

Correlation between Age related histologic changes at the root apex & Measurement of Working Length

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Abstract

Background: This study was conducted to study the impact of the age related histologic changes taking place at the root apex on time and attempts taken by an apex locator (Morita ZX), to determine the working length of the teeth.

Material & Methods: Patients indicated for a root canal were selected for this study. The study consisted of 40 teeth which comprised of 10 maxillary incisors, 7 mandibular incisors, 5 maxillary canines, 2 mandibular canines, 3 maxillary premolars, 4 maxillary molars and 9 mandibular molars (68 canals). This study was further divided into two groups, Group 1: Patients above 25 yrs of age and Group 2: Patients below 25 yrs of age. Access cavities were made initially with a round bur which were further widened with EX-24 bur. Diagnostic files 6,8,10,15 were used to locate the canals & working length was measured with the help of Morita ZX(Third generation)apex locator. Time and the no of attempts taken by the apex locator in both the groups were noted.

Results: A statistical analysis of the data indicated that the no of attempts and time taken to measure the working length in Group 1: Above 25 yrs were more as compared to Group 2: Below 25 yrs of age.

Conclusion: As the age progressed, due to histologic changes taking place there is deviation in the center of foramen from the vertex or the apical center of the root, due to which time and attempts taken to measure the working length increase.

Key Words: Working length, Apex locator, Time, Attempts, Histologic changes, Root apex, Age.

Introduction

During Endodontic procedures, thorough knowledge of the root canal & its apex is very necessary; it helps the operator determine the extent to which the files, reamers or other instruments should be inserted into the root canal. As the age progresses there are a lot of histologic changes that take place. Two major factors are responsible for changes in cellular structures. These are aging effects & environmental conditions. Both of these changes have an added morphologic effect.⁵³

The most apical portion of the root canal system narrows from the opening of the foramen (major foramen), which is within cementum, to a constriction (minor foramen) within the canal slightly coronal to cementodentinal junction. This portion is entirely within dentin. This hour-shaped portion of the canal dictates that the apical seal be made within dentin. The cementum that covers the dentin is of two types, acellular and cellular. The cementum at the apical third of the root is frequently cellular.

Kuttler studied the average distance between the major and minor diameters of the apical foramina in 268 teeth. He found the average distance to be 0.507 mm in 18-25 year old subjects and 0.784 mm in patients older than 55 years. Kuttler also showed that the center of the foramen deviated from the vertex or apical center of the root in 68% to 80% of the teeth and speculated that this deviation occurred as a result of thickening of the apical cementum; furthermore, he speculated that the position of the major foramen becomes further displaced as a result of aging.⁵³ Scanning electronic microscopic studies done by Morfis et al and Stereoscopic studies done by Green confirm Kuttler's study. The purpose of this study was to evaluate the clinical effect of this histologic changes at the root apex, in the terms of Time and no of Attempts taken by a third generation Apex locator(Morita ZX) to measure the Working length of 40 teeth(68 canals).

Material and Methods

Patients indicated for the root canal therapy were selected for this study. The patients selected were above 14 years of age, did not have open apices, external root resorption, any fractures in the coronal/root aspect of the tooth, were devoid of any developmental disorders that affected the teeth, did not have acutely curved roots and female patients in the study were not pregnant. A concise case history was taken & patients were made to fill a consent form to be made a part of this study. The patients according to their age were divided into two groups, Group 1: Above 25 yrs of age and Group 2: Below 25 yrs of age.

A IOPA was taken using Gnatus X-ray machine (Brazil, standard of 70 kvp & 7 ma with a max exposure time of 3.20 provided with a total filtration of 1mm aluminium) to confirm the extent of caries. Access cavity was made with a round bur which was further extended by EX-24 bur, Diagnostic files 6, 8, 10, 15 K files (Mani) were inserted and were connected to a third generation apex locator (Morita ZX) and the working lengths were measured, this working length was confirmed by a diagnostic radiograph (by inserting a diagnostic file to the length measured by apex locator, the length was confirmed). During this process of measuring the Working length by an Apex locator, Time taken and the no of Attempts taken to measure the working length were noted down.

Results

As stated earlier, the sample size was divided into two groups, Group 1: Above 25 yrs of age and Group 2: Below 25 yrs of age. A statistical analysis of the data was done and our results were as under:

Table no: 1 Comparison of the values of No. of attempts per canal in groups according to age (young and adult):

	Above 25 years (Old) (n=44)	Below 25 years (Young) (n=24)
	Mean \pm SD	Mean \pm SD
NO. OF ATTEMPTS PER CANAL	1.81 \pm 1.16	1.43 \pm 0.51

By applying Student's 't' test there is a significant difference between average values of no. of attempts per canal when Old patients (above 25 years of age) compared to young patients (below 25 years of age) ($p < 0.05$).

