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## EFFECTIVENESS OF ULTRASOUND (US), TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION (TENS) AND STRETCHING IN PLANTAR FASCIITIS CASES: A CASE REPORT

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### Abstract

**Introduction:** Plantar Fasciitis (PF) is a standard heel and foot pain that affects the plantar fascia. The purpose of this study is to determine the effectiveness of ultrasound (US), Transcutaneous Electrical Nerve Stimulation (TENS), and stretching in treating Plantar Fasciitis cases.

**Case Presentation:** The patient in this study was a 38-year-old man with complaints of medial heel press pain, wake-up pain in the morning and after activity.

**Management and Outcome:** given therapy in ultrasound (US), Transcutaneous Electrical Nerve Stimulation (TENS), and stretching as many as four times. The pain was measured using a numeric rating scale (NRS) and the Foot and Ankle Outcome Score (FAOS).

**Discussion:** After being given therapy, it obtained results in the form of pain reduction measured using the Numeric Rating Scale (NRS pain press T1: 5 to T4: 2, wake pain in the morning T1: 7 to T4: 3, pain after activity T1: 6 to T4: 3 and there was an increase in ability measured using FAOS (Foot and Ankle Outcome Score).

**Conclusion:** The administration of ultrasound (US), Transcutaneous Electrical Nerve Stimulation (TENS), and stretching effective reduces pain and improves functional ability in patients with Plantar Fasciitis.

**Keywords:** Plantar Fasciitis (PF), Ultrasound, Transcutaneous Electrical Nerve Stimulation, and Stretching



## Introduction

Plantar Fasciitis (PF) is a musculoskeletal system disorder that most commonly occurs in the soles of the feet and affects the plantar fascia. The prevalence of Plantar Fasciitis is more common in women compared to men. In the age range of 45-64 years, 1.19% of plantar fasciitis complaints were experienced by women and 0.47% in men [3]. According to Thompson *et al.* [7], every year, 1 million people who work in long-standing offices have Plantar Fasciitis disease.

Plantar Fasciitis is the most common cause of heel pain as the primary stabilizer of the longitudinal arch. It has a thick and strong fibrous connective tissue that extends from the medial tuberosity of the calcaneus. It becomes three tapes to cling to the base of the proximal phalange or the metatarsophalangeal joint to the longitudinal arch of the medial leg [11]. Factors that interfere with the biomechanics of the feet will increase the tension of the plantar fascia. Plantar fascia tension can be caused by running, increased activity levels on an instance basis, obesity, rapid weight gain, wearing flat shoes, standing or walking for long periods, and performing activities on hard surfaces. All made in increased tension of the plantar fascia and recurrent microtrauma [13].

The main complaint in patients with a Plantar Fasciitis diagnosis is a pain in the heel, especially the medial part of the heel, arising on waking up in the morning at the first step, walking a long way, and standing for a long time. Pain will decrease as activity increases and worsens at the end of the day. The period of symptoms of Plantar Fasciitis can range from several weeks to years. There are two treatment options for Plantar Fasciitis, which are surgical and conservative methods. The success rate is 90-95% in conservative ways, so the surgical procedure should be the last option[13].

Various conservative methods, such as physiotherapy, can reduce pain in Plantar Fasciitis. Physiotherapy modalities include Ultrasound (US), Transcutaneous Electrical Nerve Stimulation (TENS), and Stretching. Based on the background of the above problems, the purpose of this study is to find out the effectiveness of Ultrasound physiotherapy (US), Transcutaneous Electrical Nerve Stimulation (TENS), and Stretching In Plantar Fasciitis Cases.

## Case Presentation

A 38-year-old man complained of pain in the heel and soles of his medial foot, complaining of pain in the morning after waking up and on long walks. The pain would be reduced when doing activities but would worsen at the end of the day. The patient said this pain started about one month ago. The patient was self-employed and, lately, always jogging. On the examination, the pain was obtained, pressing pain in the heel medial part, pain at waking up, and pain after activity. The scope of



joint motion was still within normal limits when the windlass test obtained positive results where the patient felt pain in the heel and soles of his feet. According to Brotzman [12], plantar fasciitis signs and symptoms were stinging pain and burning in the soles of the feet during the morning. The pain would decrease after increased activity and worsen at the end of the day.

### ***Management and Outcome***

The measuring instrument used on this patient was the NRS (Numeric Rating Scale) to measure pain. The pain score using NRS was 0-10, where 0= does not hurt while 10= is very painful. The functional capability employed in this case was FAOS (Foot and Ankle Outcome Score). FAOS was one of the questionnaires with five items, including symptoms and stiffness, pain, ADL, sport and recreational, and quality of life. In each item, there were several questions. There were seven questions on symptoms and stiffness items, Pain items were nine questions, ADL items were 17 questions, Sport and Recreational items were five questions, and Quality Of Life items were four questions. This interpretation of FAOS showed that the higher the value of FAOS, the better the person's functional ability was.

