

The Effectiveness of Tecar Therapy in Musculoskeletal Disorders

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Abstract

Objective: To evaluate the effectiveness of tecar therapy in musculoskeletal disorders. Methods: Computerized search in databases such as PubMed / Medline, Web of knowledge, Lilacs, Scielo, PEDro, RCAAP and Cochrane, to identify randomized controlled trials that evaluated the effectiveness of tecar therapy in musculoskeletal conditions. Results: Six articles, were included in this review, through the inclusion and exclusion criteria, where they were divided in four categories: low back pain, femur fracture, rotator cuff tendinopathy and delayed onset muscle soreness on the quadriceps. Conclusion: The tecar therapy is an excellent therapy for the physiotherapeutic use and it's incorporation in a conventional rehabilitation program, or it's isolated use, may have advantages in the short and long term effects.

Keywords

Tecar Therapy, Capacitive-Resistive Diathermy Therapy, Musculoskeletal Pathologies

1. Introduction

Tecar therapy is considered a special form of energy that uses frequencies between 300 KHz and 1 MHz and is characterized as a non-invasive high-frequency energy that awakens the body's natural ability to self-regenerate. Thus, it promotes the natural physiological processes of the tissue, metabolically, transferring energy without introducing radiation from the external environment [1].

This equipment contains a mobile electrode handled by the therapist, which treats the part affected by the pathology, and a fixed electrode that is in contact with the patient's skin, serving as a conductor [2]. One of the main characteristics of this is the ability to use at low energy levels, and it is possible to explore the electromagnetic interaction of fabrics with little or no thermal effect. It allows the treatment of diseases also in acute and subacute phases, without causing an increase in the inflammatory process that occurs due to an increase in tissue temperature [1].

The tecar therapy can work in two modes of electric

charge transfer: capacitive and resistive mode. The reactions produced by the capacitive system through the capacitive electrode are focused on tissues with higher electrolyte content, such as soft tissues and muscles, as opposed to the resistive system that focuses on larger and more resistant tissues such as tendons, bones and articulations. With these two modes of energy transfer, the therapy allows an increase in vasodilation, oxygenation, increase in microcirculation and increase in internal temperature [3].

The physiological effects of this increase in energy are the reduction of muscle spasms and contractures as a consequence of the activity, vasodilation with increased local blood flow, contributing to oxygen supply and acceleration of hemorrhagic reabsorption, activation of major metabolic reactions, increased capacity [4].

In the present study, the results of the present study are presented. This allows a diversified range of advantages, such as: allowing a greater acceleration of the process of reconstruction of various structures, such as joints, muscles, tissues and cells, accelerating healing and alleviating muscle and joint pain, blocking nerve impulses in a lasting way,

increase the range of motion and improve circulation. This therapy offers a unique variety of treatments for chronic and acute pathologies with the following contraindications: pregnancy, pacemaker and sensitivity to high temperatures [5].

It should be noted that this new technology is a useful tool in the treatment of various pathologies, comparing with other therapies in terms of the presence and / or absence of certain positive effects, but also has distinct characteristics that are effective even when other treatments fail. There is a guarantee that therapy offers a balance between the therapist's manual ability and the special energy that this technology provides, thus providing therapists and patients with increasingly satisfactory results [4].

Thus, this review aimed to evaluate the effectiveness of tecar therapy in the treatment of musculoskeletal conditions.

2. Methods

The literature review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement (PRISMA), which aims to help authors improve the reporting of systematic reviews and meta-analyses [6].

The computerized research was carried out by a researcher in the databases PubMed / Medline, Web of knowledge, Lilacs, Scielo, PEDro, RCAAP and Cochrane, in order to identify studies that evaluated the effectiveness of Tecar Therapy, published until 02/28/2018. The search was performed using the following combination of keywords: tecar therapy OR capacitive-resistive diathermy therapy.

This sample obeyed some inclusion and exclusion criteria, such as: Inclusion criteria - Human studies; studies that were performed by physiotherapists; articles in English, Portuguese, Italian, Spanish and French; samples greater than 20 participants aged over 18 years; studies with two or more groups to be studied that included tecar therapy. Exclusion Criteria - Articles that did not include tecar therapy techniques [7],[8]; articles whose samples were carrying other additional problems, not belonging to the musculoskeletal component; systematic review studies, case studies, meta analyzes, posters and oral communications of congresses.

