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# Evaluation of endodontic lesion on CBCT and digital periapical radiography – a case report

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***Abstract :*** *Purpose: The present study aims to evaluate the extensiveness of a periapical lesion present in an endodontically treated molar using 2D-classical and 3D-modern radiological methods.Material and method: The assessment of this clinical case required the use of digital periapical radiography. Identification of endodontic treatment in upper right first molar and the periapical lesion, without being able to determine its extent, the bone defect and the possible associated maxillary sinus pathology led to the decision of performing advanced radiological investigations: CBCT (Cone Beam Computed Tomography). Results: Small field of view CBCT images provided information about the presence of two periapical lesions on mesiobuccal, distobuccal roots and interradicular bone loss. Alveolar cortical bone loss was identified in the proximity of buccal roots apex and the actual dimensions of the periapical lesions were measured. The 3D imaging of the right maxillary sinus helped identify the pathology of the lower wall sinus mucosa.Conclusions: The CBCT evaluation provides real information on the extent of periapical lesions and associated pathology. Limited information provided by periapical radiography in complex clinical cases is not sufficient to establish the appropriate diagnosis and treatment plan.*

***Keywords:*** *CBCT, endodontic, evaluation periapical, radiography*

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## I. INTRODUCTION

Establishing the correct diagnosis in endodontics requires the use of an appropriate imaging method. Periapical radiographs are a real help in visualizing the endodontic system and hard tissue around the tooth (periapical tissue, periodontal tissue, alveolar bone). However, conventional radiographic techniques, regardless of whether they are film based or digital have limitations [1]. Cone beam computed tomography provides 3-D images that can be used to identify morphological characteristics, periapical pathosis, lesion size, endodontic treatment complications, root resorption and other relevant clinical variables [1,2]. CBCT is not a replacement for digital periapical radiography, is rather a complementary modality for complex cases [3].

## II. CLINICAL CASE

**2.1. Chief complaint:** A 25-year-old patient presents for a deformation of buccal vestibule in right upper arcade. It reports that swelling occurs and disappears periodically, without presenting pain. He mentioned that in the past he had an endodontic treatment at the level of the first right upper molar, after which he experienced intermittent pain in this tooth for several months.

**2.2. Intraoral examination:** Clinical examination revealed a metal-composite crown on first upper right molar (Fig. 1). The restauration was unaesthetic and did not have an anatomical occlusal modeling. Over contoured crown and lack of adaptation at the cervical level resulted in localized gingivitis. Mobility and periodontal probing was physiological. Vertical and horizontal percussion was negative, and on palpation the vestibular and palatal mucosa showed no sensitivity. No draining sinus was observed on palatal and buccal mucosa. The overall hygiene and oral health of the patient were good.

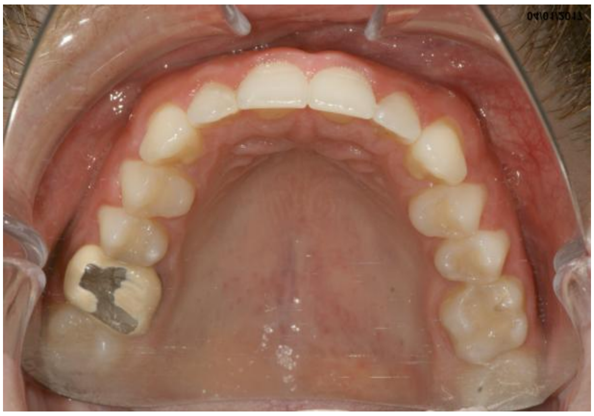

**Fig. 1.** Intraoral aspect

**2.3. Periapical radiograph examination:** Using American Dental Association and FDA (Food and Drug Administration) guidelines to limit patient exposure to radiation [4], it was indicated to perform a periapical radiography to assess the root, periodontium, and adjacent bone health status. The examination (Fig. 2) revealed a crown with a metallic infrastructure, a self-threading post (Dentatus screw) placed on the palatal root, root filling at the level of the three roots, a small periapical lesion in the mesial and distal roots and a possible interradicular lesion.

