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The Capacitive/Resistive Monopolar Radiofrequency 448kHz can be recommended as a treatment approach in the management of Lateral Elbow Tendinopathy

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1. Abstract

Lateral Elbow Tendinopathy (LET) is the most common tendinopathy in the elbow area. The majority of clinicians advocated a conservative approach. Physiotherapy is usually provided. An exercise programme is usually the first-line treatment approach for LET, reducing pain and improving function in those patients. More recently, physiotherapists are able to use a new modality called 448 kHz Capacitive Resistive Monopolar Radiofrequency (CRMRF). However, the evidence of the 448 kHz CRMRF in the management of chronic LET, is minimal. Therefore, the objective of the present editorial is to find out the effect of different modes of 448 kHz CRMRF in chronic LET.

2. Keywords

Lateral elbow tendinopathy; Exercise; Radiofrequency; 448Khz; Capacitive Resistive Monopolar Radiofrequency; Tennis elbow

3. Introduction

Lateral Elbow Tendinopathy (LET), commonly referred to as tennis elbow or lateral epicondylitis, is the most common tendinopathy in the elbow region among both athletes and non-athletes. Many physicians advocate a conservative approach, even though the ideal LET management does not exist. Physical therapy is usually recommended. A plethora of physiotherapy approaches have been recommended for the management of LET, including progressive exercise programs, manipulation and mobilization techniques, electrophysical agents and electrotherapy, external support, acupuncture, soft tissue manipulation, and ergonomic advice. The plethora of techniques suggests that the ideal management strategy remains unknown, and further research is required to determine the most effective treatment strategy for LET patients.

The most common physical therapy approach for LET management is a progressive loading supervised or in a clinical placement exercise program me [1]. The management of LET is changing, and now eccentric training is no longer the only exercise option. Malliaras and his colleagues [2] concluded that clinicians should consider eccentric-concentric loading alongside or instead of eccentric loading. Martinez-Silvestrini et al. [3] stated that, unlike Achilles tendinopathy, LET is often related to forceful grip activities requiring isometric contraction, which would be more beneficial than the eccentric contraction in LET. Recently, isometric exercises have been recommended to reduce and manage tendon pain, increasing the strength at the angle of contraction without producing inflammatory signs [4]. The exercise program in LET should include exercises not only for Extensor Carpi Radialis Brevis (ECRB) strengthening, the most commonly affected structure, but also for supinator, rotator cuff, and scapular muscle strengthening [5,6]. Moreover, patients with LET have also reduced proprioception [7]. Techniques to improve reduced proprioception are also recommended. Finally, Tendon Neuroplastic Training (TNT) is needed to combine isometric or isotonic strength training with an externally paced audio or visual cue [8]. The exercise program is individualized based on the patient's description of pain experienced during the procedure [9]. The exercise programme is combined with static stretching exercises for the ECRB, making the tendon initially more resistant to strain or to strengthen it, thereby increasing the range of motion of the relevant joint [10,11]. Secondly, it orients the new collagen fibres with a "lengthening" of the muscle-tendon unit [12].

Although the exercise programme is usually recommended for LET management, the question that arises is why the optimal treatment of LET is still unknown, symptoms may persist for many months, and recurrence is common. One possible answer is that new techniques should be used to improve patients' symptoms (pain, strength, and function). Lately, the use of 448 KHz Capacitive Resistive Monopoles Radiofrequency (CRMRF) has been advocated as a clinically relevant rehabilitation tool for patients with tendinopathies such as LET. I wondered if 448 KHz CRMRF could be an effective treatment approach in the rehabilitation of LET, thus, the literature was searched.

An electronic search for clinical studies was carried out in six databases: Medline (from 1966 to March 2025), Embase (from 1988 to March 2025), Cinahl (from 1982 to March 2025), Index to Chiropractic literature (from 1992 to March 2025) SportDiscus (from 1990 to March 2025) and Chirolars (from 1994 to March 2025). A search took a very broad approach in order to capture all published material from any source, including any clinical study, review, and letters to editors of journals. The following key words were used individually or in various combinations: ''lateral elbow tendinopathy,'' ''tennis elbow,'' ''lateral epicondylitis,'' ''lateral epicondylalgia,'' ''extensor tendinopathy,'' ''extensor tendonitis,'' ''extensor tendinosis,'' ''rehabilitation,'' ''treatment,'' ''management,'' ''protocol,'' ''optimal protocol,'' ''Capacitive Resistive Monopoles Radiofrequency,'' ''INDIBA,'' and ''TECAR''. Only English language publications were considered. Other references were attempted to identify from existing reviews, books, and other papers cited in the publications searched. Additional reports were sought from the reference sections of papers that were retrieved, from contacting experts in the field, from the Cochrane Collaboration clinical trial register (last search March 2025), and internet sites related to CRMRF. Unpublished reports and abstracts were included in the review.

Three published studies were found, one case study and two pilot trials [13-15]. In the case study [13], a patient with acute (48 hours) LET participated. The patient followed a course of 448 kHz CRMRF twice per day (morning and afternoon) for five consecutive days, providing ten sessions in total. 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 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 elbow (biceps, triceps, extensor muscles of wrist). CAP mode was delivered for 5 minutes for each muscle. The RES mode was delivered in a non-thermal dose (inflammatory stage) to the more symptomatic area. 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 scapular area. The results of the case study suggest that a course of 448 kHz CRMRF as described in the case study, can produce significant improvements in terms of pain and disability in acute LET. The patient was advised by the clinician to follow an exercise program after completing the 448 kHz CRMRF treatment.

