Analgesic effects of a capacitive-resistive monopolar radiofrequency in patients with myofascial chronic neck pain: a pilot randomized controlled trial

Isabel Maria Alguacil-Diego 1
Josue Fernández-Carnero 2,1
Sofía Laguarta-Val 1
Roberto Cano-de-la-Cuerda 1
César Calvo-Lobo 3
Rosa Martínez-Piédrola 1
Laura Cristina Luna-Oliva 1
Francisco Molina-Rueda 1

1. Department of Physical Therapy, Occupational Therapy, Rehabilitation, and Physical Medicine. Rey Juan Carlos University, Madrid, Spain
2. Hospital La Paz Institute for Health Research, IdiPAZ, Madrid, Spain
3. Nursing and Physical Therapy Department, Faculty of Health Sciences, Universidad de León, Ponferrada, León, Spain

SUMMARY

BACKGROUND: To date, there is a lack of prior studies on the use of capacitive resistive monopolar radiofrequency (RF) to treat neck pain. The objective of this study was to investigate the immediate effect of capacitive resistive monopolar radiofrequency (RF=448 kHz), in comparison with a placebo, on (1) reducing neck pain intensity at myofascial trigger points (MTrP), (2) decreasing neck disability and (3) improving cervical range of motion (CROM).

METHODS: A randomized, double-blind, placebo-controlled trial (NCT02353195) was carried out. Patients with myofascial chronic neck pain (N=24) with active MTrP in one upper trapezius muscle were randomly divided into two groups: a radio-frequency group, which received eight sessions of a monopolar capacitive resistive radio-frequency application over the upper trapezius muscle, and a placebo group (PG), which received eight sessions of placebo radio-frequency over the same muscle. Visual analog scale (VAS), CROM and Neck Disability Index (NDI) were evaluated after the first session and after the eight sessions.

RESULTS: The Wilcoxon test for VAS showed statistically significant differences between baseline, immediately after the first session and after eight sessions (p<.001). No significant differences for PG were found. No differences were observed between groups. NDI improved in both groups after eight sessions, but no differences were found between groups (p<.05). ANOVA for time factor showed statistically significant changes in the right cervical rotation in both groups (F=4.112; p=.026) after eight sessions.

CONCLUSIONS: Even though there were no differences between both groups, the monopolar capacitive, resistive RF could have a potential effect on pain intensity.


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CORRESPONDING AUTHOR: Roberto Cano-de-la-Cuerda
Department of Physical Therapy, Occupational Therapy, Rehabilitation, and Physical Medicine
Rey Juan Carlos University Alcorcón, 28922, Madrid, Spain
Telephone: 0034-914888674
E-mail: roberto.cano@urjc.es
CORRESPONDING AUTHOR: César Calvo-Lobo
Av. Astorga, s/n, Ponferrada, 24401, León, Spain
Telephone: 605811782 - Fax: 605
E-mail: ccall@unileon.es
LIST OF ABBREVIATIONS

- Cervical range of motion (CROM)
- Myofascial pain (MP)
- Myofascial trigger points (MTrP)
- Monopolar capacitive resistive radio-frequency (MCRRF)
- Neck disability Index (NDI)
- Neck pain intensity (NPI)
- Placebo group (PG)
- Radio-frequency (RF)
- Radio-frequency group (RFG)
- Visual analog scale (VAS)

INTRODUCTION

Neck pain is currently a major health problem in developed countries\(^1\) and is the leading cause of disability worldwide\(^2\). Neck pain can lead to negative coping strategies, disability and reduced quality of life, which may, in turn, lead to episodes of depression or anxiety\(^3\). It affects approximately 50% of people at some point in their lifetimes\(^4\), and its social and economic impact is considerable\(^5\). Neck pain tends to be chronic, and its etiology is rarely known; therefore, it is typically classified as nonspecific neck pain or mechanical neck pain\(^6\). In contrast to this disease entity, myofascial pain (MP) is considered a common cause of neck pain. MP is characterized, upon examination, by the presence of myofascial trigger points (MTrP) in skeletal muscles, which consists of hyperirritable areas located in a palpable, taut band of muscle fibers\(^7,8\).

