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The Effect of Transcutaneous Electrical Nerve Stimulation in Low Back Pain: A Narrative Review

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Abstract

Background: Low back pain (LBP) is a common musculoskeletal disorder in various parts of the world. Pain due to LBP causes a decrease in the quality of life and individual productivity. Pharmacological therapy that causes many side effects is felt, causing non-pharmacological therapeutic approaches to be needed, one of which is TENS, providing a positive impact with minimal side effects. **Objective:** This study aims to examine the effect of TENS on pain due to LBP. **Method:** The approach taken is a narrative review by identifying articles in PubMed, CINAHL, and Scopus from 2017-2022 using keywords: low back pain, TENS, pain level, chronic pain. **Result:** As a result, five articles with RCT studies were included in the analysis. TENS showed a positive effect on reducing pain compared to other interventions, but it was temporary. Although TENS can be used for pain management of LBP, the evidence for its effectiveness is still being studied. **Conclusion:** TENS can be an alternative therapy that can reduce pain in LBP patients. There are different TENS settings, but all show positive results. The combination of TENS with other therapies can improve better pain reduction results. **Recommendation:** Research on the effect of TENS on chronic and acute LBP patients needs to be carried out to test the efficacy of TENS on LBP.

Keywords: Chronic pain, low back pain, pain level, TENS

INTRODUCTION

Low back pain (LBP) is a common global problem in various age groups and economic levels. Low back pain is pain and discomfort localized below the costal margins and above the inferior gluteal folds with or without leg pain (1). Among other pain complaints, low back pain is most commonly reported worldwide (2). The prevalence of low back pain reached 7.5% of the global population in 2017 (3). In addition, data findings from Global, Regional, and National Incidence, Prevalence, and Years Lived with Disability for 328 Diseases and Injuries in 195 Countries show that LBP is the leading cause of disability (4).

The high prevalence of LBP requires appropriate treatment, especially in overcoming the pain that is felt. Discontinuation of treatment due to the high cost of treatment makes LBP challenging to control (5). So finding pain management in LBP is a challenge (6). Currently, pharmacological treatment is a widely used therapeutic intervention. However, inappropriate and suboptimal prescribing and use of drugs causes therapy to fail, so people look for other alternatives through non-pharmacological interventions through physical therapy, heat therapy, psychological treatment, and transcutaneous electrical nerve stimulation (TENS) therapy (4).

TENS is a low-cost treatment modality that delivers electrical impulses through the skin to activate nerves, thereby reducing pain (7). In recent decades, TENS has been recommended because it can trigger a complex neural network that activates the descending inhibitory system, reducing hyperalgesia (8). TENS also promises a highly positive effect with minimal side effects, so the use of TENS in patients with LBP can be considered.

Study of 150 low back pain patients, TENS therapy results significantly reduce pain levels due to low back pain (9). Similar to research results, the sample group using TENS had a significant reduction in pain compared to interferential current (IFC) therapy (10). But the result is inversely compared with those who stated that there was no significant reduction in pain in low back pain patients who were given TENS therapy (11). It is necessary to review TENS' effect on reducing lower back pain to make each move active and productive so that they get the highest quality of life. Therefore, this study aims to review the effect of TENS on pain in LBP patients. This study will reveal how TENS affects pain in LBP patients. TENS has positive benefits in reducing pain in LBP patients, but research on TENS on LBP is still rare. So this study will provide an updated view of how TENS influences pain due to LBP.

OBJECTIVE

This review aims to determine the effect of TENS on pain in patients with Low Back Pain so that it can be an alternative non-pharmacological therapy to improve the quality of pain management with maximum benefits and minimal side effects.

METHODS

Design

The study design used in this literature is a narrative review that aims to gather information and describe the effectiveness of TENS therapy for patients with LBP from prior experimental studies that focused on the outcomes of TENS on LBP. The limitation of this study is the research period that taken too short (<1 month) to review the prior studies. The strength of this study is to assess articles based on the JBI assessment criteria to obtain better quality articles. In searching literature using criteria such as year and language, the results of the reviews are in the form of descriptive summaries.

