

# Efficient and effective use of the electronic apex locator

“The principal aim of root canal preparation is to obtain and maintain access to the apical anatomy, for the purpose of delivering antimicrobial agents to the infection in this site’.<sup>1</sup>

Preparation of the root canal space to an adequate apical diameter to facilitate delivery of irrigant, while ensuring that the preparation, irrigation and obturation material remain within the root canal space and as close to the apical foramen as possible, presents a significant technical challenge.

## Preparing the canal

Where should we prepare the canal to? There are multiple ways in which the working length can be determined: tactile sensation; paper points; radiographs; and, the electronic apex locator (EAL). Radiographs are essential for root canal treatment, but the EAL is currently the most accurate method available for determining working length.

The apical extent of preparation should ideally terminate within the canal and at the apical constriction. Preparing the canal to/beyond the apical foramen risks obliterating the apical constriction, extruding dentine debris and/or obturation material into the periapical region that may ultimately negatively impact upon the treatment outcome. There is a consensus that the apical constriction lies 0.5-1mm from the apical foramen.

This article highlights some clinical tips to maximise effectiveness and efficiency when using the EAL to determine working length. These tips are based on the use of the Root ZX II EAL (J Morita MFG Corp), a widely used and reliable canal measurement module.

## Clinical tips

### 1. Carry out pre-operative checks to ensure that the EAL is functioning correctly

- Ensure that the batteries are full to yield the most accurate results.
- Inspect the probe cord (**Figure 1**) for cracks and exposed inner cabling.
- Ensure that the probe cord is fully inserted into the canal measurement module and is not loose.
- Connect the contrary electrode (lip ring) and file holder together, and if the LCD display shows a stable illumination of the red bars adjacent to ‘APEX’, then your EAL is working correctly (**Figure 2**). If the display

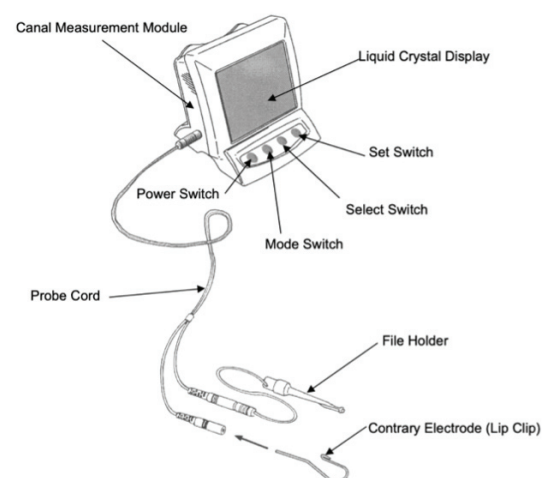


FIGURE 1: Components of the Root ZX II EAL (picture from instruction manual; J Morita MFG Corp).

flashes/jumps between blue/red bars, there is a problem with one of your connections and they should be sequentially replaced until the faulty component is identified.

### 2. Insulate files from metallic restorations

- If the file touches against metallic restorations, the circuit is shorted and an accurate determination of the apical foramen/apical constriction using the EAL is not possible. Strategies to avoid this include removing amalgam restorations prior to initiating root canal treatment. This will also help to determine if the tooth is predictably restorable, plan the definitive restoration, and ensure that there is no inter-appointment bacterial ingress under failing restorations.<sup>2</sup>
- If access is prepared through an amalgam restoration or metal crown:
  - place polytetrafluoroethylene (PTFE) tape on the file so that when the file rests against the metal it is insulated and does not short; and/or,
  - place a rim of glass ionomer cement (GIC) around the access cavity margins so that metal is not exposed at the coronal reference points.

### 3. Carefully select a reference point

- Select a reference point that doesn't involve moving the file under stress, as this can affect the accuracy/reproducibility of the working length.
- On occasion, minor modification of the tooth is indicated to achieve a stable and reproducible reference point, like flattening the cusp tip(s) using a diamond bur.



**Graham Quilligan**  
Consultant/Senior Lecturer in  
Restorative Dentistry (Endodontics)  
University College Cork/Cork  
University Dental School and Hospital



FIGURE 2:



FIGURE 3a



FIGURE 3b

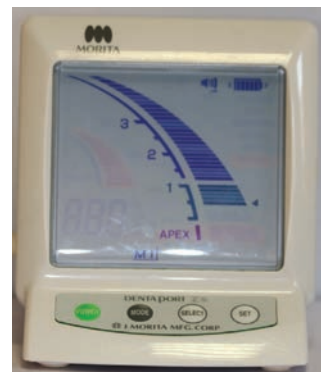


FIGURE 3c

FIGURE 2: Red bars adjacent to 'APEX' illuminated and stable on connecting the file holder and lip clip. FIGURE 3a: EAL showing the 'zero reading', identifying the apical foramen. FIGURE 3b: EAL showing that patency has been achieved. FIGURE 3c: EAL showing the '0.5 reading', indicating the position of the apical constriction.