The effectiveness and safety of combined treatments including both conventional and complementary alternative medical treatment modalities have not been fully established. Various treatment modalities are available for myofascial chronic neck pain including electrotherapy, education, injection therapy, acupuncture, and dry needling interventions\(^9,10\). Patients with neck pain tend to concurrently utilize both conventional treatment and complementary alternative treatments in the hope of achieving more positive effects with a better safety profile. These alternative therapeutic modalities include radio-frequency (RF). RF energy is currently the most commonly used energy source to generate therapeutic levels of heat. Supraphysiologic temperature has been used medically to produce structural and biologic responses in tissue. Although its most common use is as an electrocautery tool, it is possible to use RF in a nonabrasive form by controlling the heating of target tissues to achieve structural and biologic therapeutic effects\(^11-13\). This constitutes a noninvasive Monopolar Capacitive Resistive Radio-frequency (448 kHz) (MCRRF).

It has been described that the effect of RF on muscle is mediated by the impact on myogenic precursor cells. RF also induces an inflammatory and antinociceptive response\(^14\). This is possible due to the production of a reverse thermal gradient and capacitive coupling of the energy into a volume of tissue\(^12,13\). Molecular and cellular mechanisms other than thermal ones have recently been proposed for tissue repair through the local promotion of mesenchymal cells\(^15\).

A pilot study could evaluate the feasibility of recruitment, randomization, retention, assessment procedures, new methods, and implementation of a novel intervention. This pilot study aimed to evaluate the feasibility of MCRRF for the treatment of myofascial chronic neck pain immediately after one session and after eight sessions. To our knowledge, this is the first study that has investigated the MCRRF in myofascial chronic neck pain.

METHODS

Participants

The participants were recruited from the Rehabilitation Area of the Rey Juan Carlos University between October 2013 and June 2014. The inclusion criteria defined patients aged between 18 and 60 years with myofascial chronic neck pain. The area of neck pain was defined as the cervical region, possibly with referred or radiating pain into the occiput, nuchal muscles, shoulders, and upper limbs. Symptoms had to have been present for at least six months. At least one active MTrP in one upper trapezius muscle had to be present. For bilateral neck pain, the most painful side was designated for treatment\(^9,10\). All of the procedures used in this study were planned according to the ethical principles of the Declaration of Helsinki and were approved by the Ethics Committee of the Rey Juan Carlos University (15/2013), and registered in ClinicalTrials.gov (NCT02353195).

Exclusion criteria included severe disorders of the cervical spine, such as spinal stenosis, disk prolapse, postoperative conditions of the neck and shoulder areas, history of severe trauma, whiplash, spasmod-
ic torticollis, instability, migraine, peripheral nerve entrapment, fibromyalgia, shoulder diseases, inflammatory rheumatic diseases, severe psychiatric illness, and pregnancy.

Twenty-six patients with chronic nonspecific neck pain were initially recruited.

Active MTrP diagnosis criteria
An active MTrP was selected in one upper trapezius muscle following the Simons et al. criteria. The presence of a nodule in a taut band of skeletal muscle, plus the patient’s pain recognition under stimulation and the range of motion limitation at full stretch were necessary to diagnose an active MTrP. In such case, there were more than 1 active MTrP in the upper trapezius muscle; the most hyperalgesic MTrP (which produced more pain intensity under the same pressure of stimulation) was selected in order to be treated. In addition, the examiners presented the experience and specialization necessary to achieve a good inter-examiner agreement (Kappa coefficient; $\kappa = 0.63$) in order to diagnose an active MTrP in the upper trapezius muscle.

Study design
This pilot study was a prospective, randomized, double-blind, and placebo-controlled trial to determine the feasibility of MCRRF (448 kHz) in patients with myofascial chronic neck pain. The Consolidated Standards of Reporting Trials (CONSORT) guidelines were implemented in this paper.

