International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Index Copernicus Value (2016): 79.57 | Impact Factor (2017): 7.296

Evaluation of Maxillary Molars Roots Relation to Maxillary Sinus Floor by using Cone Beam Computed Tomography

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Abstract: ***The maxillary sinus (antrum of Highmore) is the first of the paranasal sinuses to develop. These structures are usually fluid-filled at birth. The growth of these sinuses is biphasic with growth during years 0-3 and 7-12. During the later phase pneumatization spreads more inferiorly as the permanent teeth take their place. Pneumatization can be so extensive as to expose tooth roots with only a thin layer of soft tissue covering those. This study aimed to evaluate the relation of maxillary molars roots to maxillary sinus floor.For the right maxillary first molar and second molar and for the left maxillary first molar, the most common type was (type 3), and the least one was (type 1),for the left maxillary second molar, the most common type was (type 2), and the least one was (type1).***

Keywords: maxillary sinus, maxillary antrum, root relation, CBCT, radiographic relation

1. Introduction

The maxillary sinus is a pyramidal cavity, and its base lies on the nasal antral wall while the tip extends to the zygomatic bone. Its estimated average volume is 15 cc[20].

It is the largest paranasal sinus and is intimately related to the upper teeth, tear duct and the floor of the orbital cavity[1,2].

The inferior sinus wall is a curved structure that is extended between adjacent teeth, or individual roots in about half of the population, creating elevations in the antral surface or protrusions of the root apices into the sinus cavity; its floor is formed by the alveolar process of the maxilla[21].

Knowledge of the relationship between the root apex and the inferior wall of the maxillary sinus are crucial for diagnosis and treating a sinus pathosis as well as in assisting dental implantation, endodontic procedures and orthodontic treatment[22].

2. Review of literature

The maxillary sinus is the largest paranasal sinus. It is intimately related to the upper teeth, tear duct and the floor of the orbital cavity[1,2].The maxillary sinus is the first of the paranasal sinuses to develop, and its growth ends with the eruption of the third molars at approximately 20 years of age[3].

The inferior sinus wall is a curved structure which is formed by the lower third of the medial wall and the buccoalveolar wall, and the floor is formed by the alveolar process of the maxilla. The extension of the sinus in adult is variable[4].

In response to reduced function associated with the loss of posterior teeth, the sinus may expand further in to the alveolar bone, occasionally extending to alveolar ridge[5].The extent of pneumatization varies from person to person and from side to side[6].

The average volume of a developed sinus at maturity varies between 15 and 20 ml almost double its size at birth. Although these dimensions remain relatively stable, once the permanent maxillary teeth have erupted and growth of the maxilla is complete. Continued expansion and pneumatization occurs in some patients throughout life[7].

MS is tubular at birth, ovoid in childhood and pyramidal shape in adults, its pyramidal shape is acquired as a result of eruption of permanent teeth from the first day of entrance, MS extended not only in posterior path but also in anterior direction from 11 weeks onwards. It has been revealed that triangular sinuses were the mainly ordinary in both genders[8,9].

Smaller maxillary sinuses usually extend from the second premolars to the second molars, while larger sinuses extend from the first premolars or even from the canine and even beyond the third molars[10].

CT scan and MRI provide multiple sections through sinus at different plane and therefore contribute to the final diagnosis and determination of extent of disease. High resolution axial and coronal CT and MRI examinations are the most revealing non invasive techniques for paranasal sinuses and adjacent stractures and areas[5,11].Cone beam computed tomography (CBCT) would potentially provide information needed for prosthetic treatment planning, implant selection, and/or surgical placement[12].

3. Materials and Methods

In this retrospective study, 70 CBCT images of Iraqi patients, retrieved from the archive of Alwasiti hospital, were evaluated.Only the good quality images with the presence of all posterior molars for one or both sides have been selected, examined and evaluated.only 30 images were selected and included in this study (15 male and 15 female).60 maxillary sinuses were examined and only 56 of these sinuses were selected and included in this study, according to the exclusion criteria shown below:

1) Patients with missing maxillary first or second molars or

both from both sides.
2) Patients with large periapical lesions or bony tumor.
3) Bad quality CBCT images.
4) Unerupted, partially erupted or ongoing eruption of first and second molars with immature apices.

The machinery use in this research was Cone beam computed tomography machine (CS 9000 3D Extra oral Imaging System-Care Stream dental, USA; the authorized representatives in the European community: Trophy, France. Radiographic machine has been used with the exposure parameters range from (60-90) kV and mA from (2-15), for (1.24) minutes, high resolution (200um), voxel size (93"width" *74"diameter" * 37 "height" mm ± 15%) and Image field (300*300 mm).

