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Therapeutic electric currents in the treatment of cervicalgy: integrative review

Summary

Neck pain is associated with factors such as sudden exertion, inappropriate postures, emotional issues and bad lifestyle habits. For this reason, physiotherapists use electro-electronic equipment that emits electromagnetic radiation to treat cervical dysfunctions. The aim of this study was to present the applicability of therapeutic electrical currents in the treatment of neck pain. This is bibliographical research, with a search in online libraries in the following databases: SciELO (Scientific Electronic Library Online), Portal of the Coordination for the Improvement of Higher Education Personnel (Capes), US National Library of Medicine National institutes of Health (Pubmed), in addition to Classic books. For the search and analysis of the studies, the following Health Sciences Descriptors (DeCS) were evaluated and used: TENS and neck pain; Neck pain and Electric currents; Functional electrical stimulation and neck pain; combined with Boolean operators (OR and AND). The eligibility criteria for the selection of articles were: articles in Portuguese and English; published in the period from 2012 to 2022; randomized controlled clinical trials and non-controlled studies, applied in a human model. The study reveals that among the main types of therapies used for cervical pain, Transcutaneous Electrical Nerve Stimulation (TENS) was the one that presented the most positive results, according to the studies revisited. It was verified, through the analyzed survey, that the increase of electrotherapy to physiotherapy can potentiate the conducts, especially to relieve pain in cases of acute and chronic neck pain.

Keywords: pain, cervical spine, chains electromagnetic, electrophysical agents

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Introduction

Most adult people complain of pain in the cervical spine. The prevalence of pain caused by cervical problems affects about 70% of people at some point in their lives, in almost all age groups and in both sexes Silva et al.,[1] From 30 to 50% of the world's population annually presents at least one episode of neck pain, and around 15% of these individuals will develop chronic pain in the region. Neck pain is the second leading cause of pain in the spine, second only to low back pain Bracht et al.,[2] Neck pain affects the overall well-being of the individual and the health of society in general, defining itself as a public health problem of great importance in world society. It can come from several causes, such as radiculopathies, cervicogenic headache, tumors, spondylitis and arthritis Silva et al.,[3] It is associated with some factors, such as: sudden effort, inadequate postures related to work, emotional issues, and bad habits of life, such as: repetitive tasks, heavy physical work and even alterations in the temporomandibular joints De Sobral et al.,[4]

Neck pain may also be related to trauma, resulting in painful, inflammatory conditions, with loss of range of motion (ROM), fatigue of cervical flexors and extensors, local stiffness and reduced proprioception Silva et al.,[3], Sprung CL et al.,[5] In addition, the problem with pain leads most people to pharmacological addictions, emotional instability, depressive conditions, dysfunctions related to work activities and deficiencies in daily activities. Non-steroidal anti-inflammatory drugs (NSAIDs) are among the drugs with excessive numbers of prescriptions, especially selective cyclooxygenase-2 (COX-2) inhibitors Coelho-De-Souza et al.,[6] The big problem is that these drugs are sold without a medical prescription, that is, the sale of these products is not accompanied by the pharmacological education of physiotherapy professionals. The consequences of the irrational use of these drugs are: thrombosis, acute renal failure and elevation of mean arterial pressure, abdominal pain, heartburn and diarrhea, in addition to the danger of myocardial infarction Batlouni,[7] The author states that the prolonged use of these drugs can cause gastric and duodenal erosions and ulcers.

Added to this is the fact that neck pain has the potential to trigger other diseases, such as headaches, temporomandibular pain, shoulder, elbow and wrist injuries, changes in the thoracic and lumbar spine Neves et al.,[8], Silva et al.,[3] Neck pain can be classified into acute and chronic, the first has a short duration and is focused on minor cervical trauma or muscle tension, and the second is related to pain and limitations in the range of motion in the cervical region, causing discomfort and intense pain and in some cases even disability De Sobral et al.,[4] The authors define the anatomical region involved in neck pain of neuro-musculoskeletal origin as the region that extends from the superior nuchal line and external occipital protuberance to the spine of the scapula, superior border of the clavicle and suprasternal notch (supreme), with irradiation to the head, trunk and upper limbs, and there may also be no irradiation.

