

Prevalence of Incidental Maxillary Sinus Findings in Kashmiri Orthodontic Patients: A Retrospective Cone-Beam Computed Tomography Study

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Abstract: Incidental findings are common in the maxillary sinus. Fewer studies have addressed the prevalence of maxillary sinus pathologies. These sinus abnormalities are benign, self limiting and usually go unnoticed in asymptomatic patients but are important for avoiding failures in future procedures involving maxillary sinus. The aim of the study was to assess the prevalence of incidental maxillary sinus pathologies on CBCT scans and to categorize incidental findings based on the parameters- Age, gender, type of pathology, and to increase the awareness of the reporting radiologists and dental practitioners with regards to the range of findings. Retrospective study was carried out using 36 CBCT scans for evaluation of maxillary sinus pathologies. The CBCT Scans were observed in the Coronal, Sagittal and Axial views, for evaluating radiopacities and mucosal thickening. Chi-square test was used for statistical analysis. Out of 36 scans, only 33 CBCT scans showed incidental maxillary sinus pathologic findings. Total prevalence of incidental pathologies was 91.7% in the total scans examined. Most prevalent incidental pathologic maxillary sinus findings in CBCT scans was partial opacification in 27 (75%) (p -0.000) followed by mucosal thickening in 25 (69.44%)(p -0.006). The difference in the frequency was observed to be statistically significant. Based on our study, it can be concluded that the prevalence of incidental maxillary sinus pathologies is high in the dental patients. Pathological changes in the maxillary antrum can be easily identified on CBCT images. CBCT as a new 3D imaging modality could be of clinical value in screening for the maxillary sinus pathologies.

Keywords: Maxillary sinus pathologies, CBCT, Mucosal thickenings, Opacifications.

INTRODUCTION

Maxillary sinus pathologies are commonly seen in patients with dental pathologies. Maxillary sinus can be evaluated on the panoramic radiograph, Water's view, computed tomography (CT) and cone beam computed tomography (CBCT). The cone beam computed tomography (CBCT) is an advanced form of three dimensional imaging which was pioneered by Mozzo *et al.* [1] and Aral *et al* [2]. Dental implant site assessment, maxillofacial trauma, periapical, bony and inflammatory pathologies, endodontic lesions, sinus augmentation, impacted and supernumerary teeth and orthodontics are frequent indications for CBCT, wherein the area of maxillary sinus maybe within the imaging field. Incidental findings are common in the area of maxillary sinus.

The increase in use of CBCT by dentists and maxillofacial surgeons requires an assessment of the prevalence of incidental findings relevant for further evaluation.

Aim and Objectives

The aim of the present study is to estimate the prevalence of incidental maxillary sinus pathologies on CBCT scans and to identify the frequency and type of these pathologies.

MATERIALS AND METHODS (STUDY DESIGN)

The Data for the study were obtained from CBCT scans taken as part of Orthodontic diagnosis and treatment planning protocol in the department of Orthodontics & Dentofacial Orthopaedics, Government Dental College and Hospital, Shereen Bagh, Srinagar. The study was approved by the ethical committee of the institute. The retrospective study included a total of 36 scans. Consent was obtained from the patients to use and share the information from the scans for purposes of education, including teaching and research. The scans were obtained using the NewTom 3G Volume Scanner QRsr 1 Verona, Italy. The Newtom 3G Volume Scanner is based on a cone-beam technique that uses x-ray emissions efficiently, thus reducing the dose

absorbed by the patient. The following settings were used:

X ray source: HF, Constant potential (DC), 90 kV; 2 mA (pulsed)
Imaging mode: CBCT
Focal spot: 0.5 mm
Dose: 80-100 μ Sv
Scan: 11 cm \times 8 cm and 8 cm \times 8 cm
Scan time: 18 seconds
Slice thickness: 0.5 mm.

All the patients had been referred for CBCT diagnosis and treatment planning, which included dental implants, maxillofacial surgery, orthodontics, endodontics, periapical pathologies etc. Age, gender and indication/purpose for scanning were recorded.

Inclusion criteria

All CBCT scans visualizing the entire maxillary sinuses unilaterally or bilaterally with at least four of sinus surfaces (medial and lateral walls, anterior wall, posterior wall, roof and floor) were included in the study sample.

