

Maxillary Sinus Pathologies In Orthopantomography

Research Article

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Abstract

Background: The maxillary sinus is clinically significant to the dental professional because of its close proximity to teeth and its supporting structures. The maxillary sinus pathologies can mimic odontogenic disease and conversely, the odontogenic disease may mimic sinus pathologies. The routine use of panoramic imaging by dentists unlocks a room of opportunity for the evaluation of the prevalence of pathologies involving the maxillary sinus. Hence the aim of the study was to evaluate the frequency and location of maxillary sinus pathologies in orthopantomogram (OPG)

Materials and Methods: A retrospective study was conducted on 1000 OPGs taken using Genoray Papaya 3D plus device in the Department of Oral Medicine and Radiology, Saveetha Dental College and hospital. Using Triana software the maxillary sinus and its floor, roof, medial and lateral wall were evaluated for the presence of any pathologies. The inter-observer agreement among the two observers was assessed using Kappa statistics.

Results: On analysing 2000 maxillary sinuses in 1000 panoramic radiographs, maxillary sinus pathology was present in 250 patients with retention pseudocyst being the most frequently found maxillary sinus seen in 105 patients. The floor of the maxillary sinus was the most frequently affected location in the maxillary sinus in 188 patients.

Conclusion: Panoramic imaging modality can be an useful imaging modality not only for routine dental purpose but also for the evaluation of maxillary sinus pathologies. The oral radiologist should be aware of the maxillary sinus pathologies, their radiographic appearance and the clinical significance.

Keywords: Maxillary Sinus Pathology; Sinusitis; Polyp, Orthopantomogram; Mucositis.

Introduction

Panoramic radiography also known as orthopantomography (OPG) is a standard diagnostic tool which is used more routinely in dental practice for evaluation of facial and dental pain. The technique of 2-dimensional panoramic imaging was first developed during the first half of the 20th century but only in the year 1959 the first device utilizing this technology was introduced [1, 2]. OPG helps in visualization of teeth and its supporting structures, jaw bones, temporomandibular joint and maxillary sinuses. The working principle behind panoramic imaging technique is that the x-ray tube and focal trough move in opposite direction at the same time leading the object within the focal trough in a fixed position with clear depiction as result. The panoramic imaging is

highly dependent on positioning of the patient [3-6]. The advantages of OPG are general availability, low costs and radiation dose as low as 10 μ Sv making them more useful in routine dental practice [7-10]. A disadvantage of the panoramic imaging is blurred or not visible image of the structures outside the focal trough.

The maxillary sinus also known as maxillary antra or antra of Highmore is one of the largest paranasal sinuses which is in pyramidal in shape. The apex of the pyramid points towards the zygomatic process of maxilla and its base points towards the lateral wall of the nose [11]. The maxillary sinus can be visualized using various imaging modalities such as OPG, water's view (paranasal sinus view), conventional tomography (CT), magnetic resonance imaging (MRI) and cone beam computed tomography (CBCT) [12,

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13]. The location and distribution of the maxillary sinus condition and pathologies requires the participation of several medical specialists such as oral and maxillofacial surgeon, otorhinolaryngologists or even an allergist in the diagnosis and management [14].

The maxillary sinus is clinically significant to the dental professional because of its close proximity to teeth and its supporting structures. Recent evidences suggest that any trauma to the teeth, complicated extractions, pulpal, periodontal pathoses and periapical abscesses, and invasive implant therapy particularly perforation of Schneiderian membrane have resulted in increased incidence of maxillary sinusitis. Subsequently, the maxillary sinus pathologies can mimic odontogenic disease and conversely, the odontogenic disease may mimic sinus pathologies. The close approximation of roots of the teeth in the maxillary posterior segments with the maxillary sinus is known as draping [15].

The maxillary sinus pathologies can be broadly classified into intrinsic disease (originating primarily from maxillary sinus) and extrinsic disease (originating outside the sinus which either impinge or infiltrate into maxillary sinus). The intrinsic maxillary sinus pathologies include sinusitis, mucositis, retention pseudocyst, antral polyp, antrolith, benign and malignant neoplasms arising from maxillary sinus. The extrinsic maxillary sinus pathologies include benign odontogenic cyst and neoplasms, bone dysplasias and dental structures such as root stumps or impacted teeth displaced into maxillary sinus [16].

Imaging modalities such as panoramic radiograph, CT and CBCT plays an essential role in the diagnosis and treatment planning of various pathologies in the maxillofacial region. The area of the maxillary sinus is within the imaging field when panoramic radiograph is indicated for routine diagnostic purposes such as periapical and periodontal pathologies, bony and inflammatory pathologies, endodontic lesion, impacted and supernumerary teeth and orthodontics [17]. Hence pathologies involving the maxillary sinus are frequently viewed by the maxillofacial radiologists. The routine use of panoramic imaging by dentists unlocks a room of opportunity for the evaluation of the prevalence of pathologies involving the maxillary sinus. The incidence of maxillary sinus pathologies in asymptomatic patients have been reported to vary

from 10.9% to 69.1% in various studies [18-22].

