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Research Article

Comparison of the Response Thresholds to Electrical Pulp Testing In Teeth of Young and Elderly People

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ABSTRACT:

Aim: The aim of the present study is to compare response thresholds ofthe teeth of young and elderly patients to electrical pulp testing.

Materials and methods: One hundred and five anterior intact teeth of volunteer patients were included. The participants were classified into 3 age categories: 18-25 years, 35-40 years and ≥ 60 years. The teeth were dried; isolated and electrical pulp tester was placed on determined area of incisal edge of tooth. The voltage was gradually increased and the response thresholdswere recorded.

Results: Average response thresholds to electric pulp testing for 18-25 years, 35-40 years and ≥ 60 years were 2.6 ± 0.9, 3.1± 0.8 and 4.8± 1.5 respectively. Thresholds of responsesincreased with age. Thedifferences between ≥ 60 years group and the other two groupswere statistically significant (P value= 0.0001). There was no significant difference between the responses of male and female patients.

Conclusion: The present study showed that elderly patients respond to higher voltages of electrical pulp testing ; however this will not prevent clinical discrimination between vital and necrotic pulps.

Clinical significance: Vitality testing is a prequisite for accurate diagnosis, treatment planning and outcome assessment in clinical practice. It is important to determine whether there is significant difference among response thresholds of young and elderly patients to electrical pulp testing.

Keywords: Case-control**,** Dental pulp, Dental pulp test, Nerve tissue, Trigeminal nerve

INTRODUCTION:

The determination of pulpal vitality is a prequisite for accurate diagnosis and treatment planning[1, 2]. Electricpulp testing (EPT), besides cold test, is an accurate way to diagnose the vitality of the pulp 1, 3).Different factors such as recent trauma, uncompleted tooth development, open apexes, large restoration, etc. can influence the response to pulp testers2).With aging, tooth pulp will histologically change; neural fibers will be less responsive to stimuli, as a result of calcification and decrease in size of pulp chamber 4). There is limited data regarding response thresholds of intact teeth in young and elderly patients5). Some authors showed that reduction in the quality and quantity of neural fibers in aged teeth might demonstrate decrease in tooth sensitivity in clinical practice6, 7), while others advocated the similar responses in teeth of young and elderly patients 8, 9). Investigating on sound teeth, Harkins found no difference in perception of pain

among young and aged patients 8, 10). Udoye examined anterior teeth of mature people, concluding that aging will increase the electrical current needed for stimulating the teeth 3).

Regarding to the controversial data on respond thresholds to electrical pulp tester in young and aged teeth, the aim of the present study is to compare response thresholds of young and aged teeth.

MATERIALS AND METHODS

One hundred and five patients including 56 females (53.3 %) and 49 males (46.7 %) participated in the study. The patients were among those who referred to Dental School of Yazd, Iran. The patientswere divided to three age groups: 18 to 25 years, 35 to 45 years and above 60 years. From each group, 35 anterior teeth were selected. The selected teeth were sound, withoutabrasion, caries, restoration, crack, fracture, periodontal disease, orthodontic history or history of trauma. Patients who had taken analgesics or sedating medicine were excluded.

The teeth were isolated by rubber dam; the dental plaque was removed by sterile gauze and the teeth were dried by air syringeto prevent false positive response. The Parkell pulp tester (USA, D624MS) was implicated in the present study. The patients were instructed to inform the practitioner the first time they perceived a sensation of pain, irritation, burning, heat or tingling, by raising their hands. A determined amount of prophylactic paste was applied on the tip of the device and the tip was located on a determined area of the incisal edge of the tooth. Next, the pulp tester was turned on and thevoltage was gradually increased. The electric signal at which the patients informed were recorded. It should be added that the patients were first examined on another tooth to get familiar to the process, in order to obtain more accurate results. The data were analyzed by SPSS ver. 15 usingOne-way ANOVA and Post hoc Tukeytests and T-test (α= 0.05).

RESULTS

The mean grades of responses to EPT are demonstrated in Table 1. One-way ANOVA revealed that there was significant difference in responses of anterior teeth to electrical pulp tester among the groups.

Table 1. Mean values and standard deviation of response grades of the three groups

Age group	Mean	Standard Deviation
18-25	2.7	0.9
35-45	3.1	0.8
≥ 60	4.8	1.6
Overall	3.5	1.5

Post hoc Tukey test demonstrated that there was a significant difference between the 18-25 and the ≥60 years group (p value< 0.05) and also 35-40 years and ≥ 60 years group (p value< 0.05); whereas the responses of the 18-25 years group and 35-45 years group were not significantly different (p value> 0.05), as seen in Table 2.