Exclusion criteria

Patients under 12 years of age were excluded because of their incomplete sinus development. Patients referred for a CBCT scan of the maxillary sinus because of sinus symptoms or suspected diseases. Images of low resolution quality and those in which the presence of metallic artifacts impaired sinus visualization were excluded from the study.

Criteria for recognizing pathologies: Radiopacities or any mucosal thickenings observed in the maxillary sinus.

METHOD OF DATA ANALYSIS

Data collected was sorted and categorized based on the incidental maxillary sinus pathologies. Percentage table used to present the data and chi-square test was applied for the statistical analysis.

RESULTS

Out of 36 scans, only 33 CBCT scans showed incidental maxillary sinus pathologic findings. Total prevalence of incidental pathologies was 91.7% in the total scans examined. Age group ranged from 12 to 52 years, patients in the age group of 3rd to 5th decade showed higher prevalence of maxillary sinus pathologic findings. Out of the 33 patients with detected maxillary sinus pathologies 13 (39.4%) were males and 20 (60.6%) were females. Females showed higher predilection for the occurrence of maxillary sinus pathologies.

Most prevalent incidental pathologic maxillary sinus findings in CBCT scans was partial sinus opacification in 27 (75%) [Fig 1], followed by mucosal thickening in 25 (69.4%) [Fig 2], Total sinus opacification in 7(19.4%) [Fig. 3], Polypoidal thickening in 5 (13.89%) [Fig. 4], Perforations in 1 (2.78%) and Calcifications in none (0%).

Out of 36 CBCT scans examined, mucosal thickening was present in 25 (69.44%) and absent in 11 (30.55%). The difference in the frequency was statistically significant ($p = 0.006$). Polypoidal thickening was present in 5 (13.89%) and absent in 31 (86.11%). The difference in the frequency was statistically significant ($p = 0.000$). Partial opacification of the sinus was present in 27 CBCT scans (75%) and absent in 9 CBCT scans (25%). The difference in the frequency was statistically significant ($p = 0.000$). Total opacification of the sinus was present in 7 CBCT scans (19.44%) and absent in 29 CBCT scans (80.55%). The difference in the frequency was statistically significant ($p = 0.000$). Perforation of the floor of the maxillary sinus was observed in only 1 (2.78%) and absent in 35 (97.22%). The difference in the frequency was statistically significant ($p = 0.000$). Calcification in the sinus was present in 0 CBCT scans (0%) and absent in 36 CBCT scans (100%). The difference in the frequency was statistically significant ($p = 0.000$) [Table 2].

