

# Efficacy of Transcutaneous Electronic Nerve Stimulation in Alleviating Pain during Inferior Alveolar Nerve Block Injections in Pediatric Dentistry

Shantanu R. Choudhari, Parikrama J. Solanki, Gaurav K. Vispute, Swati P. Goyal, Kanwaljeet D. Bharti, Bhawna S. Verma

Department of Pedodontics and Preventive Dentistry, Government Dental College and Hospital, Ahmedabad, Gujarat, India

## Abstract

**Aim:** This study was carried out with the aim of comparing the efficacy of Transcutaneous electrical nerve stimulation (TENS) and 20% benzocaine gel prior to inferior alveolar nerve block (IANB) injections in alleviating pain in children of 8–12 years of age. **Materials and Methods:** The sample included fifty children in whom TENS application was done and fifty children in whom benzocaine topical application was done prior to administration of IANB injections for the extraction of mandibular posterior teeth. Pain perception was evaluated using Wong–Bakers Facial Pain Rating Scale in both the groups. ANOVA test was used to evaluate the differences in mean pain scores between the groups. **Results:** The patients demonstrated significant reduction in pain during IANB when TENS was used with a mean pain score of 3.36 as compared to topical application of local anesthetic agent with a mean pain score of 4.76, indicating higher efficacy of TENS. **Conclusion:** Application of TENS was more comfortable and significantly reduced pain. TENS is a safe, reliable, and practical alternative to be used in pediatric dentistry.

**Keywords:** Benzocaine, inferior alveolar nerve block, TENS, Wong–Bakers Pain Scale

## INTRODUCTION

The main concern of pediatric dentists is to achieve the cooperation of child in the dental clinic during various treatment procedures. Pediatric patients are anxious regarding dental treatment mainly because of painful local anesthetic (LA) injections. According to patients, pain due to needle insertion into the tissue is the main source of anxiety.<sup>[1]</sup> Various techniques are available to reduce the discomfort caused due to painful nerve blocks. Topical anesthetic agents are commonly used prior to the administration of LA injections.<sup>[2]</sup> Nakanishi *et al.*<sup>[3]</sup> found that the site of injection plays an important role in the efficacy of topical anesthetic agents. They reported that topical anesthetic agent is more effective when needle is inserted into the mandibular mucobuccal fold adjacent to canine, but is ineffective in the pterygomandibular depression which is the site of inferior alveolar nerve block (IANB).

TENS has been suggested as a more comfortable and beneficial alternative in reducing anxiety associated with conventional LA methods.<sup>[4,5]</sup> Allgood<sup>[6]</sup> defined TENS as the direct stimulation

of the nerves by electrical impulses of short duration and small amplitude. Various theories have been proposed such as Gate control theory,<sup>[7]</sup> endorphin release theory,<sup>[8,9]</sup> and serotonin release theory<sup>[10]</sup> to explain the mechanism of action of TENS in controlling pain.

Hence, the objective of the present study was to compare the efficacy of 20% benzocaine anesthetic gel with TENS in reducing the discomfort caused due to the penetration of needle insertion in deeper tissues of the oral cavity. IANB along with lingual nerve block was the selected injection procedure in the study which involves deeper tissue penetration.

## MATERIALS AND METHODS

The study was carried out after obtaining institutional as well

**Address for correspondence:** Dr. Shantanu R. Choudhari,  
Department of Pedodontics and Preventive Dentistry,  
Government Dental College and Hospital, Civil Hospital Campus,  
Asarwa, Ahmedabad - 380 016, Gujarat, India.  
E-mail: shandent1@gmail.com

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**Figure 1:** Placement of electrodes.



**Figure 2:** Assembly of TENS system.



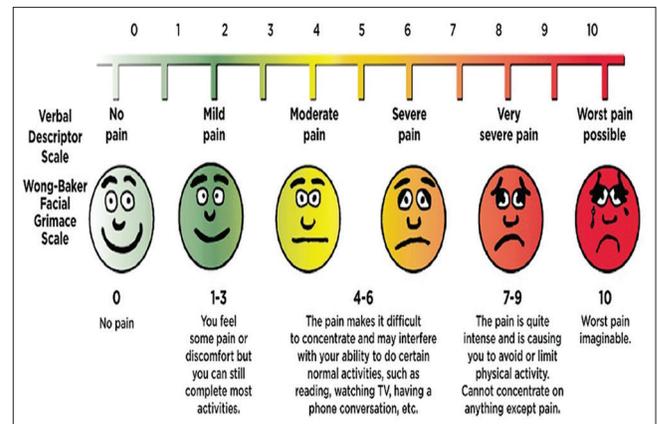
**Figure 3:** Administration of local anesthesia.

