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Case Report

The Effectiveness of 448 kHz Capacitive Resistive Monopoles Radio Frequency in Acute Ankle Sprain: A Case Report

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Abstract

The aim of the present report was to find out the effect of 448 kHz Capacitive Resistive Monopolar Radiofrequency (CRMRF) in acute ankle sprain. A patient with right unilateral acute ankle sprain participated in the present case study. The patient followed a course of 448 kHz CRMRF twice per day for seven consecutive days. Evaluations included self-reported pain via a visual analogue scale, degree of ankle edema and ankle range of motion via goniometry carried out before the treatment and at the end of the treatment. There was a decline in pain and a rise in function in all evaluations. The results of the present trial suggest that a course of 448 kHz CRMRF as described in the present trial can produce significant improvements in terms of pain and disability in acute ankle sprain; however, larger studies are required confirming these results.

Keywords: Ankle sprain; 448 kHz capacitive resistive monopolar radiofrequency; Indiba

Introduction

Ankle inversion sprains (for the purpose of the study ankle inversion sprains are referred to as ankle sprains)are among the most common acute injuries in sports [1]. These injuries result in significant societal costs in terms of work absences and use of healthcare resources [2]. Ankle sprains are commonly caused by inversion when the ankle is in plantar flexion [3]. The main symptoms of ankle sprain are pain, swelling and loss of function. Ankle sprains are divided into three grades according to the degree of damage to the ligaments, the most common being grade II injury, which is a partial ligament tear [4]. There is still some debate regarding the management of acute ankle sprains: standard treatment for the first 4-5 d usually consists of Rest, Ice, Compression and elevation (RICE) to reduce pain and swelling [5], but additional treatment is often necessary [6].

More recently, physiotherapists are able to use a new modality called 448 kHz Capacitive Resistive Monopolar Radiofrequency (CRMRF).This frequency promotes ion mobilization between the intracellular and extracellular matrix and restores cell membrane permeability [7]. The energy generated at 448 kHz improves cell membrane permeability, enhancing intracellular and extracellular exchange and tissue regeneration [7]. However, arguments for the presence of these biochemical effects are lacking and often theoretical. Even if biochemical effects are found in laboratory models, it by no means follows that they will translate into clinically meaningful effects. The extent of clinical use of 448 kHz CRMRF is not known, although novel modalities, such as this are attractive to practitioners working in rehabilitation settings. Previous trials assessed the effectiveness of this treatment in rotator cuff tendinopathy [8] and in knee OA [9]. To date, there are no previously published reports investigating the efficacy of 448 kHz CRMRF therapy in the treatment of acute injuries, such as ankle sprains; therefore, the aim of this study was to assess the clinical effectiveness of448 kHz CRMRF in the management of acute ankle sprains.

Case Report

Mr. J., a 26- year-old male, professional footballer, complained of acute pain in the lateral aspect of his right ankle, of his dominant leg. The pain was on the aspect of the lateral malleoli. He described a sudden “buckling” of his ankle (plantar flexion and inversion injury). He experienced pain immediately. He did not receive any NSAIDs. He did not have any other symptoms or any problems in peripheral joints or in the spine Clinical examination identified tenderness, swelling, and ecchymosis over the anterior talofibular and calcaneofibular ligaments, with some bony tenderness on the posterior edge of the lateral malleolus. She had no medial tenderness. Movements of the ankle were painful, with less power and decreased range of motion comparing with the other side. Ankle ligament stress testing was not performed owing to pain. He was presented with a grade II ankle sprain (confirmed by the Ottawa ankle rules) [10].

The patient received 448 kHz CRMRF intervention by a physiotherapist experienced with this technique (KP). The CRMRF at 448 kHz was delivered using ‘INDIBA Activ 902’, a new factory calibrated device with a peak power of 200 W, which delivered continuous-wave RF energy in two modes: Capacitive (CAP) and

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Resistive (RES), using metallic electrodes via a coupling medium. The CAP mode was delivered in thermal dose (according to patient feedback on his perception of moderate heating) in muscles around the ankle (gastrocnemius, soleus, anterior and posterior tibialis). CAP mode was delivered 5 minutes for each muscle. The RES mode was delivered in non-thermal dose (inflammatory stage) to the more symptomatic area (Figure 1). The RES mode was delivered for 10 minutes. Finally, CAP mode in non-thermal dose was delivered in the symptomatic area for 5 minutes. The return electrode was placed in the lumbar area. Treatment was delivered twice a day (morning and afternoon) for seven consecutive days providing 14 sessions in total.

