Cone-beam computed tomography as a diagnostic tool to locate calcified canals

Thiago Farias Rocha **LIMA**[1]
Francisco José de **SOUZA-FILHO**[2]
Adriana de Jesus **SOARES**[3]

doi: http://dx.doi.org/10.1590/2178-3713.4.2.074-078.oar

ABSTRACT

Introduction: New diagnostic tools have emerged with a view to easing and enhancing endodontic treatment. Cone-beam computed tomography is presented as a new endodontic tool used to diagnose root resorption and fracture, in addition to locating canals which are not revealed by conventional radiograph. In association with this new technology, single rotary files have been widely used in Endodontics. **Objective:** To report a case conducted by means of a single file (RECIPROC) in which cone-beam computed tomography was requested to locate calcified canals.

Keywords: Endodontics. Spiral cone-beam computed tomography. Root canal preparation.

Submitted: February 11, 2014. Revised and accepted: February 14, 2014.

How to cite this article: Lima TFR, Souza-Filho FJ, Soares AJ. Cone-beam computed tomography as a diagnostic tool to locate calcified canals. Dental Press Endod. 2014 May-Aug;4(2):74-8. doi: http://dx.doi.org/10.1590/2178-3713.4.2.074-078.oar

[1]Professor, Department of Endodontics, SENAC-SP.

[2]Full professor, Department of Dentistry, State University of Campinas (UNICAMP). Full professor, Department of Endodontics, UNICAMP.

[3]Professor, Department of Endodontics, UNICAMP and SLMANDIC.

» The authors report no commercial, proprietary or financial interest in the products or companies described in this article.

Contact address: Thiago Farias Rocha Lima
Rua Dias de Toledo, 64 – Apt. 53 – Bairro Saúde – São Paulo/SP — Brazil
CEP: 04143-030 – E-mail: thiagofrl@hotmail.com

Introduction

Endodontics has increasingly become a modern specialty. New diagnostic tools have emerged with a view to easing and enhancing endodontic treatment. In the last few years, cone-beam computed tomography and single rotary files, used with reciprocating movement, have been considered important research topics.[1,2,3]

Periapical radiograph is the major diagnostic tool used in root canal treatment. However, due to providing two-dimensional images, it may not reveal some anatomical structures and dental pathologies. Cone-beam computed tomography emerged in Dentistry with a view to addressing such an issue, as it provides high-contrast, tridimensional images of dental structures. In Endodontics, it has been used to diagnose root fracture and resorption as well as to locate canals.[4,5,6]

In addition to tomography scans, the use of single rotary instruments has been widely spread among specialists.[2] They are used in watch-winding filing motion and progressively advance into the root canal. Several studies prove the effectiveness of these new systems, not only in terms of root canal cleaning, but also in their ability to decrease working time.[7,8]

In view of the above, this article aims at reporting a case conducted by means of a single file (RECIPROC) in which cone-beam computed tomography was requested to locate calcified canals.

Case report

A 52-year-old female patient was referred to the Dental Clinics at SENAC-SP for endodontic treatment of tooth #17 for prosthetic reasons (Fig 1). Clinical examination revealed torsiversion and occlusal wear. However, the patient reported no symptoms. Radiographic examination revealed thickening in the apical region of buccal and palatal roots, in addition to narrow root canals. In view of patient's case, endodontic treatment began.

After the initial procedures of anesthesia, absolute isolation and crown opening, the clinician aimed at locating the canals with the aid of a clinical microscope. Mesiobuccal and palatal canals were located; however, distobuccal canal opening was calcified. There was an initial attempt to wear it with low-speed round burs; however, without success. In view of the impossibility to locate the canal, a CT scan was requested to confirm the existence of a distobuccal canal. The patient returned with the results which confirmed periapical thickening of all tooth roots. Additionally, CT scans revealed that distobuccal canal was calcified up to the middle third (Fig 2). Ultrasonic inserts (CV Dentus, São José dos Campos/SP, Brazil) were used to wear the calcified dentin. As a result, the canal was located.

