

Prevalence and Evaluation of Morphology of Maxillary Sinus Septae – A Digital Panoramic Study

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Abstract

Introduction: The maxillary sinuses are the largest paranasal sinuses which are pyramidal in shape and situated on either side of the nasal cavity.

Aim: This study was aimed to determine the prevalence of maxillary sinus septae on digital panoramic radiographs.

Objective: To study variations in prevalence and location of maxillary sinus septae with respect to age and gender, variations in prevalence and location of maxillary sinus septae with respect to presence or absent

of teeth and to assess interobserver variability in identifying the maxillary sinus septae.

Materials and Method: This retrospective radiographic study was carried out in the Department of Oral Medicine and Radiology at Teerthanker Mahaveer Dental College and Research Centre, Moradabad. This retrospective study comprised of panoramic radiographs of 1000 subjects of either gender, aged between 16 and 80 years.

Statistical analysis: The data were analyzed by using SPSS statistical software 21.0 version.

Result: The septae found the respect of gender by observer 1 and 2 which was found that in female prediction higher in 74 (15.6%) than males 61 (11.6%) with the P value of 0.031 significant. 9-70% as cited by Malec m et al.

Conclusion: The result of the present study important for physicians and surgeons to be aware of normal anatomic variations like M.S.S. owing to surgical complication that septae can present during maxillary sinus surgeries their identification is of at most value.

Keywords: Maxillary sinus septa, Underwood's septa, Dentate population, digital panoramic radiograph, edentulous

Introduction

The maxillary sinuses are the largest paranasal sinuses which are pyramidal in shape and situated on either side of the nasal cavity with its base directed towards lateral nasal wall and apex extending to the zygomatic process of maxilla. Maxillary sinuses are small at birth and eventually enlarged with the growing maxilla and fully developed after the eruption of the permanent dentition. Numerous anatomical variations such as hyper pneumatization, hypoplasia and antral septae are associated with maxillary sinuses, were in close relationship between tooth roots and maxillary sinus (referred to as draping) occurs.¹

The anatomist Arthur Underwood first reported Maxillary sinus septae in the year 1910.^{1,2} Consequently, the term Underwood's septae is eponymously used for maxillary sinus septae.² The septae may be defined as cortical bony partitions found in the form of inverted gothic arches that protrude from the sinus walls dividing the sinus into two or more cavities.^{1,2}

Different hypotheses such as varying eruption phases of teeth, different resorption rate of the adjacent sinus floor area subsequent to tooth loss and pneumatization and

finger like out pouching of ethmoid infundibulum during embryonic development have been attributed to the formation of maxillary sinus septae. Septae may be complete that is extending from one sinus wall to an opposing wall or may be seen as incomplete 'fin' like sharp bony protrusion from a sinus wall without compartmentalizing the antral cavity. Septae distinctively depict varied contour characteristics being usually thin but wide.² MSS are usually found against the medial wall.² They are usually made up of cortical bone, but when wider they may contain cancellous bone.² These septae may be radiographically demonstrated as white radiopaque structures or curved lines extending from the floor of the maxillary sinus.²

The prevalence of maxillary sinus septae varies from 9% to 56% according to various studies conducted on panoramic radiographs, computed tomography and cone beam computed tomography. According to the criteria suggested by Ulm and coworkers, thin bony radiopaque lamellae in the maxillary antrum with a height of at least 2.5 mm should be considered as maxillary sinus septa.²

Based on their location in the maxillary antrum, septae may be classified as anterior: present between mesial and distal aspect of second premolar, middle: being present between distal aspect of second premolar to the distal aspect of the second molar and posterior present in the distal portion of the second molar region.³

According to available literature various study performed on the prevalence of MSS conducted on digital panoramic radiographs CT, and CBCT technique. Septae missed may lead to unanticipated problems during surgeries like sinus augmentation procedures.^{1,5}

Few complications that these anatomical structures may pose include perforation of Schneiderian membrane, amputation of alveolar sinus-vascular plexus, maxillary

sinusitis and limitation in creating a window in the lateral antral wall.^{4,5}

Thus, from the above it is evident that knowledge of presence of these septae may forewarn surgeons to modify maxillary sinus surgeries in order to prevent untoward complications. The available of literature showed that panoramic radiographs can delineate these anatomical variations being especially useful in developing countries where advanced imaging is not easily available. In addition, only few studies have been performed to assess the prevalence of maxillary sinus septae on digital panoramic radiographs.⁵

Hence this retrospective study shall be performed with an aim to determine the prevalence of maxillary sinus septae and describe their characteristics in both dentulous and partially edentulous subjects.

