

Original Article

Evaluation of Relationship of Root to Sinus in Maxillary Sinusitis Patients- A Comparative Assessment of Conventional Radiographs and CBCT

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Abstract

Background: Assessment of the relationship between roots of maxillary premolars and molars and inferior wall of the maxillary sinus is essential in oral and maxillofacial pathology diagnosis. Varied radiographic techniques have been used in detection of tooth root protrusion in the maxillary sinus. CBCT (Cone beam computed tomography) offers numerous advantages compared to traditional 2D (two dimensional) and is a reliable technique for visualizing anatomical structures in the maxillofacial region and for assessing the relationship of teeth roots to adjacent structures including the maxillary sinus when compared to panoramic imaging. **Aim:** To compare CBCT with conventional radiography in evaluation of relation of root to sinus. **Methods:** A cross-sectional study was performed. 36 patients were selected and were divided into two groups and then relation of root to sinus i.e. root penetrating sinus, below sinus and root tip in contact with sinus was evaluated in OPG (orthopantomograms), PNS (paranasal sinus view) and CBCT. Data were analyzed using descriptive statistics, Pearson's Chi Square test. **Results:** Root relation to sinus floor was insignificant for Group 1 (Sinusitis of non odontogenic origin) and 2 (Sinusitis of odontogenic origin) in OPG and PNS when compared to CBCT in which it was significant (p value = 0.21) in group 2 patients i.e. sinusitis of odontogenic origin while in group 1 patients (p value = .092) which was non-significant. **Conclusion-** Relation of root to sinus is better visualized in CBCT when compared to PNS and OPG.

Key Words: Cone beam computed tomography, Maxillary Sinus, Odontogenic, Conventional radiographs.

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Introduction

The maxillary sinus 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 close relationship of the maxillary sinus and the roots of the maxillary molars can lead to accidental

oroantral communication.² It has been reported that the anatomical relationship between the root and the cortical plates might influence the spread of odontogenic infection originating in the maxillary molars.³ Furthermore, the maxillary sinus has been found to be the most significant

pathway of periapical infection spreading for maxillary first and second premolars.⁴ The maxillary tooth root and sinus relationship can be assessed using different radiographic techniques. Conventional radiographs used in dental clinics include mainly intraoral periapical (PA) radiographs and to a lesser extent orthopantomograms (OPG) and Waters view.⁵ Similarly the reliability of PA radiographs in detection of root penetration in the maxillary sinus also needs further investigations. Otherwise, cone beam computed tomography (CBCT) scanning technology, which has been in wide use in dentistry for the last decade, is advantageous over traditional CT scanning technology since it provides comparable images at reduced dose and cost.⁶ The purpose of the study was to compare CBCT with conventional radiography in evaluation of relation of root to sinus changes

Methodology

A cross sectional study was performed on patients attending OPD at Peoples Dental Academy and patient referred from ENT Department. The patient ages ranged between 7 and 82 years of both male and females were included. Subjects for the study were selected through detailed case history, clinical examination and radiographic screening.

A total of 36 patients were included in this study which were divided into two groups:

Group 1: Sinusitis of Non Odontogenic Origin

Group 2: Sinusitis of Odontogenic Origin

Diagnostic criteria as given by Michelle Maillet in (2011)⁷ was followed-

Sinusitis of Odontogenic Origin: A soft-tissue density mass within the sinuses is a sinusitis of odontogenic origin if it fulfills the following criteria: carious tooth, tooth with defective restoration, or extraction site with or without radiographically evident periapical lesion and mucosal thickening

limited to the area of the tooth or extraction site in question. (Figure1)

Sinusitis of Non-odontogenic Origin:

A soft-tissue density mass within the sinuses is a sinusitis of nonodontogenic origin if it fulfills the following criteria: teeth are noncarious, have coronal and/or endodontic restorations of good quality without radiographically evident periapical lesion or if extracted, intact or healing socket and mucosal thickening is not limited to any tooth. (Figure 2)

