

ORIGINAL ARTICLE**COMPARISON BETWEEN RVG AND ELECTRONIC WORKING LENGTH DETERMINATION IN ROOT CANAL TREATMENT IN VIVO STUDY**S Rawlani¹, Aditya Patel², Prithwish Mukherjee³, Shraddha Patel⁴, R. Bhowate⁵, M. Chandak⁶¹Reader, ⁴Senior lecturer, ⁵HOD Department of Oral Radiology and Diagnosis, ²Reader, ³Post graduate Student, ⁶HOD Department of Conservative Dentistry and Endodontics, SPDC sawangi(m)**ABSTRACT:**

Objective: The aim of this study was to compare the diagnostic efficacy of an electronic apex locator (EAL) and radiovisiography (RVG) in working length (WL) determination. **Materials and Methods:** This study was performed on Single-rooted maxillary/mandibular teeth requiring root canal treatment. After administration of local anesthesia, the teeth were isolated and the pulp cavities were accessed. Canals were irrigated and pulp was extirpated. The working length was then measured for each canal by an electronic apex locator (The Root ZX) and radiovisiography. Paired t-test was used to assess mean difference between radiovisiographic and electronic working length with 0.05 level of significant. **Results:** Mean working length in apex group was 20.08 ± 2.15 and in RVG group it was 20.42 ± 2.18 . By students paired t test statistically significant difference was found in working length at apex locator and RVG ($t=4.26, p=0.0001$). **Conclusion:** Radiovisiography demonstrated significant accuracy in determining the working length.

Keywords: Working length, Cementodentinal Junction, Apical Constriction, Radiographic Terminus (RT) Apex locator, Radiovisiography.

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INTRODUCTION:

Root canal infections are polymicrobial in nature consists of both aerobic and anaerobic bacteria. The main aim of the root canal treatment is to reduce the bacterial population and remove the bacterial products and by-products. For this proper working length is one of the most important steps.

Working length defined as the distance from a coronal reference point to the point at which canal preparation and obturation should terminate.¹ According to European Society of Endontology, The working length is measured from a point on the tooth coronal surface that is within the clinician's field of view.²

One of the main difficulties during endodontic treatment is to establish the root canal working length. However, clinically, identifying the apical constriction is a challenge, as it presents wide anatomical variations in the apical third of the root canal.³ Gutierrez and Aguayo found that the distance between the foraminal openings and the tip of the anatomical root apex ranged from 0.20 to 3.80 mm. Proper working length is very important step in the root canal procedure for its success. To minimise the post-operative flare up it is very important to restrict instrumentation until minor apical foramen. Recent

advances in technology have comparatively improved treatment success in the root canal treatment for patients with a range of 31–100%.

Traditionally radiographic method is used to determine, the distance between the tip of the file inserted in the root canal and the tip of the radiographic apex is measured. Regardless the method, once the appropriate WL is established, maintaining consistency of that measurement is crucial to the clinician throughout the treatment.

The digital radiographic method produces images using a sensor instead of radiographic film. Some advantages of digital x-ray over the conventional method are mainly a speedier image acquisition, a much lower radiation dose and image editing ability to more clearly study the details.⁵ Authors have considered that the reliability of electronic apex locators in determining apical constriction is superior to radiographic methods.⁶ Electronic apex locators are claimed to be more reliable than radiographs to identify the WL of the root canal.⁷ The studies over the years have confirmed the reliability of electronic apex locators in determination of WL.⁸

Nevertheless, the literature is not conclusive on whether the electronic method is more efficient than the digital radiographic method for root canal working length

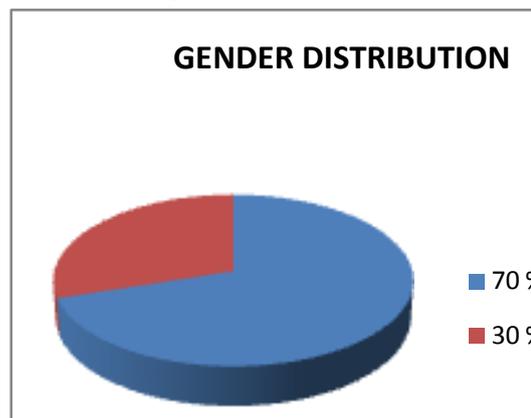
determination. Thus, the objective of this study was to compare the accuracy of the digital and electronic radiographic methods in determining root canal working length.

