

Original Research

Gender and age related correlation of root position maxillary molar with maxillary sinus in high resolution small volume CBCT- A retrospective study

¹Chhibber N, ²Gupta A, ³Vaid P, ⁴Puri C, ⁵Ahmed R, ⁶Abrol T

¹Registrar, Dept. of Oral Medicine and Radiology, Indira Gandhi Government Dental College & Hospital, Jammu, J&K- UT, India;

²Demonstrator, Dept. of Public Health Dentistry, Indira Gandhi Government Dental College & Hospital, Jammu, J&K- UT, India;

³Senior lecturer, Dept of Paediatric and Preventive Dentistry, Desh Bhagat Dental College, Punjab, India;

⁴Registrar, Dept. of Periodontology, Indira Gandhi Government Dental College & Hospital, Jammu, J&K- UT, India;

⁵Registrar, Dept. of Prosthodontics, Crown and Bridge and Implantology, Indira Gandhi Government Dental College & Hospital, Jammu, J&K- UT, India;

⁶Senior Lecturer, Dept of Orthodontics Dentofacial Orthopaedics, Divya Jyoti Dental College, Modinagar, UP, India

ABSTRACT:

Background and Aim: Study performed to evaluate relationship between roots of the maxillary first molar and maxillary sinus using CBCT, to measure the distances between the roots and sinus floor and the thickness of the bone to determine the correlation of these variability with age and gender. **Materials and Methods:** 40 subjects aged between 14-77 years, divided into 2 group's i.e. <40 years, >40 years. Out of 40 subjects 20 were male and 20 females. CBCT performed and images were sliced in axial, coronal and sagittal sections. **Results:** Showed gender and age wise significant differences in distance of root of first molar and cortical bone thickness. The mean value, gender wise for mesiobuccal root with floor of sinus, for females 3.080, for males 1.449 which showed significant result (p 0.049). Distobuccal root with sinus in age group 1, 0.784, for group 2, 3.042 respectively showing significant result (p 0.003). Thickness of buccal plate for females 1.295 and for male 2.532 which showed highly significant (p value 0.000). When compared age with gender, thickness of buccal plate <40yrs showed highly significant (p 0.000). **Conclusion:** Highlighting importance of anatomy, morphology of molar with sinus and bone thickness to determine age and gender.

Key words: Root, Sinus, CBCT, Morphology, Anatomy.

Received: 19 August, 2021

Accepted: 24 September, 2021

Corresponding author: Gupta A, Demonstrator, Dept. of Public Health Dentistry, Indira Gandhi Government Dental College & Hospital, Jammu, J&K- UT, India

This article may be cited as: N Chhibber, A Gupta, P Vaid, C Puri, R Ahmed, T Abrol. Gender and age related correlation of root position maxillary molar with maxillary sinus in high resolution small volume CBCT- A retrospective study. J Adv Med Dent Scie Res 2021;9(10):132-137.

INTRODUCTION

Maxillary sinus development starts during fetal period and continues after birth. The maxillary sinus reaches its full development with the completion of the adult dentition eruption sequence. It is a pyramid-shaped osseous cavity, with the base being represented by the nasal antral wall and the tip lying in the zygomatic bone¹. The inferior wall of the maxillary sinus, which is curved rather than flat, is formed by the lower third

of the medial wall and the buccoalveolar wall. The inferior wall with the maxillary root apices varies according to an individual's age, size and degree of pneumatization of the maxillary sinus and the state of dental retention².

The apices of the maxillary posterior teeth roots may protrude into the sinus, therefore the thickness of sinus floor is markedly reduced. After extraction, various complications might occur, like oroantral

fistulae or root displacement, especially for first and second maxillary molars. The first permanent molar is the first tooth to erupt, which is frequently prematurely extracted, thus exposing the maxillary sinus high risk of oroantral communication, Sinusitis, odontogenic infection³.

The aim of the study was to assess the distances between the apices of the each root of maxillary first molar with the floor of the maxillary sinus, thickness of the cortical bony plate, with aids of the cone beam computed tomography (CBCT) and its relevance, with gender and between age groups.

