

IN VIVO EVALUATION OF THE PRECISION OF ROMIAPEX A-15 ELECTRONIC APEX LOCATOR

Victor Hugo Dechandt Brochado

Specialist in Endodontics, Master of Science in Endodontics, Associate Professor, Endodontics Sector, Dentistry Department, State University of Londrina, State of Paraná, Brazil

Carlos Alberto Spironelli Ramos

Specialist in Endodontics, Master of Science in Endodontics, PhD in Endodontics, Titular Professor, Endodontics Sector, Dentistry Department, State University of Londrina, State of Paraná, Brazil

Roberto Prescinotti

Specialist in Endodontics, Master of Science in Endodontics, Associate Professor, Endodontics Sector, Dentistry Department, State University of Londrina, State of Paraná, Brazil

State University of Londrina

Rodovia Celso Garcia Cid | Pr 445 Km 380 | Campus Universitário
Cx. Postal 6001 | CEP 86051-980 | Londrina – PR | Brazil

Fone: 55 (43) 3371-4000 55 (43) 3371-4000 | Fax: 55 (43)3328-4440
carlos@endodontia.com.br

SUMMARY

Twenty superior premolars with previous indication of extraction for orthodontic reasons, totaling forty canals, were used in this experiment. Measurements were executed in the point 0.0 of the new Romiapex A-15 apex locator unit (Romidan, Israel). Once obtained the electronic reading, the file used as electrode was fixed in position and the tooth extracted. The gauging of the results was accomplished by wearing one of the external radicular walls of the root apical third, and direct visualization with aid of a surgical microscope. The results indicated that, on average, the measures were the 0,21mm ($\pm 0,20$) short of the exit of the apical foramen, not presenting statically significant differences between the electronic measurements and the real position of the foramen exit. The analysis of the results indicated that all measurements were inside of an acceptable clinical limit, demonstrating that the tested equipment is precise and reliable in the determination of the foramen exit position.

INTRODUCTION

The establishment of the correct apical limit of instrumentation is accepted as one of the most important operative procedures in Endodontics. Significant evidences

show that the instrumentation until the limit of the radiographic apex or above and beyond this, it can commit in a irreversible way the success of the clinical endodontic therapy.

Although the main radicular canal is limited for the apical foramen, also known as larger foramen, the point of smaller diameter of this canal is found usually in the apical constriction, equally call of smaller foramen, being located, on average, approximately 1mm short of the apical foramen, being able to, still, to vary its position from zero to 2mm short of the foramen. This point contains the pulpal tissue, communicating it to the apical periodontal ligament. The operative procedures in Endodontics should be contained in such limit that doesn't cause damages to the periapical tissue, favoring the cure and repairing of this area after the treatment. It is accepted that the apical constriction should be the ideal limit of instrumentation and filling.

Some techniques of determination of the endodontic working length were described and checked scientifically, among them the digital tactile sensibility, methods based in radiographic analysis, and electronic methods. The third generation of apex locators (ENDEX, ROOT ZX and ROOT ZX II, BINGO 1020, NOVAPEX, ROMIAPEX D-30, ROMIAPEX A-15, among others), were checked in past studies and indicated reliable and precise measurements of

the position of the apical foramen exit. The presented positive results were shown superior to the INGLE radiographic technique. The present study intends to identify if the new Romiapex A-15 presents necessary and reliable measurements for the position of the foramen exit, indispensable point in the calculation of the working length.

MATERIALS AND METHODS

- Selection of cases

Twenty superior first premolar, with previous indication of extraction for orthodontic reasons, were selected for the experiment. After the Post-Information Assent for the appropriate study, the patients were submitted to the anamnesis and clinical exam (besides eventual necessary exams to the surgical procedure). Pulp vitality tests (thermal tests to cold with freezing spray and heat) were applied, as well as vertical and horizontal percussion, inspection of fractured restorations, periodontal compromising, and dental mobility.

Initial radiographic exam was accomplished in the sense of detecting perforations, lacerations, previous endodontic treatment, lateral and periapical bone rarefactions, fracture lines, presence of strange objects or fragments of instruments fractured inside the canal, calcifications and complete formation of the apex. The teeth that presented situations to make unfeasible the experiment were discarded of the sampling. The apparent length of the tooth in the x-ray was measured being used an endodontic ruler, and calculated the temporary working length.

