Relationship between Maxillary Molar Root Tips and Maxillary Sinus Floor Using CBCT

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Abstract

Introduction: Maxillary Sinus is a triangular-shaped paranasal sinus located close to the nose and maxillary posterior teeth. It the largest of the four paranasal sinuses and is responsible for the resonance of voice and also in the dissipation of any unwanted forces preventing injury to maxillofacial bones. Overtime pneumatization of the maxillary sinus takes where age is a significant factor. Tooth loss may also lead to loss of bone, which in turn causes reduced bone density and insufficient bone quantity and quality for the placement of implants.

Materials and Method: CBCT scans were gathered and analyzed to establish a relationship between the maxillary posterior root tips and the sinus floor. We had collected 30 CBCTs the Department of Oral Medicine & Radiology, Saveetha dental college, Chennai. The distances of the root tip of the maxillary first and second molar to the sinus floor was measured. Statistical analysis was done on the collected data.

Results: Mean and standard deviations of the distance of each root tip of maxillary first and second molar from the maxillary sinus floor were obtained. No significant statistical difference was found between the respective roots of maxillary first and second molars.

Conclusion: Knowledge regarding the relationship between posterior root tips of the maxilla and the sinus is needed to prevent any unwanted complications during dental procedures

Keywords: *CBCT, maxillary sinus, maxillary molar.*

Introduction

The maxillary sinus is one of the first of the paranasal sinuses to develop, its pyramidal in shape and completes its growth around 20 years of age with the eruption of the maxillary third molar.[1] Maxillary sinus has an average volume 15cc and protrusion of the maxillary posterior root tips maybe seen in some cases which can lead to various implications during surgical and orthodontic procedures and is essential for clinicians to be aware of the apical position of the teeth in relation to the maxillary sinus.[2] Pneumatisation is a physiologic process that occurs in all paranasal sinuses leading to an increase in the volume of the sinus. With age pneumatization of the maxillary sinus occurs. Especially following extraction of posterior maxillary teeth, marked reduction in bone density is seen accompanied by disuse atrophy of the bone accelerating the pneumatization of the maxillary sinus.[3]

A periapical lesion or a periodontal lesion in relation to the maxillary molars or premolars may reach the sinus leading to sinusitis. Endodontic treatment and

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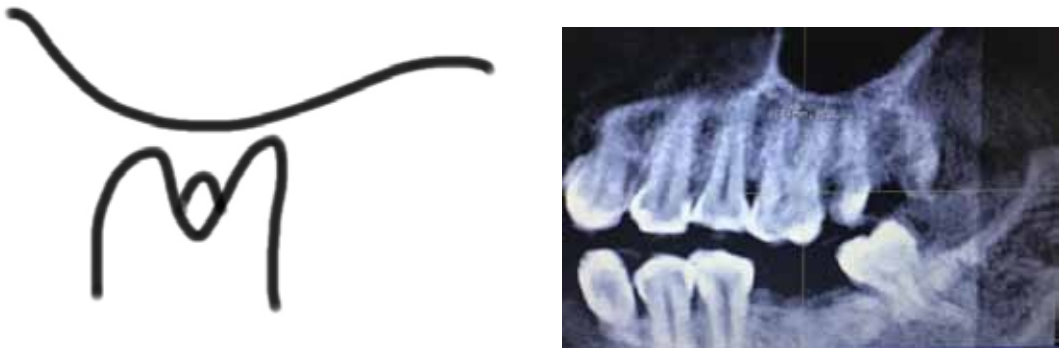
extractions of maxillary posteriors may also lead to penetration into the sinus in some cases leading to an oroantral communication,[3,4] due to high caries index of maxillary first molar it is more prone to be extracted, and the possibility of an oroantral communication is marked.[5] OPG and IOPA are commonly used radiographic imaging modalities to visualize the maxillary sinus but being two dimensional; it has its limitations. CBCT has been a more preferred choice of imaging due to its ability to provide clear images without any overlapping of anatomic structures and also its ability to visualize distinct elevations along the floor of the maxillary sinus extending between the roots of teeth commonly called as hillocks or septa.[6]

