RESEARCH ARTICLE

POSITION OF MANDIBULAR THIRD MOLAR TO INFERIOR ALVEOLAR CANAL USING CONE BEAM COMPUTED TOMOGRAPHY: A NEW CLASSIFICATION

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ARTICLE INFO	**ABSTRACT**

Background: Various imaging modalities have been used by clinicians in the preoperative assessment of the third molar position. The aim of this study is to initiate and confirm a new classification for the inferior alveolar nerve (IAN) injury with respect to positional relation between the tooth and the inferior alveolar canal (IAC) using Cone Beam Computed tomography (CBCT).

Material and Methods: Mandibular CBCT scans were assessed randomly and were reviewed retrospectively. Patients with complicated mandibular third molars cases were then selected for the study. Complicated mandibular third molars refer to those which met at least one of the following criteria i.e., partially or fully impacted, contact or interrupt the inferior alveolar canal, considerable obstruction of the longitudinal axis of adjacent tooth during teeth eruption. The new classification system was established based on: the positional relation of tooth to the IAC in the coronal/ axial reconstructions of the CBCT.

Results: Of these cases, TYPE I: Buccal and Abutting (28%), TYPE II: Lingual and Abutting (48%), TYPE III: Root Apex and Abutting (14%) (When the nerve is <5mm from the root apex), TYPE IV: Intraradicular (10%). TYPE II was the most common type of classification (48%) while TYPE IV was the least common type (10%).

Conclusions: The presented new classification system which is based on positional relation between the tooth and the IAC is proved to be applicable in detecting mandibular third molar with higher risk of IAN injury. Hence this will aid as a good guidance for the appropriate treatment design.

INTRODUCTION

There are numerous complications related to mandibular wisdom teeth surgery that have been reported including alveolar osteitis, infection and inferior alveolar nerve (IAN) injury (Godoy *et al*., 2005; Haug *et al*., 2005). Inferior alveolar nerve (IAN) injury is a common complication of mandibular third molar teeth extraction causing dysesthesia or paresthesia in 0.4% to 22% of cases (Marciani, 2012; Guerrero *et al*., 2012; Roy *et al*., 2002).

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The rate of permanent neurological damage is 1% and temporary damage occurs in 5-7% of cases (6). This occurs because of the tooth root's close approximity with IAN (Marciani, 2012; Renton *et al*., 2005). Hence, analysis of the positional relation between the tooth and the IAC is important so that the incidences of this complication can be minimised. Preoperative assessment to indicate a close relationship between the mandibular third molar and the IAC has been performed by the dentists using various radiographic imaging techniques. Every technique has its own set of advantages and disadvantages. Orthopantomography (OPG) has often been considered as the first choice of imaging technique prior to the extraction of mandibular third molar (6).

Additional investigation using computed tomography (CT) may be recommended to verify the relationship in three-dimensional view once the OPG indicates a close relationship between the third molar and the IAC (8-10). But there are drawbacks of CT i.e., there is increased cost and the radiation is high when compared to panoramic imaging (Ghaeminia *et al*., 2009). Recently developed radiographic imaging technique is Cone beam CT (CBCT) has been used in oral and maxillofacial cases. There are various advantages of CBCT over other imaging modalities like reduced radiation dose (Nakamori *et al*., 2008; Pawelzik *et al*., 2002) offers high spatial resolution and reduced financial costs, (Godoy *et al*., 2005) provides better quality images of teeth and their surrounding structures (14).

Thus, use of CBCT has been found to be useful in the preoperative diagnosis of mandibular third molars (Suomalainen *et al*., 2010). Thus, the aim of this study is to initiate and confirm a new classification for the inferior alveolar nerve (IAN) injury with respect to positional relation between the tooth and the inferior alveolar canal (IAC) using Cone Beam Computed tomography (CBCT).