Electrotherapy has been one of the key skills of Physiotherapy, with a long history in clinical practice from its earliest beginnings with the use of heat, cold and electrical stimulation. Recent years have seen the addition of numerous other treatment agents to the repertoire. Ward et al.,[9] when measuring medium frequency currents, with different carrier currents, observed that 1kHz exposed greater torques than higher frequencies. Thus, modulation in bursts, with lower frequencies than those observed in interferential and Russa, presented characteristics of better torque production and sensitivity Ward et al.,[10] Lately, medium frequency currents have been used a lot in rehabilitation, considering the teachings that they are more comfortable and more effective than low frequency currents, as they have less impedance on the skin, which leads to stimulation of deeper tissues Acedo et al.,[11], Kawamura et al.,[12]

Among the main electrotherapeutic equipment used by Physiotherapy, the following stand out: Transcutaneous Electrical Nerve Stimulation (TENS), Neuromuscular Electrical Stimulation (FES) and Interferential Current Therapy (IFC). TENS focuses on the application of electrical waves, of different shapes, intensity and frequencies, to the peripheral nerves, through electrodes. It is very important the size of the electrode and its positioning Robertson et al.,[13] The most common type of electrode, supplied as standard equipment with most TENS devices, is carbon-impregnated silicone rubber. These electrodes can be obtained in sizes: common pad measuring 4x4 cm, and large pad measuring 4x8 cm. It is a depolarized current, and its generators receive and modify alternating currents to create its primary energy and produce typical Tens waveforms, which can be applied at high frequency (>10 Hz), low frequency (≤ 10 Hz), variable frequency and acupuncture- like, with low frequency and high amplitude stimulation. The stimulation generated by TENS is understood as sensory and motor Nunes,[14]

The (FES) is an electric current aimed at gaining strength Mileski et al.,[15] but it does not act on pain. FES also acts in muscle reeducation, combating muscle atrophy, contractures, and edema. Interferential Current Therapy (IFC) provides several treatment possibilities, adjusting its parameters (carrier frequency, amplitude-modulated frequency, sweep frequency, sweep mode or oscillation pattern, type of application (bipolar or quadripolar), duration of application and intensity) Rampazo et al.,[16] Electrical stimulation or electrostimulation is effective for inhibiting pain, promoting analgesia through ascending and descending pain control pathways Zeng et al.,[17] The currents most commonly used in clinical practice are transcutaneous electrical nerve stimulation (TENS), both low and high frequency; interferential current (bi or tetrapolar) and Functional Electrical Stimulation (FES), the first two of which are usually the most chosen when aiming to reduce painful conditions Neves et al.,[8] , Silva et al.,[3] Associating electrotherapy and physiotherapy enriches the work of the physiotherapist, as it offers positive and/or satisfactory results in a shorter period of time, ensuring patient satisfaction Silva et al.,[3], Acedo et al.,[11], Kawamura et al.,[12], Mileski et al.,[15] Neves et al.,[8] To guide the research, the following question was formulated: Can the increase of electrotherapy to physiotherapy enhance the conducts, especially to relieve pain in cases of acute and chronic neck pain? Based on these considerations, the objective of this study was to evaluate the applicability and parameters of the use of therapeutic electrical currents in the treatment of neck pain.

Materials and methods

This study is designed to review the integrative literature, which is a research model widely used in the health area to assist in clinical decision making. The review used the model proposed by Mendes, Silveira and Galvão (2008), containing six steps: 1)Identification of the theme and selection of the hypothesis or research question for the elaboration of the integrative review; 2) Establishment of criteria for inclusion and exclusion of studies and search in the literature; 3) Definition of the information to be extracted from the selected studies; 4) Evaluation of studies included in the integrative review; 5) Interpretation of results; 6) Presentation of the review and synthesis of knowledge Souza et al This is a qualitative bibliographic research, in which the study of the theoretical framework was carried out, with a search in online libraries, SciELO (Scientific Electronic Library Online), Portal of the Coordination for the Improvement of Higher Education Personnel (Capes), US National Library of Medicine National institutes of Health (PubMed).

