Map-reading Strategy to Diagnose Root Perforations Near Metallic Intracanal Posts by Using Cone Beam Computed Tomography

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Abstract

Introduction: To determine the diagnostic hypothesis on the basis of periapical radiography (PR) is a great challenge for radiologists and endodontists. Visualization of three-dimensional structures, available with cone beam computed tomography (CBCT), favors precise definition of the problem and treatment planning. However, metallic artifact effect of intracanal posts might also induce untrue images. The aim of this article is to suggest a map-reading strategy to diagnose root perforations near metallic intracanal posts (ICPs) by using CBCT. **Methods and Results:** The incapacity to locate correctly the position of root perforation might lead to clinical failures. One strategy to minimize metallic artifact in root perforation associated with ICP is to obtain sequential axial slices of each root, with an image navigation protocol from coronal to apical (or from apical to coronal), with axial slices of 0.2 mm/0.2 mm. This map reading provides valuable information showing dynamic visualization toward the point of communication between the root canals and the periodontal space, associated with radiolucent areas, suggesting root perforation. **Conclusions:** The accurate management of CBCT images might reveal abnormality that is unable to be detected in conventional PR. A map-reading approach reduces problems related to detection of root perforations near metallic artifacts. The final diagnosis should always be made in conjunction with the clinical findings. *(J Endod 2011;37:85–90)*

Key Words

Artifact, cone beam computed tomography, intracanal post, post, root perforation

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Periapical radiography (PR) is often used for endodontic diagnosis, treatment planning, and follow-up. It offers evidence on the progression, regression, and persistence of apical periodontitis (AP) (1, 2). Radiolucencies around the root might constitute important vestige of endodontic treatment failure, indicating that further intervention should be required. When failure has been diagnosed, structuring new endodontic treatment might be a complex process. Root canal perforation is a procedural error resulting in communication between the root canal walls and the periodontal space, which is capable of affecting the prognosis of endodontic retreatment.

Although sealing of root perforation shows higher level of success with mineral trioxide aggregate, which has the ability to encourage the deposition of a hard tissue bridge (3–5), the impact of new therapeutic procedures on prognosis of endodontic therapy should be carefully considered.

Performing exaggerated wear during preparation of intracanal post (ICP) space is a common situation leading to perforation, which in some clinical situations requires special care to establish the hypothesis of diagnosis and therapeutic option. With the advent of computed tomography (6) and more recently cone beam computed tomography (CBCT) (7, 8), new parameters to evaluate the diagnosis and prognosis of a pathologic condition might be included in endodontic practice (9–13). However, diagnostic errors constitute a serious problem frequently detected in the presence of metallic or solid structure (with higher density), which produce image artifact, absence of homogeneity and definition on image contrasts. The problem with misdiagnosis encourages the search for alternatives to reduce the beam hardening effect during image acquisition and reconstruction or in other circumstances (14–24).

Metallic artifacts associated with ICP are potential risks of misdiagnosis, particularly when suggesting root perforation or destruction. Considering the absence of studies involving errors of diagnosis based on CBCT images associated with ICP, the aim of the present article is to discuss and present a map-reading strategy to overcome the effect of metallic artifact in CBCT images produced by ICP associated with root perforation.

Case Reports

Case 1

A 62-year-old woman was referred to the Radiological Center of Orofacial Images (CROIF, Cuiabá, MT, Brazil) for a radiographic check-up to assess and clarify sporadic discomfort during mastication that had been found in tooth #9. Medical history was negative for concomitant disease. Clinical examination revealed presence of prosthesis in this tooth and did not show any abnormalities at the level of the periodontal attachment tissues. There was no spontaneous symptom or edema, and the mobility was within normal limits. Palpation on buccal and palatal structures around this tooth was unresponsive. Radiographic imaging presented the singular appearance of root canal filling until root apex, associated with ICP and absence of apical or lateral radiolucency. The post appeared to be centered within the root canal, with acceptable length and volume. Radiographic evaluation did not show any alteration. Considering the discomfort of patient, it was suggested to perform CBCT imaging with I-CAT Cone Beam 3D imaging system (Imaging Sciences International, Hatfield, PA). The volumes were reconstructed with isotropic-isometric voxels measuring 0.20 mm/0.20 mm/0.20

mm. The tube voltage was 120 kVp, and the tube current was 3.8 mA. Exposure time was 40 seconds. Images were examined with the scanner's proprietary software (Xoran version 3.1.62; Xoran Technologies, Ann Arbor, MI) in a PC workstation running Microsoft Windows XP professional SP-2 (Microsoft Corp, Redmond, WA), with processor Intel Core 2 Duo-6300 1.86 Ghz (Intel Corporation, Santa Clara, CA), NVIDIA GeForce 6200 turbo cache videocard (NVIDIA Corporation, Santa Clara, CA), and Monitor EIZO-Flexscan S2000, resolution 1600 × 1200 pixels (EIZO NANAO Corporation, Hakusan, Japan). The involved tooth was focused, and scans were obtained in different planes (sagittal, coronal, and axial) of 0.2-mm thickness. In sagittal plane the post was observed in palatal direction, with lateral radiolucency displayed at the ICP apex level. In some slices it was possible to observe metallic artifact, providing a dubious image. Navigation in axial slices of 0.2 mm/0.2 mm involved the coronal to apical direction (and also the apical to coronal direction). This map reading provided valuable information for better visualization and localization of vestiges, suggesting diagnosis of root perforation associated with lateral radiolucency (Fig. 1).

