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The effectiveness of cold laser on plantar fascitis

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Abstract
Background & objectives: Plantar fasciitis (PF) is an infero-medial heel pain that worsens with weight bearing after a protracted period which affects the hindfoot. It affects 10% of the general population, and of those who have it, 80% are working, active individuals between the ages of 25 and 65. Treatment of PF involves several strategies; either surgical or conservative ones including therapeutic Cold Laser.
Methods: The study included 15 patients who fulfilled inclusion criteria and thereby was recruited for the study.
Result: The result of the study was assessed using Visual Analogue Scale (VAS) for the pain. At the end of 6 weeks treatment, patients showed marked reduction in the pain.
Conclusion: In this study the mean score of VAS pre-treatment was 8.3 which was reduced to mean score 1.3 post-treatment suggesting significant improvement in the pain score.

Keywords: Plantar fascitis, cold laser therapy, low-level laser therapy, pain management

Introduction
Plantar fasciitis is an infero-medial heel pain that worsens with weight bearing after a protracted period which affects the hindfoot. Overuse injuries causes inflammation of the calcaneal periosteum and adjacent perifascial tissues at the origin of the plantar fascia [1, 2]. It is a frequent orthopedics condition commonly referred to as calcaneodynia, calcaneal porosities, painful heel syndrome, heel spur syndrome, and runner's heel sub calcaneal discomfort. It affects people regardless of their sex, age, race, or degree of activity [3, 4].
In 85% of instances, the etiology is unclear and is classified as an enthesopathy [4, 5]. It is a typical issue brought on by uncomfortable and direct pain from prolonged standing [6, 7].

Incidence and prevalence
Plantar fasciitis affects between 10 to 16 percent of people with long standing type of work [8]. It frequently occurs in people who have significant internal foot rolling, which is found in flat feet, as well as extended weight bearing [9]. It affects 10% of the general population, and of those who have it, 80% are working, active individuals between the ages of 25 and 65. Most of them suffer from incapacitating pain [10, 11].

Clinical features
The majority of patients complain of heel pain, which typically affects the medial region and creeps up into the medial arch of the foot. The pain is typically worst in the morning or after a period of rest, with the most discomfort being felt during the first few steps and gradually getting better as the individual walks [12]. Running is one example of a chronic overuse condition that can cause pain. Most patients' medial heel or medial arch exhibit tenderness upon clinical examination. The foot should be examined for any neurological abnormalities, particularly sensory or motor deficits and the presence of Tinel's sign, as well as any anatomical abnormalities, such as cavus or planus deformities, restriction of motion of the ankle-foot complex, scar tissue, and loss of heel pad thickness [13, 14].

Biomechanics of plantar fascia
The plantar fascia's role is to stabilize the midfoot and support the medial longitudinal arch under static and dynamic foot loads [15, 16]. Additionally, it helps the heel pad absorb dynamic shock [17, 18]. When the foot naturally bears weight, it is put under stress, maintaining the arch.

The plantar fascia carries 14% of the load on the foot, according to a biomechanical study model. In a different cadaver investigation, the plantar fascia only ruptured under weights of up to 1189 newtons [19]. The proximal attachment location at the calcaneum was where this failure most frequently occurred. This is consistent with the calcaneal region being the site of chronic plantar fasciitis [16].

Obesity, poor footwear, abnormal foot biomechanics and/or foot types, and other variables are some that are widely thought to cause plantar fasciitis [18, 15]. More precisely, it is thought that excessive pronation of the foot increases the strain on the soft tissues of the plantar surface and increases the risk of injury [20].

Pathology of chronic plantar fasciitis

Inflammation and degeneration are two pathological alterations brought on by repetitive tensile loading of the plantar fascia at its connection to the calcaneum [10]. There could be a heel chord contracture related to this. Walking or running may cause micro- and macro-tears in the plantar fascia that cause an inflammatory reaction that is reparative in nature. Edema and later thickening of the plantar fascia are the first signs of these chronic inflammatory alterations in the tissue [2]. Additionally, heel pain's onset and persistence may be influenced by changes in nociceptor physiology, peritendinous inflammation, and reduced vascularity [16]. The persistent stress brought on by weight bearing then disrupts the healing process, leading to chronic degenerative alterations [19, 21].

