

ORIGINAL RESEARCH

Assessment of impact of root canal curvature on the accuracy of an electronic apex locator: An Observational Study

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ABSTRACT:

Background: Assessment of impact of root canal curvature on the accuracy of an electronic apex locator. **Materials & Methods:** 20 freshly extracted mandibular first premolars were included in the present study. Grouping of all the samples broadly was done into three study groups as follows: Group A: Specimens with mild canal curvature, Group 2: Specimens with moderate canal curvature, and Group 3: Specimens with severe canal curvature. Actual root canal length was determined through a number 10 file. This was named as actual working length (AL). Electronic Working Length (EL) was evaluated. **Results:** Mean difference between AL and EL was 0.195 for group A and 0.278 for group B. While comparing statistically, significant results were obtained. **Conclusion:** Electronic working length is slightly significantly affected with curvature of the root canal.

Key words: Apex locator, Curved root canal

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INTRODUCTION

An ideal root canal treatment should be limited to the root canal system. Any procedure beyond or less than this point may increase the risk of treatment failure. As a result, working length (WL) determination is a crucial factor in successful root canal therapy. The apical constriction (AC) is suggested as the end-point of root canal treatment.¹⁻³ 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. However, one of the author reported that 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.³⁻⁵

The term "Working Length" (WL) is defined in the Glossary of Endodontic Terms as "the distance from a coronal reference point to the point at which canal preparation and obturation should terminate." Failure to accurately determine and maintain 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. A WL too short of the apical constriction can lead to incomplete cleaning and under filling causing persistent discomfort, and continued periradicular infection.⁶⁻⁹ Hence; the present study was conducted for assessing the impact of root canal curvature on the accuracy of an electronic apex locator.

MATERIALS & METHODS

40 freshly extracted mandibular first premolars were included in the present study. At approximately at cemento-enamel junction, all the specimens were sectioned with the help of a diamond disk. Afterward, a number 10 K file was inserted into the root canals and the digital images were obtained in a bucco-lingual direction. The degree of root canal curvature was determined by Schneider's method. This was followed by grouping of all the samples broadly into three study groups as follows: Group A: Specimens with mild canal curvature and Group B: Specimens with moderate canal curvature. Actual root canal length was determined through a number 10 file. This was named as actual working length (AL). Plastic

cylindrical framework was made and freshly mixed alginate was poured in it for embedding the roots. The file clip was attached to the file and the file inserted until the "Apex" reading was reached. This was marked as Electronic Working Length (EL). All the results were then recorded in Microsoft excel sheet and were analysed by SPSS software. Chi- square test was used for evaluation of level of significance.

RESULTS

Mean difference between AL and EL was 0.195 for group A and 0.278 for group B. While comparing statistically, significant results were obtained.

Table 1: Mean Value of difference between AL and EL

Group	Mean	SD
Group A	0.195	0.112
Group B	0.278	0.135

Table 2: Statistical distance

Group	t- value	p- value
Group A versus Group B	15.328	0.00*

*: Significant

DISCUSSION

Root perforation is said to be an unnatural communication between the root canal to the supporting tissues of teeth. Although caries or resorptive processes may cause perforations, the most common cause of root perforation is iatrogenic, the frequency of which ranges from 3% to as high as 10%. Due to these root perforations, the infection either from the root canal or the periodontal tissues brings about inflammatory sequel which prevents healing. Many factors contribute to the healing of these perforation sites which include time from the perforation detection and its sealing, size, and shape of the perforation as well as its location. A potential detection of these root perforations during endodontic treatment is of utmost importance as it leads to extrusion of irrigation solutions or sealers into the periradicular tissues and instrumentation in the periodontal space. There are various methods to detect these perforations such as profuse bleeding from root canal during instrumentation and indirect evaluation of bleeding by paper points, radiographic assessment, and electronic apex locators (EALs).⁸⁻¹⁰ Hence; the present study was conducted for assessing the impact of root canal curvature on the accuracy of an electronic apex locator.

In the present study, mean difference between AL and EL was 0.195 for group A and 0.278 for group B. While comparing statistically, significant results were obtained. Saatchi et al evaluated the correlation between accuracy of Root ZX electronic foramen locator and root canal curvature. One hundred and ten 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 actual working length (AWL) was defined by inserting the file until its tip could be observed at a place tangential to the major apical foramen and then 0.5 mm was subtracted from this measurement. For the electronic working length (EWL) measurement, the apical 3 or 4 mm of the root was embedded in alginate as the electrolyte material. 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 ($r=0.097$, $P=0.317$). Root canal curvature did not influence the accuracy of Root ZX foramen locator.¹⁰

Shacham, M et al determined the accuracy of electronic apex locator (EAL) measurements when using files of different sizes in roots with wide apical foramina while considering a new parameter of stability of EAL reading. Ten teeth with straight roots were subjected to a sequential widening of the apical foramen to 0.6, 0.7, and 0.8 mm. The roots were embedded after each enlargement stage in an alginate mold and subjected to EAL readings. Measurements were done using sequential K-file sizes and the self-adjusting file (SAF). Measurement stability was introduced as a new additional parameter. As the difference between the file size used and the apical diameter of the canal decreases, the results obtained were more accurate and stable. The stability and accuracy of the measurements coincided with each other in a statistically significant manner. Within the limitations of the present ex vivo study, it may be concluded that in straight canals with wide apical foramina of 0.6–0.8 mm, both SS K-files which fit snugly to the walls of apical foramen and the SAF file may offer both accurate and stable EAL measurements.¹¹

CONCLUSION

Under the light of above obtained data, the authors concluded that electronic working length is slight significantly affected with curvature of the root canal. However; when used with higher precision, electronic apex locators can be used regularly in dental practice with higher accuracy.

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