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The use of electrothermal and phototherapeutic methods for the treatment of fibromyalgia syndrome: a systematic review

A utilização dos recursos eletrotermofototerapêuticos no tratamento da síndrome da fibromialgia: uma revisão sistemática

Natalia A. Ricci, Carolina N. K. Dias, Patrícia Driusso

Abstract

Objective: To systematically investigate the scientific evidence relating to electrothermal and phototherapeutic methods for the treatment of fibromyalgia syndrome (FMS). **Methods:** The search for reports on interventions using electrothermal and phototherapy for FMS was carried out in the Pubmed, Medline, Lilacs, Scielo, ISI Web of Knowledge, PEDro and Cochrane Collaboration databases. Randomized controlled clinical trials published over the past 10 years in English, Portuguese and Spanish were selected. The methodological quality of the studies was assessed using the Jadad scale. The analysis on the study results was done by means of critical review of the content. **Results:** Seven studies were reviewed in full, and these identified interventions using laser (n=4), transcutaneous electrical nerve stimulation (TENS; n=1), interferential current (IFC) alone (n=1) and IFC combined with ultrasound (US; n=1). Only two studies showed good methodological quality according to the Jadad scale. Most of the studies (n=6) used the criteria of the American College of Rheumatology for the clinical diagnosis of FMS. Pain was the most frequently evaluated FMS symptom. The intervention methods and their duration varied widely, and there was no mention of the parameters used in the electrothermal and phototherapeutic methods. Pain levels reduced significantly in all of the studies. **Conclusion:** There are still limitations on the generalization of the results, adverse reactions and doses of the FMS treatment. Further studies are needed to establish the effectiveness of electrothermal and phototherapy in treating FMS.

Key words: fibromyalgia; physical therapy methods; electrotherapy; phototherapy.

Resumo

Objetivo: Sistematizar as evidências científicas sobre os recursos eletrotermofototerapêuticos na síndrome da fibromialgia (SFM). **Métodos:** A busca de publicações sobre as intervenções por eletrotermofototerapia na SFM foi realizada nas bases de dados Pubmed, Medline, Lilacs, Scielo, ISI Web of Knowledge, PEDro e Colaboração Cochrane. Foram selecionados ensaios clínicos aleatórios e controlados dos últimos dez anos em língua inglesa, portuguesa e espanhola. A qualidade metodológica dos estudos foi avaliada pela Escala de Jadad, e a análise dos resultados, por meio de revisão crítica dos conteúdos. **Resultados:** Sete estudos foram revisados na íntegra, sendo identificadas intervenções com laser (n=4), estimulação elétrica transcutânea (TENS) (n=1), corrente interferencial vetorial (CIV) isolada (n=1) e CIV combinada com o ultrassom (n=1). Apenas dois estudos obtiveram boa qualidade metodológica pela Escala de Jadad. A maioria dos estudos (n=6) utilizou os critérios do *American College of Rheumatology* para o diagnóstico clínico da SFM. A dor foi o sintoma da SFM mais avaliado pelos estudos. O método e o tempo das intervenções variaram amplamente, além da falta de menção de parâmetros na utilização dos recursos eletrotermofototerapêuticos. Houve melhora significativa em todos os estudos quanto à dor. **Conclusão:** Generalizações dos resultados, reações adversas e doses de tratamento da SFM com eletrotermofototerapia ainda são restritas. Novos estudos são necessários para se estabelecer a efetividade da eletrotermofototerapia na SFM.

Palavras-chave: fibromialgia; modalidades de fisioterapia; eletroterapia; fototerapia.

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[1] Physical Therapy Department, Universidade Federal de São Carlos (UFSCar), São Carlos (SP), Brazil
Correspondence to: Natalia Aquaroni Ricci, Departamento de Fisioterapia,Universidade Federal de São Carlos (UFSCar), Centro de Ciências Biológicas e da Saúde (CCBS),Rodovia Washington Luis, Km 235 Cx. Postal 676,CEP 13565-905, São Carlos (SP), Brazil, e-mail: natalia_ricci@hotmail.com

Introduction

Fibromyalgia syndrome (FMS) is a chronic and nonarticular disease of unknown etiology characterized by widespread pain throughout the body and by the presence of specific tender points[1]. Symptoms also include muscle fatigue, sleep disorders, depression and cognitive complaints. These symptoms frequently result in decreased functionality, work ability and quality of life[2].