Databases

This narrative review was conducted following PRISMA guidelines. This study uses three databases, PubMed, CINAHL, and Science Direct, published in the last five years. The author worked several research processes to find relevant articles regarding the effect of Transcutaneous Electrical Nerve Stimulation (TENS) therapy on pain in patients with low back pain.

Search strategy

During the search process, the writer used several keywords such as: "Low Back Pain," OR "Lumbar Pain," OR "Lumbar Spine Pain," OR "Non-Specific Low Back Pain," OR "Chronic Low Back Pain," AND "Transcutaneous Electrical Nerve Stimulation" OR "TENS" OR "Stimulation, Transcutaneous

Electric" OR "Transcutaneous Electrical Stimulation" OR "Stimulation, Transcutaneous Electrical" AND "Pain" OR "Level of Pain" OR "Pain Management" OR "Pain Relief" OR "Pain Control" OR " Pain Reduction" OR "Managing Pain."

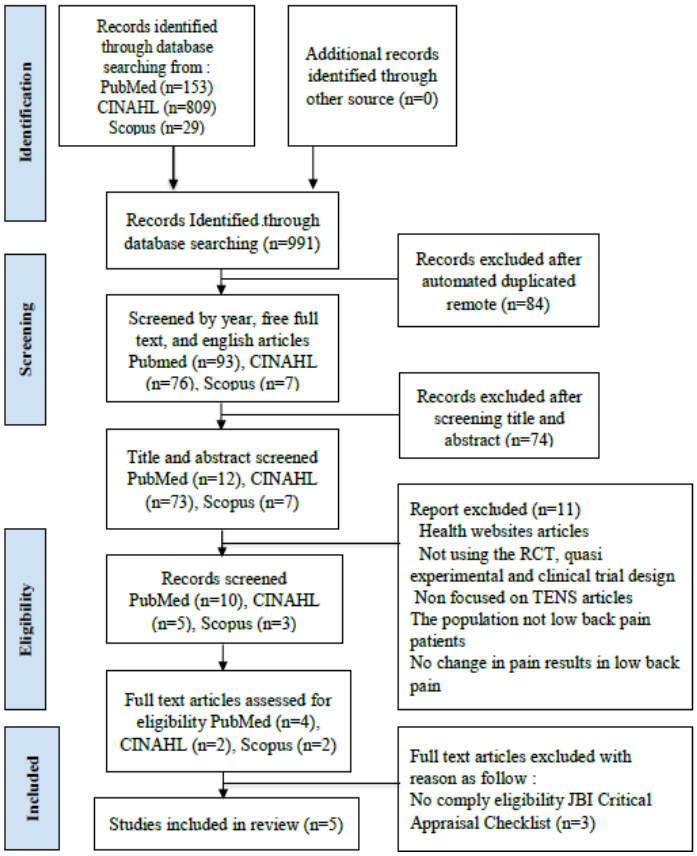
Eligibility of study

We screened full-text articles that met the inclusion and exclusion criteria. The study, which is included in this systematic review, meets the following criteria: (1) the type of research is RCT, quasi-experimental and clinical trial, (2) patients with low back pain, and (3) an intervention involving TENS. Articles published in the last five years, namely from 2017- 2018, in full text, in English, and meet the criteria of The Joanna Briggs Institute (JBI) Critical Appraisal.

Study Selection The author has completed the study of the selection process using the PRISMA 2020 diagram method. The results of the journal selection using keywords, validated against inclusion criteria and titles, are evaluated by JBI for appropriateness and appropriate journal content.

