



Scientific Highlights

X-Smart® Pro+
Endo Motor with Integrated Apex Locator

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1. Accuracy of the integrated apex locator

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Aim: The aim of the in vitro study was to determine the repeatability and accuracy of the Integrated Electronic Apex Locator (IEAL) of the X-Smart Pro+ motor (Dentsply Sirona, Germany) in locating the major apical foramen, in comparison with the AI-motor (Woodpecker, China) and the DentaPort ZX OTR (Morita, Japan) devices.

Method: The selection of root canal anatomies was based on existing Micro-CT scans of extracted human teeth (see the study of Schell et al. [1]). Inclusion criteria included but was not limited to: root canal curvature below 10°, no root canal obliteration or resorption, apical size between #15 and #25. 3D printed teeth were fabricated to obtain three test groups with identical root canal anatomies.

Then, the repeatability and accuracy in locating the major foramen by the IEALS in the X-Smart Pro+ motor, AI-motor and DentaPort ZX OTR were evaluated on sixty 3D printed teeth (n = 20). A mounting model incorporating a digital micrometer connected to a computer was used for all the measurements (see more details on the set-up in the study of ElAyouti et al. [2]). ProTaper Ultimate slider instrument was activated between 300 and 400 rpm and advanced toward the apex. Its rotation was stopped in the canal at a position indicated by each IEAL as being the apical major foramen. The distances between the instrument tip and the major foramen were calculated.

Repeatability was calculated for each IEALS and compared by paired Student's test. Accuracy of IEALS was determined with a tolerance of 0.5 mm, 95% confidence interval, and compared using Tukey Kramer and student's t tests.

Results: X-Smart Pro+ and the other evaluated motors had an outstanding repeatability and accuracy in determining the major apical foramen (tolerance +/-0.5 mm) in 3D-printed teeth with regular root canal anatomy. **The X-Smart Pro + was the only endodontic motor with no over-instrumentation beyond the major apical foramen.**

1. Schell S, Judenhofer MS, Mannheim JG, Hülber-J M, Löst C, Pichler BJ, ElAyouti A. Validity of longitudinal sections for determining the apical constriction. Int Endod J. 2017 Jul; 50(7):706-712.
2. ElAyouti, A. and C. Löst, A simple mounting model for consistent determination of the accuracy and repeatability of apex locators. International Endodontic Journal, 2006. 39(2): p. 108-112.

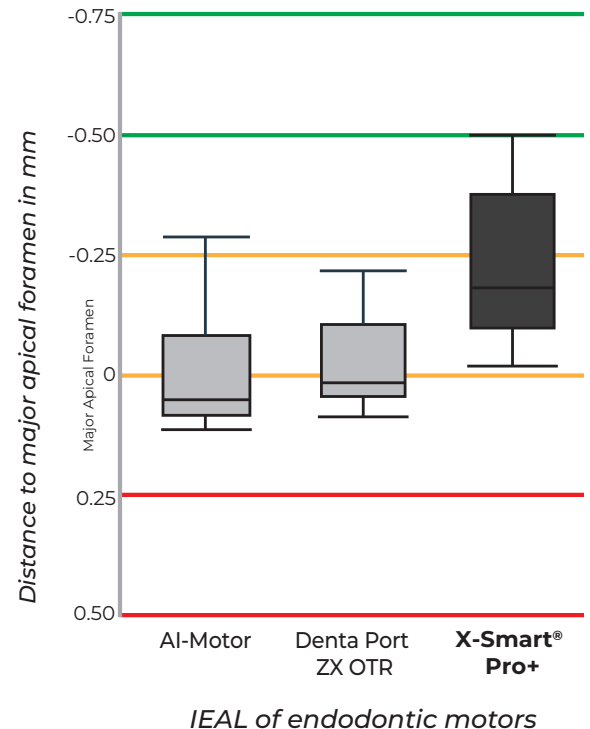


Figure 1: Representative boxplots with the medians, interquartile ranges and min max values for the distribution of the distance to the major apical foramen in mm. Negative values are short of the apical foramen. Positive values are overinstrumentation.