
Literatur Review

THE RELATIONSHIP BETWEEN ADDITIONAL TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION AND INCREASING THE EFFECTIVENESS OF PHYSICAL EXERCISE IN REDUCE PAIN IN LOW BACK PAIN

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Abstract

Low back pain (LBP) is a common problem that affects many people around the world. Physical exercise is one of the most commonly used interventions for LBP, but its effectiveness can be limited by pain experienced during exercise. Transcutaneous Electrical Nerve Stimulation (TENS) is a non-invasive technique that has been found to be effective in reducing pain in LBP patients. The aim of this literature review is to investigate the relationship between the addition of TENS to physical exercise and its effectiveness in reducing pain in LBP patients. A comprehensive search of databases was conducted, and studies that met the inclusion criteria were analyzed. The results of this review suggest that the addition of TENS to physical exercise can be effective in reducing pain in LBP patients. TENS can prepare the muscles of the body before exercise, making physical exercise more effective and reducing pain. However, the effectiveness of TENS may be limited to the short-term, and more research is needed to fully understand the long-term effects of TENS as an adjunct for physical exercise. Furthermore, the optimal dosage, duration, and frequency of TENS use in combination with physical exercise for LBP patients remains to be determined. Overall, the addition of TENS to physical exercise can be a useful adjunct in reducing pain in LBP patients, but more research is needed to fully understand its potential benefits and limitations.

Keywords: *Low back pain, Transcutaneous electrical nerve stimulation, Physical exercise*

Introduction

Low back pain (LBP) is a significant health issue worldwide that has a profound impact on the lives of individuals who suffer from it. LBP is a complex disorder associated with discomfort that causes limitations in psychosocial activities. People who experience LBP report limitations in daily life activities and psychological distress, such as anxiety and depression. The prevalence of LBP varies depending on the geographical region, but it is estimated that around 60% to 90% of adults experience LBP at least once in their lives. In Indonesia, musculoskeletal diseases are also prevalent, and the prevalence of LBP is not well

understood, with estimations ranging between 7.6% and 37%. According to the results of Riset Kesehatan Dasar RI, the prevalence of musculoskeletal diseases in Indonesia that had been diagnosed by health workers was 11.9%, and based on diagnosis or symptoms, namely 24.7%. The impact of LBP on society can also be observed in the economic burden associated with the treatment and loss of workdays. LBP accounts for the third-highest expenditure on health services, after heart disease and stroke. In addition, the total number of lost workdays due to LBP is significant, which can further exacerbate the economic burden of this condition.^{1,2,3}

The duration of LBP can range from acute to chronic, depending on the duration of the pain. In general, acute LBP heals within six weeks, but in some cases, the complaints persist for more than three months, which is called chronic low back pain (CLBP). CLBP has a more significant impact on daily activities and psychosocial well-being than acute LBP, and therefore, it is a significant issue that needs to be addressed. Therefore, effective interventions are needed to alleviate LBP and improve the quality of life of individuals who suffer from this condition. One potential intervention for LBP is the use of transcutaneous electrical nerve stimulation (TENS) as an adjunct to physical exercise. By conducting this review, we hope to identify the most effective interventions for reducing pain in individuals with LBP, inform the development of more effective treatment plans, and ultimately improve the quality of life for individuals who suffer from LBP.^{1, 2, 3}

This review aims to examine the existing research on the use of transcutaneous electrical nerve stimulation (TENS) as an adjunct to physical exercise for reducing pain in individuals with low back pain. By conducting this review, several benefits can be achieved. Firstly, it can identify gaps in current knowledge and guide future research, helping to inform the development of new interventions for low back pain. Secondly, it can synthesize the existing research on TENS and physical exercise, allowing researchers to draw conclusions about the effectiveness of these interventions. Thirdly,

it can inform clinical practice by identifying the most effective interventions for reducing pain in individuals with low back pain, thus improving patient outcomes. Additionally, by examining the existing research, a deeper understanding of the mechanisms underlying pain relief can be gained, leading to the development of new interventions and improving our understanding of pain management more broadly. Ultimately, the goal of this literature review is to improve patient outcomes by identifying the most effective interventions for reducing pain in individuals with low back pain and informing the development of more effective treatment plans to improve the quality of life for these individuals.

