



Dental Volumetric Tomographical Evaluation of Location and Prevalence of Maxillary Sinus Septa

Maksiller Sinüs Septumunun Konumu ve Yaygınlığının Dental Volümetrik Tomografik Değerlendirilmesi

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ABSTRACT

Purpose: The aim of this study was to determine the prevalence and location of maxillary sinus septa using dental volumetric tomography.

Material and Methods: This retrospective study was based on the analysis of dental volumetric tomography images for maxillary sinus in patients who visited Cukurova University, Faculty of Dentistry, Department of Oral Maxillofacial Radiology for various reasons between January 2010 to October 2011. After exclusion of patient with prior maxillary sinus surgery and presenting any pathologic conditions, 760 patients (1520 maxillary sinuses) were assessed. Analyses of maxillary sinus septa location were made for three regions: anterior for 1st and 2nd premolar, middle for 1st and 2nd molar, posterior for 3rd molar.

Results: 47 of maxillary sinus septa existed in the anterior zone (24.7%), 35 of them in the middle zone (18.4%) and 108 of them in the posterior region (56.8%).

Conclusion: The formation of the maxillary sinus septa was affected by the existence or lack of the teeth. Correct detection of the presence of maxillary sinus septa was important prior to sinus lifting and dental implant surgery. Dental volumetric tomographical evaluation of maxillary sinus septa was more useful for a correct diagnosis and treatment planning.

Key Words: Maxillary sinus septa, sinus lifting, dental volumetric tomography.

ÖZET

Giriş: Bu çalışmanın amacı, dental volümetrik tomografi kullanılarak maksiller sinüs septa konumlarını ve yaygınlığını saptamaktır.

Materyal ve Metod: Bu retrospektif çalışma Ocak 2010- Ekim 2011 tarihleri arasında çeşitli nedenlerle Çukurova Üniversitesi Diş Hekimliği Fakültesi Ağız Diş ve Çene Radyolojisi departmanına başvuran hastaların dental volümetrik tomografi görüntülerinde maksiller sinüslerin değerlendirilmesi ile yapıldı. Öncesinde maksiller sinüs cerrahisi geçiren ve herhangi bir patolojik durumu olan hastalar çalışma dışı bırakıldıktan sonra, 760 hasta (1520 sinüs) belirlendi. Maksiller sinüs septa konumlarının analizi 3 bölgeye göre yapıldı: ön bölge 1. ve 2. premolarlar; orta bölge 1. ve 2. molarlar ve arka bölge de 3. molar diş hizasında belirlendi.

Sonuçlar: Maksiller sinüs septumlarından 47 tanesi (% 24.7) ön bölgede, 35 tanesi (% 18.4) orta bölgede ve 108 tanesi (% 56.8) arka bölgedeydi.

Tartışma: Maksiller sinüste septum oluşumu dişlerin varlığı ya da kaybedilmesinden etkilenmektedir. Sinüs lifting ve dental implant cerrahisi işlemlerinden önce maksiller sinüslerde septum varlığının doğru tespit edilmesi önemlidir. Doğru teşhis ve tedavi planlaması açısından maksiller sinüslerde septum varlığının dental volümetrik tomografi ile değerlendirilmesi oldukça kullanışlıdır.

Anahtar Kelimeler: Maksiller sinüs septumu, sinüs lifting, dental volümetrik tomografi.

INTRODUCTION

Dental implants have become very commonly used tools for the rehabilitation of partial and total lack of tooth. After the loss of molar and premolar teeth, a serious resorption that may affect the amount of vertical bone occurs with the increased-osteoclastic activity in Schneiderian membrane, at the maxillary posterior region. The expansion of the maxillary sinus tends to inferior. Irregular pneumatization in the maxillary sinus can create craters in alveolar bone. The final structural changes make the region unsuited for implant applications¹⁻³.

Maxillary sinus augmentation is one of the most common surgical procedures in the cases of inadequate amount of vertical bone. In 1976, the sinus lift procedure was first considered by Tatum (Tatum H. Lectures presented at the Alabama Implant Study Group, October 3-4, 1977). In 1980, Boyne and James had reported that a bone window was opened for the lifting of maxillary sinus membrane with the lateral approach and a bone graft was placed to the region¹.