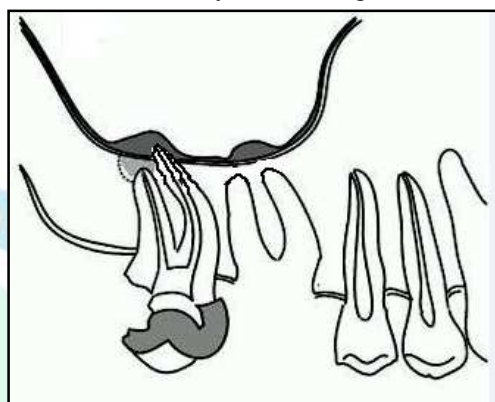


Figure 1: Sinusitis of odontogenic origin

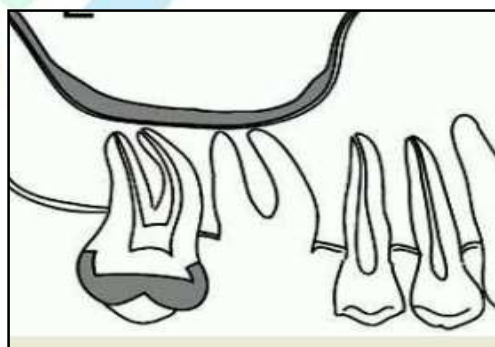


Figure 2: Sinusitis of non-odontogenic origin

In radiographic screening patients were subjected for conventional radiography such as OPG and PNS and those patients with sinus changes were subjected for CBCT. CBCT{CBCT was done at Geeta Digital Imaging Centre In Bhopal with CT Machine-Kodak (CS 9300) with scanning time of 12-28 sec. The root tip of the tooth

found in most approximation of the sinus or was found penetrating sinus was considered mainly. Lines were drawn on the cross sectional images between the deepest point of the maxillary sinus floor and the root tips of the maxillary first and second premolars and first, second molar, and the distances were measured using built-in measurement tools and relation of root to sinus was analyzed in all the three imaging modalities.

To quantify intra-observer agreements, CBCT images were randomly selected from the sample and analyzed twice by the main observer. There was a period of 1 month between readings. Another observer also measured the same images to verify inter-observer reliability.



Figure 3: Relation of root to sinus in OPG

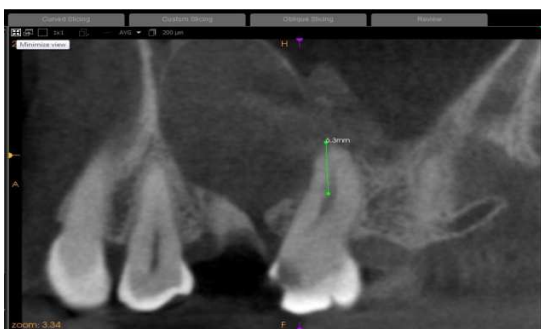


Figure 4: CBCT image showing root penetrating the sinus



Figure 5: CBCT image showing root tip in contact with sinus

Results

Our study consisted of total 36 patients that reported to PDA (Peoples Dental Academy) OMR (Oral medicine and Radiology) of which 13 were male and 23 were female patients. 24 subjects completed the required study protocol for sinusitis of non odontogenic origin (Group 1). 12 subjects completed the required study protocol for sinusitis of odontogenic origin Group 2.

All data was coded and analyzed using IBM SAS SPSS TM version 19 (International Business Machine Statistical Analyzing System Software package used for Statistical Analysis). All categorical data between experimental groups were compared using Pearson's Chi Square test. The level of significance was set at $p \leq 0.05$ at 95% confidence interval

In patients of Group 1 and Group 2 Relation of root to the sinus is evaluated in OPG, PNS and CBCT as shown in (Figure 6)

1. Root tip below the sinus
2. Root tip in contact with the sinus floor
3. Root tip penetrating into the sinus
4. Root tip penetrating into the sinus