MATERIALS AND METHODS

A Retrospective study was planned after formal approval from the review board of our institution. The present study samples were selected randomly from the archives from an exclusive maxillofacial imaging and research center between Jan 2015 to May 2015 that had normally erupted maxillary first molar. Subjects with pathology in the maxillary posterior teeth were excluded from the study. A total of 40 maxillary first molars in 40 patients were examined using CBCT images.

The sample of patients comprised 20 males and 20 females with age of 14 years to 77 years which further divided into two age groups group 1 (<40 yrs) and group 2 (>40 yrs). The CBCT examinations were

made using a Kodak 9000 C digital imaging system (Care stream Dental LLC, Atlanta, GA, USA). A written informed consent which is routinely obtained from each patient prior to imaging which had clause for use of images in this research was taken. Before measurements were made the orientation of the images was determined for each patient. The Occlusal plane was positioned horizontally to the scan plane. The mid-sagittal plane was centered. The images were obtained at 74kvp, 10mA, 10.80 sec, voxel size of 75 μm , resolution of 0.75 mm, range of exposure 236 $\text{mGy}\cdot\text{cm}^3$ and the small field of view (FOV) size of 5 $\text{cm}\times 3.75\text{ cm}$. The Kodak Dental Imaging Software CS 3D imaging V3.5.7.0 (Carestream Health Inc., St. Rochester, NY, USA) was used. The data of the CBCT images were sliced in three dimensions i.e. axial, coronal, sagittal. CBCT images were evaluated to assess the roots of the maxillary first molars, maxillary sinus, and cortical plate.

The vertical relationship between each root of the first molar and the sinus floor was classified into four types based on the CBCT cross-sectional images: Type 0, the root was not in contact with the cortical borders of the sinus; Type 1, the root was in contact with the cortical borders of the sinus; Type 2, the root was projecting laterally on the sinus cavity, but its apex was outside the sinus borders; and Type 3, the root apex was projecting into the sinus cavity (Fig. 1).

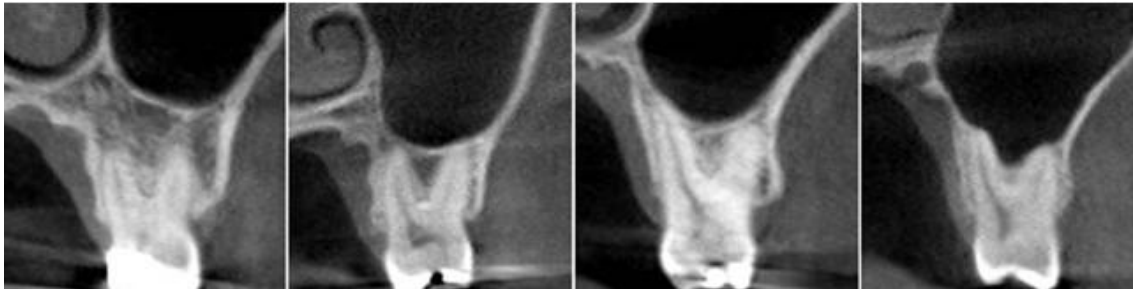


FIGURE 1:- CBCT images show 4 types of vertical relationships between the root of the maxillary molars and the sinus floor. A. Type 0, the root is separate from the sinus floor. B. Type 1, the root is in contact with the sinus floor. C. Type 2, the root is projecting laterally along the sinus cavity, but is outside the sinus borders. D. Type 3, the root is projecting into the sinus cavity.

