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The Role of Biomedical Engineering and Physical Therapy in the Management of Chronic Achilles Tendonitis in Athletes Chronic Illness

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ABSTRACT

The purpose of this research is to determine whether or not athletes suffering from chronic Achilles tendinopathy may benefit from a combination of biomedical engineering and physical therapy. A simple random sample strategy was used to choose 15 athletes who had chronic Achilles tendinopathy. All participants had their pain levels assessed using a Numerical Rating Scale before to the exam. Following the pre-test, the subjects underwent four weeks of low-level laser therapy with eccentric exercises. Following this, they were measured again for pain and increased range of motion, just as they had been before the treatment. Research has shown that athletes suffering from chronic Achilles tendinopathy may find relief with the use of low-level laser therapy in conjunction with eccentric workouts.
Eccentric exercise, biomedical engineering, physiotherapy, chronic Achilles tendinopathy, discomfort, and low-level laser treatment are all used as keywords.

INTRODUCTION

There are a number of clinical symptoms associated with tendinopathy, a common musculoskeletal condition. Increased migration of neutrophil cells, peritendinous edema, localized pain, and stiffness are hallmarks of the acute phase of inflammation [1]. Biomedical engineering, sometimes known as medical engineering, is the application of engineering ideas and principles to the fields of biology and medicine with the aim of improving healthcare via diagnosis and treatment. This area, which has long been referred to as "bioengineering," aims to bridge the gap between engineering and medicine. One product in biomedical engineering that has been used in clinical practice for some time is low-level laser treatment (LLLT), which might be useful in managing tendinopathy [2]. Multiple randomized controlled studies have shown that eccentric exercises (EEs) may help in the treatment of tendinopathy and chronic tendinopathies [3] [4]. This research aims to determine the efficacy of biomedical engineering and physiotherapy in treating chronic achilles tendinopathy in athletes by means of low-level laser therapy and eccentric workouts.

MATERIALS AND METHODS

Fifteen athletes were chosen at random from the College of Physical Education at Vinayaka Mission in Salem using a simple random sample procedure that took inclusion and exclusion into

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account. Oral and written explanations of the experiment's purpose were provided to patients. A formal informed consent was obtained by all eligible patients who consented to participate. Requirements for inclusion (1) For a minimum of six months, there must be one side of the Achilles tendon that hurts when you walk or run; (2) When you palpate the area, you should feel crepitation and tenderness; (3) You should feel pain in the Achilles tendon, about 2 to 6 cm from where it attaches to the os calcaneus; and (4) According to goniometry, your range of motion should be less than 10° when you actively bend your knee. Patients with the following conditions are not eligible: (1) systemic inflammatory arthritis or familial hypercholesterolemia; (2) symptoms that have persisted for over six months; or (3) those who have taken oral or injectable corticosteroids during the last 26 weeks.

PROCEDURE

For four weeks, each patient participated in Low Level Laser Therapy sessions that included eccentric exercises. Prior to therapy and again after four weeks, we measured active range of motion and pain.

The pain was assessed using a numerical pain rating scale, where 0 indicates no pain and 10 indicates the most excruciating agony imaginable. The patients were asked to choose a number between 0 and 10 that best represents their level of discomfort. Low Level Laser Therapy (LLLT) was used to assess active range of motion. The parameters were as follows: wavelength: 904 nm, mean power output: 12 mW, peak value: 8.3 W, and frequency: 70 Hz (pulse train). The treatment dosage was 0.36 J/point, and the tender spots were treated for 30 seconds. Six sites, two on each side of the Achilles tendon nodule that hurts, spaced one centimeter apart. For a total of 12 sessions spread out over 4 weeks, participants received therapy three times weekly.

While maintaining full weight on the forefoot and ankle joint in plantar flexion, patients stood in front of walking bars and grasped them. Then, while putting all of their weight on the injured leg, the athletes lowered themselves by dorsiflexing their ankles.

In order to eccentrically load the gastrocnemius muscle, the eccentric movements were executed with the knee straight; in order to eccentrically load the soleus muscle, the knee was bent. Once the ankles were fully dorsiflexed, the athletes used their unaffected lower extremities and arms to return to the starting position. Athletes were to work out four days a week for four weeks, doing 12 sets of twelve repetitions with one minute of break in between. On the first day of workouts, athletes would do one set of five repetitions; by the end of the first four weeks of therapy, they aimed to have completed twelve sets of twelve repetitions.

Every participant also stretched their gastrocnemius and soleus muscles statically, in addition to the exercise program. While holding the walking bars, the athletes stood on a step and stretched their gastrocnemius and soleus muscles, respectively, by extending their knees until they felt a slight stretch and by bending their knees 30 degrees. Every time, we kept this posture for 15 seconds before letting go. With a 20-second break in between each repetition, the stretching exercise was performed ten times throughout each treatment session: five times before the eccentric exercises and five times after.

RESULTS AND DISCUSSION

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The paired t-test was used for statistical analysis, which led to the study's findings. There was a difference between the computed and tabled t values. Ankle joint discomfort decreased significantly, and active range of motion increased, according to findings from a paired t-test. Athletes and sports medical experts alike worry a great deal about how quickly they can recover from injuries. A dose-dependent anti-inflammatory effect and a dose-dependent stimulating impact on the healing process of connective tissue may be induced by low-level laser treatment [5].[6]. When a 904-nm wavelength was used with a relatively modest power density and energy dosage, LLLT was shown to be effective in chronic instances of Achilles tendinopathy [7]. Athletes and experts in sports injury rehabilitation were pleased to see the positive long-term effects of the Eccentric Exercise regimens proposed by Alfredson et al. [8] for chronic Achilles tendinopathy. Additionally, when tested using rigorous scientific models such as randomized controlled trial designs, the positive benefits of eccentric exercise regimens were shown to continue [9].

Table No. 1. The collected data were analyzed using paired't' test

Variables	't' calculated value	't' table value
PAIN	12.48	2.145
Active Range of Motion	14.30	2.145

t calculated value > t table value.

CONCLUSION

When paired with an eccentric exercise program, low-level laser treatment seems to be a risk-free and efficient way to speed up the healing process. The study's findings suggest that athletes suffering from chronic Achilles tendinopathy may find relief via a mix of biomedical engineering and physical therapy.

DISCOVERY CONFLICT
There is no perceived conflict of interest, according to the writers.
A CREDENTIAL
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