as parental consent. A total of 100 pediatric patients in the age group of 8–12 years visiting the Department of Pedodontics and Preventive Dentistry, Government Dental College and Hospital, Ahmedabad, under Ethical Board approval number IEC GDCH/8.4/15 requiring extraction of mandibular posterior teeth were selected for the study.

Children exposed to TENS application for the first time, children in whom parental consent was obtained, and children requiring extraction of mandibular posterior teeth were selected for the study. Children with epileptic disorders, cardiac disorders, bleeding disorders; physically and mentally disabled children; and children with a history of allergy to LA agent were excluded from the study.

Written consent was obtained from parents after explaining the procedure to them in local language before beginning with the procedure. Patients were randomly divided into two groups undergoing one of the following preanesthetic procedures before IANB injection:

- Group 1: Application of 20% benzocaine gel at the injection site for 2 min



**Figure 4:** Wong-Bakers Facial Pain Scale.

- Group 2: Application of TENS electrodes extraorally on the skin over the coronoid notch and posterior mandibular area [Figure 1]. The TENS unit has a battery-operated electric pulse generator with fixed pulse rate and width parameters, requiring adjustment of amplitude during the procedure [Figure 2]. The amplitude was increased until the child felt a warm comfortable sensation. The LA solution was then deposited and a TENS stimulation was maintained until the deposition of solution into the tissue [Figure 3].

The LA solution used was 2% lignocaine with 1:200,000 adrenaline in each group. Pain assessment was done using Wong-Bakers Facial Pain Scale<sup>[11]</sup> [Figure 4] after administration of LA solution in both the groups.

## RESULTS

Out of the total 100 children who participated in the study, 50 children received topical 20% benzocaine application and 50 children received TENS application; it was found that the mean pain score in the TENS group ( $3.36 \pm 2.81$ ) was lower than that of the benzocaine group ( $4.76 \pm 2.93$ ). The summary of pain experienced by both the groups upon IANB injections

is shown in Table 1 and Figure 5. ANOVA test was used to determine the differences in mean pain scores between the groups. The result obtained was statistically significant with  $P = 0.016 (<0.05)$ , suggesting TENS application to be more effective in reducing pain sensation.

## DISCUSSION

Pain is the most unpleasant aspect of pediatric dentistry which can lead to significant uncooperative behavior of the child in dental office. It is a discouraging fact that the apparatus being used for controlling pain itself causes pain and anxiety in the child.<sup>[12]</sup> It was stated by Pashley *et al.*<sup>[13]</sup> that delivering anesthetic solution too rapidly or with much force is responsible for pain during needle injection. The large variation in soft tissue elasticity leads to differences in injection pressures. Furthermore, the flow and pressure rates cannot be controlled accurately with traditional manual syringe, which results in unsteady and uncomfortable injections. By reducing the pain associated with LA administration, maximum comfort and satisfaction can be provided to the patient. After all, the administration of painless LA is the primary aim of all clinicians. Continuous research has been carried out for newer methodologies and techniques which can make

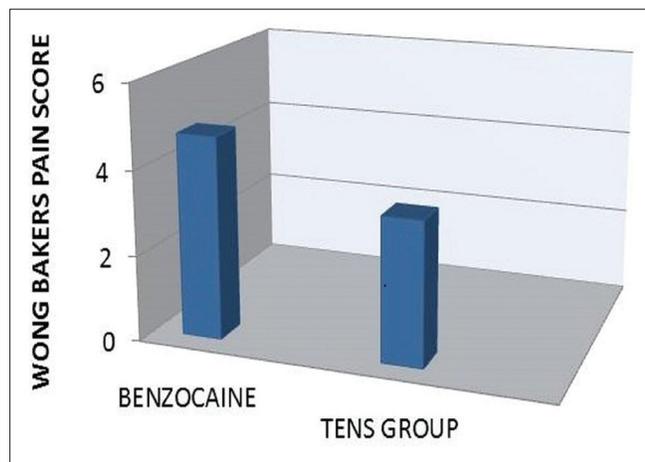
dental treatment under LA more comfortable.<sup>[14]</sup> To decrease the pain and discomfort caused by nerve block injections, various alternatives are available such as topical anesthetic application or application of transcutaneous electrical nerve stimulation (TENS).