Because of the chronic and multi-symptom character of FMS, the recommended treatment for its patients is based on the interdisciplinary approach, with physical, pharmacologic, cognitive-behavioral and educational interventions[1]. In the sphere of physical intervention, physical therapy offers a great variety of therapeutic modalities (i.e. kinesiotherapy, hydrotherapy, electrothermal and phototherapy, relaxation techniques, massage therapy, and acupuncture) that can be used to control FMS. The effectiveness of some of these modalities has been analyzed in systematic reviews and meta-analyses. In a review of 34 exercise intervention studies, Busch et al.[3] found strong evidence of the benefits of aerobic training to improve physical function and to reduce pain and the number of tender points in FMS patients. In contrast, strength and flexibility training showed moderate and weak scientific evidence, respectively. Regarding acupuncture and electroacupuncture, Mayhew and Ernst[4] identified five randomized clinical trials and concluded that the number of studies was small and that the benefit of these techniques in FMS was limited.

Electrothermal and phototherapy are widely used in the clinical practice of physical therapy, and its effectiveness was observed in reviews on musculoskeletal disorders[5,6], with no specificity regarding FMS. Electrothermal and phototherapy interventions are included in the global rehabilitation program, mainly for pain relief [1]. Once pain levels are reduced, there is an increase in range of motion, muscle strength, mobility, physical endurance, walking skills and function[6]. Thus, these therapy modalities may bring positive outcomes to FMS patients.

Electrothermal and phototherapy interventions also offer several advantages, i.e. they are non-invasive and quickly administered, resulting in few harmful effects and contraindications[5] compared to pharmacologic treatment for the reduction of FMS symptoms. Nevertheless, these techniques require the presence of an expert professional, and the patient has to make periodic visits to the intervention site. Therefore, given the need for a better understanding of the therapeutic possibilities for FMS treatment, this systematic review aimed to describe the state of the art in electrothermal and phototherapeutic methods for this syndrome, based on the methodological quality of the research, the applied therapeutic modalities, the intervention characteristics and the subsequent results.

Methods

To analyze the body of publications about interventions using electrothermal and phototherapy for FMS, a comprehensive survey was carried out in the Pubmed, Medline, Lilacs, Scielo, ISI Web of Knowledge, PEDro and Cochrane Collaboration databases. The key words used in databases were: "electrotherapy modalities", "electrotherapy", "ultrasound", "phototherapy", "laser therapy", "interferential current", "transcutaneous electrical stimulation", "TENS", "diathermy", "microwaves", "shortwaves", "thermotherapy" or "infrared therapy" combined with "fibromyalgia". The literature search was restricted to randomized clinical trials published in the past ten years (January 1998 to December 2008) written in English, Portuguese or Spanish.

The contents of the studies were analyzed by two blinded and independent assessors, and the selection was performed by consensus according to the following inclusion criteria:

- Patients with FMS clinical diagnosis;
- Investigation of the relationship between electrothermal and phototherapy and FMS;
- Randomization of the sampling process;
- Between-group comparison of electrothermal and phototherapy intervention and control group or another form of intervention.

Studies were excluded if they used non-clinical physical therapy modalities or interventions that are not included in basic physical therapy training. Studies were also excluded if they involved the use of unconventional hyperthermia treatments[7]; if they used electroacupuncture, which is not included in most physical therapy curricula[8]; if they lacked a control group or another form of intervention to compare to the electrothermal and phototherapy group[9-12]; and if they lacked a commonly used technique in physical therapy training and practice[13-15].

The studies were analyzed using a structured script including the following items: sample, research methodology design, assessed outcomes, intervention characteristics and results. To verify the quality of the selected clinical trials, the Jadad Scale[16] was applied, which consists of five questions about the study with a total score varying from zero to five points. The studies with scores below three points are considered of low methodological quality and therefore have few possibilities of generalizing the results to clinical practice.

