A computed tomographic study of the distances between the maxillary sinus floor and the apices of the maxillary posterior teeth

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The mean distance between the apices of the maxillary posterior teeth and the floor of the maxillary sinus was measured from computed tomographic display data from 12 autopsy specimens and 38 human subjects. The distance from these apices to the adjacent lateral bony surfaces was also measured. The apex of the mesiobuccal root of the maxillary second molar was closest to the sinus floor (mean 1.97 mm) but farthest from the buccal bony surface (mean 4.45 mm). The apex of the buccal root of the maxillary first premolar was closest to the adjacent lateral bony surface (mean 1.63 mm) but farthest from the floor of the sinus (mean 7.05 mm).

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Knowledge of the location of the greater palatine and incisive foramina and the maxillary sinuses is important in the practice of surgical endodontic procedures. The apices of the posterior maxillary teeth lie in close proximity to, and in some cases within, the sinus.[1,2] During both surgical and nonsurgical maxillary endodontic procedures, there is a risk of entering the inferior recess of a maxillary sinus.

Standard dental radiographs, including pantomography and pluridirectional tomography, present a two-dimensional image and as such are inadequate and/or impractical for precise morphometric assessment of osseous relationships. Pantomography presents a particularly distorted view for such assessments. Computed tomography (CT) has been used for nearly a decade in the dental fields of temporomandibular joint surgery, implantology, and maxillofacial surgery. A search of the dental and medical literature did not reveal the use of this method as a research tool for studying the apices of the teeth in relation to their surrounding structures.

The objectives of this study were to determine the distances between the apices of the maxillary posterior teeth and the floor of the maxillary sinuses, and the thickness of the lateral bone covering these apices.

MATERIAL AND METHODS

CT was used to image the skull base and maxillae of patients referred for advanced imaging for medical reasons and not specifically for endodontic radiography. Scanning was done with a General Electric 9800 CT/T Quick CT scanner (New Berlin, Wisc.).

Adult patients referred for CT head scans for medical reasons were selected for study. Criteria for exclusion from the study sample were emergency scanning for craniofacial trauma, craniofacial neoplasm, craniofacial deformity, craniofacial postsurgical scanning, and maxillary edentulism.

The scan parameters included high-resolution thin sections (1.5 mm) and axial bone detail sections acquired sequentially or with 0.5 mm overlap (i.e., the gantry moves 1.0 mm and the scan is 1.5 mm thick, thus, a 0.5 mm of overlap). Archived display data

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Table I. Distance of apices of posterior maxillary teeth to floor of maxillary sinus

Root	*Distance (mm)*	*SD*
Buccal 1st premolar	6.18	1.60
Lingual 1st premolar	7.05	1.92
2nd premolar	2.86	0.60
Mesiobuccal 1st molar	2.82	0.59
Palatal 1st molar	1.56	0.77
Distal buccal 1st molar	2.79	1.13
Mesiobuccal 2nd molar	0.83	0.49
Palatal 2nd molar	2.04	1.19
Distal buccal 2nd molar	1.97	1.21

Table II. Distance between apices of posterior maxillary teeth and their respective bone surfaces

Root	*Distance (mm)*	*SD*
Buccal 1st premolar	1.63	0.44
Lingual 1st premolar	5.42	0.86
2nd premolar	3.16	0.39
Mesiobuccal 1st molar	2.22	0.39
Palatal 1st molar	3.01	0.54
Distal buccal DB 1st molar	1.72	0.62
Mesiobuccal 2nd molar	4.25	0.61
Palatal 2nd molar	2.76	0.61
Distal buccal DB 2nd molar	3.19	0.69

were retrieved for 38 patients and studied on a display console with vertical reformatting of the Arrange software program (General Electric Co.). The accuracy of the CT software measurements were compared with macroscopic in vitro measurements from 12 preserved autopsy specimens. In this study, as in a previous CT calibration study,[3] no statistical significance differences were noted between the values measured in vitro and in situ ($p = 0.05$).

The study sites were examined in three anatomic planes: sagittal, axial, and coronal, which provided multiple views of the apices of the roots of the maxillary first and second premolars and the first and second molars. Measurements were made by depositing one reference cursor at the root apex and another at the floor of the sinus. Values were displayed to the nearest 0.1 mm. For purposes of data analysis, apices extending above the floor of the sinus were assigned negative values whereas those below the sinus floor were assigned positive values. The results from the right and left maxillary arches were averaged for each tooth type.

RESULTS

The average distance from the maxillary molars and premolars to the floor of the maxillary sinus ranged from 0.83 mm for the mesiobuccal root of the second molar to 7.05 mm for the lingual root of the first premolar.

The thickness of buccal bone covering the apices ranged from 1.63 mm over the buccal root of the first premolar to 4.45 mm over the mesiobuccal root of the second molar. The thickness of palatal bone covering the palatal roots of the first and second molars and the first premolar was 7.01, 2.76, and 5.42 mm, respectively. Two of the 38 subjects (5%) had roots that protruded into the sinus cavity. The data are presented in Tables I and II.