Cold Laser

Cold laser therapy is called as low-level laser therapy [22]. The therapeutic lasers were introduced in 1965 by Sinclair, Knoll and Master through their research with human tissues. These therapeutic lasers work by supplying energy in to the body by non-thermal photons of light. The body is able to absorb this external energy on a cellular level and transform light energy into chemical energy, which the body uses to accelerate the normal healing rate of the tissues [23].

The modality used is the Theralase TLC 1000 therapeutic laser system a Class 3B medical laser system. The therapeutic laser system has a dual wavelength, i.e., the combination of super pulsed (905nm) and continuous wavelength (660nm). This system is in direct contact with the tissues in order to emit photons non-invasively into the tissues [24].

The super pulsed near infrared laser technology is able to demonstrate therapeutic effect at up to 10cm below the tissue surface. This allows super pulsed technology to target deep tissue structures such as: bones, tendons, ligaments and cartilage. This particular wavelength of super pulsed 905nm and 660nm activates al the three cellular pathways namely, the ATP pathway, nitric oxide pathway, and lipid absorption pathway [25].

LLLT induced nitric oxide can reprogram cellular function, mainly via oxidative stress and changes of mitochondrial temperature gradient due to a process similar to selective photothermolysis, and thus initiate a cascade of local and systemic therapeutic signaling. These signal transduction pathways may lead to increased cell activation and traffic, modulation of regulatory cytokines, growth factors and inflammatory mediators and expression of protective anti-apoptotic proteins [25].

Objective of the study

To assess the effectiveness of Cold Laser Therapy in Plantar Fascitis.

Methodology: Source of Data

All patients who are coming to Sanjeevini Cold Laser Center, Jayanagar & Malleshwaram branch, Bangalore, with Lateral Epicondylitis who are fulfilling the inclusion and the exclusion criteria.

Method of collection of data

Sample Size: 15 Period of study: 1 year

Study design: One group pre & post-test design Sampling method: Purposive sampling method

Inclusion criteria

1. Age: 40-50 years.
2. Both males and females.
3. Subjects with symptoms of plantar fasciitis for 6 weeks.
4. Pain that is worse in the morning during initial steps.
5. But decreases gradually after continued walking.

Exclusion criteria

1. Pescavus.
2. Excessive foot pronation.
3. Pesplanus.
4. Tight Achilles tendon.
5. Previous Surgery on foot.
6. Reiter’s Syndrome.
7. Enclosing Spondylitis.
8. Gout.
9. Rheumatoid Arthritis.
10. Neurological disorders e.g., Tumors or epilepsy.
11. Calcaneal Stress fracture and fractures around the ankle joint.
12. Any known radiating pain (lower Limb) e.g., Disc pathology.
13. Subjects who received corticosteroid injections in last 6 months.
14. Pagets Disease.

Instrumentation: Theralase TLC 1000 therapeutic laser system, 660nm Class 3B.

Outcome measures

1. Visual Analog Scale (VAS).

Procedure for cold laser

To rule out any further musculoskeletal or neurological causes for their discomfort, each participant got a physical examination by the therapist. The respondents washed their problematic foot with soap and water during therapy, and the therapist gently scrubbed the sore area with a spirit swab. To gauge the degree of improvement, the patients filled out the VAS, FFI, and dorsiflexion range of motion before beginning therapy (zero day), at the conclusion of the first, second, third, and fourth weeks, respectively. The World Association of Laser Therapy.

(WALT) has embraced this methodology in its recommendations for using low-level laser therapy (LLLT) to treat musculoskeletal problems 26.