Due to the small number of randomized clinical trials on the subject and the great variability between the proposed interventions, the analysis was performed by means of a critical review of the content, with no possibility of statistical meta-analysis of the results.

Results

Fifty-two studies were extracted from the selected databases. Based on the analysis of the abstracts, we identified the studies that appeared in more than one database (duplication of the same study; n=14) and those that did not use an experimental design (n=30). Sixteen clinical trials were pre-selected for the full review, nine of which were excluded for failing to meet the inclusion criteria of this systematic review.

Seven studies were included in the critical review phase regarding the effectiveness of electrothermal and phototherapy in FMS. The content analysis of selected clinical trials revealed the use of laser modalities[17-20], interferential current (IFC) alone[21], IFC combined with ultrasound[22] and transcutaneous electrical stimulation (TENS)[23] as therapeutic modalities proposed for FMS treatment. No studies on thermal modalities were found. Table 1 shows the data extracted from the articles.

The sample size of the seven selected studies varied from 9[21] to 75[18] patients with FMS divided into groups receiving electrotherapy/phototherapy and control groups. To determine the clinical diagnosis of FMS that was necessary for participant inclusion, most studies[17-23] (n=6) applied the criteria proposed by the American College of Rheumatology (ACR). The samples consisted exclusively of female participants, with exception to the study by Gür et al.[18] that contained 15 male participants who were exposed to laser therapy (n=5) or control (n=10). With regard to age, the studies included participants of different age groups, varying from 25 to 60.

Among the analyzed outcomes, pain is highlighted for being present in all of the selected studies. However, the evaluation of pain levels differs between them. The most often used assessment tools were the Visual Analogue Scale (VAS; n=4)[19,21-23], digital pressure algometry over the tender points (n=3)[19-22]; and the Likert scale (n=2)[17,18]. Other analyzed outcomes were quality of life (n=5)[18-21,23], depression (n=2)[18,23], sleep (n=1)[22] and general symptoms (n=2)[17,18].

All studies used experimental methodological design with pre- and post-intervention assessment. Only the study by Armagan et al.[20] reported long term follow-up. Regarding therapy for the control group, Gür et al.[17], Almeida et al.[22] and Armagan et al.[20] used inactive currents; Silva et al. [23] used hydrotherapy; Raimundo et al.[21] applied IFC with modulation frequencies below standard; Matsutani et al.[19] applied inactive laser combined with stretching; and Gür et al.[18] had two control groups, one with inactive laser emission and the other with the use of medication.

The electrotherapy and phototherapy interventions on FMS varied greatly. The laser studies [17-20] had the same number of sessions, but with different intervals between sessions, times of application and amounts of emitted energy. However, the studies on laser intervention by Gür et al.[17,18] used the same protocol because both studies were developed by the same group of researchers. The frequency of the IFC treatment in Almeida et al.[22] and Raimundo et al.[21] varied from four to five weeks, in a total of 10 to 20 sessions, respectively. For the study that investigated TENS[23], ten sessions were applied three times a week, with duration of 40 minutes. There was significant improvement in pain levels in all studies. Raimundo, Brandão & Lucena[21] (IFC), and Matsutani et al.[19] (laser) did not find significant differences in pain levels between the electrotherapy/phototherapy groups and control groups. Regarding the methodological quality analyzed by the Jadad Scale[16], the major restriction in the studies was the lack of double-blinding and the lack of description of sample loss. Only Almeida et al.[22] and Armagan et al.[20] showed good methodological quality, as seen in Table 2.

Discussion

There is a great number of electrothermal and phototherapy modalities in use in physical therapy to manage patients with FMS. However, there are few scientific studies that indicate their effectiveness or even the need to reject these techniques. The greatest difficulty in determining the evidence for these interventions is the small number of clinical trials and the lack of methodological rigor in the existing studies[5]. This fact is evidenced by the methodological analysis through the Jadad Scale[16], according to which only two of the analyzed studies[20,22] could be considered scientifically relevant.

Electrothermal and phototherapy modalities can be considered resources, among others (exercise, medication, psychotherapy), which must be used in together in the treatment of patients with FMS so that satisfactory results can be obtained. However, the treatments proposed by the selected studies were limited in their use of a specific electrothermal and phototherapy technique, with the exception the study by Matsutani et al.[19], which associated laser with

Table 1. Data summary of the randomized clinical trials using electrothermal and phototherapy methods for the treatment of fibromyalgia.

