

PREVALENCE OF INCIDENTAL PATHOLOGIES IN THE MAXILLARY SINUS AMONG A SAMPLE OF ASYMPTOMATIC DENTAL PATIENTS USING CBCT—A RETROSPECTIVE ANALYSIS.

Prevalencia de patologías incidentales en el seno maxilar en una muestra de pacientes dentales asintomáticos mediante el uso de CBCT: un análisis retrospectivo.

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ABSTRACT:

Background: The incidence of abnormalities in asymptomatic people varies between 10.9% and 69.1%. The aim of this study was to assess the prevalence of pathologies in the maxillary sinuses using CBCT as a diagnostic tool in asymptomatic patients at King Faisal University's dental clinical complex in Al Hasa, Saudi Arabia.

Material and Methods: This retrospective cross-sectional study evaluated the CBCT images of 600 patients (male and female) and consisted of 1200 maxillary sinuses. The included patients ranged from 14–75 years old and were grouped into three age groups: (1) 14–30; (2) 31–60; (3) 61–75. The maxillary sinuses were observed for increased mucosal thickening, polypoidal mucosal thickening, polyps, and opacification changes. A correlation of these pathologic findings with age and gender was analyzed. Statistical analyses included a chi-square test and the significance level was $p < 0.05$.

Results: The incidence of the pathological findings in maxillary sinuses observed was 27.7%. The most common abnormality observed was mucosal thickening (63.3%), followed by polypoidal mucosal thickening (18.4%), opacification (10.2%) and sinus polyps (8.1%). However, there was no significant correlation between different age groups or gender.

Conclusion: The prevalence of pathologies in the maxillary sinuses is high in asymptomatic dental patients in this study; hence, dentists should be aware of them and evaluate the entire CBCT images comprehensively, as it will help with early diagnosis and treatment.

KEYWORDS:

Cone-Beam Computed Tomography; maxillary sinus; polyps; prevalence; retrospective studies; dentists.

RESUMEN:

Antecedentes: La incidencia de anomalías en personas asintomáticas varía entre el 10,9% y el 69,1%. El objetivo de este estudio fue evaluar la prevalencia de patologías en los senos maxilares utilizando CBCT como herramienta de diagnóstico en pacientes asintomáticos en el complejo clínico dental de la Universidad King Faisal en Al Hasa, Arabia Saudita.

Material y Métodos: Este estudio transversal retrospectivo evaluó las imágenes CBCT de 600 pacientes (hombres y mujeres) y constaba de 1200 senos maxilares. Los pacientes incluidos tenían entre 14 y 75 años y se agruparon en tres grupos de edad: (1) 14–30; (2) 31–60; (3) 61–75. Los senos maxilares se observaron para aumento del engrosamiento de la mucosa, engrosamiento de la mucosa polipoide, pólipos y cambios de opacificación. Se analizó una correlación de estos hallazgos patológicos con la edad y el sexo. Los análisis estadísticos incluyeron una prueba de chi-cuadrado y el nivel de significación fue $p < 0,05$.

Resultados: La incidencia de hallazgos patológicos en senos maxilares observados fue del 27,7%. La anomalía

más frecuente fue el engrosamiento de la mucosa (63,3%), seguido del engrosamiento de la mucosa polipoide (18,4%), la opacificación (10,2%) y los pólipos sinusales (8,1%). Sin embargo, no hubo una correlación significativa entre los diferentes grupos de edad o género.

Conclusion: La prevalencia de patologías en los senos maxilares es alta en los pacientes odontológicos asintomáticos de este estudio; por lo tanto, los dentistas deben analizar y evaluar las imágenes CBCT de manera integral, ya que ayudarán con el diagnóstico y el tratamiento temprano.

PALABRAS CLAVE:

Tomografía Computarizada de Haz Cónico; seno maxilar; pólipos; prevalencia; retrospective studies; odontólogos.

INTRODUCTION.

The maxillary sinuses are a pair of paranasal sinuses, lined by the Schneiderian membrane, a respiratory mucous membrane. The septa of the maxillary sinus are composed of cortical bone that divides the floor of the sinus into multiple chambers known as recesses.¹ During surgical procedures like implants, the risk of perforation of the floor increases if there are anatomic variations within the maxillary sinuses, such as septa, mucosal thickening of the sinus floor, or others. A study conducted by Raghav *et al.*,² recorded the presence of a high rate of incidental maxillary sinus abnormalities in a sample of asymptomatic dental patients. The incidence of abnormalities in asymptomatic people varied between 10.9% and 69.1%.

