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Original Article

Comparative clinical assessment of working length endomotor apex locator versus radiographic method in endodontic therapy.

Sarang Suresh Hotchandani [1,*], Priya Rani Harjani [2], Mahwish Memon[3], Rajesh Kumar [4], Naresh Kumar [5], Saeed Ahmed Rind [6].

1: Lecturer;
Bibi Aseefa Dental College, Larkana.

2: Lecturer;
Bibi Aseefa Dental College, Larkana.

3:Assistant Professor; Operative Dentistry.
Liaquat University of Medical and Health Sciences, Jamshoro.

4: Senior Registrar
Operative Dentistry
Muhammad Medical College, Mirpurkhas.

5: Assistant Professor
Operative Dentistry
Bhitai Medical and Dental College, Mirpurkhas.

6: FCPS Resident
Prosthodontics
Liaquat University of Medical and Health Sciences, Jamshoro.

***=corresponding author**
hotchandanisarang@gmail.com.

Abstract:

Introduction: The technological and therapeutic advancements suggests that, choosing an appropriate endodontic approach is the key parameter to mitigate over radiation exposure and locating precise root canal length.

Objective: Current study aims to evaluate the comparative accuracy of working length apex locator versus radiographic apex locator in in endodontic therapy among patients belonging from Sindh, Pakistan.

Methodology: Current four-month duration based cross-sectional study focusing endodontic therapeutic techniques was conducted at Bibi Aseefa Dental College Larkana Sindh Pakistan**.** 124 patients requiring non-surgical root canal therapy were included in the study for working length apex locator and radiographic apex locator techniques. Film positioner were used to assess the morphology and initial working length of tooth by radiographic apex locator technique. Whereas glide path and working length was achieved with #12/02 M3 – Pro Gold File (United Dental) with 00 reading in Endo-Matic apex locator. Further data analysis was achieved with SPSS Version 20 and Microsoft Office 2010 multiple tools.

Results: Among 124 patients, 69 (55.6%) were males and 55 (44.4%) were females with mean age of 33.60±12.87 years. We found comparative accuracy of 77 % of working length apex locator in terms of apical limit determination. Whereas, in case of radiographic apex locators 70 % accuracy was recorded.

Conclusion: Working length endomotor with built in apex locators provide satisfactory control of apical limit of endodontic treatment and better time saving option, however radiographic confirmations remain the confirmatory length measurement tool to identify the dimension of canal and path obtained by endodontic instrument.

Keywords: EndoMatic, Electronic Apex Locators, Hybrid Endomotors, Radiograph, Working Length.

Introduction:

Scientific technological advancement has revolutionized the general dentistry specially in restorative aspect of dentistry. Various materials and equipment have been developed to ease the dental procedures and make cost effective treatment feasible. Root canal therapy is one of the most common procedure in restorative dentistry and studies have showed a success rate of more than 90%[1],while on the other hand, failure rate of approximately 35.2%[2]has been reported to

be affected by experience[3] and anatomical difficulties[4].

Working length in endodontic is defined as the distance from a coronal reference point to the point at which canal preparation and obturation should finish. It is one of the important steps in root canal therapy as studies' results showed; not maintain working length results in under filling or overfilling of obturating material, apical perforation and inadequate cleaning which is associated with increase in post-operative pain and decrease success of endodontic therapy[5].Cemento-dentinal junction also known as minor apical diameter denotes the conversion between pulpal and periodontal tissue and it is the point which is indicated in histological studies to be the end point of obturating material in the root canal[6].

Historically working length is measured by tactile, periapical sensitivity, paper point bleeding points, and radiographic methods[7]. However, none of the above-mentioned methods have clearly identified the minor apical constriction to which to terminate the endodontic procedure[8].The limitation of radiograph working length interpretation include obscuring of apical structures with overlapping roots and other anatomical structures of jaws, warp, shortening and elongation of structures, inter and intra person inconsistency electronic apex locators are currently introduced to determine the apical constriction as close as possible while avoiding the radiation from radiograph to patient. Electronic apex locators measure the working length through calculating the impendence of different frequencies between file tip and periodontal tissue[9].