In Types 2 and 3, the horizontal relationship between the roots of the teeth and the sinus floor was classified into three types: Type B, the lowest point of the sinus floor was located on the buccal side; Type BP, the lowest point of the sinus floor was located between the buccal and palatal roots; Type P, the lowest point of the sinus floor was located on the palatal side of the palatal root. In Type 0 and Type 3, the distance between the apices of the first molars and the sinus floor was measured using CBCT cross-sectional images. The measurements were taken from the root apex to the cortical inferior wall of the sinus along the longitudinal axis of the root. The apices extending below the sinus floor were assigned positive values, whereas those above the sinus floor were assigned negative values. A dentomaxillofacial radiology specialist evaluated the images in a darkened quiet room with dual monitors (HP LP2475W, resolution

1920 \times 1200; Hewlett-Packard, Houston, USA). Each viewing session lasted for 30 minutes. Care was taken to ensure that 24 hours elapsed between all sessions. For intra-examiner calibration and determination of reliability and reproducibility of the measurements, the images were evaluated a second time by the same observer 2 weeks interval.

STATISTICAL ANALYSIS

The data were entered into the computer database. The response of frequencies were calculated and analyzed by using statistical software statistical package of social sciences (SPSS) version 17.0 IBM, U.S. The probability value $p < 0.05$ considered as significant, and $p < 0.001$ were considered as highly significant and value $p > 0.05$ was considered as not significant.

RESULT

In the present study, forty maxillary first molar in forty patients were examined using CBCT images, which comprised of 20 females(50%) and 20 males(50%) , ranging from 14yrs-77yrs. which was further divided into two age groups < 40yrs(GROUP 1), having 16 subjects and >40yrs(GROUP 2), having 24 subjects.

The mean value gender wise for vertical distance of mesiobuccal root of maxillary first molar with floor of maxillary sinus, for females was 3.080mm(±2.4107) and for males was 1.449mm(±2.6452) which showed

significant result(p value 0.049), which was less than 0.05. Vertical distance of distobuccal root of maxillary first molar with floor of maxillary sinus, for females showed a mean value of 2.733mm(±2.1710) and for males 1.545mm(±2.5681) showing no significant result(p value 0.125) as it was more than 0.05. Similarly the mean value for vertical distance of palatal root of maxillary first molar with floor of maxillary sinus, for females was 3.008mm(±1.9314) and for males 2.555mm(±3.2427) which showed no significant result(p value 0.595) as it was more than 0.05.(TABLE 1)

TABLE 1: Gender wise Comparison of different variables

	Sex	N	Mean	Std. Deviation	t	P Value
Vertical Relationship Misiobuccal Root	F	20	3.080	2.4107	2.038	.049*
	M	20	1.449	2.6452		
Vertical Relationship Distobuccal Root	F	20	2.733	2.1710	1.579	.123
	M	20	1.545	2.5681		
Vertical Relationship Palatal Root	F	20	3.008	1.9314	.536	.595
	M	20	2.555	3.2427		
Thickness of Buccal Cortical Plate	F	20	1.295	.5053	-4.225	.000*
	M	20	2.532	1.2083		
Thickness of Palatal Cortical Plate	F	20	1.437	.7286	-1.310	.198
	M	20	1.732	.6950		

*P< 0.05- Significant

The mean value gender wise for bone thickness of buccal cortical plate for females was 1.295mm(±0.5053) and for male 2.532mm(±1.2083) which showed significant result(p value 0.000). similarly the mean value for palatal cortical plate for females 1.437mm(±0.7286) and for male 1.732mm(±0.6950) which showed no significant result(p value 0.198).(TABLE 1, Figure 2).



FIGURE 2:- The distance between the root apex and the sinus floor is measured using CBCT cross-sectional images. The minimum bone thickness between the root and the alveolar cortical plate is measured using CBCT cross-sectional images. For the buccal roots, the distance to the buccal cortical plate is obtained, and for the palatal roots, the distance to the palatal cortical plate is measured.