The first pilot study compared 448kHz CRMRF at a continuous standard wave with a continuous modulated wave [14]. 20 patients with chronic (more than three months) LET were divided into two groups and received a supervised exercise protocol [16-18] as well as were treated with one of the two under supervision protocols of INDIBA®; 448kHz CRMRF either with thermal output power in continuous standard wave or thermal output power in continuous modulated wave) of INDIBA. Both groups received twenty sessions (5 per week). CAP electrode was applied for 5 minutes on biceps brachii, triceps brachii, and wrist extensors. RES electrode was applied for 10 minutes on the affected area. Lastly, CAP electrode was applied for 5 minutes. The return electrode was placed under the subject's elbow. 448 kHz CRMRF with continuous standard wave might be a better approach in chronic LET treatment than modulated current.

The second pilot study aimed to compare the clinical results of the use of an exercise program with those of an exercise program and thermal (thermia or hyperthermia) mode of 448 kHz CRMRF in a continuous wave in patients with chronic (more than 3 months) LET [15]. Patients were divided into two groups. Both groups received a supervised exercise protocol, total of twenty sessions (5 per week). Group A received 448kHz CRMRF with a continuous standard wave. CAP electrode was applied for 5 minutes on biceps brachii, triceps brachii, and wrist extensors. RES electrode was applied for 10 minutes on the affected area. Lastly, CAP electrode was applied for 5 minutes. The return electrode was placed under the subject's elbow. The exercise programme and thermal (thermia or hyperthermia) of 448 kHz CRMRF in continuous wave produced the largest effect at the end of the treatment and the follow-ups.

INDIBA system was used in the above-reported studies because it generates an electromagnetic wave with a frequency of 448 KHz and determines a bio-stimulation and/or thermal effect with an important role in increasing the body's self-healing capacity [19]. This frequency promotes ion mobilisation between the intracellular and extracellular matrix and restores cell membrane permeability [20]. The energy generated at 448 kHz improves cell membrane permeability, enhancing intracellular and extracellular exchange and tissue regeneration [21]. There are two modes of electric charge transfer: capacitive, which is focused on soft tissues and muscles that have higher electrolyte content, and resistive mode, which is focused on larger, deeper, and with higher resistant tissues such as bone areas and/or joints [22].

448 KHz CRMRF is a relatively new treatment approach, but it is reported to be used by clinicians worldwide. Research data for this kind of radiofrequency is really limited, since it has mainly been examined on animals and healthy populations [23-25]. Musculoskeletal conditions that have been examined and had statistically significant results are knee osteoarthritis [19], acute ankle sprain [26], and rotator cuff tendinopathy [24,25]. Avendano-Coy., et al. examined sub-acromial pain and did not find statistical differences in pain and functionality [27].

Many clinicians think that Shortwave Diathermy (SWT) and 448 KHz CRMRF are the same. However, the 448 KHz CRMRF differs from SWT mainly in two ways - firstly, the operating frequency (SWT commonly operates at 27.12 MHz) and secondly, unlike SWT it is applied using a coupling medium since CRMRF cannot be delivered through air [19]. Hence, one hypothesized advantage of 448 kHz CRMRF over SWT is that scattering of the RF waves is potentially considerably lower [19].

Since pain relief and improvements in function were noted in the above case study for a short term, it is proposed that the 448 KHz CRMRF energy may potentially have promoted an anti-inflammatory effect in the soft tissues [19]. 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 main effect of 448KHz CRMRF is tissue hyperthermia superficially and deeply that it is sustained from 54,8 minutes to 164,2 [28]. Heat increases metabolic rates, vasodilation and blood flow, promoting tissue recovery and providing pain relief by increasing the pain threshold [29]. In addition, hyperthermia can also change the nature of connective tissues and alter the properties of tendons, ligaments, and muscles, which results in an increase in their extensibility and a reduction in their tone and spasm. Finally, 448KHz CRMRF increases the ability to stimulate stem cell proliferation and differentiation [19]; induction and support of thermal adaptations of skin tissue that reflect an efficiency of cellular metabolism and deep circulation.

448 KHz CRMRF produces radiofrequency in different modes, with standard and modulated waves. When the wave is modulated, there is a reduction of voltage and an increase of electric charge. However, the thermal charge is automatically defined by the device at 40% maximum. According to the manufacturer, the results are the same, however, the results of the first pilot study proved otherwise, so we assume it is the reduction of the voltage that reflects on a lesser thermal effect. In clinical practice, this is hard to prove, since research in labs has been conducted on animals that have different thermoregulation [23].

A course of 448 KHz CRMRF treatment was applied in the above studies based on manufacturers' claims. However, in clinical practice, the last part of the capacitive electrode in non-thermal mode is omitted [23,28]. 448KHz CRMRF is a dose response therapy [24,25]; however, each person perceives temperature differently, since temperature receptors are sensitized from 30˚C to 35˚C, which is quite a range [30]. 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 LET (acute, chronic, and calcific).

Although the positive effects of such a treatment approach in LET (acute and chronic) have been reported in the above studies, the study design (case report and pilot studies) limits the generalization of the results. In all the above studies, patients received a progressive exercise program. It is worth mentioning that modalities such as 448 kHz CRMRF are used as a supplement to an exercise program and not as a substitute for exercise. Future well-designed trials are needed to confirm the results of the above studies, establishing the effectiveness of such a treatment approach in the management of LET (acute, chronic, and calcific). In addition, structural changes in the tendons related to the treatment interventions need to be investigated. 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 [31]. Last but not least, it is advised that future studies conclude about the parameters of the 448 KHz CRMRF, as well.

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