Hence the aim of the present study was to evaluate the frequency and location of maxillary sinus pathologies in orthopantomogram.

Materials And Methods

A retrospective study was conducted on 1000 OPGs taken using Genoray Papaya 3D plus device in the Department of Oral Medicine and Radiology, Saveetha Dental College and hospital taken between the month of October 2020 to December 2020. The inclusion criteria included good quality OPG images and patients aged between 18-80 years of age. The exclusion criteria included images with any positioning and radiographic errors, paediatric patients and presence of metallic artefacts impairing the maxillary sinus visualization were excluded. The research protocol was approved by the Institutional Research Ethics Committee. Using Triana software the maxillary sinus and its floor, roof, medial and lateral wall were evaluated for the presence of any pathologies. Identification of maxillary sinus pathologies:

Mucositis

Criteria used to detect the presence of mucositis is a well-defined, non-corticated radiopaque band of increased radiopacity present parallelly along the floor of the maxillary sinus (Figure Ia&Ib).

Sinusitis

The thickening of sinus mucosa and the accumulation of secretions that accompany sinusitis reduces the maxillary sinus air space and result in appearing the maxillary sinus more radio-opaque comparatively. Hence the presence of near complete or complete radio-opacification of the maxillary sinus was the criteria used to detect maxillary sinusitis (Figure IIa & IIb).

Mucous Retention Pseudocyst

Presence of a well-defined, non-corticated, smooth, dome-shaped radiopaque mass with homogenous internal aspect and more ra-

Figure Ia&Ib. Showing panoramic images of maxillary mucositis with yellow-coloured arrows showing well-defined radiopacity along the floor of the maxillary sinus.

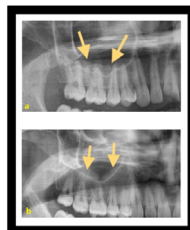
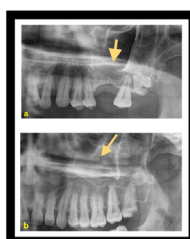


Figure IIa and IIb. Showing panoramic images of maxillary sinusitis with yellow-coloured arrows denoting partial (IIa) and complete (IIb) radio-opacification of the maxillary sinus.



diopaque than the surrounding air of the sinus cavity was considered as criteria for the detection of retention pseudocyst (Figure IIIa & IIIb). When a retention pseudocyst occurs adjacent to the root of a tooth, the lamina dura surrounding the root is intact and the width of the periodontal ligamental space is unaffected.

Antral polyp

The radiographic appearance of an antral polyp may closely mimic a retention pseudocyst. The criteria used to identify a polyp was the appearance of a well-defined, non-corticated, smooth, dome-shaped radiopaque mass with homogenous internal aspect, more radiopaque than the surrounding air of the sinus cavity and the presence of a thickened mucous membrane lining (Figure IVa&IVb). In retention pseudocyst the adjacent mucous membrane lining is not apparent usually.

Antrolith

Antrolith occurs within the maxillary sinus usually positioned above the floor of the maxillary antrum. The imaging criteria used in detection of antrolith included the presence of a smooth or irregularly shaped radiopacity with well-defined periphery.

Dental structures displaced into the sinuses

Premolar or molar teeth or root fragments may be displaced or impacted into the sinus because of their close proximity. Any well-defined radio-opaque structures mimicking tooth structure or parts of tooth structure such as root located near the floor and walls of the maxillary sinus was the imaging criteria used in iden-

tification of dental structures displaced into the maxillary sinus (Va&Vb).

The age and sex of the patient, frequency and location of the maxillary sinus pathologies observed in the OPGs were collected. The collected data was tabulated and analysed using SPSS software 23.0 for windows. The inter-observer agreement among the two observers was assessed using Kappa statistics, based on the following criteria: kappa value of, 0.40 was considered to indicate poor agreement, 0.40-0.59 fair agreement, 0.60-0.74 good agreement and 0.75-1.00 excellent agreement.

Results

A total of 1000 panoramic images of patients were examined, out of which 600 were male and 400 were female. Among the analysed sample maxillary sinus pathology was present in 250 patients (25%) and absent in 750(75%) patients.

Among the 250 maxillary sinus pathologies, retention pseudocyst was the most frequently present, seen in 105 (10.5%) patients followed by dental structures such as tooth or parts of tooth such as roots displaced into maxillary sinus seen in 55 (5.5%). Maxillary antral polyp was the least frequently present pathology present in 20 patients (2%) (Figure VI).

On analysing the location of 250 maxillary sinus pathologies the floor of the maxillary sinus most frequently affected seen in 188 (75%) patients followed by the medial wall of the maxillary sinus affected in 50 (20%) patients (Figure VII).

Figure IIIa and IIIb. Showing panoramic images of retention pseudocyst present on the floor of the maxillary sinus with red-coloured arrows denoting a well-defined, non-corticated, smooth, dome-shaped radiopaque mass with homogenous internal aspect and more radiopaque than the surrounding air of the sinus cavity.

