

Evaluating the Efficacy of TENS and Postural Training for Mechanical Low Back Pain in Pregnant Women

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Abstract: Background: Mechanical low back pain (LBP) is a common and debilitating condition that affects a large number of pregnant women, especially during the second trimester. It is primarily caused by physiological and biomechanical changes such as increased lumbar lordosis, ligament laxity, and postural shifts. Given the limitations on pharmacological treatments and diagnostic imaging during pregnancy, non - invasive interventions like Transcutaneous Electrical Nerve Stimulation (TENS) and postural education are gaining popularity. Objective: This study aimed to assess the effectiveness of combining TENS therapy with postural education in alleviating mechanical low back pain among pregnant women. Methodology: A quasi - experimental study was conducted involving 15 pregnant women aged 24 to 30 years, all in their second trimester and diagnosed with mechanical LBP. Participants received daily TENS therapy using the quadripolar technique at 100 Hz for 15 minutes, alongside a structured postural education program, over a 15 - day period. Pain levels were assessed before and after the intervention using the Visual Analogue Scale (VAS). Results: Paired t - test analysis showed a statistically significant reduction in pain levels following the intervention ($t = 10.61$, $t_{critical} = 2.145$, $p < 0.001$), indicating the effectiveness of the combined treatment approach. Conclusion: The combination of Transcutaneous Electrical Nerve Stimulation and postural education significantly reduces mechanical low back pain in pregnant women. This conservative treatment strategy provides a safe and effective alternative to medication, enhancing physiotherapy care during pregnancy.

Keywords: Transcutaneous Electrical Nerve Stimulation (TENS), postural education, pregnancy, mechanical low back pain, physiotherapy, conservative treatment.

1. Introduction

Low back pain (LBP) is a common complaint among pregnant women, with approximately half experiencing it during pregnancy.¹ This discomfort, which is usually musculoskeletal, often presents in the lower lumbar region and may radiate to the buttocks or thighs. The causes are multifactorial, including anatomical, hormonal, and biomechanical changes that occur during pregnancy.²

Adaptations such as increased lumbar lordosis from forward weight shift, weakened abdominal muscles, and hormone - induced ligament laxity contribute to spinal instability and mechanical strain.³ Diagnostic imaging during pregnancy is restricted due to fetal safety concerns, particularly with ionizing radiation.⁴ MRI is preferred when imaging is necessary, but most diagnoses rely on clinical evaluation.

Given the limitations on pharmacological treatments and diagnostics, conservative interventions are prioritized. Physical therapy, postural correction, and non - invasive modalities like TENS are commonly used.⁵ TENS delivers low - level electrical stimulation to reduce pain perception through mechanisms such as gate control theory and endogenous opioid release.⁶

Another essential intervention is postural education, which trains pregnant women in ergonomic practices for standing, sitting, and sleeping.⁷ This educational approach improves posture, reduces spinal load, and enhances overall comfort. This study evaluates the combined efficacy of TENS and postural education in reducing mechanical low back pain during pregnancy.

Objective of the study

To evaluate the effectiveness of TENS combined with structured postural education in reducing the intensity of mechanical low back pain among pregnant women during their second trimester.

2. Methodology

This quasi - experimental study was carried out in the Department of Physiotherapy, Prudence College Of Physiotherapy, Bengaluru. A total of 15 pregnant women, aged between 24 and 30 years, in their second trimester and diagnosed with mechanical low back pain, were selected using simple random sampling. Inclusion criteria were limited to primigravida women with no medical or obstetric complications.

Informed consent was obtained from all participants prior to the study. Baseline pain levels were assessed using the VAS, a widely recognized and reliable tool for measuring pain intensity.

The intervention lasted 15 days and included daily sessions of TENS therapy, applied in a side - lying position at a frequency of 100 Hz for 15 minutes. Additionally, participants received structured postural education focusing on proper ergonomic practices for standing, sitting, and sleeping. Pain intensity was reassessed at the end of the intervention using the same VAS protocol.

Study Variables:

- **Independent Variables:** TENS therapy and postural education
- **Dependent Variable:** Pain intensity

Hypothesis

Null Hypothesis (H_0):

There is no statistically significant change in the intensity

of mechanical low back pain in pregnant women before and after the administration of Transcutaneous Electrical Nerve Stimulation (TENS) combined with postural education.

