"PROXIMITY OF INFERIOR ALVEOLAR NERVE TO MANDIBULAR FIRST MOLAR BASED ON GENDER BY CBCT EVALUATION" - "A RETROSPECTIVE STUDY"

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Abstract

Aim: To evaluate whether patient's difference in gender are predictive of differences in the relative location of the inferior alveolar nerve to the roots of mandibular first molars.

Materials and method: CBCT scans were selected from a database, 50 patients meeting the inclusion and exclusion criteria were selected. Twenty two measurements (in millimetres) were made on the three aspects i.e. coronal, axial and saggital at the level of the Inferior Alveolar Nerve to the mesial and distal root apices of mandibular first molar .

Results: Females had significantly shorter vertical distances from the IAN to the mesial and distal root apices of mandibular first molar in comparison to males. ($p<0.05$)

Conclusion: CBCT evaluation should be considered in pre-surgical planning of mandibular posterior region.

Keywords: Cone beam computed tomography, Gender differences, Inferior alveolar nerve, Mandibular canal.

Introduction

The most frequently treated tooth for endodontic procedures is the mandibular first molar.[1,2] This might be due to the complexity of the root system in the mandibular first molar and possibly because it is the most restored tooth.[3] Even though there is a high success rate with non-surgical root canal treatment, root-end surgery might be required in up to 26% of cases presenting with apical periodontitis.[4] The inferior alveolar nerve (IAN) is inclined to get damaged because of surgical trauma, tumors, lower jaw fractures, impacted teeth, nearby infections (e.g., osteomyelitis, implant surrounded diseases), anasthetic infusion, over-instrumentation, over-filling, dental implants etc.

The closeness of the IAN to vital structures near root apex is an issue that has driven a few experts to minimize the use of surgical techniques on mandibular molars.[5,6,7] The endodontic treatment of mandibular molars may result in IAN paresthesia due to inadvertent root apex perforation by endodontic instruments or due to over filling of medicaments that are expressed beyond the apex. Such induced blunders might be evident when radiographic assessment is done to know the cause of side effects.[8]

Damage to the nerve while performing endodontic surgery may result in paresthesia or complete anaesthesia. Hence, the precise location of these structures can best be discovered through attentive radiographic assessment.

A thorough knowledge of the relative 3-dimensional (3D) position of the IAN to the root apices of the mandibular molars is required as apicoectomy can be carried out with minimal risk to the IAN.[14]

The various modalities to study the position of IAN can be corpse studies, 2-dimensional (2D) imaging, and 3D imaging. Conventional 2D radiographic images, such as panoramic radiographs, are most commonly used to assess the relationship between the inferior alveolar nerve canal (IANC) and mandibular molars but Localization of critical anatomic structures at the surgical site including an estimation of the location, size and configuration of the inferior alveolar nerve during mandibular surgery is usually difficult using conventional images. Superimposition of overlying anatomy, distortion and magnification, presence of acquisition and processing artifacts and lack of information in the third dimension are some of the known drawbacks of this type of imaging. [14,15,16] However, 3D radiographic modalities such as computed tomography and CBCT provide more accurate information with less distortion compared to the 2-D images. In addition, 3D imaging modalities provide cross sectional (buccolingual), axial, sagittal, coronal and panoramic views that can be used to assess in detail the relationship between the IANC and the mandibular molars.[15] It produces high-resolution, without superimposition, artifact free, non-magnified and undistorted 3D images of the maxillofacial anatomy that can be reformatted in any desired plane for interactive viewing and image manipulation. The radiation dose is significantly less than that of conventional medical grade (CT). [16]

Jay D. Simonton et al in 2009 evaluated whether diffrences in patient sex or age are predictive of differences in the relative location of the IAN with roots of the mandibular first molar in California and concluded that women have a significantly closer distance of the root apices to the IAN and significantly decreased horizontal mandibular bone width than men they also reported that in reference to age in the third decade of life had shorter distance of the mesial root apex to the IAN than men in the 5th decade of life, horizontal bone width diminished in genders from the 3rd–6th decade of life,[14] Umadevi P Nair et al in 2013 evaluated the IANC in USA by evaluating the CBCT records.[16]

As there are few studies conducted in India to assess the relationship of IAN to the apex of mandibular 1st molar with CBCT, this retrospective study was undertaken to evaluate estimation of IAN in both the gender of Indian population by using CBCT Scans".

