Evaluation of Periapical Lesions and Their Association with Maxillary Sinus Abnormalities on Cone-beam Computed Tomographic Images

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Abstract

Introduction: Periapical inflammation is often responsible for distinct maxillary sinus (MS) changes. This retrospective, cross-sectional study evaluated the association between the clinical characteristics of periapical lesions (presence, size, and distance) in maxillary posterior teeth and the presence of sinus abnormalities by evaluating cone-beam computed tomographic (CBCT) images obtained from an archived collection. Apart from sex, no other patient information was available. **Methods:** The study sample was composed of CBCT images of 143 MSs of patients with at least 1 maxillary posterior tooth with a periapical lesion and 178 MSs of patients without periapical radiolucent lesions. Sinus abnormalities were classified as mucosal thickening, sinus polyp, antral pseudocyst, nonspecific opacification, periostitis, and antral calcification; periapical radiolucent areas were classified using the CBCT periapical index, and the distance between the periapical lesion edge and the MS floor was measured. Data were analyzed using chi-square tests at a level of significance set at $\alpha = 0.05$. **Results:** Most sinus abnormalities were associated with at least 1 maxillary posterior tooth with a periapical lesion ($P > .05$). The most frequent sinus abnormality in the presence of a periapical lesion was mucosal thickening. All teeth with a CBCT periapical index score of 5 were associated with sinus abnormalities. The highest frequency of abnormalities was found when the radiolucent area was subjacent to the sinus floor. **Conclusions:** Maxillary posterior teeth with periapical radiolucent lesions had the highest frequency of sinus abnormalities. The size of a periapical lesion was not associated with the frequency of sinus abnormalities. A close spatial relationship between periapical lesions and sinuses resulted most frequently in sinus abnormalities. *(J Endod 2016;42:42–46)*

Key Words

Anatomy, cone-beam computed tomography, maxillary sinus, periapical lesion, sinusitis

Diffuse pain in the posterior maxilla may be difficult to diagnose because of the relationship between the roots of the maxillary posterior teeth and the maxillary sinus (MS) floor. Because the MS and the maxillary teeth share a common nerve supply, an accurate differential diagnosis should be made when the patient complains of pain (1, 2).

The MS floor extends from the first premolar to the maxillary tuberosity but may reach the zygomatic bone, the alveolar ridge after extractions, and the anterior canine. Located at a lower level than the floor of the nasal cavity, the MS is closely associated with maxillary tooth roots (3, 4). Normal sinus mucosa is not visualized on radiographs, but, when affected by infection or allergy, it may become thicker and, therefore, visible on images (3). Periapical infections in the maxilla may spread along several paths depending on tooth position. Bacteria, their toxins, and products of pulpal necrosis may spread to adjacent anatomic structures, such as the MS, and lead to inflammation (5–8).

Radiographs are important tools in the diagnosis of periapical changes and MS abnormalities. Panoramic radiographs, films exposed according to the Water technique, and periapical images have all been used to assess both the integrity of the MS and its anatomic relationship with roots of maxillary posterior teeth (9–11). However, radiographs are 2-dimensional (2D) representations of 3-dimensional (3D) structures, which make it especially difficult to evaluate the relationship of roots and periapical lesions (PLs) with the MS floor (5, 6, 9, 11–13).

For the MS, computed tomographic (CT) imaging is the reference imaging test because it shows bone and soft tissue and because images may be obtained in thin CT slices and multiple planes (9). Cone-beam CT (CBCT) imaging has proven to be a valuable complementary test to evaluate root canal treatment failures and probable MS involvement (1, 9, 14, 15). The well-known entity of odontogenic sinusitis is found in 10%–12% of the cases of maxillary sinusitis (9).

CBCT imaging may help make a diagnosis and define the treatment of odontogenic sinusitis (9, 13–15). Therefore, to make the diagnosis of maxillary sinus abnormalities, an accurate imaging test should be used to investigate the association of PLs and MS changes. This retrospective, cross-sectional study evaluated the association between the clinical characteristics of PLs (presence, size, and distance) in maxillary posterior teeth and the presence of sinus abnormalities by evaluating CBCT images obtained from an archived collection.

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0099-2399/$ - see front matter

http://dx.doi.org/10.1016/j.joen.2015.09.014

Materials and Methods

Image Selection

The sample was composed of CBCT images of 200 patients (125 women, 75 men; mean age = 41.2 years) seen from January 2009 to July 2013 in a private dental radiology service for diagnosis. Apart from sex, no other patient information was available. A total of 321 MSs were evaluated: 143 MSs on CBCT imaging showing all posterior teeth and at least 1 posterior tooth with a PL and 178 MSs on CBCT imaging showing no posterior teeth with PLs.

Inclusion criteria were maxillary CBCT scans showing all first and second premolars and first and second molars, all fully erupted and with fully formed roots. CBCT scans that showed the imaging device or an orthodontic retainer, bone abnormalities, and suspected tumors in the posterior area of the maxillary or in the MS were excluded. This study was approved by the research ethics committee (Proc. #19715613.5.0000.5083) of the institution.