Root canal instrumentation was carried out with a RECIPROC 25.08 rotary file (VDW, Munich, Germany) driven by VDW.Silver (VDW) endo motor. Coronal and middle thirds instrumentation was followed by odontometry carried out with a #10 K-file (Dentsply Maillefer, Ballaigues, Switzerland). Root canals underwent manual instrumentation up to file #15 (Dentsply Maillefer). Subsequently, the RECIPROC file was reused according to the manufacturer's instructions (round-tripping, progressively advancing into the root canal every 3 mm). The auxiliary chemical substance used during instrumentation was 2% chlorhexidine gel (Endogel – Essencial Pharma, Itapetininga/SP, Brazil) whereas saline solution was used as irrigating solution. Final root canal irrigation was carried out with 5 ml of 17% EDTA. Absorbent paper points were used to dry the canal. Subsequently, root canal filling and coronal sealing with composite resin (Filtek Z350, 3M Dental Products, Saint Paul, USA) were carried out. Figure 3 shows the final radiograph of the case.

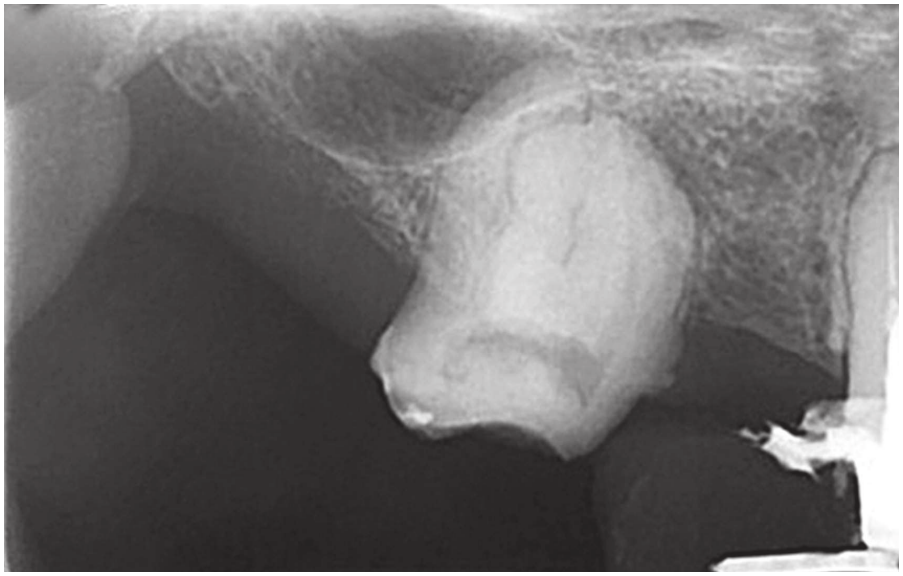

Figure 1. Initial radiograph.

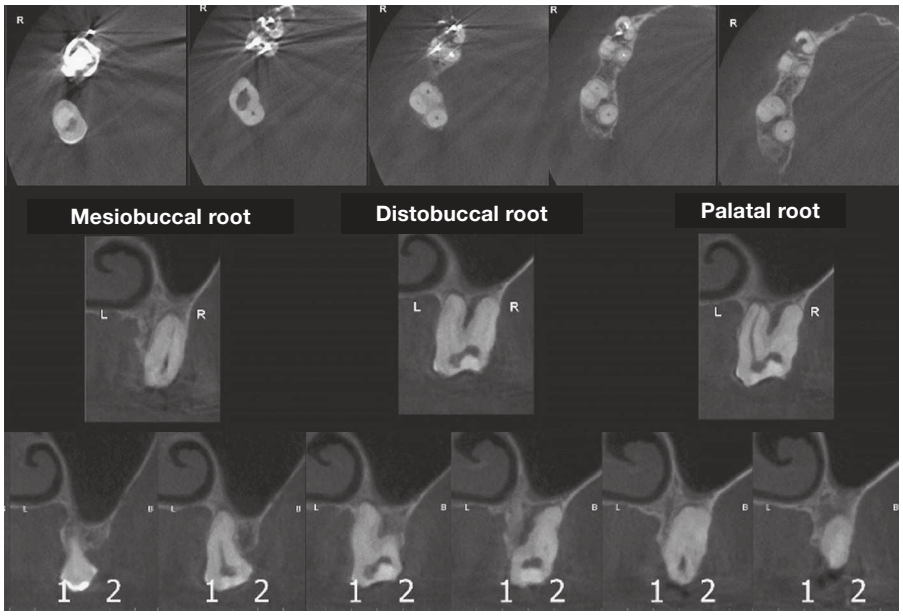

Figure 2. Cone-beam computed tomography.

