

An Analysis of the Proximity of Maxillary Posterior Teeth to the Maxillary Sinus Using Cone-beam Computed Tomography

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Abstract

Introduction: It is known that the level of the maxillary sinus floor varies with age. Because few studies have investigated whether the position of the posterior roots relative to the maxillary sinus varied with the variation of the sinus floor or not, the present study assessed the position according to age. **Methods:** Cone-beam computed tomographic images of 848 patients were reconstructed to evaluate the position of the posterior roots relative to the sinus floor, which were divided into 3 types, and quantify the distances between posterior root apices and the adjacent border of the sinus floor. Measurements were taken for each root, and data were correlated with age, which was divided into 4 groups (≤ 20 years, 21–40 years, 41–60 years, and > 60 years). **Results:** A total of 3063 premolars and 3095 molars were evaluated. The mean distances from the root tips to the border of the maxillary sinus floor increased with increasing age. From the first and second premolar roots, the mean distances ranged from 3.6 ± 4.1 mm to 8.9 ± 4.6 mm and from 0.7 ± 3.3 mm to 5.3 ± 3.9 mm, respectively. From the mesiobuccal, distobuccal, and palatal roots of the first molars, the mean distances were -0.4 ± 2.8 mm to 4.6 ± 4.0 mm, -0.3 ± 2.4 mm to 4.4 ± 3.8 mm, and -0.4 ± 3.5 mm to 3.9 ± 4.1 mm, respectively. From the mesiobuccal, distobuccal, and palatal roots of the second molars, the mean distances were -0.5 ± 2.2 mm to 3.4 ± 3.5 mm, 0.3 ± 2.2 mm to 3.9 ± 3.7 mm, and 1.1 ± 3.2 mm to 4.6 ± 4.5 mm, respectively. The frequency of type I5 decreased with increasing age. It was very low in first premolars (0%–8.13%) and higher in second premolars (0%–25.68%), first molars (0%–44.75%), and second molars (0%–32.89%). Age significantly influenced the mean distances to the sinus floor and the frequencies of type I5 (inside). **Conclusions:** Cone-beam computed tomographic imaging is an effective method

to study the position of the posterior roots to the maxillary sinus floor. Variation in proximity measurements was found by age, with those under the age of 40 showing a greater likelihood of the position of maxillary roots above/inside the sinus floor. (*J Endod* 2016;42:371–377)

Key Words

Cone-beam computed tomography, maxillary premolar, maxillary sinus, molar

Recognition of the anatomic position of the teeth relative to the maxillary sinus, which is a constant challenge in dentistry, is essential to increase successful nonsurgical endodontic diagnosis, treatment, and extraction. Close proximity between the root apex and the adjacent maxillary sinus floor is significant during a clinical operation because it may result in various complications, such as sinusitis (1, 2), penetration, oroantral fistulae, endoantral syndrome, or root displacement into the maxillary sinus (3–5). However, in periapical surgery of surgical endodontics, although the close relationship does not affect its prognosis even when there is an exposure into the sinus during surgery (6, 7), it will establish a channel between the sinus and the infected periapical tissue and then may cause acute or chronic sinusitis (8). Meanwhile, this close relationship is also relevant during implant operations. Wehrbein and Diedrich (9) and Sharan and Madjar (10) found the extraction of the roots protruding into the sinus could increase the associated risk of pneumatization using panoramic radiography. Sinus expansion after the loss of maxillary posterior roots can greatly decrease the bone height available for implant placement and occasionally reaches the alveolar ridge (3).

In general, the reliability of panoramic radiography in assessing the position between the maxillary sinus and the posterior roots is doubtful because of superposition and magnification of the anatomic structure (11). Therefore, recent studies focused on computed tomographic (CT) and cone-beam computed tomographic (CBCT) imaging. As a nondestructive tool, CBCT imaging, which provides 3-dimensional images of the oral and maxillofacial region for disease diagnoses as well as the anatomic position, not only has a lower effective radiation dose, higher spatial resolution, and cheaper price compared with CT imaging but also can accurately interpret the relationship of the maxillary roots relative to the maxillary sinus floor.

It is known that the level of the maxillary sinus floor varies widely with age (12), which is level with the nasal floor at about 12 years old and reaches the lowest point at approximately 20 years of age with the eruption of the third molars (10, 13). The investigators hypothesized that the position of the posterior roots with respect to the

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maxillary sinus may also constantly vary according to age. However, few studies revealed the anatomic position changed according to age accurately. Thus, the primary objective of the present study was to analyze the vertical relationship between the posterior roots and the adjacent maxillary sinus floor in a large sample of the Chinese population using reconstructed CBCT images. The secondary objective was to correlate the data with age.