The physiotherapy interventions given to this patient were UltraSound (US), Transcutaneous Electrical Nerve Stimulation (TENS), and Stretching. In the US, the modality used continuous current at a frequency of 1w/cm<sup>2</sup> for 8 minutes. The TENS was mounted on the soles of the feet using interference current for 10 minutes with the intensity according to the patient's tolerance. While stretching the plantar fascia, the patient was instructed to pull the toes in the superior direction for eight counts and repeat 6-8x according to the patient's tolerance.

### ***Result***

Table 1 Pain using NRS

<b>NRS</b>	<b>T1</b>	<b>T2</b>	<b>T3</b>	<b>T4</b>
Pressure pain	5	5	3	2
Morning wake-up pain	7	6	4	3
Pain after activity	6	5	5	3

Based on the table above, pain measured using NRS obtained the results of pressure pain on the heel and sole area of the foot T1: 5; wake-up pain in the morning T1: 7; and pain after activity T1: 6; After a therapy in the form of US, TENS, and stretching, there was a decrease in pain in T4 that was pressure pain: 2; morning wake pain: 3; as well as pain after activity: 3. However, on the examination of pain after activity, there was no decrease in T2 and T3.

Table 2 Functional Capabilities using FAOS



FAOS	Pre	Post
<i>Symtoms and Stiffness</i>	89,28%	92,85%
<i>Pain</i>	75%	77,77%
<i>ADL</i>	85,29%	94,11%
<i>Sport and Recreational</i>	40%	60%
<i>Quality Of Life</i>	43,75%	50%

Based on the table above, functional capabilities measured using FAOS show an increase in the ability of functional activities. It can be seen from the FAOS score on pre and post-therapy, where the Symptoms and Stiffness score is 89.28% to 92.85%, the Pain score is 75% to 77.77%, the ADL score is 85.29% to 94.11%, the Sport and Recreation score is 40% to 60%, and the Quality Of Life score is 43.75% to 50% in interpretation where the higher FAOS score increases the functional ability of patients.

## Discussion

Based on the data results obtained, there was a decrease in press pain, wake pain in the morning, and pain after activity, but in pain, after activity, there was no decrease in T2 and T3. This condition may be caused by a high patient activity because the patient was still actively working and was lately always jogging. Increased activity and running can increase the tension on the plantar fascia. Patients were advised to wear footwear that has an arch/not flat and reduces jogging hobby.

Based on research conducted by , various types of US have been used to treat soft tissue injuries. High concentrated US sound waves result in changes in thermal coagulation. Induced coagulation changes the skin's collagen formation response by thickening the dermis and straightening tissue elasticity, resulting in a decrease in pain in patients with plantar fasciitis diagnosis.

TENS in Plantar Fasciitis could stimulate large fiber sensory neurons and decrease nociceptive inputs to the central nervous system through gate control theory mechanisms to reduce pain in the patient with a diagnosis of plantar fasciitis. The TENS modalities were administered with an interference flow of 10 minutes at an intensity according to the patient's tolerance limit. According to Alotaibi et al [11]. The use of Monophasic Pulse Current (MPC) could reduce pain and thickness of plantar fascia because MPC could speed up the healing process by using negative electrodes to attract fibroblast cells. Thus it could be accelerating healing, especially in the proliferation phase, with MPC



electrodes providing direct electric current to the base of the wound and increasing cellular action and histological responses. Examples are collagen synthesis, producing adenosine triphosphate, increasing growth factor receptors, and including calcium. According to research conducted by Stratton *et al.* [2], electrical stimulation is ineffective at reducing pain in Plantar fasciitis due to each person's tolerance of different intensities. Some people may use low or high intensity because everyone has a different excitatory threshold, so the intensity becomes too much or sometimes not enough. It can affect the effectiveness of electrical stimulation to increase blood flow. The study also said stretching and the use of foot orthoses were more effective compared to electrical stimulation.

In this article, the patient was also given the purpose of stretching the plantar fascia to produce maximum tension through a controlled stretch of the plantar fascia by reproducing the windlass mechanism to improve the plantar's elasticity fascia[12]. Stretching was done for 30 seconds and repeated at least three times each session, performed daily, especially before taking the first step in the morning and before standing after long sitting[5]. A study revealed cases of Plantar Fasciitis could be solved by not leaving the problem for an extended period using stretching[1]. Stretching is beneficial for reducing pain within a period of one week to four months or more [4]

This study showed decreased pain and improved functional ability, but the pain after activity did not change in T2 and T3. That may be due to increased patient activity and patient compliance in doing exercises at home, such as stretching, so the plantar fascia again experienced tension. According to research conducted by Johnson *et al.* [6], there is no definite amount of stretching every day. Still, the increasing amount of time spent on stretching also reduces symptoms and signs of Plantar Fasciitis. According to Carlton [10], night splints can help keep the feet and ankles neutral or slightly Dorsi when the patient sleeps to reduce pain.

### **Conclusion**

After physiotherapy in Plantar Fasciitis, as much as four times using ultrasound modalities (US), Transcutaneous Electrical Nerve Stimulation (TENS), and stretching, the results were decreased pain and increased functional activity.

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