Materials and method

This study was carried out in the department of OMDR, TMDC&RC, Moradabad to evaluate prevalence of maxillary septae on panoramic radiograph. This study group consisted of 1000 orthopantomogram both male & female aged between 16 to 60 years. No fresh radiographs were taken for any of the patients for this study. These panoramic radiographs had been taken on Planmeca Proline digital panoramic system at 68Kbp, 5mA expose time 18 seconds and were visualized on Lenovo computer with optimal brightness setting using Romex is software under ideal viewing conditions. The inclusion criteria of the study were panoramic radiographs of optimum quality depicting the maxillary sinus region and belonging to patients in the age group of 16–80 yrs. The exclusion criteria of the study comprised radiographs that showed evidence of trauma/ surgeries in the maxillary sinus region, signs of maxillary sinus pathologies, and systemic disorders affecting growth of the maxillofacial region. Based on

the inclusion and exclusion criteria 1000 radiographs were included in this study. A total of 1000 panoramic radiographs with selected and retrieved the archival date base of the Department. Selected data was in accordance with the inclusion & exclusion criteria. An ethical clearance was obtained prior to conduct of this study. The institutional ethical clearance certificate numbered (TMDCRC /IEC/ 19-20/ OMR2 was granted on 06.11.2019).

These radiographs interpreted by observer 1 which was presence or absence of maxillary sinus septae. Based on the criteria was suggested by Velasquez Plata D et al in 2002.⁷ The bony extensions having minimum height of 2.5mm considered. The site of maxillary sinus septae was defined in accordance with Underwood classification as utilized by Bhattacharya et al in the year 2015 on panoramic radiographs as anterior (mesial to the distal aspect of the 2nd premolar), (Fig.1) middle (distal to the 2nd premolar to the distal of the 2nd molar) (Fig. 2), and posterior (mesial to the distal aspect of the 3rd molar (Fig. 3).¹⁶ Then the data interpreted by 2nd observer following same criteria. After interpretations done then, the data was analyzed, collected and tabulated and send for statistical analysis. The data were statistically evaluated; the Chi Square test was used for the comparison of categorically variables by using the SPSS statistical software 2.1.23 version.

Statistical analysis

The data for the present study was entered in the Microsoft Excel 2007 and analyzed using the SPSS statistical software 21.0 Version. The descriptive statistics included frequency. The intragroup comparison for the different time intervals was done using the Chi-square test. The level of significance for the present study was fixed at 5%.

Results

Through this study the prevalence of MSS was 13.1% by observation 1 and 12.2% by observation 2, this falls within the range of prevalence of mss from 9-70% which was in accordance to Malec et al¹

In present study presence septae of MSS with respect to age and gender, it was more in between 21- 30 yrs of about 14.50% by observer 1 and 2 and least number found in above 60 yrs of about 0(.0%) septae seen by both observers. (Table 1). Similarly, absence of more septae of about 310(85.6%) between the age 21-30 by the both observer which is statistically significant P value (0.001). (Table 2). Mudgade D.K et al in 2018 documented that the prevalence of septae were more between 30-32 yrs of about 24.24% using CBCT. In our study we found 21-30 yrs using digital panoramic radiograph. A study done by Sibili et al also found that no statistically significant in differences between genders, this difference could be due to varying number of males and females recruited in the study.

The septae found with the respect to gender by observer 1 and 2 which observed higher in female prediction of about 74 (15.6%) than males 61 (11.6%) with the P value of 0.031 significant.

