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Localization Of The Impacted Mandibular 3rd Molar And Its Relationship To Inferior Alveolar Canal By Use Cone Beam Tomography (CBCT) In CoparisimWith OPG

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ABSTRACT

Background*:This study was undertaken to evaluate the relationship between the mandibular third molar and the mandibular canal by Cone-Beam Computed TomographyCBCT and OrthoPantomo Graph OPG before surgical procedure of impacted lower wisdom .*

Materials and Methods:*20 patients (14 women and 6 men, 18-35 years of age)(34 mandibular wisdom teeth) with preoperative panoramic radiographs suggesting close relationship with theInferior Alveolar Nerve (IAN). The Panoramic radiographs weretaken with Kodak 8000C and the cone-beam computedtomography (CBCT) were taken using a Kodak 9500C 3D conebeam system. The exposure factors were set at 120kV, and theslice thickness of contiguous sections was 1mm.*

Results*:Panoramic radiographs suggested 34 teeth 14 women and 6 men, 18-37 years of age,*

and the number of teeth they in close relationship With IDN Vertical relationship between the mandibular third molar root and the mandibular canal in these teeth was 19(42.55%) withthe root apex at the upper half of the mandibular canal, 7(38.29%) withthe root apex at the

lower half of the mandibular canal and 4(19.14%) the root apex under the inferior wall of the

mandibular canal. the Locations of the mandibular canal in relation to the mandibular third molars as demonstrated by CBCTin the included cases were: 6(17.02%) mandibular canals were in the buccal position, 15(44.68%) were in the inferior position, 8(23.4%) were lingual, and 5(14.89%) were between the roots

Conclusion:*Cone Beam Computed Tomography provides useful informationregarding the 3-dimensional relationship between the mandibulararthird molar and the mandibular canal.it helps the surgeon for the planning of the surgery to avoid injury to the nerve and minimize the complications .*

Keywords: *mandibular, Tomography, CBCT, IAN*

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I. Introduction

The removal of mandibular third molars may cause dysesthesia orloss of sensation due to damage to the inferior alveolar nerveduring the operation [1]. Several factors are considered to beassociated with nerve damage [1-3]. It is known that the riskdramatically increases when there is direct contact between thenerve and the roots of the third molar [3,4] i.e. no cortical bonelamella separating the two. Thus, it is important to evaluate theanatomic relationship between the mandibular canal and the rootsof third molars when surgery to be considered [5].Panoramic radiographs are most commonly used for this purpose and many researchers have reported imaging features suggestiveof an intimate relationship between the 2 structures. Sedaghatfaret al. recently reported a retrospective study that showed thefollowing 4 panoramic features were significantly associated withinferior alveolar nerve exposure following third molarremoval;1-Darkening of the root. 2-lnterruption of the white line of the mandibular canal wall.3-Diversion of the mandibular canal.4-Narrowing of the root. [5].

Otherstudies suggest that seven specific signs are observed on panoramic radiograph which includes darkening of roots, deflection of roots, narrowing of roots, bifid root apex, diversion of the canal, narrowing of canal, and interruption in the white line of the canal. These specific signs indicate the risk of injury to the IAN during the surgery.]24

Due to the fact that panoramic radiographs only producetwo-dimensional image of a three-dimensional relationshipbetween the structures it has been recommended that when thepanoramic image is suggestive of an intimate relationship betweenthe impacted tooth and the mandibular canal, an additional investigation to demonstratethe three dimensional relationship between the two structures[4,6-8,23,24]. Following the recent introduction of maxillofacial cone beam CT (CBCT), three-dimensional imaging is becoming more readily available for use in dental applications. The major advantages of cone-beam CTinclude high spatial resolution and low radiation dose compared to conventional CT.[10] The positional relationship between the mandibular canal and the impacted third molar revealed through the computed tomograph was classified in terms of the position into 1 of the 4 following categories: Buccal, inferior, lingual, or between roots. The root of the lower third molar was considered to be in contact with the neurovascular bundle in the mandibular canal when loss of the cortical lining of the mandibular canal was observed on the axial and coronal computedtomographs.[10]

II. Materials And Methods

20patients (14 women and 6 men, 18-37 years of age) (34 mandibular wisdom teeth) with preoperativepanoramic radiographs suggesting close relationship with the Inferior Alveolar Nerve (IAN). The Panoramic radiographs weretaken with Kodak 8000C and the cone-beam computedtomography (CBCT) were taken using a Kodak 9500C 3D conebeam system. The exposure factors were set at 120kV, and theslice thickness of contiguous sections was 1mm.