In order to achieve the success of maxillary sinus lift surgery, the anatomy and structures of sinus must be well known⁴. The walls of cortical

bone within the maxillary sinus named as maxillary sinus septa was one of these anatomical structures. Sinus septa was first described in 1910 by Underwood². These structures may be congenital or may result in existing structures. The primary septa occurs during the development of the maxilla. The secondary septa is caused by irregular pneumatization in the base of the maxillary sinus after tooth loss². Septa can allocate the maxillary sinus into two or more compartments. The prevalence rates of reported studies which investigate the number of maxillary sinus septa vary between 13% and 35%^{2,5-8}. The presence and the height of these structures are important while sinus lifting in terms of the design of lateral window. In addition, during the sinus lift procedure increases the risk of sinus membrane perforation^{9,10}.

Two-dimensional (2D) panoramic radiographs provided limited information about the maxillary sinus septa. Cross-sectional and three-dimensional (3D) images of dental volumetric tomography (DVT) had become more readily available for use in maxillofacial applications. (Figure 1)

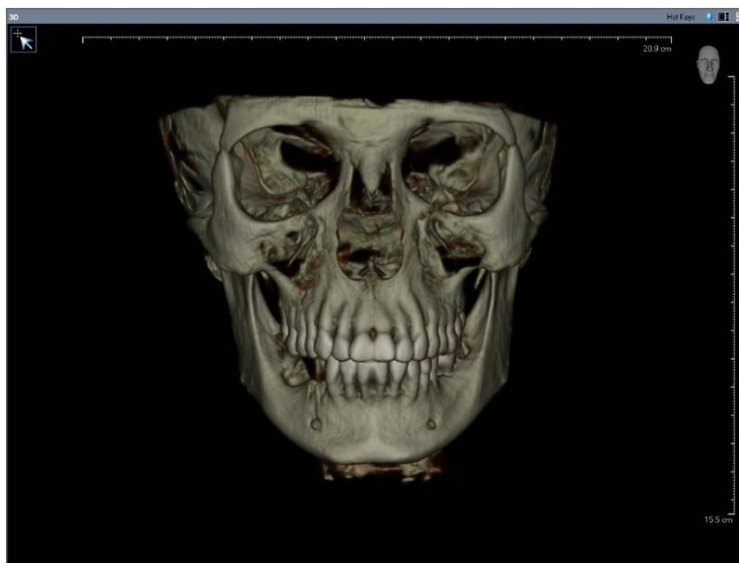


Figure 1. 3D-dental volumetric tomographical imaging of a patient in the study group.

DVT machines used a cone-beam x-ray instead of the traditional fan beam technique. This recently-designed technology became a relevant tool for oral and maxillofacial diagnostic osseous imaging, providing to professionals access to excellent image quality and greater diagnostic accuracy and sensitivity. DVT allows images to be acquired using a low dose of radiation, shorter patient examination time and lower costs than conventional computerized tomography (CT), which makes its routine use practicable for oral and maxillofacial imaging and surgical procedures¹¹⁻¹³.

The purpose of this study was to determine the prevalence and location of maxillary sinus septa with the help of dental volumetric tomography.

MATERIALS and METHODS

This study was designed with evaluation of 760 patients' DVT (Iluma Cone Beam CT Scanner, Imtec Imaging, LLC, Ardmore, OK, USA) images retrospectively who had referred to Cukurova University Faculty of Dentistry Oral and Maxillofacial Radiology Clinic for various causes during the period from January 2010 to October 2011. 1520 maxillary sinus have been included in the study, any patients who had previously maxillary sinus surgery or having a pathological condition were not included in the study.

In the study, maxillary sinus was divided into 3 zones while location of the maxillary sinus septa. The anterior zone included first and second premolar teeth, the middle zone included first and second molar teeth and the posterior zone included of the portion of third molars. (Figure 2, 3)

Location and distribution of the septa proportionally determined from the data that obtained from the identified septa.