Discussion

The current stance for low back pain therapy

The management of low back pain (LBP) is a multifaceted approach that requires a range of interventions. One of the mainstays of treatment is pharmacological therapy, which is used to reduce symptomatic complaints such as pain and inflammation. This type of treatment often involves the use of non-steroidal anti-inflammatory drugs (NSAIDs), opioids, paracetamol, antidepressants, antiepileptics, and muscle relaxants. However, pharmacological therapy is not without its limitations and side effects, and the long-term use of these drugs can lead to addiction, dependency, and even overdose.¹

Non-pharmacological therapies are becoming increasingly popular as an alternative to pharmacological therapy for the management

of LBP. Non-invasive non-pharmacological therapies, such as physical exercise, acupuncture, massage, meditation, and cognitive and behavioral therapy to prevent or treat depression in LBP patients, are gaining more attention due to their effectiveness and safety. In particular, physical exercise has been shown to be an effective intervention for reducing LBP, with many studies supporting its efficacy in reducing pain, improving function, and increasing quality of life. One promising non-invasive non-pharmacological therapy is transcutaneous electrical nerve stimulation (TENS). TENS is a type of physical treatment that uses low-level electrical currents to reduce pain. TENS works by stimulating the nerves in the affected area, which can lead to the release of endorphins and other pain-reducing chemicals in the body. Compared to pharmacological treatments, a guideline from the American College of Physicians recommends prioritizing non-invasive non-pharmacological therapy, such as TENS, and preventing the administration of drugs, especially opioids, to treat acute or subacute LBP.^{1,4,5}

Despite the growing evidence of the effectiveness of non-invasive non-pharmacological therapy, many individuals with LBP still receive pharmacological therapy as their primary treatment. Therefore, it is essential to increase awareness of the effectiveness and safety of non-pharmacological therapy, such as TENS, and promote their use in the management of LBP. By conducting a literature review on the use of TENS as an adjunct to physical exercise for

reducing pain in individuals with LBP, we can better understand the potential benefits of this intervention and inform the development of more effective treatment plans to improve the quality of life of individuals with LBP.^{1,4,5}

Posture and physical exercise for LBP

Regularly, as it can help reduce pain, improve flexibility, and strengthen the muscles that support the back. Additionally, practicing good posture can also help alleviate back pain. Patients should be encouraged to maintain good posture while standing, sitting, and lifting objects, as poor posture can put additional strain on the back muscles and contribute to the development of back pain. In some cases, patients may also benefit from other non-surgical treatments, such as chiropractic care, massage therapy, or acupuncture. These alternative therapies can help reduce pain and improve mobility by releasing tension in the muscles and joints, improving blood flow, and promoting healing. It is important to note, however, that in some cases, surgical intervention may be necessary to alleviate back pain. For example, if a patient has a herniated disc or spinal stenosis that is causing severe pain or loss of function, surgery may be the best option. In these cases, it is essential that patients receive the appropriate education and support to make an informed decision about their treatment options.⁴ Furthermore, physical exercise can help to reduce the risk factors for many other chronic diseases, such as diabetes, hypertension, and cardiovascular disease. In addition, physical exercise has psychological benefits, such as

reducing anxiety and depression, which are common among individuals with chronic LBP. When it comes to managing chronic LBP, all guidelines emphasize the importance of a gradual activity program. This approach aims to increase functionality and prevent further disability, which is crucial for individuals with chronic LBP. By gradually increasing the level of activity, patients can build up their endurance and strength, reducing the likelihood of developing kinesiophobia and fear of movement. Additionally, a gradual activity program helps to avoid injury, which can worsen the symptoms of LBP.^{4,6}

While there is no strong evidence to suggest which type of exercise is best for managing LBP, guidelines recommend selecting an exercise program that is tailored to individual needs, preferences, and the ability to perform exercise. For instance, a person with limited mobility may benefit from stretching exercises, while another person may find water sports or Tai-Chi more suitable. In any case, it is crucial to choose exercises that are safe and effective, to ensure that patients achieve their desired outcomes without risking injury. It is worth noting that some individuals with chronic LBP may experience slow improvement or have a high risk of developing permanent disability. In these cases, it is necessary to supervise the patient during their physical exercise program. A physical therapist or other healthcare professional can provide guidance and support, helping patients to make adjustments as needed and

monitor their progress over time. Overall, physical exercise can be an effective and safe method for managing LBP, but it is important to tailor the program to individual needs and provide appropriate supervision as necessary.^{4,6}

