

Clinical Evaluation of EM-07, a Cordless Endodontic Motor with Integrated Apex Locator for Ex-Vivo Use on Extracted Teeth Embedded in Alginate Model and Comparison with already Certified Reference Devices

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Introduction:

The primary objective of root canal therapy is to reduce the presence of microorganisms and pathological debris in the root canal system, focusing on a specific limit near the narrowest part called the apical constriction. This location has the smallest blood supply diameter, creating a small wound site for optimal healing conditions.

Unfortunately, the apical constriction can be accidentally disrupted during the process due to incorrect determination of the working length. This can result in the extrusion of dentinal debris, endodontic irrigants, and filling materials, leading to an inflammatory response and delayed healing. Traditional methods like radiography and tactile assessment are insufficient for accurately identifying the constriction, while electronic apex locators (EALs) are believed to provide precise measurements and the exact location.

While determining the working length is crucial, it is equally important to maintain it throughout subsequent procedures such as root canal instrumentation and obturation. Continuous monitoring of the working length, especially in curved canals, is vital. The use of endodontic instruments can remove dentin from the inner wall, straightening the root canal. Failing to adjust the working length appropriately can result in negative side effects. Therefore, the integration of an endodontic motor with a built-in apex locator would be highly beneficial in this context.

Hence, this in vitro study was designed to evaluate new motor system in measuring and maintaining the working length and ensuring the optimal shaping while shaping the canal.

Objectives:

The objective of this study is to assess the performance of the cordless endodontic motor in terms of torque, speed control, and battery life, using file systems both for continuous rotation and reciprocating movement. To evaluate the accuracy and reliability of the integrated apex locator in determining the working length on ex-vivo, extracted teeth embedded in an alginate model, and shaping of root canals. To evaluate the overall performance, usability, and user experience of the EM-07 device.

Materials and Methods:

Thirty (30) extracted molar teeth were taken (in some of the teeth, root canal treatment was already present from the past), and access cavities were prepared. The teeth were embedded in an alginate model, and the cordless EM-07 motor was used to shape the canals according to standard root canal treatment, or re-treatment procedures.

Procedure:

1. Determining the working length of each embedded tooth, irrigation with 3% sodium hypochlorite, using the integrated apex locator and comparing it to the readings of the reference device, Root ZX apex locator (J. Morita).
2. Performing root canal instrumentation using the EM-07 cordless endodontic motor and assessing its performance in terms of torque, speed control, and handling. The effectiveness of canal shaping will be compared to a reference device, X-Smart Plus endo motor (Dentsply Sirona).

The root canals will be shaped using various features of the EM-07 motor:

- Continuous rotation, CW motion using PROTAPER GOLD (Dentsply Sirona), and ONE CURVE (COLTENE) files system.
- Catheterization system. CW motion using PATHFILE 0.12, 0.16, 0.20 (Dentsply Sirona), ONE G (Coltene MicroMega), and PROGLIDER (Dentsply Sirona).
- Opener, ONE FLARE (Coltene MicroMega), and SX PROTAPER (Dentsply Sirona).
- Reciprocating motion: using WAVEONE GOLD (Dentsply Sirona), RECIPROC (VDW), and ONE RECI (Coltene MicroMega) files system.
- For re-treatment, removing the gutta-percha using REMOVER (Coltene MicroMega), and PROTAPER D1, D2, D3 (Dentsply Sirona) files system.

- Torque Trigger: Auto Stop, Auto Reverse and REC (reciprocating mode).
- Apex Trigger: Auto Stop, Auto Reverse at the 0.0 (Apex) reading.

3. Evaluating the battery life of the cordless endodontic motor by performing multiple root canal procedures on different teeth.

The primary outcomes will include efficacy, usability, and precision of the apex locator, user feedback and ergonomics.

Results:

- Accuracy and Reliability of Integrated Apex Locator:

The integrated apex locator demonstrated a high level of accuracy and reliability in determining the working length of the embedded teeth. The measurements obtained were consistently close to the reference apex locator device (Root ZX) and to actual known lengths, within an acceptable clinical range.

- Performance of Cordless Endodontic Motor:

The cordless endodontic motor exhibited excellent performance throughout the evaluation. It provided sufficient torque and precise speed control at the tested range of 250 – 450 RPM with torque levels up to 4.0 Ncm, and 1,200 RPM with torque levels up to 3.0 Ncm (for gutta-percha removal) in continuous rotation; and reciprocating movement at FW angle 30°, REV angle 150°, speed 350 RPM, with torque limits of 2.0 – 3.0 Ncm, enabling efficient and controlled instrumentation in wide range of root canals: extremely curved (>30°) or S-shaped canals, moderately curved canals (10° to 30°), and slightly curved (<10°) or straight canals.

The motor's handling was comfortable, and the controls were intuitive, allowing for easy manipulation during the root canal procedures.

Shaping performance were similar to the results of the table-top reference motor X-Smart Plus.

- Battery Life:

The battery life of the cordless endodontic motor was impressive. A single fully charged battery lasted through multiple root canal procedures, indicating that the device has a long-lasting and reliable power source.

- Usability and User Experience:

The overall usability of the cordless endodontic motor with an integrated apex locator was found to be excellent. The device was ergonomic, and easy to handle.

The integrated apex locator and motor controls were intuitive and user-friendly, facilitating efficient workflow and minimizing the learning curve for operators.

Conclusion:

Based on the clinical evaluation, the cordless endodontic motor with an integrated apex locator performed exceptionally well in all aspects. The integrated apex locator demonstrated accurate and reliable measurements of the working length, while the cordless endodontic motor exhibited excellent performance, torque, speed control, and battery life. The device's usability and user experience were also highly rated.



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Date

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