Data extraction

Data Extraction and analysis Data extraction is done manually on the articles that have been obtained. The primary data obtained were the author, the year of the study, the research design, the sample's characteristics, the intervention is given, and the study's results. The PRISMA diagram illustrates the process of selecting articles based on the title, and content of the article, according to the inclusion criteria, and so four articles were obtained. Journal eligibility was assessed using the Joanna Briggs Institute Critical Appraisal. There are 13 assessment items for RCTs. The synthesis of the results of the data is shown in table 1.0. A journal is said to be eligible when it meets >70% of the assessment.



(Figure 1. Feasibility and Inclusion Assessment Flowchart)

RESULTS

Based on the findings, five articles were selected based on established criteria to review the effect of transcutaneous electrical nervous stimulation (TENS) on pain in patients with low back pain. Of the four articles published in Belgium, Brazil, Iran, and Pakistan. Articles were quantitative and released in 2017-2022. This study had 319 participants.

(Tabel 1. Assessment of The Quality of The Literature Reviewed)

Author, Year	Design Study	JBI Critical Appraisal Checklist (The Joanna Briggs Institute, 2017) %	Literature Quality Assessment
Zerish et al. (2017)	RCT	100%	Feasible
Leemans et al., (2021)	RCT	92,3%	Feasible
Pivovarsky et al., (2021)	RCT	100%	Feasible
Jalalvandi et al., (2022)	RCT	84,6%	Feasible
Dias et al. (2021)	RCT	84,6%	Feasible

This article reviews the effect of transcutaneous electrical nerve stimulation (TENS) on pain in low back pain patients. This article is reviewed with several themes that will compare the effect of TENS therapy with other comparison therapies on the quality of pain due to low back pain.

Theme 1: TWO Models of TENS

A study analyzed the effect of TENS therapy on low back pain with two different models, namely conventional TENS and burst TENS (9). Conventional TENS is administered using continuous stimulation (biphasic, rectangular, symmetrical, and balanced waveforms) at high frequency (100 Hz) with pulse duration (100μs) and sensory intensity. TENS burst is performed with a 100 Hz frequency stimulation modulated at 2 Hz (burst mode) and a pulse duration of 100 s with a motor level intensity. After 30 minutes of therapy, the results showed that both models could reduce pain in low back pain patients. However, compared to percentage, conventional TENS can relieve pain better than burst TENS, namely 57.4% and 48.9%, respectively.

Theme 2: TENS VS Back Exercise

In two studies, transcutaneous electrical nerve stimulation (TENS) was compared with back therapy (10,11). In the other study, TENS was administered for 15 minutes with the Trio 300 ITO dual-channel burst TENS model, frequency 100 Hz, duration 0.2 ms, and intensity increased within 15 mA (10). The results showed that both treatment groups experienced a decrease in pain scores. However, the results show that TENS therapy has a more positive effect on reducing pain scores than back therapy, with an average value of 16,18. In addition, TENS has better results than back therapy in terms of the ability to rehabilitate the shape of the back. The same intervention was carried out (11) with a different TENS setting, with a dose of 190 ms and a frequency of 45 Hz with a burst TENS model for 20 minutes. The results obtained a better pain reduction score than back therapy, with an average value of 19,3. Although TENS has better pain reduction outcomes, TENS is believed to have only short-term or temporary effects.

In contrast, back exercises have long-term effects and will repair damaged structures (12). TENS and back exercises effectively reduce pain, depending on the intensity and duration of the training. Combining the two will have a more optimal effect.

Theme 3: TENS combined with Heat Therapy

TENS settings are performed with a frequency of 0,7 to 108 Hz and a pulse width of 100 s for 30 minutes. Intensity levels are instructed as high as tolerated (13). The maximum results were obtained when combining the two with an average pain reduction score of 6,2 for the control group and 5,5 for the intervention group.

Theme 4: TENS and Interferential Current (IFC)

Another study (14) analyzed the effect of TENS therapy and interferential current (IFC) and found that GI2KHz/100Hz, GI2KHz/2Hz, GI4KHz/100HZ, GI4KHz/2HZ, placebo interferential group (GIP), GT100Hz, GT2Hz, placebo TENS group (GTP). The result of the study is both TENS and IFC were influential in the immediate reduction of chronic low back pain, especially the IFC with the carrier frequency parameters of 4 KHz and amplitude-modulation frequency (AMF) of 100Hz.