The findings of this pilot study could guide in the design and implementation of a larger scale efficacy study. Those components that are deemed infeasible or unsatisfactory will be modified in the subsequent trial or removed altogether, i.e., side effects, number of dropouts, electrical dose and changes in outcome measures.

Each subject recruited in the study was randomly assigned to the placebo (PG) or radio-frequency group (RFG) using computer-generated random-sequence numbers, with Graph Pad software (Graphpad Software, Inc., La Jolla, CA 92037 USA), and a table was created beforehand to perform the study with a concealed assignment. The randomization process was blocked. The participants were blinded to the treatment. The allocation was concealed, the patients received the assigned intervention in opaque envelopes, the therapist who applied the interventions was blinded to the assessment outcomes until the end of the entire data collection, and drop-out rates were recorded after randomization.

A questionnaire was compiled to obtain baseline information about the participants’ demographics and ages, and patients were given a body chart to mark the location of their pain and answered a questionnaire regarding their pain.

Evaluation of pain intensity and cervical range of movement (CROM) were carried out before the start of treatment and after the first and eighth treatment sessions. The neck disability was evaluated before treatment and immediately after eight sessions, and the evaluation sessions were always scheduled at the same time of day. This was a pilot study.

Intervention
A INDIBA® activ 902 equipment was used for MCRRF (448 kHz). A 35-mm diameter CAP and 30-mm diameter RES movable electrode were used on the affected side, and a planar electrode was used as a return electrode on the abdomen. The application was administered in the following manner: cream was applied to the site with the severest pain and its adjacent area (near to the most hyperalgesic MTrP in the upper trapezius muscle), and the electrical dose was increased by moving the movable electrode within the patient’s tolerance level, while monitoring the skin temperature tolerable to the patient.

The PG was treated with the same device in a nonfunctional application (no energy source). The participants were informed that the system did not generate heat.

Therapy was conducted for 12 minutes, two times per week over four weeks (eight sessions in total). Therapeutic efficacy was evaluated regarding improvement in pretreatment symptoms compared to post-treatment symptoms and between-group comparisons. No other therapies that might affect the judgment of therapeutic efficacy were conducted during the treatment. No medication was taken during this study. An experienced therapist administered the treatments.

A blind-to-the-treatment-allocation evaluator recorded the visual analog scale (VAS), CROM and neck disability Index (NDI) measurements pre- and post-treatment.

Outcome measures
Pain intensity was measured using a 100-mm VAS. This scale consists of a 100-mm horizontal
line with pain descriptors ranging from “no pain” marked on the left side to “the worst pain imaginable” on the right side. The perceived pain level of the patients was measured at rest, by marking the VAS with a perpendicular line. This is a valid method to measure pain level\textsuperscript{21}, and psychometric properties of the VAS have been reported widely\textsuperscript{22}. The minimal important difference of the VAS is based on detecting an 8.6-mm difference (based on a previous study for a score < 40 mm with a pain onset of greater than 12 weeks) immediately after treatment\textsuperscript{23}. The VAS has been documented in previous studies as having good reliability and validity\textsuperscript{24,25}.

The NDI was used. NDI is a self-reporting questionnaire used to determine how neck pain affects a patient’s daily life. It consists of ten questions in the following domains: Pain Intensity, Personal Care, Lifting, Reading, Headaches, Concentration, Work, Driving, Sleeping, and Recreation. Each question contains six response options, scored from 0 (no disability) to 5 (complete disability). All section scores are then totaled. Scoring is reported on a 0–50 scale (0 being the best possible score and 50 the worst). The NDI has good construct validity. The NDI is seen as a valid tool to measure neck pain and disabilities in patients with neck pain due to acute or chronic conditions, as well as in patients suffering from musculoskeletal dysfunctions, according to its adequate psychometric properties for test-retest reliability (intraclass correlation coefficient of 0.50) and minimum clinically important difference (19-percentage points)\textsuperscript{26-28}.