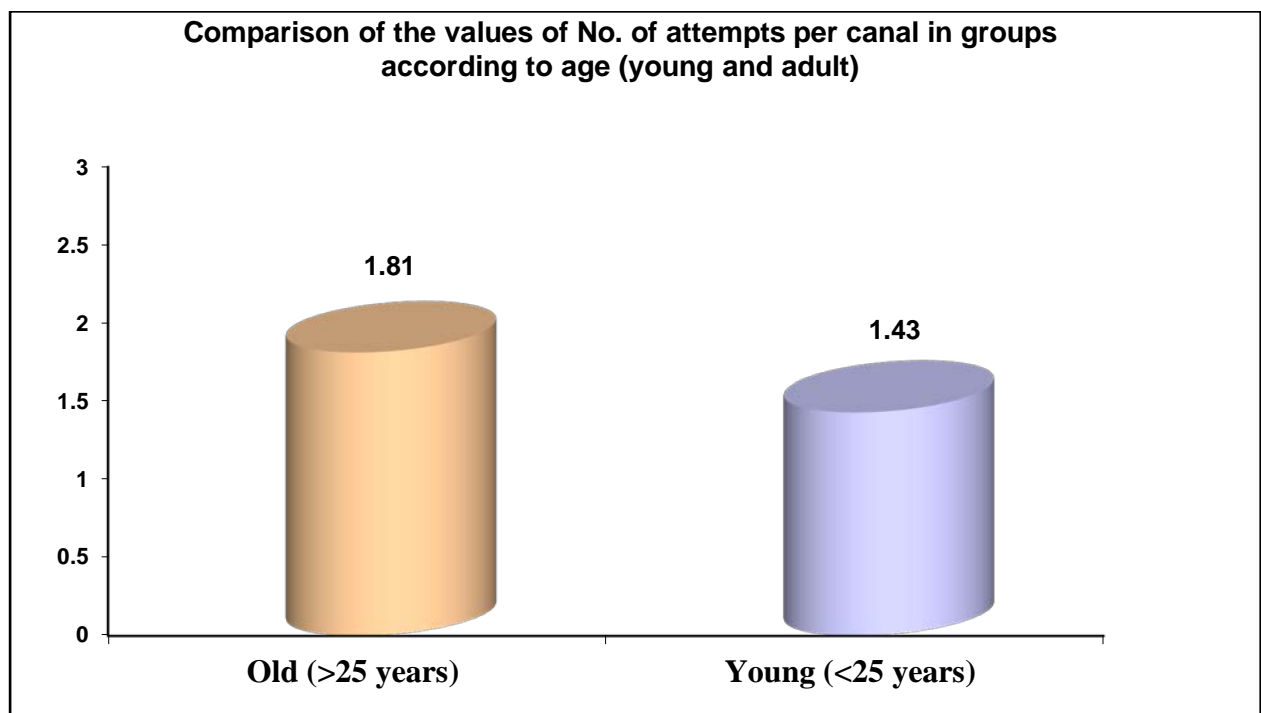
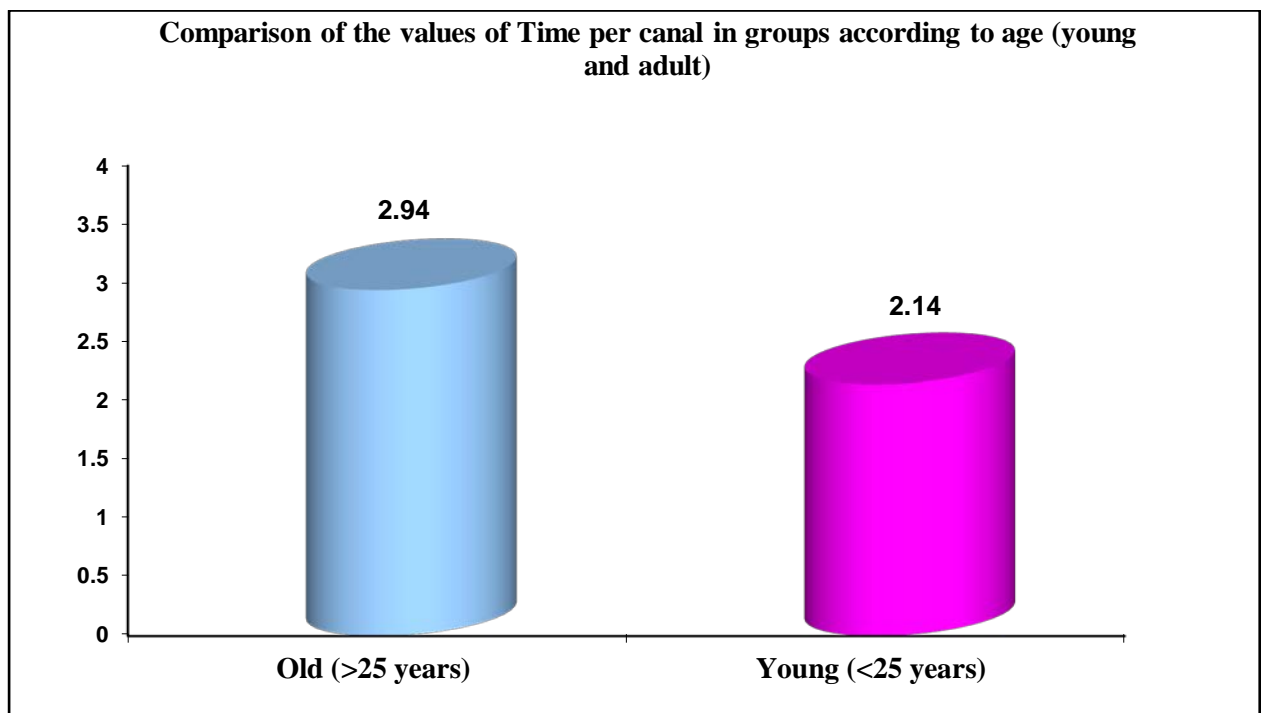