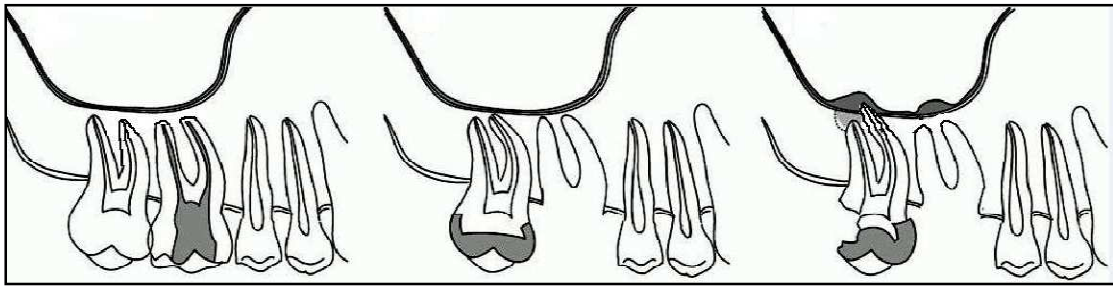


Figure 6: Relation of Root to Sinus

Table 1: Relation of root to the sinus in noted in OPG in Group 1 patients sinusitis of non odontogenic origin

Tooth Position Below Sinus	46.25
Contact with Sinus	50.0%
Penetrating Sinus	37.5%

Table 2: Relation of root to sinus is depicted in PNS of the patients

Tooth position Below Sinus	46.2%
Contact with sinus	66.7%
Penetrating sinus	20.0%

Table 3: Relation of root to the sinus in note in Group 1 patients in CBCT

Tooth position Below sinus	23.1%
Contact with sinus	50.0%
Penetrating sinus	20.0%

Table 4: Relation of root to the sinus in noted in OPG in Group 2 patient's sinusitis of odontogenic origin

Below sinus	66.70%
Tooth position Contact with sinus	60.00%
penetrating sinus	25%

Table 5: Relation of root to sinus is depicted in PNS of the patients

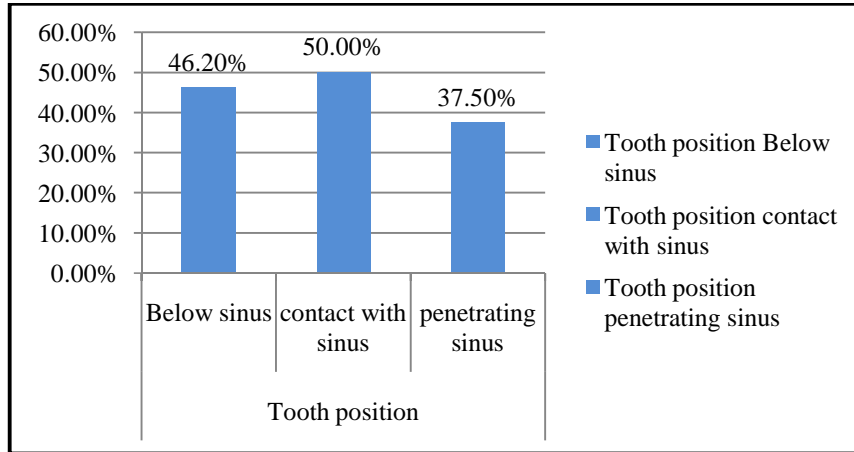
Below sinus	23.0%
Tooth position Contact with sinus	16.70%
Penetrating sinus	20%

Table 6: Relation of root to sinus is depicted in CBCT of the patients

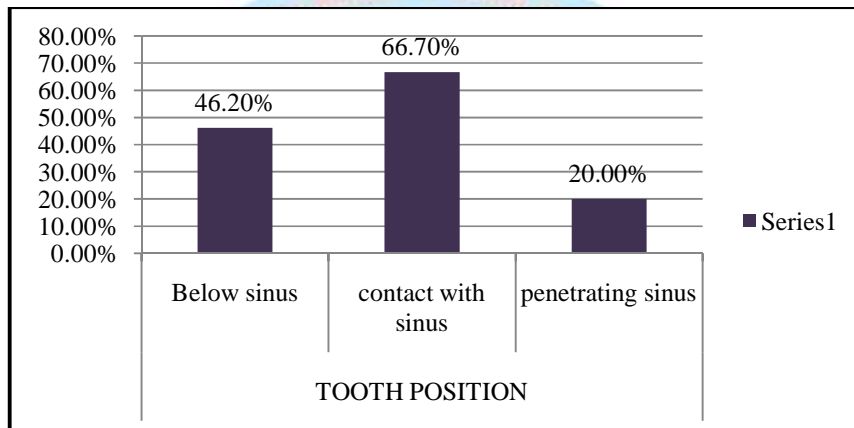
Below sinus	33.0%
Tooth position Contact with sinus	20.00%
penetrating sinus	0%

