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ORIGINAL ARTICLE

The prevalence of antral exostoses in the maxillary sinuses, evaluated by cone-beam computed tomography

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Abstract *Background/purpose:* Exostoses are outgrowths of normal compact and cancellous bone and may occur in different locations of the jaw. Exostoses are a rare anatomic variation in the maxillary sinuses. The purpose of this study was to investigate retrospectively the prevalence of location, size, shape, and symmetry of exostoses in the maxillary sinus, and to assess the relationship between demographic variables (i.e., age and sex) via cone-beam computed tomography images.

Materials and methods: Cone-beam computed tomography images of 1000 patients [521 (52.1%) females and 479 (47.9%) males], aged 10–85 years (mean age, 44 years), were examined. Two investigators examined the exostoses for location (i.e., inferior wall, medial wall, lateral wall, or posterior wall of the maxillary sinuses), size, shape (i.e., broad-based or mushroom-like), and symmetry (i.e., unilateral or bilateral). The age of the patients was categorized into three groups: 10–30 years, 31–50 years, and 51+ years. The data were statistically analyzed by using chi-square test, Fisher's exact test, and the *t* test.

Results: In total, 52 exostoses from 48 patients (4.8%) were identified. Exostoses were more common in females ($n = 28$, 58.3%) than in males ($n = 20$, 41.7%); however, there was no statistically significant difference between the sexes ($P > 0.05$). The presence of exostoses was very similar for all age groups with no statistically significant differences ($P > 0.05$).

Conclusion: Most exostoses were unilateral and on the inferior wall of the maxillary sinus. No statistically significant difference existed between the frequency and location of exostoses for sex or age groups ($P > 0.05$).

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Introduction

Exostoses are outgrowths of normal compact and cancellous bone and may occur in different locations of the jaws.[1] Maxillary and mandibular tori are the most common exostoses in dentistry. Exostoses are rare; however, they—as well as hypoplasia, pneumatization, and septa—are an anatomic variation in the maxillary sinuses. Several authors have investigated antral exostoses. In the otolaryngology literature, Ramakrishnan et al[2] first reported this entity in 2010; however, in 1993 in the dental literature, Ohba et al[3] investigated the prevalence of antral exostoses in panoramic radiographs and reported a prevalence of 0.9%. However, this relatively new diagnostic entity was disregarded by investigators until 2010, after which the subject attracted the attention of dentists and otolaryngologists.

The etiology and mechanisms of oral exostoses are unclear and there is no consensus among the investigators. Various authors have suggested several etiological factors such as genetic traits, environmental factors, mastication and occlusal stress, inflammation, systemic diseases, and the postmenopausal period.[4—9] The investigators of numerous studies have concluded that a strong association exists between parafunctional activity (e.g., clenching, grinding teeth, and/or bruxism) and the presence of mandibular tori, whereas maxillary tori shows no such association.[10—12] The presence of mandibular tori may be a useful indicator of parafunction and/or increased risk of temporomandibular disorders.[10,11] In addition, parafunctional activity could cause the formation of mandibular tori by concentrating mechanical stress in the region in which mandibular tori usually form.[12] Some authors emphasized a possible autosomal dominant inheritance with a lower penetrance,[5,13,14] whereas other authors have reported a correlation between oral exostoses and bruxism, temporomandibular dysfunction,[4,15—17] and inflammation of gingival tissue.[7]

The maxillary sinus is close to the orbita, alveolar ridge, and maxillary posterior teeth. Thus, this anatomical region may sustain injuries during dental procedures. The maxillary sinus elevation technique is a very commonly used strategies for dental implant rehabilitation in the atrophic posterior maxilla.[18—20] The assessment of several alterations in maxillary sinuses is especially essential in preoperative implant placement to the maxillary posterior region because the maxillary alveolar process forms the maxillary sinus floor.[21] An antral exostosis is an alteration in the maxillary sinus, and these formations may especially complicate the sinus elevation procedures planned before preoperative implant placement in the edentulous posterior maxilla. Therefore, before the preoperative implant planning, it is essential to evaluate the presence of antral exostoses and other alterations in the maxillary sinuses.

Several reports exist in dentistry and otolaryngology literature regarding this entity.[2,3,22—25] However, published articles on antral exostoses are mostly case reports or studies investigating incidental findings and/or pathologies in the maxillary sinuses.[2,20—26] To our knowledge, only two studies have analyzed the prevalence of antral exostoses.[3,26] A 1993 report by Ohba et al[3] via panoramic radiographs focused only on the prevalence of antral exostoses. Panoramic radiography allows visualization of the maxillary sinuses and incidental findings; however, superimpositions of the cranial structures may negatively affect the diagnostic accuracy of maxillary sinus examinations. Cone-beam computed tomography (CBCT) is a helpful diagnostic tool to identify anatomical variations and maxillary sinus abnormalities without superimpositions.[27]

The purposes of this study were to investigate the prevalence, location, size, and shape of antral exostoses and to assess the relationship between demographic variables (i.e., age and sex), and to determine the symmetry of antral exostoses between contralateral sides in the same patient.

Materials and methods

This retrospective study was approved by the Ethical Review Board of the Faculty of Dentistry, Ankara University (Tandoğan/Ankara, Turkey). Informed consent was routinely obtained from all patients before their clinical and radiographic examinations. The initial material study consisted of the demographic data (i.e., sex and age) and the CBCT images of 2385 patients who applied to the Department of Dentomaxillofacial Radiology, Faculty of Dentistry, Gazi University (Emek-Ankara, Turkey) between January 2013 and November 2014. The CBCT images of the patients were included in the study, provided the following criteria were met: (1) the patient had no trauma and/or history of head surgery; (2) the maxillary sinuses could be visualized; (3) the maxillary sinuses had no lesions; and (4) the CBCT images were of good quality and free of artifacts. Thus, after exclusion, 1000 CBCT images were included in the study.

The CBCT images were obtained using a Promax 3D unit (Planmeca, Helsinki, Finland), which was operated at 84 kVp at 9—14 mA and with a 0.16-mm voxel size, exposure time of 6 seconds, and a field of view of 8 cm. The images were examined by the consensus of one experienced oral radiologist (OD) and one oral radiology resident (GA). The CBCT images were analyzed using inbuilt software (Romexis viewer 2.7.0; Planmeca) on a 24-inch Nvidia Quadro FX 380 screen (Nvidia, Santa Clara, CA, USA) with 1280×1024 resolution in a quiet room with subdued ambient lighting. The observers were allowed to manipulate the contrast and brightness features and to use the zoom tool of the software for optimal visualization. The axial, sagittal, and cross-sectional slices (thickness, 1 mm) of CBCT images were used. All observers were blinded to the sex and age of the patients.

The antral exostoses were evaluated for location (e.g., inferior wall, medial wall, lateral wall or posterior wall of the maxillary sinuses), size (mm), and shape (i.e., broad-based or mushroom-like).[3] The symmetry (i.e., unilateral or bilateral) of antral exostoses between contralateral sides in the same patient, and the side (i.e., right or left) were also recorded. The sizes in the mesiodistal, inferosuperior, and anteroposterior directions of the antral exostoses were measured in millimeters.[3,25]

The age was categorized into three groups: 10—30 years old, 31—50 years old, and 51+ years old. The obtained data were statistically analyzed by using crosstabs and