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TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION (TENS) AS A PHYSICAL THERAPY RESOURCE FOR PRESSURE ULCER HEALING

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ABSTRACT

Introduction: Pressure ulcers occur due to friction or increased pressure in areas of the body of patients hospitalized or bedridden for a long period of time due to a process of tissue hypoxia that consequently results in tissue necrosis. The physiotherapist has the role of assisting in the healing process, through resources that accelerate tissue repair. Among the physical therapy resources for the treatment of chronic wounds is the use of electrical currents such as TENS, which promotes significant improvement through the inhibition of cytokines, pro-inflammatory, promotes vasodilation by increasing perfusion in the region, reduces the infectious process, contributes to flap and graft survival. **Objective:** To verify the influence of the use of electric currents in the tissue repair process in wounds caused by external pressure. **Material and Method:** We reviewed randomized clinical trials in Pubmed/Medline, Cochrane, Science Direct and PEDro databases published from 2016 to 2022. Seven articles were considered eligible and included in the review. **Results:** The analysis of the studies shows that this therapy can accelerate healing by reducing the area, length, width and volume of the ulcer, promote an anti-infective and anti-inflammatory effect in patients undergoing or not a surgical procedure, stimulate the formation of granulation tissue and help in the partial or complete healing of the ulcer.

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INTRODUCTION

Chronic wounds are classified as such because they present a difficult healing process, leading to a risk of complications such as amputations and infections (Barbosa, 2020). For Brazilian public health, wounds identified as complex or chronic are a problem. Significant impacts are observed in several components, such as physical, psychological and financial (Marques, 2016). The prevalence of chronic injuries has had a significant increase in recent years due to the growth in life expectancy, chronic diseases and comorbidities (Marchesini, 2020). In Brazil, there is a prevalence rate that resulted in 5.0% of pressure injuries, 3.2% of diabetic ulcers and 2.9% of vasculogenic ulcers (Vieira, 2018). Pressure ulcers occur due to friction or increased pressure in areas of the body of patients

hospitalized or bedridden for a long period of time due to a process of tissue hypoxia that consequently results in tissue necrosis (Pinheiro, 2020). The physiotherapist has the role of assisting in the healing process, through resources that accelerate tissue repair (Marchesini, 2020). Among the physical therapy resources for the treatment of ulcers is the use of electrical currents. Studies carried out in the field of electrical stimulation show that currents such as transcutaneous electrical nerve stimulation (TENS) are effective when effects such as the healing of tissues that lose their integrity are desired (Marques, 2016). Electrical stimulation (ES) has been shown to have beneficial effects on the healing of chronic skin lesions. When ES is applied to a wound, it produces beneficial effects throughout the three phases of healing: inflammation, proliferation and remodeling phases (Ud-Din, 2014). The therapeutic modality consists of the application of low frequency electrical waves, which are safe and comfortable, in which

it is applied transcutaneously and through self-adhesive or rubber electrodes (Domingues, 2019) TENS promotes significant improvement through the inhibition of pro-inflammatory cytokines, promotes vasodilation by increasing perfusion in the region, reduces the infectious process, contributes to flap and graft survival.⁽²⁾ In a systematic review, Regan *et al.* (2019) showed evidence supporting the use of electrical stimulation to accelerate the rate of tissue repair in pressure ulcers. Among these resources, electrical stimulation promotes the healing process of chronic injuries of different etiologies, as it has a significant effect on improving circulation. Therefore, this study aimed to verify the influence of low-frequency electrical stimulation on tissue repair of chronic wounds.

MATERIALS AND METHODS

This is bibliographical research carried out from the survey of articles in the online database of Google Scholar, ScientificElectronic Library Online (SciELO), Scopus bibliographic database, Virtual Health Library (BVS), Latin American and Latin American Literature. Caribbean in Health Sciences (LILACS). As inclusion criteria, free articles were used, published between 2016 and 2022, all published in indexed journals, in English and Portuguese; studies classified as experimental, quasi-experimental and systematic research. As exclusion criteria were articles published in previous years, studies that did not fit the topic addressed with paid access. The period of data collection was from August to October 2022.

After selecting the material and reading the data, they were analyzed and discussed in order to offer a greater understanding of the use and effectiveness of SS in chronic wounds and their respective relevance. Because it is not a study with human beings, this work did not need to be submitted to the ethics and research committee, according to resolution 466/12.

RESULTS

In the present study, 20 articles were found, of which 5 were selected, according to the determined inclusion criteria. The following information was extracted from the articles in condensed form: authors, year of publication, type of study, methodology and outcomes. Sample characteristics, intervention used and study results are presented in Table 1.

DISCUSSION

This systematic review shows a scarcity of intervention studies of low-frequency electrical stimulation in tissue repair of chronic wounds, despite the great importance of the subject. This scarcity may be related to innovative treatments that are currently on the market with proven efficacy in greater numbers and rapid response.