- Electronic determination of the working length

After antisepsis, the teeth were anesthetized by infiltration of local anesthetic (mepivacaine 36mg, adrenaline 18mg) and isolated with rubber dam, being any present metallic restoration removed during the procedure of coronary access. All the selected teeth presented clinical signs of vital pulp.

After the location of canals opening using an endodontic probe, the initial instrumentation was executed with type K number 10 or 15, until approximately 3mm back of the temporary length of work, established for the measurement

of the length of the tooth in the initial x-ray. Abundant irrigation of 2, 5% sodium hypochlorite was accomplished in the pulp chamber. In all of the cases was accomplished the Crow-down technique. All the teeth were irrigated abundantly with 2,5% sodium hypochlorite and aspirated excess of liquid of the pulp chamber before the measurement, according to the manufacturer's orientation.

The electronic foramen locator Romiapex A-15 (Figure 1, Romidan, Israel) was installed, being positioned the electrode of the mucous membrane in the labial commissural, and the electrode of the file in the intermediate of the instrument to be introduced in the canal.

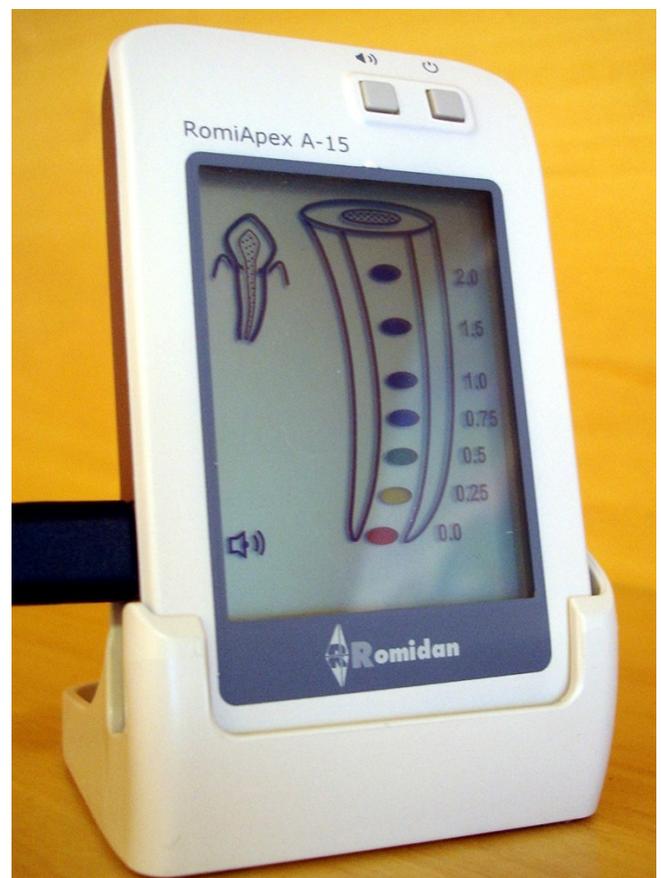


Figure 1. New Romiapex A-15 (Romidan, Israel).

For the electronic measurement, a K file that better adjusted to the apical third anatomical diameter was introduced kindly towards the radicular apical third part, until that the viewfinder of the Romiapex A-15 showed the indication 0.0.

- File fixation and extraction

The average of the electronic measurements was 0,21mm short of the foramen exit, with standard deviation of $\pm 0,20$.

CONCLUSION

Considering the results of this study, it can be concluded that new Romiapex A-15 presented precise and reliable measurements in the executed experimental conditions, being shown efficient in the determination of the foramen exit position at clinical limits.

