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Research Article

Comparative Evaluation of Root Length Values Determined by Two Different Types Of Electronic Apex Locators And Paralleling Radiographic Method In Primary Mandibular Second Molars Of Children Of 5 To 7 Years Age Group

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ABSTRACT

Aim: The aim of this study was to compare the working length values of two different types of electronic apex locators (Propex II AND DentaPort ZX), and paralleling radiographic method in mandibular primary second molars of the children between the age group of 5 to 7 years.

Material & Methods: A study was carried out on 150 root canals from 50 children in primary second molars indicated for pulpectomy in children of age 5-7 years attending Department of Pedodontics, Government Dental College & Hospital, Ahmedabad. The standard procedure for pulpectomy was carried out and the root canal length was clinically measured with the help of electronic apex locator (Propex II & DentaPort ZX) and paralleling radiographic method. The values were subjected to one-way ANOVA test.

Results: In the current study, mean canal length by Propex II apex locator was 13.158, DentaPort ZX was 13.046 and paralleling radiography was 13.021 for MB (Mesio-buccal) canal respectively, for ML (Mesio-lingual) canal the values were 13.054, 13.08 and 13.066 respectively. For D (Distal) canal mean values were 13.546, 13.47 and 13.476 respectively by ProPex II, DentaPort ZX and paralleling radiographic method. The values were subjected to one-way ANOVA test and there is no significant difference in the mean root length measurements from the three techniques ($P > 0.05$) for all the three root canals.

Conclusion: Hence to conclude, electronic apex locator is comparable to paralleling radiography in working length determination without radiation exposure in primary teeth.

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INTRODUCTION:

The popular objectives of concerns for keeping up the integrity of deciduous teeth until physiological exfoliation have several reasons such as mutilation of the developing dentition due to loss of primary molars, reduced masticatory function which affect nutritional status of child. Preservation of primary teeth by means of endodontic treatment for children leads to increase concern of parents (Tosun G et al. 2008). The success of a root canal treatment depends on an exact working length measurement because it helps in deciding proper apical stop by achieving the apical limit of canal preparation and obturation. An exact working length measurement helps in careful debridement of the canal, so that over instrumentation, injury to the periapical tissues or destruction of the anatomy of the root apex can be avoided during pulpectomy of primary teeth (KM Nanda Kishore 2012). Working length has been defined as, "the distance from a coronal reference point to the point at which canal preparation and obturation should terminate." The determination of how far working instrument should be progresses inside the canal and at what end obturation should end is one of the critical considerations in root canal treatment (Nikhil Puri et al. 2013). The working length should be deliberately decided without exceeding the apex so that limiting the harm to periapical tissue and also conceivable harm to succedaneous tooth (Neena IE et al. 2011). The most well-known technique for deciding the working length is utilization of conventional radiography. But the radiographic method has several disadvantages such as creation of two-dimensional pictures, radiation exposure, difficulty in placement of film in oral cavity of pediatric patient and complicated technique in developing the films. The use of EAL overcome the limitation of the radiographic method by decreasing radiation exposure also it has added advantages such as, they are simple, quick to work and have a decent precision. Currently EAL (Electronic Apex Locators) for working length measurement have a high reliability, high precision and high reproducibility in finding the major apical foramen regardless of the electrolyte. Still EAL is not ideal method for working length measurement and

remained aids to conventional radiography (Neena IE et al. 2011). In the present study, the null hypothesis is that there is no significant difference in the diagnostic ability of two different types of electronic apex locators (Propex II & DentaPort ZX) and paralleling radiography in determination of working length. So, the aim of this study is to compares the diagnostic efficacy of two methods, namely electronic apex locators (Propex II & DentaPort ZX) and paralleling radiography in determining the working length in root canal of primary mandibular second molar teeth in vivo.

METHOD:

This was an in vivo study of 150 root canals from 50 children in the age range of 5-7 years, who were candidates for mandibular primary second molar pulpectomy, affected by irreversible pulpal disease. Ethical clearance from Institutional Ethical Committee was obtained prior to the start of the study. The first appointment included intraoral examination, diagnosis and behavior shaping of the patient. A diagnostic Intraoral Periapical (IOPA) radiograph of the tooth was taken with paralleling radiographic method.