In dentate subject predominantly the maxillary sinus septae higher in middle portion of about 55 (6.48%) and 56 (6.60%) by observer 1 and 2. Similarly the prevalence of MSS in partially dentate subjects on right side found predominantly in anterior region of about 3(1.98%) and 2 (1.31%) by observer then the middle and posterior portion. Absence of septae of about 147 (96.72%) by both observer with P value of 0.001 statistically significant. In the present study the MSS of in dentate subject on left side showed in highest in number of about 59 (7.28%) in the middle region of sinus 61 (7.53%) were seen by observer 1 and 2. The

septae were not appreciated it was about 725(89%) seen by both observers. Left side showed of about 06(3.16%), 05(2.63%) in middle portion seen by both observers. The least number of septae has seen anterior and posterior regions. Absence of septae observed by both observer by 94.21% (table 3,4,5,6)

in dentate than partially dentate through panoramic radiograph and CBCT scans and stated that middle of sinus septae present more in number than other regions. (tab7)

In our study both dentate and partially dentate subjects on left side compared by both observers, it was found that more number of absence of septae in dentate subjects with both observer. Similarly, partially dentate patients also showed the absence of septae of about 89.51%. However the middle region of maxillary sinus septae showed predominately in both partially dentate 3.16%, 2.63% and dentate subject 7.28%, 7.53% with both the observer which is statically significant with p value of 0.001. Similarly the study done by Patil A. et al in 2020 and AL Kurt T.M et al in 2016 documented that the distribution of septae the anterior, middle and posterior region showed through CBCT and OPG, the majority of septae seen in middle region of sinus of about 19.35%. (Table 8)

The present study inter observer agreement was done between 2 observer and both dentate and partially dentate subject. It was found that right and left dentate subjects showed scores of ICC 0.971, and 0.927 with P value of 0.001 which is significance, similarly the right and left partially dentate septae ICC 0.833, 0.872 P value of 0.001 statically significance which similar study done by AL Kurt T.M et al in 2016 compare septae CBCT and OPG, they started that the dentate subjects show more in number 45.8% through OPG which is similar to our study. We observed that inter observer P value 0.001

statically significance in both dentate and partially dentate subjects. (Table 9).

Different observers have made different observations with respect to side for the prevalence of maxillary sinus septae. Wide variations of observations have been reported depending upon the imaging modalities used and on the presence absence of teeth. According to the study by AL Kurt T. et al majority of septae noted in dentate posterior maxillary segment on both panoramic and CBCT images. According to Bhattacharya PT et al higher quantity of septae was present in dentate arches in the middle and anterior portion and this difference was statistically significant. Through this study and an easy radiographic technique to recognize, the mss in the North Indian population is presented.

Discussion

Maxillary sinus septae are bony walls arising from the sinus floor that divide the antral cavity in to compartments. Their shape has been reported as an inverted gothic arch arising from the inferior and later wall of sinus. According to Underwood septae are formed during various eruption phases of teeth. It has also been hypothesized that finger like projection formed by embryonic out pouching of ethmoid infundibulum lead to development of MSS. Anatomic variations like septae enhance the risk of Schneiderian membrane formation, perforation in lateral antral wall, amputation of alveolar sinus, elevation of hinged door. Thus, only when the precise occurrence site and variation of mss are understood a meticulous surgical plan can be made and surgical obstacles can be avoided.^{1,2}

The available research revealed that opg can depict this anatomic form of Maxillary sinus being mainly useful in developed countries where advance radiographic technique is not available. Few studies that evaluate the occurrences of MSS on opg in Indian population.⁴

This study was conducted on 1000 panoramic radiographs to evaluate the site and to describe the features of M.S.S in both dentate and partially dentate patients in Uttar Pradesh population, which was retrieved the archival date base of the Department, fulfilling the inclusion & exclusion criteria.

It was observed that septae were 13% prevalent by observer 1 and 12% by observer 2 with statistically significant interobserver difference. Both observer 1 and 2 found the septae to be higher in female with age ranging for 21-30 yrs. Maximum number of septae on the right and left side among dentate subject were seen in the middle region. In the partially dentate subject on the rt side more quantity of septae were seen in anterior region while on the left side majority of septae present in middle region. Interobserver agreement between the observers was statistically significant. Interobserver agreements for dentate, partially dentate and right and left maxillary arches were statistically significant with p value of (0.001).

Considering the findings of present study, maxillary sinus septae important findings for the oral physician to be aware unwanted complications. Knowing to these surgical obstacles that may arise mostly in ms surgeries and their identification was main concern for surgeons.