During the reading, information about the authors and year of publication, type of study, sample size, author formation, treatment method, treatment and evaluation period, evaluation parameters and finally results were collected.

3. Results

3.1. Selection of Articles

Through the use of databases, an article search was performed, where 34 articles were found. Subsequently duplicate articles were then removed, reducing the number to 29, having been duly analyzed through the title and abstract. Of these, 10 studies were rejected after reading the title and

abstract. The full texts of the 19 studies were evaluated by the eligibility criteria, where 13 studies were excluded. In total, 6 studies were included in this review. The reasons for exclusion are presented in the PRISMA diagram (Figure 1).

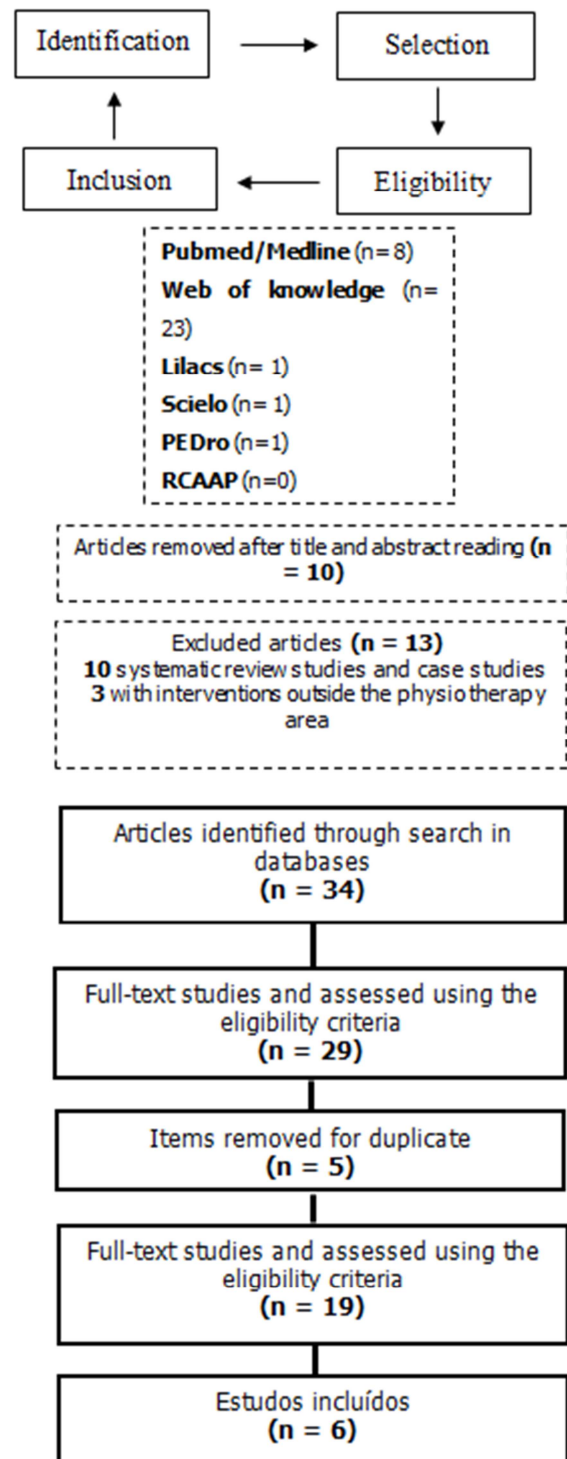


Figure 1. PRISMA diagram of the articles included in the review.

The studies were divided into four categories: low back pain (3 studies), femur fracture (1 study), rotator cuff tendinopathies (1 study), and delayed sensation of muscle discomfort in quadriceps (1 study).

3.2. Description of Studies

In the 6 articles included in this review, a total of 210 individuals participated, and the mean number of participants per study was 35 individuals [9] and 60 [10]. The age of the patients ranges from 18 to 80 years old and all have some type of musculoskeletal pathology. During the

study period, no subject in the sample could perform any other type of intervention, whether conventional, pharmacological or surgical. Of the articles mentioned in this review, all studies have two groups, where one group always uses tecar therapy and another group uses another type of therapy or even placebo treatment (Table 1).