Following plantar fascia stretching exercises, patients underwent low-level laser treatment at a wavelength of 780 nm. In order to prevent clear laser viewing, the patient is lying on his or her back with the probe making right-angle contact with the skin. A 780 nm continuous wave laser was used to irradiate the foot. The treatment involved two 90-second laser sweeps over the prominent medial border of the plantar fascia, followed by 90 seconds of laser irradiation across the origin

of the plantar fascia on the anterior inferior calcaneus. For four weeks, therapy will be provided three times each week. Device having an energy density of 10 J/cm2 and a continuous wave output of 100mW at 780 nm. The patient was taught to cross the injured leg over the opposite leg while seated before beginning the plantar fascia stretch. The affected side's metatarsophalangeal joint was then exerted distally by the patient, who pulled the toes up toward the shin until the foot's sole felt stretched. The stretch was performed while palpating the plantar fascia with the opposite hand. The given stretch had to be held by both groups for ten (10) seconds, then repeated ten (10) times. The allocated regimen was to be followed by the patients three times per day, with the first stretch being performed before the patient's first step in the morning and before engaging in any weight-bearing exercise [27].

Procedure for measuring VAS

All the subjects were evaluated for pain. VAS method was used (Melzack and Wall 1994) to measure the pain; for this ten-centimeter scale was taken to understand the intensity of pain in the individual. Recording was done before and after the treatment session.

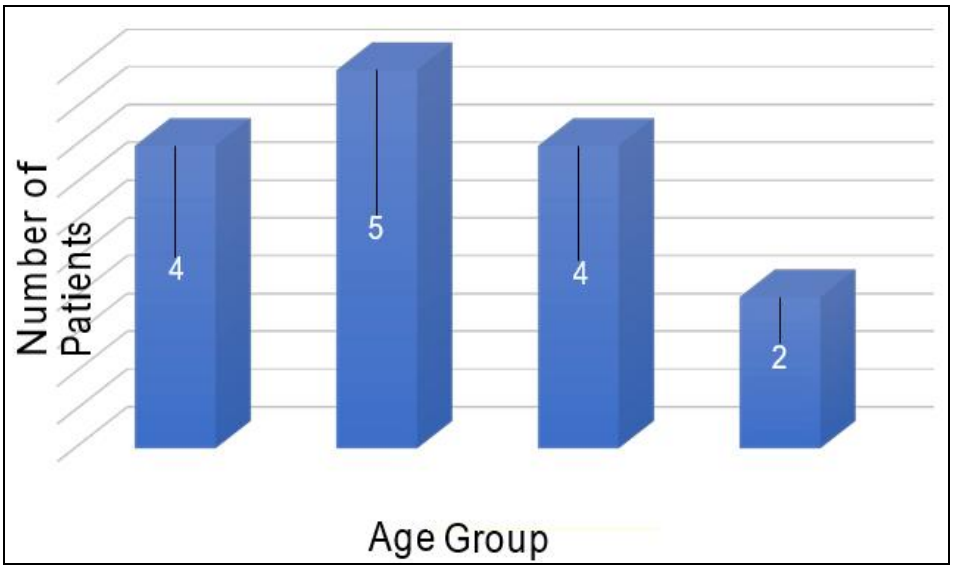
Statistical software

The Statistical Software namely SPSS 22.0 was used for the analysis. Descriptive statistics was used to calculate mean and SD whereas. Paired t-test was used for statistical analysis. Microsoft Word and Microsoft Excel was used to generate graphs and tables.

