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Original Research

Intricate Estimation of Effects of Different Root Canal Curvatures on Accuracy Of Apex Locator: An (In-Vitro) Original Study

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ABSTRACT:

Background: Working length is defined in the endodontic glossary as the distance from a coronal reference point to the point at which canal preparation and obturation should terminate. Inaccuracy in determining and maintaining working length (WL) may result in length being too long leading to apical perforation. The present study was conducted to assess the effect of different canal curvature on accuracy of working length determination using apex locator. **Materials & Methods:** The present study was conducted on 45 mandibular molar teeth of either gender. The degree of root canal curvature was determined by Schneider's method. Samples were divided into three groups. Group I were with mild canal curvature (< 20°), group II were moderate canal curvature (20-36°) and group III were severe canal curvature (>36°). The actual root canal length was determined using a no. 8 or no. 10 file into the canal until the tip of the file emerged through the major apical foramen. Differences between EWL and AWL were calculated. **Results:** Statistical analysis was done using statistical software 'Statistical Package for the Social Sciences (SPSS)'. The recorded data was subjected to suitable statistical tests to obtain p values and mean. $P \leq 0.05$ was considered as statistically significant. Group I teeth were with root curvature < 20°, group II with 20-36° and group III with >36°. Maximum difference was observed in group III, followed by group II and group I. In group I, the difference was 0.182 mm, in group II was 0.214 mm and in group III was 0.227 mm. The difference was significant (P< 0.05). **Conclusion:** Apex locator found to be more accurate for the mild curvature group than moderate and severe groups.

Key words: Apex locator, Canal curvature, Root canal length

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INTRODUCTION

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.[1] A WL too short of the apical constriction can lead to incomplete cleaning and under filling causing persistent discomfort, and continued periradicular infection. The apical constriction (AC) is suggested as the end-point of root canal treatment.[2] This anatomical landmark is a point where pulpal and periodontal tissues reach together and is 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 to3 mm from the anatomical apex. Moreover, the position and topography of minor foramen varies between teeth, making it difficult to determine clinically.[2] Electronic apex locators have been used clinically for over 30 years as an aid in deciding where canal preparation and obturation should

terminate. Suzuki[3] 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. Sunanada[4] determined this constant electrical resistance to be 6.5 kilo ohms and stated that it is possible to use this value of resistance in the estimation of root canal length. Electronic apex locators can be a useful adjunct with a high level of accuracy for determining the real root canal length in clinical practice. The working length is the distance from a coronary reference to a point where instrumentation and root canal filling should end. The distance must be well established by the endodontist to prevent over-instrumentation or over-filling of the root canal, and favor the repair process of the apical and remaining tissues. It is believed that the foramen is located at the limit of cementum-dentin junction, where the periodontal ligament begins, and the dental pulp ends. Several studies have determined that the limit is 0.5 mm or 1.0 mm short of the radiographic apex, but the ideal limits for instrumentation and obturation of the root canal may range from 0.0 to 2.0 mm. However, its exact location is still a clinical challenge for the professional. The present study was conducted to assess and evaluate the effects of various canal curvatures on the accuracy of apex locator.

MATERIALS & METHODS

The present study was conducted in the department of Endodontics of the institute. It comprised of 45 mandibular molar teeth of either gender. The teeth were kept immersed in 2.5% sodium hypochlorite solution for 6 h to remove remnants of periodontal ligament tissue and other debris from the external root surface. Afterward, the teeth were stored in 0.9% sterile saline solution at 9°C for 7 days. Following the access opening procedure, occlusal flattening of the tooth crowns was performed to facilitate the placement of the rubber stop during the measurement of the working length, and to standardize the reference for the apex electronic locator. Working length was determined using no.10 K file which was inserted into the mesio-buccal canal of each tooth and IOPAR was taken. The degree of root canal curvature was determined by Schneider's method. In this method, a straight line is drawn from the canal orifices to the point of curvature and a second line is drawn from the apex for the apical curvature and the angle is measured at the point of intersection between the two lines. Samples were divided into three groups. Group I were with mild canal curvature (< 20°), group II were moderate canal curvature (20-36°) and group III were severe canal curvature (>36°). The actual root canal length was determined using a no. 8 or no. 10 file into the canal until the tip of the file emerged through the major apical foramen. The stopper was adjusted to correspond to the flat reference surface. A digital caliper was used to measure the length between the stopper and the tip of the file to the nearest of 0.01 mm. This was taken as the actual working length (AWL).The file clip of apex locator was attached to the file and the file inserted until the "Apex" reading was reached in Root ZX. This was the electronic working length (EWL). Differences between EWL and AWL were calculated. Results were tabulated and subjected to statistical analysis. P value less than 0.05 was considered significant.

