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The Effect of Full Strength Sodium Hypochloride on the Readings of Apex DSP Apex Locater: An In-Vivo Study

Abstract

AIM: The aim of this in vivo study is to evaluate the effect of full strength NaOCl on the readings of Apex DSP _one of the third generation apex locators _ as a variable environment that the apex locator may face during the measurement phase and how that can affect the reading and accordingly the accuracy of the measurement method considered. **METHOD:** 89 patients that needed an RCT for an irreversible pulptitis in simple anterior teeth were selected. Standard endodontic access and caries removal was done. The length of 128 canals was measured under two conditions, using full strength NaOCl and with normal saline as a control group. **RESULTS:** The results showed that there is significant difference ($p>0.05$) between the groups mentioned as the usage of NaOCl with full concentration may cause tendency of the Apex locator to give a slight shorter reading. **DISCUSSION:** Lots of methods has been used by dentist all over the world to in order to accurately measure the actual working length of the root canal, development of apex locators and the continuous enhancing of the generations was very beneficial for development of modern endodontics and increasing the accuracy of the treatment and predictability of the success rate . Apex DSP (SeptoDont (R)) is a frequency apex locator with reliable accuracy.

Key Words

Apex DSP; full strength NaOCl; apex locator; working length

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INTRODUCTION

The goal of the root canal treatment is to cure disease or to prevent disease.[1] Modern endodontics aimed to develop the treatment and to increase the success rate of the treatment by enhancing modalities of the treatment. Working length determination on one of the primary steps in modern endodontics. A lot of methods have been used by dentist all over the world to in order to accurately measure the actual working length of the root canal, some was using traditional instruments or findings and some may actually depending on the tactile sensation and the expertise of the treating dentist. The invention of the Apex locators 40 yrs ago was a break-throw in modern endodontics as an accurate way to determine the length of the canal during root canal treatment many generations were developed of the device in order to increase the accuracy of the device for all of the conditions that is going through during the treatment a various cases. The determination of working length is one of the decisive links in the chain of successful root canal treatment. Deciding where the apical constriction of the canal lies is based on the clinician's basic knowledge of apical anatomy, tactile sensation, radiographic interpretation, apex locators, apical bleeding, and if not anesthetized the patient's response.[2] Traditionally, for endodontic instrumentation and obturation the point of termination has been determined by taking radiographs. The development of the electronic apex locator has helped make the assessment of

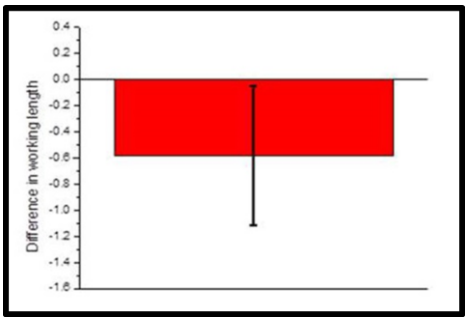

Fig. 1: chart showing the shift toward giving a shorter reading in cases were NaOCl 5.25 % is used

Table 1

Group	Number of canals	Mean length of the canals in mm (SD)	Std. deviation	Paired t-test	Correlation (P-value)
Control	128	21.30	8.03	0.073	0.114 (0.201)
NaOCl	128	20.01	2.04		

working length more accurate and predictable.[3]

History of Electronic Apex Locators

An electronic method for root length determination was first investigated by Custer (1918). The idea was revisited by Suzuki in 1942 who studied the flow of direct current through the teeth of dogs. He registered consistent values in electrical resistance between an instrument in a root canal and an electrode on the oral mucous membrane and speculated that this would measure the canal length (Suzuki 1942). Sunada took these principles and constructed a simple device that used direct current to measure the canal length. It worked on the principle that the electrical resistance of the mucous membrane and the periodontium registered 6.0 kX in any part of the periodontium regardless of the persons' age or the shape and type of teeth.[4] Using direct current caused instability with measurement, and polarization of the file tip altered the measurement.[2] While the first and second generations of the apex locators were lacking ultimate accuracy affected by the presence of the contents of the canal; blood, irrigants, etc. The more recent generations (frequency-based apex locators) claimed to overcome this drawback.[5,6] No study has been found in the literature that studied the Apex DSP accuracy and the influence of the variable irrigants on it, although some studies had been found that cleared the Morita apex locator and its accuracy,[7,8] which is also a third-generation frequency- based apex locator with a comparable accuracy. In this in-Vivo study the effect of Full strength NaOCl on the readings of Apex DSP by septodent apex locater (frequency-based apex locater) were studied.

