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Expert Opinion Article

A Clinical Evaluation Of The Electric Pulp Tester As An Indicator Of Analgesia In Cases Of Chronic Irreversible Pulpitis

Dr Omkar Eswara Babu Danda[1*], Raghu Deep Darisi[2], Dr. Jaheer Shaik[3], Dr. Rajeswari Putchala[4],

[1*]Senior Lecturer. MDS (Conservative Dentistry And Endodontics) Dr NTR University Of Health Sciences, Vijayawada. Email: g3eswar@gmail.com
[2](DDS, MPH, BDS), General Dentist, Department Name Private Practice Chicago, USA. ORCID ID: 0000-0003-1258-3314
[3]Department Of Conservative Dentistry And Endodontics CARE Dental College, Guntur . India. jaheer.se@gmail.com, 9966738048
[4]Conservative & Endodontics, Senior Lecturer In ST. Joseph's Dental College Duggirala. NTR University Of Health Sciences Andhra Pradesh. dr.rajijoy@gmail.com

***Corresponding Author:** Dr Omkar Eswara Babu Danda
*Senior Lecturer. MDS (Conservative Dentistry And Endodontics) Dr NTR University Of Health Sciences, Vijayawada. Email: g3eswar@gmail.com

Abstract
Background: Profound local anesthesia is essential for pain-free endodontic treatment. Conventional indicators such as lip numbness and soft tissue anesthesia are subjective and often unreliable, particularly in cases of chronic irreversible pulpitis.
Aim: To evaluate the effectiveness of the Electric Pulp Tester (EPT) as an objective indicator of pulpal analgesia prior to endodontic procedures in mandibular first molars diagnosed with chronic irreversible pulpitis.
Materials and Methods: Sixty patients requiring endodontic treatment of mandibular first molars were evaluated using an electric pulp tester before and after administration of inferior alveolar nerve block anesthesia. Pain experienced during access cavity preparation was assessed using a Visual Analog Scale (VAS).
Results: Despite all patients exhibiting soft tissue signs of anesthesia, 25% experienced severe pain during access preparation. Post-injection EPT responses showed a statistically significant correlation with intraoperative pain ($p < 0.002$).
Conclusion: The Electric Pulp Tester is a reliable and objective tool for predicting pulpal anesthesia and identifying potential anesthetic failure in cases of chronic irreversible pulpitis.

Introduction

In dental practice, local anesthesia remains the primary modality for controlling pain during clinical procedures. However, inadequate anesthesia continues to be a significant clinical challenge. Fiset et al. provided an extensive review of patients' psychological responses to dental injections and inadequate anesthesia, highlighting the clinical relevance of this problem.

Traditionally, dentists rely on subjective soft tissue signs such as lip numbness to evaluate the onset of anesthesia. These indicators, however, have shown variable reliability. Patient perception of pain is influenced by emotional, physiological, and psychological factors, as well as prior experiences (Harris & Topazian, 1957).

Previous studies by Björn and Harris demonstrated that the Electric Pulp Tester (EPT) provides a more objective and precise measure of pulpal anesthesia. Nevertheless, no clinical study to date has evaluated the ability of EPT to predict pain during endodontic procedures in cases of chronic irreversible pulpitis.

Aim

To evaluate the Electric Pulp Tester as an indicator of pulpal analgesia in cases of chronic irreversible pulpitis.

Objectives

1. To assess the ability of the electric pulp tester to predict the level of anesthesia prior to endodontic procedures.
2. To minimize the need for supplemental anesthetic injections.
3. To improve patient comfort and acceptance of endodontic treatment.