For the search and analysis of the studies, the following Health Sciences Descriptors (DeCS) were evaluated and used: 1- TENS and neck pain; 2- Neck pain and electrical currents; 3- Functional electrical stimulation and neck pain; 4- interferential current (IFC) and neck pain, combined with Boolean operators (OR and AND). The search focused on studies published in the period from 2012 to 2022. The following eligibility criteria were adopted for the selection of articles: Inclusion criteria, 1- articles should be in Portuguese or English; 2- published in the period from 2012 to 2022; 3- Included are randomized controlled clinical trials and non-controlled studies, applied in a human model, 4- With neck pain pathology. Exclusion criteria: 1- studies that were not available in full; 2- studies in which the title did not match the topic addressed: neck pain; therapeutic electric currents in the treatment of neck pain; 4- studies outside the outlined period; 5- studies in other languages, other than English and Portuguese. The information extracted in the selected studies was categorized as follows: author/year, place where the study was carried out, type of study, population studied, variables studied.

Results

From the descriptors used, 502 articles were found, among the bases: SciELO (Scientific Electronic Library Online), Portal of the Coordination for the Improvement of Higher Education Personnel (Capes) and US National Library of Medicine National institutes of Health (Pubmed). After the removal of duplicate articles (190) and those that did not cover the subject studied (207), 98 irrelevant articles were eliminated, those in which the title presented a study and the text brought others. At the end of this process, 7 articles remained for inclusion in this integrative review, according to the flowchart Figure 1.

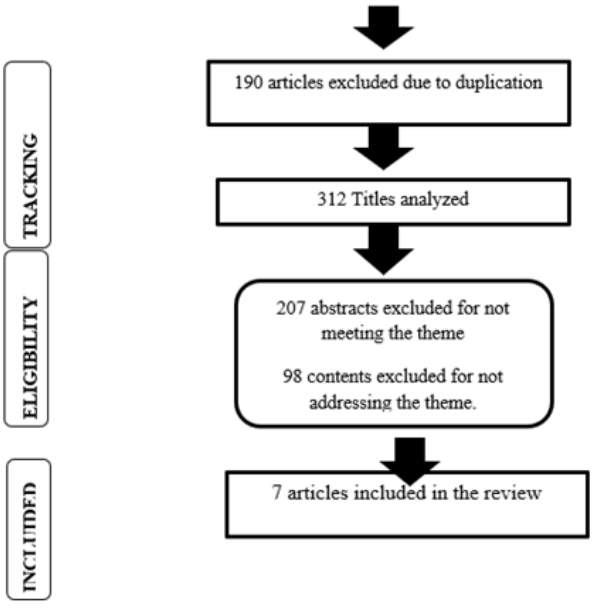

Figure 1 Article search flowchart and selection criteria.

The selected works were read, identifying the important points that could compose analysis categories. Next, data were presented from the following categories: 1- Evaluate the efficiency of Transcutaneous Electrical Nerve Stimulation (TENS) alone or in association with other interventions, for the treatment of neck pain; 2- Evaluate TENS current modulations (pulse width and frequency) for the treatment of neck pain; 3- Evaluate the short- and long-term effects; 4 evaluate the weekly or daily frequency, according to Table 1.

Of the seven articles selected for this study, four evaluate the efficiency of Transcutaneous Electrical Nerve Stimulation (TENS) alone or in association with other interventions, for the treatment of neck pain; three of the studies evaluated interferential current (IFC) in association with other interventions.