METHODOLOGY

The total number of 100 patients were treated in endodontic department out of which seventy patients (70 %) were female and thirty patients (30 %) were male. The study was conducted at Sharad Pawar Dental College Sawangi Meghe for about 6 to 9 months. It was Cross sectional comparative study. The objective was to establish the length at which canal preparation and consequent obturation has to be completed by using radiovisiography and apex locator. Consent was obtained from Ethical Review committee prior to initiation of the study. Single-rooted maxillary/mandibular teeth requiring root canal treatment of presented with irreversible pulpitis were selected for the study. Teeth with sound cusp anatomy and complete root apex on radiographs were selected. The patients with heart pace maker or had a contributory medical history, teeth with metallic restorations, radiographically invisible canal, open apices, resorbed roots and root fracture were excluded from the study. A detailed medical and dental history was taken. selected patients were briefed about the procedure and the product. Their written consent was taken. Before starting any procedure a standardized periapical radiograph was taken for each tooth in buccolingual projection to exclude teeth with radiographically invisible canal, open apices, resorbed roots and root fracture. Intraoral periapical radiograph was taken prior to the initiation of treatment. After the administration of local anesthesia (Medicaine, Huons co. Ltd.Korea), a conventional endodontic access was prepared by using high speed hand piece with a number (02) round diamond bur and number (02) tapered fissure diamond bur. Pulp tissue was completely extirpated using fine H file no 15. After pulp extirpation the canal was irrigated by copious amount of 2.5 % sodium hypochlorite used in 27 gauge needle. The absorbent paper points were used to dry the canal after irrigation of the root canal. The optimal length is 1 to 2mm short of the apex in radiographic method and apical constriction in electronic working length determination (Considering the preoperative radiographs as baseline). a size 25 K-file will be connected to the electronic apex locator Root ZX (J. Morita, Kyoto, Japan) and inserted into the root canal to the point where the device will indicate the APEX

measurement, and also radiovisiograph technique used to measure the working length , which has a rubber stop properly adjusted to tip of the buccal or lingual cusp as a coronal reference point. After the radiograph had been exposed the file was removed. Once the working length radiograph with a file in canal was obtained, the proper radiographic working length was established. On some working length radiograph, if the difference between the end of the instrument and the root apex was more than 2mm than the file was readjusted to obtain the accurate working length.

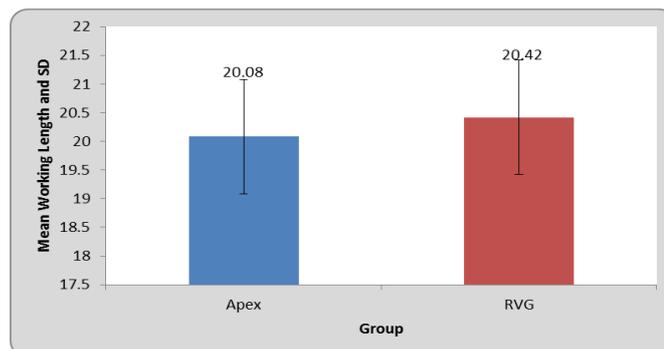
The file was removed and the electronic working length was calculated by measuring the length of working length file from rubber stop that was fixed to coronal indication point to tip of the file. This length was recorded on data sheet as electronic working length. Statistical package for social sciences (SPSS-10) was used to analyze the data. The significant descriptive statistics mean and standard deviation were computed for quantitative variables, radiovisiograph and electronic working length of root canal. Paired t-test was used to assess mean difference between radiovisiographic and electronic working length with 0.05 level of significant.



RESULTS

In study total number of 60 patients were treated with root canal treatment . Seventy patients (70 %) were female and thirty patients (30 %) were male . In which working length evaluated by using different techniques i.e. apex locator and radiovisiography.

Mean working length in apex group was 20.08±2.15 and in RVG group it was 20.42± 2.18. By students paired t test statistically significant difference was found in working length at apex locator and RVG (t=4.26,p=0.0001).



Statistical analysis was done by using descriptive and inferential statistics using student's paired t test and software used in the analysis was SPSS 17.0 version and $p < 0.05$ is considered as level of significance.