Materials and Methods

A database of more than 1,000 CBCT scans was searched, and the 50 patients that conformed to the inclusion and exclusion criteria were selected for the study. CBCT scans were obtained using the CS 9300 Carestream CBCT Machine. The scans were shown in every one of the 3 planes- Axial, coronal, and sagittal, measurements on the scan were done by using

Carestream CS 3d Imaging software (variant 3.3.11.0) and visualized on a LG VGA screen with the following specifications: screen size 19-inch diagonal, screen resolution 1280 x 1024 pixel, pixel dot size 0.264 mm, and contrast ratio 500:1.

Inclusion criteria (1) known gender (n = 25 males and 25 females) and (2) CBCT scans showing the mandibular first molar and IAN.

Exclusion criteria Any pathosis that might alter the relationship of the mandibular first molar and the IAN.

There were 14, 6 and 2 estimations made on the coronal, axial and saggital views respectively. In this fashion, totally 22 estimations were made. The scans were randomly chosen as to whether the right side or the left side was utilized from a single patient. This allowed for statistical independence of observations, because analysis that included both sides of the mandible would produce correlated observations confounding the statistical tests used in this study.

Seven sets (14) of measurements on Coronal view

i) The distance from the buccal cortical plate to the most buccal aspect of the root at a level 3 mm coronal to the apex, ii) The distance from the most lingual aspect of the root to the lingual cortical plate 3 mm coronal to the apex, iii) The total buccolingual dimension of the mandibular bone at a level 3 mm coronal to the apex, iv) The distance from the buccal cortical plate to the most buccal aspect of the inferior alveolar canal at the point perpendicular to the long axis of the root, v) The distance from the most lingual aspect of the mandibular canal to the lingual cortical plate, vi) The total buccolingual width of the mandible at the level of the inferior alveolar canal, vii) The distance from the closest aspect of the root to closest portion of the inferior alveolar canal.(Figure 1)

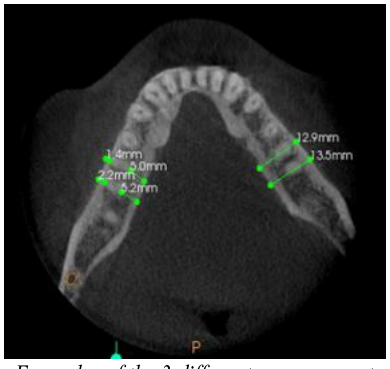

Figure 1: *Examples of the 3 different measurements taken for both the mesial and distal roots of the mandibular first molar on (Axial View) CBCT Scan.*

3 sets (6) of measurements on the axial view

i) The distance from the buccal cortical plate to the most buccal aspect of the root apex, ii).The distance from the most lingual aspect of the root apex to the lingual cortical. iii)The total buccolingual dimension of the mandibular bone. (Figure 2)

One set (2) of measurements on the saggital view:

The distance from the closest aspect of the root to closest portion of the inferior alveolar canal. (Figure 3)

Figure 2: *Examples of the 7 different measurements taken for both the mesial and distal roots of the mandibular first molar on (Coronal view) CBCT Scan.*

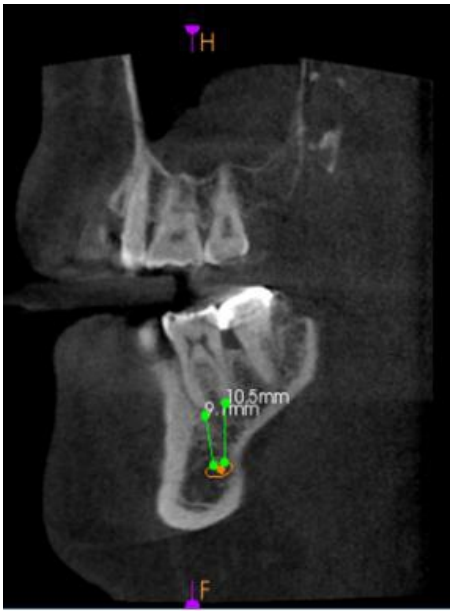

Figure 3: *Examples of the measurements taken for both the mesial and distal roots of the mandibular first molar on (Saggital View) CBCT Scan.*