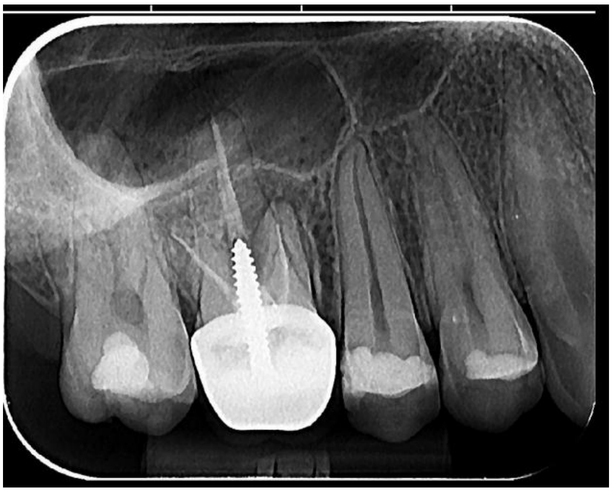

**Fig. 2.** Periapical radiograph

**2.4. Cone Beam Computed Tomography examination**

Compared with traditional radiographic methods, which reproduce the three-dimensional anatomy as a two-dimensional image, CBCT is a three-dimensional imaging method that offers the possibility to view an individual tooth or teeth in any view, rather than predetermined 'default' views. Therefore, CBCT can be a powerful tool in endodontic diagnosis, treatment planning and follow-up [5]. Perhaps the most important advantage of CBCT in endodontics is that it demonstrates anatomic features in 3D that intraoral, panoramic, and cephalometric images cannot [3]. At the same time CBCT has limitations, and radiation dose to the patients must always be taken into consideration when selecting the modes of diagnostics [5].

In general, the smaller the scan volume, the higher the spatial resolution of the image. As the earliest sign of periapical pathology is discontinuity in the lamina dura and widening of the periodontal ligament space, it is desirable that the optimal resolution of the any CBCT imaging system used in endodontics does not exceed 200 $\mu$m—the average width of the periodontal ligament space [3]. However, in this particulary case was selected a medium field of view (FOV) - 5 to 7 cm for evaluation of tooth, surrounding tisue, but also for maxillary sinus mucosa . In this CBCT evaluation the resolution was 0.5 mm (Fig. 3).

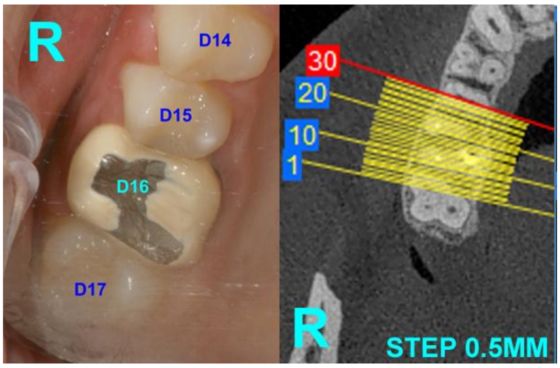


**Fig. 3.** CBCT - The axial image is sectioned in 0.5 mm cross sections

Analyzing cross sectional images through la first upper maxillary molar and surrounding tissue we identified buccolingual extension of a pathosis and its relationship with the cortical bone [6] and maxillary sinus. Cursor-driven measurement algorithms provide the clinician with an interactive capability for real-time dimensional assessment. On-screen measurements are free from distortion and magnification [3].