In normal physical situations, the mucous mem-

brane of the maxillary sinus is approximately 1mm thick, and radiographically, it is not detectable. However, if it is inflamed or any pathological changes occur, the thickness of the mucous membrane increases, and it becomes detectable under radiographs. The maxillary sinus can be examined with the help of radiology imaging techniques such as panoramic radiographs, paranasal sinus views, computed tomography (CT), magnetic resonance imaging (MRI), and cone beam computed tomography (CBCT).³⁻⁵

Among them, CT is considered the preferred option for examination of the maxillary sinuses. Due to their higher cost and radiation dose used, CT machines have limitations in dentistry.

As such, CBCT has emerged as an acceptable alternative to CT in dentistry. Despite its limitations

in differentiation of soft tissue, CBCT helps in identifying sinus abnormalities without additional radiation exposure.^{6,7}

Since it consists of a 3D imaging technique, it avoids the superimposition of the adjacent structures and provides images without geometric distortion. In comparison with conventional medical computed tomography, the patient's exposure to radiation is minimal with CBCT. Because of these qualities, it has become the imaging modality of choice for dental and maxillofacial imaging both for diagnosis and treatment planning.^{8,9}

A comprehensive radiological examination of the maxillary sinus includes assessment of the mucosa, fluid levels, bone alterations, and ostium. A treatment plan can be drawn with CBCT images and the help of various software.^{10,11}

There are only a few studies on the prevalence of maxillary sinus pathosis in Saudi Arabia, and none on the eastern province. Thus, the aim of this study was to assess the prevalence of pathosis in the maxillary sinuses using CBCT as a diagnostic tool in asymptomatic patients at King Faisal University's dental clinical complex in Al Hasa, Saudi Arabia.

MATERIALS AND METHODS.

Approval was obtained from King Faisal University's Institutional Research Ethics Committee (HAPO-05-HS-003). This retrospective study was conducted using electronically archived CBCT images, obtained with the help of i-CAT (Imaging Science International, Haffield, PA) for different diagnostic and treatment purposes.

At the time of taking CBCT, patients' consent was obtained for future research purposes of images usage maintaining confidentially. The asymptomatic patients' images (300 male and 300 female) were chosen based on their medical background and clinical test history entered the clinical history; 1200 maxillary sinuses were included. The sample size was calculated using an estimated prevalence of 50%, a precision level of 5% and a confidence interval of 90%.

The minimum number of samples needed for this

study was 271. This study comprised 600 images to overcome attrition and obtain more precise results.

The ages of the included patients ranged from 14 to 75 years and were grouped into:

(1) 14-30years; (2) 31-60 years; and (3) 61-75 years.

Inclusion criteria

This retrospective study included CBCT scans of the bilateral maxillary sinuses of patients.

1. 14 years and above
2. Presence of all permanent teeth in the maxilla except the 3rd molar.

Exclusion criteria

1. A history of antral pathologies and trauma
2. History of allergic sinusitis
3. Relapse of previously diagnosed and/or treated maxillary lesions
4. An infection that spreads to the maxillary sinus but originates in another location.
5. Infectious lesions with odontogenic origin.
6. Patients with syndromes and cases of congenital deformity
7. Images with artifacts and low quality.

A radiologist with 16 years of experience used i-CAT vision software to interpret CBCT pictures, and the same examiner repeated measurements after two weeks to assess fluctuations. The observer was calibrated by inspecting 15% of the sample before analyzing the images. The intra-examiner reliability test was done with Cohen's Kappa index and scored at 0.8 to rule out variables.

The maxillary sinuses were examined for increased mucosal thickening (MT), polypoidal mucosal thickening (PT), sinus polyps (SP), and opacification (OP); MT was evaluated by measuring the distance between the air-mucosal interface and the inner bony margins of the sinus, and when the mucosal thickness was greater than 3 mm, it was considered as pathology.^{8,11}

The presence of dome-shaped radiopacity in the maxillary sinus was considered a polyp. On imaging (CT, MRI), polyps usually appear as smooth, outwardly convex soft tissue masses, and they cannot be differentiated. Hence, both were included under polypoid thickening.

Statistical Analysis

All statistical analyses were carried out using SPSS 21.0 (SPSS for Windows; SPSS Inc., Chicago, IL, USA). The association between gender and age with the presence of maxillary sinus pathologies was carried through the chi-square analysis and the statistical significance level was set at $p < 0.05$.

