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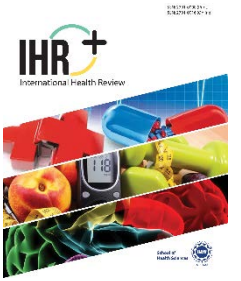

Title:	**Role of Electrotherapy in Treating Chronic Musculoskeletal Conditions: A Narrative Review of the Last 5 Years**
Author (s):	Riha Zahid, Ifrah Khan, Rahila Anis, Hafiz Junaid Ahmed, Saba Riaz
Affiliation (s):	University of Management and Technology, Lahore, Pakistan
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Role of Electrotherapy in Treating Chronic Musculoskeletal Conditions: A Narrative Review of the Last 5 Years

Riha Zahid, Ifrah Khan, Rahila Anis, Hafiz Junaid Ahmed, and Saba Riaz*

Department of Physical Medicine and Rehabilitation, School of Health Sciences, University of Management and Technology

Abstract

Chronic musculoskeletal conditions encompass a variety of disorders and impairments, some of which include chronic low back pain, carpal tunnel syndrome, arthritis, fibromyalgia, tendonitis, osteoporosis, and so on. Electrotherapy refers to the use of electrical modalities in order to treat such conditions in physiotherapy. This non-pharmacological treatment equipment, such as, transcutaneous electrical stimulation, interferential therapy, shortwave diathermy, and LASER (light amplification by stimulated emission of radiation), may or may not have profound effects on the aforementioned conditions. The purpose of this review article was to investigate and summarize the role of electrotherapy in order to manage chronic disorders and hence, try to quantify its magnitude while updating previous relevant knowledge on this particular topic. The design of the current study was based on a narrative review. A total of 58 studies were consulted. According to the inclusion criteria of the current research, studies published within last five years treating chronic musculoskeletal diseases, using electrotherapy modalities were included. However, any study more than five years' time period was excluded. The primary hypothesis of this study suggested that the electrotherapy carries significant effect to treat chronic musculoskeletal conditions. According to the secondary hypothesis, there exists no relationship between electrotherapy modalities and chronic musculoskeletal conditions.

Keywords: chronic musculoskeletal conditions, electrotherapy, pain, physical therapy, rehabilitation

Introduction

The musculoskeletal system plays a vital role throughout life as it supports the body structures and protects them while allowing a range of complex

* Corresponding Author: sabariaz317@gmail.com

along with fine movements required for daily life. The injuries to the musculoskeletal system occur as a result of variety of impacts, either repetitive or single which affects it both acutely and chronically [1]. The pains or disabilities that arise due to any problem in the joints, bones, muscles, or surrounding structures that persist for a long time are referred to as Chronic Musculoskeletal Conditions [2]. The complaints that arise from the skeletal or muscular system of the body may vary in intensity from mild to severe and are referred to as musculoskeletal problems. When a muscle is subjected to a load for a long or short time, however, repeatedly, it damages the bones or soft tissues, resulting in an injury to the musculoskeletal system also known as musculoskeletal disorder [3].

Some of the common chronic musculoskeletal disorders are carpal tunnel syndrome, tendonitis, ligament sprain, thoracic outlet syndrome, rotator cuff tendonitis, epicondylitis, DeQuervain's syndrome, mechanical backache, degenerative disc bulge, and many more. In this article, the effect of different modalities on musculoskeletal conditions would be determined. Physiotherapists utilize multiple modalities to treat the disorders of each patient in their practices. They are a burden on the health care system because of their high prevalence and are one of the leading causes of disability among people. Therefore, it increased the attention of researchers towards finding a more cost-effective and resource-friendly way to improve the prognosis of musculoskeletal conditions while reducing the utilization of resources simultaneously [4].

As musculoskeletal conditions become more chronic, they take longer to recover which increases the burden on the healthcare providers. This is because unlike medicine or surgical interventions, physiotherapy interventions are provided to the patients throughout their course of recovery and are more time-consuming. Over the time, the development in the field of non-invasive electro-modulation for chronic pain has increased exponentially. To date, it is known that the stimulation of nerves and muscles, using electrical stimulus or modalities may influence pain intensity in chronic conditions [5]. The advantages of these modern trainings or therapeutic technologies, for instance, whole-body electro myo-stimulation (WB- EMS), transcutaneous electrical nerve stimulation (TENS), shock-wave diathermy, and laser, are purely in the fact that they are joint-friendly, customizable, and time-effective [6]. Electrotherapy modalities provide physiological and therapeutic effects and those practicing modalities along

with manual therapy proved to be more beneficial than depending on manual therapy alone. Many types of painful or inflammatory musculoskeletal conditions are managed by physiotherapy. There is a wide range of modalities that are categorized as electrotherapy modalities (TENS, electronic muscle stimulation- EMS), acupuncture, and thermal modalities (Infra-red, Hot-packs, Ultrasound) which help the patient to overcome the disability [7].