References

- [1] J. T. Stein, J. F. Corcoran, A. A. Mich, "Radiographic "working length" revisited", *Oral Surgery, Oral Medicine, Oral Pathology*, vol. 74, no. 6, pp. 796-800, 1992.
- [2] A. Elayouti, R. Weiger, C. Löst, "Frequency of Overinstrumentation with an Acceptable Radiographic Working Length", *Journal of Endodontics*, vol. 27, no. 1, pp. 49-52, 2001.
- [3] A. Katz, A. Tamse, A. Y. Kaufman, "Tooth length determination: A review", *Oral Surgery, Oral Medicine, Oral Pathology*, vol. 72, no. 2, pp. 238-242, 1991.
- [4] S. Shabahang, W. W. Goon, A. H. Glusking, "An in vivo evaluation of Root ZX electronic apex locator", *Journal of Endodontics*, vol. 22, no. 11, pp. 616-618, 1996.
- [5] C. A. Dunlap, N. A. Remeikis, E. A. Begole, C. R. Rauschenberger, "An In Vivo Evaluation of an Electronic Apex Locator that Uses Ratio Method in Vital and Necrotic Canals", *Journal of Endodontics*, vol. 24, no. 1, pp. 48-50, 1998.
- [6] A. Elayouti, R. Weiger, C. Löst, "The Ability of Root ZX Apex Locator to Reduce the Frequency of Overestimated Radiographic Working Length", *Journal of Endodontics*, vol. 28, no. 2, pp. 116-119, 2002.
- [7] J. A. Jenkins, W. A. Walker, W. G. Schindler, C. M. Flores, "An In Vivo Evaluation of the Accuracy of the Root ZX in the Presence of Various Irrigants", *Journal of Endodontics*, vol. 27, no. 3, pp. 209-211, 2001.
- [8] C. Lucena-Martin, V. Robles-Gijon, M. Ferrer-Luque, J. M. M. Navajas-Rodriguez, "In Vitro Evaluation of the Accuracy of Three Electronic Apex Locators", *Journal of Endodontics*, vol. 30, no. 4, pp. 231-233, 2004.
- [9] W. A. Meares, H. R. Steiman, "The Influence of Sodium Hypochlorite Irrigation on the Accuracy of the Root ZX Electronic Apex Locator", *Journal of Endodontics*, vol. 28, no. 8, pp. 595-598, 2002.
- [10] D. H. Pratten, M. S. McDonald, "Comparison of Radiographic and Electronic Working Lengths", *Journal of Endodontics*, vol. 22, no. 4, pp. 173-176, 1996.
- [11] A. R. Welk, J. C. Baumgartner, J. G. Marshall, "An in Vivo Comparison of Two Frequency-based Electronic Apex Locators", *Journal of Endodontics*, vol. 29, no. 8, pp. 497-500, 2003.
- [12] D. Krizaj, J. Jan, V. Valencic, "Numerical Computation of Impedances of a Human Tooth for Estimation of the Root Canal Length", *IEEE Transactions on Biomedical Engineering*, vol. 49, no. 7, p. 746-748, 2002.
- [13] N. Meredith, K. Gulabivala, "Electrical impedance measurements of root canal length", *Endodontics & Dental Traumatology*, vol. 13, pp. 126-131, 1997.
- [14] M. H. Nekoofar, M. M. Ghandi, S. J. Hayes, P. M. H. Dummer, "The fundamental operating principles of electronic root canal length measurement devices", *International Endodontic Journal*, vol. 39, pp. 595-609, 2006.
- [15] I. Sunada, "New Method for Measuring the Length of Root Canal. *Journal of Dental Research*", vol. 41, no. 2, pp. 375-387, 1962.
- [16] C. Kobayashi, "Electronic canal length measurement", *Oral Surgery, Oral Medicine, Oral Pathology*, vol. 79, no. 2, pp. 226-231, 1995.
- [17] M. P. J. Gordon, N. P. Chandler, "Electronic apex locators", *International Endodontic Journal*, vol. 37, pp. 425-437, 2004.
- [18] N. J. McDonald, "The electronic determination of working length", *Dental Clinics of North America*, vol. 36, no. 2, p. 293-307, 1992.
- [19] C. Kobayashi, H. Suda, "New Electronic Canal Measuring Device Based on the Ratio Method", *Journal of Endodontics*, vol. 20, no. 3, pp. 111-114, 1994.
- [20] T. F. Pilot, D. L. Pitts, "Determination of Impedance Changes at Varying Frequencies in Relation to Root Canal File Position and Irrigant", *Journal of Endodontics*, vol. 23, no. 12, pp. 719-724, 1997.