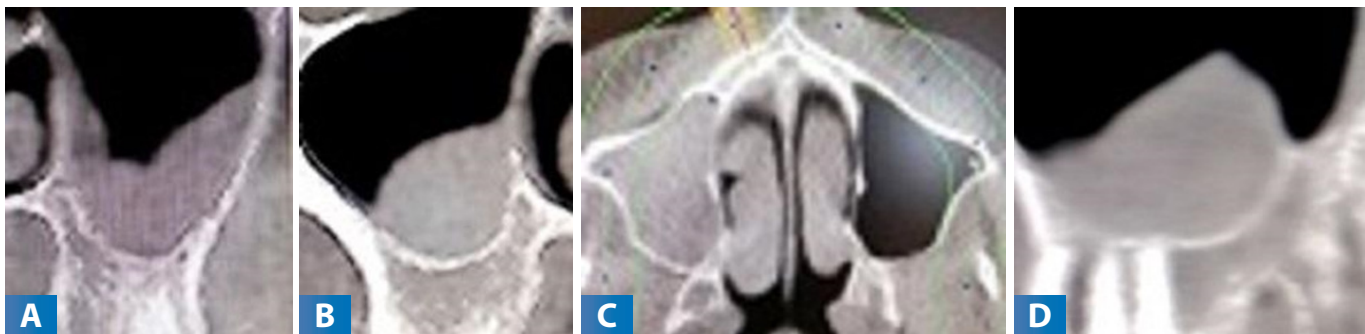
RESULTS.

The present study included 600 patients divided into three age groups, with an equal distribution of 200 patients in each group, with an equal gender distribution in each group, and a mean age of 38.6 ± 5.4 years (Table 1).

Of a total of 600 patients, 368 patients were advised CBCT for surgical procedures (61.3%), 171 patients (28.5%) underwent CBCT analysis for prosthetic rehabilitation, 43 patients (7.1%), and 18 patients (3%) had miscellaneous reasons, including references from other institutions for CBCT imaging (Table 2).

The prevalence of pathological findings in maxillary sinuses was 27.7% (332 images). Among the 332 identified pathologies, 47.1% were found in males and 52.9% in females. Even though the prevalence rate of sinus pathologies was found to be numerically higher in females than in males, the differences between the genders were not

Figure 1. Examples of Maxillary Sinus Pathologies found on Cone-Beam Computed Tomography.



A: Mucosal Thickening. B: Polypoidal Growth. C: Opacification of maxillary sinus. D: Sinus polyp.

Table 1. Participants characteristics distribution, n=600.

Variables		N	Mean age (years) ± SD
Age groups (years)	14-30	200	38.7 ± 5.4
	31-60	200	
	61-75	200	
Sex	Male	300	
	Female	300	

SD: Standard deviation.

Table 2. Characteristics frequency of Cone-Beam Computed Tomography (CBCT) included in this study.

REASONS FOR CBCT	N (%)
Surgical procedures	368 (61.3)
Prosthetic rehabilitations	171 (28.5)
Orthodontic reasons	43 (7.1)
Miscellaneous reasons	18 (3)
Total	600

Table 3. Prevalence of Maxillary Sinus Pathologies found on Cone-Beam Computed Tomography (CBCT).

LESIONS		GENDER		SIDE		AGE RANGE (YEARS)		
		Male	Female	Right	Left	14-30	31-60	61-75
Mucosal Thickening	Numbers	98	112	114	96	65	75	70
	Percentage (%)	(46.7)	(53.3)	(54.3)	(45.7)	(31.0)	(35.7)	(33.3)
Polypoidal Growth	Numbers	27	35	34	27	17	25	19
	Percentage (%)	(44.3)	(55.7)	(55.7)	(44.3)	(27.9)	(41.0)	(31.1)
Opacification	Numbers	16	18	18	16	11	13	10
	Percentage (%)	(47.1)	(52.9)	(52.9)	(47.1)	(32.4)	(38.2)	(29.4)
Sinus polyps	Numbers	14	13	15	12	8	12	7
	Percentage (%)	(51.9)	(48.1)	(55.6)	(44.4)	(29.6)	(44.4)	(25.9)
χ^2		1.43		0.087		4.3		
degree of freedom		6		0.933		3		
p-value		0.964		0.993		0.933		

significant ($p= 0.933$). (Table 3). Among the 332 identified pathologies, the prevalence of mucosal thickening (MT) was 63.3% (Figure 1A); polypoidal growth (PG) was 18.4% (Figure 1B); Opacification of maxillary sinus was 10.2% (Figure 1C); and sinus polyps 8.1% (Figure 1D).

About 54.3% of MT was present in the right sinuses and 45.7% in the left sinuses. Similarly, opacification was seen in 52.9% of the left sinuses and in 47.1% of the right sinuses (Table 3).

