Association between the Presence of Apical Periodontitis and Clinical Symptoms in Endodontic Patients Using Cone-beam Computed Tomography and Periapical Radiographs

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Abstract

Introduction: Cone-beam computed tomographic (CBCT) imaging is a valuable adjunct to endodontic practice. Among the endodontic applications of CBCT imaging, it aids in the diagnosis of apical periodontitis, often in cases in which there is no evidence of pathosis identified by conventional imaging. The purpose of this study was to correlate the presence of apical periodontitis of teeth evaluated with 2-dimensional periapical (PA) radiographs and 3-dimensional CBCT volumes with clinical signs and symptoms. **Methods:** Clinical records were reviewed from patients examined at the graduate endodontics clinic. The examination included clinical examination, sensibility tests, PA radiographs, and limited field-of-view CBCT scans. Of 498 cases, 67 fulfilled the inclusion criteria and were evaluated for apical periodontitis and symptomology. CBCT slices and PA radiographs were evaluated by 2 board-certified endodontists and a board-certified oral and maxillofacial radiologist for the presence of apical periodontitis. **Results:** Thirty eight of 67 teeth showed the presence of apical radiolucencies on PA radiographs and on CBCT imaging, whereas 14 teeth had no evidence of apical radiolucencies on either imaging modality. Fifteen cases showed the presence of apical radiolucencies visible on CBCT imaging that were not visible on PA radiographic images. The presence of apical radiolucencies on CBCT slices and PA radiographic images was correlated with clinical signs and symptoms, including the chief complaint. **Conclusions:** This research has important implications to prevent overexposure to radiation and to provide treatment for those patients with persistent symptoms lacking proper diagnosis based on conventional (2D) radiographs. *(J Endod 2015;41:1824–1829)*

Key Words

Apical periodontitis, cone-beam computed tomographic imaging, endodontic, radiographs, symptoms

Periapical (PA) radiographs combined with clinical examination have long been the standard for endodontic diagnosis and postoperative evaluation of healing. However, PA radiographs only provide a 2-dimensional (2D) view of 3-dimensional (3D) structures. Classic studies by Bender and Seltzer (1, 2) showed that erosion of junctional bone is necessary for radiographic detection of bony destruction. Bender (3) later estimated that 7.1% mineral bone loss in cortical bone is required to produce a radiolucent area when accounting for soft tissue absorption.

Cone-beam computed tomographic (CBCT) imaging is a relatively new technology currently available in endodontic practice. Among the many uses of CBCT imaging is aiding in the differential diagnosis of apical periodontitis, often in cases in which there is no evidence of pathosis identified by conventional imaging (4). This advantage is reflected in the estimated sensitivity of 1.0 for CBCT imaging (125-μm voxel) compared with 0.248 for intraoral 2D radiography. Both imaging modalities have estimated specificity values of 1.0 (5). Accordingly, the detection of apical periodontitis is increased when roots are assessed with CBCT imaging compared with PA radiographs (6).

Although there is little debate about the benefits of CBCT imaging in endodontics, all clinicians must always consider the principle of ALARA (As Low As Reasonable Achievable) when using CBCT imaging and any other imaging modalities. To minimize radiation exposure while maximizing diagnostic information, clinicians should consider the use of CBCT imaging only when the need for imaging cannot be answered adequately by lower-dose conventional dental radiography or alternate imaging modalities. Therefore, it is important to consider the effective dose of various imaging modalities and their resolution in relation to the information they provide to the clinician.

The preoperative correlation between clinical data, including chief complaint, and radiographic findings should allow the clinician to determine predictive factors for more accurate diagnosis before endodontic therapy. Recently, it was reported that when atypical odontalgia is suspected, the use of CBCT imaging improved the diagnostic certainty compared with sole use of PA and panoramic radiographs because of the superior ability of CBCT imaging to exclude inflammation as the cause of pain (7). Previous research has shown that CBCT imaging improves the identification of existing PA lesions in patients that may otherwise remain undetected using

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conventional radiography, facilitating differentiation between non-endodontic and endodontic signs and symptoms (8). However, at present, no study has correlated these signs and symptoms with radiographic findings.

Therefore, the purpose of this study was to correlate the evidence of apical periodontitis evaluated with 2D PA radiographic images and 3D CBCT volumes with clinical signs and symptoms.

Materials and Methods

The present study was approved by the Human Subjects Division (Case #45203) at the University of Washington, Seattle, WA. Figure 1 is a flowchart that explains the methodology used to conduct this study, including the exclusion and inclusion criteria, calibration, and scoring criteria.