Case 2

A 55-year-old woman was referred to the CROIF for evaluation and further aid in diagnosis of AP involving tooth #13. Medical history did not include any important data concerning concomitant disease. Clinical examination revealed presence of crown, with absence of any

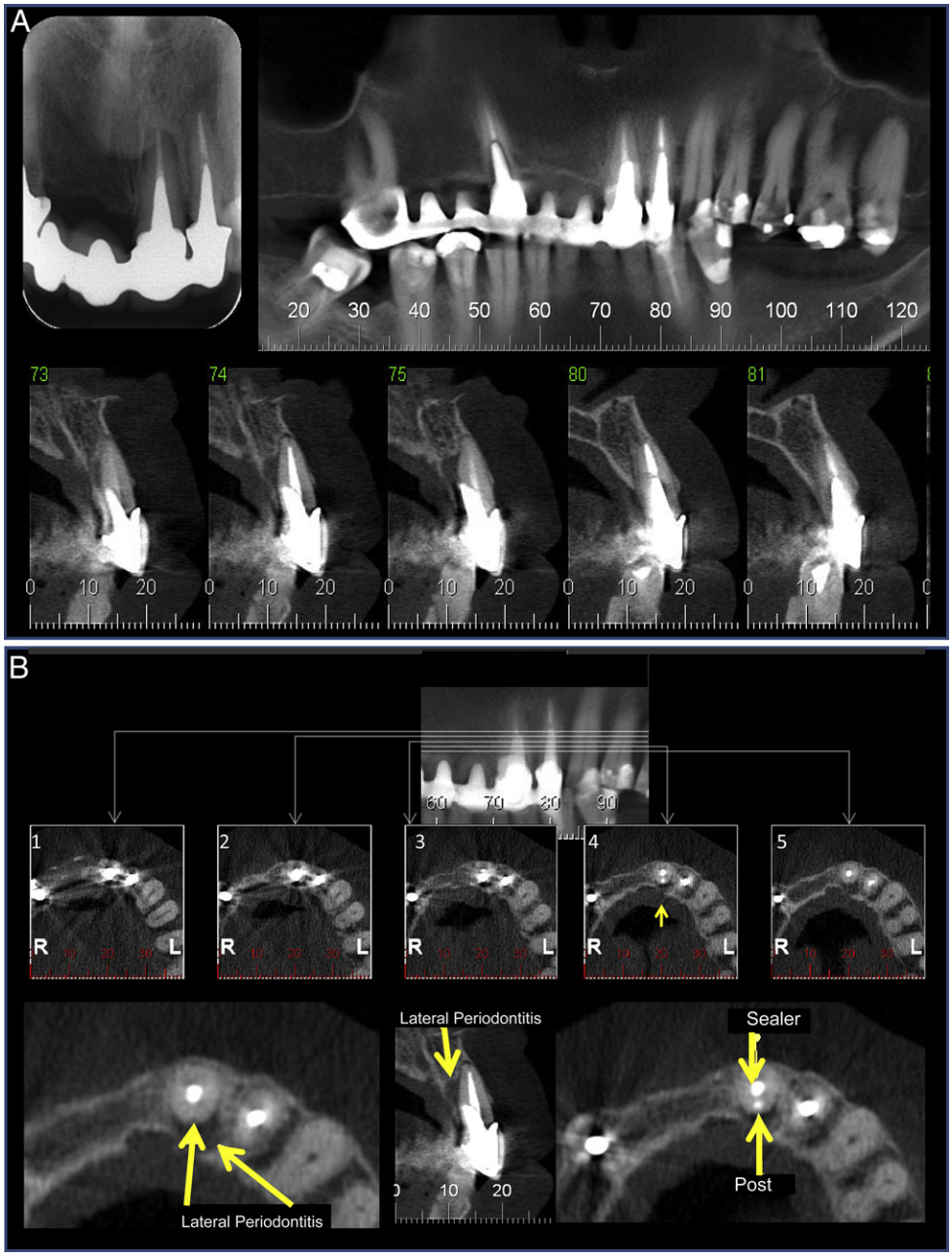

Figure 1. (*A*) Radiographic imaging of tooth #9 presented root canal filling until root apex, associated with ICP and absence of apical or lateral radiolucency. CBCT view shows in sagittal plane the ICP in palatal direction, presence of lateral radiolucency, associated with destruction of palatal wall. (*B*) (Tooth #9). Navigation in axial slices of 0.2 mm/0.2 mm involving the coronal to apical direction (and also in apical to coronal direction) provided important information regarding better visualization and localization, suggesting diagnosis of root perforation associated with lateral radiolucency.