Some physiotherapists believe that these modalities have only psychological effects on the patients, however, not therapeutic effects and it's yet to be proved on a large scale how it works, as for now it just plays the role of a placebo for patients. However, still there is a need to find a clear relationship between conventional physiotherapy along with electrotherapy modalities on chronic musculoskeletal conditions [8]. The main objective of this article was to determine the effective use of modalities, such as ultrasound, EMS, shock wave diathermy, and LASER on chronic musculoskeletal conditions and their results.

The current study is directed to evaluate the benefits of electrotherapy modalities that are utilized in research in order to treat chronic musculoskeletal conditions, such as chronic neck pain, chronic low back pain, chronic temporomandibular joint disorders, chronic sub-acromial impingement pain, and disability. Moreover, it also attempted to determine whether the electrotherapy modalities are beneficial for the patient or not. This research would focus on both aspects, that is, the effects of physiotherapy on these chronic conditions alone and the effects of electrotherapy on chronic musculoskeletal conditions as adjunctive therapy (as a therapy that is used in addition to primary care used in physiotherapy).

Moreover, this study would discover if the assumptions made about electrotherapy having no effect other than placebo are true or not. If they have an effect, is that good enough or big enough to make a difference in the recovery of a patient, to shorten the time of rehabilitation, and recovery for the chronic musculoskeletal conditions.

Literature Review

Several articles and studies including randomized control trials, meta-analysis, COCHRAINE library reviews along with systemic reviews were consulted and the following seventeen studies were summarized. A study was conducted in America in 2022 which was concerned to relieve the

effect of interferential current on musculoskeletal pain. According to this study, only interferential current when compared with placebo showed p <0.05 and displayed a significant pain-relieving effect. While the placebo plus standard treatment, interferential current plus placebo, and standard treatment alone showed no significant difference [9]. A study was conducted on 1st March 2022 on the effect of transcranial direct current stimulation in older adults. A significant difference between the base line and post-treatment was shown which proved that when direct current stimulation is used with physiotherapy in older adults, it showed maximum results [10]. The article was published in 2022 about the instant pain relieving effect of modulation frequency on chronic low back pain. After a single session of 30 minutes, a significant difference of less than 0.05 ($p<0.05$) was determined between the groups for placebo, intervention, and narrow

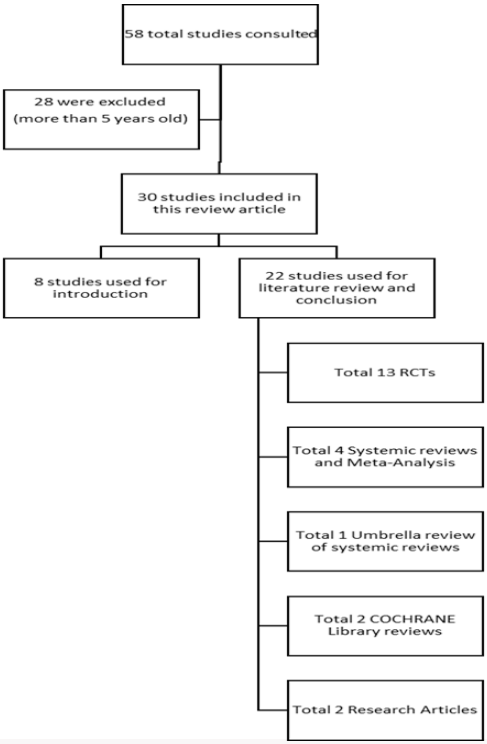

Figure 1. Flow Chart of Literature Selection Process for Current Article

Confidence intervals were seen consequently which proved good results regarding pain relief and improving flexibility in patients [11]. A research

