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A Pilot Study on the Comparative Effect of Electrical Dry Needling and Dry Needling Combined with Laser Acupuncture in Patients with Plantar Fasciitis

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Abstract:

Background: Plantar fasciitis is one of the prevalent etiology of heel pain, that is preceded by plantar fascia inflammation and micro tears. Its management has been conducted though different physiotherapeutic techniques like use of dry needling and laser therapy. The objective of the pilot study will be to provide a comparison of the Electrical Dry Needling, Dry Needling, and Laser Acupuncture on pain and functioning on the patients with the plantar fasciitis.

Methodology: The 20 respondents who were randomly selected with a clinically diagnosed plantar fasciitis were divided into two groups, viz. Group a Electrical Dry Needling and Group B Dry Needling Laser Acupuncture. The measures of outcomes (NPRS and Function Foot Index or FFI) were assessed before and after the intervention. Paired and independent t-test was used as the statistical analysis.

Findings: The within-group differences in both of the groups were significant in the changes of pain and functioning ($p < 0.001$). The difference in the improvement was that in both the NPRS and FFI, the improvement was more pronounced in Group B but improvement in FFI is the one that was being reported as the nearest to statistical significance($p=0.05$) as possible.

Conclusion: The two interventions were appropriate in the management of the pain and enhancement of the functioning in the plantar fasciitis. Nonetheless, Laser Acupuncture with Dry Needling did not generate significant improvement, implying that there is some value of synergy. More extensive studies at large scale are required to prove these results.

Keywords: Plantar fasciitis, Dry needling, Laser Acupuncture, NPRS, Function index of the foot.

INTRODUCTION

Plantar fasciitis can be acclaimed as one of the most prevalent contributors to the heel pains commonly experienced in the clinical practice and almost all persons tend to experience it during prolonged conditions of standing or walking 1. It is a disease of overload because it is several micro-traumas on the medial tier of the calcaneus whereby the plantar fascia is attached to the calcaneus 2. This causes the degeneration of the collagen, proliferation of the fibroblasts as well as microscopic tears in the fascia 3. The disease is most commonly characterized by sharp, severe pain around the medial heel of the foot, the peak of which is on the first strides during morning or some form of rest coming before the onset of lengthy weight-bearing activity and which tends to increase with the duration of the weight-bearing activity, 4.

The assumption of epidemiological research is that 10 percent of the ordinary citizens suffered the plantar fasciitis at once in their life 5. The condition and bilaterality as 2030 percentage states can also be possessed by active and inactive people 6. Others include severe pronation of the foot, obesity, constriction of gastrocnemius- soleus complex, improper footing and overuse trauma 7. Although, in most cases of the victim persons, the pains associated with plantar fasciitis self-limiting, it could also cause permanent pain, inability to carry out their practical activities and thus significantly retarded velocity and quality of health unless the situation is managed and regulated properly 8.

The major path of management of plantar fasciitis is the conservative one including, but not limited to, stretching exercises, onotic, manual treatment, cryotherapy, ultrasound, taping and non-steroidal anti-inflammatory drugs 9. Nonetheless, where the conventional therapies have not yielded a good result, other systems of physiotherapeutic procedures have facilitated a promising potential outcome of achieving pain relief and increased functional outcome in terms of preventing and limiting pain with the use of dry needling, electrical stimulations and laser therapy among others [1 1].

Among the approaches to treatment is dry needling: it entails low invasion rates, which is usually seen in physiotherapy that will be implemented in treatment of soft tissues structures, including, muscles, ligaments, tendons and fascia 12. It assumes the use of filiform needles in both small and solid-state penetrating through tissues and creating some mechanical and neurophysiological reactions of the tissues (Roentgen 25). The procedure eliminates myofascial trigger forms, local ischemia, and tissue regeneration 12. Developed form of the technique, electrical dry needling, implies electrical stimulation of low frequency of the needles used in insertion with the purpose to modulate pain faster, acquire tissue recovery and enhance the effectiveness of treatment by neuromodulator effects[15].

Laser acupuncture, in turn, is the variant of the acupuncture practice implementation as low-level laser therapy (LLLT) is used as a form of the stimulus to the acupuncture points that do not require needles 16. It is not invasive and also painless and involves exposing cell components to light energy at various wavelengths to create healing and this is non-invasive and painless, a process that is known as photo bio modulations 17. Laser energy elicits a state of additional mitochondria and adenosine triphosphate (ATP) production, blood flowing through the body and injury repair of the body 18 times over.