Conclusion

The result of the present study found to be a promising led up concluded that the maxillary sinus septae, considering its prevalence, it's important for physicians and surgeons to be aware of normal anatomic variations like M.S.S. owing to surgical complication during maxillary sinus surgeries, the septae and their identification is of at most value. Hence care should be taken to assess the septae and surgical complications. Nonetheless same researches use larger sample sizes with advanced imaging methods like CBCT imaging

technique is recommended to confirm the findings of our study.

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Legend Figures

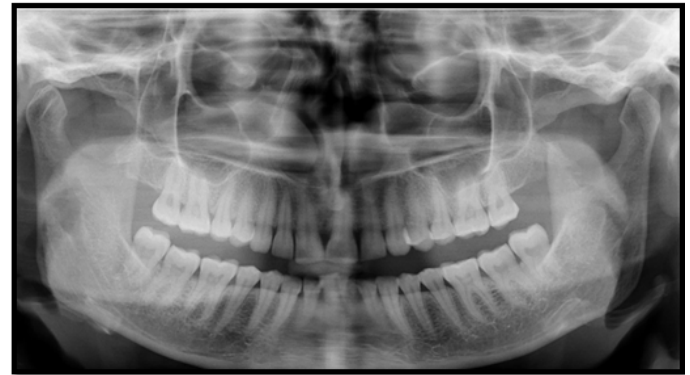


Figure 1: Septae present in anterior region.



Figure 2: Septae present in middle region

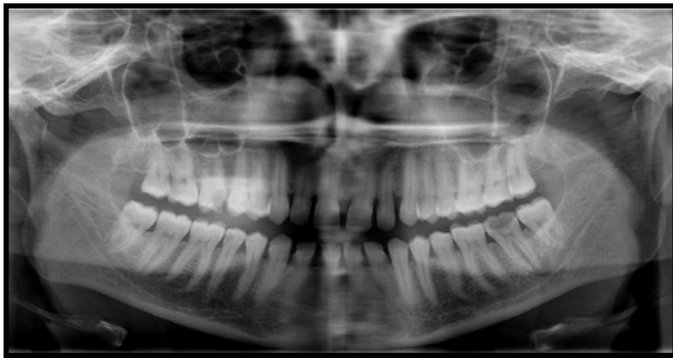


Figure 3: Septae present in posterior region

Legend Tables

	Observer 1		Observer 2	
	Absent	Present	Absent	Present
Age groups				
11-20 years	169	22	169	22
	88.5%	11.5%	88.5%	11.5%
21-30 Years	310	52	310	52
	85.6%	14.4%	85.6%	14.4%
31-40 years	135	29	135	29
	82.3%	17.7%	82.3%	17.7%
41-50 Years	116	15	116	15
	88.5%	11.5%	88.5%	11.5%
51-60 years	121	17	121	17
	87.7%	12.3%	87.7%	12.3%
Above 60 years	14	0	14	0
	100.0%	.0%	100.0%	.0%
Chi Square value	6.152		6.152	
P value	0.001 (Significant)		0.001 (Significant)	

Table 1: Prevalence based on age groups

	Observer 1		Observer 2	
	Absent	Present	Absent	Present
Gender				
Male	465	61	465	61
	88.4%	11.6%	88.4%	11.6%
Female	400	74	400	74
	84.4%	15.6%	84.4%	15.6%
Chi Square value	3.344		3.344	
P value	0.031 (Significant)		0.031 (Significant)	

Table 2: Prevalence based on Gender

	Observer 1	Observer 2
No septae	773 (91.16%)	773 (91.16%)
Anterior	11 (1.30%)	10 (1.17%)
Middle	55 (6.48%)	56 (6.60%)
Posterior	9 (1.06%)	9 (1.06%)
P value	0.001	0.001
Significance	Significant	Significant

Table 3: Prevalence of septae among dentate subjects on the right side (N=848)

	Observer 1	Observer 2
No septae	147 (96.72%)	147 (96.72%)
Anterior	03 (1.98%)	02 (1.31%)
Middle	01 (0.65%)	02 (1.31%)
Posterior	01 (0.65%)	01 (0.65%)
P value	0.001	0.001
Significance	Significant	Significant

Table 4: Prevalence of septae among Partially dentate subjects on the right side (N=152)

		No septae	Anterior	Middle	Posterior	P value	Significance
Observer -1	Dentate	773	11	55	9	0.001	Significant
		91.16%	1.30 %	6.48 %	1.06 %		
	Partially dentate	147	03	01	01		
		96.72%	1.98 %	0.65 %	0.65 %		
Observer-2	Dentate	773	10	56	9	0.001	Significant
		91.16%	1.17 %	6.60 %	1.06 %		
	Partially dentate	147	02	02	01		
		96.72%	1.31 %	1.31 %	0.65 %		

Table 5: Intergroup comparison between dentate and partially dentate on the right side.

