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Research Article

Effect of Transcutaneous Electric Nerve Stimulation (TENS) on Post-Operative Pain After Surgical Removal of Mandibular Third Molars: A Prospective Comparative Study

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Abstract

Background: Surgical removal of impacted mandibular third molars is frequently associated with postoperative pain, traditionally managed with analgesics. However, pharmacological methods may have adverse effects. This study investigates the efficacy of Transcutaneous Electric Nerve Stimulation (TENS) as a non-pharmacological alternative for pain relief.

Methods: A prospective comparative study was conducted on 10 patients requiring bilateral mandibular third molar extractions. Each patient served as their own control: one side was managed with standard analgesics (Group A) and the other with TENS therapy (Group B). Pain was assessed using the Visual Analog Scale (VAS) on postoperative days 1 and 3. TENS therapy involved low-intensity, high-frequency stimulation via electrodes placed on the cheek and C7 vertebral level.

Results: On day 1, mean VAS scores reduced from 8.00 to 4.50 in Group A and from 8.40 to 3.10 in Group B ($p < 0.001$). On day 3, pain scores decreased from 4.00 to 2.60 in Group A and from 3.50 to 1.70 in Group B ($p = 0.004$). TENS demonstrated a greater and statistically significant reduction in pain compared to standard treatment.

Conclusion: TENS therapy significantly reduces postoperative pain following third molar surgery. It is a safe, cost-effective adjunct that can enhance patient comfort and reduce dependency on pharmacological analgesics.

Keywords: Transcutaneous Electric Nerve Stimulation; Visual Analog Scale; Pharmacological Analgesics

Introduction

In early 1954, Mead has defined an impacted tooth as a tooth that is prevented from erupting into position because of malposition, lack of space or other impediments [1]. The impaction rate is higher for mandibular third molars when compared with other teeth and its surgical extraction is one of the most frequently performed procedures by an oral surgeon [2,3]. Surgical interventions such as disimpaction surgery can be a major cause of pain and discomfort to the patient post-operatively and thus require optimum pain management protocols [4,5]. Pain, according to the International Association for the Study of Pain (IASP), is an unpleasant and emotional experience associated with actual or potential tissue damage. Pain is a result of inflammation, the tissue response to the surgical injury and is produced by the release of chemical mediators such as histamine and bradykinin [5]. After third molar surgeries, the onset of pain is after the loss of effects of anesthesia and the pain levels peak in the first 6-12

hours post procedure [5-7]. It has been reported that pain negatively affects the quality of life of patients [6,7]. Therefore, postoperative pain control is very important for the comfort of patients. With the advent of non-pharmacological techniques for pain management, the Transcutaneous Electric Nerve Stimulation (TENS) is a non-pharmacological pain control method based on application of different frequency electrical currents via the surface electrodes placed on the skin and activates a complex neuronal network to reduce pain by activating descending inhibitory systems in the central nervous system to reduce hyperalgesia. TENS is an inexpensive, safe and easy to apply technique which can be used as an adjunct to pharmacological agents in the treatment of post operative pain [8,9]. It has been previously reported that TEN acts through central as well as peripheral mechanisms.

This study aims to evaluate the effect of TENS on the post-operative pain levels after disimpaction of mandibular third molars.

Material and Methods

This study was a prospective comparative study conducted on patients coming to the OPD of Dept of Oral and Maxillofacial surgery seeking treatment for removal of impacted mandibular third molars after getting approval from the Institutional Ethics Committee. This study was performed with 10 patients above the age of 18 years who were systemically healthy and presented with bilateral impacted mandibular third molars with a Pederson's difficulty index of 3-7. The exclusion criteria were: Patients requiring coronectomy, Immuno-compromised patients, Pregnant or lactating females and patients not willing to give informed consent. All patients were provided with detailed information about the study and consent was obtained from each participant. In this study, 20 impacted third molar surgeries were performed under local anesthesia on 10 patients. The 20 disimpaction surgeries were randomly divided as10 in each group, into Group A - Control group and Group B - Test group.

Surgical procedure - The disimpaction surgeries were performed under local anesthesia using 2% lignocaine hydrochloride with 1:2,00,000 adrenaline, following adequate elevation and reflection of the buccal mucoperiosteal flap. The extractions were carried out after adequate bone guttering done under continuous irrigation with 0.9% physiologic saline. Then, the mucoperiosteal flap was repositioned and sutured with Silk 3-0 sutures. The average operation duration was 20-25 minutes. Post procedure, Group A was prescribed antibiotic - Tablet Amoxyclav 625 mg (Amoxycillin 500 mg + Clavulanic acid 125 mg- Abbott India Limited), analgesic - Tablet Zerodol SP (Aceclofenac 100 mg + Paracetamol 325 mg + Serratiopeptidase 15 mg - IPCA Laboratories Limited). Group B patients were prescribed the TENS therapy for which they were recalled on post operative day 1 and day 3. TENS therapy procedure consisted of a low intensity and high frequency TENS signal via placement of two electrodes - One on the cheek (near the angle of mandible) on the side of disimpaction and the other on the posterior aspect of neck at vertebra C7 level (Fig. 1,2). The duration of TENS was nearly 10 minutes. Group B patients were prescribed the same medications as group A but were asked to take them only as 'Rescue medication' if pain levels don't subside after TENS therapy. All surgeries and TENS application were performed by an oral and maxillofacial surgeon (the researcher).

