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Cone-Beam Computed Tomography As An Auxiliary Method to Identify Accessory Canals In Lower Incisors

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ABSTRACT

The use of cone-beam computed tomography (CBCT) can be decisive for diagnosis and treatment in certain cases. The presented clinical case illustrates the importance of CBCT imaging in identifying accessory canals of the lower incisors. A male patient showed on periapical radiography an extensive lesion involving the four lower incisor apices, on which partial endodontic treatment was performed. CBCT was performed and showed the presence of untreated accessory canals in the four teeth. After six months of endodontic retreatment and obturation of the accessory canals, new periapical radiography was performed. CBCT showed the presence of accessory canals in the four lower incisors, which was very important in the planning and subsequent endodontic retreatment.

Keywords: cone-beam computed tomography, diagnosis, endodontics.

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INTRODUCTION

The success of the endodontic treatment can be attributed to several factors, including knowledge of the root canal morphology, a correct diagnosis, proper instrumentation and filling of the root canal with material, among others [1-5]. Detailed knowledge of the anatomical features of each dental element is fundamental to the success of the treatment, especially in teeth with prevalent anatomical variations such as molars, premolars and lower incisors [3,5,6]. The studies evaluating the root canal morphology of mandibular incisors have shown differences in relation to anatomical features [1,2,8].

The current accepted reference standard for the detection of apical pathosis is the periapical radiograph [9]. These images show good results when properly prescribed; however, there are some specific cases where these exams have limitations, such as anatomical noise, geometrical distortion and being two dimensional [10], which are directly linked to the success of endodontic treatment. Recently, the use of three-dimensional images, such as the CBCT, has been recommended for endodontic treatment since it enables better structural visualization compared to two-dimensional radiographs, which can be a key factor in clinical success [3,11], as these images provide relevant information [12]. Previous clinical studies have noted that CBCT identified 20–35% more lesions than periapical radiographs when comparing the presence or absence of periapical areas in root filled teeth [13-16].

This type of examination provides high-resolution images of the oral structures and allows for the detection of changes in dentomaxillofacial structures. This technology also allows for the determination of linear distances and the volume of anatomic structures, which can be used in different cases.

1) Pre-surgical planning, recommended only in cases which two-dimensional images have failed to provide relevant information, such as in implantology, where the bone thickness and the presence of fine structures in the region could not be assessed [12]. Furthermore, CBCT can also be recommended for patients with facial trauma when two-dimensional images do not clearly show the degree of the displacement or fracture type, for example, suspected condyle fractures [12].

2) The evaluation of impacted teeth, when conventional radiography fails to provide the necessary information.

3) The relation between the third lower molar and the mandibular canal where surgical removal will be performed.

4) Periodontal injuries in cases of intraosseous defects and furcation lesions[12].

5) Periapical lesions, in selected cases, when conventional X-rays do not provide any findings of injuries and when there are contradictory clinical signs [12].

6) Internal and external root resorption in cases where the three-dimensional information will change the conduct and prognosis of the tooth [12].

The purpose of this case was to describe the importance of using CBCT in the assessment of the anatomical characteristics of the lower incisors and its relation to the success of endodontic treatment.

CASE REPORT

A 36-year-old male patient was referred to a Dental Radiology clinic for periapical radiography (Figure 1) after reporting pressure/discomfort in the anterior mandible. Upon examination, there was a radiolucent image with defined boundaries involving the root portion of elements 31, 32, 41 and 42. In the radiographic examination, it was observed that the patient presented an endodontic treatment in the four lower incisors. When talking to the patient, he reported that, as a child, he had a large lesion in the area around the lower incisors and that he had undergone endodontic treatment at that time, simultaneously with the surgical removal of the lesion. For a more accurate diagnosis, it was decided to perform the CBCT, which showed that the lower incisors had two root canals, with only one root canal of each tooth treated endodontically (Figure 2). The patient was instructed to see a specialist in Endodontics for further treatment.

The endodontist then removed the filling from the previously treated teeth, then instrumented and retreated both root canals of each tooth. The patient was in treatment for over 6 months and had to change the dressing every two months. The dressing was made of calcium hydroxide and camphorated parachlorophenol. After this period, the root canals were filled and periapical radiography was performed again (Figure 3). Considering the discrete regression of the lesion after six months, we could report the periapical lesions were undergoing a repair process, thus CBCT was fundamental to providing the correct retreatment.

Figure 1: Periapical radiograph of the lower incisors, showing teeth with endodontic treatment, a well-defined radiolucent area in the root tips, and teeth 31, 32 and 42 with external root resorption.