Imaging Methods

The CBCT images were obtained using an I-CAT Cone Beam 3D System unit (Imaging Sciences International, Hatfield, PA). The following settings were used: field of view of 16 × 6 cm, volume reconstruction using 0.25-mm isometric voxels, a voltage of 120 kVp, a tube current of 3.8 mA, and an exposure time of 40 seconds. The images were analyzed using the CBCT unit software (Xoran 3.1.62; Xoran Technologies, Ann Arbor, MI) and a computer running Microsoft Windows 7 Professional 32-Bit with XP Mode

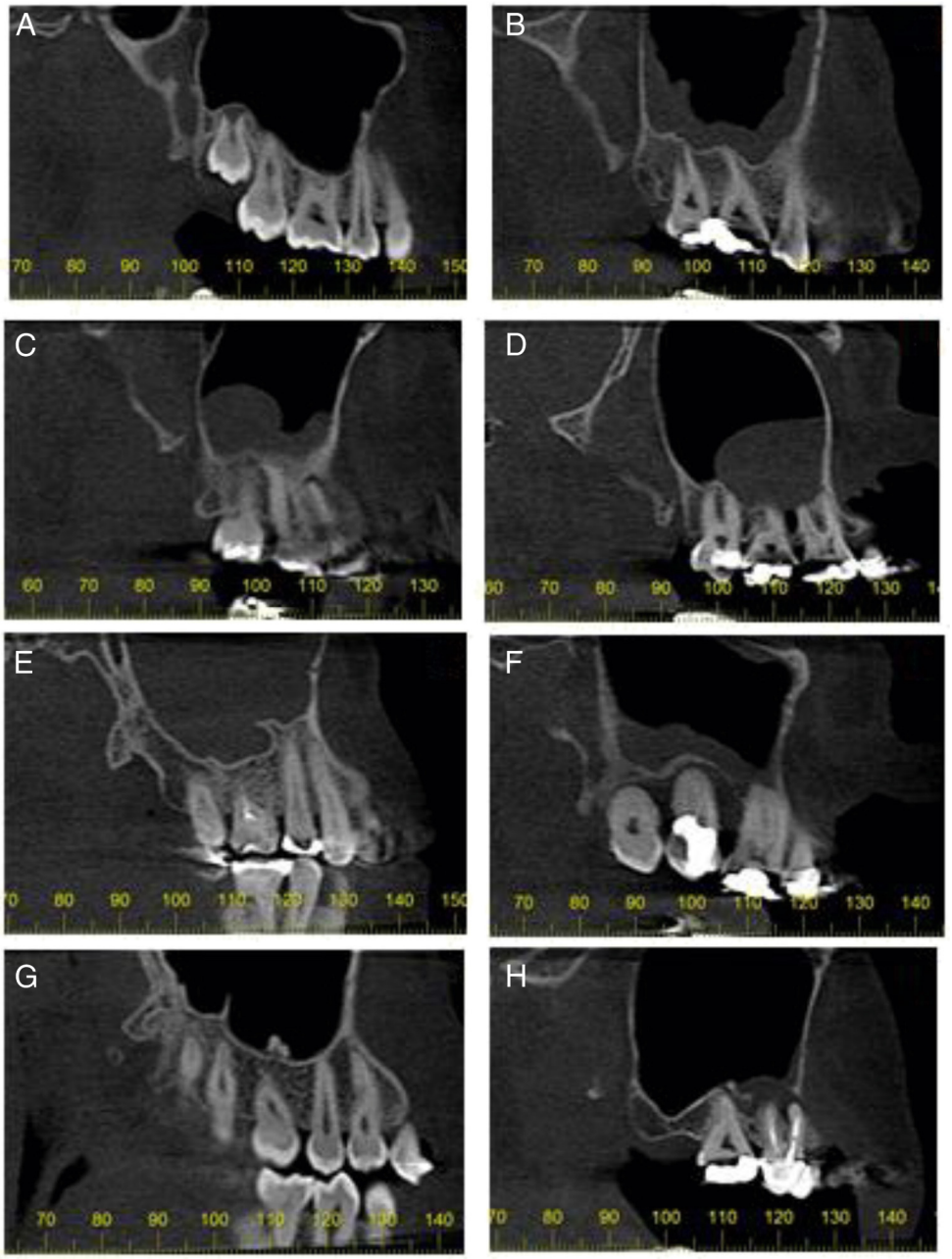

Figure 1. Changes in MS observed in sagittal CBCT imaging: (*A*) absence of alteration; (*B*) mucosa thickening; (*C*) sinus polyp; (*D*) antral pseudocyst; (*E*) nonspecific opacification; (*F*) mucosa thickening and periostitis; (*G*) antrolith; and (*H*) mucosa thickening and antrolith.