Table 2. P values between different groups

Age group	P value
18-25 35-45	0.27
18-25 ≥ 60	0.0001
35-45 ≥ 60	0.0001

The mean value of response grades of the female patients was 3.5± 1.5 and the male patients was 3.6± 1.4; however, T-test showed that the difference between male group and female group was not statistically significant (p value> 0.05). The pulp tester could stimulate painful response in all examined teeth, therefore false negative response was not observed.

DISCUSSION

The present study showed that there is significant difference among responses of anterior teeth to electrical pulp tester in different age groups. It is previously demonstrated that the lowest threshold response to EPT was noted at the incisal edge of the tooth 11). In the present study the electrode was placed on the incisal edge of all examined teeth. When no electric media is used, responses to EPT are inaccurate 12). As there is no significant difference between various electric media 13), in the present study prophylaxis paste was used as media. Electrical pulp testing is an accurate way to diagnose the vitality of the pulp. The basic mechanism of electric pulp testing is

introducing a current through the tooth pulp and increase the signal gradually. This process includes exciting intact A-delta nerves in the pulp–dentine complex. A positive response to EPT curtails from an ionic swing in the dentinal fluid within the tubules leading to local depolarization and later generation of an action potential together from A-delta fibers of nerves 14).

The mechanism of electric pulp tester follow a physical formula; I = V/R, where I is the current, V is the voltage, and R is the resistance 12).

The current in the present study was controlled by placing determined amounts of prophylaxis paste on each tooth. The voltage was increased by the analog dial of the device. According to the above formula, The more resistance encountered (here, enamel and dentin), the higher voltage is needed to provide a current strong enough to stimulate the neurons 12). Age is the paramount determinant of pulp size which decreases via the accumulation of secondary dentin 15), increasing thicknesses of dentin. Thick dentin provides increased electric resistance 12), which might explain higher voltages needed for pulpal stimulation in the teeth of elderly patients.

Furthermore, neurological practical studies demonstrate that neurons of elderly people are stimulated with higher electric voltages. Rivner et al. in a retrospective study investigating electrodiagnosticstudies, concluded that age was strongly inversely correlated with the amplitudes of both sensory and motor responses 16). Dorfman and Bosley in an experimental study evaluated the somatosensory evoked potential latencies as well as motor in elderly and young volunteers. The onset latencies of somatosensory evoked potential increased gradually with advancing age. Neural evoked potential latencies, showed little change until approximately age 60, and declined sharply thereafter 17). Sturrock measured the number of neurons in mesencephalic nuclei of the mouse trigeminal nerve in relation to aging. He showed that the number of neurons decreased with age, which might also justify delayed response of aged pulp to electrical pulp testing 13).

Morse 18) in an investigation on the age-related changes of the dental pulp complex and their relationship to systemic aging, explained aging theories relevant to dental pulp complex. The aging theories which may explain delayed responses of aged patient to EPT are explained below.

Clinker theory suggests that age pigments such as lipofuscin and ceroid accumulate in nondividing neurons. These substances are considered to interfere with or choke off the activity of the neurons, and delay pulp responses to EPT as a result 18).

Falling Domino theory, declares that aging makes certain toxic substances accumulate in neurons, inhibiting the activity of a specific structure. Accordingly, the other structures inside the neuron –similar to falling dominos- also become inhibited and gradual inhibition of cellular constituents takes place and proper on time responses to EPT will not probably happen 19).

Disposable Soma theory is based on the concept of genes that allow for an optimum amount of energy to be available during a person's youth to maximize reproductive capability. Once the reproductive period is over and aging happens, sufficient energy is no longer available to ensure optimum performance. As a result, decrease in circulation and innervations of the dental pulp is observed, which may also justify delayed responses to EPT 20).

Hypoxia theory states that aging is mainly the result of lowered oxygen concentrations in critical areas of the body 18). The Studies have also shown that the aged pulp has a lower oxygen tension than the mature pulp 19). The lower the oxygen, the less effective the neural function and probably delayed responses to EPT.

Chandler et al. reported that the pulp chambers in male teeth were larger; and also there are significant in different aspects of pulp spaces between the genders 21). Bodrumlu et al. demonstrated that the sizes of pulp chamber in male teeth were larger than the female and significant differences were found 22). Bargale and Padmanabh found highest test values of electric pulp testing response present in males

compared to female subjects 11). In a study by Shaw and Jones, there was no significant difference found in the size of the pulp chambers based on the gender 23). In the present study there was no significant difference found in the responses of pulp based on the gender. The diversity of these results may come back to methods of the studies, as Shaw and Jones estimated the size of the pulp chambers using bitewing radiographs 23). Also, the ethnicity may be a contributing factor to different results. Furthermore, the examined teeth were different in the studies.