Table No.2: Comparison of the values of Time per canal in groups according to age (young and adult):

	Above 25 years (Old) (n=44)	Below 25 years (Young) (n=24)
	Mean ± SD	Mean ± SD
TIME PER CANAL (min)	2.94±1.85	2.14±1.06

By applying Student's 't' test there is a significant difference between average values of time per canal when Old patients (above 25 years of age) compared to young patients (below 25 years of age) ($p < 0.05$).



Discussion

The purpose of this study was to evaluate the extent to which a dentist is affected by the histologic changes that take place over time. Kuttler and other researchers like Morfis. et al and Green have proved through several types of microscopic studies that there are profound changes that take place histologically as the age progresses, this lead to the change in foramen location with thickening of the apical cementum. This change in location of the foramen leads to difficulty in measuring the working length by an Apex locator or even by a simple manual method of tactile sensation. Our main aim was

bring into light this clinical effect so that measures to overcome them can be found out and thus success rates of Endodontic therapies can further be enhanced.

The advantage of apex locators are that they are supposedly accurate, easy, fast and reduce exposure to radiation. Artificial perforation can be recognized and it is the only method that can measure length to the apical foramen and not the radiographic apex.⁴¹ The apex locator used in this study is Morita ZX, it is a third generation apex locator based on the ratio method introduced by Kobayashi & Suda in 1994. In this method the quotient of two simultaneously measured impedance of two different frequencies are calculated to reveal the portion of an endodontic file inside the canal, this quotient reduces rapidly when apical constriction is reached because the capacitance at the apical constriction is highest compared to other portion of the canal, the instrument gives a signal at this point.

With an increase in the patient's age, certain physiologic changes seem to occur resulting in deviation of the foramina, in addition to this several variations also occur in the root canal morphology. Burch et.al in 1972 proved that the percentage of the major foramina deviating from the anatomic apex ranged from 78% to 98.9%, with a mean of 92.4%, a percentage that is higher than those reported by other investigators. Green's studies showed that 69.3% of the anterior and 50% of the posterior teeth exemplified deviation from the anatomic apex. Kuttler reported that up to 80 % of the teeth had deviated major foramina, while a study by Levy and Glatt reported a deviation percentage of 66.4%.³⁸

The physiology of the root canal preparation and obturation is never to be beyond the apex into the periapical tissues. That is why most clinicians recommend a working length that is 0.5 to 1.5 mm short of the radiographic apex. It is well known that during tooth life cementum is deposited at the apex, which is responsible for the change of location of the foramen,¹⁸ so our main aim clinically is to locate this deviated foramen and estimated the precise length upto which obturation should be done, apex locators to very large extent help in this process but the thickening of the apical cementum makes it difficult to get precise estimation of the working length in the first attempt and thus also increases the time required in the age group that is above 25 yrs.

Conclusion

1. There is definitely an impact on the time taken to measure the Working length of teeth in older patients.
2. No matter how updated a apex locator is, but due profound histological changes taking place, the no attempts required to measure the working length in older patients increase.
3. Further studies using a larger sample size and standardized radiographic methods are recommended.

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