

Importance of Dental Scan in Development of Relationship Between Maxillary Sinus and Adjacent Structure

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ABSTRACT

Objectives: The study aimed to investigate the importance of dental scan in finding the relationship between the distance of maxillary posterior teeth roots and the sinus floor using Denta scan®.

Duration: January 2017 to November 2017.

Methodolo: Denta scan® images of sixty patients with I maxillary first premolar to maxillary second molar. The association of tooth root with maxillary sinus is classified into four types of Denta scan. Distance amongst the sinus floor and root, the bone thickness between the root and alveolar cortical plate was measured and being analyzed.

Conclusion: The bone thickness was significantly thinner in the maxillary premolar and maxillary molar as compared to other maxillary posterior teeth roots. Anatomical relationship increased the knowledge and guided us further treatment of proper preoperative planning. Avoided the possible complications encounter while performing the minor oral surgical procedures.

Key words: Anatomy, sinus floor.

Introduction

The anatomical relationship are very important in choosing the treatment. A challenge in dentistry, especially during the endodontic and prosthetic procedure. Finding of the relationship has provided us a way to use new techniques effectively.,¹ Maxillary sinus usually develops during the infancy. Shape and size of the sinus changes with the increase in the age.^{2,3} On X-ray, it is commonly observed that roots penetrate the sinus floor, but, it is the maxillary sinus that has extended around the roots of the tooth. Extraction of tooth can lead to perforation and creation of oroantral fistula or root dis-placement into the maxillary sinus if it is very close or protrudes into the maxillary sinus.² the anatomical relationship plays a significant role in determining the orthodontic tooth movements. Sinus can appear on the floor or spread of infection from periapical region to the sinus.³ The thickness of bone among the alveolar cortical plate and roots of maxillary molars puts a great effect on the spread of odontogenic infection.^{3,4} The present study aimed to investigate maxillary posterior teeth to maxillary sinus, and to measure the distance of maxillary posterior tooth root and floor of the maxillary sinus, and to find out the thickness of bone

between the root and alveolar cortical plate using Denta scan®.

Methodology

This is a retrospective, and randomized, study with measurements taken from Dental scan® of sixty patients Dental scan® was obtained from the dental unit of the same university. Denta scan® is a computer software program which gives computed tomographic (CT) imaging of the maxillofacial bones such as maxilla and mandible in three planes of reference: axial, panoramic, and oblique sagittal (cross-sectional). The definite measurable scale between the different views enables uniformity of measurements and cross-referencing of important anatomical structures (inferior alveolar nerve and mental foramen maxillary sinus) through all three planes. The Dental scan® has also been proven as a diagnostic tool to predicate the invasion in the mandible in those patients having oral squamous cell carcinoma.^{5,6} Inclusion criteria for the study: Dental scan® of patients with normally erupted maxillary premolar to maxillary molar, with tooth extraction

The Dental scan® images were collected from the patients (the data was collected and analyzed on SPSS. The relationship between the tooth root and the floor of the maxillary sinus is classified into four types of Dental scan® images, based on Jung classification (2009)

Relationship measurement in type 0 and 3, the distance between tooth root apex and sinus floor was measured on Denta scan® images. A positive value is given for the root apices extending below the floor of the maxillary sinus and negative value for the root apices above the floor of the maxillary sinus. For measurement of the bone thickness, the distance from roots of maxillary posterior teeth to their corresponding alveolar cortical plate was measured on Dental scan®. For the buccal and palatal root, the distances of buccal and palatal cortical plate were measured, respectively.²

For analysis and comparison of the left and right sides measurement, a paired t-test was done. Data analysis was presented as mean, frequency, and standard deviation. ANOVA test was used to assess the bone thickness of all four vertical relationships that exists between the floor of maxillary sinus and teeth roots.

Results

In this study, sixty Dental scan® of the patients (26 females and 34 males) with age range from 14 to 18 year were analyzed. Type 0 relationship was most commonly seen in the first and second premolars, whereas in the first and second maxillary molars, type 1 relationship was commonly seen (Table I)

Tooth	Type 0, n (%)	Type 1, n (%)	Type 2, n (%)	Type 3, n (%)
Maxillary first premolar				
B	48 (96)	2(4)	-	-
P	48 (5)	2(5)	-	-
Maxillary second premolar				
B	35 (70)	14(28)	-	1 (2)
P	32 (65)	17(34)		1 (1)
Maxillary first molar				
MB	15 (30)	28(57)	2 (4)	4 (9)
DB	18 (36)	22(45)	8 (17)	1 (2)
P	21 (41)	21(42)	7 (15)	1 (2)
Maxillary second molar				
MB	14 (28)	30(61)	-	6 (11)
DB	28 (57)	21(42)	1 (1)	-
P	33 (66)	16(32)	1 (1)	1 (1)

The mean distance from floor of the maxillary sinus to the root was longest for the palatal root of molars and the buccal root of premolar. However, it was shortest for the mesiobuccally root

of maxillary first molar and the palatal root of second premolar (Table II).

