Journal of Advanced Medical and Dental Sciences Research
@Society of Scientific Research and Studies ***NLM ID:*** *101716117*

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr Indian Citation Index (ICI) Index Copernicus value = 100

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Research

Assessment of accuracy of electronic apex locator in the presence of different irrigating solutions

[1]Malik Ashim Showkat, [2]Muskan Gupta, [3]Priyanka Verma, [4]Rimi Saikia

[1]Private Practitioner, Srinagar, Jammu and Kashmir, India;
[2]BDS, Government Dental College, Patiala, Punjab, India;
[3]BDS, Geetanjali Dental College, Udaipur, Rajasthan, India;
[4]BDS, Apollo Dental Clinic, Dispur, Assam, India

ABSTRACT:
Background: The removal of all pulp tissue, necrotic material and microorganisms from the root canal is essential for endodontic success. The present study was conducted to assess accuracy of electronic apex locator in the presence of different irrigating solutions. **Materials & Methods:** 60 extracted, single rooted human teeth were decoronated at CEJ. Working length was determined. Samples were divided into three groups. Group I used normal saline 0.9%, group II used 0.2% chlorhexidine and group III used 2.5% Na OCl. The electronically measured Working length (EL) was compared with the actual canal (AL) length. **Results:** Group I used normal saline 0.9%, group II used 0.2% chlorhexidine and group III used 2.5% Na OCl. Each group had 20 samples. The mean actual length determined in group I was 21.520 mm, in group II was 20.310 mm and in group III was 22.040 mm. The mean electronic length determined in group I was 21.430 mm, in group II was 20.280 mm and in group III was 21.090 mm. The maximum difference was observed in group III, followed by group I and group II. The difference was significant (P< 0.05). **Conclusion:** Within 0.5 mm of AL, the EL measurement accuracy of Root ZX was consistently high when with 0.2% chlorhexidine followed by normal saline, and 2.5% sodium hypochlorite.
Key words: Apex locator, Working length, irrigating solutions

Received: 22 August, 2023 Accepted: 27 September, 2023

Corresponding author: Malik Ashim Showkat, Private Practitioner, Srinagar, Jammu and Kashmir, India

This article may be cited as: Showkat MA, Gupta M, Verma P, Saikia R. Assessment of accuracy of electronic apex locator in the presence of different irrigating solutions. J Adv Med Dent Scie Res 2023;11(10):49-51.

INTRODUCTION

The removal of all pulp tissue, necrotic material and microorganisms from the root canal is essential for endodontic success.[1] On the other hand, determination of an accurate working length is also a critical step in endodontic therapy. Therefore, proper instrumentation upto the apical constriction or also called as the cemento-dentinal junction as seen earlier is also one of the vital factor for a good prognosis.[2] Failure to accurately determine and maintain working length (WL) may result in length being too long leading to apical perforation, overfilling or overextension and increased post-operative pain with prolonged healing period and a lower success rate.[3] A WL too short of the apical constriction can lead to incomplete cleaning and underfilling causing persistent discomfort, and continued peri-radicular infection. Electronic apex locators have been used clinically for over 30 years as an aid in deciding where canal preparation and obturation should terminate.[4] Suzuki in 1942 first studied the flow of current through teeth. He found that a constant electric resistance was obtained between an electrode attached to a root canal instrument and one applied to the oral mucous membrane.[5] The present study was conducted to assess accuracy of electronic apex locator in the presence of different irrigating solutions.

MATERIALS & METHODS

The present study comprised of 60 extracted, single rooted human teeth. The study protocol was approved from the institutional ethical committee. Teeth were decoronated at CEJ. Working length was determined using no.10 K file which was inserted into the canal of each tooth and IOPAR was taken. Samples were

divided into three groups. Group I used normal saline 0.9%, group II used 0.2% chlorhexidine and group III used 2.5% Na OCl. The electronically measured Working length (EL) was compared with the actual canal (AL) length measured conventionally and scores were attributed to the resulting values as score 0- working length (WL) equal to gold standard, score 1- working length (WL) from 0.5 to 1 mm shorter than gold standard, score 2- working length (WL) > 1 mm shorter than gold standard, and score 3- working length (WL) exceeds gold standard. Results were tabulated and subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table: I Distribution of teeth