Discussion

In the studies selected for discussion and analysis, the interventions used to reduce pain from the cervical spine were mainly of the comparison type, between: Transcutaneous Electrical Nerve Stimulation (TENS) and Ultrasound compared to high intensity laser therapy (HILT), for range of motion (ROM) and functional activity in patients with cervical spondylosis Venosa et al.,[18] According to the authors, after 4 weeks of therapy, both modalities are effective in analgesia and function improvement in patients affected by cervical spondylosis. TENS and photo biomodulation Rampazo et al.,[15] for relief of chronic neck pain, both isolated and combined. The participants of this study (144) were divided into four groups, namely: one that received both techniques combined; another who received TENS and laser simulation; a third treated with photo biomodulation and TENS simulation; and one in which the application of the two therapies was simulated, as a placebo. The study revealed that the combined use of the two electrophysical agents, concomitantly, did not potentiate the analgesic effect; the same benefits were found as with the isolated application of TENS and laser.

Interferential current (IFC) and stabilization exercises Yesil et al.,[19] study with 8 1 patients with CNP, divided into three groups according to age and gender. The first group had NSE, the second group had TENS and NSE, and the third group had IFC and NSE. Patients were randomly assigned. Physical therapy modalities were applied for 15 sessions in all groups and all participants did group exercises accompanied by a physical therapist for 3 weeks plus 3 weeks of home exercise program. The study achieved its goal of reducing pain, increasing ROM, improving disability, quality of life, mood, and reducing drug use in all three treatment groups ($P < 0.05$). The authors state that TENS and IFC therapies are effective in the treatment of patients with CNP, but they are not better or superior to NSE. Interferential Therapy Sutariya et al.,[20] together with the exercise. The objective was to compare the effectiveness of a medium frequency current and a high frequency current in relieving pain and improving function in patients with neck pain. 24 patients participated, divided into two groups (1 and 2), with 12 participants each. Group 1 were administered shortwave diathermy with conventional therapeutic exercises. In Group 2, Interferential Therapy was administered along with conventional therapeutic exercises. The treatment was administered for 15 days. Results showed statistically significant improvement in NPRS, NDI and PPT [$p<0.05$] in both groups. According to the authors, there was a statistically significant, with little difference in the NPRS score of patients in group 2. According to the authors, any of the shortwave Diathermy or Interferential Therapy can be used as a complement to therapeutic exercise to improve pain and function in patients with mechanical neck pain. But for greater improvement in pain and function, the use of Interferential Therapy may be more effective.

Interferential therapy compared to TE alone Albornoz Cabello et al.,[21] The authors investigate the immediate clinical effect of the IFC and TE combination and claim that it achieved greater immediate clinical impact on self-reported neck pain intensity and disability, compared with TE alone, in adults with long-standing NSNP. Both approaches showed a similar effect on active cervical ROM, except for neck flexion and right rotation, where the addition of IFC to exercise therapy proved to be more clinically relevant. There was also a decrease in pain intensity after the intervention in both groups, with significant differences in favor of those who also received IFC. Adding IFC to a supervised TE regimen resulted in greater improvement in neck pain intensity compared to TE alone. These positive results were attributed to the plausible effect of SFI to improve muscle blood circulation. Most research in this area has investigated the impact of CSI in adults with persistent low back pain, with little focus on the NSNP. Thus, clinically relevant differences were found only in the IFC plus TE group. Furthermore, the addition of IFC to a 2-week exercise therapy regimen has demonstrated greater clinical efficacy immediately after the intervention, compared with the use of exercise alone, in decreasing the intensity and disability of neck pain, but not improve active cervical ROM in adults with chronic NSNP.

Compare Interferential Therapy to isometric strengthening exercise Khanam et al.,[22] A group of 30 participants were divided into 2 groups of 15, with the conventional group (A) treated with interferential therapy and the experimental group (B) treated with isometric strengthening exercise. The Treatment was 5 days a week, for four weeks, completing 20 sessions. Neck pain and functional capacity were measured using the Visual Analog Scale (VAS) and the Neck Scale Disability Index (NDI) to find the result before and after treatment. The study observed a significant difference between the experimental and control groups on the VAS at post-treatment with $P < 0.001$. There was a significant difference between the experimental and control groups in the NDI with $P < 0.001$. The authors state that there was a clear decrease in the level of aggravation and disability in the test and control collection group, however when both meetings were thought about the test group it proved to be preferable improvement over the control group. Therefore, going by the overall result of the study, it was concluded that early isometric strengthening is indeed effective in reducing pain and improving functional capacity in professionals with mechanical neck pain.

