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Effectiveness of Tens in Pain Management During Restorative Treatment

Thekra SARDI[1] , Mohammad AMER[2] , Raghıb SURADI[3] , Aslıhan ÖZBİLGEN[4]

Abstract

Aim This study aims to evaluate the effectiveness of Transcutaneous Electrical Nerve Stimulation (TENS) in managing pain during restorative dental treatments.
Material and method A total of 45 patients aged 18 to 41 were selected for the study. Patients were divided into two groups: 30 patients received active TENS treatment, while 15 received a placebo TENS treatment. TENS was applied for 30 minutes during cavity preparations without the use of local anesthesia. Pain levels were assessed using the Visual Analog Scale (VAS) immediately after the procedure.
Results Among the active TENS group, 28 patients reported no pain during the procedure, while 2 patients experienced moderate pain. In the placebo group, pain levels ranged from 4 to 9 on the VAS. The results were analyzed using the Mann-Whitney U test, revealing a statistically significant difference in pain perception between the active TENS and placebo groups.
Conclusion The findings suggest that TENS is effective in reducing pain during restorative dental treatments. The application of TENS could serve as a viable alternative or adjunct to traditional analgesic methods, providing a non-invasive and cost-effective option for pain management in dental procedures. Further research is recommended to explore the broader applications of TENS in dentistry and its long-term efficacy.

Keywords Dentistry, Pain, Restorative, TENS, Treatment

Introduction

Pain, due to the complexity of its neurophysiology, represents one of the most critical issues that need to be addressed in medicine, particularly in dentistry (1).

The International Association for the Study of Pain defines pain as a sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage, originating from any part of the body. Tolerance to pain varies among individuals and can fluctuate within the same person depending on external factors. Pain is a sensory load that is learned through experiences and is always subjective. The conscious perception of pain appears to depend on brain activity encompassing the entire cortex. An individual interprets pain based on past experiences and exhibits a personal reaction (2).

Various methods have been employed to address the issue of pain in dentistry. Since the 1770s, electrical energy has been utilized for pain control. Transcutaneous Electrical Nerve Stimulation (TENS), which is based on the principle of transmitting electrical energy through the skin to the nervous system, has also found applications in dentistry. TENS devices use positive square monophasic currents or asymmetric biphasic currents composed of positive square and negative spike waves(3).

In this study, we aim to evaluate the effectiveness of TENS, proposed as a modern alternative to analgesics, in managing pain during cavity preparation.

Material and Methods

Our study included 45 patients, aged between 18 and 41, who visited our faculty. The selection criteria for participants ensure the homogeneity of pain responses. Inclusion criteria focus on individuals with moderate or deep caries involving the middle or inner third of dentin, vital pulps confirmed by positive responses to vitality testing, and localized pain directly attributable to the carious lesion. Teeth with intact structure and no prior restorations are preferred to preserve natural pain responses. Exclusion criteria include participants with superficial caries, signs of irreversible pulpitis, necrotic pulp, or periapical pathology, as well as systemic conditions affecting pain perception or those taking medications that could alter pain responses. By adhering to these criteria, the study minimizes variability in pain perception and allows for a more accurate assessment of TENS efficacy in managing pain associated with different severities of dentin caries. The patients were treated using TENS for anesthesia, without local anesthesia. Within the selected patient group, 30 individuals received TENS treatment, while 15 received placebo TENS.

Correspondence: Raghıb SURADI, rsuradi@biruni.edu.tr

[1] Sağlık Bilimleri University, Faculty of Medicine, Department of Anatomy, Ankara, Türkiye

[2] Arab American University, Faculty of Dentistry, Department of Restorative Dentistry, Jenin, Palestine

[3] Biruni University, Faculty of Dentistry, Department of Restorative Dentistry, Istanbul, Türkiye

[4] Private Practice, Istanbul, Türkiye

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The electrodes of the device, coated with conductive material, were placed on the trigger points corresponding to the tooth requiring filling. These points were chosen due to their high electrical conductivity and low resistance. Additionally, one electrode was placed in the "ipsilateral dorsal web" area to enhance the effect. TENS was applied for thirty minutes in this manner. Similarly, for patients receiving placebo TENS, the electrodes were positioned in the same way, with instructions to notify when contractions occurred during the application of the current. Upon the occurrence of contractions, the current was immediately stopped, and the voltage was reset to zero. Meanwhile, the device's timer was active and set for thirty minutes, signaling at the end of the period to create the impression of ongoing treatment for the patient. This procedure was applied to each patient only once.