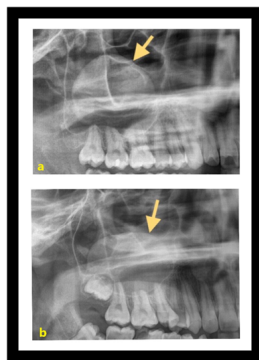


Figure IVa and IVb. Showing panoramic images of antral polyp present on the floor of the maxillary sinus with red-coloured arrows denoting a well-defined, non-corticated, smooth, dome-shaped radiopaque mass with homogenous internal aspect and more radiopaque than the surrounding air of the sinus cavity with the presence of a thickened mucous membrane lining.

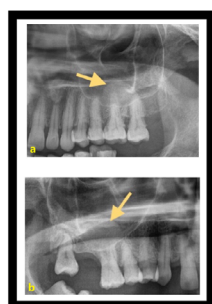


Figure Va. Showing radiopaque root like structure seen displaced into the floor of the right maxillary sinus and Figure Vb showing radiopaque teeth-like structure seen impacted on the lateral wall of the left maxillary sinus.

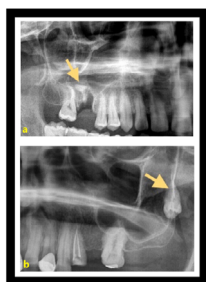


Figure VI. Showing the frequency distribution of maxillary sinus pathologies.

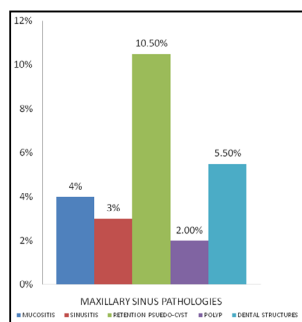


Figure VII. Showing the location wise distribution of maxillary sinus pathologies.

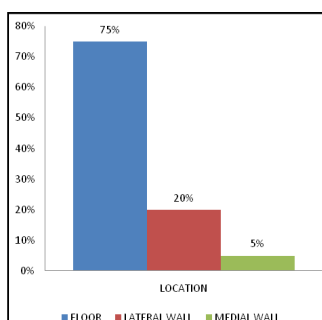


Table 1. Showing the prevalence of maxillary sinus pathologies in males and females.

MAXILLARY SINUS PATHOLOGIES	MALES	FEMALES
Present	170	80
Absent	430	320
Total	600	400

The inter-observer agreement for OPG was excellent for all types of maxillary sinus pathologies (kappa is 0.97 for mucositis, kappa is 0.84 for sinusitis, kappa is 0.96 for retention pseudocyst, kappa value is 1 for mucosal polyp and dental structures in sinus).

Discussion

In this study 1000 (2000 maxillary sinus) OPGs were evaluated retrospectively for the presence of maxillary sinus pathologies. The prevalence of maxillary sinus pathologies was higher in males than females in our study which is in accordance with other previous studies [22, 23].

In our study the retention pseudocyst was the most frequently present pathology followed by dental structures displaced into the sinus. The results are in contrast to previous studies [24, 25]. The variations observed in the study could be due to different imaging modality used, difference in the population evaluated, the variation in the sample size and the different diagnostic criteria utilised

for various pathologies.

In previous studies different modalities have been used to detect maxillary sinus pathologies and results have shown a wide range of incidence from 11% to 69% with most of the studies having the prevalence of maxillary sinus pathologies between 30% to 50% which was in accordance to our study result [26-32]. Among the different imaging modalities MRI seems to demonstrate higher levels of incidental maxillary sinus abnormalities than CT scans due to their higher sensitivity in detecting soft-tissue pathologies [33-34]. MRI studies have found the prevalence of maxillary sinus pathologies in a range of 26-50%.

Recently, CBCT is used in many studies for detecting incidental maxillary sinus pathologies because of its increased applications in dentistry. CBCT as an emerging 3D imaging modality which could be of clinical value in diagnosis of maxillary sinus pathologies. But OPG is more cost-effective, have increased availability and low radiation dose when compared to CBCT. Hence

OPG can be used for screening of maxillary sinus pathologies in asymptomatic dental patients. The maxillary sinus pathologies detected in OPGs can also help in early diagnosis and treatment before the progression of the disease.

Even though OPG has several advantages over CBCT, it can only be used for screening maxillary sinus pathologies for confirmatory diagnosis a 3-dimensional imaging modality such as conventional CT or CBCT remains to be a gold standard. The limitations of the present study are all the diagnosed maxillary sinus pathologies are not further evaluated using 3D imaging or histopathological evaluation. Since panoramic image has numerous superimposition and blurring, the diagnostic validity is highly variable.

In spite of the limitation, the present study indicates that OPG can be useful in early identification and evaluation of maxillary sinus pathologies.

Conclusion

Panoramic imaging modality can be an useful imaging modality not only for routine dental purpose but also for the evaluation of maxillary sinus pathologies. The oral radiologist should be aware of the maxillary sinus pathologies, their radiographic appearance and the clinical significance. Incidental maxillary sinus pathologies are highly prevalent in asymptomatic dental patients. Hence a comprehensive evaluation of the panoramic image and subjecting the patient to 3d-imaging whenever necessary can help in early diagnosis, treatment and follow-up of the patient.

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