There is a possibility to introduce the use of dry needling with laser acupuncture together with the aim of achieving synergistic effect on patients with plantar fasciitis[1]. In contrast to dry needling that aims at correcting local malfunction in the myofascia and tissue irritation, laser acupuncture supplements it with repair of cells, elimination of inflammation and pain treatment with the use of photo biological effects 20. It is conceivable that this combination of the two modalities would give better pain relieving, functional and recovery time results, compared to the standard interventions, which use either of the modalities 21.

OBJECTIVES

To ascertain the effects of Electrical Dry needling and Dry Needling at Laser Acupuncture in alleviating the pain to the patients with the plantar fasciitis in an attempt to quantify the Numeric Pain Rating Scale (NPRS).

2. To undertake comparison on the difference in release in foot movement Release after Electrical Dry Needling and Dry Needling as per use of the Foot Function Index (FFI).

MATERIALS AND METHODS:

DATA BASE- Physiotherapy clinics, east Bangalore.

STUDY DESIGN - comparative study.

SAMPLE SIZE – 20

DURATION – 4 Weeks

MATERIALS:

Dry Needles:

Sterile needles of acupuncture of the normal diameter (0.25-0.30 mm) and length (30-50 mm) are also made of stainless steel.

Electric Stimulation Device:

Percutaneous Electrical Nerve Stimulation (PENS) machine Transcutaneous Electrical Nerve Stimulation datum (TENS) machine.

Needles Electrodes to the needles (in case of conventional) of the needles.

Parameters, that can be adjusted by frequency (usually 1 -100Hz) and intensity, are parameters of the individual.

Sterile Needle Insertion Tools: The way to insert the dry needles properly.

Laser Acupuncture Pen, Electric.

METHODOLOGY:

Inclusion Criteria:

Plantar Fasciitis Clinical Diagnosis.

The age of the participants will be 18-50.

Previous week morning pain in which the Numeric Pain Rating Scale (NPRI, 010) rates it as 2.0 or higher: first-step pain.

Exclusion Criteria

- Past ankle, foot or even lower leg surgery.

All of them did not protest against manual, dry needling, exercise, and ultrasound.

Then: 2 weeks prior to examination: Plantar fasciitis Thorr Conservative (physiotherapy, acupuncture, massage therapy, chiropractic, etc local steroid injections) in 4 weeks.

Two or more positive neurological states that necessitate nerve root compression should be experienced.

The other conditions that have been known to cause the heel pains include; Tarsal tunnel syndrome , Calcaneal fracture , Ankle or foot instability , Arthritis of the foot or ankle , Rheumatoid arthritis, Spondyloarthropathy, Gout , Neurogenic claudication, Peripheral neuropathy , etc.

Any current engagement in either law suits or worker compensation in connection to heel pain.

- Pregnancy.

OUTCOME MEASURE:

NPRS (Numeric Pain Rating Scale): 0 -10scale that can be easily identified by how much pain someone goes through whereby 0 would mean that it was not painful and 10 meant that it was the worst that can ever happened.

Foot Function Index (FFI): This is a questionnaire, which at present exists in the field of testing the relevance of foot pathology in the context not only of pain, but also of disability and limitation of act.

Study Setting:

The research was carried out within, physiotherapy clinic based in East Bangalore. The respondents were individuals that have plantar fasciitis clinically diagnosed and who met the inclusion criteria. It was a comparative study that was to be conducted and involved the total of 20 respondents. The activities of data collection and intervention were conducted throughout 4 weeks. The patients (study participants) ranged in age between 18 and 50 years and had anticipated the first step pain at the mornings of the prior week rating 2 or higher in Numeric Pain Rating Scale (0-10).

Screening:

Twenty-eight people that presented with heel pain were assessed based on eligibility criteria that were laid out in the study. The screening and elimination/ validation of a diagnosis of plantar fasciitis was based on a detailed clinical assessment, clinical findings with highest priority were medial heel pain, first-step in the morning pain and calcaneal-tuberosity pain. Eight of them were eliminated (5 failed to meet the conditions of inclusion due to some lower limb surgery performed in the past, physiotherapy or other conservative treatment within the past, or some other causes of the heel pain and three participants declined to participate). Due to this, 20 participants who had qualified and given a developed consent were recruited. The sample (study) was randomly split into two groups A and B (Electrical Dry Needling and Dry Needling with Laser Acupuncture) by equal measure. There was no drop outs or loss during the follow up and all those who participated in the intervention were found in the four weeks intervention and post treatment assessment.