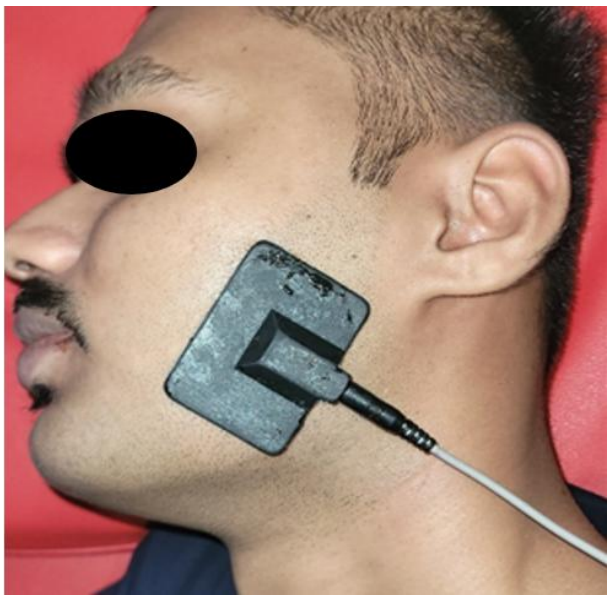

Figure 1: Placement of TENS electrode-one on the cheek (near the angle of mandible) on the side of surgical removal of tooth.

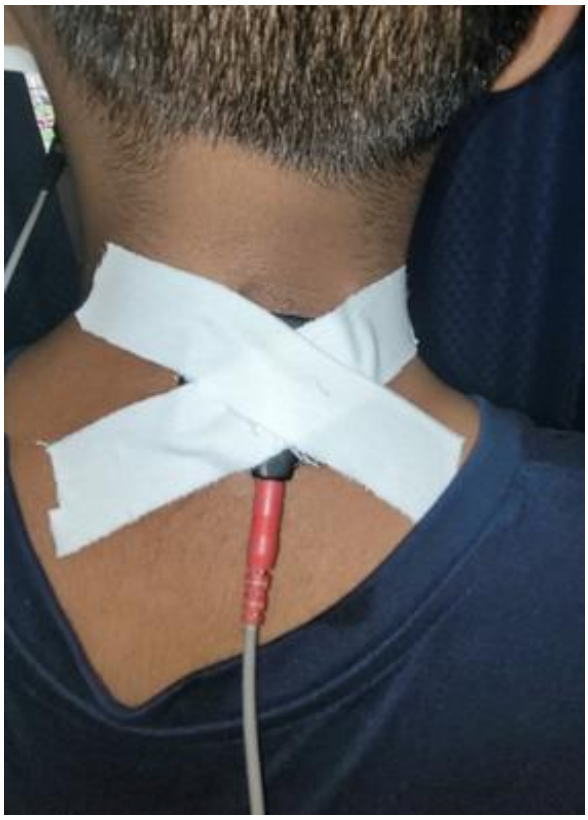

Figure 2: Placement of TENS electrode-posterior aspect of neck at vertebra C7 level.

Methods of Measurement

The parameter evaluated was pain which was measured using the Visual Analog Scale (VAS) for Pain. The pain levels were evaluated on Post operative day 1 and day 3 prior to medications for Group A and 30 minutes after medications. Whereas, for group B, the pain levels were measure before TENS therapy and immediately after TENS therapy.

The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 24.0 (IBM Corporation, Chicago, USA and data was analyzed by the Shapiro-Wilk test. The independent sample t-test and paired t-test was used to check mean differences among the groups. The t-test was calculated using three fundamental data values including the difference between the mean values from each data set, the standard deviation of each group and the number of data values. The level of significance was kept at $p<0.05$.

Results

The study was carried out in 10 patients 5 (50%) female and 5 (50%) male, aged between 18 and 32 years. There was no statistically significant difference between the sex distributions of the groups. The mean VAS score for patients prior to taking analgesics in group A was 8.00 whereas for Group B prior to undergoing TENS therapy was 8.40 on post operative day 1. On postoperative day 1, for group A, after consuming analgesics, the mean VAS score levels reduced to 4.50 whereas for group B, the VAS score levels reduced to an average of 3.10 after TENS therapy and this difference was statistically significant ($p < 0.001$).

