

Original Research

Assessment of smart phone interference with electronic apex locator in working length determination

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ABSTRACT:

Background: Electronic apex locators (EALs) have been used worldwide for working length determination. The present study was conducted to assess smart phone interference with electronic apex locator in working length determination.

Materials & Methods: 60 patients requiring root canal treatment of both genders were selected. The working length was measured using third-generation apex locator. Two smart phones were used. For each canal, electronic working length was determined using a no 15 K-file under three different criteria: no smart phone was placed next to the EAL; an I Phone 6s with activated Wi-Fi, Bluetooth, and calling mode was placed next to the EAL; and Samsung S7 with activated Wi-Fi, Bluetooth, and calling mode was placed next to the EAL during the working length determination. Working length was determined three times for each canal. D

Results: The mean working length in group I was 19.6 mm, in group II was 19.53 mm and in group III was 19.56 mm. The difference was non-significant ($P > 0.05$).

Conclusion: Authors found that smart phones can be used without the fear of electromagnetic radiation interference with the EAL during the working length determination.

Key words: Electromagnetic radiation, working length determination, Root canal treatment

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INTRODUCTION

Root canal therapy is an integral part of dental practice. The success of root canal therapy depends on various factors among which correct working length estimation is a crucial step. Electronic apex locators (EALs) have been used worldwide for working length determination.¹ These devices can help reduce treatment time and radiation dose to the patient. Various factors such as correct usage, presence of irrigants, vital or necrotic pulp, inflammatory exudate,

and obturating material in the root canal, contribute to the accuracy of EALs. Moreover, studies have shown that EALs provide accurate working length estimation when compared with the radiographic method.²

The electronic apex locator (EAL) acts as an aid in determining the working length accurately and precisely.³ Electronic apex locators help reduce the treatment time and the radiation dose, while the radiographic method aids in diagnosing the root canal anatomy. The amount of electromagnetic radiation

emitted from a digital smart phone is estimated to be low, which is around 42 V/m at 0.1 m dropping to below 7 V/m at 1 m in the standby mode.⁴ So, when a medical equipment is used in the vicinity of a smart phone, two things have to be taken into consideration; one is the amount of electromagnetic radiation they produce and the other is the safe distance at which the equipment should be placed.⁵The present study was conducted to assess smart phone interference with electronic apex locator in working length determination.

MATERIALS & METHODS

The present study comprised of 60 patients requiring root canal treatment of both genders. All gave their written consent for the participation in the study.

Data such as name, age, gender etc. was recorded. The working length was measured using third-generation apex locator. Two smart phones were used. For each canal, electronic working length was determined using a no 15 K-file under three different criteria: no smart phone was placed next to the EAL; an I Phone 6s with activated Wi-Fi, Bluetooth, and calling mode was placed next to the EAL; and Samsung S7 with activated Wi-Fi, Bluetooth, and calling mode was placed next to the EAL during the working length determination. Working length was determined three times for each canal. Data thus obtained were subjected to statistical analysis. P value < 0.05 was Considered significant.

RESULTS

Table I: Distribution of electronic apex locator (EAL)

Groups	Group I	Group II	Group III
Method	EAL	EAL+S7	EAL+16S

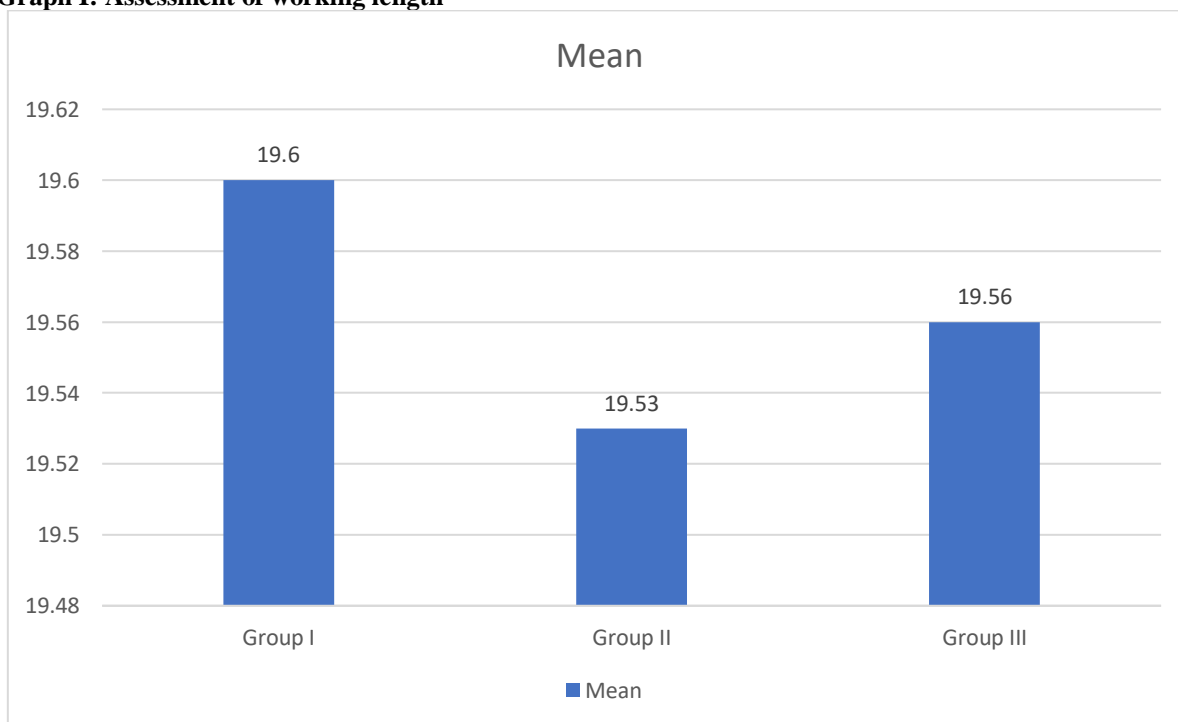
Table I shows distribution of EAL based on smart phone used.