Computer system connected to Cone beam computed tomography machine for image manipulation and viewing.
Maxillary molars root relation to maxillary sinus divided into three types (classes) according to Kilic et al classification[13].

- Type 1: roots penetrated into the sinus.
- Type 2: roots contact the sinus floor.
- Type 3: roots below the sinus floor.

4. Results

The study sample was composed of 15 male and 15 female individuals with age ranged between 15-50 years.56 maxillary sinuses were evaluated from 30 different CBCT images. For the right maxillary first molar, the most common type was (type 3), and the least one was (type 1).For the right maxillary second molar, the most common type was (type 3), and the least one was (type 1).For the left maxillary first molar, the most common type was (type 3), and the least one was (type 1).For the left maxillary second molar, the most common type was (type 2), and the least one was (type1).

Table 1: Percentages of different relation types of right maxillary molars root to maxillary sinus floor.

types	upper right 6			upper right 7		
	m	d	p	m	d	p
	n / %	n / %	n / %	n / %	n / %	n / %
T1	6 / 0.06%	4 / 0.04%	2 / 0.02%	5 / 0.05%	4 / 0.04%	1 / 0.01%
T2	6 / 0.06%	7 / 0.07%	10 / 0.1%	15 / 0.15%	8 / 0.08%	9 / 0.09%
T3	15 / 0.15%	16 / 0.16%	15 / 0.15%	7 / 0.07%	15 / 0.15%	17 / 0.17%
TOTALL	27	27	27	27	27	27

Table 2: Percentages of different relation types of left maxillary molars root to maxillary sinus floor.

types	upper left 6			upper left 7		
	m	d	p	m	d	p
	n / %	n / %	n / %	n / %	n / %	n / %
T1	6 / 0.06%	5 / 0.05%	3 / 0.03%	10 / 0.1%	4 / 0.04%	1 / 0.01%
T2	9 / 0.09%	11 / 0.11%	12 / 0.12%	12 / 0.12%	15 / 0.15%	12 / 0.12%
T3	14 / 0.14%	13 / 0.13%	14 / 0.14%	7 / 0.07%	10 / 0.1%	16 / 0.16%
TOTALL	29	29	29	29	29	29

5. Discussion

Kilic et al in (2010) conducted a study on 92 Turkish patients by using CBCT and found that the longest distance between sinus floor and root tips was for the first premolar and the shortest for the second molar distobucccal root tips for both right and left sides. These results disagreed with the results of this study. These differences may be due to the sample size or different race group[13].

Abd al-Hassan & Alnakib in (2013) made a study on 120 Iraqi patients using spiral CT and found that the longest distance was for the first premolar root apex and the shortest for the second molar mesiobuccal root apex for both sides. These results agreed with the results of this study[14].

Ok et al in (2014) conducted a study on 849 Turkish patients using CBCT and found that (type 3) occurred mostly in the premolar teeth and mesiobuccal and distobuccal roots of the first molar teeth, (type 1) occurred most frequently in the palatal roots of the first molar teeth, (type 2) occurred most frequently in the mesiobuccal roots of the second molar teeth. The results of (type 1) and (type 3) don't match the results of this study while the results of (type 2) agreed with this study results. These differences may be due to sample size or the method of measuring[15].

Lavasani in (2015) conducted a study on 155 American patients using CBCT and found that the farthest root from the sinus was distobuccal root of first molar and the closest to the sinus was mesiobuccal root of second molar. The results of the farthest roots from the sinus disagreed with the results of this study while the results of the closest roots to the sinus match the results of this study. These differences may be due to different sample race & sample size[16].

Roque et al in (2015) made a study on 78 Brazilian patients using CBCT and observed that the mesiobuccal and distobuccal roots of the second molars were found to be closest to the maxillary sinus, whereas the buccal and palatal roots of the first premolars were found to be farthest from the maxillary sinus. These results disagreed with the results of this study which may be due to different sample race, sample size or method of measuring[17].

Shokry et al in (2016) conducted a study on 50 Saudi Arabian patients using CBCT and found that class 1 roots had the highest prevalence and Their percentage was the highest among palatal roots (60.6%), followed by distobuccal roots (53.5%), and mesiobuccal roots (48%). These results disagreed with the results of this study. These differences may be due to the method of measuring and sample size[18].

Tawfieq & Fattah in (2017) conducted a study on 70 Iraqi patients using CBCT and found that the closest root to the sinus was the mesiobuccal root of second molar. This result is similar to the results of this study[19].

6. Conclusion

CBCT considered now as the best technique (no superimposition, better quality, 3D image viewing and manipulation, less radiation dose than computed tomography, more accurate diagnosis and treatment planning).