In the present study, comparison of TENS and 20% benzocaine topical anesthetic gel was done in reducing pain during administration of IANB injection. It was found that TENS can significantly reduce the pain and discomfort when compared to application of 20% benzocaine gel for 2 min. Topical anesthetics have a limited capacity of penetrating deep into tissue. Although the discomfort due to surface penetration is reduced, they are ineffective at greater penetration depths which are required for regional block injections such as the IANB.<sup>[2]</sup> Another aspect related to pain of needle insertion is the difference in the manner of administering an injection by the practitioner.

The study carried out by Martin *et al.*<sup>[15]</sup> concluded that patients experienced less pain if they thought they were receiving topical anesthetic, whether they received or not. Hence it can be said that, the main aim of using topical anesthetic may be the psychological effect on the patient rather than its clinical effectiveness, as the patient feels that the clinician is doing everything to reduce pain and discomfort. Finally, they stated that the use of a topical anesthetic was unsuccessful in reducing the pain experience.

Results of the present study are in accordance with the study conducted by Meechan *et al.*<sup>[2]</sup> which showed that TENS is more effective than topical benzocaine in reducing discomfort caused due to injections requiring deeper tissue penetration such as IANB. TeDuits *et al.* (1993)<sup>[16]</sup> and Munshi *et al.*<sup>[17]</sup> conducted a study showing that perception of pain was greatly reduced with the help of TENS and was found to be more acceptable by children when compared to conventional LA syringe. Recent studies conducted by Dhindsa *et al.*<sup>[18]</sup> and Varadharaja *et al.*<sup>[19]</sup> found that efficacy of TENS was comparable to 2% lignocaine while performing minor pediatric dental procedures.

The reduction in heart rate associated with stress<sup>[20]</sup> indicates that electrical stimulation by TENS may be used as an analgesic during certain dental procedures. There are two mechanisms by which TENS produces an analgesic effect. First, the dual mechanism of stimulation of muscle contraction and an increase in tissue perfusion helps in removing the products of tissue destruction. Second, the release of endogenous pain control mediators such as endorphins is activated with the continuous use of TENS.<sup>[5]</sup> TENS stimulates large diameter nerve fibers with a lower threshold to electrical activity than smaller diameter fibers. This in turn controls the gating mechanism to small diameter nerve transmission, and thus helps in reducing pain.<sup>[7]</sup> Further studies are still required, wherein the efficacy of TENS applied extraorally and that of TENS applied intraorally can be compared and evaluated.



**Figure 5:** Bar diagram showing differences in pain scores on Wong–Bakers Facial Pain Scale between the two groups.

Serial number	Pain score	Benzocaine group (n=50)	TENS group (n=50)
1	0	5	12
2	2	10	14
3	4	13	9
4	6	10	10
5	8	7	3
6	10	5	2
Mean±SD		4.76±2.93	3.36±2.81

$P=0.016 (<0.05)$ . TENS: Transcutaneous electronic nerve stimulation, SD: Standard deviation

Using electrical stimulation leads to decreased occurrence of some disruptive clinical behaviors, such as crying and abrupt movement during various dental procedures, thus aiding in behavioral management of the patient.<sup>[21]</sup> A 93% success rate was reported in a study conducted by Bishop,<sup>[22]</sup> in which TENS was used as an analgesic in place of LA during restorative procedures. Although TENS is a substantially useful component of the clinician's pain control armamentarium, it is not possible to use it in all patients. Its use is contraindicated in children with epileptic disorders, central nervous system disorders such as trigeminal neuralgia, congenital heart diseases, and children with pacemakers.<sup>[2]</sup>

## CONCLUSION

Application of TENS was more comfortable and significantly reduced pain when compared to 20% topical benzocaine application during the administration of IANB injections. Thus, it can be concluded that, TENS is a safe, reliable, and practical alternative to be used in pediatric dentistry but it cannot be used in all children.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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## Conflicts of interest

There are no conflicts of interest.