#### 4. Determine important anatomical landmarks using the EAL

- Perform coronal flare of the canal prior to obtaining the zero reading.
- Using a small file – generally a size 08 or 10 – advance the file towards your estimated working length (a larger file – 15 or 20 – may be required for large/wide canals).
- As you approach that length, attach the file holder to the endodontic file within the canal and advance slowly with a watch-winding motion until the file reaches the bottom green bar on the EAL (**Figure 3a**). This is the zero reading and represents the file being at the apical foramen.
- Advance the file slightly to the first red bar with small files only (**Figure 3b**). This length represents the length to which your patency file should be placed.
- Rotate the file counter-clockwise until it gives a stable reading at the '0.5 reading' (middle of the green bars) (**Figure 3c**). In most cases, this reading can be reliably used to determine the position of the apical constriction.
- If the reading is not stable, consider using a larger file size.
- Excessive irrigant in the canal/pulp chamber, excessive inflammatory exudate entering the canal via the apical foramen, root fractures, immature/open apical foramina, perforations and resorptive defects may affect the accuracy of the EAL readings.

#### 5. Determine the working length

- In most instances, subtracting 0.5-1mm from the zero reading to determine working length yields a satisfactory point to terminate the canal preparation.
- Work to the EAL '0.5 reading': attach the file holder to each file to ensure that it terminates exactly at the '0.5 reading' length and confirm/adapt the working length as required. As the canal geometry changes with increased dentine removal during chemo-mechanical preparation, the working length may also change, and this method ensures that the clinician prepares to the same anatomical point each time.
- When using rotary instrumentation, the rotary file may be removed from the handpiece and used like a hand file to confirm the '0.5 reading'. It may also be used as a hand file to refine the apical preparation as required (**Figure 4**).
- Patency should be confirmed between each file by placing a small file to the 'zero reading' +0.5mm and attaching to the EAL to ensure that it enters the red bars adjacent to 'APEX' on the LCD.

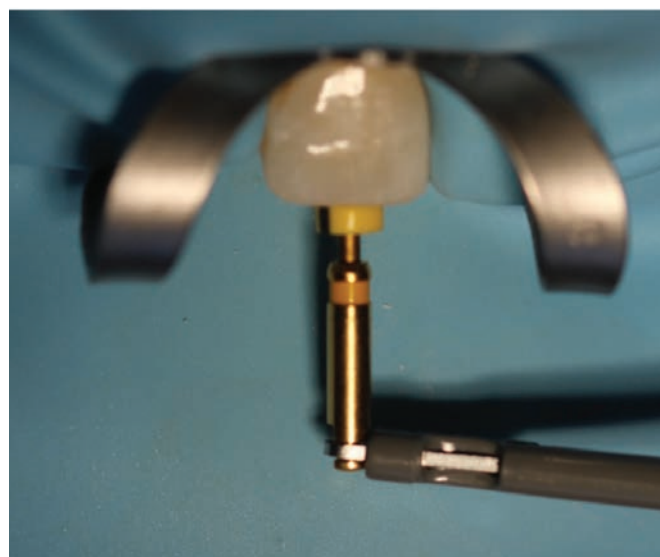


FIGURE 4: EAL attached to rotary file during preparation to confirm that preparation is at the 0.5 reading.

#### 6. Dealing with long canals

- With the rubber bung fully seated against the handle of the file, a working length greater than 23.5mm is difficult to manage with standard 25mm files. If longer files, e.g., 31mm, are not available, trim 2-3mm from the handle of the 25mm files using a high-speed handpiece. This provides additional file length to aid length determination.

When used correctly, the EAL may expedite treatment, reduce the need for intra-operative radiographs and result in a biologically orientated chemo-mechanical preparation length that maximises the likelihood of a successful outcome.

#### Reference

1. Gulabivala, K., Patel, B., Evans, G., Ng, Y.-L. Effects of mechanical and chemical procedures on root canal surfaces. *Endodontic Topics* 2005; 10: 103-122.
2. Quilligan, G., McKenna, G., Allen, F. The restorability assessment and endodontic access cavity interface. *Dent Update* 2016; 43: 933-938.