Figure 2. Sagittal section of DVT; arrow A shows maxillary sinus septa on the anterior and arrow B points maxillary sinus septa on the middle zone.



Figure 3. Sagittal section of DVT showing the maxillary sinus septa on the posterior zone in an edentulous patient.

RESULTS

Prevalence of maxillary sinus septa was calculated based on septa numbers and maxillary sinus numbers (Table 1). As a result of the study, 190

septum were identified in 1520 maxillary sinus (12.5%). 47 of maxillary sinus septa existed in the anterior zone (24.7%), 35 of them in the middle zone (18.4%) and 108 of them in the posterior region (56.8%). (Figure 4, 5, 6)

Table 1: Prevalence and localization of maxillary sinus septa (n=1520)

Septum region	Anterior	Middle	Posterior	Total
Septum number	47	35	108	190
Percentage (%)	24,7	18,4	56,8	100

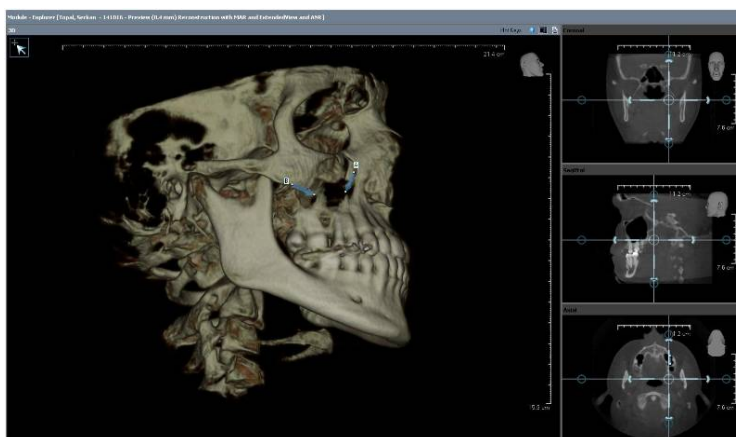


Figure 4. 3D-dental volumetric tomographical imaging showing the maxillary sinus septa, (arrow A) is on the anterior and (arrow B) is on the middle zone.

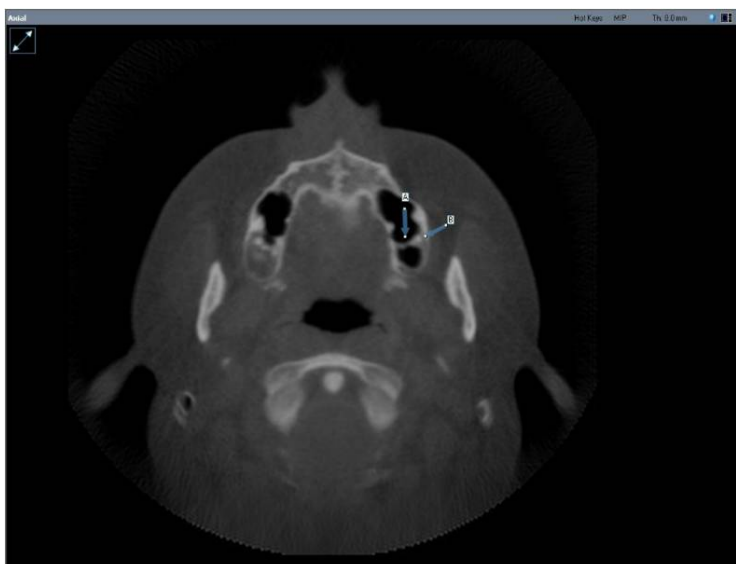


Figure 5. Axial section of DVT; arrow A points maxillary sinus septa on the middle zone and arrow B shows maxillary left second molar's roots.