## REFERENCES

- Milgrom P, Coldwell SE, Getz T, Weinstein P, Ramsay DS. Four dimensions of fear of dental injections. *J Am Dent Assoc* 1997;128:756-66.
- Meechan JG, Gowans AJ, Welbury RR. The use of patient-controlled transcutaneous electronic nerve stimulation (TENS) to decrease the discomfort of regional anaesthesia in dentistry: A randomised controlled clinical trial. *J Dent* 1998;26:417-20.
- Nakanishi O, Haas D, Ishikawa T, Kameyama S, Nishi M. Efficacy of mandibular topical anesthesia varies with the site of administration. *Anesth Prog* 1996;43:14-9.
- Schanzer RB, Black RR. Efficacy of electronic dental anesthesia during routine dental operative procedures. *Gen Dent* 1994;42:172-7.
- Clark MS, Silverstone LM, Lindenmuth J, Hicks MJ, Averbach RE, Kleier DJ, *et al.* An evaluation of the clinical analgesia/anesthesia efficacy on acute pain using the high frequency neural modulator in various dental settings. *Oral Surg Oral Med Oral Pathol* 1987;63:501-5.
- Allgood JP. Transcutaneous electrical neural stimulation (TENS) in dental practice. *Compend Contin Educ Dent* 1986;7:640, 642-4.
- Melzack R, Wall PD. Pain mechanisms: A new theory. *Science* 1965;150:971-9.
- Adams JE. Naloxone reversal of analgesia produced by brain stimulation in the human. *Pain* 1976;2:161-6.
- Abram SE, Reynolds AC, Cusick JF. Failure of naloxone to reverse analgesia from transcutaneous electrical stimulation in patients with chronic pain. *Anesth Analg* 1981;60:81-4.
- Hochman R. Neurotransmitter modulator (TENS) for control of dental operative pain. *J Am Dent Assoc* 1988;116:208-12.
- Venham LL, Gaulin-Kremer E. A self-report measure of situational anxiety for young children. *Pediatr Dent* 1979;1:91-6.
- Nicholson JW, Berry TG, Summitt JB, Yuan CH, Witten TM. Pain perception and utility: A comparison of the syringe and computerized local injection techniques. *Gen Dent* 2001;49:167-73.
- Pashley EL, Nelson R, Pashley DH. Pressures created by dental injections. *J Dent Res* 1981;60:1742-8.
- Kreider KA, Stratmann RG, Milano M, Agostini FG, Munsell M. Reducing children's injection pain: Lidocaine patches versus topical benzocaine gel. *Pediatr Dent* 2001;23:19-23.
- Martin MD, Ramsay DS, Whitney C, Fiset L, Weinstein P. Topical anesthesia: Differentiating the pharmacological and psychological contributions to efficacy. *Anesth Prog* 1994;41:40-7.
- TeDuits E, Goepferd S, Donly K, Pinkham J, Jakobsen J. The effectiveness of electronic dental anesthesia in children. *Pediatr Dent* 1993;15:191-6.
- Munshi AK, Hegde AM, Girdhar D. Clinical evaluation of electronic dental anesthesia for various procedures in pediatric dentistry. *J Clin Pediatr Dent* 2000;24:199-204.
- Dhindsa A, Pandit IK, Srivastava N, Gugnani N. Comparative evaluation of the effectiveness of electronic dental anesthesia with 2% lignocaine in various minor pediatric dental procedures: A clinical study. *Contemp Clin Dent* 2011;2:27-30.
- Varadharaja M, Udhy J, Srinivasan I, Sivakumar JS, Karthik RS, Manivanan M. Comparative clinical evaluation of transcutaneous electrical nerve stimulator over conventional local anesthesia in children seeking dental procedures: A clinical study. *J Pharm Bioallied Sci* 2014;6 Suppl 1:S113-7.
- San Martin-Lopez AL, Garrigos-Esparza LD, Torre-Delgadillo G, Gordillo-Moscoso A, Hernandez-Sierra JF, de Pozos-Guillen AJ. Clinical comparison of pain perception rates between computerized local anesthesia and conventional syringe in pediatric patients. *J Clin Pediatr Dent* 2005;29:239-43.
- Wilson S, Molina Lde L, Preisch J, Weaver J. The effect of electronic dental anesthesia on behavior during local anesthetic injection in the young, sedated dental patient. *Pediatr Dent* 1999;21:12-7.
- Bishop TS. High frequency neural modulation in dentistry. *J Am Dent Assoc* 1986;112:176-7.