Table 1. Summary of included studies.

Authors (year)	Pathology under study / Sample size / Author's training	Method of treatment	Treatment and evaluation period
Morelli et al. (2016) [9]	Low back pain / 20 / Physiotherapists.	Group 1: TG + Conventional physiotherapy; Group 2: Inverting paravertebrals in the lumbar (oxygen-ozone therapy) + Conventional physiotherapy,	Group 1: 10 sessions, 2x per week, for 5 weeks; Group 2: 1x per week in the first 3 weeks, decreasing dose once every two weeks, for a total of 4 paravertebral infiltrations per session.
Notarnicola et al. (2017) [10]	Low back pain / 60 / Physiotherapists.	Group 1: TG (0.45 - 0.60 MHz); Grupo 2: LASER.	Group 1: 10 sessions; Group 2: 10 sessions.
Stagi et al. (2008) [11]	Low back pain / 30 / Physiotherapists.	Group 1: TG + Massotherapy; Group 2: TG (placebo) + Massotherapy.	Group 1: 8 sessions; Group 2: 8 sessions. Group 1: 12 weeks; Group 2: 12 weeks. The conventional rehabilitation protocol was performed daily during the first week, then 3x from the 2nd to the 3rd week, 2x, the 4th to the 6th week and finally 1x from the 7th to the 12th week. The tecar therapy, at day 2 was used for 20min, in the capacitive; at the 3rd day 15min in the capacitive mode and 5min in the resistive mode; at the 4th and 5th day, 20min in the capacitive mode and 10min in the resistive; from the 2nd to the 6th week 15min in the capacitive mode and 15min in the resistive; from 7 to 12, 5min in capacitive mode and 20min resistive followed by 5min in capacitive mode.
Terranova et al. (2008) [12]	Fracture of the femur / 30 / Physiotherapists.	Group 1: TG + conventional pathology rehabilitation protocol; Group 2: conventional pathology rehabilitation protocol.	Group 1: 8 weeks Group 2: 8 weeks Daily treatment with 2 phases: application of the therapy according to the group and functional reeducation in both groups. Moments of evaluation: beginning of treatments, and after 4 and 8 weeks.
Sanguedolce et al. (2009) [13]	Rotator cuff tendinopathy / 30 / Physiotherapists.	Group 1: Functional reeducation and combined therapies, (TENS, iontophoresis, ultrasound and LASER); -Group 2: Re-education functional and tecar therapy.	Group 1: 8 weeks Group 2: 8 weeks Daily treatment with 2 phases: application of the therapy according to the group and functional reeducation in both groups. Moments of evaluation: beginning of treatments, and after 4 and 8 weeks.
Andrade et al. (2016) [14]	Delayed onset muscle soreness on the quadriceps / 40 / Physiotherapist.	Group 1: GWT; Group 2: TG (300KHz- 500KHz).	Evaluated in 5 moments. In the immediate, 24 hours before and after and 48 hours before and after.

Table 1. Continue.

Authors (year)	Evaluation parameters	Results
Morelli et al. (2016) [9]	Formetric Spinometry; Oswestry Questionnaire (Low back pain). Fill in at the beginning and end of the treatments.	There was a similar improvement in both groups over the course of treatment, with a significant change between the two groups after treatment completion. Group 1 had a greater decrease of pain (22.80%). Group 2 showed a more marked improvement through the evaluation with Formetric Spinometry. Group 1 (from 20% to 38%) and Group 2 (from 6% to 57%).
Notarnicola et al. (2017) [10]	VAS; Oswestry Disability Index. They were evaluated before starting the treatment (T0), 2 weeks later (T1), 1 month later (T2) and 2 months after (T3) after the end of the treatment.	Pain and disability showed a tendency to improve over time in both groups. This improvement was statistically significant at all times of evaluation. Only in T1 the LASER group obtained better results than GT ($p < 0.01$). Comparing the two methods, a significant difference emerged in favor of the GT group in T2 and T3 ($p < 0.01$). The results show that the GT also determined a significant improvement at the end of the treatment.
Stagi et al. (2008) [11]	Disability Questionnaire by Roland and Morris, who assess the inability generated by daily to low back pain; EQ-5D, which evaluates the quality of daily life; VAS; These scales were applied in 5 assessment	Based on the analysis of the data collected, we observed a marked improvement in pain symptomatology in the majority of patients treated with tecar therapy, whereas the treatment with simulation technique showed little or no improvement.

