



Association between Odontogenic Conditions and Maxillary Sinus Disease: A Study Using Cone-beam Computed Tomography

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Abstract

Introduction: The maxillary sinus can be affected by dental infections because of its close relationship with upper teeth. This study aimed to assess the most common types of maxillary sinus alterations and to associate them with odontogenic conditions using cone-beam computed tomographic (CBCT) images. **Methods:** CBCT scans of 400 patients showing sinus disease in 1 or both maxillary sinuses were evaluated. Sinus alteration was considered as follows: generalized or localized mucosal thickening (MT), maxillary sinusitis (MS), and retention cysts (RCs). The odontogenic conditions evaluated were inadequate endodontic treatment, periapical lesions, and periodontal bone loss. Descriptive and multiple logistic regression analyses were performed. **Results:** Sinus diseases were observed in 85.9% of the maxillary sinuses. The most prevalent condition was generalized MT (65.2%) followed by localized MT (24.8%), MS (6.4%), and RCs (3.6%). Generalized MT was more related to males (odds ratio = 1.45, $P < .05$) and periodontal bone loss ($P < .05$). Localized MT was associated with periapical lesions (odds ratio = 3.09, $P < .05$) and showed a close anatomic relationship between teeth and the sinus floor (odds ratio = 2.77, $P < .05$). There were no statistically significant associations between either MS or RCs and the odontogenic conditions studied. **Conclusions:** The most prevalent sinus diseases were the generalized and localized MT, and they were the only ones related to odontogenic conditions (periodontal bone loss and periapical lesions, respectively). We emphasize that CBCT imaging is an appropriate method for evaluating the maxillary sinus findings and their associated odontogenic conditions. (*J Endod* 2016;42:1509–1515)

Key Words

Alveolar bone loss, cone-beam computed tomography, maxillary sinus, periapical disease, sinusitis

The maxillary sinus may be affected by odontogenic infections because of its anatomic relationship with the upper teeth (1). Researchers have shown that infection spread is not only determined by the topographic proximity between dental roots and the maxillary sinus but also by the common vascularization of sinus mucosa and periodontal tissue (2) and/or by the spread between the fascial spaces (3).

According to recent studies (4, 5), maxillary sinusitis (MS) is related to dental causes in more than 50% of cases. Several sources of odontogenic infection may be associated with sinus alterations including periapical lesions (4–8), periodontal bone loss (9–11), extensive caries (4, 11), defective restorations (4, 12), endodontic treatments (10, 11), bone grafts and dental implants (13, 14), and iatrogenesis during surgical procedures (1, 15).

Odontogenic sinus diseases can be presented in various ways, and they are particularly characterized by inflammation and localized mucosal thickening (MT), which may subsequently lead to MS (4, 10, 12). Moreover, retention cysts (RCs) or antral pseudocysts (different pathological conditions but radiographically indistinguishable) presented a controversial etiology because they may or may not be associated with dental infections (16), appearing as a dome-shaped radiopacity within the sinus.

Identifying the relationship between odontogenic and sinusal pathologies is essential to establish the correct diagnosis and management of the patient. For this, the professional should use an adequate and high-precision diagnostic method. Cone-beam computed tomographic (CBCT) imaging is capable of providing 3-dimensional images with high quality by using a lower radiation dose and presenting a lower cost compared with multislice computed tomographic imaging (17). CBCT imaging allows the identification of changes in the maxillary sinus and their potential causes (4) as well as the

Significance

This retrospective CBCT study of the relationship between dental and sinus diseases found that different types of mucosal thickening are related to different odontogenic conditions, which highlights the importance of correct diagnosis to conduct patient care.

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relationship between maxillary sinus and adjacent teeth (5) and is therefore the ideal examination for assessing patients who have both dental and sinusal complaints (18).

Although some studies have shown a significant association between MT and periapical lesions (5, 7), no information has been available yet for a separate analysis of generalized and localized MTs. Thus, the aim of this study was to assess the most frequent types of maxillary sinus disease, including the different presentations of MT, and to check their association with odontogenic conditions, such as the presence of inadequate root canal filling, periapical lesions, and periodontal bone loss, using CBCT images.

Materials and Methods

Study Sample

This retrospective study was performed with approval by the local research ethics committee of the health sciences center (protocol number 273.599).

From a pool of 2000 CBCT scans of the maxilla and paranasal sinuses obtained between January 2010 and January 2011 in a radiology clinic in Pernambuco, Brazil, 400 images were randomly selected according to the following inclusion criteria: examinations of patients with sinus disease in at least 1 of the maxillary sinuses and good quality images for diagnosis. MT (generalized or localized), MS, and RCs were the sinus diseases considered in the study. Other sinus pathological conditions were excluded. Also excluded were patients with no maxillary molars or premolars, the presence of injuries or tumors in the maxilla, a scan with a field of view that impaired visualization of the sinus change along its entire length, and the presence of metal artifacts that

might interfere with the view of the maxillary sinuses and adjacent structures.

Of a total of 800 maxillary sinuses of 400 patients, 34 (18 right and 16 left) were excluded because of the presence of edentulous maxilla (26 cases), an insufficient field of view (7 cases), and a pathological lesion involving the region to be assessed (1 case). Thus, 766 maxillary sinuses were included in the study.

All images were acquired with an i-CAT scanner (Next Generation; Xoran Technologies, Ann Arbor, MI, and Imaging Sciences International, Hatfield, PA) operating at 120 kV, 3–8 mA, 0.25-mm voxel size, and a 26-second acquisition time. Subsequently, the images were reconstructed by using specific software (Xoran CAT version 2.0.21, Xoran Technologies). Multiplanar reconstructions were obtained and assessed simultaneously by 2 calibrated evaluators who used a 19-inch LCD monitor (Infoway; Itaútec, Taubaté, SP, Brazil) under dim light conditions. Furthermore, the density and contrast of images could be adjusted accordingly to assist the evaluators during identifications and measurements.

Evaluators were calibrated by viewing 30 CBCT scans before the evaluation sessions. The observers were trained to record the presence or absence of sinus disease and the odontogenic conditions analyzed. Eventual disagreements were discussed and resolved subsequently to the initial observation in order to reach a final consensus.

Assessment of the Maxillary Sinus

The maxillary sinuses were analyzed in sagittal and coronal views. Therefore, localized or generalized MT, dome-shaped hypodense



Figure 1. Imaging aspects of the maxillary sinus alterations. CBCT sagittal reconstructions showing (A) generalized MT, (B) localized MT, (C) the presence of fluid and air bubbles compatible with sinusitis, and (D) dome-shaped radiopacity suggestive of RCs.

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