

Role of Cone-beam Computerized Tomography in evaluating the relationship between the Maxillary Sinus Floor and the Maxillary Posterior Teeth Root Tips

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Abstract:

Objectives: The purpose of the current research was to employ dental cone-beam CT to investigate the connection between the floor of the maxillary sinus and the root apexes of the maxillary posterior teeth. **Methods:** In this study, dental cone-beam CT scans were used to examine the right and left maxillary sinuses of 100 different people. A radiology specialist in the head and neck area reviewed the photographs. The root points of the maxillary first premolars and molars, as well as the first and second premolars, were measured from the most inward point of the maxillary sinus floor. All of the premolars and molars on both sides had their averages, standard deviations, lowest, and highest values determined. T-tests were used to compare the measured values of the left and right sides of the body as well as those of male and female patients. **Results:** The buccodistal root tip of the second molar was the most distant from the sinus floor for both the right and left sides. There were no statistically significant differences between the sexes ($P > .05$) in the measurements taken of the patients' right and left sides. **Conclusions:** It is crucial to learn the anatomical connection between the sinus floor and the root ends of the maxillary posterior teeth before beginning sinus treatment.

Keywords: Maxillary sinus, Posterior teeth, Cone beam, Computerized tomography

Introduction:

Among the paranasal sinuses, the maxillary sinus develops earliest, and it finishes growing when the third molars come in, usually around the age of 20.¹ Both the buccalveolar and medial walls slope downward to create the inferior sinus wall.² The ground is formed by the maxillary alveolar process. Sinus size in adults may be rather variable. About half of the world's population,³ Expansions of the sinus floor between teeth or individual roots may

cause what seem to be 'hillocks' on the antral surface.⁴ The maxillary sinus may be invaded by the roots of upper canine, premolar, and molar teeth.⁵ Successful surgical operations need precise localization of the maxillary sinus floor in respect to the apical roots of the maxillary teeth.

In Wehrbein and Diedrich⁶ discovered that the degree to which the maxillary sinuses pneumatize following tooth extraction is positively correlated with the depth to which the tooth's roots extended into the sinus during

panoramic x-rays. After an extraction, the sinuses may swell, reducing the available bone height for an implant.¹ Sinusitis may be brought on by an upper premolar or molar infection that has progressed from the periodontal or periapical pocket into the maxillary sinus.^{3,7,8} When these teeth are extracted or undergo endodontic treatment, penetration might occur.² sinus infection caused by root displacement or oroantral fistulae.¹⁰ The link between dental roots and the inferior sinus wall is known to have an impact on orthodontic tooth movement.¹¹ It has been established that orthodontic therapy causes mild apical root resorption and significant tilting due to the intrusion or physical movement of teeth over the sinus floor.⁶ The link between dental roots and the inferior sinus wall is known to have an impact on orthodontic tooth movement.

Materials and methods:

One hundred patients' dental conebeam CT scan data was collected from a private dentomaxillofacial radiology practice's electronic medical records. There was a median age of 40 (range, 10-66) and there were somewhat more women than men. There were a total of 160 maxillary sinus areas investigated (80 right and 80 left). Each picture has been reviewed by an expert in the field of oral and maxillofacial radiology. Lines were drawn using cross-sectional images to connect the points of

the roots of the first and second premolars and molars in the maxilla to the deepest part of the maxillary sinus floor. The distance from the floor of the maxillary sinus was used to categorize images of the root tips. Group 1: roots with apices that rest on the sinus floor; Group 2: roots with apices that pierce the sinus; Group 3: roots with apices that rest below the sinus floor. The space between each tooth and its root tip was calculated. Group 1 had their root tips labeled with a zero, Group 2 had theirs labeled with a negative number, and Group 3 had theirs labeled with a positive number. The premolars and molars on both the right and left sides of the mouth were analyzed statistically, and their means, standard deviations, minimums, and maximums were determined. Measurements were compared between the left and right sides of individuals, as well as between male and female patients, using T-tests.

Results:

“Tables 1 and 2 summarize information for both the right and left sides of the mouth, including the premolars and molars. The buccodistal root point of the second molar and the root tip of the first premolar were the furthest away from the sinus floor on both sides. There were no statistically significant differences ($P > .05$) between the right and left sexes on any of the measures.

Table 1: The right premolar and molar data used to determine the mean, standard deviation, minimum, and maximum values.

	N	Mean	Std. Dev.
R 1st pm	80	8.1	7.1
R 2nd pm	80	3.4	5.6
R 1st mobm	80	1.5	4.5
R 1st mobd	80	0.56	5.6
R 1 stmo pal	80	1.67	4.1
R 2nd mobm	80	0.34	1.5
R 2nd mobd	80	0.19	2.1

R 2nd mo pal	80	1.11	1.9
R 3rd mobm	80	1.45	2.3
R 3rd mobd	80	0.56	3.1
R 3rd mo pal	80	0.78	2.8

Table 2: The left premolar and molar data was used to calculate mean, standard deviation, minimum, and maximum values.

	N	Mean	Std. Dev.
L 1st pm	80	6.21	5.3
L 2nd pm	80	3.33	3.4
L 1st mobm	80	0.43	1.4
L 1st mobd	80	0.07	1.5
L 1st mo pal	80	0.11	0.22
L 2nd mobm	80	0.23	2.1
L 2nd mobd	80	0.32	1.5
L 2nd mo pal	80	0.67	0.9
L 3rd mobm	80	0.66	1.6
L 3rd mobd	80	0.81	1.9
L 3rd mo pal	80	0.88	0.8

Discussion:

The maxillary sinus floor is linked to the upper jaw's root tips, as shown by our study. Both the left and right sides of each subject were evaluated separately.