Authors (year)	Evaluation parameters	Results
Terranova et al. (2008) [12]	moments, before starting the treatments, in the fifth week, after the last session, 3 months later, and finally 6 months after the last session. VAS; Perimetry of both femoral quadriceps 25 cm from the marrow, to measure edema.	Pain significantly reduced TG on day 4 ($p = 0.045$) and day 7 ($p = 0.033$). In relation to group 2, there was no significant decrease in pain. The edema in the TG had a smaller increase until the 4th day ($p = 0.009$). Then, the perimetry value remained similar until the 30th day. This decrease in volume was, however, earlier in the TG as compared to the control group. In summary, TG treatment was effective in reducing edema and postoperative pain. The results were faster and more effective in TG compared to group 2
Sanguedolce et al. (2009) [13]	Barthel scale to determine the quality of life; VAS; Simple Shoulder Test, test of Jobe, Neer, Yocum, Hawkins and Gerber. Pressure pain threshold;	Comparing the results obtained between the patients in group 2 and those in group 1, it was concluded that group 2 had a rapid resolution of the acute inflammatory process, early recovery of the joint passively and actively and a rapid recovery of muscle strength.
Andrade et al. (2016) [14]	Muscle discomfort; Member Functionality; Isokinetic evaluation.	G2 presented significantly less pain than G1 at the time point 24 hours later ($p = 0.027$). However, there were no differences in the Single Leg Hop variable and the pressure pain threshold variable.

Legend: TG: Tecar Group; GWT: Group Without Tecar; VAS: Visual Analog Pain Scale; LASER: Light Amplification by Stimulated Emission of Radiation; TENS: Transcutaneous Electrical Nerve Stimulation; EQ-5D: EuroQol-5D.

3.3. Results of the Studies

All studies have shown the effectiveness of tecar therapy in the treatment of musculoskeletal disorders, compared to some therapies.

3.3.1. Low Back Pain

In the studies covering low back pain, the pain and disability they caused were measured in all studies, where they achieved a decrease after treatment with the tecar therapy.

Through the questionnaire and the disability index due to low back pain (Roland Morris disability and Oswestry disability index Questionnaire) [9]-[11], after the completion of the treatments, the groups where the tecar therapy was applied showed significant differences in the decrease of disability due to pain, in comparison to the other groups under study.

Only one study, analyzing the data collected through the analysis with Formetric spinometry noted an improvement in both groups; however, the improvement is greater in the second group, which used the oxygen-ozone therapy in conjunction with conventional physiotherapy, in the which is evidence of improvement, increased from 6% to 57%, compared with 20% for 38% of the tecar therapy group. Thus, the validity of the two treatments that lead to an improvement in symptoms has been demonstrated [9].

Another of the evaluative methods used by two of these studies was the Visual Analogue Pain Scale (VAS) [10], [11]. There was improvement from the first treatment until moments after treatment with a temporary benefit that was not always stabilized at the end of the therapy cycle, but where in both treatment groups a statistically significant difference in treatment and last follow-up. Thus, the lowest results were achieved by patients treated with tecar therapy.

3.3.2. Fracture of the Fémur

One of the studies, obtained the following results: There was only a statistically significant reduction in pain on the

fourth day and on the seventh day there was no reduction in the control group. Regarding edema, there was an increase in perimeter in the two groups until the 4th day, and these values decreased, first in the tecar group [12].

3.3.3. Rotator Cuff Tendonopathy

Another study showed that the treatment performed by the group that used tecar therapy determined the reduction of edema in the first three treatment sessions and the restoration of active and passive mobility with significant reduction in pain symptoms, as demonstrated by VAS and Simple Shoulder Test, already after the first four weeks, with further improvements following the eighth week [13].

3.3.4. Delayed Onset Muscle Soreness on the Quadriceps

The randomized controlled study, compared the results of both groups, through the Numerical Pain Scale, the tecar group obtained less pain, than the group without tecar. With regard to the Single Hop Test, it was observed that both groups significantly increased the jump length. In the Peak Torque Body Weight variable, the non-weave group found a smaller increase in strength than the weave group. In the variable Total Work and Average Power there was an increase of the total work and of the maximum power of the muscle in the group without tecar.