STATISTICAL ANALYSIS AND RESULTS

Resultant data were sent for statistical analysis using statistical software Statistical Package for the Social Sciences version 21 (IBM Inc., Armonk, New York, USA). The resulting data was subjected to suitable statistical tests to obtain p values, mean, standard deviation, chi- square test, standard error and 95% CI. Table I shows that group I teeth were with root curvature < 20°, group II with 20-36° and group III with >36°. Table II shows that maximum difference was observed in group III, followed by group II and group I. Table III illustrates comparison of difference between groups and basic statistical description with level of significance evaluation using Pearson chi-square test. Table III, graph I literally shows that in group I, the difference was 0.182 mm, in group II was 0.214 mm and in group III was 0.227 mm. The difference was significant (P< 0.05).

Table I: Distribution of teeth

Groups	Group I	Group II	Group III
Root curvature	< 20°	20-36°	>36°
Number	15	15	15

Table II: Difference in AWL and EWL

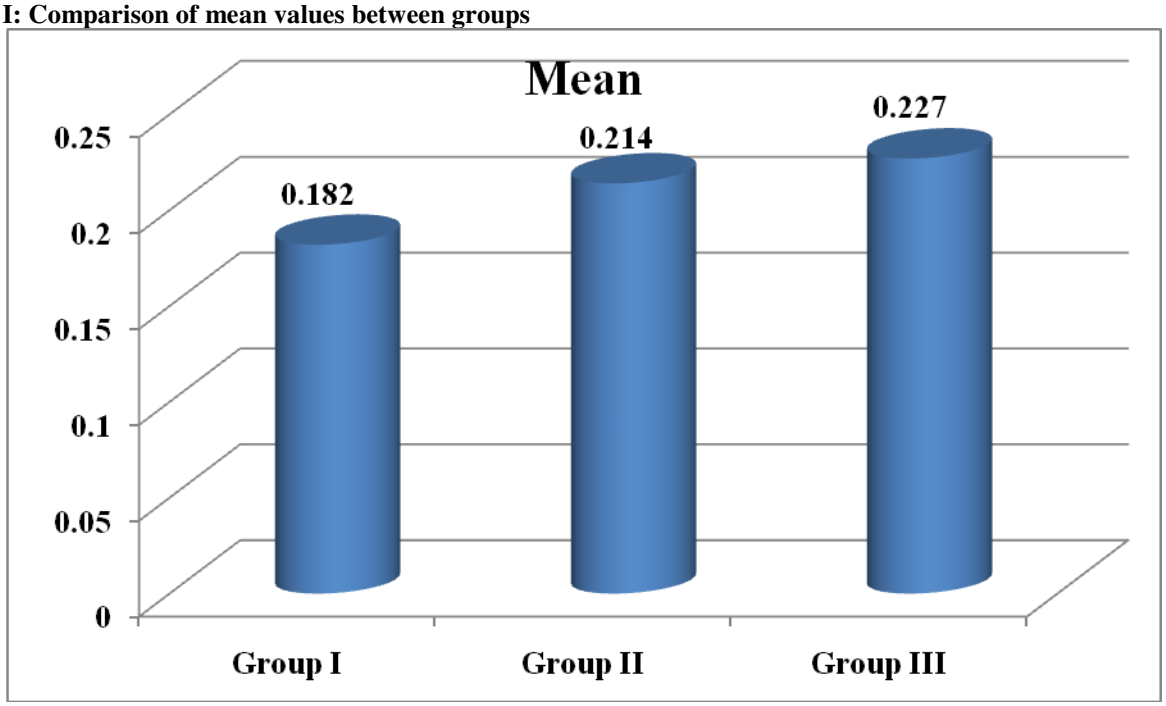
Difference	Group I	Group II	Group III
>1	0	0	0
0.5-1	1	0	0
0.01-0.5	4	1	1
0	0	0	0
−0.5-−0.01	13	16	17
−1-0.5	2	3	2
−1	0	0	0

Table III: Comparison of difference between groups and basic statistical description with level of significance evaluation using Pearson chi-square test