Materials and Methods

Study Sample

- Sixty patients (20 males, 40 females) aged between 18 and 60 years

- Sixty mandibular first molars diagnosed with chronic irreversible pulpitis
- All subjects were systemically healthy
- No contraindications to 2% lidocaine with 1:80,000 epinephrine

Diagnostic Criteria

Diagnosis of chronic irreversible pulpitis was established through:

- Detailed pain history
- Presence of spontaneous pain
- Pain aggravated at night or by cold stimuli
- Clinical and radiographic examination

Electric Pulp Testing Procedure

- An Analytic Technology electric pulp tester (Model: Denjoy) was used
- A lip clip was used to complete the electrical circuit
- The rate of current increase was kept constant
- Total elapsed testing time was 40 seconds (0 to maximum reading)
- Teeth were isolated with cotton rolls and air-dried
- A small amount of electrolyte was placed between the electrode tip and the tooth
- The probe was positioned on sound enamel on the occlusal two-thirds of the buccal surface of the mesiobuccal cusp (Jacobsen, 1984)
- Care was taken to avoid contact with gingival tissues

Testing began upon electrode contact and was terminated when the patient raised a hand to indicate the first sensation. Teeth that showed no response at maximum EPT value were excluded from the study.

Anesthetic Technique

- Local anesthesia was administered using 2 mL of 2% lidocaine with 1:80,000 epinephrine
- Inferior alveolar nerve block was performed using the Monheim technique, modified by Hayden
- An additional one-fourth cartridge was used for long buccal nerve anesthesia

A waiting period of 5 minutes was allowed. Onset of anesthesia was assessed by:

- Lower lip numbness
- Negative response to mucosal probing

Clinical Procedure and Pain Assessment

Once subjective signs of anesthesia were present and post-injection EPT readings were recorded:

1. Teeth were isolated with a rubber dam
2. Standard access cavity preparation was performed (Cohen & Ingle)
3. Patients rated pain during access opening using a Visual Analog Scale (VAS)
4. Supplemental intrapulpal anesthesia was administered if pain was unbearable

Results

- All 60 subjects exhibited soft tissue signs of anesthesia
- During access cavity preparation:
  - **15 patients (25%)** reported severe pain (VAS 6–7) and required supplemental anesthesia
  - **33 patients (55%)** reported mild to moderate pain and did not require supplemental anesthesia
  - **12 patients (20%)** reported no pain

Statistical Analysis:

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
AGE	60	18.00	60.00	32.6833	11.91423
BEFORE	60	5.00	39.00	15.8500	8.76013
AFTER	60	.00	38.00	24.3333	14.56332
VAS	60	.00	7.00	3.1333	2.46650
Valid N (listwise)	60				

GENDER

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	FEMALE	38	63.3	63.3	63.3
	MALE	22	36.7	36.7	100.0
	Total	60	100.0	100.0	

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	BEFORE	15.8500	60	8.76013	1.13093
	AFTER	24.3333	60	14.56332	1.88012

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	BEFORE - AFTER	-8.48333	20.61388	2.66124	-13.80846	-3.15820	-3.188	59	.002

Soft tissue signs alone produced a **false-positive indication of anesthesia in 25% of cases**.
Statistical analysis using **Fisher's Exact Test (two-tailed)** demonstrated a significant correlation between positive post-injection EPT responses (non-40/40 readings) and intraoperative pain ($p < 0.002$), indicating a 98% probability of anesthetic difficulty, particularly with inferior alveolar nerve blocks.

Discussion

The findings of this study demonstrate that the Analytic Technology electric pulp tester is a valuable adjunct for predicting anesthetic adequacy in endodontic procedures involving chronic irreversible pulpitis.
Despite the presence of subjective soft tissue signs, a significant number of patients experienced pain during access preparation. This confirms that soft tissue anesthesia alone is an unreliable indicator of pulpal anesthesia.
The results are consistent with previous studies by Certosimo and Archer, which established the usefulness of EPT in assessing clinical anesthesia during operative dental procedures.
Possible reasons for anesthetic failure in 25% of patients include:

- Technical errors in block administration
- Increased patient anxiety
- Presence of a "hot tooth" with heightened pulpal inflammation

Conclusion

Within the limitations of this clinical investigation, it can be concluded that:

- The electric pulp tester is an accurate and objective predictor of pulpal anesthesia

- EPT can help identify potential anesthetic failure before initiating endodontic procedures
- Its use may reduce patient discomfort and the need for supplemental injections

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