Children of 5 to 7 years age, patients and parents willing to sign consent form for child's treatment of pulpectomy and children with no systemic history were included in this study. Teeth with perforation of the floor of pulp chamber, non-restorability of the crown, resorption of the root and intra-canal calcifications were excluded from this study. The standard procedure for pulpectomy was carried out in the consecutive appointment, after obtaining complete anesthesia by inferior alveolar nerve block with lidocaine and adrenaline (1: 80,000) followed by isolation with rubber dam, all caries were removed with a round bur in a low-speed handpiece; then access cavity was prepared by a fissure bur in a high-speed handpiece. The area was rinsed by normal saline. The root canal length was clinically determined with the help of two different types of electronic apex locators Propex II (Densply-maillefer, Switzerland), fifth generation apex locator and DentaPort ZX (J. Morita Mfg. Corp., Kyoto, Japan), third generation

apex locator. The file was attached to the file holder and the lip holder was attached to the patient's lip. The file was advanced till the device indicates that the apical constriction has reached and the working length was estimated. Then the distance between rubber stop and file apex was measured by a millimeter ruler and measurements were recorded as the measured working length by electronic apex locator in mm. Same procedure was done with another electronic apex locator and values were recorded. By using preoperative radiograph measurement was taken using ISO size 15-20 number K-files with rubber stoppers, keeping them 0.5 mm short of the root apex as in Ingle's method. With these measurements, a file was inserted into the canal and intraoral periapical

radiograph was taken with paralleling radiographic method and root canal length was measured. In all patients, radiographic measurements were taken by a single investigator.

RESULTS:

The present study showed that mean of ProPex II apex locator was 13.158, DentaPort ZX was 13.046 and paralleling radiography was 13.021 for MB canal respectively, for ML canal the values were 13.054, 13.08 and 13.066 respectively. For D canal mean values were 13.546, 13.47 and 13.476 respectively for ProPex II, DentaPort ZX and paralleling radiographic method as shown in [Table 1].

Table 1: Descriptive statistics of root length (mm):

Technique	Canal	Total number	Mean	Std. Deviation	Std. Error Mean	Variance
Apex locator ProPex II	MB*	50	13.158	0.952781	0.135539	0.907792
	ML#	50	13.054	0.827637	0.120451	0.684984
	D+	50	13.546	0.941169	0.136984	0.8858
Apex locator DentaPort ZX	MB	50	13.046	0.899481	0.135539	0.809065
	ML	50	13.08	0.815413	0.120451	0.664898
	D	50	13.47	1.035936	0.136984	1.0731163
Paralleling radiography	MB	50	13.021	1.019208	0.13559	1.038785
	ML	50	13.066	0.90905	0.12045	0.826371
	D	50	13.476	0.925061	0.136984	0.855739
*MB=MESIO BUCCAL,# ML= MESIO LINGUAL,+D = DISTAL						

The above ANOVA table shows that the sum of squares between groups is 0.5323, 0.016933 and 0.178533 respectively for MB, ML and D; within group is 135.0265, 106.6364 and 137.9204 respectively for MB, ML and D. Degree of freedom between groups is 2 for all the root canals and within

group is 147 for all the root canals. Hence to conclude that the mean root length measurements from the three techniques for all the three root canals in primary mandibular second molars shows no significant difference (**P > 0.05**) [Table 2].

Table 2: Comparison of the three groups by ANOVA test:

Canals	Sources	SS	df	MS	F	P value
MB	Between Groups	0.5323	2	0.26615	0.289751	0.748876
	Within Groups	135.0265	147	0.918547		
	Total	135.5588	149	0.90979		

ML	Between Group	0.016933	2	0.008467	0.011671	0.988397
	Within Groups	106.6364	147	0.725418		
	Total	106.6533	149	0.715794		
D	Between Group	0.178533	2	0.089267	0.095143	0.90923
	Within Groups	137.9204	147	0.938234		
	Total	138.0989	149	0.926838		

This implies that the measuring accuracy of Propex II, DentaPort ZX and paralleling radiography were almost similar.