MATERIALS AND METHODS

Subjects and study samples

We retrospectively reviewed 1017 CBCT images (Sirona CBCT system with the use of computer software Galileo with slice thickness of 1mm) obtained from the Department of Oral Medicine and Radiology who had been referred for scans of complicated mandibular third molars. Complicated mandibular third molars refer to those which met at least one of the following criteria i.e., partially or fully impacted, contact or interrupt the inferior alveolar canal, considerable obstruction of the adjacent tooth during teeth eruption. 1137 complicated mandibular third molars in scans were included in the study with age range from 21 to 33 years.

Methods

The new classification system was established based on the positional relation of mandibular third molar to the IAC in the coronal/ axial reconstructions of the CBCT

Data management and analysis

All CBCT images were evaluated twice by the same investigator on the same computer through the Galileo software program with an interval of at least 1 week. All the images were randomly disordered before the second evaluation was done. The multiplanar reconstruction (MPR) screen was used through the axial/coronal planes. The images were evaluated in all three dimensions. If an agreement between both evaluations was not achieved, an oral and maxillofacial radiologist with a 25 years experience was consulted to confirm the final results.

The variables

The predictable variables were the Types (I, II, III, and IV). TYPE I: Buccal and Abutting, TYPE II: Lingual and Abutting (Figure 1) TYPE III: Root Apex and Abutting (When the nerve is <5mm from the root apex) (Figure 2), TYPE IV: Intraradicular (Figure 3).
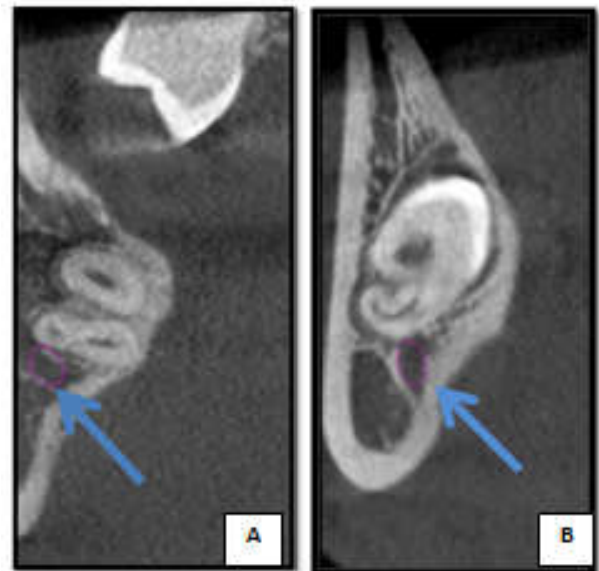
RESULTS

1137 complicated mandibular third molars in 1017 scans were included in the study. The mean age of individuals ranged from 21 to 33 years.

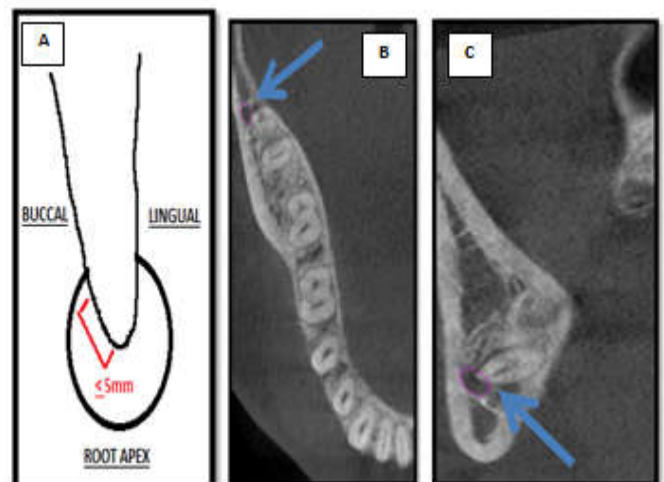**Table 1. Classification of position of mandibular third molar to inferior alveolar canal**

Classification	Number of Patients	Percentage
TYPE I	323	28%
TYPE II	546	48%
TYPE III	155	14%
TYPE IV	113	10%

The new classification system was established based on the positional relation of mandibular third molar to the IAC in the coronal/ axial reconstructions of the CBCT i.e., TYPE I: Buccal and Abutting, TYPE II: Lingual and Abutting, TYPE III:

**Figure 1. Classification based on position of mandibular third molars based on the positional relation to IAC.
(a) Type I Buccal and abutting
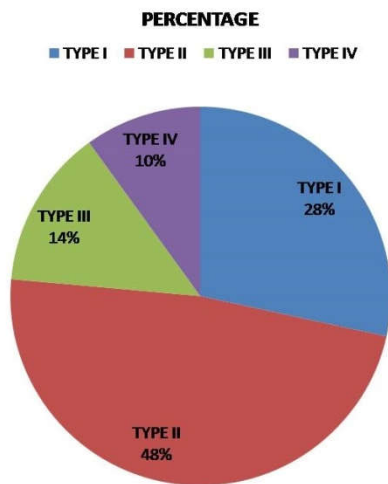(b) Type II Lingual and abutting**

**Figure 2. Classification base on position of mandibular third molars based on the positional relation to IAS
(a,b,c) Type III Root apex and abutting**

Figure 3. Classification based on position of mandibular third molars based on the positional relation to IAC (a, b) Type III Intraradicular

Root Apex and Abutting (When the nerve is <5mm from the root apex), TYPE IV: Intraradicular. Out of 1137 complicated mandibular third molars, 323 patients (28%) were under TYPE

PIE DIAGRAM showing position of mandibular third molar to inferior alveolar canal

I, 546 patients (48%) were TYPE II, 155 patients (14%) were TYPE III, 113 patients (10%) were under TYPE IV(Table 1) and (Pie diagram 1) TYPE II was the most common type of classification (48%) while TYPE IV was the least common type (10%).

DISCUSSION

The extraction of a complicated mandibular third molar requires an experienced surgeon because it has higher risks to cause severe complications. Thus, it is necessary to evaluate the risk of complications. Both Panoramic radiographs and CBCT are of a great value in evaluating the proximity of the tooth root to the IAC. Rood *et al.* (1990) suggested seven radiographic indicators on panoramic radiographs describing the proximity of the tooth root to the IAC, of which, four were about the root (darkening, deflection, narrowing of the root, and a bifid root apex), and the other three were about the IAC (diversion, narrowing, and interruption of the white line of the IAC). However, panoramic radiographs have the shortcoming of the overlapping of the images (Komerik *et al.*, 2014). On the

other hand, the use of Cone Beam CT to evaluate the proximity of tooth (complicated mandibular third molars) to IAC have markedly reduced severe complications. Thus, using CBCT as a complementary imaging tool should be suggested in teeth that are closely related to the IAC. Maegawa *et al.* (2003) and Ghaeminia *et al.* (2009) reported that the IAN was more frequently exposed during third molar removal when the mandibular canal was positioned at the lingual side or interradicular to the third molar tooth rather than buccally Khan *et al*[6] reported that of the total number of teeth examined, the mandibular canal was on the lingual side in the majority of instances. Howe and Poyton (1960) have reported that whenever an intimate relation between the tooth and the canal exists, it is found to be more on the lingual aspect. Current study has classified the positional relation of tooth to IAC into four types i.e TYPE I: Buccal and Abutting, TYPE II: Lingual and Abutting, TYPE III: Root Apex and Abutting (When the nerve is <5mm from the root apex), TYPE IV: Intraradicular. The position of the third molar in relation to the mandibular canal had most significant risk factor in the occurrence of IAN exposure when the mandibular canal was positioned at lingual and abutting. The patient can also be more adequately informed about his or her risk factor.

It can be concluded that a CBCT image is specifically indicated when the panoramic radiograph shows that the apex of the third molar root abutting the inferior border of the mandibular canal.

Conclusion

The presented new classification system based on position of mandibular third molar to inferior alveolar canal using CBCT is proved to be valuable in detecting wisdom teeth with higher risk of IAN injury during extraction of a complicated mandibular third molar and hence, it will enable the surgeons to carry out the necessary dental procedures without causing any deleterious effects.

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