Working length measurement with apex locators are validated in many studies[10-12]. But comparative assessment of working length apex locator versus radiographic apex locator in endodontic therapy is still debatable. Choosing case specific technique in clinical settings at local level is considered a major challenge for dental physicians. Current study formulated a complex hypothesis that, working length apex locators are more plausible choice in apical limit determination and time saving, whereas radiographic apex locators are more accurate in assessment of root canal dimensions declaring a significant relationship between both techniques.

Methodology:

This cross-sectional study was conducted at Bibi Aseefa Dental College Larkana Sindh from January 2021 to April 2021. Patients from age ranges 12 – 60 years requiring non-surgical root canal therapy were included in the study. While the patients with apical resorption, open apex and metallic or ceramic restoration, retreatment cases, root fractured, and calcified canals were excluded for further assessment.

A pre-operative radiograph was obtained with film positioner to assess the morphology and initial working length of tooth under treatment. Following Local anesthetic administration, isolation of teeth was achieved with rubber dam. After access preparation, glide path was achieved, and the working length was obtained with #12/02 M3 – Pro Gold File (United Dental) with 00 reading in EndoMatic. The working length was measured and recorded in proforma. After achieving preliminary working length from initial radiograph, subtraction of 1 mm was achieved, and file was again inserted into canal with stopper at stable reference point on teeth and radiograph was taken by paralleling technique using plastic film holder. The radiographic length was also entered in proforma. The working length on endomotor of 0–2 mm short of radiographic length was considered positive accurate. If endomotor working length exceeded or short of more than 2 mm negative accuracy was labeled.

By following convenience sampling technique 124 patients were included in the study. Where Z-test was employed for proposed one tailed complex hypothesis testing mean and standard deviation were calculated for patient's age and working length for both methods. Frequency along with percentage was calculated for accuracy, type of tooth and gender. SPSS version 20 and Microsoft Office 2010 used for statistical analysis.

Results:

Among 124 patients, 69 (55.6%) were males and 55 (44.4%) were females with mean age of 33.60 ±12.87 years. In these patients, 9 (7.3%) were central incisors, 6 (4.8%) were lateral incisors, 5 (4.0%) were canines, 9 (7.35%) were 1st premolars, 13 (10.5%) were 2nd premolars, 58 (46.8%) were 1st molars and 24 (19.4%) were 2nd molars. The mean radiographic working length was 21.71±1.05 (95% confidence interval 21.52; 21.90), while on EndoMatic mean working length was 21.02±1.28 with (95% CI: 20.79;21.25). The accuracy between both working length apex locator and radiographic apex locator was determined by univariate analysis as represented in table 1.

Table 1 Accuracy of Working Length with respect to Gender and Type of Tooth

Factor	Accuracy	
	Positive	*Negative*
GENDER		
Male	54	15
Female	42	13
Working length endo-motor apex locator	96	28
Radiographic apex locator	87	37
TOOTH TYPE		
Central Incisor	8	1
Lateral Incisor	6	0
Canine	4	1
1st Premolar	8	1
2nd Premolar	5	8
1st Molar	47	11
2nd Molar	18	6

Working length accuracy was considered positive in 96 patients while negative in 28 patients. For path dimension calculations 87 cases were positive for radiographic apex locator and 37 cases were negative. We found comparative accuracy of 77 % of working length apex locator in terms of apical limit determination. Whereas, in case of radiographic apex locators 70 % accuracy was recorded. Cross tabulation of accuracy with respect to gender, tooth type is shown in Table 1.Further, non-significant difference between working length endo-motor apex locator and radio-graphic apex locator technique was noted.