On the CBCTimages, the presence or absence of corticalization betweenthe mandibular third molar and the mandibularcanal(interruption in the white line of the canal) was evaluated using cross-sectional images.Absenceof corticalization was defined as a loss of cortical lining the canal was traced, and the image formed was seen in 3D view, i.e., sagittal, coronal, and axial planes.

III. Results

Panoramic radiographs suggested 34 teeth 14 women and 6 men, 18-37 years of age. **(Table 1)**

Table 1: The average age of male and female.

Age group	Males	Females
18-22	2(10%)	4(20%)
23-27	1(5%)	5(25%)
28-32	3(15%)	3(15%)
33-37	0	2(10%)

Vertical relationship of mandibular canal to the impacted lower third molar in 19 cases examend bypanoramic radiograph was classified into 3 categories according to the position of the tip of the root, A: the root apex at the upper half of the mandibular canal, B: the root apex at the lower half of the mandibular canal, oand C: the root apex under the inferior wall of the mandibular canal. Type A: 8(42.55%) ,Type B: 7(38.29%) ,Type C: 4(19.14%) **(Table 2)**

Table 2: Vertical relationship between the lower third molar root and the mandibular canal on the panoramic radiograph

N0 of cases	Position of the tip of the root	Percentage
8	A	*42.55%*
7	B	*38.29%*
4	C	*19.14%*

Locations of the mandibular canal in relation to the mandibular third molars as demonstrated by CBCT was classified into 4 positions. In each position, the presence or absence of cortical bone around the mandibular canal was examined to evaluate the proximity of the root to the mandibular canal.in the included cases were: 6(17.02%) mandibular canals were in the buccal position, 15(44.68%) themandibular canal was inferior position to the root of the tooth, 8(23.4%) the mandibular canal was lingual position, and 5(14.89%) the position of the canal was between the roots **(Table 3).**

Table 3: The buccolingual relationship between the mandibular canal and the mandibular third molar by CBCT

Non no of cases	Position of impacted lower 3rd molar	Percent
15	Inferior	44.68%
8	lingual	23.4 %
6	Buccal	17.0

		2%
5	Between	14.8 9%

Evaluation of the panoramic radiographs and computed tomographs

CASE: I (Between Roots)

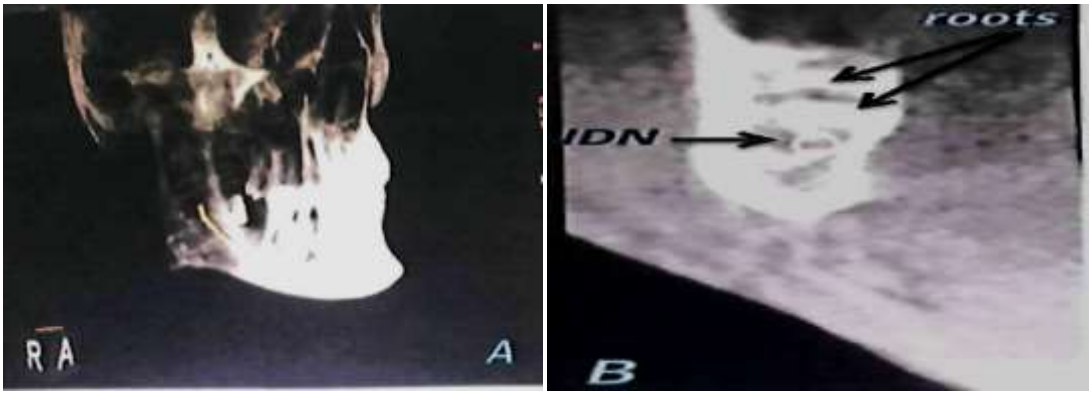
A deeply seated left lower third molar tooth ,the root was located in cloes relation with the inferior border of the mandibular canal. The relation of both structures were not clearly identified on a panoramic radiograph. On CBCT the border of the inferior alveolar canal was abscent which meens that there is no separation between the roots and the canal .The surgical procedure was done with out any trauma or pressure to avoid injury to the nerve.Post operative follow up ,the patient has normal sensation . **(Fig.1)**

(A) **(B)**

Fig. 1 A: The cranial and caudal borders and periodontal membrane space of the left lower third molar are not clearly seen on the panoramic radiograph. **B**: 3D view.

