Quest Journals
Journal of Medical and Dental Science Research
Volume 3~ Issue 7 (2016) pp: 10-13
ISSN(Online) : 2394-076X ISSN (Print):2394-0751
www.questjournals.org

Research Paper

Comparative evaluation of accuracy in Working length determination by using four methods namely, Digital Tactile Sensation (DTS), Conventional radiography (IOPA), Radiovisiography (RVG) and Electronic Apex Locator (EAL)- An In vivo study.

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Received 11 August, 2016; Accepted 23 August, 2016 © The author(s) 2014. **Published** with open access at **www.questjournals.org**

ABSTRACT: *The aim of this study was to compare the diagnostic efficacy,advantages and limitations of the four methods of working length determination by using Digital Tactile Sensation, Conventional Radiography, Radiovisiography and Electronic Apex Locator[1].This study was performed on 30 randomly selected patients only inposterior teeth (pre molars and molars), scheduled for root canal treatment due to Dental caries.After administration of local anaesthesia, the teeth were isolated and the pulp cavities were accessed.The working length for each tooth was measured by electronic apex locator(i-root),conventional (IOPA)and digital radiographies(kodak).The working length was also assessed by digital tactile sensation. The mean value of differences between four experimental methods were statistically insignificant.Electronic Apex Locator gave the most accurate readings within the acceptable range whereas Digital Tactile Sensation method hadmore limitations.The study concludes that all the four methods have their own advantages and disadvantages in determining the working length.*

Keywords*: Apex locator, Intra-oral periapical radiograph, Radiovisiography , Tactile sense, Working length determination.*

I. INTRODUCTION

The foremost concern in root canal treatment is to determine how far the working files should be advanced within the root canal and at what point the preparation and obturation should be located.Over-instrumentation can cause tissue destruction which leads to inflammatory responses and foreign body reactions, whereas under-preparation will entail the risk of leaving the infected tissue remains within the apex region.This insufficient cleaning may lead to failure of the treatment.

The literature gives two valid positions for apical stop preparation:Cementodentinal junction or at minor apical foramen.Root canal fillings ending with the apical constriction or cement-dentinal junction yields optimal healing conditions .It minimizes the contact between the filling material and the apical tissue,hence reducing the inflammatory responses and foreign body reactions but it is difficult to achieve due to its variable positions and topography.

Lots of techniques have been used to measure the working length of root canals like digital tactile sensation,periodontal sensitivity, moisture on paper, radiographs and electronic apex locators.

The most commonly used method is radiographic technique.Conventional film based radiography has the disadvantages such as more radiation exposure and time consuming.Radiovisiography, an advanced imaging technology, allows image enhancement, low radiation exposure and less time consuming[3].Though radiography is the common diagnostic aid , it is only able to provide a two dimensional image.The apical foramen used as landmark in radiographs often lies on the lingual/buccal or mesial/distal aspects.These factors increase the inaccuracy and discrepancy of radiographic canal length determination[4].

In order to overcome these drawbacks, the electronic apex locator was developed by Custer in 1918.These devices also have some disadvantages like, inability to give an idea about the curvature of the root

canal ,showing improper results in case of non vital teeth and blood and pus filled canals. At times the results are varied in sodium hypochlorite(NaOCl) filled canals which is the common irrigantsolution[5].
Though the improved technologies reduced the probability of varied results from electronic apex locators in working length determination, the combined approach of all four methods gives a clear idea about the exact working length of the canals,presence of curvatures, blockages and helps in filing motion and speed[6].

II. MATERIALS AND METHODS

This study was performed on 30 randomly selected patients whose posterior teeth were scheduled for Root canal treatment.The teeth with root resorption, Fractures,open apices ,metallic restorations,radiographically blocked canals were excluded.The entire treatment procedure was well explained to the patient and their consent was obtained prior to the procedure. A pre-operative intraoral periapicalradiograph(IOPA) with conventional radiography and a digital image by using Radiovisiography(RVG) (KODAK) was taken for each tooth in bucco-lingual projection using bisecting angle technique[7].The tooth was anaesthetized,followed by rubber dam isolation.The access cavity was prepared using high speed diamond round bur and tapering fissure bur under water coolant.The orifices of the canals were located using endodontic explorer and the contents of the canals were removed with barbed broach followed by irrigation with 1 % NaOCl.[8]The excess irrigant was gently removed using cotton pellet.Then the Working length for each tooth was measured by all four methods(Digital tactile sensation, conventional radiography,radiovisiography and Electronic Apex locator).

