ACCURACY OF A NEW APEX LOCATOR APEX NRG BLUE
AN IN-VITRO STUDY

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ABSTRACT
The purpose of this study was to test in an in-vitro model the accuracy of a new multi frequency third generation apex locator Apex NRG blue both in dry and various wet environments. 60 extracted teeth were taken. The teeth were divided into 6 groups of 10 each. The actual length of the root canal of each tooth was determined and then the teeth were embedded in an alginate model. The radiographic working length was determined and later the electronic working length was taken using different irrigating solutions, (3%H₂O₂, 3%Naocl, 0.2% chlorhexidine, normal saline and 17%EDTA). The results were compared and sent for statistical analysis. This study showed that the new multi frequency electronic apex locator NRG blue is quiet reliable in determining the root canal length both in dry as well as in wet environment.

KEY WORDS: NRG Blue, irrigating solutions, root length determination.

INTRODUCTION
The establishment of correct working length is one of the fundamental parameter for endodontic success. Traditionally radiograph is most commonly and widely used for determination of root canal length; but it is difficult to achieve accuracy of canal length because the apical constriction (AC) cannot be identified, and variables in technique angulations and exposure distort this image and lead to error (1,2). Thus in addition to radiographic measurements, electronic root canal working length determination has become increasingly important.

Electronic apex locators (EALs) have been used clinically for more than 40 years as an aid to determine working length of teeth. The present third generation apex locators have been found to be quiet accurate in both dry and wet canal conditions (3,4). Recently a novel miniature apex locator, apex NRG blue (medic NRG Ltd,Tel Aviv, Israel) was introduced. The technology of this apex locator is based on digital processing (DSP) technology and uses square multi-frequency currents. The aim of the study was to list the in-vitro reliability and accuracy of the new apex locator Apex NRG blue.

Materials and Method
A total of 60 extracted teeth, preserved in thymol solution and kept refrigerated, were use for the study. The experiment was performed on single rooted teeth and on one root canal, chosen randomly in multi-rooted teeth. The teeth were randomly divided into 6 groups of 10 each. After access preparation the actual length (AL) was measured with the help of magnifying loops (HEINE CO, Germany) (Fig.1). The teeth were embedded in an alginate model specially developed for testing apex locators (Fig.2). Electronic tooth length measurements (EL) were carried out prior to root canal preparation (Fig.3). Three measurements were taken and an average was computed. Then the radiographic length (RL) was recorded. Each root canal was then prepared to a no 40 K file diameter using a standardized technique. Upon completion of root canal preparation, EL measurements were taken in dry and different wet conditions using different irrigating solutions (Fig. 4).

The different irrigating solutions used were:

1. 3% Naocil ( Prime Dental, Mulund, Mumbai, India)
2. 0.2% Chlorhexidine ( Orasep, ELAN Pharma, deonar, Mumbai, India)
3. Saline( NS, Baxter Pvt ltd, Aurangabad, Maharashtra, India)
4. 17% EDTA (RC help, Prime Dental, Thane, India)
5. 3%H₂O₂ (Unimac Generics, Ujjain, M.P. , India)
Each measurement was repeated three times and average taken. Results were subjected to statistical analysis as follows:

1. Comparison between the AL and the initial electronic measurements before preparation of root canal.
2. Comparison between the AL and EL obtained in the presence of various irrigants.
3. Comparison between AL, the RL, and the EL

**Results**

**EL compared to AL before canal preparation:**
The electronic measurements were mostly short of actual length (AL). The mean difference between the AL and the length measured by NRG blue was -0.35mm (SE 0.03). Within the range difference of -1.5≤L≤0, the working length was found to be 86.6% accurate. (Table 1).

**Root canal content:**
Statistical difference were found amongst the different canal contents (P=0.000) in the presence of EDTA and Saline measurements were close to AL, while those carried in dry canals were shorter (range of >-0.5mm). (Table 2)

**EL compared to RL:**
Statistical differences were found between the EL & RL. RL were found to be longer than AL as compared to EL.

<table>
<thead>
<tr>
<th>EL-AL</th>
<th>No. of teeth</th>
</tr>
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<tbody>
<tr>
<td>-2 ≤ L ≤ -1.5</td>
<td>5</td>
</tr>
<tr>
<td>-1.5 ≤ L ≤ -1</td>
<td>8</td>
</tr>
<tr>
<td>-1 ≤ L ≤ -0.5</td>
<td>12</td>
</tr>
<tr>
<td>-0.5 ≤ L ≤ 0</td>
<td>32</td>
</tr>
<tr>
<td>0 ≤ L ≤ 0.5</td>
<td>3</td>
</tr>
</tbody>
</table>

**Discussion**
One of the most crucial factors that determine the success of a root canal treatment is root length determination. The best prognosis is reported when the root filling is done up to the apical constriction, that either is slightly short of or at the same level of the apical foramen. The traditional radiographic method has shortcomings. The radiographic apex most of the time do not coincide with the actual location of the apical foramen. This leads to constant error.

To overcome the shortcomings of traditional radiographs electronic apex locator has been used. The present third generation apex locators have
been found to be quite accurate in determining the location of the apical foramen. The accuracy of the recent third generation apex locators averages around 90%6, 7, 8, . A new multi frequency apex locator NRG blue has been launched in the market which the manufacturer claims to be more accurate than 90%.

To evaluate its accuracy and reliability an in vitro alginate model was chosen. Researchers have found that alginate as media gave predictable results with apex locators when compared with in vivo clinical studies9. The result of our study showed that the measurements are usually short of the AL. 86.6% of the measurements were within -1.5 to 0 mm of the AL. Our results were more close to the results of other studies done with different third generation apex locators and not as the manufacturer’s claims.

Similar results were obtained often completion of root canals in the presence of different irrigants. Recently chlorhexidine di gluconate has gained quite popularity as an irrigant and as an intra canal medication10, 11. To date very few studies has been conducted to test the effect of this solution on electronic measurements. The result of our study indicates that the electronic measurement in presence of chlorhexidine can be performed safely. Our results also indicate that 17%EDTA and Saline gave the closest result to the actual length. Thus, these irrigants can be considered as reliable solutions for electronic measurements.

Table II: Mean difference between the AL and the EL, measured by the apex locator in the presence of different media in the root canals(in mm).

<table>
<thead>
<tr>
<th>Medium</th>
<th>NRG blue (SE)</th>
</tr>
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<tbody>
<tr>
<td>1. Dry</td>
<td>-0.50 (0.10)</td>
</tr>
<tr>
<td>2. Naocl</td>
<td>-0.32 (0.10)</td>
</tr>
<tr>
<td>3. EDTA</td>
<td>-0.05 (0.10)</td>
</tr>
<tr>
<td>4. Saline</td>
<td>-0.10 (0.15)</td>
</tr>
<tr>
<td>5. Chlorhexidine</td>
<td>-0.35 (0.11)</td>
</tr>
<tr>
<td>6. H₂O₂</td>
<td>-0.30 (0.10)</td>
</tr>
</tbody>
</table>

n=10 for each medium

CONCLUSION: The new Apex NRG blue EAL is found to be adequately reliable and accurate. It is equally effective both in dry and wet environment. In our in vitro study the results of apex NRG blue has been found to be promising, but further in vivo clinical studies are required to substantiate its accuracy and reliability

References
10. Kuruvilla JR, Kamath MP Anti-microbial activity of 2.5% sodium hypochlorite and 0.2% chlorhexidine gluconate separately and combined, as endodontics irrigants. Journal of endod 1998; 24:472-475.

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