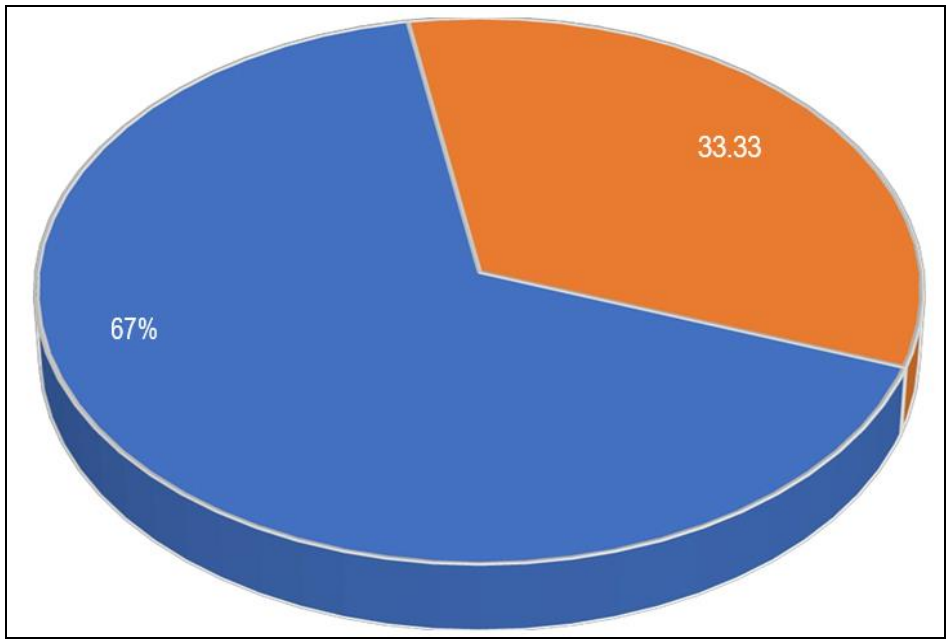
Result

The present study comprised of 15 subjects were in the intervention group. Among the 15 subjects in the group there were 10 (66.67%) females and 5 (33.33%) were males. Thus, there is a preponderance of female subjects in this study. The mean ± SD of age was 47.4±4.8 years. The mean ± SD of VAS score before treatment was 8.3±1.2 and after treatment it was 1.3±1.2.

The VAS score which was recorded before and after the treatment were analyzed statistically. It was noticed that the changes in the mean score of VAS compared between before treatment (8.3±1.2, $p > 0.17$) and after treatment (1.3±1.2, $p < 0.001$).



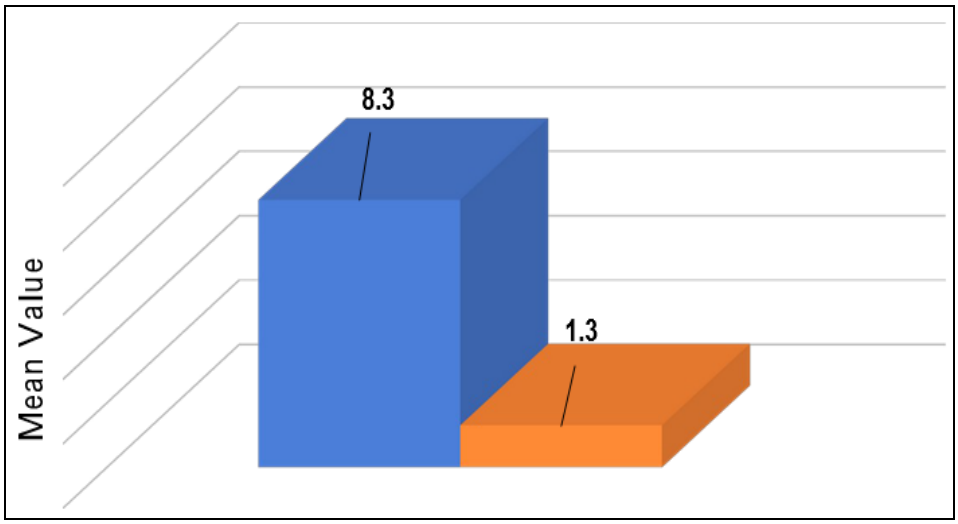
Graph 1: Bar graph showing the age distribution



Graph 2: Pie chart showing the gender distribution

Table 1: Descriptive statistics of vas during pre and post treatment

VAS	Mean	SD	*p*-value
Pre	8.3	1.2	0.17
Post	1.3	1.2	< 0.0001



Graph 3: Graph showing mean vas pre and post treatment

Conclusion

In this study, taking into consideration the parameter for pain VAS score was determined. Since, the mean score of VAS is less in the post treatment we can conclude that Cold Laser Therapy is an effective treatment options in individuals with Plantar Fascitis.

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