Alternative Hypothesis (H_1):

There is a statistically significant reduction in the intensity of mechanical low back pain in pregnant women following the administration of Transcutaneous Electrical Nerve Stimulation (TENS) combined with postural education

3. Result Analysis

Data were analyzed using a paired 't' test. The calculated 't' value was 10.61, exceeding the critical value of 2.145 at the 5% significance level, indicating a statistically significant reduction in pain following the intervention.

The line chart below displays individual pain scores for each participant before and after the intervention

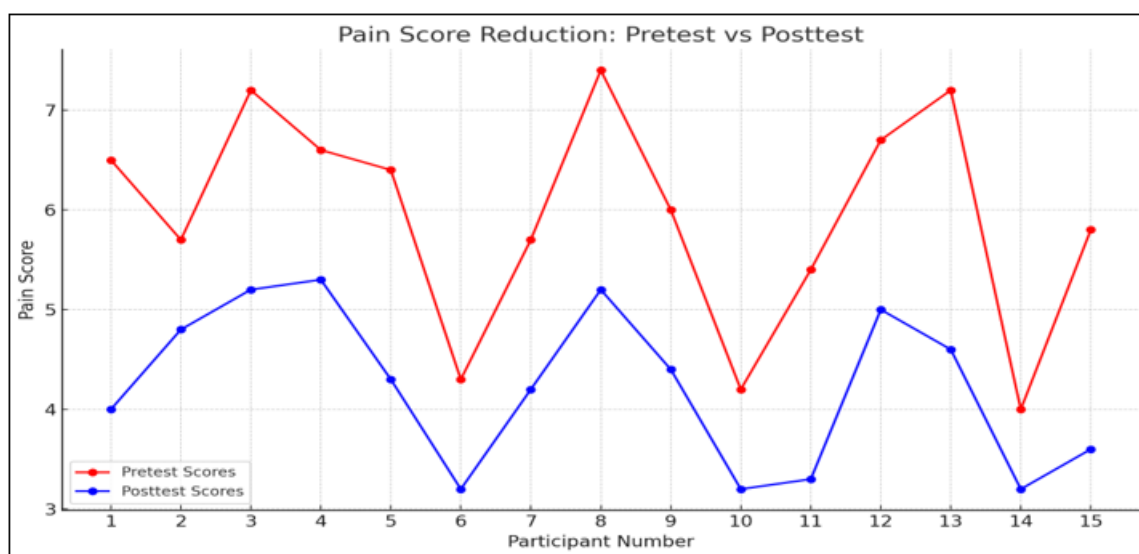


Figure 1: Pre test and Post test Pain Scores

Data obtained from the pre - and post - intervention pain assessments were subjected to **paired t - test analysis** to determine the effectiveness of the combined TENS and postural education intervention.

The analysis yielded a **calculated t - value of 10.61**, which notably exceeds the **critical t - value of 2.145** at the 5% level of significance with 14 degrees of freedom. Correspondingly, the **p - value was found to be < 0.001**, indicating **high statistical significance**. Hence, Null hypothesis is rejected.

This result strongly suggests that the observed reduction in pain scores following the 15 - day intervention is reflects a **true therapeutic effect** of the combined Transcutaneous Electrical Nerve Stimulation and postural education approach. The intervention significantly reduced pain intensity among pregnant women experiencing mechanical low back pain

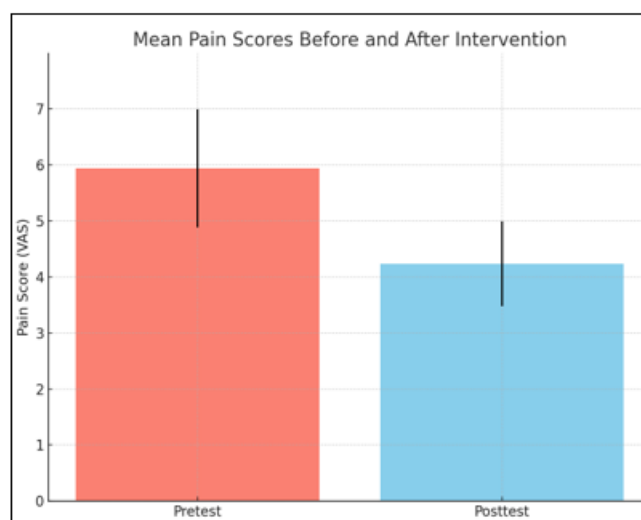


Figure 2: Mean pain scores before and after intervention

4. Discussion

The observed reduction in mechanical low back pain following the combined intervention of TENS and postural education can be explained through established neurophysiological and biomechanical principles.