The distance between the relationship of the maxillary sinus and teeth root for right to the left was not statistically meaningful ($P > 0.001$); the relationship between different types was statistically significant ($P > 0.001$). The buccal root of maxillary first premolar and the mesiobuccally root of maxillary first molar were seen very close to the cortical plate. The distobuccal root of maxillary third molar observed farthest from the cortical plate. Among the four vertical relationships, a statistically significant difference was found in the bone thickness surrounding the roots.

Table II: Mean distance from the maxillary posterior teeth to respective cortical plate in mm

Maxillary first premolar		Maxillary second premolar		Maxillary first molar			Maxillary second molar		
B	P	B	P	MB	DB	P	MB	DB	P
0.8	1.4	1.6	1.7	1	1.9	1.2	2.2	2.5	1.8

Discussion

It was really difficult to assess the relationship between maxillary posterior tooth root and floor of the maxillary sinus before starting any treatment procedure to avoid any procedural complication. There are potential risks which are usually associated with maxillary posterior root tips in close location to the sinus floor. For example, during endodontic/extraction procedure, there is increased risk of perforation of sinus floor with the root canal instruments in Type 1 and 3 relationships. the case of orbital abscess had been reported in the literature, this may have resulted from a rapid exacerbation of periapical inflammation after endodontic treatment of a maxillary molar.⁸ It is proven fact that during the periapical surgery, conventional periapical radiographs should not be used in prediction of maxillary sinus perforation. Therefore, it is recommended that, advanced imaging modalities such as Dental scan or cone beam CT (CBCT) are highly recommended.⁹ CBCT analysis has known to be shown that significant correlation exists between thickening of sinus mucosa and carious maxillary posterior teeth and/or periodontal disease.¹³ Microorganisms, particularly bacteria and viruses and their toxins present in the periapical lesions of involved teeth may infiltrate maxillary sinus through either the blood/lymph vessels or porous maxillary bone. So, it can be concluded that there is positive correlation exist between the periodontal lesions and maxillary sinus mucosal thickening.^{10,11} The relationship between tooth root and sinus floor played a

very significant role in periodontal surgery. The literature showed that A case reported by Huang and Brunsvold, maxillary sinusitis resulted from periodontal treatment of the first molar having deep periodontal pockets and bony defects.^{12,13} Eberhardt et al. found that the mesiobuccally roots of maxillary second molar were seen close to floor of the maxillary sinus. Another study done by Kilic et al. observed that the distobuccal root of maxillary second molar was found close to the sinus floor.^{14,15} Jung and Cho in their study done by using CBCT images for maxillary molars observed that the buccal root more commonly protrudes into the maxillary sinus.³ The results of our study revealed that the mesiobuccally roots of maxillary first molar seen at the shortest distance from the sinus floor, and for premolars, the palatal root of premolar was found close to the sinus floor. Type 1 relationship was observed more commonly for molars and type 0 for the maxillary premolars. Arijji et al., In their study, it had been observed that for maxillary molars, the buccal root was seen close to the buccal cortical plate.¹⁶ The result of our study revealed that the thickness of bone was found thinnest for mesiobuccally roots of maxillary first molar and thickest for the distobuccal roots of maxillary molar.

Conclusion

A very important relationship had been observed between the maxillary posterior teeth and floor of maxillary sinus with the buccal and palatal roots. The buccal root of the maxillary molars had been found to be more commonly protruded into the maxillary sinus. Among the roots of maxillary posterior teeth, mesiobuccally root of molar and palatal root of premolar were found in close proximity to floor of maxillary sinus. The thickness of the bone on the buccal aspect to the root had found to be significantly thinner in the maxillary premolar and maxillary molar as compared to other maxillary posterior tooth roots. Clinical significance of the study: prior Knowledge of anatomical relationship between the maxillary posterior tooth and maxillary sinus guides us to know the relationship in proper preoperative treatment planning. It also provided us the guidelines to avoid the possible complications encounter while performing the minor oral surgical procedures which are more common in dentistry procedures..

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