the stimulation mechanism used with the NeuroTherm device.

## CONCLUSIONS

The treatment of plantar fasciopathy with RFNA was superior to ESWT. When compared to reports in the literature, we found a higher percentage of patients showed improvement (88.9% w/ RFNA vs. up to 75% w/ ESWT), faster response times (1 week w/ RFNA vs. 12 weeks w/ ESWT), easier use (RFNA is Office Based vs. ESWT is Hospital Based), and comparable complication rates. In addition, the cost of the RFNA equipment is a fraction of ESWT, and the precision of the treatment is much higher with RFNA. For all of these reasons, we found RFNA to be an excellent alternative to ESWT, and should be considered at the earliest stages of treatment, along with other conservative modalities.

## ACKNOWLEDGEMENTS

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