CROM was measured with a CROM device (Performance Attainment Associates, Roseville, MN)\textsuperscript{29}. The CROM device was placed on the subject’s head, and a magnetic collar, also part of the CROM device, was placed on the shoulders to take into account any rotation of the trunk. The collar was always placed in the same position to the magnetic pole; the chair on which the subjects were sitting was kept in the same position for all data collection. The initial position of the head was set to neutral at the zero mark of the inclinometer for flexion, extension and both side flexion. For rotation, the dial was set to zero with the head in the neutral position. When the motion was performed in one direction, the final position was read and recorded for each trial. Subjects moved their heads back to the initial position once the reading was finished. Three trials were executed consecutively in each direction, and the average of the three trials was computed for the analysis. This is a reliable method of measurement\textsuperscript{29}, providing intra-meter reliability ranging from 0.70 to 0.90 and inter-meter reliability from 0.80 to 0.87.

Data analysis
The statistical analysis was carried out using the SPSS statistical software system (SPSS Inc., Chicago, IL; version 20.0). Normal distribution for the CROM variable was found using the Shapiro-Wilk test, except for VAS and NDI.

The independent t-test and one-way ANOVA were used for analysis of CROM, as well as the subjects’ socio-demographic data (age, and pain duration), comparing the baseline data for the two groups. Analyses were performed according to the intention-to-treat principle.

For the CROM variable, two-way repeated measures within-between ANOVA interaction factors were performed; the factors analyzed were group (RFG vs. PG), time (Pre-, Post- and Post-eight sessions), and group x time interaction. Post hoc analysis with Bonferroni corrections was performed in the case of significant ANOVA findings for multiple comparisons between variables.

We used nonparametric statistics for VAS and NDI variables, which were abnormally distributed. Descriptive statistics were used to summarize data, including means and SDs, medians and interquartile ranges (IQR) for continuous data. For comparisons across and between-groups, we used the U Mann-Whitney. The Friedman test was used to analyze the change from the intra-group results, and the Wilcoxon signed-rank test was used for post-hoc intra-group comparisons. Statistical tests were interpreted at the 5% significance level.

RESULTS
Twenty-six patients with myofascial chronic neck pain in the trapezius muscle were screened for possible eligibility criteria, and twenty-four patients successfully completed the study protocol, of which 14 were randomly assigned to the RFG and completed the study protocol (four male, 10 female; mean age ± SD, 31.8 ± 12.4 ys) and 10 were assigned to the PG (six male, four female; mean age ± SD, 42.1 ± 12.6 ys). Figure 1 shows the diagram of recruitment and dropouts. Demographic and clinical characteristics at the beginning of the study are summarized in Ta-
ble 1. There were no significant differences between the two groups regarding demographic and clinical characteristics at baseline. No adverse events were reported in this study.

**VAS score**

RFG presented statistically significant differences between pain intensity in baseline versus all measurement periods ($p < .001$) but not PG. In comparisons between groups, no differences were found using the U Mann-Whitney test. The results for VAS are presented in Table 2.

**Neck disability outcomes**

NDI improved in both groups with statistically significant differences after receiving eight sessions of intervention ($p < .05$). In comparisons between groups, no differences at eight sessions were found using the Mann-Whitney U test. The results for neck disability are presented in Table 2.

**CROM outcomes**

Repeated ANOVA measures showed no effect for time in all cervical range of motions (Flexion $F = 2.47$; $p = .101$; Extension $F = .044$; $p = .957$; $\eta^2 = .003$; Right lateroflexion $F = 2.812$; $p = .076$; $\eta^2 = .158$; Left lateroflexion $F = 1.472$; $p = .246$; $\eta^2 = .089$; Left Rotation $F = .713$; $p = .498$; $\eta^2 = .045$), except right rotation (right rotation $F = 4.112$; $p = .026$; $\eta^2 = .215$); time X group interaction was not found (Flexion $F = 1.356$; $p = .273$; $\eta^2 = .083$; Extension $F = 1.73; p = .842$; $\eta^2 = .011$; Right lateroflexion $F = .198$; $p = .821$; $\eta^2 = .013$; Left lateroflexion $F = 1.406$; $p = .261$; $\eta^2 = .086$; Right Rotation $F = .066$; $p = .936$; $\eta^2 = .004$; Left Rotation $F = .425$; $p = .658$; $\eta^2 = .028$). The comparison of the results for CROM within groups is presented in Table 3.