Finally, at the threshold of pain under pressure there are no significant differences in both groups at all times [14].

4. Discussion

The purpose of the present review was to verify the effectiveness of the physiotherapeutic intervention through tecar therapy. Throughout this study, several limitations and lack of methodological quality studies on the eventual effectiveness of this therapy were proven. On the other hand, the studies carried out showed the quality of this therapy, mainly in terms of pain, where a marked reduction occurred in short periods of time.

Of the 6 selected studies, 3 have as objective the study of the best therapy to solve one of the most common musculoskeletal pathologies in the present day, low back pain. However, all studies used different techniques to prove the effectiveness of tecar therapy. There was only one study that the tecar therapy did not stand out in relation to the other therapy, both being considered suitable for treating low back pain [9]. This was the only study that the therapy used (paravertebral infiltrations) compared to the tecar therapy, had better result in one of the methods of evaluation (Formetric Spinometry).

Through the Oswestry Questionnaire assessing the inability of low back pain, it was possible to observe that the first group, who underwent tecar therapy, had an improvement immediately after the therapeutic cycle. These results are corroborated by the spinometry test performed, where it was possible to observe an improvement in almost all parameters evaluated in all patients, and it could also be observed in the group treated by paravertebral infiltrations in the lumbar region. However, when analyzing the questionnaire responses, and the other evaluation components, the improvement was smaller compared to the group that underwent tecar therapy.

It can be can verify that the study corroborated the validity of the two treatments that had as objective the improvement of the symptomatology. While a treatment leads to some relapses after a few months (tecar therapy), the other has a lasting effect over time (paravertebral infiltrations).

There was a study, which was the first to compares the effectiveness of tecar therapy with another type of treatment in patients with low back pain, in this case Light Amplification by Stimulated Emission of Radiation (laser) [10].

The results showed that both methods, given separately, determined a significant improvement in pain and function at the 1st evaluation time. At the second moment, through VAS and the Oswestry disability index, there were no significant differences in both groups. At the 3rd and 4th evaluation moments (1st and 2nd months), the patients treated with the tecar therapy presented statistically better results than patients treated with LASER.

These improvements can be interpreted considering the biological effects of the treatment applied to the pathology itself. As for example, anti-edema and anti-inflammatory action, muscle relaxant action in contraverted paravertebral muscle, release of endorphins that control neuropathic and nociceptive pain and, finally, the increase of cellular metabolism that contrasts with the degenerative processes [15].

There were 3 limitations in this study, the first being the lack of long-term follow-up of the sample; the second one includes the assistant responsible for data collection, the latter not having distributed the groups at random and finally, the third limitation was the absence of a placebo group.

What can be concluded with this study, is that the results, aim to support that the professor of therapy can be effective in the treatment of patients with low back pain.

The authors from the analysis of the data collected, observed a marked improvement of the pain symptomatology

in the majority of patients treated with tecar therapy and massage therapy, while the placebo treatment together with massotherapy did not show any type of improvement. This was evidenced through daily VAS analysis. It has been suggested that the use of tecar therapy is a useful aid in the management of low back pain, with a rapid and intense short-term effect. It was retained from this study that the experimental group that benefited from the use of the tecar therapy obtained extremely positive results, whereas the control group showed no benefit [11].

In summary, with the reduction of the intensity of low back pain already in the acute phase, it enables patients to be able to work in a more complex and precocious way already from the first moments of rehabilitation, with different techniques simultaneously, decreasing the probability of secondary complications, due to immobility and non-use. Through these three studies, it can be affirm that the tecar therapy, in comparison with LASER, is the best therapy to be used for this type of pathology.

Another study demonstrate that pain and edema were significantly reduced in relation to the conventional pathology rehabilitation protocol after the application of this therapy [12].