DISCUSSION

The root tips of the molars generally lay closer to the sinus than those of the premolars. Additionally, less bone overlies the second molars (Table I). An inverse relationship exists between the thickness of bone buccolingually and the bone thickness superior to the apices of the teeth.

The thickness of bone buccal to the root tips varied for different roots. From these results it is obvious that the thinnest buccal bone is found over the buccal root of the first premolar. Palatally, the roots of the first and second molar were relatively close to the bone surface whereas the lingual root of the first premolar was relatively far from the bony surface.

Solely on the basis of the thickness of bone, one could reason that the palatal roots of the first and second molars should be approached palatally whereas the palatal root of the first premolar should be approached buccally. However, other factors such as soft tissue reflection, control of hemorrhage, and visibility of the surgical field must also be considered.

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CORRECTION

In the article "Tissue reaction to endodontic materials: Methods, criteria, assessment, and observations" by Pascon et al., which appeared in the August 1991 issue (ORAL SURG ORAL MED ORAL PATHOL 1991;72:222-237), the following corrections should be noted:

On page 230 in the third line from the bottom of the first column, the figure citation should read (Fig. 12) *not* (Figs. 12 and 13).

On page 233 (Fig. 13, *B*) should be deleted from the second line in the second column.

On page 234 in line 4 in the first column, the reference to (Fig. 13, *A* to *C*) should be deleted, and in line 5 of the same column, (Fig. 14, D) should read (Fig. 12, *D*).

On page 235 the legend for Fig. 13 is incorrect and should have appeared as follows:

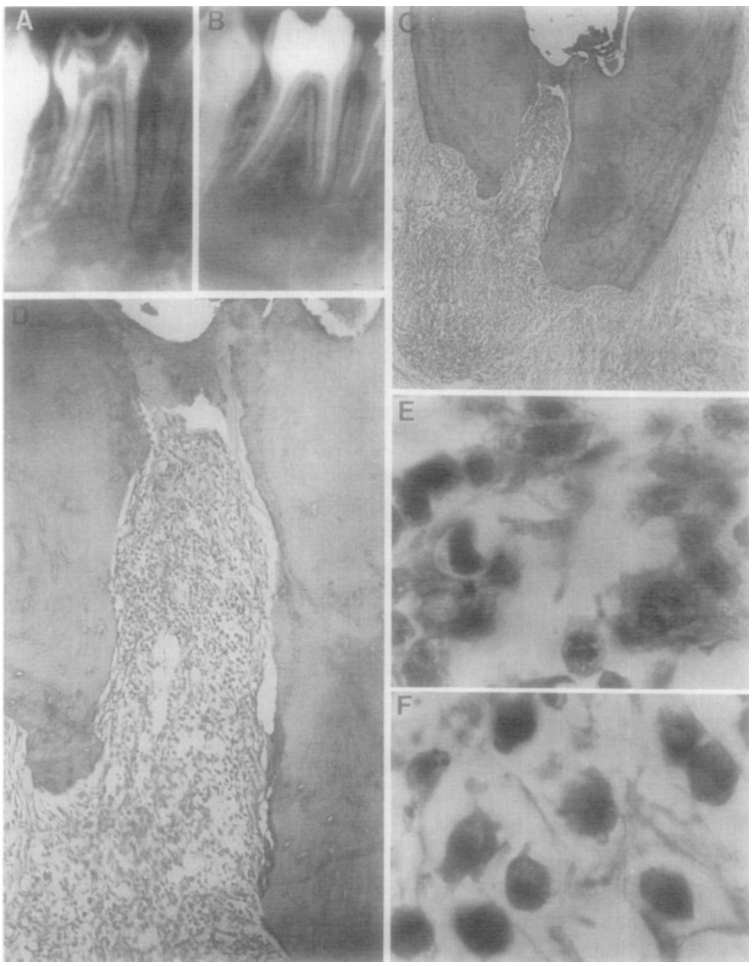

Fig. 13. Tooth 4.6, mesial root, Kloroperka N.Ø., 2 years. **A,** Preoperative radiograph. **B,** Postoperative radiograph. **C,** Root tip with debris in the canal and apparent "dentin bridge"; apical resorption and periapical lesion. (Hematoxylin-eosin stain. Original magnification, ×40.) **D,** Coronal side of the "bridge" with debris; apical aspect of the "bridge" with vital but inflamed tissue. (Hematoxylin-eosin stain. Original magnification, ×125.) **E,** Acute and chronic inflammatory cells in coronal part of the canal. (Hematoxylin-eosin stain. Original magnification, ×1250.) **F,** Chronic inflammatory cells in the periapical lesion. (Hematoxylin-eosin stain. Original magnification, ×1250.)