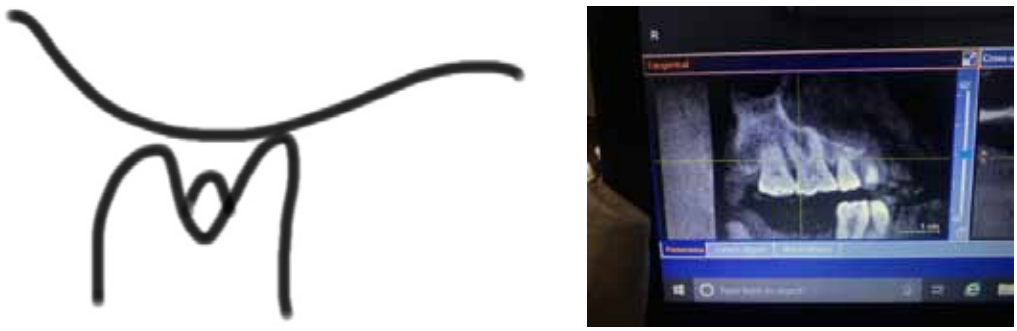
This study aimed to establish a relationship between the maxillary sinus floor and the apices of the maxillary teeth roots using dental CBCT, thereby to provide clinicians with a protocol while working on posterior maxillary teeth. Though several studies have been done on the same note, we have not observed an adequate number of studiesin the Indian population.

Materials and Method

We obtained the CBCT scans for the study from the Department of Oral Medicine and Radiology, Saveetha dental college. A total of 30 scans was collected. Out these 12 were men and 18 were female, and the average age was 31.8. CBCTs were all obtained during routine investigations for several procedures, among which scans with no pathology or missing teeth in the maxillary region were selected. Exclusion criteria include root canal treated maxillary posteriors, fractures, periapical lesions or patients who have undergone orthodontic treatment. Inclusion criteria consisted of patients without any periapical lesions in the maxillary posterior region, healthy maxillary bone with no break in the continuity of the bone and patients with vital maxillary posteriors. All CBCT scans obtained were nalysed and lines were drawn using the GALILEOS Viewer by DENTSPLY Sirona USA, Field of view size was 8x8cm and 400 Hm resolution, to measure the distance of the apices of the maxillary 1st molars and maxillary 2nd molars. All root tips were grouped based on their relation to the maxillary sinus floor, as follows: Group 1: Root tips away from the sinus floor. Group 2; anyone root tips in contact with the sinus floor; Group 3: All root tips of the molar in contact with the sinus floor; Group 4; Root tips into the maxillary sinus.(Fig1) Unpaired T-tests were used to compare measurements between maxillary sinus floor and mesial, distal and palatal root tips of the maxillary molars. Statistical analysis was done using SPSS V.23.

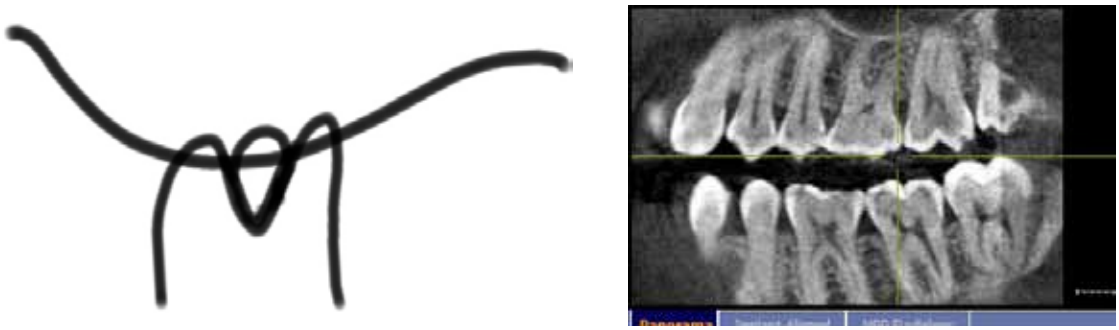


Group 1



Group 2

Group 3



Group 4

Fig 1: CBCT Cropped panoramic images showing the relationship of maxillary root tips to the maxillary sinus

Results

Mean and standard deviations of the distance of each root tip of a maxillary first and second molar from the maxillary sinus floor were obtained and are given in the table below.

A significant 41% of the 1st molars and 43% of the 2nd molars were classified under group 1. About 24% of the 1st molars and 20% of the 2nd molars had their root tips into the sinus.