Groups	Group I	Group II	Group III
Irrigating solution	0.9% normal saline	0.2% chlorhexidine	2.5% Na OCl
Number	20	20	20

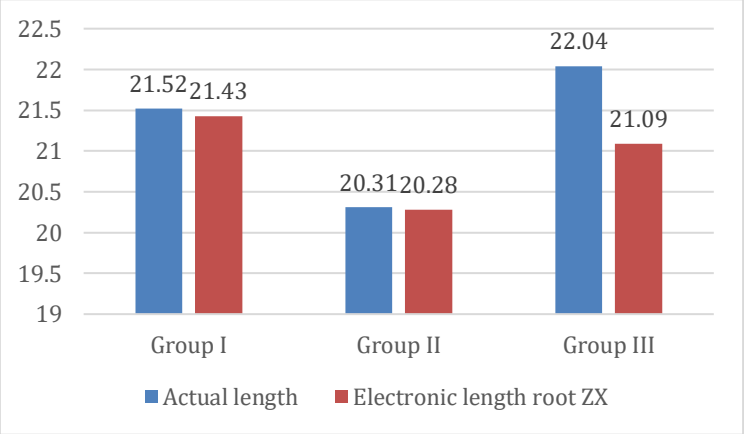
Table I shows that group I used normal saline 0.9%, group II used 0.2% chlorhexidine and group III used 2.5% Na OCl. Each group had 20 samples.

Table: II Difference in AWL and EWL

Groups	Actual length	Electronic length root ZX	Difference	P value
Group I	21.520	21.430	0.09	0.05
Group II	20.310	20.280	0.02	
Group III	22.040	21.090	0.95	

Table II, graph I shows that the mean actual length determined in group I was 21.520 mm, in group II was 20.310 mm and in group III was 22.040 mm. The mean electronic length determined in group I was 21.430 mm, in group II was 20.280 mm and in group III was 21.090 mm. The maximum difference was observed in group III, followed by group I and group II. The difference was significant (P< 0.05).

Graph: I Difference in AWL and EWL



DISCUSSION

The apical constriction (AC) is suggested as the end-point of root canal treatment. This anatomical landmark is where pulpal and periodontal tissues reach together and are identified as minor apical foramen. It is generally accepted to be located at 0.5-1 mm coronal to the radiographic apex. AC might be located on one side of root at a distance up to 3 mm from the anatomical apex. Moreover, the position and topography of minor foramen varies between teeth, making it difficult to determine clinically.[6] The limitations of radiographs were intended to be addressed by the design of electronic foramen locators, or EFLs. The initial devices used a constant value of 6.5 k7 to calculate the electrical resistance between the oral mucosa and the periodontal ligament in order to determine WL.[7] The first EFLs were impacted by different root canal irrigation solutions and did not show enough accuracy to measure the WL. This issue has been resolved in later EFLs, which can now measure the canal length when electrolytes are present. Regardless of the electrolyte type, the Root ZX requires no calibration and measures the impedance ratio of two different frequencies (0.4 and 8 kHz) to determine the tip of the file in the canal. The development of EAL has helped in making the assessment of working length more accurate and predictable.[8,9] The present study was conducted to assess accuracy of electronic apex locator in the presence of different irrigating solutions. We found that group I used normal saline 0.9%, group II used 0.2% chlorhexidine and group III used 2.5% Na OCl. Each group had 20 samples. Khattak et al[10] assessed the accuracy of Root ZX in determining working length in presence of normal saline, 0.2% chlorhexidine and 2.5% of sodium