Digital tactile sensation method;

A stainless steel 15 size K-file was inserted gently into the canals until the resistance was created.The stopper was adjusted to the reference point.The highest point in buccal and palatal cusps are used as reference points in premolars. The highest point in the distobuccal ,mesiopalatal and mesiobuccal cusps are used as reference points for mesiobuccal, distobuccal and palatal canals respectively for maxillary molars.And the highest point in the mesiobuccal, mesiolingual and distobuccal cusps are used as reference points for mesiobuccal, mesiolingual and distal canals respectively for mandibular molars.The length was then measured usingendogaugein millimeters.

Intraoral Periapicalradiograpy(IOPA);

The stainless steel 15 size K-file is then inserted into the canals as the same mentioned in the tactile sensation method.A conventional E-Speed(Ektaspeed) X-ray film(KODAK)was placed inside the patient's mouth and the X-ray beam is positioned accordingly using bisecting angle technique.Keeping the X-ray film in position X-rays are exposed.The x-ray film is developed and the working length is measured by using Ingle's method.

The length of the root was measured on the preoperative radiograph, from the reference points considered to the root apex, and 1 mm substracted from this length to avoid distortion and magnification errors (safety allowance).The comparison was made with the radiograph with instrument inserted into it.After this the difference between the end of the instrument and the end of the root was measured on the radiograph and this amount was added/sustracted to the original measured length.From this reading,substract 1mm using endogauge and the final WL was established.

Digital radiovisiography;

The radiographic image by RVG(KODAK) with CCD sensor was taken by using the sensor as x-ray film and the imaging technique is as same as conventional radiography.But the exposure time is less compared to IOPA radiographic technique[9].The measuring options were available in the RVG software as each canal is measured in different colours and the calibrations are noted.
Likewise IOPA technique, the difference between the end of the instrument and the end of the root was measured and this amount was added/substracted to the original measured length by comparing the preoperative RVG image of the tooth.

Electronic Apex locator;(i-root)

The clip was attached to the Patient's lip and a 15 size stainless steel K-file was connected to the file holder of the Electronic Apex Locator.Then the file was advanced slowly within the canal until the visual reading showed the position of file tip at the target.ie.,0.5 mark ahead of apex mark.Measurement was considered final if the reading remained stable for 5 seconds.Then thestopper was adjusted to the reference point and the length was measured using endoguage in millimeters.

III. RESULTS

Based on these four methods the study carried out to demonstrate and find out the most prior way of determining the root canal length.They are,

- Accuracy of the root canal length,
- Efficiency in various types of canals
- Ruling out the morphology of canals
- The easiness of the procedure.

Accuracy of the root canal length

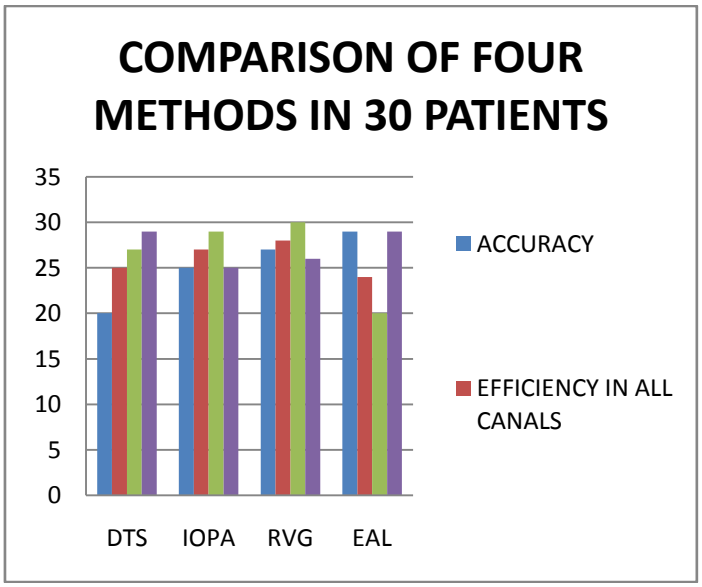
On doing this experiment over 30 number of patients,the EAL gives most accurate reading for almost all patients.In order to work in the canal ,the exact position of apical stop should be maintained.By achieving this , the entire removalof infected region in the canal is possible also it prevent the periapical tissues injury by not pushing the debris outside the canal.

