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Case Report Open Access

Effectiveness of Electron Modulation Procedure in Chronic Achilles Tendinopathy

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Abstract

Achilles tendinopathies are challenging to treat due to the presence of chronic inflammation and poor vascularization. Cases of acute and chronic Achilles tendinopathies experience some form of a chronic inflammatory profile. As a result, therapies that target and reduce inflammation are beneficial in both cases. The cellular basis for inflammation lies in the improper function of ion channels within cell membranes, resulting in altered cation flow and cell function. To reduce ion channelopathy, an Electron Modulation Device (EMD) has been developed that delivers multi-channelled vectored and triangulated electron energy to affected areas. EMD therapy can reduce the free radical formation and correct molecular isometric structure, thus improving cell membrane and ion channel function. This reversal in ion channelopathy can lead to a decrease in chronic inflammation and pain. The benefits of modulated electron energy were tested in the case of a 21-year old college football player presenting with bilateral Achilles tendonitis who underwent twelve treatments over eight weeks while continually practicing with little rest. The subject's pain level was assessed via a visual analogue scale (VAS) 0-10 Numeric Rating Scale before and after treatment. After every treatment session, the patient recorded a pain score of 0, indicating no pain, for his left Achilles tendon while also noting improved mobility and reduced inflammation. The therapeutic benefits of EMD are attractive as the ability to rapidly reduce pain and inflammation can promote healing, thus effectively managing sports-related injuries or musculoskeletal dysfunctions without the use of opioids or opiates and the risk of addiction.

Keywords: Achilles tendinopathy; Electron modulation; Procedure reduced inflammation; Reduced physical pain rehabilitation

Introduction

Achilles tendinopathy is a chronic condition that results in pain, inflammation, and limited activity. The majority of sports-related injuries have been attributed to tendon disorders, and the frequency of Achilles injuries have been increasing in frequency due to increased sporting activity by the athletic and general population [1-3]. These tendinopathies are challenging to treat because of the tendon's inflammatory profile and poor vascularization which can result in degeneration of the tendon, predisposing the patient to recurrent Achilles tendon tears [4]. The customary conservative management for Achilles tendinopathies such as rest or physical therapy has been relatively unsuccessful with 25% to 45% of patients undergoing surgery as a last resort [5].

With a greater need for a more effective, non-invasive therapy, there have been attempts to use energy-based devices, such as ultrasound, electromagnetic fields, and transcutaneous electrical stimulation, to treat Achilles tendinopathies by reducing chronic pain and inflammation [1, 6-11]. However, reports on the efficacy of these tools are inconsistent, and some studies find that transcutaneous electrical stimulation can impede collagen repair in Achilles tendinopathies [12]. Fortunately, the recent development of the Electron Modulation Device (EMD) offers a more robust procedure of treating tendinopathies with its ability to alleviate ion channelopathies through the delivery of electron interventional energy. We introduce a year-long case of Achilles tendinopathy in a college football player who presented with bilateral Achilles tendonitis. Early in his course of treatments, he reportedly tried available conservative therapies that failed to manage or relieve his soreness, inflammation, and range of motion restriction. Attempts at rest and recovery were hindered by continued involvement with athletics, causing his symptoms to flare. The patient experienced a distinct improvement in his pain management and healing only after receiving EMD therapy that reduced inflammation and enhanced cellular metabolism.

Case Report

A healthy 21-year-old football player came to the clinic with bilateral Achilles tendonitis, reporting more discomfort in his left Achilles tendon that has persisted for over a year. The subject reported that his tendinopathy started during his offseason training sessions and progressively worsened as time passed. In response, he took oral non-steroidal-anti-inflammatories, underwent six months of physical therapy treatments, and received amniotic fluid injections; all of which had the minimal effect of alleviating the inflammation and pain in both of his tendons. Since returning to his college to participate in off-season organized team activities, he had been practicing daily with little time for recovery, causing his symptoms to be unbearable to the point of him seeking medical treatment. On exam, he had pain upon palpation, observable inflammation, and decreased range of motion over the right and left ankles and Achilles tendons. He stated that his aching and swelling continued while at rest and were exacerbated upon doing movements, such as running, that involved the flexion and extension of both the right and left ankle.

The patient agreed to undergo EMD therapy starting at three times per week. Normally, the protocol includes a break from all physical endeavours along with a one to four-week series of treatments

resulting in cumulative improvements in pain and inflammation. However, in this case, the patient was reluctant to remove himself from athletic activities as the first game of his last season was soon approaching. As a result, he continued to participate in practices and games as opposed to letting his Achilles tendons rest and recover during the treatment period. The patient was asked to report his pain on the visual analogue scale VAS 0-10 Numeric Rating Scale: zero is no pain, 5 is moderate pain, and 10 is the worst possible pain. Before treatment, he experienced a pain level of 7/10 at rest (Figure 1). Throughout the treatment series, the patient remained fully physically active and involved with his team. Although both Achilles tendons were treated, we reported on the more painful left tendon. The right Achilles tendon improved immediately with 0/10 pain after the first week. The right tendon remained unremarkable with treatment and had no relapses.