hypochlorite. Sixty extracted, single rooted, single canal human teeth were used. Teeth were decoronated at CEJ and actual canal length determined. Then working length measurements were obtained with Root ZX in presence of normal saline 0.9%, 0.2% chlorhexidine and 2.5% Na OCl. The working length obtained with Root ZX were compared with actual canal length and subjected to statistical analysis. No statistical significant difference was found between actual canal length and Root ZX measurements in presence of normal saline and 0.2% chlorhexidine. Highly statistical difference was found between actual canal length and Root ZX measurements in presence of 2.5% of Na OCl, however all the measurements were within the clinically acceptable range of ±0.5mm. We observed that the mean actual length determined in group I was 21.520 mm, in group II was 20.310 mm and in group III was 22.040 mm. The mean electronic length determined in group I was 21.430 mm, in group II was 20.280 mm and in group III was 21.090 mm. The maximum difference was observed in group III, followed by group I and group II. Saatchi et al[11] in their study, 110 extracted mandibular molars were selected. Access cavity was prepared and coronal enlargement of mesiobuccal canal was performed. A #10 Flexofile was inserted into the mesiobuccal canal, and a radiography was taken to measure the degree of curvature by Schneider's method. The accuracy of Root ZX within ±0.1 mm and ±0.5 mm was 38.2% and 94.6%, respectively. There was no correlation between the distance from the EWL to the AWL and the degree of root canal curvature. Santosh et al[12] divided 60 samples into three groups of mild (<20º), moderate (20-36º) and severe curvature (>36º). After enlarging the orifice, the actual canal length was determined by introducing a file until the tip emerged through the major foramen when observed under 20X magnification. The teeth were embedded in an alginate model and the Root ZX was used to determine the electronic length. The difference in measurement of Actual and Electronic working length was statistically significant between group 1 and 2 ($P < 0.05$) as well as between group 1 and group 3 ($P < 0.05$) with group 1 showing the lowest difference.

CONCLUSION

Within 0.5 mm of AL, the EL measurement accuracy of Root ZX was consistently high when with 0.2% chlorhexidine followed by normal saline, and 2.5% sodium hypochlorite.

REFERENCES

1. Mull JP, Manjunath V, Manjunath M. Comparison of accuracy of two electronic apex locators in the presence of various irrigants: An *in vitro* study. J Conserv Dent 2012;15:178-82.
2. Pagavino G, Pace R, Bacetti T. A SEM study of *in vivo* accuracy of the Root ZX electronic apex locator. J Endod 1998;24:438-41.
3. Ibarrola JL, Chapman BL, Howard JH, Knowles KI, Ludlow MO. Effect of preflaring on Root ZX apex locators. J Endod 1999;25:625-6.
4. Sunanada, Ebrahim AK, Wadachi R, Suda H. *Ex vivo* evaluation of the ability of four different electronic apex locators to determine the working length in teeth with various foramen diameters. Aust Dent J 2006;51:258-62.
5. Suzuki, Venturi M, Breschi L. A comparison between two electronic apex locators: An *in vivo* investigation. Int Endod J 2005;38:36-45.
6. Sadeghi S, Abolghasemi M. A comparison between the Raypex5 apex locator and conventional radiography for determining working length of straight and curved canals. Iran Endod J 2007;2:101-4.
7. Schneider SW. A comparison of canal preparations in straight and curved root canals. Oral Surg Oral Med Oral Pathol 1971;32:271-5.
8. Kuttler Y. Microscopic investigation of root apexes. J Am Dent Assoc 1955;50:544-52.
9. Shearer AC, Horner K, Wilson NHF. Radiovisiography for length estimation in root canal treatment: an in vitro comparison with conventional radiography. *Int Endod J.* 1991;24:233–9.
10. Khattak O, Raidullah E, Francis ML. A comparative assessment of the accuracy of electronic apex locator (Root ZX) in the presence of commonly used irrigating solutions. Journal of clinical and experimental dentistry. 2014 Feb;6(1):e41.
11. Saatchi M, Iravani S, Akhavan Khaleghi M, Mortaheb A. Influence of Root Canal Curvature on the Accuracy of Root ZX Electronic Foramen Locator: An In Vitro Study. Iran Endod J. 2017;12(2): 173-8.
12. Santhosh L, Raiththa P, Aswathanarayana S, Panchajanya S, Reddy JT, Susheela SR. Influence of root canal curvature on the accuracy of an electronic apex locator: An in vitro study. J Conserv Dent 2014;17:583-6.