Study	Subjects	Assessment	Study design	Intervention	Outcomes
Gür et al. [17]	Diagnosis: ACR. Inclusion: no medication for at least one month. Age: not mentioned Groups: EG=Laser (n=20 ♀). CG=Placebo (n=20 ♀).	Likert Scale for Symptoms (0=none; 1=mild; 2=moderate; 3=severe; 4=extreme): - pain. - number of tender points. - morning stiffness. - sleep disturbance. - skinfold tenderness. - muscle spasms. - fatigue.	Prospective, controlled, randomized, pre/post-intervention assessment.	EG: Low power laser (Ga-As). CG: Placebo. Same procedure without the emission of rays. Intervention EG: - Laser Ga-As, 904 nm, power 11.2 mw. - Application: patient seated with 2J/cm^2 emission for 3 minutes in each tender point. - Individual treatment. - 5x/week. - Total: 2 weeks (10 sessions). - Sessions in the afternoon at a room temperature of 20°C.	- Significant improvement in all parameters evaluated in the EG. - Significant improvement in all parameters evaluated in the CG, except for skinfold tenderness, sleep disturbance and fatigue. - With respect to pain, muscle spasms, morning stiffness and number of tender points, the EG had greater improvement than the CG.
Gür et al. [18]	Diagnosis: ACR. Inclusion: no medication for at least one month. Age: mean of 30 years. Groups: EG=Laser (n=20 ♀ 5 ♂). CG1=Placebo (n=19 ♀ 6 ♂). CG2=Medication (n=21 ♀ 4 ♂).	Likert Scale for Symptoms (0=none; 1=mild; 2=moderate; 3=severe; 4=extreme): - pain. - number of tender points. - morning stiffness. - sleep disturbance. - skinfold tenderness. - muscle spasms. - fatigue. Quality of life: FIQ Depression: Hamilton Depression Scale	Prospective, controlled, randomized, pre/post-intervention assessment.	EG: Low power Laser (Ga-As). CG1: Placebo. Same procedure without the emission of rays. Intervention EG: - Laser Ga-As, 904 nm, power 11.2 mw. - Application: patient seated with 2J/cm^2 emission for 3 minutes in each tender point. - Individual treatment. - 5x/week. - Total: 2 weeks (10 sessions). - Sessions in the afternoon with the room temperature of 20 °C. CG2: Medication - 10 mg amitriptyline before bed, daily for 8 weeks.	- Significant improvement in all parameters evaluated in the EG. - Significant improvement in all parameters evaluated in the CG, except for skinfold tenderness, sleep disturbance, depression and fatigue. - Significant improvement in all parameters evaluated in CG2, except for fatigue. - With respect to pain, muscle spasms, morning stiffness and number of tender points, the EG had greater improvement than CG1.
Matsutani et al. [19]	Diagnosis: clinical Inclusion: cognition to follow commands. Age: 25-60 years (mean of 45 years) Groups: EG=Stretching/Laser (n= 10♀) CG=Stretching (n= 10 ♀)	Pain: - Pain threshold by dolorimetry at tender points. - VAS of pain Quality of life: - FIQ - SF-36	Prospective, randomized, pre/post-intervention assessment.	EG and CG: Education (booklet and lecture) Intervention EG: - Laser GaAlAs, 830nm, power 30 mw. - Application: 3 J/cm^2 continuous emission at each tender point. - general stretching exercises. - 1 hour session, individual treatment. - 2x/week. - total: 5 weeks (10 sessions). Intervention EG: - general stretching exercises. - 1 hour session, individual treatment. - 2x/week. - total: 5 weeks (10 sessions).	- Significant improvement in pain as evaluated by VAS in both groups. - Significant worsening in the pain threshold at tender points in both groups. - FIQ and SF-36 – improvement in both groups after intervention. No difference between groups after the interventions.

