

Prediction of possible maxillary sinus membrane perforation during dental extraction using panoramic radiography

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ABSTRACT

Objective: The purpose of the study was to evaluate the accuracy of predicting the potential for maxillary sinus exposure or perforation during routine dental extraction using panoramic radiograph.

Method & Materials: Fifty patients were included in this study. These were 28 men and 22 women ranging in age from 19 to 67 years. Preoperative measurement of the distance between the most superior point on the most superior root of the tooth to be extracted and the floor on the maxillary sinus was made on the panoramic radiograph using a millimeter ruler. Immediately following tooth extraction, patients were evaluated for perforation of the maxillary sinus by having them perform a Valsalva maneuver and an endoscopic fiber optic light source (Olympus, CLK-4) was used to look into the extraction site to determine if the sinus membrane could be visualized or if a perforation was present.

Result: The sinus membrane exposure or a perforation was visualized in only 4 instances : 1 1 first molar, 2 second premolar and 1 second molar . The mean distance from the sinus floor to the root tip in this group was -2.92 mm (range: -1 to -11 mm).

Conclusion: Based on these data, a panoramic radiograph cannot be used to accurately predict maxillary teeth with a high risk of sinus membrane exposure or perforation.

Introduction

The maxillary sinus is the first of the paranasal sinuses to develop and ends its growth at approximately 20 years of age with the eruption of the third molars.[1,2] The adult sinus is variable in its extension. Its floor extends between adjacent teeth or between individual roots in about half of the population,[3] creating elevations in the antral surface (commonly referred to as "hillocks")[4] or protrusions of root apices into the sinus. [5] In these cases, the thickness of the sinus floor is markedly reduced. Histological sections show that most of the roots that protrude radiographically into the sinus are actually enveloped by a thin cortical layer with perforations in 14% to 28% of the cases.[5]

The purpose of this study was to evaluate the accuracy of predicting the potential of maxillary sinus exposure or perforation during routine dental extraction using panoramic radiography.

Materials and method

Fifty patients were included in this study. These were 28 men and 22 women ranging in age from 19 to 67 years who had dental extractions performed in oral surgery clinic of the Rungta College of Dental Sciences & Research, Bhilai. Each case was evaluated by a single examiner. Preoperative measurement of the distance between the most superior point on the most superior root of the tooth to be extracted and the floor on the maxillary sinus was made on the panoramic radiograph using a millimeter ruler. If a root tip appeared to be protruding into the sinus on the panoramic radiograph, the distance was given a negative value. A positive number indicated that there appeared to be bone between the sinus floor and the root of the tooth. It was predicted that any tooth with the root tip touching the antral floor or with a negative number was likely to result in sinus membrane exposure or perforation following removal. Immediately following tooth extraction, patients were evaluated for

perforation of the maxillary sinus by having them perform a Valsalva maneuver with the nares closed and viewing the extraction site for evidence of an air leak. Additionally, an endoscopic fiber optic light source (Olympus, CLK-4) was used to look into the extraction site to determine if the sinus membrane could be visualized or if a perforation was present. Both visualization of the sinus floor and perforation of the sinus membrane were considered a positive finding.

Results

Altogether, 5 maxillary first premolars, 11 second premolars, 16 first molars, 11 second molars, and 7 third molars were extracted. The measurement from the sinus floor to the root tip ranged from -11 mm to +09 mm. Nineteen teeth had measurements that would predict possible membrane exposure or perforation following extraction (0 to -11 mm): 3 second premolars, 9 first molars, 6 second molars and 1 third molar. However sinus membrane exposure or a perforation was visualized in only 4 instances: 1 first molar, 2 second premolar and 1 second molar (figs. 1 and 2). The mean distance from the sinus floor to the root tip in this group was -2.92 mm (range: -1 to -11 mm). The mean distance from the sinus floor to the root tip in the remaining 17 teeth that did not result in sinus involvement was -4.32 mm (range: 0 to -9 mm). In positive value cases the mean distance from sinus floor to the root tip was +4.3 mm (range: +1 to +8 mm) (figs 3 and 4).

Discussion

The occurrence of oroantral communication is a nightmare for a dental surgeon as it possesses challenge not only in handling the patient but also in its surgical repair. Predicting the occurrence of oroantral communication based on panoramic radiograph might help in informing the patients of its probability and preparing the dentist to appropriately close it.



Figure 1. Right maxillary second premolar accurately predicted to perforate the sinus floor.



Figure 2. Left maxillary second premolar accurately predicted to perforate the sinus floor.

The relation between the roots of the maxillary molars and premolars and the sinus has been studied by different authors. [6,7,8] The roots of the maxillary first and second molars are in intimate relation to the floor of the maxillary sinus in 40% of cases. [7] The palatine roots of these teeth are closer to the antral floor than to the palate, and in 20% of cases are in close proximity to the maxillary sinus. [4] Their location complicates an approach through the sinus, and a palatine access is therefore usually adopted. [8] The vestibular roots of the upper posterior teeth are closely related to the floor of the maxillary sinus. However, root access is much easier in this case than in the case of the palatine roots, and in most cases treatment can be carried out without having to perforate the sinus wall. [8] In some cases the apex protrude into the sinus, and the sinus membrane must be raised in order to treat them.

Sharan and Madjar found that most roots of maxillary teeth projecting into the sinus cavity on panoramic radiographs did not show such protrusion when observed in computerized tomographic images. [9] Freisfeld et al showed that roots apparently penetrating into the maxillary sinus on the panoramic radiograph had only the apices in contact with the sinus floor in the vast majority of cases. [10]

Conclusion

The panoramic radiograph has limited value for predicting sinus perforation because of morphology of the sinus floor. A panoramic radiograph of the maxillary sinus is a 2-dimensional representation of 3-dimensional structure. Although a maxillary tooth's roots may appear to be projecting into the sinus, they may very well be encased in solid bone. Based on these data, a panoramic radiograph cannot be used to accurately predict maxillary teeth with a high risk of sinus membrane exposure or perforation.

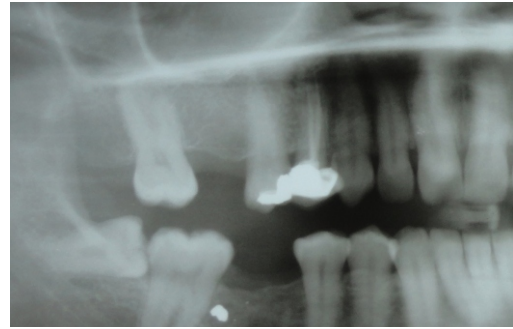


Figure 3. Right maxillary first premolar inaccurately predicted to perforate the sinus floor.



Figure 4. Right maxillary second molar inaccurately predicted to perforate the sinus floor.

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