TENS alleviates pain by activating peripheral sensory nerves and engaging intrinsic pain modulation systems. Depending on the stimulation parameters, two primary analgesic mechanisms are proposed: the Pain Gate Theory and the Endogenous Opioid System. High - frequency stimulation (90–130 Hz) preferentially activates A - beta ($A\beta$) fibers, which inhibit nociceptive input from C - fibers at the spinal dorsal horn, effectively "closing the gate" to ascending pain signals and reducing pain perception. Conversely, low - frequency stimulation (2–5 Hz) targets A - delta ($A\delta$) fibers, stimulating the release of endogenous opioids such as endorphins and enkephalins. These neurochemicals bind to opioid receptors within the central nervous system, offering sustained analgesia through modulation of nociceptive pathways.

In parallel, postural education addresses the biomechanical contributors to low back pain, particularly relevant during pregnancy when physiological changes—such as an anterior shift in the center of gravity, increased lumbar lordosis, and pelvic misalignment—exacerbate spinal stress. Structured postural training facilitates the adoption of neutral alignment during daily activities (e. g., sitting, standing, and sleeping), thereby improving musculoskeletal efficiency and minimizing cumulative strain.

Moreover, postural education promotes self - awareness and active patient participation, which may enhance long - term self - management and prevent recurrence. The combined application of TENS and postural education offers a synergistic benefit, with evidence suggesting that multimodal interventions yield superior outcomes. For instance, Santiestebon (1999) and Barnett & Gilleard (2013) demonstrated significant reductions in pain and functional disability among pregnant women receiving both interventions compared to either treatment alone. Similarly, Brosseau et al. (2002) and Khadilkar et al. (2005) confirmed the safety and effectiveness of TENS when integrated with postural and physical therapies. Further support comes from studies by Ferreira et al. (2006) and Lewis et al. (2005), who observed improvements in pain control and functional performance following structured postural training.

Taken together, these findings emphasize the importance of a conservative, multimodal approach in managing pregnancy - related low back pain. This strategy not only delivers symptomatic relief but also promotes functional recovery without the risks associated with pharmacological treatments.

5. Conclusion

This study concludes that the combination of Transcutaneous Electrical Nerve Stimulation (TENS) and postural education represents an effective, non - invasive intervention for the management of mechanical low back

pain during pregnancy. By addressing both neurophysiological and biomechanical factors, this integrative approach provides significant pain relief and functional improvement. Moreover, it offers a safe and practical alternative to pharmacological therapies, aligning with the need for conservative management strategies during pregnancy.

6. Limitations of the Study

Despite the encouraging outcomes, this study has several limitations that warrant consideration:

- 1) **Limited Sample Size:** The small sample of 15 participants restricts the statistical power of the study and limits the generalizability of the findings to the broader population of pregnant women experiencing mechanical low back pain.
- 2) **Absence of a Control Group:** The quasi - experimental design lacked a control group, making it difficult to attribute the observed improvements specifically to the intervention. Without comparison to a non - treated or placebo group, the influence of natural symptom progression or placebo effects cannot be ruled out.
- 3) **Short Duration of Intervention:** The 15 - day intervention period may not be sufficient to evaluate long - term benefits or the recurrence of symptoms. Chronic conditions such as mechanical low back pain often require extended follow - up to assess sustained efficacy.
- 4) **Use of a Single Subjective Outcome Measure:** Pain intensity was measured exclusively using the Visual Analogue Scale (VAS), a subjective tool influenced by individual pain tolerance, mood, and psychological state. The inclusion of objective or functional outcome measures could have provided a more comprehensive evaluation.
- 5) **Homogeneous Participant Demographics:** All participants were pregnant women in their second trimester, which limits the applicability of the findings to other stages of pregnancy, such as the first or third trimesters, where biomechanical and physiological changes may differ.
- 6) **Lack of Follow - Up Assessment:** The absence of a follow - up period after the intervention prevents evaluation of the treatment's long - term effectiveness and sustainability of pain relief.

Conflicts of Interest

The authors affirm that there are no conflicts of interest associated with the publication of this paper.

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