Groups	Mean	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square Value	df	Level of Significance (p value)
I	0.182	0.546	0.546	2.57	2.374	1.0	0.020*
II	0.214	1.765	0.576	1.96	2.957	1.0	
III	0.227	1.254	0.560	1.96	2.634	1.0	

***p<0.05 significant**

Graph I: Comparison of mean values between groups



DISCUSSION

Electronic foramen locators (EFLs) were designed to overcome the limitations of radiographs. Initial devices determined WL by calculating electrical resistance between the periodontal ligament and oral mucosa, which is the constant value of 6.5 k7.[5] The first EFLs did not exhibit sufficient accuracy for measuring the WL and were influenced by various root canal irrigation solutions.[6] The subsequent EFLs have overcome this problem and are capable of measuring the canal length in the presence of electrolytes. The Root ZX measures the impedance ratio of two different frequencies (0.4 and 8 kHz) for determining the tip of the file in the canal, regardless of the type of electrolyte, and requires no calibration.[7] The accuracy of this device between the in vivo and in vitro models is not different. The development of EAL has helped in making the assessment of working length more accurate and predictable.[8] The present study was conducted to assess the canal curvature on accuracy of apex locator. In present study, we included 45 mandibular molars. Group I teeth were with root curvature < 20°, group II with 20-36° and group III with >36°. Santosh et al[9] conducted a study on sixty mandibular posterior teeth were decoronated. A number (No.) 10 file was inserted into the mesiobuccal canal and radiographs were taken to determine the degree of curvature by Schneider's method. Samples were divided into three groups of mild (<20°), moderate (20-36°) and severe curvature (>36°). 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. We observed that maximum difference in AWL and EWL was observed in group III, followed by group II and group I. In group I, the difference was 0.182 mm, in group II was 0.214 mm and in group III was 0.227 mm. Saatchi et al[10] in their study, one hundred and ten extracted mandibular molars were

selected. Access cavity was prepared and coronal enlargement of mesiobuccal canal was performed. A #10 Flexo-file was inserted into the mesiobuccal canal, and 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. Over-filling of the root canal is usually preceded by over-instrumentation, which is responsible for microorganisms and necrotic material transport beyond the apical foramen, making the postoperative period painful due to infection and inflammation of the periapical tissues.[11-14] The inflammatory reaction impairs the process of tissue repair in the periapical region, leading to treatment failure. On the other hand, under-filling must also be avoided, since hermetic sealing failure in the apical region may allow survival and multiplication of residual bacteria and microorganisms, which may cause leakage of tissue fluids into the root canal, leading to the appearance of periapical lesions.[15-17]

CONCLUSION

Within the limitations of the study, authors found Apex locator to be more accurate for the mild curvature group than moderate and severe groups. Our study results must be considered as suggestive for presuming prognosis for similar clinical conditions. However, we expect some other large scale studies to be performed that might further establish certain standard and concrete norms in these regards.

REFERENCES

1. 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.
2. Ibarrola JL, Chapman BL, Howard JH, Knowles KI, Ludlow MO. Effect of preflaring on Root ZX apex locators. J Endod 1999;25:625-6.
3. Suzuki, Venturi M, Breschi L. A comparison between two electronic apex locators: An *in vivo* investigation. Int Endod J 2005;38:36-45.
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. 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.
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. Santhosh L, Raiththa P, Aswathanarayana S, Panchajanya S, Reddy JT, Susheela SR. Infl uence of root canal curvature on the accuracy of an electronic apex locator: An in vitro study. J Conserv Dent 2014;17:583-6.
10. 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.
11. Ingle IB, Bachanan S. Endodontic cavity preparation. 4th edition. William & Wilkins; Endodontic Maloern, Philadalphia: 1994. pp. 92–227.
12. Pallares A, Faus V. An in-vivo comparative study of two apex locators. J Endodon 1994;20:576-9.
13. Kuttler Y. Microscopic investigation of root apexes. J Am Dent Assoc 1955;50:544-52.
14. Weine FS. Endodontic therapy. 5th ed. Mosby – Year Book Inc: USA; 1996.
15. Leddy BJ, Miles D A, Newton CW, Brown CE Jr. Interpr etation of endodontic file lengths using radiovisiography. J Endodon 1994;20:542-5.
16. Frank AL, Torabinejad M. An in-vivo evaluation of Endex electronic apex locator . J Endod 1993;19:177-9.
17. Himel VT, Cain C. An evaluation of two electronic apex locators in a dental student clinic. Quintessence Int 1993;24:803-6.