DISCUSSION

In endodontic therapy correct working length determination is one of the vital initial steps. Established an accurate WL is a basic, but critical, step in root canal debridement and preparation resulting in complete cleaning of the canal and avoiding damage to periapical tissues from over instrumentation leading to victorious root canal treatment.

For determining the position of the canal terminus and measure the WL of root canals various techniques have been used with variable results. However, locating the appropriate apical position has always been a challenge in clinical endodontics. There are two valid position recommended for working length; at the dentinocemental junction, as suggested by Kuttler, or at the apical foramen. The dentinocemental junction is the ideal physiologic apical limit of working length and the dentinocemental junction is a histological entity, with varying extensions of the cementum into the root canal. Hence, the apical constriction (AC) is the other anatomical landmark for limiting instrumentation. The significance of the AC in endodontic therapy is well standard and the reliance on the dictum that canal preparation should terminate 1 mm short of radiographic terminus (RT) is becoming increasingly dreadful. The invasion of this point, in an apical direction with instrumentation and/or filling material could affect apical healing.

There are various methods for determination of working length (Radiographic, Apex locators, Tactile), but none of these are perfect. In root canal therapy the radiographic method is the most common method (and remains so) of measuring working length.

Determination of the working length and its maintenance during canal cleaning and shaping of procedures play an important role in the successful endodontic therapy. With the advances of technology, now apex locator becomes the essential part of armamentarium of root canal procedure. The use of an electronic apex locators have improved the accuracy of the working length measurement in clinical⁹ endodontics and are used with appropriate radiographs, which allows for much greater accuracy^{9,10} of working length determination.

The present clinical study incorporates all reported errors, which may be encountered in the mouth and, in this connection the radiographic length compared with electronic length. This study has shown that electronic measurements tend to be different and statistically significant different than radiographic measurements between the same in working length determination of a root canal. The results of present study have also shown similar result in comparison with previous study reported by Foud AF et al.¹¹

It is important to emphasize that this device indicates the location of the apical foramen, which in most cases does not coincide with the apex. Various schools of thought

exist for the termination of root canal working length. Kuttler (1955) stated that the cementodentinal junction lies 0.507 mm short of the apical foramen in persons 18-25 years of age and 0.784 mm short in persons 55 years of age and older.¹² This natural constriction, where the dentin meets cementum, appears to be the ideal location for development of an apical seat for the root filling material.¹³

The Root ZX electronic apex locator was used in this study because it presents higher precision and reliability in the measurements.¹⁴ de Vasconcelos in 2010 stated that only Root ZX did not suffer a significant negative effect on precision when compared with other electronic apex locator.¹⁵

There are several advantages reported using electronic apex locator. First, they are beneficial in reducing the number of radiographs essential to determine WL. Some dentists determine the WL only by using the apex locators; others use only one radiograph to verify the initial measurement. Thus, by decreasing the total number of required radiographs, the patient's exposure to radiation is also reduced. It can be especially invaluable in cases where the patient is at high risk when exposed to radiation. Another advantage is by providing a greater precision in locating the apical foramen compared to the radiographic method.

The limitation of the conventional radiographic method is due to the dentist's ability to interpret the images; therefore, large variations may arise from one to another professional if a previous calibration is not done.¹⁶

The correct use of electronic apex locator may help to reduce the risk of instrumentation beyond the apical foramen but electronic apex locators used alone without the radiographic method cannot give any information about the curvature and direction of the root canal. Thus, it can be stated that one should use the combination of both radiographic and electronic method for appropriate determining the WL of root canal. The knowledge of apical anatomy or curvature by prudent use of radiographs and the correct use of electronic apex locator will assist practitioners to achieve predictable results.

CONCLUSION

Radiographic techniques were used conventionally as the main tools by practitioners during endodontic WL measurements for many years and the introduction and evolution of electronic WL measurement devices have provided another reliable means to help practitioners in their endodontic treatment procedures. Although there is no significant difference between the radiographic method and electronic apex locator method in establishment of precise working length of root canal but both tendencies should be considered together. Both the radiographic methods and electronic apex locator method have their own benefits and constraints, but greater advantages of electronic apex locators have made them an authentic mean of working length determination for day to day endodontic applications.

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