Table 1. Presentation of results

| Nº | AUTHOR / YEAR | TYPE OF STUDY | OBJECTIVE | METHODOLOGY | OUTCOME |
|----|-------------------------|--|---|---|--|
| 1 | Marques et al., 2016 | Systematic review of the literature | Analytically describe the effects of TENS currents in promoting healing of chronic wounds. | Through research on sites such as: MEDLINE, PubMed, Cochrane Central Register of Controlled Trials, B-on, PEDro.. | TENS therapy appears to be an effective therapeutic modality in promoting the healing process of chronic wounds. |
| 2 | Diez Anton et al., 2021 | Double-blind Randomized Clinical Trial | To determine the effectiveness of TENS treatment as adjunctive therapy in the healing of pressure injuries in the hospital environment. | To this end, an essay was designed with a study population of 16 participants with pressure ulcers, in different places, selected by consecutive non-probabilistic sampling, who will be randomized into two groups, control and experimental, with 8 participants each, only one group (group 2) receiving electrostimulation intervention as adjuvant treatment. And the other group only care for hygiene, cleaning and dressings. | The results are satisfactory with the electrophysiotherapy intervention. The clinical indicators Decreased wound size and Scar formation showed a statistically significant difference in the intervention group, greater number of healed wounds, lower rate, longer time for recurrences. |
| 3 | Davini et al., 2016 | Case study | To examine the effects of treatment using low-voltage electrical stimulation in four patients (n=4) with chronic skin ulcers of different etiologies. | For treatment, a monophasic, quadratic, double and twin pulse current was used, with T=10µs and f=100Hz, cathodic stimulation performed on the lesion and average intensity of 150 times for 30 minutes, 3 times a week. | The results of this study, within the experimental conditions carried out, point to the possibility of adopting high voltage electrical stimulation in the treatment of chronic cutaneous ulcers of different etiologies, due to the sampling of an improvement in the healing of ulcers in patients. |
| 4 | Souza et al., 2017 | Case study | Evaluate the effectiveness of low-voltage electrical stimulation in a male participant with sacral pressure ulcer. | Electrical stimulation was applied to the ulcer; a silicone rubber electrode with sterile gauze soaked in saline solution was positioned over the lesion. Electric current was applied for 45 minutes/session, three times a week, for four weeks, totaling twelve sessions. | The results showed a percentage of 17% reduction in the area, in addition to a better appearance of the wound, suggesting a greater number of sessions for more satisfactory results. The parameters used in the present study proved to be effective in improving the healing of the patient's wound, but insufficient for the complete closure of the wound. |
| 5 | Forti et al., 2018 | Case study | Evaluate the effect of 30 electrostimulation sessions on the healing of cutaneous ulcers of different causes. Six volunteers participated in the study and ten ulcers were treated. | Photogrammetry was performed every ten sessions to quantify the areas of lesions (cm ²). The intervention consisted of applying the ulcer two or three times a week, lasting 30 minutes. The active (negative) electrodes were placed on the ulcer and the dispersive (positive) electrode was positioned in the vascular path. | The five venous ulcers (ankle region) presented, after 30 stimulation sessions, a reduction of approximately 80%. High Voltage Pulsed Stimulation (HVPS) was effective in promoting complete healing of four ulcers and assisted in the reduction of six other ulcer areas. |

Epidemiological data highlight that the formation of this type of lesion is extremely common. According to surveys, 4% to 10% of patients admitted to hospitals in developed countries have skin lesions that progress to the formation of pressure ulcers, which can lead to a direct increase in major infections and, consequently, a reduction in the quality of life of patients, in addition to raising the cost of hospitalization for patients too much (Ana Clara Santana de Souza, 2017). For the authors, pressure ulcers can occur when greater pressure is applied to an area of the skin for a short period or when less pressure is applied for a prolonged period. In common, these injuries are located in regions that are difficult to heal, due to the difficulty of removing pressure, since it is an area that serves as a body support point - especially in a paraplegic individual (Marques, 2016; Diez, 2021). For the most part, the resources of phototherapy and electrotherapy modalities have positive effects on pain relief, reduction of edema, significant reduction in the length and width of the wound surface, improvement of the biochemical markers involved, improvement in the modulation of neovascularization and acceleration of proliferation, promoting continuous healing.⁽¹²⁾ Electric current corresponds to the circulation or flow of charged particles through a conductor, in response to an applied electric field. (Ana Clara Santana de Souza, 2017). It is also believed that EE applied externally to the wound (exogenous) will promote healing. recreation of the endogenous electric field, which may alter the proliferation of the epithelium, macrophages, granulocytes, as well as acting on growth factors (Marques, 2016). When alterations occur in the valves of the veins, components such as fibrin are allowed to leave, with greater difficulty in healing. TENS is commonly used for analgesia, also showing an effect in increasing tissue perfusion, as well as reducing vascular resistance (Sakabe, 2018). The study showed that TENS improves the healing process by inhibiting pro-inflammatory cytokines, regulating re-epithelialization and granulation tissue formation (Marques, 2016; Ana Clara Santana de Souza, 2017). The frequency of this means of therapeutic intervention must be between 2Hz and 100Hz, the amplitude must vary according to the type of ulcer: between 0 mA and 70 mA for diabetic ulcers and 20 mA to 45 mA for venous ulcers. The time of exposure to TENS recommended by the authors ranges from twenty minutes to two hours. Other authors refer that the placement of TENS electrodes should be on the margins of the wound, unlike direct currents, where the electrodes are placed on top of the wound. In addition, authors report that the electric current is stronger at the margins of the wound than in the center of it. Therefore, the effect promoted by electrical stimulation (accelerating the tissue healing process) is interrupted by continuous exposure to pressure on the skin, delaying tissue regeneration (Sakabe, 2018).

CONCLUSION

From the results obtained in published studies, the positive effects of Electrotherapy on the healing process of pressure ulcers were identified. Electrical stimulation has provided satisfactory results in the treatment of chronic venous ulcers, however there are few studies published in recent years, thus the research becomes incomplete due to lack of recent data. Therefore, it is necessary to carry out studies with a greater number of individuals with the resource, since the prevalence of available studies was of the case study type.

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