Although conventional radiography and radiovisiography gives some comparable values,it is only a two-dimensional image.In many cases, the root tips may curved at the apex region and it is not clearly read through the 2D images.Digital tactile sensation gives varied measurements over different patients because of canal patency and curvatures[10].

Efficiency in various types of canals

The EAL method gives most accurate readings over many patients but sometimes it failed to give appropriate results due to various canal contents and periapical pathologies.The periapical cysts,granulomatous tissue, Non vital teeth affects the measuring tendency of the EAL and gives false readings. Sometimes NaOCl(sodium hypochlorite) filled canals showed false results since it is a common method of irrigating the canals.

While doing measurements with RVGs and IOPAs,these types of errors were rarely seen.Also it can be corrected by adjusting the measurements on comparing with the radiographic image.Tactile sensation gives the knowledge about the type of canal and gives the preliminary idea for working in the root canal.



Ruling out the morphology of canals

Knowing the morphology of root canals gives us an idea about the nature and curvature of the canals,so as to achieve the knowledge to use the instruments inside the canal in a very proper and in efficient manner.We should take alternative precautions in curved and narrowed canals to avoid instrument separation inside the canal.

Only through EAL,the morphology cannot be studied in a proper manner rather tactile sensation gives an idea about the canal pathway.Radiographic methods are aiding in superior manner in finding out the detailed structure of root canals.

The easiness of the procedure

Although the various methods of working length determination are available,the procedure should be considerably comfortable for the patient and the dentist as well.It has to be noted that the time taken for the procedure,Patient's and operator's posture,radiation exposure,post-procedural pain etc.,.

Radiographic methods are time taken procedures and the patients will be exposed to more amount of X-ray radiations.EAL method is most reliable and Patient-friendly method compared to other methods which are providing almost accurate readings.Tactile sensation method will not be considered as a confirmatory method of finding the working length determination[11].

IV. CONCLUSION

The four methods discussed here in this article,Digital tactile sensation,Conventional radiography(IOPA),Radiovisiography(RVG) and Electronic Apex locator(EAL) will have its own advantages and limitations.The method also depends on the type of tooth to be treated.Each method will be helpful in finding the root canal length in different conditions.Sometimes , the combined approach also will do it.

These issues can be solved by newer advancement techniques like CT scan .But that will take a few more years to be portable and inexpensive to enter in Dental clinics for every Root canal treatment cases.

REFERENCES

[1]. Martinez-Lozano MA, Forner-Navarro L, Sanchez-Cortex JL,Llena-Puy. Methodological considerations in the determinationof working length. IntEndod J 2001;34:371-76.

[2]. Duran-Sindreau F, et al. Comparison of in vivo and in vitroreadings when testing the accuracy of the root ZX apex locator.Journal of Endod 2012 Feb;38(2):236-39.

[3]. Neena IE, et al. Comparison of digital radiography and apexlocator with the conventional method in root lengthdetermination of primary teeth. J Indian SocPedodPrev Dent2011;29:300-04.

[4]. Griffiths BM, Brown JE, Hyatt AT, Linney AD. Comparisonof three imaging techniques for assessing endodontic workinglength. IntEndod J 1992;25:279-87.

[5]. Tosun G, et al. Accuracy of two electronic apex locators inprimary teeth with and without apical resorption: A laboratorystudy. IntEndod J 2008;10:365-71.

[6]. Vieyra JP, et al. Comparison of working length determinationwith radiographs and four electronic apex locators. IntEndod J2011 Jun;44(6):510-18.

[7]. Brown R, Hadley JN, Chambers DW. An evaluation of ektaspeedplus film versus ultra speed film of endodontic working lengthdetermination. J Endod 1998;24(1):54-56.

[8]. Brunton PA, Abdeen D, Macfarlane TV. The effect of an apexlocator on exposure to radiation during endodontic therapy. JEndod 2002;28(7):524-26.

[9]. Burger CL, Mork TO, Hutter JW, Nicoll B. Direct digitalradiography versus conventional radiography for estimation ofcanal length in curved canals. J of Endod 1999;25(4):260-63.

[10]. Eikenberg LTCS, Vandre COLR. Comparison of digital dentalX-ray systems with self-developing film and manual processingfor endodontic file length determination. J Endod 2000;26(2):65-67.

[11]. El Ayouti A, Weiger R, Lost C. The ability of root ZX apexlocator to reduce the frequency of overestimated radiographicworking length. J Endod 2002;28(2):116-19.