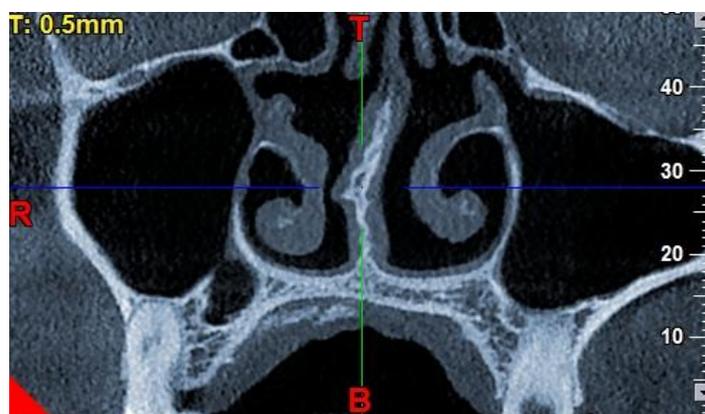


Fig-1: Partial opacification of both right and left maxillary sinuses

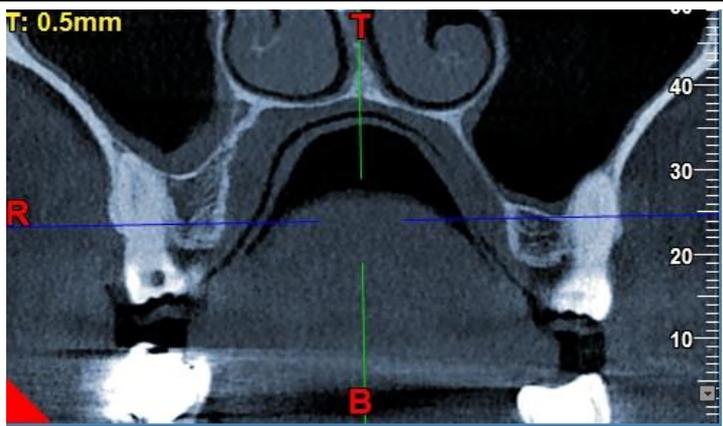


Fig-2: Mucosal thickening on right side of maxillary sinus

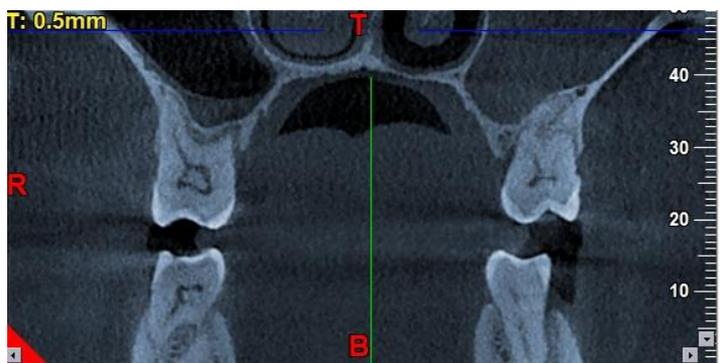


Fig-3: Complete opacification of left maxillary sinus

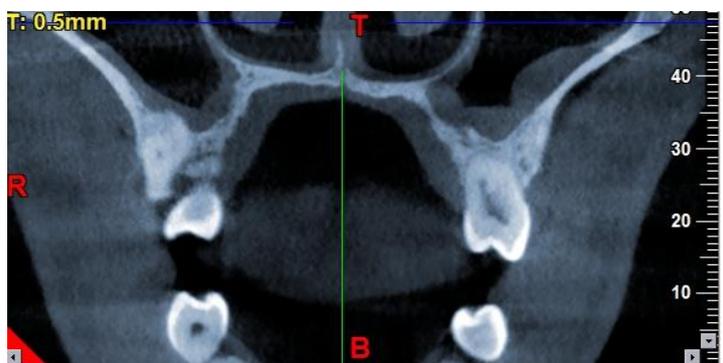


Fig-4: Polypoidal thickening in left maxillary sinus

Table-1: Age distribution of studied patients

Age group	Male	Female	Total
12-18 years	2	2	4
19-25 years	1	7	8
26-40 years	7	9	16
41-52 years	4	4	8
Total	14	22	36

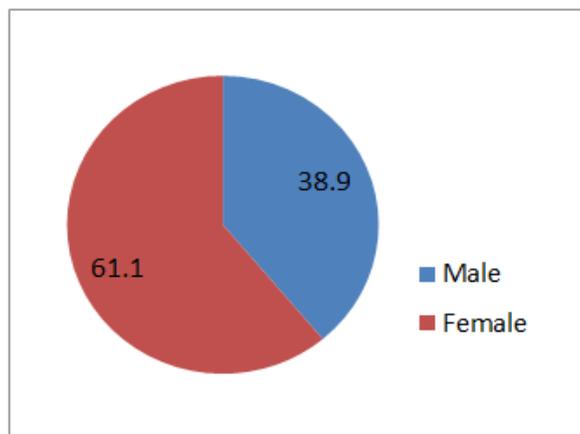


Fig-5: Gender distribution of the sample

Table-2: Prevalence of maxillary sinus pathologies

	Number and Percentage		P value*
	Absent	Present	
Mucosal Thickening	11 (30.55 %)	25 (69.44 %)	0.006
Polypoidal Thickening	31 (86.11%)	5 (13.89 %)	0.000
Partial Opacification	9 (25 %)	27 (75 %)	0.000
Total Opacification	29 (80.55 %)	7 (19.44 %)	0.000
Perforation	35 (97.22 %)	01 (2.78 %)	0.000
Calcification	36 (100%)	0 (0%)	0.000