Tabe 1. continuation

Armagan et al.[20]	Diagnosis: ACR. Inclusion: no medication. Age: 26-47 years (mean 38 years) Groups: EG= Laser (n=16 ♀). CG= Placebo (n=16 ♀).	Likert Scale: - morning stiffness (0=none; 1=mild; 2=moderate; 3=severe; 4=extreme). - subjective wellbeing (1=great improvement; 2=moderate improvement; 3=mild improvement; 4=without improvement; 5=worsening.) Pain score (0-54 points) Quality of life: FIQ. - number of pain tender points by the digital pressure.	Prospective, controlled, randomized, pre/post-intervention assessment and 6 months of follow-up.	EG: Laser GaAlAs, 830 nm, power 50 mw. - Application: 2J emission for 1 minute at each tender point. - Individual treatment. - 5x/week. - Total: 2 weeks (10 sessions). CG: Placebo. Same procedure as EG without emission of rays.	- Significant improvement in all parameters evaluated in the EG after intervention and in the follow-up compared to baseline. - Significant improvement in number of tender points and stiffness in the CG after intervention. - Significant improvement in the FIQ, subjective wellbeing and pain in the EG compared to the CG after intervention. - Significant improve in all parameters evaluated in the EG compared to the CG during follow-up.
Raimundo et al.[21]	Diagnosis: ACR. Inclusion: positive tender points of the trapezius muscle. Age: 27-50 years. Groups: EG= IFC 150HZ (n=5 ♀). CG= IFC 20Hz (n=4 ♀).	Pain: - pain points: digital pressure grading (0-5 points). - intensity: VAS. Quality of life: FIQ.	Prospective, randomized, pre/post-intervention assessments.	EG: IFC application at 150 HZ . CG: IFC application at 20 HZ. Intervention in both groups: - individual sessions. - 2x/week. - total: 5 weeks (10 sessions). - Application: 30 minutes with tetrapolar 5x9 cm electrodes, tetrapolar sweep mode.	- VAS: significant improvement in the CG (IFC 20 Hz). - Tender points: significant improvement in the CG (IFC 20 Hz) and the EG (150Hz). - FIQ: improvement in both groups after intervention, but without statistical analysis.
Almeida et al.[22]	Diagnosis: ACR. Inclusion: women, ≥50 years; pain and sleep disorder in the last 6 months. Age: ≥50 years. Groups: EG= IFC and US (n= 9 ♀). CG= placebo (n= 8 ♀).	Pain: - VAS body map. - pain points: digital and pressure algometry. Sleep assessment: - Brazilian list of sleep disorders. - Polysomnography.	Prospective, randomized, pre/post-intervention assessment.	EG: Combination therapy CG: Placebo, inactive current in different parts of the body. Intervention in both groups: Pain electrodiagnosis: - continuous US – 1 Mhz; 0.5 W/cm2 - IFC – 4000HZ, AMF 100 Hz Treatment: - pulsed US (1MHz; 2.5 W/cm2) - IFC - individual treatment. - 3x/week. - total: 4 weeks (12 sessions).	- Greater improvement in the pain parameters of the EG than the CG - Greater improvement in the sleep parameters of the EG than the CG - Improvement in all parameters of the EG before and after intervention.
Silva et al.[23]	Diagnosis: ACR. Inclusion: no disability. Age:.mean between 47 and 50 years. Groups: EG=TENS (n=5 ♀). CG=hydrotherapy (n=5 ♀).	Flexibility: finger-to-floor distance. Pain: VAS. Quality of life: - SF-36. - Nottingham Health Profile (NHP). Depression: Beck Inventory.	Prospective, randomized, pre/post-intervention assessment.	EG: TENS. - Application of TENS using surface electrodes and conductive gel placed at the tender points of the trapezius, supraspinous, gluteus and medial joint line of the knee, bilaterally. - Parameters: pulse frequency of 15 Hz, pulse time of 150 μs and the intensity of tingling sensation. - Total time of application: 40 minutes. - 3x/week (total of 10 sessions). CG: Hydrotherapy. - Therapy consisting of warm-up (5 min), stretching (20 min) and aerobic exercise (15 min).	- In the EG, improvement in pain and depressive symptoms evaluated by the Beck Inventory and improvement in quality of life evaluated by SF-36. - In the CG, improvement in quality of life evaluated by SF-36 and NHP (Emotional Reactions dimension). - After intervention, the EG had lower VAS than the CG.