DISCUSSION:

Measurement of the correct working length is considered an important step of root canal treatment because of the fact that chemo-mechanical preparation and obturation should be limited within the root canal (Melius B et al. 2001). Usual technique to determine the working length requires a combination of the information of root canal anatomy, a preoperative diagnostic radiograph to direct the entry of the instrument into the root canal, tactile perception and radiographic assessment with a file of adequate size placed into the root canal (Santos-Pinto L et al. 2007). Conventional radiographs are required to assess the success or failure of endodontic treatment, pre-operatively, intra-operatively and post-operatively. So there is consequently regular introduction of undesirable radiation exposures. Various animal and human investigations have been studied the harmful effects of radiation exposure which includes, for example, oral tissues, head and neck regions, human embryos and fetuses in pregnant women (Yousef saad A et al. 2000). The use of radiographs during paediatric endodontic therapy should carefully be considered. The diagnostic value is often limited and the exposure of children to radiation should be as low as possible (Mente J et al. 2002). Also, the physiological resorption in primary teeth occurs on the buccal or lingual aspects of the root which makes its radiographic assessment difficult. This will often not be seen radiographically, which results in an increased risk of over instrumentation and/or over filling. While

over instrumentation and over filling of a primary tooth can damage the permanent tooth germ, under filling on the other hand, is also a risk for ongoing disease to occur (Orosco et al. 2012). In spite of these drawbacks, it still remains the most commonly used method to determine the working length. The above problems associated with conventional radiographs were overcome with the help of electronic apex locators. The main advantage of apex locators lies in the measurement of the root canal length up to the apical foramen, not the radiographic apex. They are easy and fast to operate, give good accurate results along with reduction in radiation exposure to the patient (Lamus F et al. 2001). Due to large number of variations in the tooth morphology, and medico-legal record keeping requirements, the use of apex locator alone without preoperative and postoperative radiographs is not a recommended practice (Grimberg F et al. 2002). The present study on root length determination was done using two different types of apex locators, Propex II & DentaPort ZX, which was then compared with the paralleling radiographic method. In this study, 50 primary teeth were taken which would give a statistically significant result and patients selected were in the age group of 5-7 years as they would be having 2/3rd of the root length. Recent studies demonstrated high accuracy of the apex locator ProPex II in the determination of the working length in permanent teeth (Ozsezer et al. 2007) and primary teeth (Nelson-Filho et al. 2010). The apical zone in ProPex II is extended from 0.9 mm to 0.0 mm; hence it is more sensitive in working length determination. In this study, we used another apex locator DentaPort ZX, which is commonly used apex locator used in primary teeth. Past studies showed that this apex

locator is not based on single criterion for working length determination in primary teeth, For example (Beltrame et al. 2011) assessed the working length at "0.0" mark i.e. Apex. (Angwaravong et al. 2009) compared the measurement meter readings at "0.5" bar and "Apex" and found that the error in locating the apical foramen was smaller at meter reading "Apex" than "0.5" bar. In this present study "0.5" bar was selected and showed accurate measurement. Files selected to measure working length were of the number 15-20, similar to the study conducted by Ssu Kuang Chen et al. where they have used files of 15-20 size. This is because the tips of the No. 10 K- files were not identifiable as the tip diameter is less than 120 micrometer required.

Various studies have mentioned numerous techniques employed in working length determination including radiographic method, electronic apex locator, by means of tactile perception and paper points; however, due to reliability and reproducibility of conventional films, they have become a gold standard to which all other techniques are compared (Leonardo MR et al. 2008). The result of this study shows that apex locator is similar to paralleling radiographic method because there is no significant difference in working length measurements from the three techniques, it was observed that. From the results obtained, it can be concluded that paralleling radiography and apex locator are similar methods of determining the root canal length is similar in primary teeth can be considered as reliable and safe methods in the endodontic treatment of children.

CONCLUSION:

The present comparative study demonstrated that satisfactory estimations of working length could be made in more than 90% of root canals of primary teeth utilizing both apex locators and radiographs. Apex locator is similar to paralleling radiograph in determining the working length without irradiation to the primary teeth.

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