

To Assess the Efficacy of Electric Pulp Tester In Different Conducting Media: An In Vitro Study

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ABSTRACT

Background: Background: The electric pulp tester has been used as a diagnostic modality to discriminate the periapical diseases of endodontic basis from various other pathological articles with similar radiographic findings. The results can be false-positive or false-negative amongst 10 to 20% of the cases. Electric pulp tester producers differ on their references of media, ranging between toothpaste to gel based electronic media. The present study was conducted with the aim to determine the conductance of the electric pulp tester through different conducting media invitro.

Materials and methods: Freshly extracted premolars were used for the study. Pulp chamber was exposed and cathode was put into the pulpal tissues. The voltage at the cathode was recorded. The readings were recorded on the voltmeter when the digital display showed 40. Average of 5 readings was obtained in all the cases

Results: All the toothpastes showed similar conductance of around 0.6. K-Y brand lubricating jelly, media recommended by the manufacturer showed a conductance of 1.3.

Conclusion: Therefore, it is crucial to determine the sort of interface while testing for pulpal obliteration. A weak conducting material may result in false positive results.

Keywords: Conductance, pulp, obliteration, toothpaste.

INTRODUCTION

The capability of the clinician to properly manage ailments of endodontic derivation is grounded on accurate diagnosis. The electric pulp tester is been used as a diagnostic modality to discriminate the periapical diseases of endodontic basis from various other pathological articles with similar radiographic findings⁽¹⁾. Even though the pulp tester is an excellent object for diagnosis of pulpal pathologies, it is associated with some limitations. A positive rejoinder to the electric pulp testing does not significantly provide any data regarding the state or

integrity of the pulp. A positive response simply shows that there is presence of vital sensory fibers within the pulp ⁽²⁾. The pulp tester also does not show any info about the vascularity of the pulp, that is the true basis of pulp vitality. Due to this, teeth that have temporarily or permanently lost their sensation will be not responsive to pulp tester but these teeth may have integral vasculature ⁽³⁾. The results can be false-positive or false-negative amongst 10 to 20% of the cases^(4, 5). A conducting medium is crucial and concentration at the tip of the electric pulp tester is important for conductance. ⁽⁶⁾
⁷⁾A study by Martin et al. ⁽⁶⁾found that there were no

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substantial differences in the voltage or the potential difference transmitted by the pulp tester with different media. Electric pulp tester producers differ on their references of media, ranging between toothpaste to gel based electronic media. The present study was conducted with the aim to determine the conductance of the electric pulp tester through different conducting media invitro.

MATERIALS AND METHODS

Freshly extracted premolars were used for the study. Pulp chamber was exposed and cathode was put into the pulpal tissues. Coupling of the anode was done with electric pulp tester handpiece. The pulsations of the electric stimulation of the pulp tester was made at 5 to enable readings at the cathode and to imitate the clinical use of the pulp tester. The operator was not permitted to wear gloves at all the times. Negative control was taken when 0V was recorded with dry tip to tooth interface. The tip of pulp tester directly touching the cathode and giving a reading of 3.9V was taken as positive control. The test media used were K-Y gel, wax, lipstick, lip balm, White petroleum jelly, Hand soap toothpastes, and liquids. All the materials and given in a tabulated form. These media was applied to the tooth and tip of tester at the occlusal level. The voltage at the cathode was recorded. The readings were recorded on the voltmeter when the digital display showed 40. Average of 5 readings was obtained in all the cases. All the data obtained was arranged in a tabulated form and analysed statistically.

RESULTS

There were different kinds of water based and petroleum based materials used in the study. The study analysed 17 types of conducting media in vitro. No conductance was shown by wax, lipstick, petroleum based jelly, Neosporin and lip balm. Significant conductance was shown by saline. Saliva and 0.12% chlorhexidine showed comparable conductance or more than 1. All the toothpastes showed similar conductance of around 0.6. K-Y brand lubricating jelly, media recommended by the manufacturer showed a conductance of 1.3. Sodium fluoride demonstrated a conductance of 0.3 which was comparable to that of EDTA preparation i.e. 0.4. Hand soap showed a conductance of 0.1.

Table 1: Mean readings of voltmeter using different interface media

S.No.	Media used	Voltmeter readings
1	Dry	0
2	K-Y gel (K-Y brand lubricating jelly)	1.3
3	Wax	0
4	Lipstick	0
5	Saline (0.9% irrigating solution)	3.1
6	White petroleum jelly	0
7	Topical LA	0.8
8	Neosporin	0
9	Lip balm	0
10	sodium fluoride	0.3
11	Hand soap	0.1
12	Chlorhexidine (0.12%)	1.3
13	Regular paste	0.6
14	Topical fluoride gel	1.0
15	EDTA preparation	0.4
16	Saliva	1.7
17	0.4% stannous fluoride	0.6

DISCUSSION

Dental pulp testing is a mode of diagnosis that yields valuable diagnostic and management information to a dentist^[8]. If pathology is present, pulp testing along with details obtained from the history, clinical examination, and other investigations like radiographs gives the diagnosis of the underlying pathosis. In between 1970s and 1990s, the pulp testing applications in various areas of dentistry met with variable degrees of success^[8,9]. From this it could be interpreted that the ideal diagnostic test^[10] is still to be found out. Pulp tissue may have enough blood supply, but may not be necessarily innervated^[11]. Therefore, most of the pulp testing methodologies do not directly evaluate the pulp vascularity and this is proven by clinical results^[12] that teeth with trauma do not show any response to a stimulus for a period after injury. Electric pulp testing is since electrical stimuli lead to an ionic alteration across the nerve membrane, thus inducing an action potential with a rapid action in the region of the nodes of Ranvier^[13]. The direction for the electric current is from the probe tip of test device to tooth, alongside the enamel prisms and dentine tubules, and then within the pulp tissue^[14]. The "circuit" is complete when the patient wears a lip clip or touches the probe handle

with his hand ^[15,16]. A “tingling” feeling^[17] can be felt by the subject once the voltage reaches the pain threshold, but this level of threshold differs amongst patients and teeth, and is altered by factors like age, pain, tooth surface conduction, and materials resistance. In the present study, no conductance was shown by was, lipstick, petroleum-based jelly, Neosporin and lip balm. Significant conductance was shown by saline. Saliva and 0.12% chlorhexidine showed comparable conductance or more than 1. All the toothpastes showed similar conductance of around 0.6. K-Y brand lubricating jelly, media recommended by the manufacturer showed a conductance of 1.3. Sodium fluoride demonstrated a conductance of 0.3 which was comparable to that of EDTA preparation i.e. 0.4. Hand soap showed a conductance of 0.1. These results of the present study were contrasting to those conducted by Martin et al. ⁽⁶⁾ and Cooley and Robison ⁷, they found that the type of media used for coupling the probe of the pulp tester with the tooth surface does not significantly alter the readings. One reason for this could be the lesser number of used in their study, they even didn't use water as a media. The results of the present study indicate that interface media could be water-based and but never petroleum-based. Petroleum-based materials did not allow impulses to the cathode in the pulp tissue. This is a crucial finding as many subjects, especially females, wear some kind of lip balm or lip stick, and contamination of teeth could lead to, a false negative response. Even the salivary contamination could yield a false positive readings as well ⁽¹⁸⁾.

CONCLUSION

The present study concluded, that the materials used can affect the results of pulp testing. Therefore, it is crucial to determine the sort of interface while testing for pulpal obliteration. A weak conducting material may result in false positive results.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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