ACR=american college of rheumatology; CG=control group; EG=Experimental Group; US=ultrasound; IFC=interferential current; VAS=visual analog scale; FIQ=fibromyalgia impact questionnaire; AMF=amplitude-modulated frequency.

Table 2. Methodological analysis of electrothermal and phototherapy in fibromyalgia by the Jadad scale of randomized controlled trials.

	Gür et al.[17]	Gür et al.[18]	Matsutani et al. [19]	Armagan et al. [20]	Raimundo et al. [21]	Almeida et al. [22]	Silva et al. [23]
Was the study described as randomized?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Was the method of randomization appropriate?	Yes	Yes	No	No	No	Yes	No
Was the study described as double blind?	No	No	No	Yes	No	No	No
Was the method of double blinding appropriate?	No	No	No	Yes	No	No	No
Was there a description of withdrawals and dropouts?	No	No	Yes	Yes	No	Yes	No
Score	2	2	2	4	1	3	1

flexibility exercises. The lack of overall treatment compromises the comprehensive approach that must be offered to FMS patients so that they can obtain multiple benefits in the control of their symptoms. In contrast, the combination of therapies limits the clarification of the role of each therapeutic modality in FMS and requires more elaborate experimental designs to observe the results of each intervention in alone.

Regarding the assessed outcomes, it is important to emphasize that the use of validated and reliable instruments increases the consistency of the findings. The Fibromyalgia Impact Questionnaire (FIQ) and the VAS for pain were the most commonly used assessment tools in the studies, and they are also widely used in the literature[8].

In most of the studies, the FMS diagnosis was based on ACR criteria, which include chronic generalized pain for at least three months and the presence of pain in 11 of the 18 tender points[2]. In clinical trials and observational studies, FMS is commonly diagnosed using these criteria[24]. However there is a series of controversial factors regarding their use (lack of clinician training, difficulty in the standardization of tender point assessment, the need to evaluate other symptoms to characterize the disease) that can compromise the power of the evaluated sample[25]. It is worth noting that sample representativeness was low, considering the small amount of assessed participants. The samples included a small number of male participants and had a wide variation in age, two characteristics that are compatible with epidemiologic data that show that FMS is more prevalent in the female gender and between the ages of 35 and 60[24].

Low-power laser therapy, proposed by studies included in this review, is widely used in patients with bone, muscle and joint disorders. Among its main effects are anti-inflammatory action, analgesia and cell activity modulation[26]. In FMS, laser is recommended specially for pain relief. Because chronic pain is highly associated with other FMS symptoms, it is believed that its reduction would trigger a cascade event that would improve other symptoms. It is worth noting that these effects are dose-dependent, and the doses vary widely from 1 to 23 J/cm^2 [26]. Establishing the ideal dose must take into account the thickness of the tissue layer that is to be treated, the size of the affected area, the type of laser, the power and the duration of application[27]. It must be mentioned that the analyzed studies[17-20] used the same dose over the tender points for all participants despite recognizing that there is variation in tissue layers between individuals. Another key factor for the effectiveness of the laser therapy is the number of applications. The World Association for Laser Therapy (WALT) recommends daily sessions for two weeks or sessions on alternate days for three to four weeks[28]. Gür et al.[17],[18] and Armagan et al.[20] applied daily sessions of laser therapy with significant improvement observed in all symptoms after the intervention. Meanwhile, Matsutani et al.[19] used two sessions a week and concluded that this time constraint may have limited the pain outcomes.

According to the consensus on laser clinical trials[29], studies must thoroughly describe the parameters of the intervention, such as wavelength, emitted energy, energy density, laser beam area, duration of application, peak power and density power[27]. The lack of a full description of parameters prevents the reproduction of the results, both in clinical and experimental settings. Although the results of the four analyzed studies[17-20] had positive outcomes for the laser therapy, any conclusion regarding ideal dose, harmful effects and target population would be premature because of the small number of subjects (n=71), the different types of laser and the lack of long term follow-up in most of the studies. In a systematic review with 33 clinical trials on laser therapy for musculoskeletal disorders, there was also no consensus on the ideal type of laser and its proper dose, however this form of intervention is superior to the placebo treatment[6].