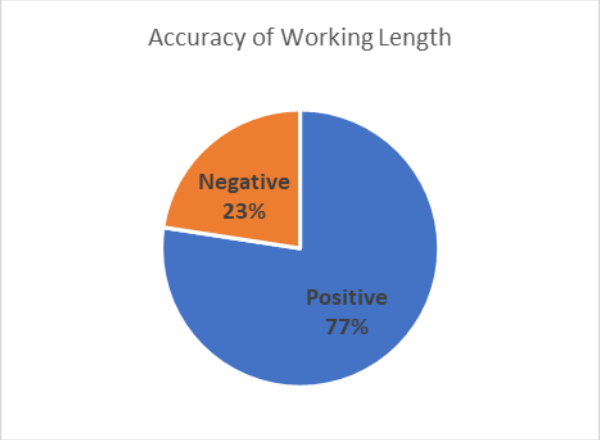
Table.2. The comparative accuracy assessment of don-tonic therapeutic techniques.

don-tonic technique	Positive cases	Negative cases	Risk ratio	P- Value CI = 95 %
working length endo -motor apex locator	96	28	0.95	
radio-graphic apex locator	87	37	1.28	P ≥ 0.20

Z= 1.29.

The comparative accuracy assessment of don-tonic therapeutic techniques suggests insignificant difference between subjected techniques accepting the null hypothesis (P ≥ 0.20 at 95 % CI) Table.2. Accuracy of Working Length Endo-motor apex locator is shown graphically in fig 1**.**

Figure 1 Accuracy of Working Length Endo-motor apex locator



Discussion

The determination of working length is controversial in literature where some studies report positive results with working length determined by apex locator while other literature conveys opposite and find no significant difference between radiographs and apex locators[13,14]. The purpose of this study was to evaluate the accuracy of determining working length in endo-motor with built in apex locator and traditional radiographic method. These modern hybrid endomotors with built in apex locators are preferred among clinicians because of simplicity and relatively speedy work and maintenance of working length and apical end throughout the preparation[15]. In our present research minimum age of 12 years which is minimum age of root completion of permanent tooth.

EndoMatic is an endomotor from WOODPECKER which combines with the length measurement function and makes the endodontic treatment safer by displaying file position on the display screen and it stops rotating or reverse as the file touches apical limit. M3-Pro GOLD 2018 file system from United Dental Group (PRC) are NiTi files with features advocated by company are high flexibility, sharp cutting edge, controlled memory material, resistant to cyclic fatigue and non-cutting tip safeguarding the design.#12/02

path file of this series was used as most clinicians are preferring the rotary glid path preparation than manual [16].

Study conducted by S.Y.A. Abidi, et al.[17] showed accuracy of 88.5% with X smart dual endomotor while in our study 77% accuracy was obtained with EndoMatic endomotor. This could be due to previous studies used only single rooted teeth while current study was performed in multi rooted teeth with a larger sample size. Finding of current study are in agreement to the study of Schweiz [18] that showed 77.2% accuracy; also our findings matches to the study conducted by Stavrianos[19] which showed 70% to 97% accuracy in working length determination with apex locators. In literature, tooth type is reported as a factor influencing the accuracy of working length measurement. Our studies showed negative accuracy to be more prevalent in 2nd premolar followed by 1st molar which could be due to unpredictable anatomy and curvatures seen in 2nd premolars. This finding is also in agreement to study conducted by Elayouti[20] which showed working length measurement were inaccurate in 56% of premolars and 22% of molars. Studies[21,22] also report decrease accuracy in wide apical foramina which can be due to difficulty in identifying the narrowest part of apex to calculate impedance, that why patients with open apex, resorption and traumatic root fractures were excluded from our study.

According to our results there was insignificant difference in their measurement, and both are similar in locating the apical extent while at the same time not affected by tooth type or gender, which could be due to increased sensitivity to apex locator or relatively small study sample. A study with a larger sample must be conducted to find any difference in accuracy.

Conclusion:

Within limitation of this study, it is concluded that hybrid endomotor with built in apex locators provide satisfactory control of apical limit of endodontic treatment and better time saving option, however radiographic confirmations remain the confirmatory length measurement tool to identify the dimension of canal and path obtained by endodontic instrument.

Conflict of Interest:

None.

Source of Funding:

None.

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