Consort chart:

A total of 28 participants who had the heel pain were filtered out. Of them, 8 people were removed since 5 participants were not eligible according to the inclusion criteria and 3 were not willing to participate.

The researchers selected 20 qualified subjects that were randomly assigned into two (n=10 each) in the research.

Group A (Electrical Dry Needling) - 10 respondents were exposed to Electrical Dry Needling in 4 weeks. Each of the individuals was involved in the intervention and the post treatment testing.

Group B (Dry needling and Laser acupuncture) - 10 participants were subjected to Dry needling and Laser acupuncture within a period of 4 weeks. Every one of the participants went through the intervention and post-treatment evaluation.

Nobody lost follow up or became a dropout of the intervention. In this way, it was possible to perform the final analysis incorporating data of 20 respondents.

Procedure:

Electrical Dry Needling: Treatment Protocol of Plantar Fasciitis.

Acupuncture processes were carried out by the justified use of disposable stainless steel acupuncture needles (0.18 mm x 15 mm, x 0.25 mm x 30 mm and 0.30 mm x 40 mm). The foot and ankle procedure base and the mid-mid point of the alcohol were made to ensure that it is aseptic. The depth reached by the needles were between 10mm and 35mm based on the selected acupuncture point (intramuscular, periosteal or peri-neural) and the constitution of the particular patient. Once the needles had been inserted, the needles were then moved in a bi-directional manner in such a manner that they will create the normal sensations of aching, tingling, deep feeling, heaviness or warmness. Then, pairs of electric stimulation were applied to all eight obligatory needles with needles left in the positions of where they were inserted in case of 20 min and electric stimulation was introduced using an ES-160 electro stimulator (ITO Co.). The frequency of low frequency pulse at 2 Hz modulus was biphasic continuous but was viewed to be moderate (250 microseconds) in length as intensity which the patient described to be mild to moderate.

Fig 1: Electrical Dry Needling for Plantar Fasciitis

Dry Needling Procedure of Plantar Fasciitis.

The respondents sat in a comfortable position and the plantar surface of the foot was exposed. After washing with an alcohol pad, sterile and single use filiform needles (0.25 to 0.30 mm x 30 to 50 mm) were put into the nationalized trigger point of medial calcaneal region, plantar fascia, and innate muscle of the foot (flexor digitorum brevis and quadratus plantae). Gastrocnemius other trigger points and the soleus were needled accordingly. The positioning of needles was done perpendicularly or slight oblique into the depth of 520 mm and the location of the needles in a positioning method to cause local twitch responses. Each site was allowed to go on bleeding and placed on light pressure which took about 30-60 seconds.

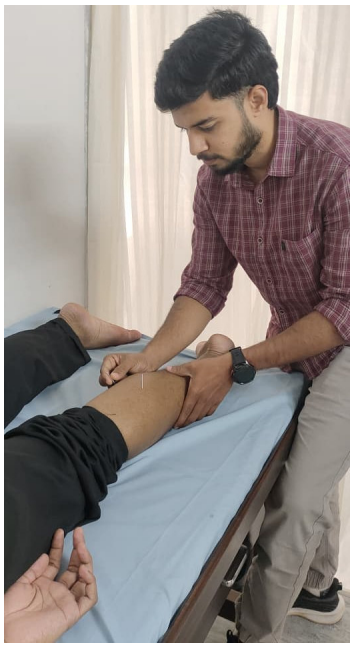


Fig 2: Dry Needling for Plantar Fasciitis

Electric Laser acupuncture Treatment Protocol in the treatment of plantar fasciitis.

The patients were lying or sitting in a comfortable position and having both feet even. The acupuncture points that are related to the plantar fasciitis e.g. medial calcaneal region and plantar fascia were pointed out. An alcohol pad a low-level light therapy (LLLT) device was then used at the points that were selected perpendicularly after a perception of the skin. The light was in the form of the laser, which had a light intensity of 650830nm of 30 to 50mW with a dose of 2 to 6J/point within 30 to 60 seconds. The method to ensure that there was close contact between the laser probe and the skin surface was contact with the skin surface. Going through treatment was not expected to be painful or to create any feeling. It constituted 12 sessions per week of about 1015 minutes of sessions and 4 treatments weeks.