However, there was no significant difference in overall occurrence between the two groups ($p= 0.942$). The age range of 14–30 years exhibited

the least number of individuals with maxillary sinus pathologies (30.4%), while the age group of 31–60 years demonstrated the highest incidence of sinus pathologies (37.7%). About 31.9% of the patients in the age group of 61–75 years presented pathologies (Table 3).

Overall, the prevalence did not differ significantly between the age groups ($p= 0.964$).

DISCUSSION.

Different imaging modalities have been used for detecting maxillary sinus abnormalities. In general, MRI imaging demonstrates higher levels of accuracy

than other techniques. This study found the recent introduction of CBCT to be a feasible option for detecting incidental maxillary sinus pathologies.

Since it is cheaper and more radiation-effective than MRI and CT, respectively, it can be used easily for evaluating maxillary sinus pathologies. Similarly, the 3D imaging technique of CBCT is not only useful in screening but also in treatment planning for surgery in paranasal and implanted areas.¹²

Based on previous studies, it is understandable that the prevalence of maxillary sinus pathologies in asymptomatic patients is to a certain degree abnormal. Despite previous research linking the proximity of dental structures to maxillary sinuses as a cause of these pathologies, the link between periapical pathology and the type of maxillary sinus abnormality remains unclear.⁵

Early detection of maxillary sinus pathologies can help in timely diagnosis and treatment. The aim of the present study was to detect incidental pathologic findings in the maxillary sinuses of patients who had undergone CBCT imaging for various treatment purposes. The prevalence of pathological findings in maxillary sinuses observed in this study was 27.7% (332), lower than that reported by Raghav *et al.*,² study, which found maxillary sinus abnormalities in 52.7% of cases and Elwakeel *et al.*,¹³ study, which found incidental abnormalities in the maxillary sinus in 73% of cases. This study's results are closer those of Al-Zoubi *et al.*,¹⁴ (30.1%), Zain-Alabdeen *et al.*,¹⁵ (27.4%) and Binshabaib *et al.*,¹⁶ (32.1%).

In this study, a higher number of pathological findings were noted in females. However, these differences were not statistically significant, in accordance with Al-Zoubi *et al.*,¹⁴ Jagam *et al.*,¹⁸ Kumar *et al.*,¹⁸ and Kurtuldu *et al.*,¹⁹ who noted no gender predilection in their study samples. However, Elwakeel *et al.*,¹³ observed a higher prevalence of pathologies in females in their study. In contrast, other studies reported a significantly higher number of sinus pathoses in males.^{6,9,20}

In the present study, the most common finding was mucosal thickening (56.1%). This observation was consistent with several previous reports. Furthermore

Elwakeel *et al.*,¹³ reported 16% mucosal polypoid lesions, Al-Zoubi *et al.*,¹⁴ reported 21%, Binshabaib *et al.*,¹⁶ 26.7%, and Kurtuldu *et al.*,¹⁹ 11.8%.

In this study, the prevalence of mucosal polypoid lesions were 16.3%, similar to previous studies. The highest percentage of abnormalities was found in individuals ranging from 31 to 60 years of age, but no significant difference between different age groups was noted. This result is similar to the results of Kumar *et al.*,¹⁸ Al-Zoubi *et al.*,¹⁴ and Kurtuldu *et al.*¹⁹ However, some studies conducted by other researchers are not in agreement:

Elwakeel *et al.*,¹³ reported that patients in the second decade of life presented with the highest prevalence of abnormalities. However, this contrasts with the observations of Raghav *et al.*,² who noticed that the patients in the third decade presented with more pathologies in the maxillary sinus.

The limitations of the present study are that differentiation between polypoid thickening and mucous retention cysts, and partial and complete opacification was not discerned. In spite of these limitations, the present study emphasizes the need for CBCT scans and their role in diagnosis and treatment planning for early diagnosis and treatment.

CONCLUSION.

Based on the findings of this study, even among asymptomatic dental patients, maxillary sinus diseases are common. As a result, dentists should be aware of the high prevalence of these abnormalities in the maxillary sinus.

Dentomaxillofacial radiologist examinations of routine dental patients aid clinicians in accurate diagnosis, prompt referrals, comprehensive treatment planning, and follow-up.

Conflict of interests:

The author deny any conflicts of interest.

Ethics approval:

Study approved by the Institutional Research Ethics Committee of King Faisal University (HAPO-05-HS-003).

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Authors' contributions:

Mahabob N: Conceptualization, Analysis, Writing.

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