	Observer-1	Observer-2
No septae	725 (89.51%)	725 (89.51%)
Anterior	21 (2.59%)	20 (2.46%)
Middle	59 (7.28%)	61 (7.53%)
Posterior	5 (0.62%)	4 (0.49%)
P value	0.001	0.001
Significance	Significant	Significant

Table 6: Prevalence of septae among dentate subjects on the Left Side (N=810)

	Observer-1	Observer-2
No septae	179 (94.21%)	179 (94.21%)
Anterior	03 (1.58%)	03 (1.58%)
Middle	06 (3.16%)	05 (2.63%)
Posterior	02 (1.05%)	03 (1.57%)
P value	0.001	0.001
Significance	Significant	Significant

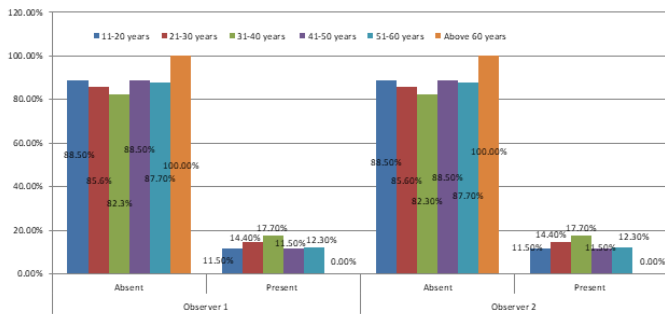
Table 7: Prevalence of septae among partially dentate subjects on the Left Side (N=190)

		No septae	Anterior	Middle	Posterior	P value	Significance
Observer-1	Dentate	725	21	59	05	0.001	Significant
		89.51%	2.59 %	7.28 %	0.62 %		
	Partially dentate	179	03	06	02		
		94.21%	1.58 %	3.16 %	1.05 %		
Observer-2	Dentate	725	20	61	04	0.001	Significant
		89.51%	2.46 %	7.53 %	0.49 %		
	Partially dentate	179	03	05	03		
		94.21%	1.58 %	2.63 %	1.57 %		

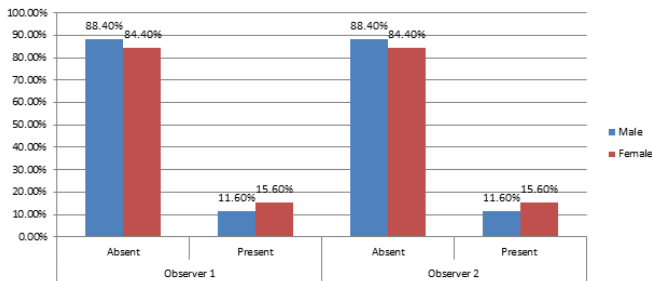
Table 8: Intergroup comparison between dentate and partially dentate on the left side.

	ICC	P value	Significance
Right Dentate	0.971	0.001	Significance
Left Dentate	0.927	0.001	Significance
Right Partially Dentate	0.833	0.001	Significance
Left Partially Dentate	0.872	0.001	Significance

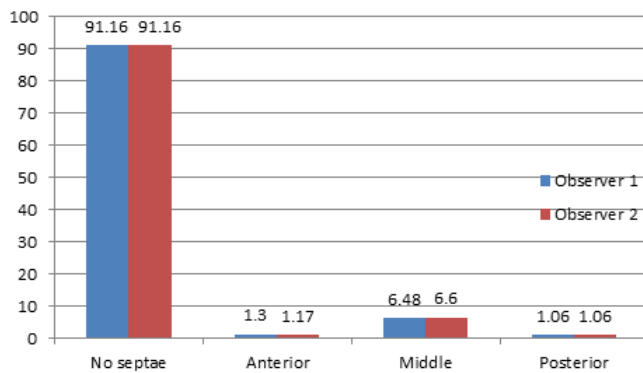
Table 9: Inter Observer agreement between the observers.



