Prevalence of Sinus Membrane Thickening and Association With Unhealthy Teeth: A Retrospective Review of 831 Consecutive Patients With 1,662 Cone-Beam Scans

Michael S. Block, DMD, * *and Kamran Dastoury, DDS, MD*†

Purpose: The purposes of this retrospective review of cone-beam computed tomographic (CBCT) scans were to *1)* determine the prevalence of sinus membrane thickening in a consecutive series of patients; *2)* identify the prevalence of healthy or unhealthy teeth associated with sinus membrane thickening; and *3)* document changes of the sinus membrane after the removal of unhealthy teeth.

Materials and Methods: Consecutive patients had CBCT scans examined and the sinuses were graded. Grade 1 represented membrane thickening of 0 to less than 2 mm; grade 2 represented thickening of 2 to 5 mm; grade 3 represented membrane or material thickening greater than 5 mm to the level of the ostium; and grade 4 represented soft tissue material superior to the ostium. Cross-sectional images were examined using software by the manufacturer of the CBCT scanner. Unhealthy teeth were identified. The examiner used a standardized approach in viewing the CBCT scans. Intraexaminer error was determined.

Results: Eight hundred thirty-one patients had 1,662 sinuses evaluated, with thickening of at least 1 sinus membrane in 46.7% (388 patients) and 30.1% (469) of all sinuses evaluated. The prevalence of patients and sinuses with sinus membrane thickening according to the grading criteria was grade 2 for 36.8% of patients and 24.3% of sinuses, grade 3 for 6.0% of patients and 3.7% of sinuses, and grade 4 for 3.6% of patients and 2.2% of sinuses. Unilateral sinus disease was more common than bilateral disease. Of those sinuses with thickening, 80.6% were grade 2, 12.2% were grade 3, and 7.2% were grade 4. Of the 469 sinuses with membrane thickening, 210 were adjacent to unhealthy teeth, 233 were adjacent to healthy teeth, and 26 were in edentulous maxillas. Of the 210 unhealthy teeth, 30 had postextraction CBCT scans available for evaluation. Grade 2 sinus membrane thickening showed a 75% resolution to grade 1 after adjacent tooth removal. Grade 3 sinuses resolved in 25% to grade 1 and grade 2, with 50% remaining at grade 3. There were 2 grade 4 sinuses with follow-up scans, with 1 resolving to grade 2 and the other remaining at grade 4.

Conclusions: Sinus membrane thickening is present in 46.7% of patients presenting to an oral and maxillofacial surgical practice. The prevalence of sinus membrane thickening was almost equal in association with unhealthy and healthy teeth. The removal of unhealthy teeth decreased, but did not completely resolve sinus membrane thickening.

J Oral Maxillofac Surg 72:2454-2460, 2014

Before surgery in the posterior maxilla, the sinus should be examined to note anatomic variability of bony structures and the presence of sinus pathology.[1,2] The evaluation should include determination of bone quantity and quality, the periodontal status of the adjacent dentition, history of tooth pain, and the presence of sinus problems.[3] The use of a pretreatment cone-beam computed tomographic (CBCT) scan allows for visualization of the maxillary sinus and can detect membrane thickening.

*Private Practice, Metairie, LA.

†Resident, Department of Oral and Maxillofacial Surgery, Louisiana State Univeristy School of Dentistry, New Orleans, LA.

Conflict of Interest Disclosures: None of the authors reported any disclosures.

Address correspondence and reprint requests to Dr Block: 110 Veterans Memorial Blvd, Suite 112, Metairie, LA 70005-4948; e-mail: drblock@cdrnola.com

Received April 1 2014

Accepted June 17 2014

0278-2391/14/01101-X

http://dx.doi.org/10.1016/j.joms.2014.06.442

Mucosal thickening greater than 2 mm is considered a pathologic sinus membrane.[4-8] The greatest thickness in the diseased population tends to be located in the midsagittal sinus region and adjacent to the maxillary first and second molars.[5,6]

Local odontogenic findings, such as periodontal disease, and the health of the adjacent dentition have been implicated as a trigger of an inflammatory response in the adjacent sinus membrane.[1,4,5,9,10] Odontogenic factors causing sinus membrane inflammation has been reported in 12% of cases,[11] with 1 recent study of 411 patients with maxillary sinusitis showing that 25% had a suspected odontogenic origin.[12] The resolution of sinus disease with tooth removal is not known. The extent of sinus disease and its correlation to improvement after tooth treatment are not known.