Study Sample

Clinical charts were reviewed retrospectively to identify all patients presenting to the graduate endodontic clinic from September 1, 2009, to June 1, 2013. Patients were eligible for the study sample if their visit included a complete clinical examination with sensibility, percussion, palpation tests, and periodontal probing; their chief patient complaint was recorded; at least 2 preoperative intraoral periapical radiographic images were taken with Kodak 6100 (Carestream, Atlanta, GA) using paralleling devices (Dentsply Rinn, Elgin, IL); and a preoperative limited

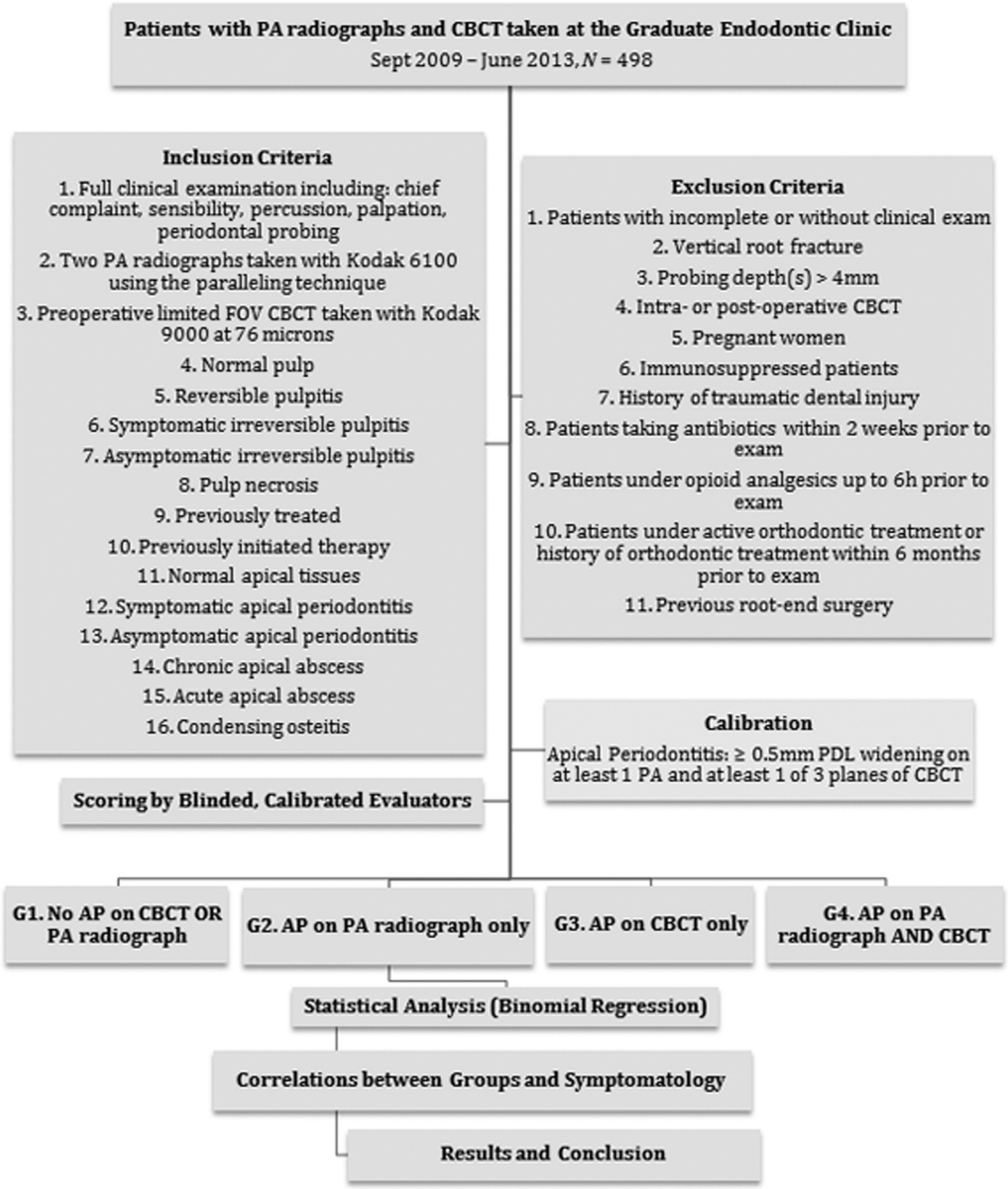

Figure 1. Flowchart of methodology used to conduct this study. It includes the exclusion and inclusion criteria, calibration, and the scoring criteria.