Ultrasound (US) is used in physical therapy for the physiological effects derived from its mechanical and thermal action. The mechanical action increases cell permeability, decreases

inflammatory responses, reduces pain by decreasing nerve conduction velocity and favors the remodeling process of soft tissue. Continuous US has a thermal action that contributes to local vasodilatation leading to an improvement in chronic inflammation, muscle spasm and pain[30]. IFC is a type of electrical current formed by alternating sine waves of medium frequency, with the amplitude modulated at a low frequency for therapeutic purposes. Because it is formed by medium frequency currents, IFC is able to reach deep muscles and nerves, stimulate active contraction, enhance peripheral blood flow and reduce pain[1,22]. The use of US combined with other forms of electrotherapy, such as IFC or combined therapy, promotes analgesia in painful areas previously detected by electrodiagnosis[1,30].

For the US, Almeida et al.[22] used the pulse parameters of 1MHz and 2.5 W/cm^2, with no mention of repetition of pulse cycle, probe area, duration or area of application. For the ICF, the parameters were 4000Hz, Amplitude-Modulated Frequency (AMF)-100Hz, with omission of the size of electrode, duration and form of application. In contrast, Raimundo et al.[21] cited AMF, electrode size, duration and form of application. To reproduce the results of the published articles, it is crucial to report proper details of the characteristics of the electrothermal and phototherapy application. The characteristics of the instruments (i.e. US probe), therapeutic application (specific area or mode of application), duration and intervention site must be mentioned[5]. This information is the basis for reproducing the effects found in these studies.

With regard to TENS, its most recognized effect is analgesia by means of low threshold electric current that inhibits the transmission of painful stimuli to the spinal cord and releases endogenous opioids such as endorphins[31]. The American Pain Society considers TENS a therapeutic modality with high scientific evidence[5]. Silva et al.[23] had positive outcomes after applying TENS for pain control, depression and quality of life in FMS patients, despite the fact that the sample of this study was not representative.

Even though the biophysical action of several physical therapy modalities is partially known, additional investigation is required into the field of electrothermal and phototherapy for the treatment of musculoskeletal disorders[6]. The purpose is to develop a better understanding of the mechanisms of action, effects of different doses, duration of treatment, effects related to the stage of disease, combination of treatments and adverse reactions.

Three studies that used electrical transcranial stimulation to treat FMS symptoms were excluded. This resource acts through neuromodulation, being used by physicians since the 1950's to treat sleep disorders, pain, cognitive deficits, depression, anxiety, among others, and it has been reported as a resource for FMS treatment[13-15]. This modality consists of a micro-current that acts at a subliminal level with direct effect on the brain, on the limbic system, on the reticular activating system level and/or the hypothalamus. However, its mechanism of action is complex and requires better understanding.

There is evidence that electrical transcranial stimulation not only improves symptoms related to syndromes such as FMS but also has few side effects, and it is used in conjunction with medication[32]. In spite of its common use in physical therapy practice, the application of this resource is not studied in depth in the physical therapy training. Thus, it could be another type of micro-current technique to be investigated in the future, not only to treat FMS but also to treat other psychosomatic conditions.

There is still a lack of studies with electrothermal and phototherapy interventions that could also be used as a form of treatment for FMS, such as diathermia and excitomotor currents. Additionally, studies that have a more comprehensive focus on rehabilitation, using exercise, hydrotherapy, and manipulation combined with electrothermal and phototherapy could assist in the treatment of FMS.

Conclusion

This present systematic review shows that there are restrictions on generalizations of the benefits, adverse effects and doses of electrothermal and phototherapy for the treatment of FMS. However these methods are frequently used by physical therapists in clinical practice, despite the lack of scientific evidence for its effectiveness in FMS, therefore they should be used with caution. This fact must encourage the development of new studies with greater methodological rigor to increase the knowledge on various therapeutic modalities and their interaction with other proposed interventions for FMS, leading to evidence-based practice in a safe, appropriate and effective manner.

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