**DISCUSSION**

The purpose of this study was to evaluate MCRRF (448 kHz) for the treatment of neck pain compared to a placebo intervention. Most studies that analyze the effects of RF in pain intensity have not included a placebo group. Therefore, the placebo effect of RF remains unexplored. The results obtained from this study suggest that RF could potentially be used to treat myofascial chronic neck pain in the trapezius muscle.
Neck pain intensity

A significant improvement in pain intensity was observed in the RF group immediately after the first session and after receiving eight sessions.

The magnitude of change was clinically important in the RF group. It has been established that a reduction of 0.85 cm is a minimally detectable change\(^2\), and we initially found 2.9 cm and 4.4 cm after eight sessions on the visual analog scale. The short-term effects showed in this study are slightly less significant than the outcomes found by Llamas-Ramos et al.\(^3\), with a variation of between 4.3 and 5.3 cm immediately and at two weeks during follow-up post-treatment in which dry needling was applied over the trapezius muscle. Nevertheless, Mejuto-Vázquez et al.\(^3\) reported a change between 1.9 cm and 3.7 immediately and one-week post-treatment. However, our results are superior to Seo et al.\(^2\), which treated patients with mean electoral nerve stimulation and botulinum toxin A, although they followed up with the patients for 16 weeks.

Therefore, according to early clinical studies with RF, this technology could have the potential to become an effective therapy for neck pain. However, these differences were not significant between groups. Therefore, further trials should include other types of measures for outcomes in order to assess in-depth the RF effects on pain. In this sense, it could be interesting to include outcome measures such as clinical pressure-pain algometric measurements.

**TABLE 1: BASELINE CHARACTERISTICS OF PATIENTS IN BOTH GROUPS**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>RFG (n = 14)</th>
<th>PG (n = 10)</th>
<th>Total (n=24)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years</td>
<td>31.8 ± 12.4</td>
<td>42.1 ± 12.6</td>
<td>36.3±13.3</td>
<td>.06</td>
</tr>
<tr>
<td>Gender (female/male)</td>
<td>10/4</td>
<td>4/6</td>
<td>14 (58.3)</td>
<td>.12</td>
</tr>
<tr>
<td>Neck pain duration (months)</td>
<td>13.35 ± 11.39</td>
<td>12.00 ± 8.64</td>
<td>12.79 ± 10.15</td>
<td>.75</td>
</tr>
<tr>
<td>VAS_NPI (0-10 cm)</td>
<td>4.7 ± 1.8</td>
<td>4.9 ± 2.6</td>
<td>4.5 ± 2.03</td>
<td>.34</td>
</tr>
<tr>
<td>NDI</td>
<td>10.5 ± 4.6</td>
<td>13.8 ± 6.7</td>
<td>12.45 ± 5.59</td>
<td>.06</td>
</tr>
<tr>
<td>CROM FLEX</td>
<td>45.57 ±13.63</td>
<td>43.66 ±2.03</td>
<td>44.90 ±12.74</td>
<td>.80</td>
</tr>
<tr>
<td>CROM EXT</td>
<td>63.84 ±10.31</td>
<td>48.77 ±12.50</td>
<td>58.52 ±13.05</td>
<td>.03*</td>
</tr>
<tr>
<td>CROM LAT FLEX RIGHT</td>
<td>37.27 ± 8.26</td>
<td>34.00 ± 4.71</td>
<td>36.11 ± 7.22</td>
<td>.76</td>
</tr>
<tr>
<td>CROM LAT FLEX LEFT</td>
<td>40.51 ± 6.82</td>
<td>33.11 ± 6.23</td>
<td>37.90 ± 7.38</td>
<td>.69</td>
</tr>
<tr>
<td>CROM ROT RIGHT</td>
<td>59.75 ± 13.39</td>
<td>56.66 ± 13.59</td>
<td>58.66 ±13.12</td>
<td>19</td>
</tr>
<tr>
<td>CROM ROT LEFT</td>
<td>62.48 ± 14.69</td>
<td>55.33 ± 18.10</td>
<td>59.96 ±15.80</td>
<td>.10</td>
</tr>
</tbody>
</table>