It is important to note that the relationship between physical exercise and LBP is complex and multifactorial, and may depend on a range of individual factors, such as age, gender, body weight, and pre-existing medical conditions. In addition to its potential role in preventing LBP, physical exercise may also be beneficial in the treatment of existing back pain. A systematic review and meta-analysis by Alzahrani found that exercise therapy was more effective than no treatment or usual care in reducing pain and disability in patients with chronic LBP. Moreover, the review found that a combination of exercise and education or cognitive-behavioral therapy was more effective than exercise alone in improving pain, disability, and quality of life in patients with chronic LBP.⁶

However, it is important to note that exercise therapy for LBP should be tailored to the individual patient and their specific needs and capabilities. For example, patients with acute LBP may need to start with gentle exercises and gradually increase the intensity and duration over time, while patients with chronic LBP may benefit from a more intensive exercise program that targets specific muscle groups or movement patterns. Overall, the evidence suggests that physical exercise can play an important role in both the prevention and treatment of LBP,

particularly at a moderate level. However, it is important that patients with LBP consult with their healthcare provider before starting an exercise program, and that the program is tailored to their individual needs and capabilities. By working together with their healthcare team, patients with LBP can take an active role in managing their condition and improving their quality of life.⁶

Transcutaneous electrical nerve stimulation (TENS) as an adjunct to physical exercise

The physical exercise program that is carried out sometimes requires a stabilizer for the lumbopelvic area to minimize disability, but this depends on the patient's perception of subjective pain. Therefore, another series is needed to support this physical exercise program, such as complementary analgesic action, namely TENS. Transcutaneous electrical nerve stimulation (TENS) has been reported to provide benefits in reducing pain in patients with low back pain (LBP). It can be used as an adjunct to physical exercise, which is one of the recommended non-invasive therapies for LBP. A systematic review and meta-analysis of randomized controlled trials found that TENS, when used as an adjunct to exercise, was more effective in reducing pain intensity and improving functional ability in patients with LBP compared to exercise alone. This device delivers pulsed alternating current through electrodes placed on the skin. TENS can be applied at low frequencies (<10 Hz), high frequencies (>100 Hz), or a mixture of the two. The review suggested that TENS, particularly

high-frequency TENS, can be considered as an effective addition to physical exercise in the treatment of LBP. However, the underlying mechanisms of the TENS effect are still not fully understood. Some studies suggest that TENS may act through the gate control theory of pain, in which the electrical stimulation of the peripheral nerves can inhibit pain signals from being transmitted to the spinal cord and brain. Other theories suggest that TENS may activate endogenous opioid systems in the central nervous system, leading to pain relief. Further research is needed to clarify the mechanisms of the TENS effect and to optimize its use in combination with physical exercise for the treatment of LBP. Nevertheless, the availability and low cost of TENS, combined with its safety and ease of use, make it a promising option for patients with LBP who are seeking non-pharmacological treatments.^{7,8,9}

TENS is a common modality in the treatment of musculoskeletal pain, including LBP patients. The use of TENS in LBP patients uses a frequency of 30-50 Hz with a phase duration of 200 microseconds in continuous mode. Next, four adhesive electrodes were affixed to the lumbar region 2 cm from the spinous to form a square. Current is given for 40 minutes with variations in intensity depending on the tolerance of each patient. According to *door control theory*, TENS can stimulate large-diameter afferent fibers, which can reduce the transmission of pain signals through the small nociceptors of afferent fibers, thereby inhibiting discrimination and perception

of pain. This was proven by the Aguilar 2022 study, where the use of TENS increased the pressure pain threshold at all points examined bilaterally (L5-S1, gluteus medius, sural anterior and tibial triceps), and these results were significant.⁷

