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ORIGINAL ARTICLE

Use of cone beam computed tomography to determine the accuracy of panoramic radiological markers: A pilot study

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cone beam computed tomography;
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Abstract *Background/purpose:* Various imaging modalities have been used by clinicians in the preoperative assessment of the third molar position. The purpose of this study is to investigate the diagnostic accuracy of orthopantomography (OPG) markers in determining the anatomical relation between the mandibular third molar and the mandibular canal by comparison using cone beam computed tomography (CBCT).
Materials and methods: Ninety patients' panoramic and CBCT images were chosen for the study. From these, 180 teeth were studied by four trained examiners. The frequency of angulation, Monaco classification, spatial relation, and cortical perforation were detected. The values were then compared using a Chi-square test for both of the imaging modalities.
Results: On OPG, 17.9% superimposition, 22.4% narrowing, 18.4% increased radiolucency, 28.3% interruption, and 13% diversion/deviation were recorded. On CBCT images, 57.8% of the molars were in a direct relation with the inferior alveolar canal and 42.2% had no relation. The statistically significant predictive values of positive test results are narrowing of the canal (72%), and interruption of the radiopaque border with the ratio (77.7%). Of the third molars in a direct relation with the canal, narrowing was recorded in 72% and interruption was recorded in 77.8% of cases with statistical significance.
Conclusion: The presence of narrowing of the canal and interruption of the radiopaque border as radiographic markers on OPG predict contact between the lower third molar

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and inferior alveolar canal. Detailed radiological examination on CBCT is recommended in such cases.

Introduction

Several complications of lower third molar surgery have been reported, including alveolar osteitis, infection, and inferior alveolar nerve (IAN) injury.[1,2] Damage to the IAN is a serious complication following third molar removal. The overall risk of temporary IAN injury associated with third molar removal ranges from 0.4% to 6.0%.[3,4] According to various surveys, the rate of permanent neurological damage is 1% and temporary damage occurs in 5—7% of cases.[5]

Damage of the IAN has been linked to factors such as age, sex, type of anesthesia used, and the experience of the surgeon.[6] The most evident risk factor for injury of the IAN is the proximity of the root of the third molar to the mandibular canal.[7] The risk increases dramatically when there is contact between an impacted molar and the mandibular canal, which is defined as the absence of cortical bone around the alveolar nerve, the point at which the root touches the nerve.[8,9]

Preoperative assessment of the topographic relationship of the impacted mandibular third molar to the inferior alveolar canal (IAC) has been performed by means of different imaging modalities. Each modality comes with its associated package of advantages and disadvantages. Orthopantomography (OPG) has often been cited as the imaging modality of choice prior to the surgical removal of an impacted mandibular third molar.[5]

It is important to assess the position, and establish the relationship, of the third molar with the IAC preoperatively to minimize the risk of nerve injury. OPG is the standard diagnostic tool for this purpose. Clinicians use various radiographic markers to indicate a close relationship between the third molar and the IAC.[8] If the radiological marker on the OPG indicates there is a close relationship between the third molar and the IAC, additional investigation using computed tomography (CT) may be recommended to verify the relationship in three-dimensional view.[10,11] The drawbacks of CT are the higher radiation dose and increased financial costs compared with panoramic imaging.[7]

Cone beam CT (CBCT) scanners have recently been developed for dentomaxillofacial imaging. CBCT reduces the radiation dose,[6,12] offers high spatial resolution and decreases costs,[1] provides better quality images of teeth and their surrounding structures.[13] CBCT examination has been found to be useful in the preoperative diagnosis of lower third molars.[14] To justify the application of CBCT in the preoperative assessment of impacted third molars, it is necessary to assess whether it gives the practitioner a more detailed insight into the anatomical relationship between the third molar and the IAC than conventional imaging techniques.[6]

The aim of this study is to evaluate the diagnostic accuracy of the panoramic radiological markers in determining the relationship between impacted third molars and the IAC by comparison with CBCT.

Materials and methods

Ninety OPG and 90 CBCT images obtained from an imaging center in Ankara (Turkey) were evaluated in this retrospective cohort study. From these, 180 impacted mandibular third molar teeth from 45 male and 45 female patients were included. The mean age of individuals was 29.2 years, with a range from 18 years to 56 years. Two images were excluded because of the existence of a lesion.

Evaluation of images was carried out by three trained radiologists and one maxillofacial surgeon with consensus decision. The observers evaluated first OPG and then CBCT images at 2-week intervals.

Digital panoramic radiographs were taken with Planmeca Proline XC (Helsinki, Finland) operated at 60 kVp, 7 mA, 18 s using charge-coupled device sensor.

On OPG, the anatomical relationship between third molars and the IAC was classified according to Monaco et al's classification consisting of five radiographic markers.[11] They are as follows (Fig. 1A—E): (1) superimposition of the canal with third molar roots; (2) increased radiolucency between the canal and third molar roots; (3) interruption of the radiopaque superior corticated margin of the mandibular canal; (4) diversion/deviation of the mandibular canal; and (5) narrowing of the mandibular canal.

Impacted teeth were also classified according to Pell and Gregory's [15] classification on OPG.

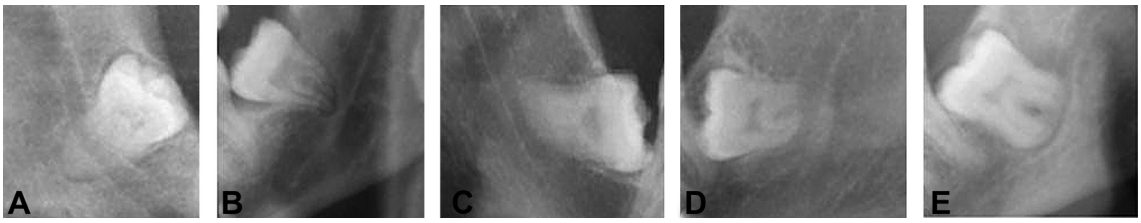

Figure 1 Five radiographic markers on panoramic radiography: (A) superimposition, (B) increased radiolucency, (C) interruption of the radiopaque border, (D) diversion of the mandibular canal, and (E) narrowing of the mandibular canal.