NOTE. Values are mean ± SD. Abbreviations: RFG= Radio-frequency group; PG=Placebo group; VAS =Visual Analogue Scale; NPI= neck pain intensity; NDI=Neck Disability Index; CROM= Cervical Range of Motion; FLEX=flexion; EXT=Extension; LAT=Lateral.

*The data for both groups were not normally distributed: the Mann-Whitney U test was used.

**TABLE 2: NON-PARAMETRIC TESTS OF OUTCOME DATA COMPARISONS WITHIN GROUPS AND BETWEEN GROUPS**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group</th>
<th>Median (first and third quartiles)</th>
<th>Friedman ANOVA</th>
<th>Wilcox on value (a)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Basele in</td>
<td>Immediately after the first session</td>
<td>Immediately after eight sessions</td>
</tr>
<tr>
<td>VAS</td>
<td>RFG</td>
<td>4.9 (2.8 and 6.4)</td>
<td>2.0 (1.0 and 3.0)</td>
<td>0.5 (0 and 2.0)</td>
</tr>
<tr>
<td></td>
<td>PG</td>
<td>5.7 (2.4 and 7.0)</td>
<td>6.0 (1.9 and 7.1)</td>
<td>2.5 (1.1 and 5.5)</td>
</tr>
<tr>
<td>NDI</td>
<td>RFG</td>
<td>10.0 (8.0 and 12.0)</td>
<td>__</td>
<td>3.0 (2.0 and 9.0)</td>
</tr>
<tr>
<td></td>
<td>PG</td>
<td>14.0 (10.3 and 20.5)</td>
<td>__</td>
<td>7.0 (6.0 and 14.5)</td>
</tr>
</tbody>
</table>

Abbreviations: RFG= Radio-frequency group; PG=Placebo group; VAS=Visual Analogue Scale; NDI=Neck Disability Index. Within groups analysis: **P<.05 using Friedman ANOVA for k repeated measures; †P<.05 using Wilcox on test for two related samples. Between groups comparisons:** **P<.05 using Mann-Whitney U test.**
Neck disability

Both groups decreased from the baseline after eight sessions, but no significant differences were found between groups. As far we know, there are no studies in which radio-frequency has been administered for this condition.

In our study, the RFG achieved a 40% improvement. These changes in neck disability did not exceed the minimal detectable change (7.5 points on the NDI) (28). We also observed a 30% improvement in PG. This placebo effect could be a psychobiological phenomenon that may be attributable to different mechanisms, including the expectation of clinical improvement. Overall, the placebo effect appears to be an excellent model to understand how a complex mental activity, such as expectancy, interacts with different neuronal systems29.

Cervical range of motion

The administration of MCRRF and placebo did not show a significant improvement in CROM, except for right rotation, but no differences were found between groups. Cervical right rotation showed significant improvement of 8.1° after the eight sessions in the RF group and 6.8° in the placebo group. Cervical right rotation seems to improve 2° more with RFG. The minimal detectable change of 6.1° for right rotation was achieved in both groups, as stated previously 29.

To the best of the authors’ knowledge, this is the first time that MCRRF has been investigated on CROM as a treatment for myofascial neck pain, however our results contradict those of previous studies, in which CROM improved after the administration of other therapies, such as trigger point dry needling30,31, lidocaine injection30 and transcutaneous electrical nerve stimulation32-34.