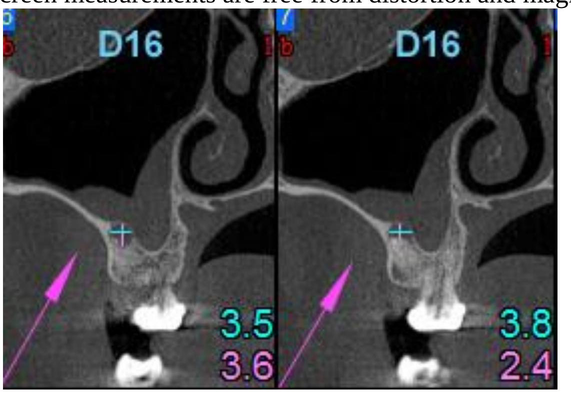


**Fig. 4.** CBCT cross sections of distal root

CBCT-section of the distal root analysis revealed an underfilled and inhomogenous root canal. The periapical lesion has the maximum dimension to the distal portion of the distal root: 3.5 mm vertical, 3.6 mm horizontally (Fig. 4).

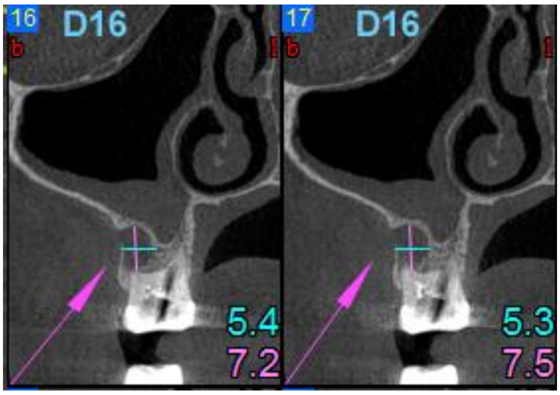


**Fig. 5.** CBCT images of interradicular lesion

The intraosseous lesion with the largest dimensions is interradicular: 7.5 mm vertical and 5.3 mm horizontally. At this level it destroys buccal cortical bone (Fig. 5). Corroborating the anamnesis with the clinical and radiological examinations, we concluded that the lesion extends beyond the cortical bone – submucosal.

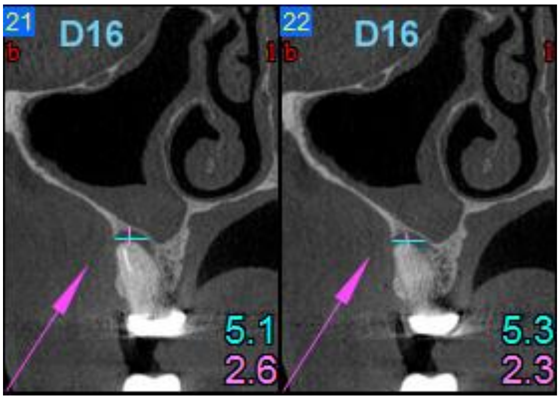


**Fig. 6.** CBCT cross section of mesial root

On periapical radiography, the lesion associated with the mesal root is the easiest to visualize. However, the 3D radiological examination reveals that at this level the lesion has smaller dimensions (2.6 mm vertically, 5.1 mm horizontally) and interrupts the continuity of the buccal cortical bone (Fig. 6).

Using Cone Beam Computed Tomography Periapical Index (CBCTPAI) [9] the periapical lesion was classified as Score 4 (diameter of periapical radiolucency 4-8 mm) + E (expansion) + D (destruction). The CBCTPAI was determined by the largest extension of the lesion [9].

**2.5. CBCT Maxillary sinus evaluation**

Computed tomography scanning has become the standard in medicine for visualizing the maxillary sinuses because of the ability to visualize both bone and soft tissue in multiple views with thin sectioning [7].

Diagnostic criteria for sinusitis diagnosis were developed based on published literature . These criteria divided maxillary sinusitis into four categories[8]:

**1. Normal sinus:** a sinus is considered normal if it has no mucosal thickening detected on the images or uniform mucosal thickening less than 2 mm. The adjacent teeth may be healthy, carious, pulp exposed, restored, extracted, and with or without radiographically evident periapical lesion[8].

**2. Sinusitis of odontogenic origin:** a soft-tissue density mass within the sinuses is a sinusitis of odontogenic origin if it fulfills the following criteria: carious tooth, tooth with defective restoration, or extraction site with or without radiographically evident periapical lesion and mucosal thickening limited to the area of the tooth or extraction site in question[8].