The drawbacks of the present study was that mA was controlled by applying certain amounts of prophylactic paste on the teeth and mA values were not numerically calculated. Also, as the patients might have forgotten the exact history of the examined tooth (trauma etc.), the results may be affected by these factors.

CONCLUSIONS:

The present study showed that the responsiveness of pulpal sensory neurons of tooth of older patients is higher than young patients, however this contrast is not clinically important.

CLINICAL SIGNIFICANCE:

Vitality testing is a prequisite for accurate diagnosis, treatment planning and outcome assessment in clinical practice. It is important to determine whether there is significant difference among response thresholds of young and elderly patients to electrical pulp testing.

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REFERENCES

1. Kenneth M. Hargreaves SC. Pathways of the Pulp. 10 ed: Mosbey; 2011. p 15.
2. Farac RV, Morgental RD, Lima RK, Tiberio D, dos Santos MT. Pulp sensibility test in elderly patients. Gerodontology. 2012 Jun;29(2):135-9.
3. Udoye CI, Jafarzadeh H, Okechi UC, Aguwa EN. Appropriate electrode placement site for electric pulp testing of anterior teeth in Nigerian adults: a clinical study. Journal of oral science. 2010 Jun;52(2):287-92.
4. Tranasi M, Sberna MT, Zizzari V, D'Apolito G, Mastrangelo F, Salini L, et al. Microarray evaluation of age-related changes in human dental pulp. Journal of endodontics. 2009 Sep;35(9):1211-7.
5. Seltezer B. Dental Pulp: Quintpub; 2012.p 421-45.
6. Ehrmann EH. Pulp testers and pulp testing with particular reference to the use of dry ice. Australian dental journal. 1977 Aug;22(4):272-9.
7. Rubach WC, Mitchell DF. Periodontal disease, age, and pulp status.Oral surgery, oral medicine, and oral pathology. 1965 Apr;19:482-93.
8. Harkins SW, Chapman CR. Detection and decision factors in pain perception in young and elderly men. Pain. 1976 Sep;2(3):253-64.
9. Kollmann W, Mijatovic E. Age-dependent changes in thermoperception in human anterior teeth. Archives of oral biology. 1985;30(10):711-5.
10. Harkins SW, Chapman CR. The perception of induced dental pain in young and elderly women.Journal of gerontology. 1977 Jul;32(4):428-35.
11. Bargale SD, DavangerePadmanabh SK. Appropriate electrode placement site of electric pulp tester for the premolars: a clinical study. Journal of the Indian Society of Pedodontics and Preventive Dentistry. 2015 Apr-Jun;33(2):138-42.
12. Cooley RL, Robison SF. Variables associated with electric pulp testing. Oral surgery, oral medicine, and oral pathology. 1980 Jul;50(1):66-73.
13. Sturrock RR. Changes in the number of neurons in the mesencephalic and motor nuclei of the trigeminal nerve in the ageing mouse brain. Journal of anatomy. 1987 Apr;151:15-25. PubMed PMID: 3654348.

14. Abd-Elmeguid A, Yu DC. Dental pulp neurophysiology: part 1. Clinical and diagnostic implications.Journal (Canadian Dental Association). 2009 Feb;75(1):55-9.
15. Du C, Zhu Y, Hong L. Age-related changes in pulp cavity of incisors as a determinant for forensic age identification. Journal of forensic sciences. 2011 Jan;56Suppl 1:S72-6.
16. Rivner MH, Swift TR, Malik K. Influence of age and height on nerve conduction. Muscle & nerve. 2001 Sep;24(9):1134-41.
17. Dorfman LJ, Bosley TM. Age-related changes in peripheral and central nerve conduction in man. Neurology. 1979 Jan;29(1):38-44.
18. Morse DR. Age-related changes of the dental pulp complex and their relationship to systemic aging. Oral surgery, oral medicine, and oral pathology. 1991 Dec;72(6):721-45.
19. Ketterl W. Age-induced changes in the teeth and their attachment apparatus. International dental journal. 1983 Sep;33(3):262-71.
20. Seltzer S, Bender IB. The dental pulp.biologic considerations in dental procedures. 3rd ed. Philadelphia: JB Lippincott, 1984:324-438.
21. Chandler NP, Pitt Ford TR, Monteith BD. Coronal pulp size in molars: a study of bitewing radiographs. International endodontic journal. 2003 Nov;36(11):757-63.
22. Bodrumlu E, Cicek E, Dundar C. Age and sex-related differences of pulp chamber size in mandibular second molars. Indian journal of dental research : official publication of Indian Society for Dental Research. 2013 Nov-Dec;24(6):742-4.
23. Shaw L, Jones AD. Morphological considerations of the dental pulp chamber from radiographs of molar and premolar teeth.Journal of dentistry. 1984 Jun;12(2):139-45.