The etiology of MTrP is unknown, but the cascade of mechanisms postulated by Simons describes three features involved in MTrP mechanisms, which are as follows: increased acetylcholine release in the motor endplate, a release of sensitizing substances and increase of the muscle fiber tension35,36. Considering the previous hypothesis, one plausible explanation for our results is that MCRRF could produce vasodilation due to the increased temperature, reverting local ischemia and hypoxia and decreasing the release of sensitizing substances and acetylcholine. RF induces the inflammatory cascade necessary to remove hemorrhage remnants and produce an antinociceptive response37. In our study, if there were more than 1 active MTrP, the most hyperalgesic active MTrP was selected to receive the intervention17,18. However, MCRRF would not reduce sarcomere shortening because the patients in our study did not improve in range of motion; however, they did improve in pain intensity.

Study limitations

The primary limitation of the study is the small sample size. Consequently, the results need to be interpreted with due caution. The statistical analysis has shown no differences between groups after the intervention. However, the differences were ob-

**TABLE 3: CERVICAL RANGE OF MOVEMENT, EXPRESSED IN DEGREES, OVP TECHNIQUE GROUPS**

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Immediately after the first session</th>
<th>Immediately after eight sessions</th>
<th>ANOVA p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flexion</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RFG</td>
<td>45.5 ± 13.6</td>
<td>52.4 ± 10.8</td>
<td>58.0 ± 10.6</td>
<td>&gt;.05</td>
</tr>
<tr>
<td>PG</td>
<td>43.6 ± 12.0</td>
<td>42.6 ± 11.4</td>
<td>45.7 ± 28.0</td>
<td>&gt;.05</td>
</tr>
<tr>
<td><strong>Extension</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RFG</td>
<td>63.8 ± 10.3</td>
<td>64.6 ± 11.8</td>
<td>62.9 ± 16.1</td>
<td>&gt;.05</td>
</tr>
<tr>
<td>PG</td>
<td>48.7 ± 12.5</td>
<td>45.7 ± 14.8</td>
<td>48.0 ± 14.0</td>
<td>&gt;.05</td>
</tr>
<tr>
<td><strong>Right Lateroflexion</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RFG</td>
<td>37.2 ± 8.2</td>
<td>40.0 ± 7.5</td>
<td>44.4 ± 12.2</td>
<td>&gt;.05</td>
</tr>
<tr>
<td>PG</td>
<td>34.0 ± 4.7</td>
<td>35.2 ± 6.4</td>
<td>38.1 ± 9.8</td>
<td>&gt;.05</td>
</tr>
<tr>
<td><strong>Left Lateroflexion</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RFG</td>
<td>40.5 ± 26.8</td>
<td>43.2 ± 8.2</td>
<td>44.1 ± 9.0</td>
<td>&gt;.05</td>
</tr>
<tr>
<td>PG</td>
<td>33.1 ± 6.2</td>
<td>28.8 ± 9.7</td>
<td>34.9 ± 15.5</td>
<td>&gt;.05</td>
</tr>
<tr>
<td><strong>Right Rotation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RFG</td>
<td>59.7 ± 13.3</td>
<td>60.2 ± 10.9</td>
<td>67.8 ± 9.8*</td>
<td>&gt;.05</td>
</tr>
<tr>
<td>PG</td>
<td>56.6 ± 13.5</td>
<td>54.8 ± 12.2</td>
<td>63.4 ± 12.6*</td>
<td>&gt;.05</td>
</tr>
<tr>
<td><strong>Left Rotation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RFG</td>
<td>62.4 ± 14.6</td>
<td>62.9 ± 14.3</td>
<td>63.5 ± 13.3</td>
<td>&gt;.05</td>
</tr>
<tr>
<td>PG</td>
<td>55.3 ± 18.1</td>
<td>57.6 ± 11.3</td>
<td>62.9 ± 15.0</td>
<td>&gt;.05</td>
</tr>
</tbody>
</table>

NOTE. Values are mean ± SD. Abbreviations: RFG= Radio-frequency group; PG= Placebo group

*Significantly lower than baseline (P<.05) using two-way repeated-measures ANOVA (Bonferroni adjustment)

† Reached minimal detectable change from pre-intervention (P<0.05)
served in the RFG. Further studies have to increase the sample size with the aim to increase statistical power. Second, in cases of bilateral neck pain, we only treated the more painful side, which may bias the results. In addition, the localization of the myofascial trigger points may change along the different sessions of treatment. Third, only one muscle was treated, the treatment of more muscles could modify the outcomes. Fourth, the lack of follow-up is another bias that must be taken into account in future studies. Fifth, we did not take into account psychological variables, and the emotional state may influence outcomes. Finally, the placebo procedure used in this study has not been previously validated, and the results should be interpreted with caution.