Materials and Methods

Subjects

The study materials were composed of dental CBCT images retrospectively selected from the CBCT database at the department of Stomatology Special Consultation Clinic, Ninth People's

Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China, from January 2013 to December 2013. Because of the retrospective nature, the study was exempt from approval by an institutional review board. Subjects were selected, and a total of 848 patients' CBCT images fulfilled the following inclusion criteria.

Inclusion Criteria

Cases presenting with the following findings were included for further analysis:

1. Presence of maxillary permanent premolar or molar teeth on scans
2. Fully erupted teeth and fully formed apices

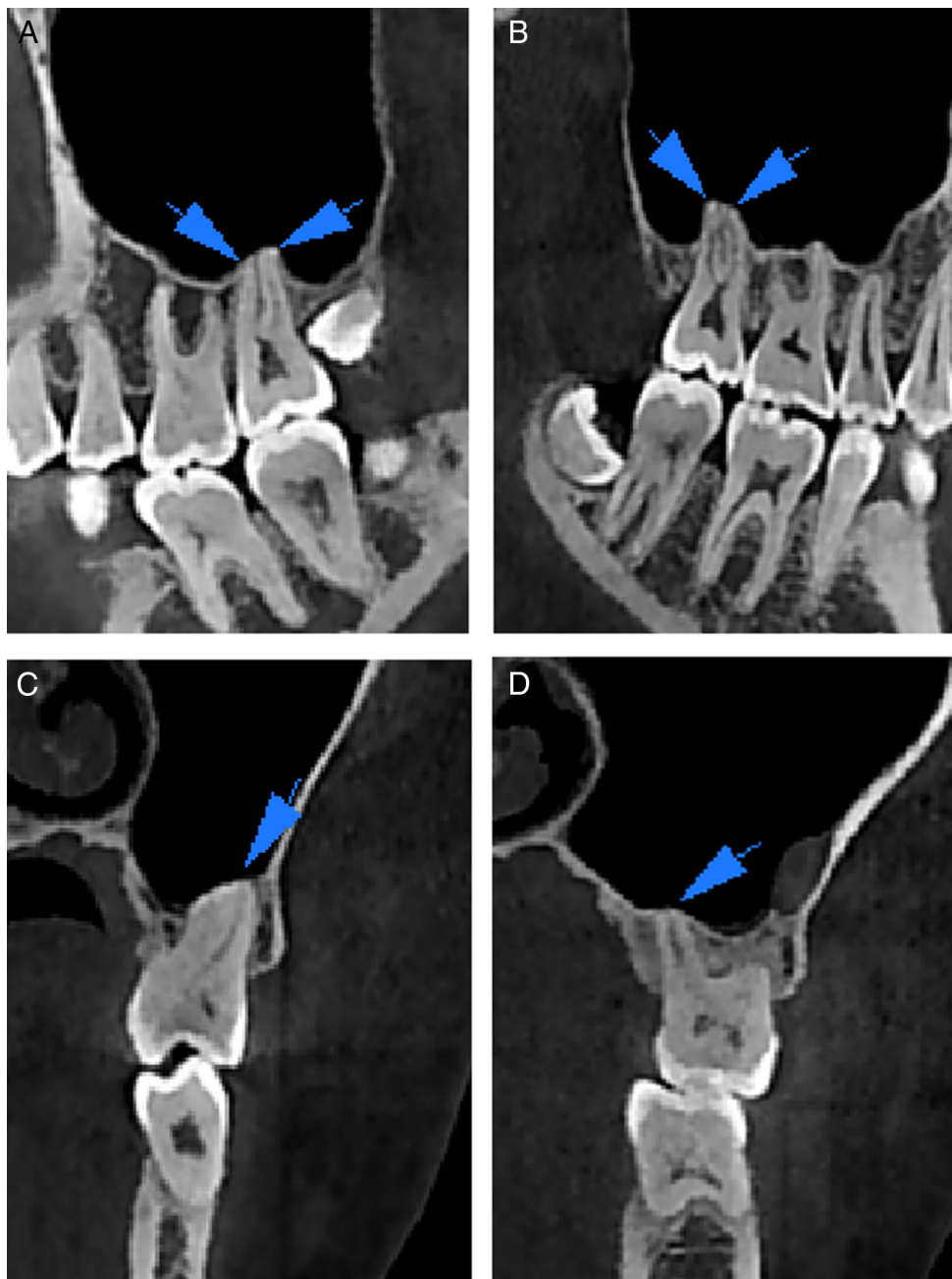


Figure 1. (B and C) Type IS and (A and D) CO were shown (arrows) in the sagittal and coronal planes.

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