Table II: Assessment of working length

Groups	Mean	Mean rank	P value
Group I	19.6	45.6	0.82
Group II	19.53	45.3	
Group III	19.56	45.1	

Table II, graph I shows that mean working length in group I was 19.6 mm, in group II was 19.53 mm and in group III was 19.56 mm. The difference was non- significant (P> 0.05).

Graph I: Assessment of working length



DISCUSSION

It is known that electromagnetic radiation emitted from devices such as cellular phones, iPods, dental

devices such as electronic pulp testers, electro surgery units, and ultrasonic scalars can interfere with the function of implanted cardiac pacemakers in patients

with implanted cardiac devices.⁶ Electrical energy from these dental devices can travel down the lead wires and can induce ventricular or a trial fibrillation and reprogram the cardiac device. Studies have reported that cellular phones can inhibit the function of a pacemaker, and this depends on the distance between the pacemaker and the electronic device, power output of the electronic device, type of pacemaker, age of pacemaker, and model of the cellular phone.⁷ It is advised that the use of cellular phones should be restricted in hospitals because electromagnetic interference (EMI) caused by cellular phones can interfere with functions of medical devices. Allowing usage of cellular phones in non-patient areas, restrictions in clinical areas, cellular phone safe wards, and use of distance greater than 1 m from all medical equipment are some precautions taken to prevent this interference.^{8,9} The present study was conducted to assess smart phone interference with electronic apex locator in working length determination.

We found that mean working length in group I was 19.6 mm, in group II was 19.53 mm and in group III was 19.56 mm. Sidhu et al¹⁰ in their study fifteen intact, non-carious single-rooted teeth were decoronated at the cement of enamel junction. Visually, working length was determined by using a#15 K-file under stereomicroscope. The effect of cellular phones on electronic working length (EWL) was determined under 2 experimental settings: (1) in a closed room with poor signal strength and (2) in a polyclinic set up with good signal strength and 5 conditions: (1) electronically, without cellular phone in room; (2) electronically, with cellular phone in physical contact with EAL; (3) electronically, with mobile phone in physical contact with EAL and in calling mode for a period of 25 seconds; (4) electronically, mobile phone placed at a distance of 40 cm from the EAL; and (5) electronically, mobile phone placed at a distance of 40 cm and in calling mode for a period of 25 seconds. The EWL was measured 3 times per tooth under each condition. Stability of the readings was scored from 1 to 3: (1) good stability, (2) stable reading after 1 attempt, and (3) stable reading after 2 attempts. The EWL measurements were not influenced by the presence of cellular phone and could be determined under all experimental conditions.

Nishathine et al¹¹ determined the reliability of the electronic apex locator (EAL), in the presence and absence of a smartphone during working length determination. Thirty patients requiring root canal treatment were included in this study. The working length was measured using Denta Port ZX, a third-generation apex locator. It was possible to determine the working length using an EAL under all three experimental conditions. The results of the non-parametric test was found to be non-significant. No significant difference ($p = 0.991$) was found for

electronic working length measurement in the presence or absence of smart phones.

Hurstel et al¹² determined the effect of a smart phone (I Phone 5) in working length determination with EALs Root ZX module and Propex II and concluded that electromagnetic radiation from a smart phone does not cause any interference with electronic working length determination. Thereby, patients can keep their smart phones on the switch-on mode during root canal therapy. Angwaravong O et al¹³ determined the effect of two smart phones (I Phone 5S and Samsung Galaxy S5) on the reliability of two EALs (Novapex and Root ZX II) under two experimental conditions and concluded that mobile phones used in the study did not affect the accuracy of electronic working length determination in vivo.

The limitation the study is small sample size.

CONCLUSION

Authors found that smart phones can be used without the fear of electromagnetic radiation interference with the EAL during the working length determination.

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