**3. Sinusitis of nonodontogenic origin:** a soft-tissue density mass within the sinuses is a sinusitis of nonodontogenic origin if it fulfills the following criteria: teeth are noncarious, have coronal and/or endodontic restorations of good quality without radiographically evident periapical lesion or if extracted, intact or healing socket and mucosal thickening is not limited to any tooth[8].

**4. Sinusitis of undetermined origin:** a soft-tissue density mass within the sinuses is a sinusitis of undetermined origin if it fulfills the following criteria: carious tooth, tooth with defective restoration, presence of a periapical lesion, or a disrupted socket and mucosal thickening is not limited to any tooth[8].

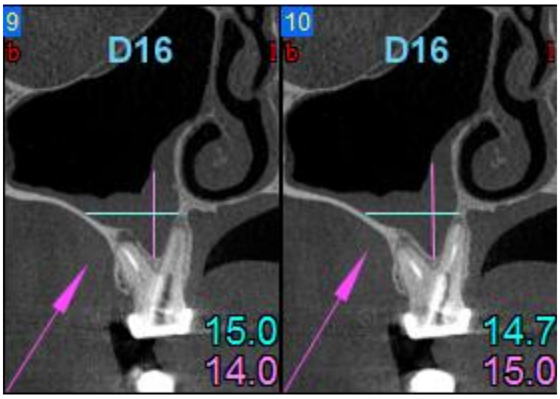


**Fig. 7.** Mucosal thickening in maxillary sinus floor

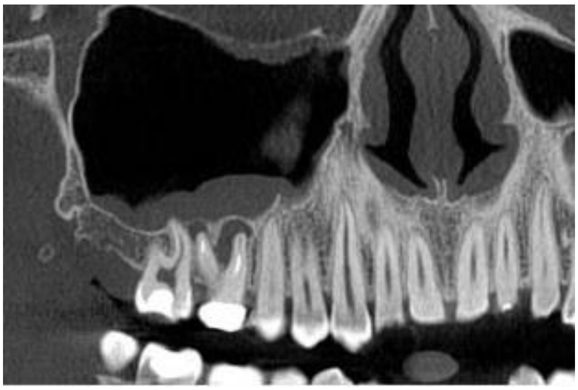

**Fig. 8.** Panoramic reconstruction from CBCT

Analyzing the cross sections (Fig. 7) through the right upper maxilla, as well as the panoramic digital image reconstructed by CBCT (Fig. 8), the sinus floor mucosal thickening was identified from the level of posterior maxillary sinus wall to the anterior wall. Maximum thickening of sinus floor mucosa was 15 mm (Fig.7). Since the deficient endodontic treatment of the first right maxillary molar and its unsatisfactory restoration resulted in a large periapical lesion with consecutive bone expansion and destruction it was concluded that the sinusitis is of odontogenic origin.

## III. Discussion

Intraoral radiography is based on the transmission, attenuation, and recording of X-rays on an analog film or digital receptor, and requires optimized geometric configuration of the X-ray generator, tooth, and sensor to provide an accurate projection of the tooth [3]. The image produced is a two-dimensional (2D) representation of a three-dimensional (3D) object [3]. If any component of the imaging chain process is compromised, the resulting image may demonstrate exposure or geometric errors and be suboptimal [3].

Success in endodontics is assessed in healing of the periapical bone adjacent to obturated canals [3]. Goldman et al. showed that in evaluating healing of periapical lesions using 2D periapical radiographs there was only 47% agreement between six examiners [3]. Goldman et al. also reported that when those same examiners evaluated the same films at two different times, they only had 19%–80% agreement between the two evaluations [3].

The use of conventional radiography for detection of apical periodontitis should be done with care because of the great possibility of false-negative diagnosis [9].