Discussion

Based on the results of a review of five articles, the Transcutaneous Electrical Nerve Stimulation (TENS) intervention has a positive effect in reducing pain in patients with low back pain. This intervention is widely used as adjunctive therapy in managing LBP (15). TENS is an electrical nerve stimulation therapy carried out through the skin (16). TENS refers to a portable device that produces a pulsed electric current sent across the surface of intact skin via conduction electrodes to stimulate peripheral nerves (17).

TENS affects the quality of pain in patients with low back pain because TENS will activate inhibitory interneurons in the spinal cord so that the rate of neuronal firing is reduced. TENS affects the quality of pain in patients with low back pain because TENS will activate inhibitory interneurons in the spinal cord, so the rate of neuron firing is reduced.

TENS will close the neural gates to pain input, which blocks nociceptive impulses from passing through the central nervous system (15). TENS triggers a complex neural network that activates the descending inhibitory system, reducing hyperalgesia (13). His therapy controls pain in people with various acute and chronic conditions (18).

The use of TENS is based on several interrelated theories regarding the mechanism of pain transmission and its inhibition mechanism. The first theory is the gate control theory, the second relates to the endogenous release of morphine-like substances (endorphins) after electrical stimulation, and the second relates to automatic and involuntary muscle contractions (16). TENS is postulated to "close the gate" and dampen pain perception.

Several TENS applications differ in the frequency, amplitude, pulse width, and waveform used in clinical practice (19). Among the five types of TENS, there are conventional and burst TENS. The difference between the two types is in conventional or high-frequency TENS with a frequency of more than 80 Hz and a pulse width of less than 150 sec with low intensity. At the same time, TENS Burst uses high-frequency pulses sent at a low frequency (less than 10 Hz) and high enough intensity to activate the motor fibers and primary sensory afferents (19). This is also found in the research of Gibson (18) that low-frequency TENS is often used at higher intensities, causing muscle contraction. In contrast, high-frequency TENS has traditionally been used at lower intensities.

Conventional TENS reduces pain by selectively activating large-diameter non-noxious afferents (A-beta) to reduce nociceptor cell activity and sensitization at the segmental level in the central nervous system (17). Conventional TENS is used in the dermatology of pain relief and hypoalgesia. Meanwhile, Burst TENS mode is used for vascular resistance pain. Burst TENS mode is used for vascular resistance pain. The risks and benefits of this treatment vary. Acute and chronic LBP require separate consideration because they may respond differently to the same intervention.

There is no universal consensus regarding the efficacy of TENS in managing pain. However, several studies have found a positive impact on patients with a low risk of complications/side effects (9). Our study found that TENS had a positive impact on reducing pain intensity as well as creating an additive effect in repeated treatments. TENS is effective for short-term joint sensory and motivational implications but is not exclusively efficient in treating non-specific low back pain (11). Another study stated that no difference in the results of the Numeric Pain Rating Scale (NPRS) was identified between the TENS groups, so Conventional and Burst TENS modes were equally effective in providing pain relief (9). The results of another study also showed that the level of pain reduction in the exercise plus TENS group was significantly higher than in the TENS alone group (10). Therefore, TENS therapy can be a non-pharmacological intervention with non-invasive methods to reduce pain in patients with low back pain.

CONCLUSION

TENS can reduce pain in patients with low back pain. Most studies involving patients with low back pain focus on providing TENS interventions with conventional and burst models. All articles analyzed showed positive results on improving perceived pain so that TENS can be used as a non-pharmacological therapy to manage low back pain. Combination with other therapies can increase the effect of TENS on low back pain. However, the perceived short-term effects of TENS on pain reduction are still being considered. In the future, a meta-analysis of the effects of TENS on low back pain can be carried out without comparison with other methods.

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