Graphs 1, 2 and 3: It depicts relation of root to the sinus in OPG, PNS and CBCT in Group 1 patients.

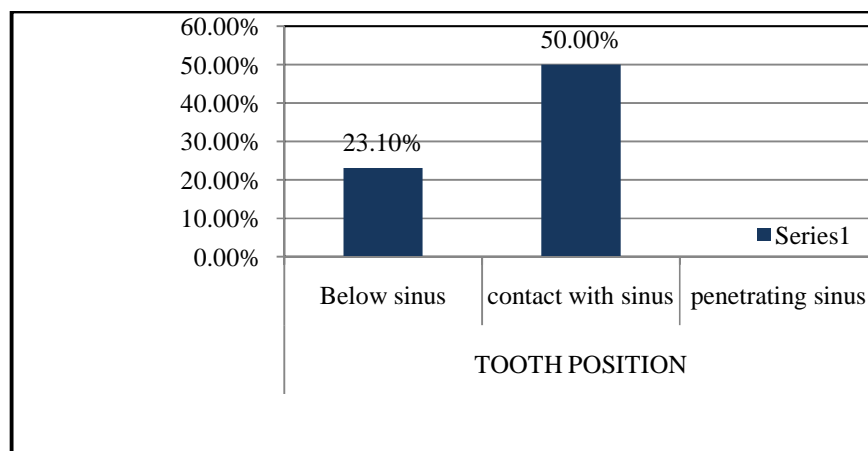
Graph 1



Graph 2

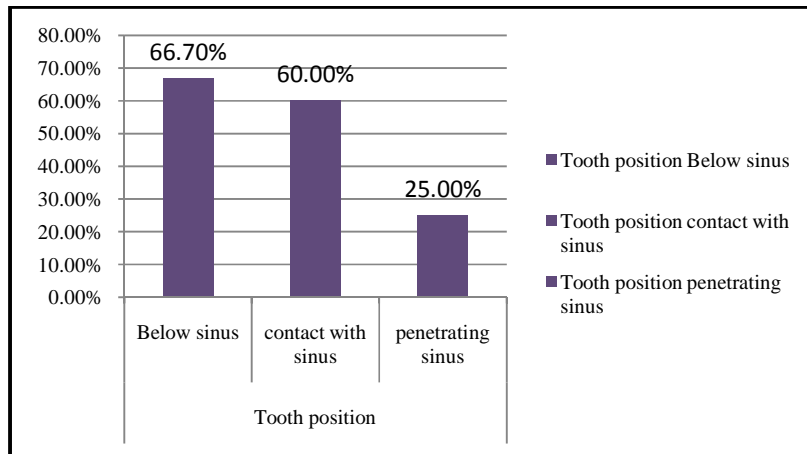


Graph 3

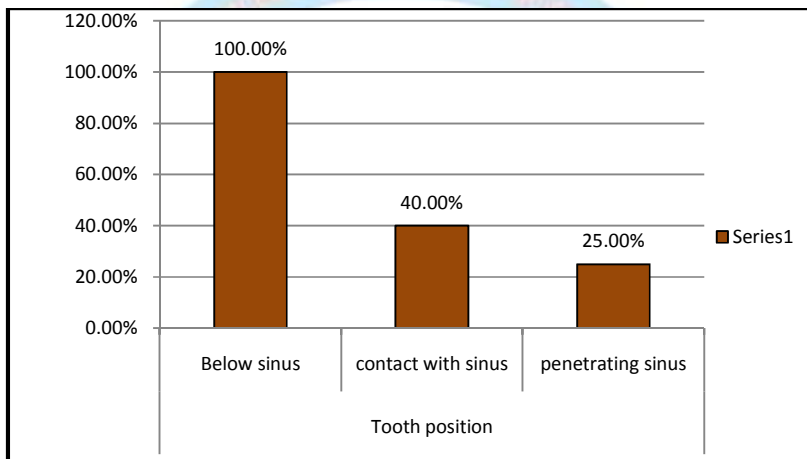


Graphs 4, 5 and 6: It depicts relation of root to the sinus in OPG, PNS and CBCT in Group 2 patients

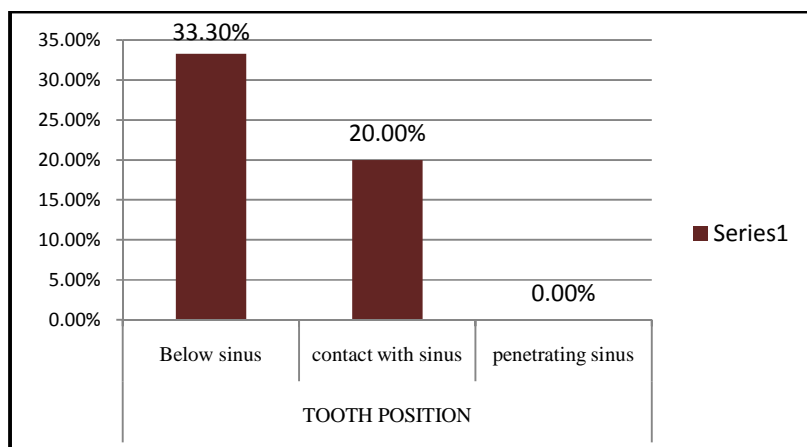
Graph 4



Graph 5



Graph 6



Discussion

In our study we found that root relation to sinus floor was insignificant for Group 1 (Sinusitis of non odontogenic origin) and group 2 (Sinusitis of odontogenic origin) patients in conventional radiography such as OPG and PNS when compared to CBCT in which it was significant (p value =0.21) in group 2 patients i.e sinusitis of odontogenic origin concluding the fact that CBCT is more specific and sensitive technology when compared to conventional radiography in evaluating relation of root to sinus. These findings correlated with the findings of Bassam A. Hassan et al (2009)⁸ who concluded in his study that both periapical radiographs and orthopantomograms are not reliable in determination of exact relationship between the apex of tooth root and the maxillary sinus floor. Periapical radiography is slightly more reliable than orthopantomography in determining this relationship. Overall correlation between OPG and CBCT assessments scores independently of tooth type was 50%, 26% and 56.1% for (class 1) in which the root penetrated the sinus wall (class 2) at least one root tip is against the sinus wall , (class 3) there were no contact between the root and the sinus floor and this was most frequently observed with the first premolar.

Reports indicate that CBCT images provide clinically relevant information not found in periapical images .Bornstein. R et al (2013)⁹ in A recent study used CBCT as the reference imaging modality(gold standard) to compare the accuracy of periapical and panoramic radiography in detecting periapical lesions. This study concluded that CBCT had better diagnostic accuracy than periapical and panoramic radiography. Panoramic images were the least sensitive in detecting lesions. Similarly Brüllmann et al in (2011)¹⁰ conducted a study to evaluate sinus changes in CBCT and he found that the percentage of patients with sinus findings

upon CBCT examinations in this study (74%) was higher than the percentage found by Logan and Brocklebank¹¹ in occipitomental radiograph.

Conclusion

Relation of root to sinus is better visualized in CBCT than in PNS and OPG .CBCT is more sensitive imaging modality as compared to OPG and PNS, because of the complex anatomy of the oral and maxillofacial region, it is difficult to visualize important anatomical features due to the superimposition of structures. Among the different radiographic techniques, the method used in the present study, that is CBCT, is valuable technique due to the 3D imaging of hard tissue structures, being appropriate for evaluation of sinus floor and root relationship for patients with sinus changes.

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