The benefits of using CBCT in endodontics refer to its high accuracy in detecting periapical lesions even in its earliest stages and aiding in differential diagnosis as a noninvasive technique [9]. When both diagnostic methods were analyzed by all observers, they agreed that the CBCT images provided clinically relevant additional information not found in the periapical films [9]. The capacity of computed tomography to evaluate a region of interest in 3 dimensions might benefit both novice and experienced clinicians alike [9]. The advantages include increased accuracy, higher resolution, scan-time reduction, and lower radiation dose [9].

Cone beam computed tomography also have limitations. While clinical applications of CBCT have expanded, current CBCT technology has limitations related to the ‘‘cone-beam’’ projection geometry, detector sensitivity, and contrast resolution that produces images that lack the clarity and usefulness of conventional CT images [10]. The clarity of CBCT images is affected by artifacts, noise, and poor soft tissue contrast [10]. In spite of the dental imaging technique, care should be taken to avoid misinterpretation [9].

## IV. Conclusion

While there are presently no definitive patient selection criteria for the use of CBCT in endodontics, the use of CBCT in endodontic diagnosis should not be avoided or ignored[3].

Cone beam computed tomography overcomes many of the limitations of periapical radiography. The increased diagnostic data should result in more accurate diagnosis and therefore improved decision-making for the management of complex endodontic problems [5].

CBCT produces high-resolution images and provides more detailed information about the bone lesions and the outcome of an endodontic treatment. Compared with periapical radiograpy, CBCT showed a higher accuracy in detecting periapical lesions, canal anatomy, and root canal fillings [11].

**ContributionNote**

The authors contributed equally to this paper.

## References


[1] Patel S, Durack C, Abella F, Roig M, Shemesh H, Lambrechts P, Lemberg K., European Society of Endodontology position statement: The use of CBCT in Endodontics. International Endodontic Journal, 47, 2014, 502–504.

[2] Fujii R[1], Suehara M, Sekiya S, Miyayoshi N, Asai T, Morinaga K, Muramatsu T, Furusawa M., CBCT-based Diagnosis of Periapical Lesion of Maxillary First Premolar Mimicking That of Second Premolar, Bull Tokyo Dent Coll., 57(4), 2016, 291-297.

[3] Scarfe WC, Levin MD, Gane D, Farman AG. Use of Cone Beam Computed Tomography in Endodontics. International Journal of Dentistry. 2009; 2009:634567. doi:10.1155/2009/634567.

[4] ***, Dental radiographic examinations recommendations for patient selection and limiting radiation exposure, www.ada.org,2017, http://www.ada.org/~/media/ADA/Publications/ADA%20News/Files/Dental_Radiographic_Examinations_2012.pdf?la=en

[5] Patel S, Durack C, Abella F, Shemesh H, Roig M, Lemberg K. Cone beam computed tomography in Endodontics – a review. International Endodontic Journal, 48, 3–15, 2015.

[6] Flint DJ, Ruiz Velasco RC, Cone-Beam Computed Tomography (CBCT) Applications in dentistry course, www.dentalcare.com/en-us/professional-education/ce-courses/ce531, 2017.

[7] Nishimura T, Iizuka T, Evaluation of odontogenic maxillary sinusitis after conservative therapy using CT and bone SPECT. Clin Imaging, 26:153-160, 2002.

[8] Maillet M, Bowles WR, McClanahan SL, John MT, Ahmad M., Cone Beam Computed Tomography evaluation of maxillary sinusitis, J Endodontics, Volume 37, Number 6, 753-757, 2011.

[9] Estrela C, Bueno MR, Azevedo BC, Azevedo JR, Pécora JD., A new periapical index based on cone beam computed tomography, J Endod.34(11):1325-1331, 2008

[10] Scarfe WC, Farman AG, What is cone-beam CT and how does it work?, Dent Clin North Am.52(4):707-30, 2008

[11] Perlea P, Nistor C, Suciu I, Post-treatment periapical periodontitits. X-ray versus CBCT – a case report, Journal of Medicine and Life, Vol. 9(1): 84-87, 2016


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