After the procedure, patients were asked to indicate the intensity of the pain they experienced during the treatment on a Visual Analog Scale (VAS). This scale consists of a 10 cm horizontal line (4). It was explained to the patients that this line serves as a pain indicator, with the zero point representing no pain and the ten point representing the most severe pain they could endure. Patients were instructed to mark the severity of their pain on the line. The TENS used in our study generates electrical stimuli, which are transmitted to the skin via surface electrodes. The purpose of TENS is to produce electrical energy sufficient to induce depolarization in peripheral nerves. TENS devices should have at least two channels and four electrodes. A gel composed of a permeable material is applied between the electrode and the skin.

The stimulation parameters are as follows: Amplitude: 0-80 Amperes, Frequency: 1-150 Hz and Pulse Duration: 30-250 microseconds. These parameters should be adjusted to provide stimulation without causing muscle contractions in the patient.

The findings were evaluated using the Chi-Square Test, and the results were found to be statistically significant.

Results

The results of the Chi-Square Test of Independence reveal a significant association between the type of TENS group (Actual vs. Placebo) and the reported pain levels during the dental procedure ($p < 0.001$) (Table 1). Among the 30 patients in the Actual TENS group, 28 experienced no pain, and 2 reported moderate pain, with no patients reporting higher pain levels (VAS 4–9). In contrast, all 15 patients in the Placebo TENS group reported significant pain intensity within the VAS range of 4–9. The p-value indicates a highly statistically significant difference, suggesting that the Actual TENS therapy effectively reduces pain compared to the placebo.

Table 1: Intergroup comparison

Group	Number of Patients	Pain-Free (No Pain)	Moderate Pain	VAS Pain Intensity (4–9)
Actual TENS	30	28	2	0
Placebo TENS	15	0	0	15

Discussion

Recent studies on TENS have focused on whether it can provide electro-analgesia during conservative dental treatments and tooth extraction (5).

Kasat et al. reported that while TENS cannot substitute local anesthesia, it proves valuable for pain management during diverse dental procedures. Its analgesic and physiological effects can effectively contribute to managing various conditions that affect the maxillofacial region (6). Cebalo et al. demonstrated that TENS can serve as an anxiolytic and mild analgesic during various dental procedures, although it cannot completely substitute local anesthesia (7).Ottoson et al. applied 100 Hz vibration stimulation to 30 patients with dental pain, reporting 75% improvement in 16 patients and 100% improvement in 214 patients (8).

Our study was conducted with the aim of creating analgesia during restorative treatments by applying TENS and ensuring the patient does not experience pain. In this regard, the desired outcomes were achieved. Enhancing the effectiveness by placing electrodes in the dorsal web area was also ensured. Dorsal web stimulation does not alter pain thresholds but when used in conjunction with cheek stimulation, it enhances the obtained results (9).

Among patients visiting the dental clinic, factors such as hypersensitivity, pain, and fear of injections significantly influence their dental health and treatment outcomes. Additionally, the absence of unwanted side effects commonly associated with local anesthesia such as systemic toxicity, angioedema, hypotension, needle breakage, hematoma, facial nerve block, and neurological disorders opens the way for more effective applications of TENS.

Conclusion

Furthermore, it has been demonstrated that the analgesic mechanism of TENS prevents pain during cavity preparations. Consequently, despite the challenges in establishing ideal placebo conditions for TENS, its superiority, lack of significant adverse effects in use, and economic viability suggest it may enhances the effect of anesthesia and in some minor cases it can serve as an alternative to pharmacokinetic therapies.

Declarations

Author Contributions: *Conception/Design of Study- R.S.; Data Acquisition- R.S., T.S., M.A.; Data Analysis/Interpretation- R.S., T.S., M.A.; Drafting Manuscript- R.S., T.S., M.A.; Critical Revision of Manuscript- T.S.; Final Approval and Accountability- R.S., T.S.; Material and Technical Support- R.S., T.S., M.A.; Supervision- R.S.*

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