For the right maxillary first molar and second molar and for the left maxillary first molar, the most common type was (type 3), and the least one was (type 1).For the left maxillary second molar, the most common type was (type 2), and the least one was (type1).

References

[1] Porter GQ, Francis BQ, Matthew WR. Paranasal sinus anatomy and function. Master thesis submitted to grand rounds presentation, UTMB, Department of autolaryngology 2002.
[2] Whaites E. Essentials of dental Radiography and Radiology. Thirdedition R.A Cawson 2002; 17:243-567.
[3] Misch CE. Contemporary implant dentistry. 2nd ed. St. Louis CVMosby Co 1999; 10:76–194.
[4] McGrowan DA, baxter PW, james J. The Maxillary Sinus and its Dental Implications. 1st ed. London Wright Co 1993; 22:1-25.
[5] White SC, Pharoah MJ. Oral Radiology –principles and practice.4th ed Mosby yearbook 2000; 15:180-1.
[6] Van den Bergh JP, ten Bruggenkate CM, Disch FJ, Tuinzing DB. Anatomical aspects of sinus floor elevations. Clin Oral Implants Res 2000; 11:256–265.
[7] Mehra P, Murad H. Maxillary sinus disease of odontogenic origin. Otolaryngol Clin North Am 2004; 37:347-64.
[8] Koppe T, Yamamoto T, Tanaka O, Nagai H. Investigations on the growth pattern of the maxillary sinus in Japanese human fetuses. Okajimas Folia Anat J 1994; 71:311–318.
[9] Gunay Y, Altinkok M, Cagdir S, Kirangil B. Gender determination with skull measurements. J Forensic Med 1997; 13:13–9.
[10] Pasler FA, Kuhnisch J, Bucher K, Hickel R, Heinrich R. Triangular-shaped radiolucencies leading to false positive caries diagnoses from bitewing radiographs. 8th congress of the European Academy of Paediatric Dentistry Amsterdam 2007.
[11] Perez CA, Farman AG. Diagnosis radiology of maxillary sinus defects. Oral Surgary Oral Med Oral Pathol 1988; 68:507-12.
[12] Tyndall DA, Price JB, Tetradis S, Ganz SD, Hildebolt C, Scarfe WC. American Academy of Oral and Maxillofacial Radiology. Position statement of the American Academy of Oral and Maxillofacial Radiology on selection criteria for the use of radiology in dental implantology with emphasis on cone beam computed tomography. Oral Surg Oral Med Oral Pathol Oral Radiol 2012; 113: 817-26.
[13] Kilic C, kamburoglu K, yuksel S, Ozen T. An assessment of the relationship between the maxillary sinus floor and the maxillary posterior teeth root tips using dental cone-beam computed tomography. Eur J Dent 2010; 4: 462–467.
[14] Abd al-hassan Z & alnakib L. Assessment the relationship between maxillary sinus floor and maxillary posterior teeth root apices using spiral CT scan. J. coll dentistry 2013; 25(3):400-50.
[15] Ok E, gungor E, colak M, altunsoy M, nur BG, aglarci OS. Evaluation of the relationship between the maxillary posterior teeth and the sinus floor using cone-beam computed tomography. PubMed 2014; 36:907-14.
[16] Lavasani S. CBCT measurements of maxillary molars and relation to the buccal/palatal plate and sinus. Master thesis submitted to the Faculty of university of Minnesota 2015.
[17] Roque GD, Ramirez LR, bovi SM, boscolo FN. 2D and 3D imaging of the relationship between maxillary sinus and posterior teeth. Brazilian journal of oral sciences 2015; 14(2):1120-1456.
[18] Shokry SM, El wakeel EE, AL Sbaih T, Al Otaibi M, Al Osaimi M. Proximity of the maxillary first molar roots and the maxillary sinus floor using cone beam computed tomography. Master thesis submitted to Al Riyadh College of dentistry 2016.
[19] Tawfieq A & Fattah A. Radiographic assessment of Maxillary posterior teeth roots in relation to Maxillary sinus and adjacent cortical plates using Cone Beam Computed Tomography. Master thesis submitted to college of dentistry university of Baghdad 2017 .
[20] Didilescu A, rusu M, sandulescu 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.
[21] Hauman CH, chandler NP, tong DC. Endodontic implications of the maxillary sinus. International endodontic journal 2002; l35:127–141.
[22] Kwak HH, Park HD, Yoon HR, kang MK, koh KS, kim HJ. Topographic anatomy of the inferior wall of the maxillary sinus in Koreans. Int J Oral Maxillofac Surg 2004; 33:382-8.