work was also conducted in 2021 about the improvement of the effect of Kinesio-functioning exercises with electrotherapy in low back pain. The treatment significantly reduced the low back pain in all groups with ($p < 0.0001$) [12]. A systemic review was carried out regarding the efficacy of TENS in a cervical review conducted in 2021. TENS proved to be effective in order to relieve the intensity of chronic and acute cervical pain, majorly in short term [13]. A randomized controlled clinical trial, published on 19 February 2021, showed the effect of radial extracorporeal shock wave therapy on pain intensity. Significant differences were seen between the groups after one month with ($p=0.043$) and three months from the end of therapy with ($p<0.001$), resulting in significant postural improvement with core stability exercises [13]. The statistical analysis of 2021 publication about the use of electron modulation procedure for the treatment of chronic musculoskeletal pain suggested that the electron modulation procedure may quickly relieve the chronic musculoskeletal conditions, which was statistically significant at 5%. Different anatomical areas of the body respond differently to electromagnetic pulse or EMP treatment [14]. A study was conducted in 2020 to determine the combined effect of mulligan mobilization amalgamated with Low Level Laser Therapy (LLLT). The pain and range of motion improved with $p<0.05$ which proved it an effective method to treat chronic low back pain patients [15]. A pilot study was conducted in 2021 to compare the effect of osteopathic manipulation of SI joints with electrotherapy for functional disability in people with chronic low back pain. The results of the intra group study showed a statistical intra-group difference which proved that osteopathic manipulation is much more effective than electrotherapy to improve pain [16].

According to an RCT study conducted in 2018, the effects of High Intensity Laser Therapy (HILT) were tested on chronic musculoskeletal neck back, arms, hands, or shoulder pain. According to the results, in 11 out of 12 studies, pain was relieved in the treatment group using HILT as compared to the control group (MD: −1.01; 95% confidence interval [CI]: −1.28 to −0.74) [17]. In an RCT of 2019, results showed that electrotherapy carries similar effects as myofascial release therapy, however, electrotherapy is better than conventional exercises to relieve chronic mechanical neck pain [18]. An RCT conducted in 2018 suggested that whole-body EMS showed improvement in patients with chronic low back pain as compared to the control group. Baseline values showed no differences between groups, however, the mean intensity was lowered in whole body-EMS (P=0.002).

An inter-group significant difference was reported to be (P=0.027) [19]. A study conducted in 2018 suggested that patients receiving MWM (Mobilization with movement) and passive mobilization (manual therapy techniques) reported better Visual Analogue Scale scores as compared to patients who received electrotherapy modalities to improve knee osteoarthritis pains ($p < 0.05$) and completed a follow-up of 12 months [20]. [(21)]A study conducted in 2018 proved that two groups were receiving treatment to reduce urinary incontinence in a woman by either pelvic floor muscle training (PFMT) alone or by combining it with intravaginal electrical stimulation (IVES+PFMT) and the latter is not any better to improve urinary incontinence. The difference determined between the groups was not significant. The only difference present was in the PFMT group from baseline to post-treatment on ICIQ-UI-SF [-2.4 (95%CI-4.3--0.5), $p = 0.018$] [21]. A 2018 study compared the effects of LLLT combined with usual care and only usual care in participants of plantar fasciitis. Both groups showed improvement to lower the pain over 3 months (LLLT, $p < 0.001$; control, $p = 0.01$), however, in the LLLT group, significantly more pain reduction was seen as compared to controls at 3 months (p=0.03). Hence, LLLT combined with usual care therapy was considered superior over usual care alone to treat plantar fasciitis [22]. A 2021 study proved that people with TMJ disorders, who were treated with ultrasound, recovered better in terms of pain and functioning in mouth opening after 3 and 6-month follow-up periods as compared to people who were given no treatment [23]. In 2019, an RCT was conducted in which two groups of participants, suffering from chronic neck pain were compared to improve pain, disability, psychological status, and ranges of motion. The experimental group was treated with interferential current therapy (IFT) along with regular exercises, while the control group was only given regular exercises. Post-treatment, significant differences between groups were present for all of the outcome measures including the VAS score (2.73 ± 1.24 vs. 4.99 ± 1.56) for pain. Hence, the addition of interferential current therapy to regular care for chronic pain resulted in enhanced results [24].

Another study conducted in 2018 investigated the effects of TENS on ankylosing spondylitis. The treatment and control groups both received regular exercises with the treatment group receiving TENS therapy additionally. VAS (Visual Analogue Scale) was chosen as a primary outcome measure of choice for pain intensity; however, secondary outcome measure, such as, functional limitation was measured by BASFI (Bath

Ankylosing Spondylitis Functional Index). After 6 weeks of treatment and follow-up, no significant beneficial changes were seen in the former group [25].

A 2019 study was conducted that compared the effect of mirror therapy on balance and motor function in chronic stroke patients with combined electrical stimulation and mirror therapy. The experimental group received actual electrical stimulation combined with mirror therapy, while the control group received pretense aforementioned combined therapy. The outcome measures used for motor function and balance were measured by a handheld dynamometer and Modified Ashworth Scale respectively. The experimental group showed significant differences with $p<0.05$ hence, proving that electrotherapy is effective in treating hemiplegic patients [26].