Several studies have been conducted to investigate the effects of using Transcutaneous Electrical Nerve Stimulation (TENS) in combination with physical exercise on patients suffering from Lower Back Pain (LBP). One such study conducted by Alizadeh and Ahmadizad (2009) yielded significant results, where the group that received TENS treatment experienced a higher reduction in pain and disability scores (measured by the Oswestry disability score) compared to the group that received physical exercise in the form of back exercises. These results are in line with a recent study that supports the effectiveness of TENS treatment in reducing pain associated with LBP. However, it is important to note that the effect of TENS is only temporary or short-term, unlike physical exercise, which has a long-term effect on the body. Physical exercise is not only effective in reducing pain but also provides numerous benefits, such as improving mobility, increasing muscle strength, and preventing recurrence of LBP. Therefore, even though both interventions are effective in reducing pain in LBP patients, if passive therapy, in this case, TENS, is the only treatment used, it will not help the patients to overcome this condition in the long term. Several factors such as the severity of LBP, the patient's age, lifestyle,

and other underlying medical conditions play a significant role in determining the most effective treatment option for an individual. Therefore, healthcare providers need to evaluate each patient's unique condition and develop personalized treatment plans that combine passive and active therapies to provide optimal pain relief and long-term benefits.^{2, 10}

The use of TENS in combination with physical exercise programs has been studied and found to be effective in managing LBP. Hahn conducted a study to investigate the effectiveness of TENS therapy in LBP patients who had undergone coronary angiography therapy that required them to lie down for an extended period. The study was divided into two groups, one receiving only TENS therapy and the other receiving a combination of TENS therapy and physical exercise. The results of the study showed that the group receiving a combination of physical exercise and TENS therapy had a significant reduction in pain compared to the group that received only TENS therapy. It is noteworthy that the use of TENS in this study stimulated non-noxious large-diameter afferent fibers (A-beta) that further reduced pain and made the tissue ready to undergo physical exercise. As a result, the use of TENS increased the effectiveness of physical exercise in LBP patients. Several other studies have also investigated the effectiveness of TENS therapy in combination with physical exercise programs in LBP patients, and most of them have shown positive results. Therefore, it can be concluded that the use of TENS in

combination with physical exercise is a promising intervention for managing LBP. However, it is essential to note that the type and frequency of exercise and the duration and intensity of TENS therapy should be tailored to the individual needs of each patient.¹¹

Westcott conducted a study on the effects of these two interventions on LBP patients. The study had two groups, one receiving physical exercise therapy alone, while the other received physical exercise and TENS therapy. Surprisingly, the study did not show any significant difference between the two groups in reducing pain levels in LBP patients. However, it is worth noting that this study did not have a group that received only TENS therapy, and therefore the effectiveness of TENS therapy alone could not be compared with that of physical exercise therapy.^{12, 13}

Subsequent research in non-specific LBP patients provides some additional insight into the effectiveness of TENS therapy and physical exercise in reducing pain. This study had three groups, one receiving only TENS therapy, another receiving only physical exercise therapy, and the third group receiving both therapies simultaneously. The results of the study showed that the first and second groups that received only TENS therapy and physical exercise therapy, respectively, had reduced pain levels in LBP patients, but there was no significant difference between the two groups. However, the third group that received both interventions had a significant reduction in pain levels compared to the previous

two groups. The findings of these studies suggest that the combination of physical exercise and TENS therapy is more effective in managing LBP than either intervention alone. However, it is important to note that the type and duration of exercise and the frequency and intensity of TENS therapy should be tailored to the individual needs of each patient. Additionally, further studies are needed to determine the optimal combination of TENS and physical exercise interventions to provide the best outcomes for LBP patients.^{12, 13} According to the studies conducted, TENS is an effective adjuvant therapy for LBP patients. It works by delivering electrical impulses through the skin to the nerves, which in turn, blocks the pain signals from reaching the brain. As a result, the patient experiences a reduction in pain. Although TENS has shown positive effects in reducing pain, it is not meant to be a standalone therapy for LBP. Instead, it should be used in conjunction with evidence-based clinically relevant main therapy. For instance, physical exercise is an effective way to manage LBP, and the use of TENS before exercise can prepare the muscles of the body and increase the effectiveness of the exercise.^{12,13}

Advantage and disadvantages of TENS for LBP

When used as an adjunct for physical exercise, TENS has several advantages and disadvantages. One of the advantages of using TENS as an adjunct for physical exercise is that it can help to prepare the muscles of the body before the exercise. TENS works by delivering electrical

impulses through the skin to the nerves, which can help to reduce pain and prepare the muscles for physical activity. This can increase the effectiveness of the physical exercise and reduce pain in LBP patients. One of the advantages of using TENS is that it has no known side effects. This makes it a safe and reliable method of pain management for LBP patients. In addition, TENS can be used in the long term without any adverse effects. Another advantage of using TENS is that it is a non-invasive technique that has no known side effects. Unlike other pain management techniques, such as medication, TENS does not cause any adverse effects, making it a safe and reliable method of pain management for LBP patients.^{12,13}