The only work that did not present a comparative study and that highlighted Current Modulation - TENS - (pulse width and frequency); the short-term and long-term effects and the weekly or daily frequency for the treatment of neck pain, was that of Borges et al.,[23] who dealt with the effectiveness of treatment with TENS, stretching exercises, infrared radiation, and therapeutic massage, together, for patients with chronic neck pain. The study had 15 participants who had chronic pain in the cervical spine, with a mean age of 61 years, consisting of 10 women and 5 men. The duration of treatment was 12 continuous weeks, on Mondays, Wednesdays and Fridays, totaling 36 sessions, following the following therapeutic protocol: The conventional Tens Current used in the frequency (R) - 100 Hz, pulse permanence of 150 µs, for 45 min, with amplitude adjusted according to the susceptibility of the patient, using 4 electrodes of 15 cm2 (5 cm x 3 cm) of silicone latex and carbonada, arranged in parallel to each other in the cervical region. For affixation, conductive gel and adhesive tape were used, as well as a Kinesis New Microcontrolled®, duly calibrated by the manufacturer.

Conclusion

This research identified studies that proposed several comparisons that evaluated the efficiency of Transcutaneous Electrical Nerve Stimulation (TENS) alone or in association with other interventions, for the treatment of neck pain. The tendency of treatments in the last ten years (2012 to 2022) is towards multimodal treatments, in which different types of physical therapy treatments are compared to achieve better results in cases of acute and chronic neck pain; neck pains; cervical spondylosis, among others. It was verified, through the

analyzed survey, that the increase of electrotherapy to physiotherapy can potentiate the conducts, especially to relieve pain in cases of acute and chronic neck pain. The Transcutaneous Electrical Nerve Stimulation (TENS) parameters used in neck pain therapies were: frequency (R) - 100 Hz, pulse duration of 150 μs for 45 min, with amplitude adjusted according to the patient's susceptibility, using 4 electrodes of 15 cm^2 (5 cm x 3 cm) of siliconized and carbonated latex, placed parallel to each other in the cervical region.

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Conflicts of interest

The authors declare no conflict of interest.

