



PULP SENSIBILITY TESTS

Dental Science

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ABSTRACT

Response to heat and cold have been accepted as a valid parameter for testing the integrity within the pulp. In the selected 20 volunteers, various pulp sensibility test and the most appropriate site for carrying out these test in Maxillary Central Incisor and First Molar teeth were tested. EndoIce gave the quickest response, followed by heated Gutta Percha and Electric pulp tester. In Maxillary Central Incisor, the most sensitive site was found to be incisal third followed by middle and cervical third on facial and palatal surface. In Maxillary First Molar, the most sensitive site was found to be mesio-buccal cusp tip followed by incisal third of facial surface.

KEYWORDS

Dentinal lymph, Odontoblastic processes, A-delta fibres, C-fibres

INTRODUCTION

The clinical diagnosis of pulpal diseases is primarily based upon the history, clinical signs and symptoms, clinical tests and radiographic examination.¹ The disease, although would be appropriately identified on histopathologic examination, is seldom carried out. For clinical diagnosis, apart from the other mentioned criteria, the symptoms of pulp are the guiding factor. Vitality of the pulp is depended on the presence of adequate and proper blood supply.² Testing the status of blood flow within the pulp is cumbersome due to elaborate apparatus required, its restricted availability and prohibitive cost.³ Again as a compromise for the sake of convenience, the test of intact nerve supply of the pulp is considered as an alternative to blood flow.

Response to heat and cold have been accepted as a valid parameter for testing the integrity within the pulp.⁴ The clinical diagnosis has been made upon the finding of thermal test, comprising both heat and cold, along with the electric current.⁵ The later has been proved to be an effective test modality.⁶

This study was carried out to test the effectiveness of the various pulp sensibility test and the most appropriate site for carrying out these test in Maxillary Central Incisor and First Molar teeth.

METHADODOLOGY

The permission for carrying out this clinical study was taken from R.K.D.F. institutional ethical committee, Bhopal, India. 20 volunteers were selected on the basis of following criteria.

INCLUSION CRITERIA

- Patient between age group 18-25 years.
- Maxillary Central Incisors and Maxillary 1st Molars.
- Teeth with healthy sound tooth structure.

EXCLUSION CRITERIA

- Teeth with carious lesion or restoration.
- Teeth with fracture or craze lines.
- Medically compromised patient.
- Patients on medication.
- History of trauma or root canal treatment in relation to the chosen teeth.
- Teeth with defects or disease involving pulp.

The selected 20 volunteers were explained in detail about the study and possible outcomes, their informed consent was taken. Right Maxillary Central Incisor and 1st Molar were designated as experimental teeth, Left Maxillary Central Incisor and 1st Molar as control. Same examiner carried out the test, using Endo Ice spray {Coltene, GERMANY}, heated gutta percha stick and Electric Pulp tester {Denjoy, CHINA} for cold, heat and electric pulp test, respectively.

In Maxillary Central Incisors, the site of test were Incisal, Middle and Cervical third of facial and palatal surface, whereas in Maxillary 1st Molar they were Mesio-buccal cusp tip, Occlusal, Middle and Cervical third of facial and palatal surface. The test agent was applied at these

sites after proper isolation and as soon as a response was elicited, the agent was removed. After the control, the experimental teeth were tested in the same manner. The response of the teeth to the test agents was graded, on the basis of time period, within which a response was elicited.

- A - within 2 seconds
- B - 2-5 seconds
- C - beyond 5 seconds

The grade obtained were tabulated and statistically analysed using Chi-square test.

RESULTS

Amongst the different agents, EndoIce gave the quickest response. 191 teeth responded within 2 seconds, 85 teeth between 2-5 seconds and 201 teeth beyond 5 seconds, across the test sites. The next quickest response was elicited by heat test followed by electric pulp test. In response to heat, 171 teeth responded within 2 seconds, 91 teeth between 2-5 seconds and 218 teeth beyond 5 seconds. On electric pulp test, none of the teeth responded within the first 2 seconds of application, 37 teeth between 2-5 seconds and 443 teeth beyond 5 seconds.

In Maxillary Central Incisor the most sensitive site was found to be incisal third followed by middle and cervical third on facial and palatal surface. On the incisal third, the response was elicited in the first 2 seconds in 157 teeth, 27 teeth between 2-5 seconds and 56 teeth beyond 5 seconds. On the middle third, the response was elicited in the first 2 seconds in 139 teeth, in 30 teeth between 2-5 seconds and 73 teeth beyond 5 seconds. On the cervical third the response, was elicited in the first 2 seconds in 66 teeth, 90 teeth between 2-5 seconds and 94 teeth beyond 5 seconds.