*Chi square test applied for statistical analysis

Table-3: Right, left and bilateral occurrence of maxillary sinus pathologies

	Right side	Left side	Bilateral
Mucosal Thickening	3(12%)	6(24%)	16(64%)
Polypoidal Thickening	1(20%)	4(80%)	0(0%)
Partial Opacification	5(18.52%)	2(7.41%)	20(74.1%)
Total Opacification	5(71.43%)	2(28.57%)	0(0%)
Perforation	1(100%)	0(0%)	0(0%)
Calcification	0	0	0

Table-4: Male and Female occurrence of maxillary sinus pathologies

	Male(n=13)	Female(n=20)
Mucosal Thickening	12(36.4%)	13(39.4%)
Polypoidal Thickening	2(6.1%)	3(9.1%)
Partial Opacification	9(27.3%)	18(54.5%)
Total Opacification	5(15.15%)	2(6.1%)
Perforation	1(3.03%)	0(0%)
Calcification	0	0

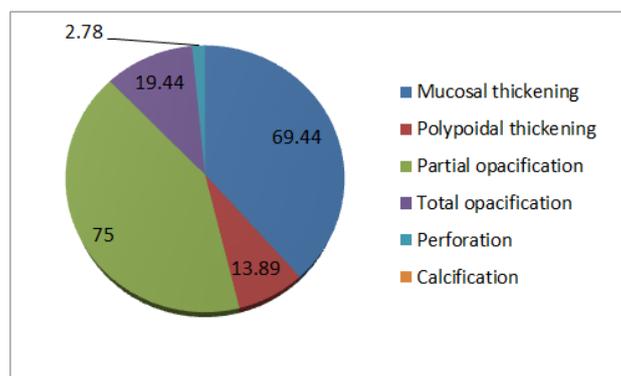


Fig-6: Prevalence of different pathologies in maxillary sinus

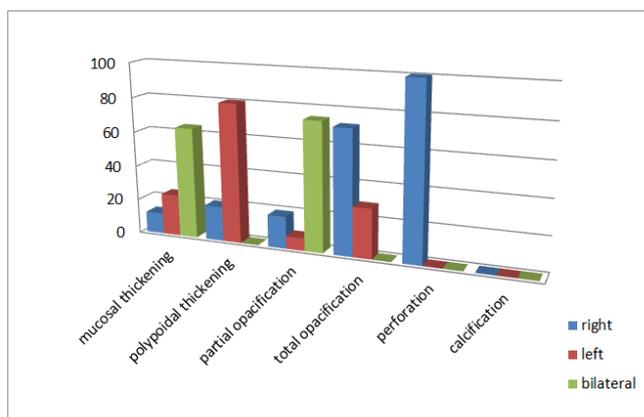


Fig-7: Sideways prevalence of maxillary sinus pathologies

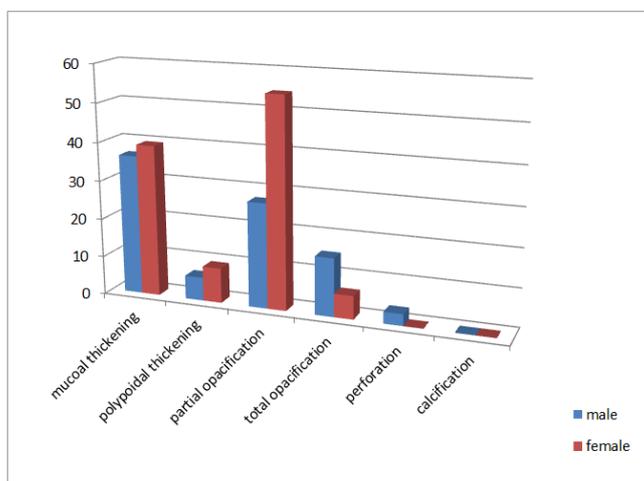


Fig-8: Gender prevalence of maxillary sinus pathologies

DISCUSSION

Incidental findings are defined as any or all discovered findings that are unrelated to the clinical indication for imaging being performed. Their identification may have significance in diagnosis and treatment planning. For effective identification of such incidental maxillary sinus findings, it is important for users of CBCT to be familiar with their prevalence. Therefore, the purpose of the present study is to retrospectively to identify the maxillary sinus pathologies and to determine the prevalence of these findings.