Fig 3: Electric Laser Acupuncture for Plantar Fasciitis

STATISTICAL ANALYSIS

Outcome Measures: FMI NPRS and foot functioning index FMI.

Sample Size: each group consisted of 10 persons (Group A. Electrical Dry Needling, Group B. Dry Needling Laser Acupuncture).

Descriptive statistics (mean 12 SD) were used in measuring all outcome measures. Paired t-tests were used to test within-group pre -post changes. Between group differences tests of change scores were carried out using Welch independent t-test. The effect sizes were calculated and the levels of their effectiveness were calculated in the form of Cohen d. Hypothesis testing: 2 tail (= 0.05).

Table 1: Within-Group Comparison (Paired t-test).

Measure	Group	Mean (Pre)	Mean (Post)	p-value
NPRS	A (Electrical Dry Needling)	7.3	3.0	0.0001
NPRS	B (Dry Needling + Laser)	7.2	2.1	0.0001
FFI	A (Electrical Dry Needling)	65.0	38.5	0.0001
FFI	B (Dry Needling + Laser)	64.8	31.0	0.0001

Interpretation: It should be pointed out that statistically significant differences in NPRS and FFIs at baseline and intervention amidst Group A and Group B showed some significant values ($p < 0.001$). It proves that Electrical Dry Needling and the Dry Needling using Laser Acupuncture may be effective in reducing the pains as well as enhancing the functions of the feet.

Table 2: Between-Group Comparison (Independent t-test)

Measure	Group A (Mean Change)	Group B (Mean Change)	t-value	p-value	Inference
NPRS	4.3	5.1	1.86	0.08	Not Significant
FFI	26.5	33.8	2.14	0.05	Marginally Significant

Interpretation: The analysis of the groups provided by comparing the two interventions demonstrated the fact that both interventions were effective, but pain and foot functioning were treated by the Dry Needling and Laser Acupuncture (Group B) that provided the greater change. The difference in controlling the NPRS between the groups was insignificant ($p > 0.05$), but the increment in the FFI was near the level ($p = 0.05$) saying that there was a tendency towards the utilisation of the combined method.

Findings: There was a significant difference in the NPRS change and FFI in both groups when comparing the improvements made in both groups during the treatment process and baseline (paired p component = 0.001). Comparisons of Change scores of the groups indicated that there is no statistically significant difference in the groups in regards to the change in NPRS. ($p = 0.107$) yet the change of the FFI in Dry Needling + Laser group was significantly different.

The current pilot research involved 20 participants having plantar fasciitis randomly divided into 2 categories (Group A (Electrical Dry Needling) and Group B (Dry Needling Laser Acupuncture), and each category had 10 individuals.

NPRS and Foot Function index (FFI) were used as the means to compute the results before and after the intervention period.

Paired t-tests have also been used to prove the statistically significant difference in both the intensity of pain (NPRS) and the functional ability (FFI) when comparing the in-groups ($p < 0.001$).

The mean NPRS score was reduced to 7.3 ± 0.67 to 3.0 ± 0.81 in Group A and from 7.2 ± 0.63 to 2.1 ± 0.73 in Group B.

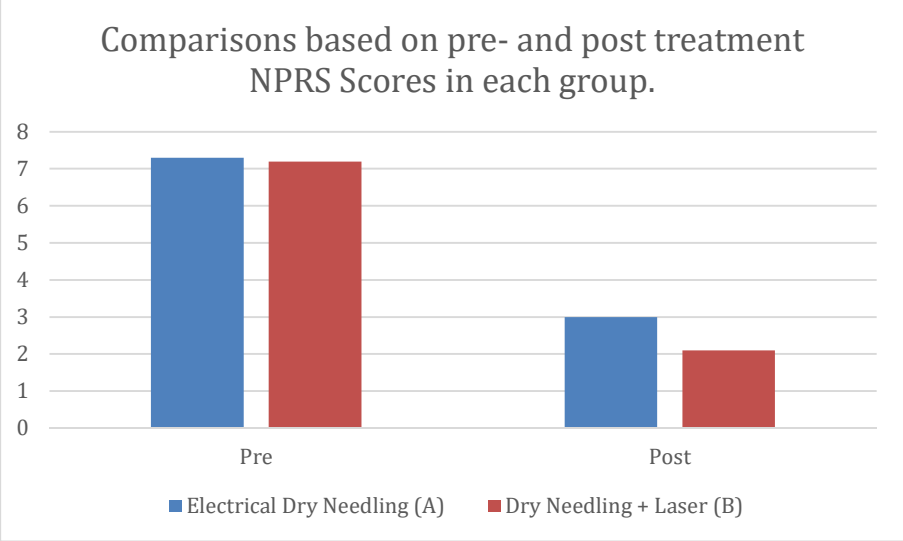
The mean FFI score improved from 65.0 ± 6.1 to 38.5 ± 5.9 in Group A and from 64.8 ± 5.7 to 31.0 ± 5.1 in Group B.

