

Accuracy of spiral computed tomography in evaluation of maxillary sinus septa among dentate and edentulous Iraqi subjects (Comparative study)

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ABSTRACT

Background: Presence of maxillary sinus septa has been known to be a complicating factor for sinus elevation procedure and implant placement in posterior maxilla. The maxillary sinuses septa are thin walls of cortical bone inside the sinus. They vary in number, location, and height. This study aimed to discover the accuracy of Spiral Computed Tomographic Scan in evaluation the maxillary sinus septa (prevalence, location, height) in subjects with dentate, partially edentulous and completely edentulous maxilla.

Material and method: This study included (267) subjects ranged from (20-70 years), (132) male and (135) female divided into three groups, (97) fully dentate group, (102) partially edentulous group and (68) completely edentulous group who admitted to Spiral Computed Tomography Scan in Al-Karkh General Hospital in Baghdad to have Computed Tomography Scan of the brain and paranasal sinuses for different diagnostic purposes from November 2012 to April 2013. The maxillary sinus septa were evaluated in the axial and sagittal views and the data were subjected to statistical analysis using Statistical Package for Social Sciences version 20.

Result: The prevalence rate of septa was 77.3% among fully dentate maxilla sample. Almost the same prevalence rate was obtained in the other two study sample (partially edentulous maxilla 77.5% and completely edentulous maxilla 76.5%). No important or statistically significant difference in prevalence was observed between the three study groups. Age and gender showed no important or statistically significant difference in prevalence rate in each study group, the mean septal height was slightly higher in fully dentate group (7mm) compared to partially edentulous maxilla group (6.2 mm) and completely edentulous maxilla group (6.5 mm). The difference in mean between the 3 groups however was not significant statistically. The rate of septa at floor position was significantly lowest in fully dentate maxilla group (36.1%) compared to partially edentulous maxilla group (52.1%) and completely edentulous maxilla group (53.3%).

Conclusion: Spiral Computed Tomography is a precise diagnostic tool for the examination of this zone capable for investigating their location and height during different maxillary sinus surgical procedures. In the posterior maxilla, regardless of type of ridge (atrophy/edentulous or non-atrophy/dentate), the anatomical variation of sinus septa is diverse in its prevalence and location.

Keywords: Maxillary sinus septa, Spiral computed tomography, Maxillary sinus surgery. (J Bagh Coll Dentistry 2014; 26(2): 64-68).

INTRODUCTION

The maxillary sinus (MS) in the adult consists of a pyramid shaped cavity in the facial skull with its base at the lateral nasal wall and its apex extending into the zygomatic process of the maxilla ⁽¹⁾.

The proximity of MS to the alveolar crest can be enhanced by sinus pneumatization, as well as resorption of the alveolar ridge due to tooth extraction, trauma or pathology. At the edentate stage of life, the size of MS increases further, often filling a large part of the alveolar process, leaving sometimes only a paper-thin bone wall on the lateral and occlusal sides. This process of pneumatization of the sinus varies greatly from person to person and even from side to side ⁽²⁾.

Various surgical operations involving the MS in the posterior maxillary region demand adequate knowledge about the possible anatomical variations. Exact knowledge of the patient's morphological condition allows accurate planning

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of invasive surgery and helps to prevent complications ^(3,4).

The presence of anatomical variations such as maxillary sinus septa (MSS) has been reported to hamper the preservation of the mucous membrane lining of MS during the surgical sinus elevation procedure ⁽⁵⁻⁸⁾.

Underwood ⁽⁹⁾ first described and analyzed MSS as barriers of cortical bone or bony ridges that divide the MS floor into multiple compartments, known as recesses.

Krennmair et al ⁽¹⁰⁾ further classified the septa into primary and secondary septa; primary septa arised from the development of the maxilla, whereas the secondary septa were said to arise from the irregular pneumatization of the sinus floor following tooth loss.

Evaluation of the anatomical structures inherent to the MS is crucial for the success of sinus surgical procedures. Therefore, an exact and definitive radiological assessment is necessary ^(11,12).

The CT scan is an imaging method that uses X-rays to create cross-sectional pictures of the

body. A computer produces separate image of body area, called slices, were can be stored, viewed on monitor or printed on film. In its simplest form a CT scanner consists of an x-ray tube that emits a finely collimated, fan-shaped x-ray beam directed through a patient to a series of scintillation detectors or ionization chambers. These detectors measure the number of photons that exit the patient and create the cross-sectional image^(13,14).