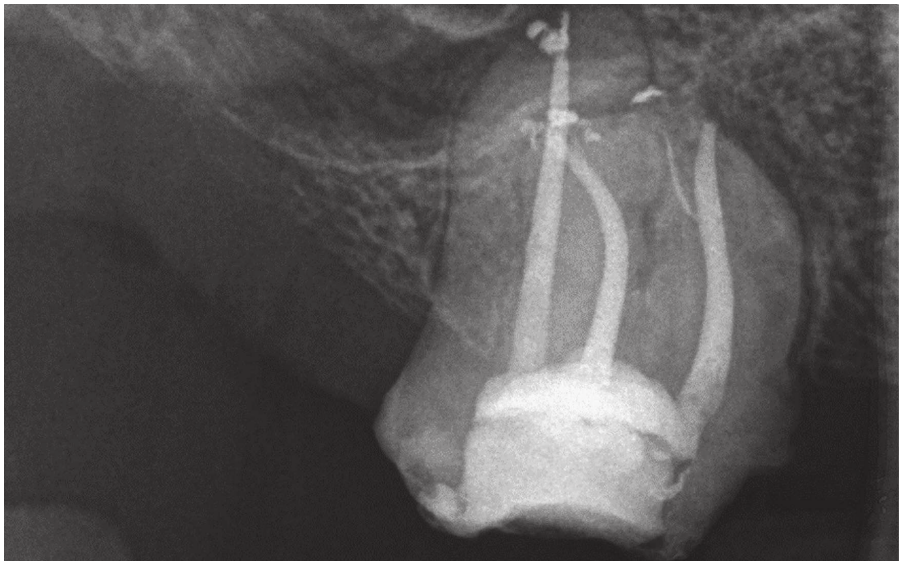

Figure 3. Final radiograph.

Discussion

Cone-beam computed tomography has become an important subsidiary method for endodontic diagnosis. Oftentimes, periapical radiograph is not capable of identifying the endodontic problem. Inflammatory or replacement resorption, root fracture, perforation and accessory canals might only be observed by tomographic examination.[1,9] In the present case, CT scans were requested due to difficulty in locating the distobuccal canal.

There are several models of CT scanners available on the market. They differ in terms of receptor design and function. Importantly, FOV and voxel dimensions affect the quality of image. CT scanners with smaller voxel size are more often used in Endodontics, as they produce clearer scans that allow visualization of the inner anatomical shape of teeth.[10-13] Hassan et al[14] found that variations in FOV and voxel size contribute to better detect root fracture in CT scans. The CT scanner used in this study was Prexion 3D (PreXion Inc, Tokyo, Japan) with a voxel size of 0.1 mm.

Calcification hinders or precludes root canal localization and cleaning. It might be of physiological origin or caused by an etiological factor such as tooth trauma or pulpotomy.[15] Operating microscope is of paramount importance to remove calcification from the pulp chamber or the root canal, as it allows the operator to visualize the area.[16] The present case had procedures carried out with the aid of a clinical microscope.

Ultrasound was used to wear the calcified root canal area without excessively removing the dentin and causing iatrogenesis. In Endodontics, ultrasound is used to remove intracanal posts, fractured instruments, root-filling and calcifications in the pulp chamber or inside the root canal. It is currently considered an important tool for the endodontist.[17]

Root canal instrumentation was carried out with a RECIPROC rotary file driven by VDW.Silver of which reciprocating movement allows the file to rotate 150° counter-clockwise and 30° clockwise. There are three types of files available on the market: 25.08; 40.06; 50.05. Since root canals were too narrow, 25.08 was the file of choice. It is used by progressively advancing into the root canal every 3 mm. Subsequently, it must be removed and the canal irrigated before the file is reintroduced into the canal. Several researches have proved the cleaning ability of this new system, with most researchers finding favorable results.[3,18] Other researches also found root canal deviation not to be significant while working time was considerably reduced.[7,8]

Single rotary files were first developed with the aim of easing endodontic treatment; however, more important than the instrument used during root canal preparation is knowing root canal anatomical shape and reaching proper diagnosis. CT scans might aid the dentist in endodontic planning, particularly in cases in which a canal is not localized.

Conclusion

Cone-beam computed tomography is a subsidiary method used to perform endodontic treatment with higher predictability. It allows localization of root canals which could not be identified by periapical radiograph, thereby further allowing complete root canal system disinfection. Single rotary files were developed to enhance endodontic treatment. In the present case, they proved effective in root canal preparation.

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