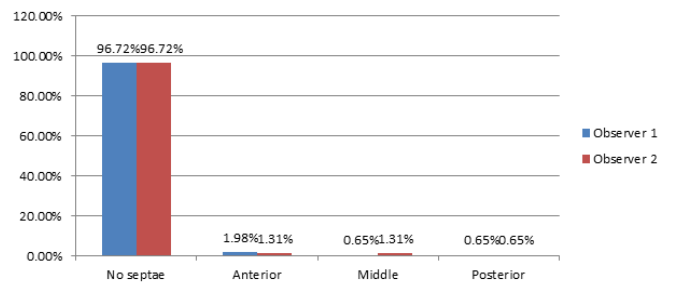
Graph 1:



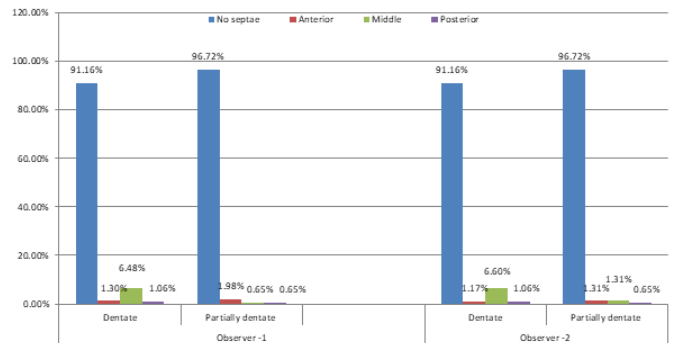
Graph 2:



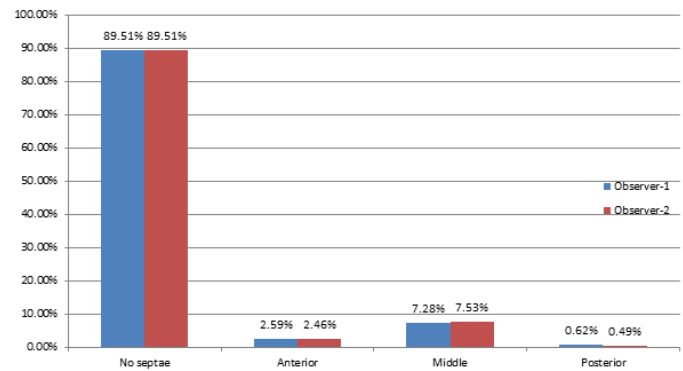
Graph 3:



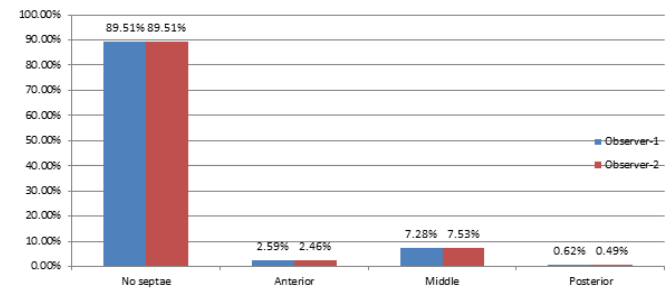
Graph 4:



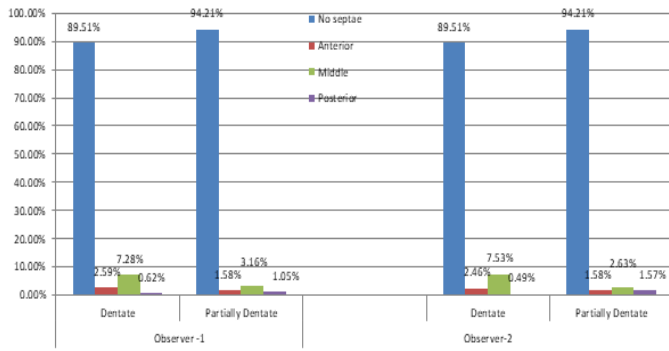
Graph 5:



Graph 6:



Graph 7:



Graph 8: