



Comparison of Orthopantomography and Computed Tomography Image for Assessing the Relationship between Impacted Mandibular Third Molar and Mandibular Canal

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ABSTRACT

Background: Permanent mandibular third molar are most commonly impacted teeth. In planning the surgical removal of mandibular third molar, correct diagnosis requires not only their precise spatial location, but also a thorough and accurate assessment of the intimate relationship with adjacent anatomical structures. Various imaging modalities have been used for localizing the mandibular third molar but not satisfactorily.

Aim: This prospective study of 30 patients with 42 impacted mandibular third molars was carried out with the aim of finding evidence for justifying the use of computed tomography and orthopantomography as a diagnostic modality, prior to surgical intervention of impacted mandibular third molar.

Materials and methods: Subjective evaluation of the CT and OPG images by two observed had shown that there was significant difference between the CT and OPG for radiographic visibility of mandibular canal in relation to third molar.

Results: Data analysis was done with Chi-square test (χ^2) and z-test to find the significant difference between the two radiographic modalities OPG and CT in localizing special relationship of impacted mandibular third molar. The comparison of OPG and CT showed z-value >1.5 in darkening of roots (1.98), deflection of root (2.00) interruption of z-value = 0 in narrowing of canal and dark, bifid apexes. Also it showed p-value <0.05 in all the radiographic signs except narrowing of mandibular canal and dark and bifid apexes.

Conclusion: The spiral CT image provides a unique opportunity to determine the exact position of impacted mandibular third molar and their relationship to adjacent structure in all three planes.

Clinical significance: Computed tomography is highly instrumental in depicting the relationship of mandibular third molar with inferior alveolar nerve canal before treatment and accurate appraisal of the several aspects can be made regarding prognosis.

Keywords: Mandibular canal, Third molar, Computed tomography, Orthopantomography.

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INTRODUCTION

Mandibular third molars are the most commonly impacted teeth in the oral cavity. Impaction is defined as a 'tooth which is completely or partially unerupted and is positioned against another tooth, bone or soft tissue so that its further eruption is unlikely, described according to anatomical position.¹ Precise anatomic definition of the mandibular canal with respect to the lower third is of utmost importance in preventing injury to inferior alveolar nerve during surgical extraction of impacted lower molar. The inferior alveolar nerve injury ranges from 0.6 to 5.3% with permanent injury occurring in less than 1% of patients. Between the apex of third molar and mandibular canal, several types of relationships may be established that should be identified before surgical intervention by means of diagnostic imaging.^{2,3} An accurate preoperative radiographic examination is therefore consideration indispensable before extraction of third molar. Ideally this examination should help the surgeon to evaluate the difficulty of operation and to choose most appropriate surgical techniques, e.g. where to remove bone, how to split the tooth and in what direction roots can be lifted.^{4,5}

MATERIALS AND METHODS

This study was carried out at oral and maxillofacial surgery department with the aim of finding evidence of orthopantomograph and computed tomograph as a diagnostic modality prior to surgical intervention of impacted mandibular third molars.

Case Selection

Patients visiting the oral and maxillofacial surgery department outpatient department with impacted mandibular third molars were chosen as the subjects of our study.

Inclusion Criteria

Healthy young individual with impacted mandibular third molar symptomatic or asymptomatic and impacted mandibular third molars showing some radiological sign of close proximity with mandibular canal, as given by Rood (1990).⁶

Deep seated mandibular impaction classified as Pell and Gregory⁷ (class II, III and position B, C) and Winter's⁸ classification (mesioangular, distoangular, vertical, horizontal).

Orthopantomogram

OPG was taken as a part of study for all patients, OPG specification:

Planmeca 2002 machine was used with KVP—68 to 72, mA—12.

The films were processed using visual method. Each OPG was evaluated for following features (Rood, 1990).

- Darkening of roots
- Deflection of roots
- Narrowing of apex
- Narrowing of canal
- Deviation of mandibular canal
- Interruption of white line
- Dark and bifid apices.