Gender wise vertical relationship between each root of the first molar and the maxillary sinus floor were classified into 4 types, based on CBCT cross-sectional images. For females and males maximum relationship was observed in Type 0(16 cases,80%) and Type 0(12 cases, 60%) respectively having p value 0.468 which showed no significant correlation. (Table 2) For group 1 (age <40 years) and group 2 (age >40 years) maximum relationship was observed in Type 0(9 cases,56.25%) and (19 cases, 79.16%) respectively having p value 0.238 which showed no significant correlation. (Table 2)

TABLE 2: Gender wise and Age-wise vertical relationship between each root of the first molar and the maxillary sinus floor - classified into 4 types

		TYPE				P value Chi-square
		0	1	2	3	
Gender	Female	16	3	1	0	.468
	Male	12	4	2	2	
Age	<40 yr	9	3	2	2	.238
	>40yr	19	4	1	0	

*P< 0.05- Significant

Gender wise horizontal relationship between the roots of first molar and sinus floor were classified into 3 groups. In present study we observed only 5 subjects having Type B and Type BP relationship, in which females showed 1 case (5%) and males 4 cases (20%) having p value 0.407 which showed no significant result. (Table 3) During age wise distribution, we observed only 5 subjects having Type B and Type BP relationship which were further divided into group 1(<40 yr), 4 case (25%)and group 2 (>40yr), 1 case (4.1%) having p value 0.133 which showed no significant result. (Table 3)

TABLE 3: Gender wise and Age-wise horizontal relationship between the roots of first molar and sinus floor were classified into 3 groups

		Horizontal Relationship		P value Chi-square
		B	BP	
Gender	Female	1	0	.407
	Male	2	2	
Age	<40 yr	2	2	0.133
	>40yr	1	0	

*P< 0.05- Significant

Gender wise positive relation was observed in 16 cases, (80%) in females and no negative relationship was observed. For males,12 cases (60%) showed positive relation and 2 cases (10%) showed negative relationship, having p value 0.260 which showed no significant relationship.(Table 4) Positive relation was observed age wise in 9 cases(56.25%) in group 1(<40 yr), and 2 cases (12.5%) showed negative relationship. For group 2 (>40yr),19 cases (79.16%)showed positive relation and no cases showed negative relationship, having p value 0.147 which showed no significant relationship.(Table 4)

TABLE 4: Distribution of Gender wise and age wise positive and negative relation

		Positive & Negative Relationship		P value Chi-square
		Positive	Negative	
Gender	Female	16	0	.260
	Male	12	2	
Age	<40 yr	9	2	.147
	>40yr	19	0	

*P< 0.05- Significant

The mean value age group wise for vertical distance of mesiobuccal root of maxillary first molar with floor of maxillary sinus, in group 1 was 1.419mm(±2.5893) and for group 2 was 2.829mm(±2.5564) which showed no significant result(p value 0.097) as it was more than 0.05. The mean value of vertical distance of distobuccal root of maxillary first molar with floor of maxillary sinus, for age group 1 (<40 yr) was 0.784mm(±1.9326) and for group 2(>40yr), 3.042mm(±2.3215) respectively which showed significant result(p value 0.003) as it was less than 0.05. Similarly the mean value for, vertical distance of palatal root of maxillary first molar with floor of maxillary sinus, for age group 1 was 1.721mm(±2.2467) and for group 2, was 3.488mm (±2.6948) showing significant result(p value 0.37) as the value was less than 0.05.(TABLE 5)

TABLE 5: Age wise Comparison of different variables

	Agegrp	N	Mean	Std. Deviation	t	Sig. (2-tailed)
Vertical Relationship Misiobuccal Root	<40yrs	16	1.419	2.5893		
	>40 yrs	24	2.829	2.5564	-1.696	.097

Vertical Relationship Distobuccal Root	<40yrs >40 yrs	16 24	.784 3.042	1.9326 2.3215			
Vertical Relationship Palatal Root	<40yrs >40 yrs	16 24	1.721 3.488	2.2467 2.6948		-3.337 -2.247	.003* .037*
Thickness of Buccal Cortical Plate	<40yrs >40 yrs	16 24	2.160 1.749	1.0966 1.1081		1.154	.257
Thickness of Palatal Cortical Plate	<40yrs >40 yrs	16 24	1.916 1.364	.7611 .6086		2.542	.015*

*P< 0.05- Significant

DISCUSSION

Present study examined the relationship between the root of the maxillary first molar and the maxillary sinus floor based on CBCT images and its correlation to determine gender and age of the individuals. Our study is in accordance to the previously published study on most frequent relationship of the sinus floor which did not contact the roots of the molars in which we determined the maximum relationship for gender determination for females and males was observed in Type 0 (16 cases,80%) and Type 0 (12 cases, 60%) respectively. For group 1 & group 2 maximum relationship for age determination was observed in Type 0 (9 cases,56.25%) and (19 cases, 79.16%) respectively. Meanwhile, according to Jung HY et al⁴ apical protrusion into the maxillary sinus (Type 3) of one or more roots of the second molars was most frequent although the roots being separate from the sinus (Type 0) was most frequent in each root of the second molars⁴.