In the present study, 36 CBCT scans were retrospectively evaluated for incidental pathologic findings in the maxillary sinus. The present study showed a prevalence of 91.7% of maxillary sinus pathologies. The study by Pazerra and Gracco reported that almost half of the dental patients had incidental maxillary sinus pathologies [3, 4]. Higher prevalence was reported by Ritter and Rege who had prevalence of 56.3% and 68.2% respectively [3, 4]. Based on the results of our study, there was female gender predilection in the study population for the prevalence of pathologic findings in the maxillary sinus. However, the study results are in contrast to some previous studies

which have found a higher frequency of pathologic findings in males. Raghav *et al* and Rege *et al*. have observed statistical difference between the genders for the prevalence of maxillary sinus pathologies [5,6]. Age group of the study population ranged from 12 to 52 years, patients in the age group of 3rd to 5th decade showed higher prevalence of maxillary sinus pathologic findings. Our study results are in concordance with observations of Raghav *et al* who have reported that the patients in 3rd to 5th decade showed higher prevalence of maxillary sinus pathologic findings. Gracco *et al* have reported that patients in the age group of 41 to 60 years have the highest risk for maxillary sinus pathologies [4]. There was no statistical significance for the prevalence of maxillary sinus pathologic findings in the different age groups as observed by Rege I *et al*. And Dobe I [6].

Most prevalent finding in our study population was partial sinus opacification followed by mucosal thickening, complete sinus opacifications, Polypoidal thickening in descending order [Fig.1 to Fig.4]. Partial sinus opacification and mucosal thickening were the most common pathologic finding in our study [Fig. 1 and 2]. Similar observation was seen in study conducted by Ritter and Raghav *et al*. [5,7] Mucosal thickenings

are inflammatory changes in the maxillary sinus, they may be caused due to various etiologies most commonly related to dental infections as the maxillary teeth are in close proximity to the floor of maxillary sinus. Other reasons could be due to allergy, trauma and microbial infections. These could manifest in the maxillary sinus as linear mucosal thickening which may progress to partial and total opacification [8,9]. Differences in the prevalence found in the present study compared with other reported studies can be explained by certain factors. Different age and patient groups, definitions for pathologic changes and its classification varies, various imaging modalities explaining the range of pathologic findings prevalence. Though in our study we have not been able to co-relate it with the symptoms of patients. Most of the patients were found to be asymptomatic for maxillary sinus pathology. Multiplanar images are available in CBCT which makes it easier to analyse all the surfaces of the maxillary sinus and found to be very useful diagnostic tool and be used in the initial evaluation of the maxillary sinus. So the dental surgeon needs to be well aware of these incidental findings especially when it comes to planning for implant placement, sinus graft procedures which may result in failure of procedures if underlying pathologies are not diagnosed.

Although incidental, maxillary sinus pathologies were main focus of our study, there were certain shortcomings because various studies have different parameters for assessment of these pathologies and also no standardization protocol. Therefore, there will be wide variations in the results by different researchers. Also there is no differentiation between the natures of fluid in the sinus as blood, mucous or pus appears same in the images.

The etiology of Maxillary sinus pathology is multi-factorial. A multidisciplinary approach involving the dentist, oral and maxillofacial surgeon, Ear Nose and Throat (ENT) specialist, pulmonologist, allergy experts and the radiologist may be required in the diagnosis and management of significant maxillary sinus findings [10, 11]. Pathological changes in the maxillary antrum can be easily identified on CBCT images. CBCT could be applied in the initial evaluation of the maxillary sinus due to its low cost and less radiation as compared to CT scan [12].

CONCLUSION

Based on our study, it can be concluded that the prevalence of incidental maxillary sinus pathologies is high in the asymptomatic dental patients. Therefore, oral radiologists, dentists, medical practitioners, maxillofacial and ENT surgeons should be aware of these incidental sinus pathologies. A comprehensive radiological examination of the entire CBCT volume helps clinician in early diagnosis, to make appropriate referrals, treatment planning and follow-up of the patient.

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