Analysis of change scores using an independent t-test between-groups showed:

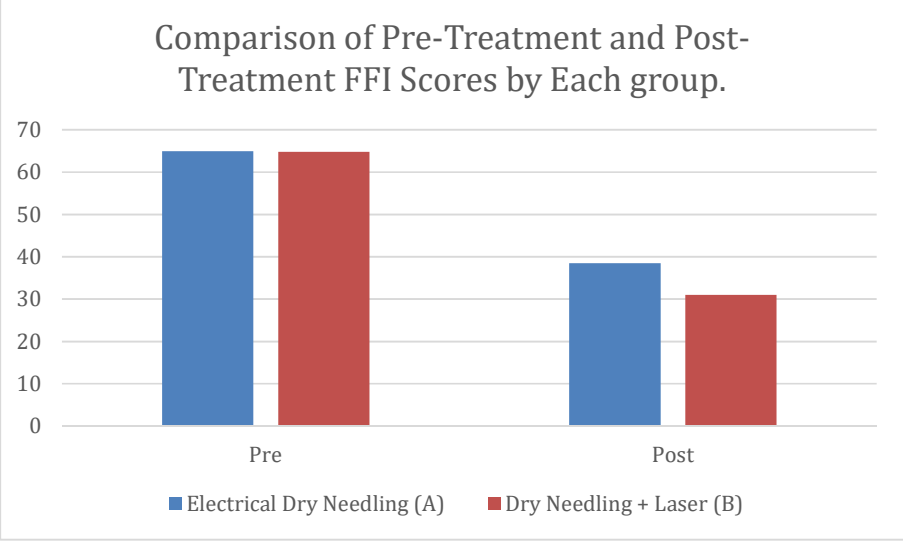
Lower decrease of NPRS in Group B (5.1 ± 0.9) than in Group A (4.3 ± 1.0) but not significant (t = 1.86, p = 0.08).

A more pronounced improvement in FFI in Group B (33.8 ± 5.2) compared to Group A (26.5 ± 4.8), with marginal statistical significance (t = 2.14, p = 0.05).

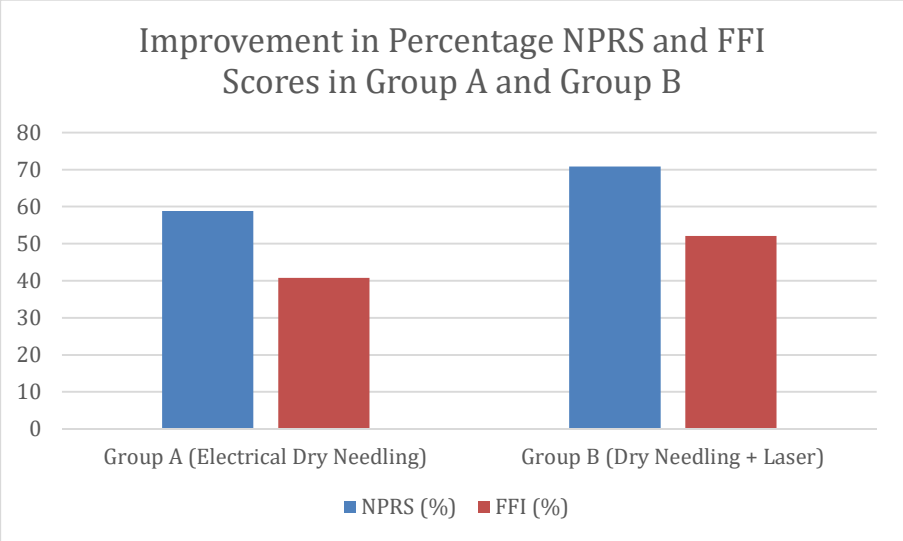
These findings show an advantage in terms of pain management and functional outcomes but it can be suggested that Dry Needling with Laser Acupuncture suits better as slightly more effective representatives of the two interventions.