Computed Tomography (CT)

All the subsumed patients were subjected to CT scan for spatial orientation of impacted mandibular third molars. Computed tomography scanning system used for the study

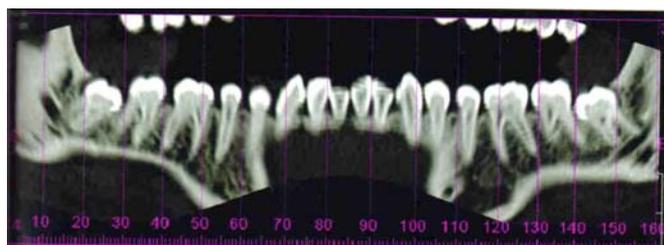


Fig. 1: Panoramic view of CT scan showing bilaterally impacted mandibular third molar

was Siemens volume access multislice spiral CT in the Department of Radiology.

KVP – 120, mA – 90, CT dose index – 14 to 20 milligrey, Gantry tilt – 0, Slice thickness – 0.75 mm, Recon increment – 0.6 mm.

Image were reconstructed in sharp kernel H60S in dental window (Figs 1 and 2).

Subjective Evaluation of CT Scan and OPG

All CT scan and OPG were assessed by two observers viz:

- Senior oral and maxillofacial surgeon
- Senior radiologist.

All the images were graded visually and the scale of grading was verbalized to facilitate the scale of observer. The following grading scale was used:

- OPG was better than CT
- No difference between OPG and CT
- CT was much better than OPG.

Both the observers were consulted to access both the CT scan and OPG and record their assessment for the radiographic proximity of third molar with the mandibular canal and radiographic markers as given by Rood.⁶

Statistical Tests used

Chi-square test (χ^2): This is a nonparametric test which is used to find out significant association between the two variables.

Z-test for proportion: This test applied to find out significant difference between two proportions of two different group under comparison.

Data analysis was done to find the significant difference between the two radiographic modalities OPG and CT in localizing special relationship of impacted mandibular 3rd molar.

RESULTS

It was found that 12 patients out of 30 evaluated subjects had bilateral impactions, whereas in unilateral cases, there was predilection for left side.

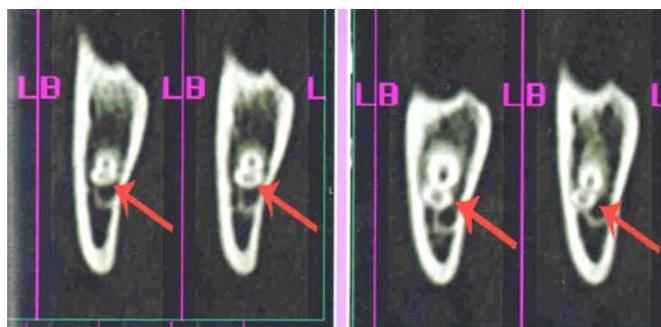


Fig. 2: Direct coronal CT image depicting intimate relationship between mandibular third molar and mandibular canal

Out of the 30 patients in whom total of 42 impacted mandibular third molar were evaluated, mesioangular impaction was found to be the most common, followed by horizontal, distoangular and vertical.

When the course of mandibular canal was studied on CT, lingual course was mostly come across, followed by buccal course.

Out of seven signs given by Rood, the most common radiographic sign observed was darkening of roots (42.88%), followed by narrowing of apex (28.97%). Incidences of narrowing of root canal and deviation of mandibular canal was found to be almost same (11.90%). Also deflection of roots and interruption of white line found to be of same level of occurrence (9.52%). Dark and bifid root apex was the least common radiographic finding (2.38%).

Darkening of root was again the most common finding on CT also (38.10%), followed by narrowing of apices.

Thus, the comparison of OPG and CT showed z-value >1.5 in darkening of roots (1.98), deflection of root (2.00) interruption of z-value = 0 in narrowing of canal and dark, bifid apices. Also it showed p-value <0.05 in all the radiographic signs except narrowing of mandibular canal, dark and bifid apices. (p-value < 0.05 is significant; p-value > 0.05 is not significant). Hence, a significant number of patients who were termed as at high-risk turned into low risk category. Also it gave detailed 3D information of high risk category patients, which helped modifying presurgical planning.