Results

A significant difference was obtained in the position of inferior alveolar nerve based on gender. On applying Paired t-test it was seen that Females have shorter distance from the apex of mandibular first molar to the IAN in comparison to males on mesial and distal root apices, which is statistically significant ($P < 0.05$).It is 7.5 mm for mesial roots and 8.1 mm for distal roots in males and 6.2 mm for mesial roots and 7.0 mm for distal roots in females. (Table 1 and 2)

	Male	Female
Mean	7.5936	6.2960
SEM	0.3555	0.4481
N	25	25

P=0.0277

Table 1: *Mesial Root Male and Mesial Root Female*

	Male	Female
Mean	8.1816	7.0360
SEM	0.5461	0.5851

P=0.0437

Table 2: *Distal Root Male and Distal Root Female*

Discussion

The IAN is a basic anatomic structure whose area can frequently impact the surgical management of root-end surgery on mandibular molars. It is typically situated in closeness to the root apices. Often IAN injuries occur during endodontic treatment of the mandibular molars due to root-canal over-instrumentation or overfilling beyond root apex. [17] Sometimes root canal irrigating solutions, such as sodium hypochlorite, may pass beyond apical foramen resulting in an injury to IAN and surrounding tissues.[18] The expulsion of infected debris into the MC is another potential complication of root-canal treatment in mandibular molars with apical periodontitis. Thus accurate knowledge of IAN location is essential for the prevention of iatrogenic errors. Many dental specialists nowadays are choosing to place implants as compared to root-end surgery on mandibular molars to stay away from potential complications. In this regard, endodontists can have an edge over other specialists, if they understand the anatomy of mandible and performs endodontic surgery to save a tooth as opposed to placing an implant .[14]

Jay D. Simonton et al evaluated whether differences in patient age or gender are predictive of differences in the relative location of the IAN to the root apex of the mandibular first molar in Californian population and they found that females have shorter distance in comparison to males from the IAN to the apex of mandibular first molar,[14] Umadevi P Nair et al evaluated the IANC position by assessing the CBCT records in American population they reported that mean distance from the LCP to the IANC at the level of the molars was 2.2 mm and the separation to the Inferior BM was 6.68 mm.[16] Kovisto T et al assessed the distance from the apices of mandibular premolar and molar teeth to the outer border of the MC by using CBCT scans in American population and they found that root apices of the mandibular 2nd molars were nearer to the MC than other teeth, the mesial border of the 2nd molar was nearer to the nerve in females in comparison to male patients, Adigüzel O et al assessed whether age and sex differences are predictive components for IAN position as for mandibular first molar roots by using CBCT in Turkish population and they found that distance between IAN and mandibular 1st molar roots relies on the age and sex: it is less in females than in males and in subjects matured 16–25 years and >55 years than in other age groups. Çağlayan F et al evaluated the vertical position , horizontal position, angle, and measurement of the MF on the basis of age and gender by CBCT in a Turkish population they concluded that location and the position of MF can give significant information for preoperative arrangements (for surgery and dental implant surgery systems) particularly in the mandibular premolar region.

As far as it is known, there have been few studies with this new innovation - CBCT, in populace of patients in India to decide the position of the IAN.

This study has revealed that the distance between the IAN and the root apices of mandibular first molars is significantly shorter in females than in males, thus results are consistent with Simonton et al.

Gender differences seem to influence the closeness of the MC to root apices; however, the course of the canal crosses through the mandible might be different in patients.

Finally it is observed that 3D radiography has been used in numerous studies as a suitable diagnostic procedure to evaluate the course of the IAN of the mandible. CBCT can give this 3D data at a high resolution with a lower dosage of radiation than medical CT.[19]

Conclusion

A thorough understanding of the anatomy and prevention of IAN damage is the prime aim of CBCT imaging for an accurate surgical planning. During root canal treatment over instrumentation of the molar roots or surgical instruments close to MC may result in IAN damage so a fresh CBCT scan might be recommended before surgical treatment.

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