In Maxillary First Molar the most sensitive site was found to be mesio-buccal cusp tip followed by incisal third of facial surface. None of the site, responded within 2 seconds on application of all the three agents. On the mesio-buccal cusp tip, the response was elicited in 57 teeth between 2-5 seconds and 63 teeth beyond 5 seconds. On the incisal third of facial surface, the response was elicited in the 14 teeth between 2-5 seconds and 106 teeth beyond 5 seconds. On the remaining sites, the response was elicited beyond 5 seconds only.

DISCUSSION

In this study the selected patients were between 19-24 years, as with advancing age there are evident changes in the pulp status and its response. The sensation of the pulpal afferents is reduced due to calcification of the root canal system is associated with aging. There is a gradual decrease in number of nerve fibers and size of the pulp chamber due to increasing deposition of reparative dentine due to advancing age. The cellular component is replaced with fibrous. All these changes result in altered response to pulp sensibility test.

In this study cold test produced the quickest response, as they stimulate A-delta fibres which are predominantly present in periphery. Thermal

tests stimulate the nerves by the flow of dentinal lymph with temperature change, which in turn leads to movement of the odontoblastic processes and subsequent stimulation of the pulpal nerves. Cold test has been found to be quiet accurate and reliable by J. Mumford.⁷ Petersson et al found that the probability that with the cold test a sensitive reaction represented a vital pulp was 90%.⁸

The second quickest response was elicited by Heat test. Application of heat results in bi-phasic stimulation of A-delta fibres initially, followed by the pulpal C fibres.⁹ Excessive heat application may result in pulp damage. Heat tests should be applied for no more than 5 seconds. Prolonged application results in activation of C fibres which in turn may cause a lingering pain. Late response to heat test observed in our study may be due to inadequate heating of the gutta-percha stick that could result in the stimulus being too weak to elicit a response.¹⁰

The electric pulp test gave the most delayed response because of high threshold level needed to stimulate the pulp. The electric pulp tester (EPT) stimulates the closest myelinated A-delta fibers and indicates presence of vital nerve fibers. An electrical current is conducted through the tooth, giving an electrical stimulation to the nerves.¹¹ It works on the principle that electrical stimuli causes an ionic change across the neural membrane, thereby inducing an action potential with a rapid hopping action at the nodes of Ranvier in myelinated nerves but depends on threshold level which is affected by factors such as individual age, tooth surface conduction, pain perception and resistance varies between patients and teeth.¹²

In Maxillary Central Incisors the incisal third responded fastest as the thickness of the overlying enamel and dentin is less, so they have low threshold value and cervical third responded late as the thickness of tooth surface is more. The incisal edge of a tooth that has thin enamel encounters less resistance and least distance to travel to reach the pulp. The higher threshold value at the cervical region may be due to the lower concentration of neural elements, which decrease progressively from incisal edge to the cervical and radicular areas.¹³ The orientation of tubules is straight from the incisal edge to the pulp horn, but elsewhere the course of the tubules is somewhat curved and resembles an S in shape.¹⁴ The size of the pulp chamber also has an effect on the threshold; greater electrical current is needed to produce a response in teeth with large pulps than in teeth with small pulps.¹⁵

Similar to our finding Bender et al¹⁶ found incisal third to possess lowest threshold response in anterior teeth also Christopher et al¹⁷ and Al-Salman TH¹⁸ found that incisal edge needs lower threshold value when used as the site of application. On the contrary Jacobson et al found that the optimal placement site is the middle third of the labial surface¹⁹ whereas Cooley and Robison found that optimal placement site is on the cervical third of the tooth.²⁰

In Maxillary First Molar, the mesio-buccal cusp tip responded fastest as distance to the pulp horn is less. Similar to our study Lin et al.²¹ and Kalhoro et al²² found that the fastest response is elicited on placement of electrode on the mesiobuccal cusp tip of permanent first molars due to the higher location of pulp horn. The second site to respond was occlusal third of facial surface, apart from this none of the other site responded within 5 seconds because of greater enamel and dentin thickness. Contrary to our finding, West reported that the gingival third of the buccal surface was the best location for placement of electrode.²³ Donyavi et al found that central fossa in molars was the most appropriate site for placement of pulp tester electrode as enamel is very thin or usually absent on this site.²⁴

CONCLUSION

In endodontic practice, Pulp sensibility tests, even with all its limitations, is a very helpful aid. In current study, the fastest response to check for vitality of pulp is elicited by cold test followed by heat and EPT. The most accurate site in anterior teeth is incisal third and in posterior is mesio-buccal cusp tip.

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