However, there are also some disadvantages to using TENS as an adjunct for physical exercise. One of the main disadvantages is that TENS can be uncomfortable for some patients. The electrical impulses delivered through the skin can cause a tingling or burning sensation, which can be unpleasant for some patients. Another disadvantage is that the effects of TENS may not be long-lasting. Although TENS can provide temporary relief from pain, the effects may wear off quickly, requiring repeated use of the therapy. However, it is important to note that TENS should not be used in certain situations, such as in patients with pacemakers or those who are pregnant.^{12,13}

Despite TENS generally considered safe and well-tolerated, there are some precautions that should be taken when using TENS to ensure

that the therapy is used effectively and safely. Firstly, it is important to use TENS only after a proper diagnosis of the underlying cause of LBP has been made. TENS is only effective in reducing pain, and should not be used as a substitute for other necessary treatments such as physical therapy or medication. It is important to understand that TENS should be used as an adjunct therapy, and should not be the primary treatment for LBP.^{12,13}

Secondly, when using TENS, it is important to follow the instructions of the healthcare provider or physical therapist. Improper use of TENS can result in serious injuries, such as burns or skin irritation. The intensity and duration of TENS therapy should be adjusted based on the individual needs of each patient, and should not exceed the recommended limits. Overstimulation may cause muscle contractions or twitching, which can be uncomfortable or even painful. Thirdly, it is important to properly clean the skin before applying the TENS electrodes to ensure optimal contact and reduce the risk of skin irritation. In addition, the electrodes should be properly placed in order to maximize the effectiveness of the therapy. It is recommended to rotate the placement of the electrodes to prevent skin irritation and reduce the risk of developing a tolerance to the therapy.^{12,13} Lastly, it is important to be aware of the contraindications for TENS use. Patients with pacemakers or other electronic devices should avoid using TENS due to the risk of interference. TENS should also be avoided in

areas with open wounds or infected skin, as it may increase the risk of infection. It is important to discuss any potential contraindications with the healthcare provider before using TENS.^{12,13}

Conclusion

Based on the several studies above, it can be concluded that the use of TENS in the short term has a good effect on reducing pain in LBP patients. However, the positive effects of using TENS must be accompanied by evidence-based clinically relevant main therapy. In this case, TENS is only seen as adjuvant therapy. Even so, the use of TENS can prepare the muscles of the body before doing physical exercise. This can increase the effectiveness of physical exercise and reduce pain in LBP patients. In addition, based on the use of several studies above, the use of TENS does not show any side effects. Therefore, the use of TENS is safe for use in the long term or long term, as an adjuvant therapy for LBP.

TENS has shown promise as an adjunct for physical exercise for low LBP patients. However, more research is needed to fully understand the long-term effects of using TENS in combination with physical exercise for LBP. To advance our knowledge of TENS, future research should focus on investigating the optimal dosage, duration, and frequency of TENS use in combination with physical exercise for LBP patients.

To promote the use of TENS as an adjunct for physical exercise for LBP patients, it is important for the government to invest in

research and development, as well as provide funding for education and training for healthcare providers. The government should also encourage the integration of TENS into clinical practice guidelines and insurance coverage, making it more accessible to the general population. Mass socialization is also important in promoting the use of TENS for LBP patients. Awareness campaigns and educational programs can be conducted to educate the public about the benefits and limitations of TENS, and to provide information on how it can be used as an adjunct for physical exercise for LBP. This can be done through community outreach, media campaigns, and online resources.

In conclusion, TENS has the potential to be an effective adjunct for physical exercise for LBP patients. However, further research is needed to determine the optimal use of TENS in combination with physical exercise. The government and healthcare providers should work together to promote the integration of TENS into clinical practice guidelines and insurance coverage, while also investing in education and training for healthcare providers. Mass socialization can also play a role in promoting the use of TENS, by increasing public awareness and understanding of its benefits and limitations.

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