The authors conclude that the results should be granted due to the properties of the device that allows heat transfer treatment with no heat from the first day after surgery with a probable positive effect on the arterial microcirculation and lymphatic diseases that may be responsible for the positive results achieved. This therapy represents an added value to patients undergoing surgery to the locomotor system. It can also see based on clinical findings, tecar therapy is proposed as a useful resource in the control of stroke after traumatic episodes, and maintains that the third post-injury day is a sufficiently safe starting point considering the deep endothermic effect that tecar therapy is capable of producing [5].

Comparing the results achieved between the patients who underwent tecar therapy and those who performed the combined therapies, the tecar therapy associated with a functional re-education program allowed a rapid resolution of the acute inflammatory process, early recovery of the active and passive joint and a rapid recovery of the muscle strength [13].

It can then be concluded that the approach through the tecar therapy allowed a quick resolution of the pain symptomatology, a rapid restoration of function and a better quality of life. In another research, the results also argued that the use of tecar therapy, in comparison with TENS, has a more significant and immediate therapeutic analgesic effect, in this case in the short-term treatment of phantom pain [16].

Regarding the difference between groups regarding pain, the group that used the tecar therapy presented a lower pain than the group without tecar therapy in the 24 hours after the treatment. However, there were no differences between the groups at the other moments, such as the Single Leg Hop variable and the pressure pain threshold variable [14].

Tecar therapy is a good complementary method in the treatment of osteoarticular pain in geriatric patients and does not interfere with the use of other therapeutic methods, being

a very useful tool for the physiotherapist, and can provide professional satisfaction in the geriatric field [17].

There were only one authors who compared tecar therapy with other therapies, in this case Cryoultrasound, had a worse result when it came to tecar therapy [18].

Compared with tecar therapy, Cryoultrasound provides a better variety of efficacy, greater patient satisfaction, and longer results. Following these results, it can be affirmed that, among the proposed therapies, Cryoultrasound is a new and effective means for the treatment of tendinous pathologies.

Tecar therapy complements physical therapy in several fields such as orthopedic, sports, vascular, rheumatic and aesthetic problems, making it one of the many therapies in favor of the health of humanity [4]. The main advantage is that it significantly reduces recovery time in acute and chronic injuries, which is vital for example in sports physiotherapy, where patients can reduce their rest periods in order to train. If after training or competition, suffer from delayed feeling of muscle discomfort, they can recover in a faster and more efficient way.

The main therapeutic applications of this therapy can be classified into three groups, corresponding to the three most important physiological actions: anti-spastic action, analgesic and metabolic stimulant. These include cervical, thoracic and lumbar pains, joint pain, muscle pain, rheumatism and also arthrosis.

In short, the tecar therapy seems to be a very auspicious complement, in relation to the other techniques of Physiotherapy, namely to manual therapy, due to the energy that it transmits. It thus offers a synergistic effect between the two techniques, in order to promote a more effective and satisfactory rehabilitation protocol for both the patient and the physiotherapist.

As a limitation of these studies, it can be considered that the main one was the scarcity of controlled randomized articles, which were extremely important for research in this field to be fostered so that physiotherapists could obtain a clearer perception of the efficiency of tecar therapy in these types of pathology; Follow-ups in all studies, lack of information on the way they performed the treatment (longitudinal, transverse, which power) and finally who applied and evaluated the treatment should be only physiotherapists.

The only limitation of the review was that there was only one researcher conducting the research.

One of the suggestions is that the randomized controlled trials should be double blind, in which they could have 3 groups (experimental, control and placebo), and follow ups after the end of treatment in the short and long term; the physiotherapist who performs the treatment should use it regularly in clinical practice and finally studies that have larger samples and a longer duration of the intervention period, focusing only on one pathology.

5. Conclusion

By the analysis of the studies, this therapy seems to have effectiveness in the treatment of the musculoskeletal

disorders mentioned here, and may be of great importance in the rehabilitation of these same ones.

Despite the limitations of literature on methodological quality and the need to perform more randomized controlled trials, the achievement of this review regarding its objective was achieved.

The results of the present literature review demonstrate that tecar therapy may be a good adjunct therapy in a physiotherapy treatment and that its incorporation into a conventional rehabilitation program or its isolated use may have advantages in the short and long term effects.

In short, one of the main advantages of this therapy, and the one that allows the success in the rehabilitation of the recipient, is the possibility of its use in acute phases, which allows an earlier treatment to be started and can considerably reduce the risks complications related to motor or immobility.

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