CONCLUSION

The Monopolar Capacitive Resistive Radio-frequency could have a potential effect on pain intensity. Neck pain intensity improved immediately after one and eight sessions of Monopolar Capacitive Resistive Radio-frequency (448 kHz) in RF group. Additionally, neck disability and right cervical rotation improved after eight sessions of RF and placebo. However, there were no statistical differences between RF and PG in the outcome measures.

The findings of this pilot study show that RF has no side effects and the electrical dose described in this manuscript could be taken into account in a large study. Further trials should include a follow-up assessment, additional outcome measures, and larger sample sizes.

RESUMO

ANTECEDENTES: Até a data, há uma falta de estudos prévios para tratar a dor no pescoço por radiofrequência (RF) monopolar capacitiva resistiva. O objetivo deste estudo foi investigar o efeito imediato da radiofrequência monopolar capacitativa resistiva (RF = 448 kHz) versus placebo em (1) redução da intensidade da dor no pescoço em pontos de gatilho miofascial (MTrP), (2) diminuição da incapacidade do pescoço e (3) melhorando a amplitude de movimento cervical (Crom).

MÉTODOS: Foi realizado um ensaio randomizado, duplo-cego, controlado por placebo (NCT02353195). Os pacientes com dor no pescoço crônica miofascial (N = 24) com MTrP ativo em um músculo trapézio superior foram divididos aleatoriamente em dois grupos: um grupo de radiofrequência, que recebeu oito sessões com uma aplicação de radiofrequência capacitiva resistiva monopolar sobre o músculo trapézio superior, e um grupo de placebo (PG), que recebeu oito sessões de radiofrequência de placebo no mesmo músculo. A escala analógica visual (VAS), Crom e Índice de incapacidade do pescoço (NDI) foram avaliadas após a primeira sessão e após as oito sessões.

RESULTADOS: O teste de Wilcoxon para VAS mostrou diferenças estatisticamente significativas entre a linha de base e imediatamente após a primeira sessão e após oito sessões (p < 0,001). Não foram encontradas diferenças significativas para PG. Não foram observadas diferenças entre os grupos. O NDI melhou em ambos os grupos após oito sessões, mas não foram encontradas diferenças entre os grupos (p > 0,05). A Anova para o fator de tempo mostrou mudanças estatisticamente significativas na rotação direita cervical em ambos os grupos (F = 4,12; p = 0,26) após oito sessões.

CONCLUSÕES: Apesar de não haver diferenças entre os dois grupos, o RF capacitativo monopolar pode ter um efeito potencial sobre a intensidade da dor.


REFERENCES


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THE ANALGESIC EFFECTS OF A CAPACITIVE-RESISTIVE MONOPOLAR RADIOFREQUENCY IN PATIENTS WITH MYOFASCIAL CHRONIC NECK PAIN


Erratum


Names of the authors in the article changed from: Isabel Maria Alguacil Diego, Josué Fernández-Carnero, Sofia Laguarta Val, Roberto Cano-de-la-Cuerda, César Calvo-Lobo, Rosa Martínez Piédrola, Laura Cristina Luna Oliva, Francisco Molina Rueda

Now Read: Isabel Maria Alguacil-Diego, Josué Fernández-Carnero, Sofia Laguarta-Val, Roberto Cano-de-la-Cuerda, César Calvo-Lobo, Rosa Martínez-Piédrola, Laura Cristina Luna-Oliva, Francisco Molina-Rueda