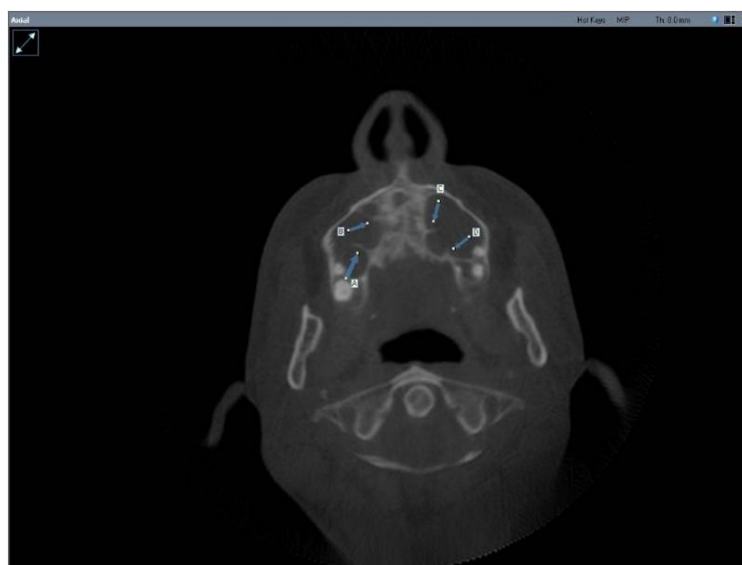


Figure 6. Axial section of DVT; arrow A and D show maxillary sinus septa on the middle zone and arrow B and C show the septa on the anterior zone.

DISCUSSION

Many authors have made studies on the distribution of the maxillary sinus septa and achieved different results. Underwood² had found 30 septum in 90 maxillary sinus (33%), Krenmair et al⁵ had found 32 septa in 200 maxillary sinus (16%), Velasquez-Plata et al⁶ had found 75 septa in 312 maxillary sinus (24%) and Gonzales-Santana et al⁷ had found 13 septa in 60 maxillary sinus (21.7%). Shibli et al had encountered 221 maxillary sinus septa in 1024 patients (21.58%).^[8] According to the literature, the prevalence rates generally ranged from 13% and 35%. In our study, we detected 190 sinus septa in 1520 maxillary sinus (12.5%).

In the present study it was shown that the maximum distribution of the maxillary sinus septa was on the posterior region (56.8%). This distribution was followed by 24.7% in the anterior region and 18.4% in the middle region. However in previous studies, Kim et al has reported the location of septa was 25.4% at the anterior region, 50.8% at the middle region and 23.7% at the posterior region¹⁴. The results of Lee et al were similar to these studies (24% at the anterior region,

50% at the middle region and 22.4% at the posterior region)³. In contrast to these studies, Krenmair et al has reported 70-75% of the distribution was on the anterior region⁵.

The formation of the septa was affected by the existence or lack of the teeth at the region. After the loss of teeth occurred at different times, sinus pneumatization can cause the formation of secondary maxillary sinus septa. Difference in results of the previous studies can be connected to this situation. In addition, the population's different methods of the study and data collection may lead to variable results.

The distribution of septa varies according to the type of edentulism. Krenmair et al reported that the prevalence of septa was higher in totally edentulous patients with atrophic areas than partial edentulous patients with nonatrophic areas¹⁵. However, there was no relationship between the distribution of septa and age and gender⁸. Therefore, we did not make any classification of age and gender in this study.

Maxillary sinus lifting techniques were applied when the amount of vertical bone was inadequate for placing dental implants to the maxillary posterior region¹. Modified sinus lifting procedures can be applied by opening a bone window laterally while the presence of maxillary sinus septa^{9,10}. Therefore, correct detection of the presence of maxillary sinus septa was important prior to surgery.

Radiographic identification of septa is significant in order to perform the right design of the lateral window during sinus lift. Two-dimensional (2D) panoramic radiographs provided limited information about the maxillary sinus septa. For this reason, evaluation with DVT was more useful for a correct diagnosis and treatment planning.

DVT had provided better image quality of teeth, surrounding and anatomical structures compared with conventional CT^{16,17}. It reduces the radiation dose as compared with conventional CT¹⁸ and offers high spatial resolution¹⁹.

Consequently DVT evaluation is today the better diagnostic technique to underline the real maxillary anatomy for highlighting the presence of septa.

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