Figure 1: Application Indiba Resistive.

The primary efficacy outcome was assessed via self-reported degree of pain using the 10 cm visual analogue scale (VAS; ranging from 0 to 10, where 0 indicates 'no pain' and 10 indicate the 'worst pain imaginable'). This form of assessment was considered most appropriate because of its high level of repeatability when used serially on the same patient [11]. Secondary outcomes included an assessment of ankle edema using the figure of eight methods (ankle circumference using eight ankle/foot landmarks) and an assessment of ankle range of motion using goniometry. The figure of eight method has been shown to be a highly reliable [12,13] and valid [13] tool for measuring the girth of both healthy and edematous ankles. The assessment of ankle range of motion using goniometry has demonstrated validity and reliability in patients with acute ankle sprains [14]. Patients were assessed before treatment, and at the end of the final (14^{th}) treatment. Assessments were made by the same examiner (DS) and carried out in the same order.

Results

Pain on VAS was 8, edema score was 57, dorsiflexion score using goniometer was 10 and plantar flexion score using goniometer was 14 at the initial evaluations. At the end of the treatment (session 14), there was a decline in pain on VAS of 8 units, there was a decrease in edema score of 3.5 units, there was an increase in dorsiflexion score of 8.0 degrees and an increase in plantar flexion score of 27 degrees (Table 1).

	Pain (cm)	edema (cm)	Range of motion – dorsiflexion (degrees)	Range of motion – plantar flexion (degrees)
Before treatment	8	57	10	14
After treatment	0	53.5	18	41

Table 1: Range of treatment.

Discussion

The present case report has looked at the effect of 448 kHz CRMRF in a patient experiencing acute ankle sprain and its findings have demonstrated significant improvements in terms of pain and disability. The results obtained from this case report are novel; as to date, similar studies have not been conducted.

The most common physiotherapy treatment for ankle sprain is a supervised or in clinic exercise program. However, the patient with acute ankle sprain was not able to perform an exercise program due to pain. The patient was advised by the clinician to follow an exercise program after completing the 448 kHz CRMRF treatment.

448 kHz CRMRF is a relatively new treatment approach, but it is reported to be used by clinicians worldwide. Many clinicians think that Shortwave Diathermy (SWT) and 448 kHz CRMRF is the same. However, the 448 kHz CRMRF differs from SWT mainly in two-ways - firstly the operating frequency (SWT commonly operates at27.12 MHz) and secondly, unlike SWT it is applied using a coupling medium since CRMRF cannot be delivered through air [9]. Hence, one hypothesized advantage of 448 kHz CRMRF over SWT is that scattering of the RF waves is potentially considerably lower [9].

Since pain relief and improvements in function were noted in the present case study on a short term, it is proposed that the 448 kHz CRMRF energy may potentially have promoted an anti-inflammatory effect in the soft tissues [9]. However, to understand the potential changes to the tissues in response to 448 kHz CRMRF treatment, future studies should consider employing outcome assessments that are capable of monitoring the changes in deeper tissues.

The present case study was the first report to examine the effectiveness of 448 kHz CRMRF on acute ankle sprain. Previous studies assessed the effectiveness of this treatment on chronic knee osteoarthritis [9] and rotator tendinopathy [8]. However, ankle sprain, rotator tendinopathy and knee osteoarthritis are three different conditions and the results are not comparable. The three previously reported trials found that a course of 448 kHz CRMRF may improve patients' symptoms. The findings of these trials encourage the design of future well-designed RCTs that might produce strong evidence for the effectiveness of 448 kHz CRMRF on sports/musculoskeletal injuries.

A course of 448 kHz CRMRF treatment was applied in the present study based on manufacturers' claims. It is a dose-response modality and the optimal treatment dose has obviously not yet been discovered. Future studies are needed to standardize 448 kHz CRMRF parameters in the management of ankle sprain.

Although the positive effects of such a treatment approach in acute ankle sprain have been reported in the present study, its study design limits the generalization of these results. Future well-designed trials are needed to confirm the results of this case report establishing the effectiveness of such a treatment approach in the management of ankle sprain. Further research is needed to establish the cost-effectiveness of such treatment, because reduced cost is an important issue for the recommendation of any given treatment and the possible mechanism of action of this treatment approach [15].

Conclusion

A course of 448 kHz CRMRF treatment had reduced the pain and improved the function in a patient with acute ankle sprain at the end of the treatment. Further well-designed trials to confirm the results of the present case study are needed.

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