Analysis of the Morphology of Maxillary Sinus Septa on Reconstructed Cone-Beam Computed Tomography Images

Liang Qian, MDS, * *Xiao-mei Tian, MDS,* † *Li Zeng, MDS,* ‡ *Yao Gong, DDS,* § *and Bin Wei, DDS* ‖

Purpose: Preoperative assessment of maxillary sinus anatomy can prevent complications associated with sinus grafting or implant procedures. The purpose of this study was to measure the frequency, numbers, locations, orientations, and heights of maxillary sinus septa.

Materials and Methods: Reconstructed cone-beam computed tomographic images of 1,012 sinuses were analyzed using NewTom VG software (NNT 2.21, ImageWorks, Elmsford, NY). This cross-sectional study included patients who underwent radiography at the department of radiology. The presence, numbers, locations, orientations, and heights of septa were analyzed. To establish multiple predictors in this study, groups were defined according to different radiographic features of the septa. Differences between male and female groups and between edentulous and dentulous groups were tested with χ^2 tests and the level of significance was set at 5%.

Results: The sample consisted of 506 patients (168 men and 338 women; average age, 35.1 yr). A significantly ($P < .05$) greater occurrence rate of 57.4% was observed in the edentulous group compared with the rate of 39.7% observed in the dentulous group.

Conclusions: The difference in the prevalence of maxillary sinus septa between the edentulous and dentulous groups was statistically significant ($P < .05$), and the septa exhibited variable characteristics. It is essential and effective to analyze computed tomographic images of sinuses to evaluate the characteristics of septa before performing surgical procedures.

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The maxillary sinus septum is a thin wall of cortical bone inside the maxillary sinus that separates the maxillary sinus into at least 2 basins and plays a role in strengthening the bone structure of the sinus. After tooth loss, the alveolar process of the posterior maxilla often can be affected by resorption. Such bone resorption varies from one person to another, often resulting in inadequate volume and density for the placement of implants. A surgical procedure for maxillary sinus elevation was first reported in 1980, and it is performed to restore the alveolar ridge to achieve the appropriate bone height for implantation. However,

Received from the Ninth People's Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai Key Laboratory of Stomatology, Shanghai, China.

*Resident, Stomatology Special Consultation Clinic, Department of Prosthodontics.

†Resident, Stomatology Special Consultation Clinic, Department of Prosthodontics.

‡Resident, Stomatology Special Consultation Clinic, Department of Prosthodontics.

§Professor, Department of Orthodontics.

‖Professor, Stomatology Special Consultation Clinic, Department of Prosthodontics.

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Liang Qian and Xiao-mei Tian contributed equally to this work.

Address correspondence and reprint requests to Professor Wei: Stomatology Special Consultation Clinic, Department of Prosthodontics, Ninth People's Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai Key Laboratory of Stomatology, Shanghai 200011, Peoples' Republic of China; e-mail: weibin0328@hotmail.com

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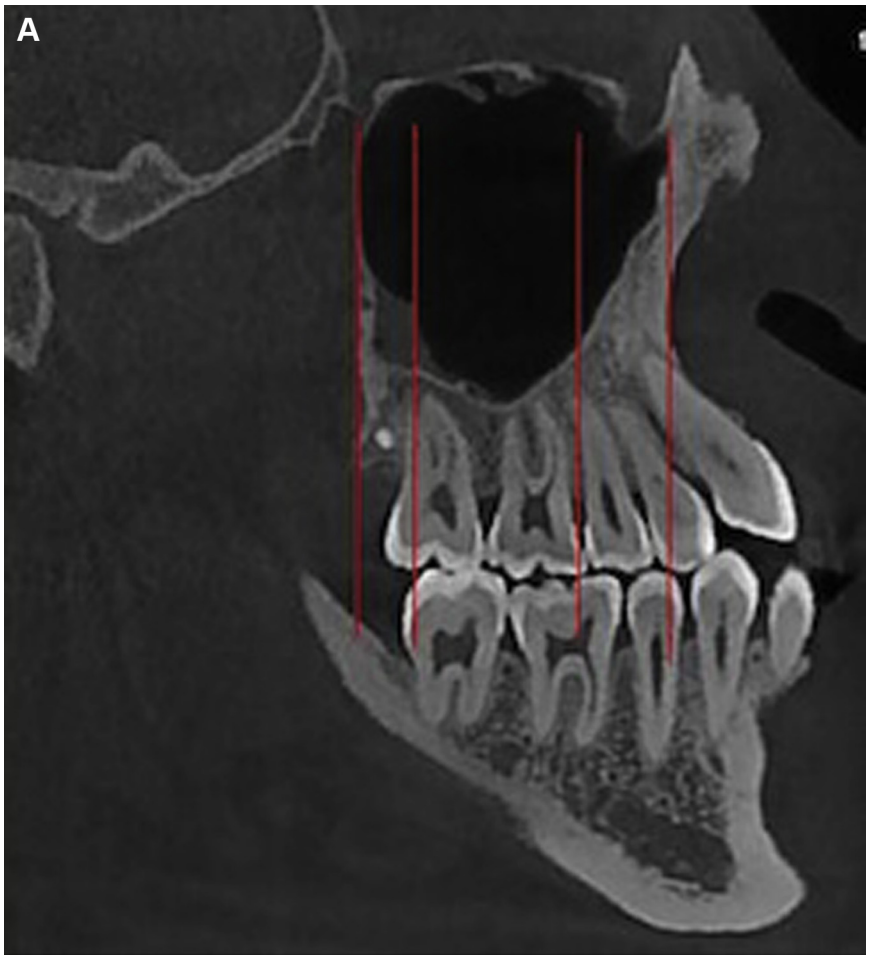

FIGURE 1. *A*, Locations of the septa were divided into anterior, medial, and posterior regions. **(Fig 1 continued on next page.)**

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the appearance of maxillary sinus septa interferes with the procedure[1] and increases the risk of perforation of the Schneiderian membrane.[2] Thus, it is essential to carefully assess the maxillary sinus before elevation.

The development of the maxillary sinus septum was first described by Underwood[3] in 1910. He held the view that the origin of the septum was relevant to the growth and eruption of the teeth. The septa that he described were later defined as the primary septa. In 1999, Krennmair et al[4] identified another type of septa, the secondary septa, which are thought to arise from irregular pneumatization of the sinus floor.

Some studies have reported characteristics of the septa. Lugmayr et al[5] observed 26 septa in 200 sinuses with a prevalence of 13%. Kasabah et al[6] reported a prevalence of 35.9% based on analysis of cone-beam computed tomographic (CBCT) images of 68 sinuses. The reported locations of the septa varied in the relevant references. Underwood[3] noted that the most common location was the posterior region. However, according to Lee et al,[7] most septa are located in the middle region. Regarding the orientation of the septa, Pommer et al[8] and Jang et al[9] found that the buccopalatal type is the most common. The heights of the septa also have been measured. Velásquez-Plata et al[10] reported a mean height of 3.5 mm for the lateral region, 5.9 mm for the middle region, and 7.6 mm for the medial region.

Large numbers of implants are placed in China each year. The purpose of this study was to obtain additional insights into the morphologies of the septa at the individual level. The authors hypothesized that the morphology of maxillary sinus septa would vary among individuals. The specific aims of this study were *1)* to measure variables related to the sinus septa (prevalence, numbers, locations, orientations and heights) on reconstructed CBCT images and *2)* to