Case: II (Inferior position)

A right lower third molar. The tooth is located in horizontal position in the arch , OPG shaws superior position of the root to the upper border of inferior alveolar canal , and the apex of the tooth is not clearly seen in 3D view, but the coronal section gives the precise position of the roots which was above the canal and the canal seems to be inferior position to the root apex**(Fig. 2).**The surgical procedure was done carful removal of the tooth with minimal trauma . there was no postoperative complication.



(A) **(B)**

Fig. 2 A: 3D view of the right lower third molar area reveals that the root apex is in the superior position to the mandibular canal and **B:** coronal view**.**

Case III (Lingual position)

A right lower third molar tooth ,the panoramic radiograph shaws a clear mandibular canal croosed by the root, the periodontal membrane space was normal ,there was suspicious if the tooth was located lingaully or buccaly .CBCT shawed the location of the tooth lingually far from the canal .Surgical removal of the tooth was done with out any compromising of sensation . **(Fig.3**)

Fig. 3 A: The panoramic radiograph with collimation on the right molar area reveals the lingualposition of the mandibular canal **B:** 3D view

IV. Discussion

The advanced radiological technology with 3D imaging facilitate the correlationship between the lower third molar and IAC&N .Although OPG give details about the lower 3rd molar and its position in the jaw,precise position of the tooth with the canal and its neurovascular bundle cannt be detected by OPG ,CBCT make the assessment easy for the planning of the surgical procedure with minimal or abscense of injry to the nerve .this study gose with many studies were done previously . A well-described risk factor that is significantly correlated with IAN injury following third molar removal is exposure of the neurovascular bundle during extraction [6,7,9,10]. An accurate preoperative prediction of IAN exposure is important to determine the risk of IAN injury. This information can be helpful in deciding whether to remove a symptomless third molar and can be used to obtain correct informed consent [9,10]. In general, a panoramic radiograph can help to determine the location of the mandibularcanal; however, this technique provides limited information because it only provide a 2-dimensional image so sufficient diagnostic information related to the actual 3-dimensional anatomy is lacking with this method (e.g., the presence or absence ofcortical bone around the mandibular canal, the buccolingua lrelationship between the mandibular canal and the lower thirdmolar, and the detailed shape of the root might not be clearlyevident on a panoramic radiograph). [11,12] Although panoramic images cannot provide three-dimensional information, numerous clinical studies have been performed to determine signs predictive of intraoperative neurovascular bundle exposure during surgery orpostoperative dysesthesia/paresthesia. [4-6,13,14]Juodzbalys G, Daugela P 2013 found that diversion of the canal, darkening of the root,and interruption of the white line corresponding to the cortical bone of the mandibular canal on periapical and panoramic radiographs were significant signs related to risk of inferior alveolar nerveinjury. Rud [14]andKipp et al.[3] reported similar findings.Sedaghatfar et al. [5] recently conducted retrospective study, found that those four features were significantly associated with inferioralveolar nerve exposure at surgery .

The usefulness of CBCT has been described in endodontology[14]. implantology [16], periodontology [17] and oral surgery [15],but few systematic validation studies are available. One study hasreported the diagnostic accuracy of CBCT in predicting IANexposure following third molar removal [9].

Computed Tomography provides surgeons with useful and relevant anatomical information, due to the high resolution of CT.[2,4]. the usefulness of conventional CT in evaluating thetopographic relationship between the mandibular canal and thethird molars have been reported. [4,6,8] However, there are few studies that correlated CT findings with surgical outcome with respect to nerve injuries. Thus, accurate preoperative determination of neurovascular bundle position and its relationship to the roots of wisdom teeth in all 3 dimensions is very useful fo rpredicting potential risk of injuring the inferior alveolar nerve duringsurgery. Also, this information is very useful when informing the patient about surgical risks and obtaining informed consen texperimental studies have confirmed the geometric accuracy of cone-beam CT [18,19] due to the recent and spread of ConeBeam CT, three dimensional images are becoming more easily available in dentistry.[20]

Hashimoto et al.[21]reported that cone-beam CT was significantly superior toconventional multidetector CT in visualizing teeth and theirsurrounding structures. On the CBCT images, the canal was traced in three planes. The acquired images were assessed for the presence or absence of corticalization.[22][23][24]

V. Conclusion

Cone Beam Computed Tomography provides useful informationregarding the 3-dimensional relationship between the mandibular third molar and the mandibular canal. Thus, it can be used for theplanning of surgical procedure and assessment the risk for alveolar nerve injury. It also showedthat CBCT is more accurate in demonstrating the presence or absenceof cortical bone separating the nerve and the root.

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