Apical lesions of endodontic origin may have a higher correlation with the presence of sinus disease compared with periodontal lesions because the tooth apices are close to the sinus.[5] Endodontic treatment of apical inflammation has been reported to fully or partially resolve mucositis in 30% of patients after 3 months.[10]

Mucosal membrane thickening and chronic sinusitis may be present in patients presenting for posterior maxillary implant placement.[5,9] Patients who have these underlying disease states may deny sinus symptoms at the time of presentation, yet it has been found that 12 to 65% of patients presenting for maxillary reconstruction exhibit abnormal thickening of the sinus membrane.[1,2,4-10,13,14]

The hypotheses of this retrospective review of CBCT scans were that *1)* sinus membrane thickening is strongly correlated with the health of posterior maxillary teeth and *2)* definitive treatment of unhealthy teeth in the posterior maxilla would decrease sinus membrane thickening after 3 to 6 months.

Materials and Methods

STUDY DESIGN

This project is a retrospective radiographic evaluation of CBCT scans used to evaluate the prevalence of sinus membrane thickening in patients referred to a private practice office for any reason. The evaluation included CBCT evaluation of a consecutive group of patients. Changes in sinus membrane thickening after tooth extraction were documented when a postextraction CBCT scan was available.

This study was conducted with the approval of the institutional review board of Louisiana State University (protocol 8449).

SETTING

All patients who presented to the private practice of the senior author had a CBCT scan taken if they had a dental, sinus, temporomandibular joint, orthognathic, or other need to visualize the bones of the jaws. Patients who received treatment underwent rescanning only if they had a procedure performed that necessitated another scan to evaluate bone thickness before dental implant placement. No additional radiation exposure was performed except that needed for routine care of the patient.

Consecutive CBCT scans were read by a clinician who had no previous exposure to the patient and who did not treat the patients.

Cross-sectional images were examined using the software supplied by the manufacturer of the CBCT scanner (i-CAT; Image Sciences International, Hatfield, PA). The gray scale was set to optimally show the soft tissues.

PARTICIPANTS

CBCT scans included patients seen from January 1, 2008 through December 3, 2012.

A consecutive series of patients who had CBCT scans taken in the private practice office of the senior author were evaluated, without exception. No patients were excluded from this consecutive series.

Patient histories did not include a thorough history of allergies or a detailed sinus history unless the patient was referred specifically for sinus-related disease. Because of the lack of consistency with patients' sinus histories, data were not adjusted to this variable. Patients' medications did indicate the use of prescribed but not over-the-counter medication; thus, a complete sinus medication profile for each patient was not available.

For the present evaluation, an unhealthy tooth was defined as having periapical lesions, osteolysis, periodontal disease with bone loss, or extensive caries with bone loss. Root canal therapy was not considered an adverse finding unless there was evidence of radiologic bone loss.

METHODS RELATED TO HYPOTHESES

Eight hundred thirty-one consecutive patients with 1,662 CBCT scans were reviewed. The sinus membrane was evaluated on the CBCT scans according to the grade criteria described in the analysis section.

When reviewing the CBCT scans, the presence of unhealthy teeth adjacent to the sinus was noted on the spreadsheet. Unhealthy maxillary posterior teeth were used as a variable to determine whether there was an association between tooth health and the thickness of the sinus membrane.

GRADING CRITERIA

1. Minimal to no sinus membrane thickening (ie, <2 mm) as measured on cross-sectional reconstructions