References

1. Silva T, Oliveira AL, Santos SM, et al. Quality of life and prevalence of pain in the cervical region in academics. *REAS/EJCH*. 2020;39:1–9.
2. BRACHT MA, Vier C, Neves ML, et al. Effects of spinal manipulation and pain education in chronic neck pain: a randomized controlled clinical trial. *Integr Med Res"[jour]*. 2018;7(3):271–278.
3. Silva AF. Prevalence of neck pain in dental students at a University Center. *Rev Port Health and Society*. 2017;2(2):422–434.
4. De Sobral MKM. The effectiveness of positional release therapy (PTT) in patients with neck pain. *Physiotherapy in Movement*. 2017;23(4).
5. Sprung CL, Silverio-Lopes S. Use of traditional Chinese medicine (TCM) techniques for neck pain analgesia in adults: systematic review. *Rev Bras Terap E Saúde*. 2016;7(1):7–15.
6. COELHO-DE-SOUZA LN, Gomes ST, Vasconcellos Abdon AP, et al. Knowledge and attitudes of physiotherapists about non-steroidal anti-inflammatory drugs. *Rev Pain*. 2013;14(1):44–47.
7. Batlouni M. Nonsteroidal Anti-Inflammatory Drugs: Cardiovascular, Cerebrovascular and renal effects. *Arch Bras Cardiol*. 2010;94(4):556–563.
8. Neves RH. Therapeutic modalities in the treatment and prevention of delayed onset muscle soreness - literature review. *Biological Sciences and Health Unit*. 2017;4(1):147–158.
9. Ward AR, Robertson VJ. Variation in torque production with frequency using medium frequency alternating current. *Arch Phys Med Rehabil*. 1998;79(11):1399–1404.
10. Ward AR, Chuen WL. Lowering of sensory, motor, and pain-tolerance thresholds with burst duration using kilohertz-frequency alternating current electric stimulation: part II. *Arch Phys Med Rehabil*. 2009;90(9):1619–1627.
11. Acedo AA, Luduvice Antunes AC, Barros Dos Santos A, et al. Upper Trapezius Relaxation Induced By Tens And Interferential Current In Computer Users With Chronic Nonspecific Neck Discomfort: An Electromyographic Analysis. *J Back Musculoskeletal Rehabilitate*. 2015;28(1):19–24.
12. Kawamura H, Nishigami T, Yamamoto A, et al. Comparison of the pain-relieving effects of transcutaneous electrical nerve stimulation applied at the same dermatome levels as the site of pain in the wrist joint. *J Phys Ther Sci*. 2017;29(11):1996–1999.
13. Robertson V, Alex Ward, John Low BA, et al. *Electrotherapy explained - principles and practice*. Rio de Janeiro: Elsevier. 2009.
14. Nunes RFS. *Transcutaneous Electrical Nerve Stimulation (TENS) in the control of Myofascial Pain associated with Bruxism*. 2019.
15. Mileski ME. Effects of electrostimulation and proprioceptive neuromuscular facilitation on the gait of hemiparetic patients. *Science and Health Magazine*. 2013;6(1):29–36.
16. Rampazzo EP, Andrade ALM, Silva VR, et al. Photobiomodulation therapy and transcutaneous electrical nerve stimulation in patients with chronic neck pain: clinical trial of study protocol. *Medicine*. 2020;99(8):e19191.
17. Zeng C, Li H, Deng ZH, et al. Electrical stimulation for pain relief in knee osteoarthritis: systematic review and network meta-analysis. *Osteoarthritis Cartilage*. 2015;23(2):189–202.
18. Venosa M, Romanini E, Padua R, et al. Comparison of high-intensity laser therapy and combination treatment with ultrasound and transcutaneous nerve stimulation in patients with cervical spondylosis: a randomized controlled trial. *Lasers Med Sci"[jour]*. 2019;34(5):947–953.
19. Yesil H, Hepguler S, Dundar U, et al. Does the Use of Electrotherapies Increase the Effectiveness of Neck Stabilization Exercises for Improving Pain, Disability, Mood, and Quality of life in Chronic Neck Pain? A Randomized, Controlled, Single Blind Study. *SPINE*. 2018;43(20):E1174–E1183.
20. Sutariya N, Shuskla Y. Effect of Interferential Therapy versus Shortwave Diathermy on Pain and Function in Mechanical Neck Pain - A Comparative Study. *International Journal of Science and Healthcare Research*. 2020;5(1):279–288.
21. Albornoz Cabello M, Barrios-Quinta CJ, Espejo-Antúnez L, et al. Immediate Clinical Benefits of Combining Therapeutic Exercise and Interferential Therapy in Adults with Chronic Neck Pain: A Randomized Controlled Trial. *European Journal of Physical and Rehabilitation Medicine*. 2021;57(5):767–774.
22. Kanam S, Avinash N, Addanki Premchand, et al. Comparative Effect Between Interferential Therapy and Isometric Exercises on Postural Neck Pain Among Dentist. *Acta Scientific Orthopedics*. 2022;5(5):23–27.
23. Borges Mc, Borges Cs, Jordão Silva Ac, et al. Evaluation of Quality of Life and Physiotherapeutic Treatment In Patients With Chronic Neck Pain. *Physioter Mov*. 2013;26(4):873–881.
24. Santos LRCS, Assunção AÁ, Lima Ede P. Back pain in adults living in quilombola territories of Bahia, Northeastern Brazil. *Thesis (doctorate)*. 2014;48(5):750–757.
25. Ward AR, Oliver WG, Buccella D. Wrist Extensor Torque Production and Discomfort Associated With Low-Frequency and Burst-Modulated Kilohertz-Frequency Currents. *Phys Ther*. 2006;86(10):1360–1367.