MATERIALS AND METHODS

A pre-operative x-ray was taking in 3 different angles to rule out any anatomical complexity before starting the treatment. Cases were selected basically according to a criteria in which all cases that will be involved procedure should be anatomically simple (single or two-rooted only) and cases with irreversible pulpits will be included in the collected sample (necrotic cases and cases with chronic apical periodontitis were excluded to prevent the bias might happen because of the possible root resorption and the micro-abscesses accumulated apically that may interfere with the apex locator readings. Under local anesthesia (septocaine (R) 1.8 mm septodont (R)) a simple unified procedure was done before taking the reading of the apex locator. Rubber dam is placed; access was done by a high speed straight fissure bur and a round low speed bur for removal of caries. Pulp extirpation was done using barbed broach and K-file, next step was gaining a striaght line access to the canals. Coronal flaring was done by either SX protaper rotary file and / or gates Glidden no. 2 and no. 3. Patency was achieved was by using file no. 10 MANI K-files before taking the working length measurement by using either file no. 15 or no. 20. The lengths of a total of 128 canals were measured using Apex DSP. Two readings for each canal were taken one with normal saline inside the canal and the other with full strength NaOCl inside the canal. The reading was confirmed twice before it was recorded to ensure the producibility of the reading on both irrigants (normal saline and sodium hypochlorite). The collected data were analyzed using by SPSS Pair T-Test, Descriptive statistics were expressed as numbers and percentages shown in Table 1.

RESULTS

Although most of the readings of the Apex DSP were affected by the full strength NaOCl, 93 readings were shorter, 3 were longer and 32

readings were not changed. The statistical analysis shows that there is significant difference ($p>0.05$) between the readings of the Apex DSP with normal saline or with NaOCl, noticing that there is a shift toward giving a slight shorter reading (Fig. 1)

DISCUSSION

Neither in vitro nor in vivo results can be a true representative of clinical situations in which the whole treatment is done in the mouth. The aim of the study is not to determine the accuracy of the Apex DSP whose performance and reliability has been reported previously. Lewinka found that The Apex DSP located the apical constriction accurately within +/- 0.5 mm in 88.2% of canals. Statistical analysis has shown that more accurate results were reached when the file was introduced until the last green diode lit ($p<0.05$).[9] A study[10] compared this apex locator with the Morita apex locator in alginate impression model found that the accuracy of both apex locator is commiserable. Rather this study were designed to evaluate the effect of full strength NaOCl on the reading of Apex DSP, as NaOCl is the irrigant of choice in the root canal treatment ,and large group of endodontists use it in full strength (5.25%). In this in vivo study the length of the canal was measured using Apex DSP under two conditions, one using normal saline and the other using the 5.25% NaOCl. Another study[8] reviewed the influence of the Morita ® apex locator in vitro, which is another type of the third -generation frequency apex locator that is known comparable to the Apex DSP Apex locator Root ZX measurements were within 0.5 mm of the actual length 83% of the time, which indicated that the Root ZX is not adversely affected by the presence of sodium hypochlorite. In this study, After taking the readings of 128 canals under the two conditions, most of the readings (93 out of 128) were shorter using the full strength NaOCl, 3 readings were longer, 32 readings were similar under the two conditions. After analyzing data using paired t-test, there was significant difference between the two conditions, the results didn't correlate with a study that showed that the ratio of different frequencies has definitive values, and that the ratio rate of change did not change with different electrolytes in the canal. This may be explained by the concentration that was used is different so the available free electrolytes in the solution will be enomerous and that what can cause the change in the value that the apex locator is reading.

CONCLUSION

Within the limitation of our study, we can conclude that the readings of Apex DSP are significantly different between using it with normal saline or the full strength (5.25%) NaOCl as an irrigant solution in regular Endodontic treatment may cause shorter reading (around .5 mm) compared to the controlled situation.

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