In the present study determination of MSS prevalence, location and height by Spiral CT was indispensable to prevent possible complications during different sinus surgeries.

MATERIALS AND METHODS

A prospective study consist of (267) Iraqi subjects (132 males and 135 females) with age ranged from (20-70) years attended the Maxillofacial Department at Al-Karkh General Hospital in Baghdad city who admitted to have Spiral CT scan of the brain and paranasal sinuses for different diagnostic purposes from November 2012 to April 2013.

The study sample divided into the following 3 groups:

- 1) Patients with fully dentate maxillae (97).
- 2) Patients with partially edentulous maxillae (102).
- 3) Patients with completely edentulous maxillae (68).

Criteria for patient's inclusion and exclusion:

The maxillary sinuses included in this study should be asymptomatic and clearly free of any pathology that might obscure the examined regions.

Exclusion criteria involved:

1. Any patients with middle third fractures or maxillofacial deformities.
2. Patients with extensive pathological lesions affecting the examined area.
3. Patients with a history of previous dentures.

Identification of MSS

CT scans for (right & left) maxillary sinuses were taken for each patient. The information obtained was assessed in the (axial and sagittal) sections that may be further manipulated by rotation about any axis to display the septa of maxillary sinus from many angles.

These CT scan images were used to identify the MSS in order to obtain the following parameters:

- The prevalence of MSS [one or more septa per sinus] among the 3 study groups (fully dentate,

partially edentulous and completely edentulous maxillae) (Figure 1).

- For the previous 3 study groups, determination of specific septal position at MS (roof, floor, anterior and posterior walls) and determination the type of septa at floor position whether primary or secondary in relation to dentate status. The location of MSS in the floor of MS was divided into 3 regions: the anterior (1st and 2nd premolar), middle (1st and 2nd molar) and posterior (behind 2nd molar) regions.
- Measurement of septal height in millimeters (mm) from the base of septum to the most highest point and correlate it with the dentate status, age and gender of the study sample whether the septum was located in sinus floor, roof, anterior and posterior walls.

Figure 1: Sagittal section shows MSS in sinus



floor (anterior location) with measurement of its length (15.4 mm).

RESULTS

The total studied samples composed of 267 subjects ranged from (20-70 years).The results were based on three study groups(of both genders).

The first group composed of (97 subjects with fully dentate maxilla), the second group composed of (102 subjects with partially edentulous maxilla) and the third group composed of (68 subjects with completely edentulous maxilla). The prevalence rate of maxillary sinus septa by study sample subjects was measured as shown in the table (1).

Table 1: Prevalence rate of maxillary sinus septa in 3 study groups

	Total		Positive presence of septa		P
	N	N	%	95% confidence interval (%)	
Dentate status					0.9 NS
Fully Dentate Maxilla	97	75	77.3	(69 to 85.7)	
Partially Edentulous Maxilla	102	79	77.5	(69.3 to 85.6)	
Completely Edentulous Maxilla	68	52	76.5	(66.4 to 86.6)	

The maxillary sinus was taken as the sampling unit, and subjects with positive septa (206) are included only. As shown in table (2), the count of septa per sinus ranged between a minimum 1 to a maximum 6 per a single sinus.

Table 2: Relative frequency and cumulative relative frequency of different values for count of septa per single sinus

Count of septa	N	%	Cumulative %
6	1	0.5	0.5
5	3	1.4	1.9
4	20	9.7	11.6
3	31	15	26.6
2	65	31.4	58
1	86	42	100
Total	206	100.0	

Subjects with positive MSS were included in further analysis. The MS septum was taken as (the sampling unit). As shown in table (3), there are four age groups, the first age group which is less than 30 years represents about 28.5% from the whole septa that are found in the three study groups, while in the age group that is more than 60 years it represents 20% from the total septa.

For the gender, the septa were found in almost equal distribution between males and females. (The septa were presented in 50.4% in males).

Table 3: Frequency distribution of maxillary sinus septa sample by age and gender

		N	%
1.	Age group (years)		
	<30	117	28.5
	30-44	113	27.5
	45-59	99	24.1
	60+	82	20.0
	Total	411	100.0
2.	Gender		
	Female	204	49.6
	Male	207	50.4
	Total	411	100.0

For the dentate status, the septa were found in higher percentage in fully dentate maxilla group 38.4% than the other two groups (in

partially edentulous maxilla 35.5% and in completely edentulous maxilla 26%).Table (4).

