ENDODONTIC IMAGING

Panoramic radiographs to diagnose apical periodontitis

Check for updates

BACKGROUND

Periapical bone lesions are produced by apical periodontitis (AP), an endodontic space infection of the apical periodontium. AP results from the host response to microbial agents that have penetrated up to the apex of the root canal. AP is often asymptomatic or lacking in clear clinical signs, so radiographic evaluations are critical for detecting it. However, 2-dimensional imaging such as panoramic radiography (PAN) or periapical radiography has inherent disadvantages that cannot ensure the periapex is clear of any infection. Cone-beam computed tomographic (CBCT) imaging is a powerful noninvasive imaging tool that can diagnose periapical bone lesions. The radiation dose is relatively low, and image quality does not suffer because of metal artifacts. However, CBCT has limited capacity to detect soft tissues and the scan time is considerable, with motion artifacts a concern. In addition, current guidelines state that CBCT should be considered only for patients whose initial evaluation yielded diagnostically insufficient clinical signs/symptoms and when 2-dimensional imaging cannot produce acceptable diagnostic images. CBCT imaging is therefore only requested when additional information could potentially alter the treatment plan or outcome. A retrospective study was undertaken to assess the diagnostic accuracy of PAN in detecting clinically or surgically confirmed asymptomatic AP after endodontic treatment compared to the standard of CBCT imaging.

METHODS

The population included 240 patients with endodontically treated AP and 240 patients with root filling and a healthy periapex. The disease group had undergone CBCT imaging, then were divided into groups of 20 patients each based on lesion size (2 to 4.5 mm and 4.6 to 7 mm) and anatomic area involved (incisor, canine/premolar, and molar) in both arches. All patients underwent PAN first, then a CBCT scan within 40 days. The detection of AP using PAN was assessed according to the periapical index (PAI) system. In addition, sensitivity, specificity, diagnostic accuracy, positive predictive value, and negative predictive value were assessed for PAN images compared to CBCT imaging.

RESULTS

Inter-observer agreement was moderate. The PAN images had very high specificity and positive predictive values compared to CBCT images, and diagnostic accuracy was relatively high.

About half of the cases were true positives, and slightly more than half were underestimated as PAI 2 to 3. For the upper arch, the true positives were 32.5% in the incisor, 47.5% in the canine/premolar, and 37.5% in the molar areas. When lesions affecting just

Figure 2. True positive. **A,** Upper jaw CBCT imaging showing a 4.7-mm AP affecting the second premolar. **B,** In PAN, the AP appeared to be a small change in the bone structure with some mineral loss. Thus, it was underestimated as PAI 2 to 3. (Courtesy of Nardi C, Calistri L, Grazzini G, et al: Is panoramic radiography an accurate imaging technique for the detection of endodontically treated asymptomatic apical periodontitis? *J Endod* 44:1500-1508, 2018.)

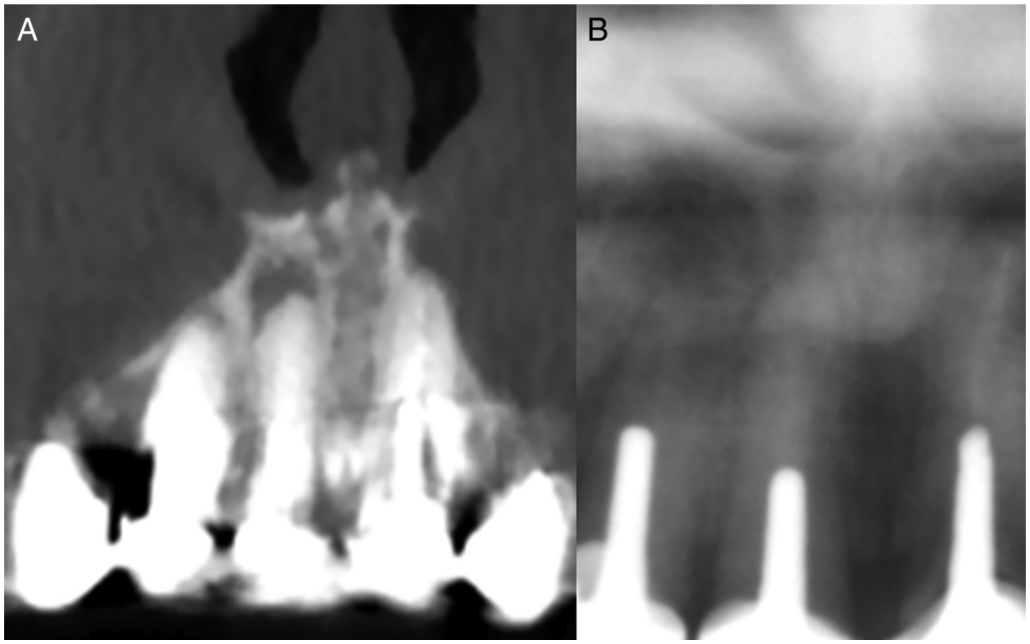

Figure 5. False negative. **A,** Upper jaw CBCT imaging showing a 3.9-mm AP affecting the right central incisor. **B,** In PAN, no periapical bone lesion was detected at the level of the periapex of the right central incisor. (Courtesy of Nardi C, Calistri L, Grazzini G, et al: Is panoramic radiography an accurate imaging technique for the detection of endodontically treated asymptomatic apical periodontitis? *J Endod* 44:1500-1508, 2018.)

the cancellous bone were considered, small lesions had a 14.3% rate of true positives and large lesions a 38.9% rate (Figure 2).

For the lower arch, true positives were 32.5% for the incisor, 72.5% for the canine/premolar, and 78.5% for the molar areas. When lesions affecting just the cancellous bone were considered, small lesions had a 40.0% rate of true positives and large lesions as 78.5% rate.

PAN errors included 15 false positives, with 7 PAI 2-3 and 8 PAI 4-5. They were identified in the lower incisor (5), upper molar (4), and upper incisor (3) areas. False negatives were seen in about half of the cases. Most of the AP lesions were not recognized in the upper and lower incisor areas (Figure 5).

DISCUSSION

Good diagnostic accuracy was found for PAN's ability to detect endodontically treated asymptomatic AP lesions. However, different levels of accuracy were related to anatomic area, lesion size, and cortical bone involvement. The sensitivity of PAN was low (48.8), the negative predictive value was mediocre (64.7), and the specificity (93.8) and positive predictive values (88.6) were high. PAN had a high risk for underdiagnosing AP.

Clinical Significance

PAN had some concerning limitations in its ability to detect asymptomatic AP lesions that had been treated endodontically. Although it offered high specificity and good diagnostic accuracy, its sensitivity was low. It had better ability to detect larger lesions affecting the cortical bone and in the lower canine/premolar and molar areas, but less impressive ability detecting lesions smaller than 4.6 mm that affected only cancellous bone in the upper molar area and upper and lower incisor areas.

Nardi C, Calistri L, Grazzini G, et al: Is panoramic radiography an accurate imaging technique for the detection of endodontically treated asymptomatic apical periodontitis? *J Endod* 44:1500-1508, 2018

Reprints available from C Nardi, Università di Firenze, Dipartimento di Scienze Biomediche Sperimentali e Cliniche, Radiodiagnostica 2, AOU Careggi, Largo Brambilla 3, 50134 Firenze, Italy; e-mail: cosimo.nardi@unifi.it