DISCUSSION

The maxillofacial application of the CT scan has been revolutionary in the sense that questions that could not be answered in the dentist's office with conventional radiographs can be answered in radiology department with dental CT scans. The evaluation of impacted third molar by means of computerized tomography has been stressed by numerous authors. Thus, armed with this background knowledge and quest for determining the role of dental CT scans for impacted mandibular third molars, this study was designed.⁹⁻¹¹

A total of 30 patients with 42 impacted mandibular third molars, from which 11 were male and 19 were female patients were included in the study. The ratio of female to male observed in our group is 1.9:1.

The present study shows unilateral impacted molars in 18 patients, as compared to 12 patients with bilateral impactions. Also in seven cases the impactions were on right side as compared to 11 on left side.

Evaluation of CT scan and OPG was done to determine basically, the ease of visualization and image interpretation pertaining to both the diagnostic modalities. Also to further ascertain the facilitation of presurgical planning, as per the new diagnostic modality. The observers were chosen from two different specialties so as to minimize any observer related bias as well as for the ease of extrapolation of the results obtained. These observers viz oral and maxillofacial surgeons, and maxillofacial radiologists are frequently associated with diagnosis and management of impacted mandibular third molars.¹²⁻¹⁴

For comparison on point A (radiographic proximity of third molar to mandibular canal), the OPG was found to be almost equal to CT scan in significant number of cases.¹⁵⁻¹⁸

For comparison on point B (radiographic markers given by Rood), CT scan performed much better than OPG in significant number of cases (z-value = 2.17, p < 0.05, i.e. significant).

The role of preoperative CT imaging of inferior alveolar nerve for patients at increased risk for nerve injury during mandibular third molar extraction. They concluded, the additional information provided by three-dimensional imaging changed the majority of patients from increased risk for nerve injury to lower risk.^{19,20}

In our series of 42 impacted teeth, CT findings were significant for root proximity of impacted lower third molar with mandibular canal. OPG were evaluated for Seven radiographic markers, which were compared with the occurrence of these signs on CT.

Darkening of roots was seen in 18 cases on OPG whereas in 16 cases on CT (z-value = 1.98). Narrowing of apices seen in 12 cases in OPG and eight cases in CT (z-value = 2.07). thus, doubtful radiographic signs could be excluded with a significantly better accuracy with CT than with OPG. Moreover, we could localize the course of mandibular canal and buccolingual relationship of impacted lower third molars.

However, there was general agreement between OPG and CT in visualization of narrowing of mandibular canal and dark, bifid apex (z-value = 0), deflection of roots (z-value = 2). Thus, the result of present study are in accordance with the above views.

CONCLUSION

Subjective evaluation of the CT and OPG images by two observers shows that there was a significant difference between the CT and OPG for radiographic visibility of mandibular canal in relation to third molar. The results for the CT were better than OPG for this point of comparison.

The seven radiographic signs were appreciated better in CT as compared to OPG.

The essential finding of the study is that the spiral CT image provides a unique opportunity to determine the exact position of impacted mandibular third molar and their relationship to adjacent structure in all three planes. This results in valuable information for decision making.

- The conventional panoramic radiographic has limitation in assessing the proximity of mandibular impacted third molar with mandibular canal.
- The spiral CT images definitely enhance the visualization of the seven radiographic sign between impacted mandibular canal, a fact that has therapeutic consequences.
- The spiral CT depicts closeness of the impacted mandibular third molar to adjacent anatomical structure accurately which aid in establishing good surgical plan and predicting postoperative complication which is of utmost importance in the era of medicolegal consumerism.
- Nonetheless, orthopantomogram acts as a valuable guide in depicting mandibular third molars when used in stepwise logistic manner.
- Increased radiolucency, narrowing and interruption of radiopaque border, as well as the concomitant presence of two or more radiographic marker, on the OPG were highly predictive of contact between third molar and mandibular canal, and axis CT scan is probably indicated in such cases.

The results of this study may lead to guidelines for oral surgeons evaluating whether to obtain an axis CT for further investigation after examining an impacted mandibular third molar via panoramic radiograph.

CT is currently the method available for the evaluation of hard tissue lesion, even subtle ones, because of high resolution and details provided by this technique.

From this study it can be concluded that CT is highly instrumental in depicting the relationship of mandibular third molar with inferior alveolar nerve canal before treatment, accurate appraisal of the several aspects can be made regarded prognosis, when treatment is at stake. But a significant assertion can be made only with a larger sample size.

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