A research compared the effects of dry needling with TENS on heart rate variability, photo plethysmography, pain intensity, galvanic skin response, and SpO_2. The results showed that dry-needling was more effective than TENS and that a significant difference existed ($p=0.001$) in all aspects related to pain and no significant difference occurred with photo plethysmography and SpO_2 [27].

A 2021 study was conducted on cancer patients with chronic musculoskeletal pains to investigate and compare the effects of auricular acupuncture and electro-acupuncture versus usual care. The pain was assessed on self-reported pain on BPI (Brief Pain Inventory) where "0" indicated no pain and 10 indicated worst pain. The results showed mind-boggling effects of electro-acupuncture and auricular acupuncture over usual care with 97.5% CI and $p < 0.001$ for both the aforementioned treatments. However, the effects of auricular acupuncture were slightly inferior to those of electro-acupuncture [28].

A systemic review and meta-analysis was conducted to check the response of low-intensity extracorporeal shock wave therapy on patients with chronic pelvic pain syndromes. The experimental group received treatment with low-intensity extracorporeal shockwave therapy (Li-ESWT), while the control group received fake treatment. The outcome was assessed on the basis of NIH-CSPI (National Institute of Health- Chronic Prostatitis Chronic pelvic pain Syndrome). The results showed that the experimental group had an effective recovery from pain and quality of life at 4 and 12

weeks after treatment. However, there was no significant difference after 24 weeks for pain score (p=0.32) [29].

Methodology

The current research is based on a narrative review which focused to evaluate the effectiveness of electrotherapy in musculoskeletal conditions. A total of 58 studies were accumulated, however, only 30 of them fulfilled the inclusion criteria of this study whereas, 28 were excluded. The articles were searched on Pub med, Pedro, and Google scholar. The keywords used were electrotherapy and modalities with OR as Boolean operator along with MSK, musculoskeletal condition, soft tissue injuries or chronic disorders with OR as Boolean operator in addition to AND in between both categories. All researches including systemic reviews, randomized control trials, case studies, umbrella reviews, and COCHRAINE library reviews were included in these researches which were not more than 5 years old. Moreover, the studies which focused on the effect of any kind of electrotherapy on musculoskeletal conditions were also added to this narrative review. However, the studies that were older than 5 years were excluded from the sample. The results of the remaining researches were evaluated on the basis of their analysis and limitations that the studies provided.

Results

Table 1. Representation of Studies

Article No	Effect on chronic MSK condition	Effect produced
1.	Electrotherapy treatment with placebo relieved pain.	Significant
2.	Maximum results	Significant
3.	Instant pain relief	Significant
4.	Pain relief	Significant when combined with exercises.
5.	Decrease the intensity of pain with postural improvement and core stability	Significant
6.	Pain intensity decreased	Significant
7.	Relieving effect	Varies according to area
8.	Pain and ROM improved	Significant
9.	Manipulation decrease more pain than electrotherapy	Significant
10.	Pain was improved.	significant

Article No	Effect on chronic MSK condition	Effect produced
11.	Electrotherapy was better in relieving chronic back pain than just exercises.	significant
12.	WB-EMS had better effects in treating chronic pain than control group.	Significant
13.	Mobilization with movement was better than electrotherapy for relieving knee osteoarthritis pain	Insignificant
14.	Electrotherapy alone is not beneficial, but when used in conjunction with muscular training, it gives significant results.	Significant if used with exercises.
15.	For treating plantar fasciitis, electrotherapy used with usual care was more effective than using electrotherapy alone.	Significant if used with exercises.
16.	In treating temporomandibular joint pain, electrotherapy was more beneficial than no treatment.	Significant
17.	More enhanced results in treating chronic neck pain in experimental group (interferential current therapy and exercise) than control group (regular exercise	Significant
18.	No additional effect of modalities in treating pain caused by Ankylosing Spondylitis in patient treated with and with our electrotherapy modalities	Insignificant
19.	Hemiplegic patients treated with mirror therapy and electrotherapy showed better results than those treated with just mirror therapy.	Significant
20.	Dry needling was more effective that TENS in all aspects of pain.	Insignificant
21.	Electro-acupuncture is very effective in relieving chronic pain.	Significant
22.	Low-intensity extracorporeal shock wave diathermy was very effecting in relieving pelvic pain as compared to patient in which electrotherapy was not used (control group).	Significant

Conclusion

From the studies that were summarized to conclude this review article, it is clear that the electrotherapy alone has minimal to no significant effect on chronic musculoskeletal conditions. However, electrotherapy as an adjunct therapy is effective to a good extent. It is itself a very broad field in physiotherapy, supporting the primary hypothesis. The future studies would certainly address the same question in detail whether electrotherapy is effective to treat chronic musculoskeletal conditions or not and to what extent.

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