Table 4: Frequency distribution of maxillary sinus septa sample by dentate status group

Dentate status	N	%
Fully Dentate Maxilla	158	38.4
Partially Edentulous Maxilla	146	35.5
Completely Edentulous Maxilla	107	26.0
Total	411	100.0

Maxillary sinus septa measurements

As shown in table (5) the mean septal height was slightly higher in fully dentate group (7mm) compared to partially edentulous maxilla group (6.2 mm) and completely edentulous maxilla group (6.5 mm). The difference in mean between the 3 groups however was not significant statistically.

To show the effect of each group of the study sample on the side and position of MSS, the following table (6) will discuss the difference in side and position among the 3 groups according to their dentate status.

DISCUSSION

The accurate identification of MSS location and height is important for both diagnostic and clinical procedures. As surgery involving the maxillary sinus segment (implant insertion in posterior maxilla, sinus lift procedure) is applied more frequently, radiological evaluation determining the heights and localizations of the septa has gained importance for oral and maxillofacial surgeons⁽¹⁵⁾.

Shibli et al⁽¹⁶⁾ made a retrospective study in the Brazilian population by means of panoramic radiography, the prevalence rate is (21.58%) which is too much less than the prevalence rate in this study for all groups, this is may be due to influential effects like human variability and the type of radiography. Logistic regression failed to detect any correlation between the presence of maxillary septa, age, and gender that agree with this study.

In 2009 Masoumeh et al⁽¹⁷⁾ up on studying a total of 132 sinuses in 66 patients (39 male and 27 female), They found that the prevalence of one or

more septa was 35.52% (27/76) for edentulous and 21.42% (12/56) for dentate patients. These results were largely lower than that of the current study and this may be due to the small sample size used in their study in addition to ethnic variations and also found that the mean heights of septa were 6.52 ± 3.87 mm, 7.58 ± 3.56 mm and 5.33 ± 4.23 mm in medial, lateral and middle regions of maxillary sinus, respectively.

Rosano et al⁽¹⁸⁾ in their cadaveric study found that the septal height with a mean value of 8.72

mm which was slightly higher than the mean height in the present study and this might be related to the type of the study and anatomical variation.

Kaan et al⁽¹⁵⁾ found that mean height of septa for males was 4.86 ± 2.01 mm, for females 5.02 ± 2.14 mm, and this slightly shorter than that in the current study and that might be due to human sample variability.

Table 5: The mean septal height by selected independent variables

	Septal height (mm)					
	Range	Mean	SD	SE	N	P
Dentate status						0.29 NS
Fully Dentate Maxilla	(1.1 - 26.3)	7.0	4.6	.37	158	
Partially Edentulous Maxilla	(1 - 25.8)	6.2	4.5	.38	146	
Completely Edentulous Maxilla	(1.5 - 22.1)	6.5	4.0	.39	107	
Age group (years)						0.51 NS
<30	(1 - 26.3)	6.3	4.6	.43	117	
30-44	(1.3 - 25.8)	7.1	4.8	.45	113	
45-59	(1.4 - 20.1)	6.5	4.1	.41	99	
60+	(1.5 - 22.1)	6.3	4.0	.44	82	
Gender						0.05 NS
Female	(1 - 25.8)	6.2	4.3	.30	204	
Male	(1.5 - 26.3)	7.0	4.5	.31	207	
Side (Right Vs Left)						0.95 NS
Left	(1 - 26.3)	6.6	4.4	.31	208	
Right	(1.1 - 22.7)	6.6	4.4	.31	203	

Table 6: The difference in septal side and position among the 3 study groups

Variables	Fully Dentate Maxilla		Partially Edentulous Maxilla		Completely Edentulous Maxilla		Sig.
	N	%	N	%	N	%	P
Side (Right Vs Left)							0.2 NS
Left	74	46.8	82	56.2	52	48.6	
Right	84	53.2	64	43.8	55	51.4	
Total	158	100.0	146	100.0	107	100.0	
Septal position							
Roof	76	48.1	60	41.1	31	29.0	0.008
Floor	57	36.1	76	52.1	57	53.3	0.005
Anterior wall	41	25.9	25	17.1	17	15.9	0.07NS
Posterior wall	15	9.5	7	4.8	7	6.5	0.27NS

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