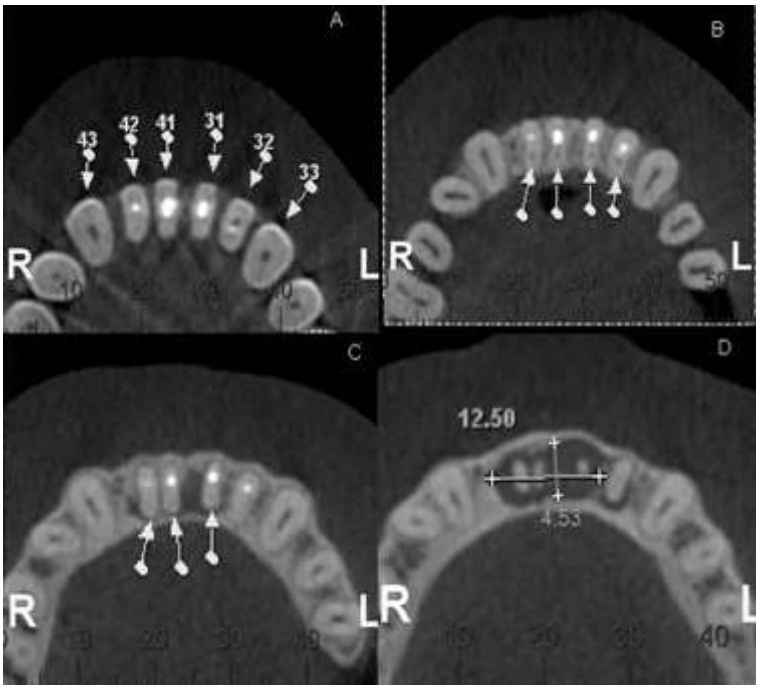

Figure 2: CBCT axial scans of lower incisors. A) Root canals already treated; B) accessory root canals in the four lower incisors; C) accessory canal atresia; D) extension of the hypodense area located below the apex of the lower incisors.

Figure 3: Periapical radiograph of the lower incisors after retreatment and obturation of the root canal.

The patient signed a release form allowing the scientific disclosure of all the radiographic materials and records of his clinical case.

DISCUSSION

This case report shows the importance of using the CBCT in the assessment of the anatomical features of the lower incisors. CBCT was extremely useful in this case, considering that it added relevant information regarding the accessory canals of the lower incisors. It also helped in assessing the extent of the periapical injury associated with these teeth.

The high failure rate in endodontic treatment of the mandibular incisors has been attributed to a lack of knowledge of the anatomy of the root canals on these teeth[6]. Endodontic therapy

requires planning, knowledge and good surgical skills. Errors that occur during procedures often point to professional negligence for not planning accordingly and a lack of knowledge of the case in question, which could have serious consequences for the patient [3]. For this reason, every time the diagnosis is not clear, the dental professional must make use of the resources available that will ultimately help in the success of the case.

The first study evaluating the presence of alterations in the morphology of root canals in the lower incisors was done by Rankine-Wilson and Henry in 1965 [17] Since their work, a number of studies have been performed to evaluate the morphology of the lower incisors; the results show an average of 10-61.5% bifurcated root canals [8]. Considering the present case and the failure rate in the endodontic treatment of these teeth, it seems that this may be the result of professional ignorance or neglect with regards to the morphological alterations present in some cases.

Periapical radiographic examination is often used in endodontics to assess the number of roots and root canals, root curvatures and pulp calcifications, among other alterations [3,8,18]. However, in some cases, this examination fails to provide relevant information to increase the success of the treatment since it provides a two-dimensional image. In contrast, CBCT provides multiplanar reconstructions (MPR), generating a high level of image detail and providing information that is simply not possible to obtain using conventional radiographs [11,12,19,20]. According to Brito-Junior et al. [3], CBCT is a valuable method of imaging for assessing the number of root canals, since this examination provides relevant information in more complex anatomical variations. CBCT is currently not recommended for routine assessment of the outcome of root canal treatment, but its use is justified in research to provide a more objective indication of the outcome.

In this case, the presence of an existing anatomical variation in the four lower incisors was only observed after CBCT was performed, and it was essential for the correct diagnosis and successful retreatment.

Microscopy could be recommended as a first option to identify accessory canals that are not visible in the periapical radiographs because it does not expose the patient to ionizing radiation [12]. However, many endodontists do not have access to this equipment. For these professionals, CBCT may be the only alternative to finding these canals, as seen in this case, where CBCT was shown to clearly find the accessory canals in the lower incisors.

Despite the many advantages of CBCT, in some specific cases, this method of imaging fails to provide important details due to the presence of artifacts in the image. This is due to the presence of any metal object in the tooth or in the assessed area, leading to the production of beam hardening artifacts and making it difficult to view the details [21,22]. Another limitation

regarding the usage of CBCT is that it is not accessible to everyone, because of its high cost compared to other digital intraoral radiographs. In addition, this examination delivers a higher radiation dosage compared to a periapical radiograph [22]. Importantly, every time a patient undergoes CBCT examination, they should be made aware of the high radiation dosage received and the advantages of this examination regarding the outcome of the case [23,24] Considering the various advantages and limitations of CBCT, this method of imaging provides more precise details when compared to 2D radiographs, especially in cases of variations in the morphology of the root canals [24,25].

This case shows that a general dentist should consider the use of CBCT in the treatment of patients with suspicious cases of accessory canals. Despite the fact that CBCT is not the first option according to the literature [12, 22], it helped in the planning and treatment of this case.

CONCLUSION

In this clinical case, it was concluded that, considering only the two-dimensional radiographic images and clinical assessment, the identification of these morphological changes in the root canal would have been impossible to detect, because the canals were very atresic. Therefore, the tomographic image provided relevant radiographic information to identify the cause of the recurrence of the periapical lesion. This is in agreement with the Sedentexct guide[12], which indicates the use of CBCT in high resolution and limited volume for periapical assessment in selected cases where there are signs and contradictory clinical symptoms [12]. Furthermore, without CBCT, this case would not have been treated correctly.

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