The mean value gender wise for vertical distance of mesiobuccal root of maxillary first molar with floor of maxillary sinus, for females was 3.080mm(\pm 2.4107) and for males was 1.449mm(\pm 2.6452) which showed significant result(p value 0.049). The mean value of vertical distance of distobuccal root of maxillary first molar with floor of maxillary sinus, for age group 1, 0.784mm(\pm 1.9326) and for group 2, 3.042mm(\pm 2.3215) respectively which showed significant result(p value 0.003). Eberhardt et al⁵ and Georgescu et al⁶ reported that the mesiobuccal roots of second molar were closest to the sinus floor, and Kilic et al⁷ reported that the distobuccal root of second molar was closest to the sinus floor. Jung HY⁴ showed that the distance between the sinus floor and the root of the second molar was shortest for the mesiobuccal roots of second maxillary molar. Whereas our study reported that distobuccal root of maxillary first molar closer to the sinus floor which showed similar result as reported by Kilic et al.⁷

The mean value gender wise for bone thickness of buccal cortical plate for females was 1.295mm(\pm 0.5053) and for male 2.532mm(\pm 1.2083) which showed significant result(p value 0.000), which was in accordance with Jung HY⁴ who also showed buccal thickness to be more than palatal bone.

CONCLUSION

Cone beam computed tomography (CBCT) should be recommended as a dose-sparing technique compared with standard medical computed tomography (MDCT) scans for dentomaxillofacial imaging. Regardless of type of imaging technique used kV, mA, exposure time, and field of view increase the radiation dose. The effective dose (International Commission on Radiological Protection - ICRP 2007) from a standard dental protocol scan with MDCT is 1.5 to 14 times greater than from comparable small-field of view dental CBCT scans. Thus, CBCT is frequently used for preoperative assessment of the alveolar ridge and maxillary sinus in patients receiving implants in the posterior maxilla and also can also be used for age and gender determination by cortical bone thickness and distance between maxillary first molar root and inferior border of maxillary sinus.

DECLARATIONS

Conflict of Interest

NIL

REFERENCE

1. Waite, DE. Maxillary sinus. Dental Clinics of North America, 1971, 15, 349-368.
2. Laine, F. Diagnostic imaging of the maxillary sinus. Oral and Maxillofacial Surgery Clinics of North America, 1999, 11, 45-67.
3. Didilescu A, Rusu M, Săndulescu M, Georgescu C, Ciuluvica R Morphometric, Analysis of the relationships between the maxillary first molar and maxillary sinus floor. Open Journal of Stomatology, 2012, 2, 352-357.
4. Jung HY, Cho HB . Assessment of the relationship between the maxillary molars and adjacent structures using cone beam computed tomography. Imaging Science in Dentistry 2012; 42 : 219-24.
5. Eberhardt JA, Torabinejad M, Christiansen EL. A computed tomographic study of the distances between the maxillary sinus floor and the apices of the maxillary posterior teeth. Oral Surg Oral Med Oral Pathol 1992; 73 : 345-6.
6. Georgescu CE, Rusu MC, Sandulescu M, Enache AM, Didilescu AC. Quantitative and qualitative bone analysis in the maxillary lateral region. Surg Radiol Anat 2012; 34 : 551-8.
7. Kilic C, Kamburoglu K, Yuksel SP, Ozen T. An assessment of the relationship between the maxillary

sinus floor and the maxillary posterior teeth root tips using dental cone-beam computerized tomography. Eur J Dent 2010; 4 : 462-7.