Clinicians undertaking preprosthetic and preimplant surgical operations in the posterior maxilla must be cognizant of the extent to which dental roots extend into the sinus in order to mitigate the risk of post-extraction pneumatization⁶, which reduces bone availability at the implant or denture site. A panoramic radiograph is often all that is available to the clinician, and only a tiny fraction of patients actually get a cone-beam

CT.¹² In order to determine how close the maxillary tooth roots were to the maxillary sinus floor, researchers studied panoramic radiographs and CTs from 30 participants."When comparing panoramic radiographs and CT scans obtained on average of 2.5 months later, The topographic connections between the roots and sinus varied greatly. CT cross-sections only showed 37 of 129 roots entering the maxillary sinus, however panoramic radiographs showed 64 of 129 roots entering the sinus.¹³ Cone-beam CT scans were employed throughout this study instead of panoramic radiography due to their lack of horizontal and vertical magnification as well as their superior resolution and ability to show cross-sectional details.

“The average distances between the apexes of the posterior maxillary teeth and the floor of the maxillary sinus and the apexes of the posterior maxillary teeth and the surrounding lateral bony surfaces were calculated using CT display data from 12 autopsy specimens and 38 human participants. When measuring distances from the sinus floor and the buccal bony surface, it was determined that the apex of the maxillary second molar mesiobuccal root was 1.97 mm and 14.0 mm, respectively. The buccodistal root tip of the second molar was found to be closest to the sinus floor on both sides, whereas the root tip of the first premolar was shown to be the farthest away. CT scans were used by Kwak et al.¹⁵ to define 5 vertical connections and 3 horizontal ones; they found that the most frequent vertical link was one in which the tooth roots did not touch the sinus floor. The majority of the vertical connections seen in this study were not with the sinus floor, and this was true for both the right and left sides.”

Due to their physical closeness, the root tips of maxillary premolars and molars might cause accidental oroantral communication if they are subjected to endodontic treatment.¹⁶⁻¹⁸ Infected periapical tissue, root tips that have been removed, and bone drilling dust are all potential vectors for bacterial infection that might lead to sinusitis.¹⁸ Oral vestibular space constraints complicate flap creation. further complicating surgical treatment of posterior teeth.¹⁹

Several studies have looked at the maxillary sinus's possible link to the upper teeth's roots.^{3,4,14,20} Eberhardt et al.¹⁴ the average distance between the floor of the maxillary sinus and the back teeth in the upper jaw was 1.97 millimeters. The roots of the upper first and second molars are attached directly to the floor of the maxillary sinus in around 40% of people.²⁰ Studies have indicated that in 20% of people, the palatine roots are located near the maxillary sinus rather than the palate.⁴ This position makes a sinusotomy more difficult, therefore palatinal access is often necessary for surgical procedures.¹⁴ The vestibular roots of the upper posterior teeth are also quite near to the maxillary sinus floor, but they are much more accessible than the palatinal roots, thus they may be treated without perforating the sinus wall.³ In order to treat root tips that have

grown into the sinus, it is necessary to elevate the sinus membrane.²¹

“As with all apicoectomies, it is likely that a neighboring tooth may be harmed during periapical surgery on the maxillary molars and premolars. When treating maxillary molars and premolars, it is necessary to make a small incision in the maxillary sinus wall or floor. This must be done with extreme caution to avoid perforating the sinus membrane and introducing foreign substances into the maxillary sinus.^{18,20,22,23} Ericson et al.⁶ Eighteen percent of the 159 maxillary premolars and molars that underwent periapical surgery had an aperture in the wall or floor of the maxillary sinus. The scientists also found that the likelihood of developing maxillary sinusitis, with its distinctive thickening of the sinus mucosa and accompanying symptoms, was increased when foreign substances were introduced into the maxillary sinus during surgery. Jerome and Hill were careful to shield themselves from any dangers by²⁴ highly suggest stuffing gauze into the maxillary sinus opening. According to Friedman et al.²⁵ After periapical surgery was performed on 94 maxillary tooth roots, 12 of which were maxillary molar roots, the researchers found an 11.8% frequency of opening of the sinus wall or floor.” In Selden's opinion,²⁶ When the maxillary sinus floor is pathologically exposed after periapical surgery, orosinusal communications are more likely to develop.

In a study including periapical surgery on 18 maxillary teeth, Persson²³ found that 44% of the sinus membranes needed to be repaired due to perforation. There was no correlation between membrane perforation and postoperative complications, and the stated surgical success rate remained at 78%. Borstlap and Ioannides¹⁷ 47 maxillary molars were operated on, and 14.8% of them were perforated. These authors report that periapical bone growth was unaffected by membrane puncture.

Conclusions:

Before initiating treatment on the maxillary sinus, it is necessary to understand the anatomical connection between the floor of the

sinus and the root tips of the maxillary posterior teeth. Due to their proximity to the floor of the maxillary sinus and the root tips of the maxillary teeth, clinicians must take extra care while operating on the maxillary posterior teeth. The current study's numerical data support the idea that prior treatment planning is essential.

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