On post operative day 3, prior to taking medications, the mean VAS score level for group A was 4.50 whereas for group B, prior to undergoing TENS therapy, it was 3.50. However, for group A the mean VAS levels after medications dropped to 2.60 and for group B, after TENS therapy, it reduced to 1.70 which was statistically significant ($p<0.004$).

The results showed that there was statistically significant difference in pain levels on post operative day 1 and day 3 in patients who had taken TENS therapy as compared to the group who were prescribed analgesics (Table 1).

Timeline	Group	N	Mean	S.D.	t-value	P-value#
VAS Score Pre-medication on POD-1	Routine	10	8	0.81	-1.177	0.255
	Tens	10	8.4	0.69		
VAS Score post-medication/post TENS on POD-1	Routine	10	4.5	0.52	4.882	**<0.001†**
	Tens	10	3.1	0.73		
VAS Score Pre-medication on POD-3	Routine	10	4	0.47	1.464	0.16
	Tens	10	3.5	0.97		
VAS Score post-medication/post TENS on POD-3	Routine	10	2.6	0.51	3.349	**0.004†**
	Tens	10	1.7	0.67		
#P-value derived from independent t-test; †significant at $p < 0.05$						

Table 1: Comparison of VAS score on pre and post-medication on day 1 and 3 between the two groups.

Discussion

Third molar surgeries are typically accompanied by certain unavoidable postoperative effects, mainly, pain along with oedema and trismus. The post operative pain can significantly affect the quality of life of the patient. Traditionally, many surgeons have employed various techniques to minimize postoperative sequelae using analgesics, non-steroidal drugs or corticosteroids. However, the side effects of these medications can pose challenges for patients with contraindications [10].

TENS is a non-pharmacological pain management technique that uses surface electrodes on the skin to deliver electrical currents at varying frequencies. This stimulates a complex neuronal network, activating descending inhibitory pathways in the central nervous system to alleviate hyperalgesia. Safe, cost-effective and easy to use, TENS can be combined with prescription medications to enhance postoperative pain relief [11,12]. Belanger, suggested that the analgesic effect of TENS is partially influenced by the brain's endogenous opioid-related pain modulation system [13]. Thorsteinsson G, et al., investigated the placebo response to TENS treatment and observed that placebo-induced analgesia occurred in 32% of trials compared to actual electrical stimulation [15]. Similarly, Kitchen S, concluded in his study that the effects of placebo and TENS were comparable [14].

The findings of this prospective comparative study demonstrate that Transcutaneous Electric Nerve Stimulation (TENS) therapy significantly reduces post-operative pain levels in patients undergoing disimpaction of mandibular third molars, compared to conventional analgesic therapy alone. The results highlight the potential of TENS as an effective non-pharmacological adjunct for pain management in oral surgical procedures.

On postoperative day 1, the mean VAS score reduction in the TENS group (from 8.40 to 3.10) was significantly greater than that in the control group (from 8.00 to 4.50), with a statistically significant difference ($p < 0.001$). This suggests that TENS therapy provides immediate and substantial pain relief, likely due to its mechanism of activating descending inhibitory pathways in the central nervous system, thereby modulating pain perception. Similarly, on postoperative day 3, the TENS group exhibited a more pronounced reduction in pain (from 3.50 to 1.70) compared to the control group (from 4.00 to 2.60), further supporting the sustained efficacy of TENS ($p = 0.004$).

The superior pain relief observed in the TENS group aligns with previous studies that have reported the benefits of TENS in post-operative pain management. The non-invasive nature of TENS, coupled with its lack of systemic side effects, makes it an attractive alternative or adjunct to pharmacological analgesics. This is particularly relevant for patients who may experience adverse effects from medications or those with contraindications to certain drugs.

A notable strength of this study is its design, where each patient served as their own control, minimizing inter-individual variability. Additionally, the use of standardized surgical techniques and pain assessment tools (VAS) enhances the reliability of the results.

Conclusion

TENS therapy significantly reduces post-operative pain following mandibular third molar disimpaction, offering a safe and effective non-pharmacological option for pain management. Its integration into post-operative care protocols could improve patient comfort and reduce reliance on analgesics, thereby enhancing overall recovery experiences.

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Acknowledgement

None

Data Availability Statement

Not applicable.

Ethical Statement

The project did not meet the definition of human subject research under the purview of the IRB according to federal regulations and therefore, was exempt.

Informed Consent Statement

Informed consent was taken for this study.

Authors' Contributions

All authors contributed equally to this paper.

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