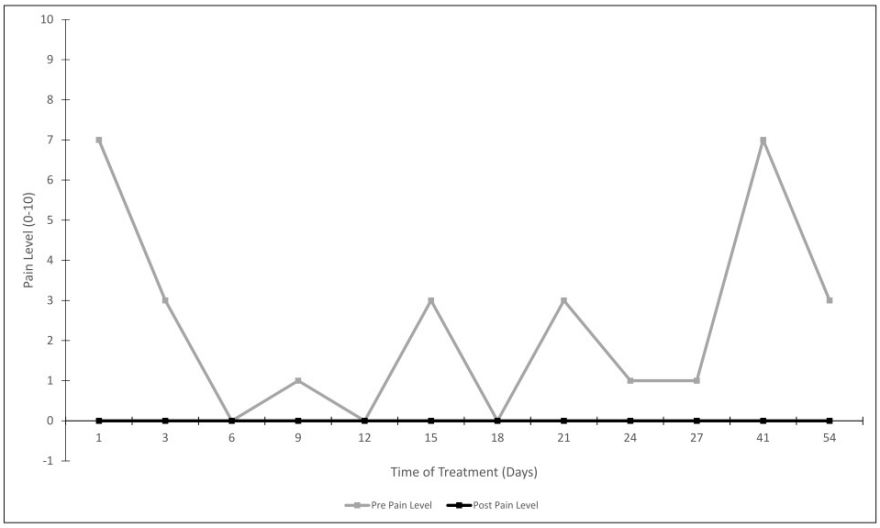

Figure 1: Pain levels before and after treatment of EMP. Pain levels below 0 do not exist and were added for visual purposes only.

Discussion

Achilles tendinopathies are divided into acute and chronic stages of tendinopathies. The acute stage begins with an acquired channelopathy caused in many cases by overuse or trauma followed by edema, clotted blood, inflammatory exudate, polymorphonuclear cells, and cellular necrosis [8]. Chronic Achilles tendinopathies are characterized by a different array of chronic non-resolving inflammation, disorganized collagen formation, and low vascular supply [4,13]. More recent studies have shown a variety of inflammatory cells that include macrophages, T cells, natural killer cells, and mast cells in chronic human Achilles tendinopathies. These chronic tendinopathies at the cellular level are also expressing an increased level of NF-KB, interferon, and STAT-6 activation pathways. Moreover, studies have shown an increase in PTGS2 and interleukin-8 expression in chronic tendinopathy. Tendon cells from chronic Achilles tendinopathies also show increased stromal fibroblast activation markers over healthy tendons [13].

Because of this disparate chronic inflammatory profile in acute and chronic Achilles tendinopathies, strategies that target inflammation are of potential therapeutic benefit, and new therapeutic approaches are required to promote resolution of the inflammatory process in such cases. The cellular basis of inflammation includes malfunction of the ion channels within the inflammatory cell membranes causing cells to have modified cation flow and subsequently altered function and metabolism [14-16]. This suggests that the inflammation caused by ion channelopathy can hinder wound repair. On the molecular level this translates into changes to the isometric molecular structures which is a result of electron instability within the atom associated with formation and accumulation of free radicals [14,15]-the molecules of high instability and reactivity due to the presence of an odd number of electrons in the outermost orbit of their atoms [7,8]. The free radical-related electron instability is measurable information, while electron-

based fields are active in regulating inflammatory processes *in vitro* and *in vivo* [17,18]. It has been shown that pulsed electron-based fields can modify ionic flow across biological membranes and alter cell metabolism and function [16].

A practical new clinical technology for the modulation of electron activity and ion channelopathy reduction has been developed. This Electron Modulation Device (EMD) introduces measured multi-channeled vectored and triangulated electron energy to the affected areas utilizing electron-based assessment and interventional energy for the treatment of acquired channelopathy. This channelopathy in certain inflammatory cells is the basis of the chronic inflammatory profile. The EMD has been specifically developed to counteract molecular and sub-molecular events resulting in chronic inflammation. The principals of the EMD include 1) electron related stability assessment comparing stable vs. unstable signal, and 2) applied interventional stabilizing electron-based energy output. This stabilization can lead to the reduction of free radical formation, the correction of the molecular isometric structure, improvement of cell membrane structure and function and the improvement of the ion channel function within the inflammatory cell membrane resulting in reversals in ion channelopathies. The normalization of ion channel function within the cell membrane brought on by EMD therapy contributes to an eventual decrease in chronic inflammation and related pain symptomology.

Conclusion

In conclusion, EMD therapy was able to reduce Achilles tendinitis pain, increase range of motion, and reduce levels of inflammation immediately. Because the patient continued to practice and did not allow for resting recovery time during the treatment series, the effects of the decreased pain and inflammation had to be maintained with 3x/week EMD treatments. A prolonged non-treatment interval of 2 weeks with no rest as demonstrated between Day 27 and 41 and continued football practice allowed the patient's pain rankings to return to pre-treatment baseline pain levels (Figure 1). Subsequent EMD treatment again reduced the pain level to 0/10 VAS.

No counter indications or adverse side effects were observed or reported. EMD is a safe and non-invasive tool to treat inflammation and pain of Achilles tendinitis. Although the patient was unable to fully rest during the treatment intervals (because of football practice), the patient did experience significant improvements with the procedure. More studies are needed to determine further improvement levels in inflammation and pain with concomitant prolonged rest and treatments. The decrease in free radicals and improvement in channelopathies of the inflammatory cells needs further elucidation. It is hypothesized that a limited series of repeated treatments and rest are needed to maintain the cumulative decrease in inflammation. The improvements in pain immediately after the treatments, also imply that the nociceptive neural pathways are directly affected with the EMD. This neuronal effect seems to last longer and is consistent with the fact that neural pathways have multitudes of voltage-gated and ligand-gated ion channels that can be modulated by the EMD. Anything that interferes with the neuronal membrane voltage can alter channel gating and comparatively small changes in the gating properties of a channel can have profound effects [15]. As such, EMD may have future therapeutic benefits for rapid injury recovery, resulting in avoidance of opioid and opiate use and addiction as seen with many patients with musculoskeletal dysfunction.

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