Table 1: Mean distatances of Mesiobuccal root of maxillary molar to sinus

Mesiobuccal Root	1st Molar	2nd Molar
Group 1	1.94±1.40	1.5±0.39
Group 2	0.67±0.62	0.55±0.56
Group 3	2.58±1.60	0
Group 4	1.05±0.66	0.92±0.4
Mean	0.74267	0.592

Table 2: Mean distatances of Distobuccal root of maxillary molar to sinus

Distobuccal Root	1st Molar	2nd Molar
Group 1	1.77±1.47	1.71±0.71
Group 2	1.02±0.14	1.01±0.16
Group 3	0.25±0.55	1.31±0.62
Group 4	0.8±0.44	1.18±0.66
Mean	0.801333	0.716667

Table 3: Mean distatances of Palatal root of maxillary molar to sinus

Palatal Root	1st Molar	2nd Molar
Group 1	1.51±0.75	1.64±1.08
Group 2	1.41±0.40	1.02±0.14
Group 3	1.24±0.41	1.47±0.30
Group 4	1.01±0.73	1.32±0.40

No significant statistical difference (P>0.05) was found between mean distances of each root of 1st and 2nd molar.

Discussion

The relationship of the maxillary sinus to the posterior maxillary teeth plays a major role in treatment planning. This study was conducted to establish a relationship of roots of maxillary first molar and roots of the maxillary second molar to the floor of the maxillary sinus. Pneumatisation of the sinus and bone loss following extractions is a significant concern during prosthetic replacements.

Practitioners must be aware of the bone loss that follows extraction and the length of bone available for implant placements to prevent perforation of the sinus floor[5]. Oro antral spread of infections maybe associated with the relationship of the root tips of posterior teeth to the sinus floor. Cases of orbital abscess accompanied with periapical inflammation have been reported following root canal treatment of maxillary molars.[7] Hence, while planning for root canal treatment or endodontic surgery of maxillary molars, the proximity of the root tips to the sinus must be assessed to prevent any unwanted oroantral communication. A similar complication may also arise during periodontal or implant therapy. It has also been proven that usage of periapical radiographs for assessment of perforations of the maxillary sinus is not recommended.[8] Advanced imaging modalities such as CBCT are currently being used to understand and analyze the anatomy of the maxillary sinus and the relationship of maxillary posterior root tips to the sinus floor. From various CBCT analysis, it can be inferred that Maxillary sinus floor thickening maybe seen in some instances due to infiltration of microorganisms and toxins from periapical lesions. These pathogens may spread the porous maxillary bone or through blood or lymph node.[9-11] Also, Interestingly Huang and Brundsvold reported a case of maxillary sinusitis following periodontal treatment of a maxillary first molar with deep pockets and bone loss. [12]

CBCTs obtained were analyzed and classified into groups based on their relationship of the root tips to the sinus floor. All root tips were grouped based on their relation to the maxillary sinus floor, as follows: Group 1: Root tips away from the sinus floor; anyone root tips in contact with the sinus floor; Group 3: All root tips of molar in connection with the sinus floor; Group 4; Root tips into the maxillary sinus. In our study, similar to what was reported by Jung [9;] Group 1 was found to be the majority among the classes with 41% and 43% for 1st and 2nd molars respectively in their study. The mesial roots of the maxillary first and second molars were found to be closest to the sinus floor with an average mean distance of 0.742mm and 0.592mm from the sinus floor. On the whole, the buccal roots were found in closer proximity than the palatal roots. ANOVA test was done to compare the roots of the maxillary first and second molars and paired T-tests were done to compare each root tip to the sinus. It was also seen that 24% of the root tips of the maxillary first molar and 20% of the root tips of the maxillary second molar perforated or extended into the maxillary sinus.

Conclusion

Good knowledge regarding the relationship of the maxillary posterior root tips and the maxillary floor is necessary for treatment planning. On statistical analysis, no significant difference was found between the root tips of the maxillary molar root tips and the sinus floor suggestive that ideally equal care and precautions have to be taken while periodontal, orthodontic, endodontic or any surgical procedures to prevent any infection of sinus or development of an oroantral communication. Given the unpredictability of the relationship of the sinus with the maxillary molar root tips, clinicians must be aware and should take necessary precautions and also calls for a need for accurate pre-operative analysis and treatment planning. Though study size was small in our study, very few studies have been conducted on an Indian population, and extensive studies on the topic may provide more information on the various relations of the maxillary molars to the maxillary sinus floor.

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