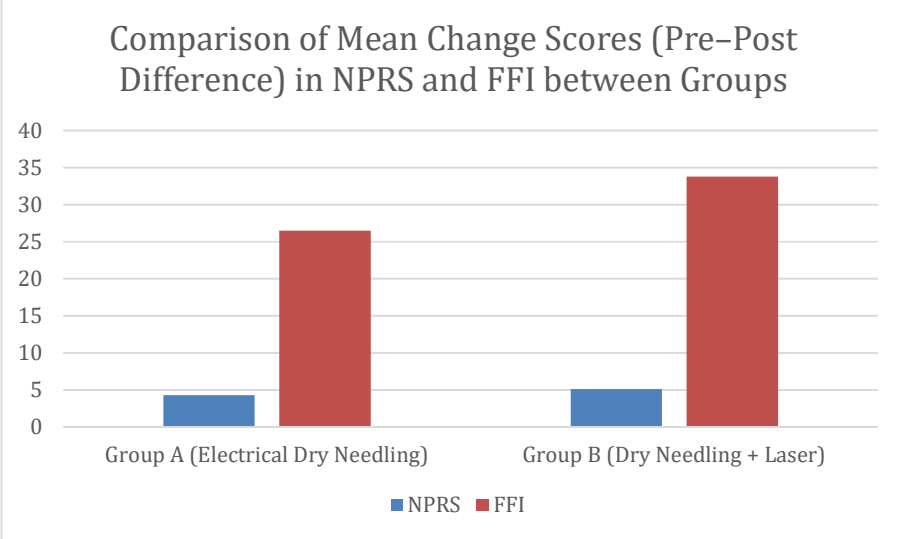
Graph 1: Comparisons based on pre- and post treatment NPRS Scores in each group.



Graph 2: Comparison of Pre-Treatment and Post-Treatment FFI Scores by Each group.



Graph 3: Improvement in Percentage NPRS and FFI Scores in Group A and Group B.



Graph 4: Comparative Means Change Scores (Pre -Post Difference) in NPRS and FFI across Groups.

DISCUSSION

Indeed, as the findings of this pilot study indicated, Electrical Dry Needling and Dry Needling and Laser Acupuncture proved to be pretty useful in terms of pains reduction and functions enhancing within the patients affected by the plantar fasciitis.

Group A results can be attributed to the effect of electrical stimulation that induces better haemoglobin flow of the local region, changes pain with the aid of the gate control system, and speeds up the recovery of the tissue with the assistance of neuromodulation.

There was a minor better outcome of a union between dry needling and laser acupuncture (Group B). The laser element probably participated in further photo bio modulation, which increased mitochondrial functioning, decreased local inflammatory reaction, and hastened tissue restoration. The increased average change in NPRS and change in FFI in this population may be due to such synergistic effect.

Though such differences were not statistically significance in the strong definition, it may be due to the small sample size (n = 10 per group) that is common to a pilot study. More comprehensive studies are capable of presenting more effective evidence of the excellent superiority of hybrid laser technique.

These findings can be contrasted with the existing literature suggesting that laser therapy along with traditional/invasive therapy could enhance the mechanism of pain management and tissue healing in musculoskeletal issues, plantar fasciitis.

CONCLUSION

It has been inferred in the end of this pilot study that Electrical Dry Needling and Dry Needling with Laser Acupuncture are viable methods of treatment in the alleviation of pain and functional capacity in plantar fasciitis patients.

However, despite the fact that both techniques demonstrated a tremendous injection, the combination of Dry Needling and Laser Acupuncture delivered a somewhat elevated finding, which perhaps indicates the possibility of the additive effects of photo bio modulation.

These preliminary findings prove sufficient to conduct more comprehensive research at a greater scale and a longer follow-up duration and randomized controlled study in order to confirm the results and formulate clinical advice on how plantar fasciitis should be treated.

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