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Radiological locations of mental foramen in local population

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ABSTRACT

Objective: To evaluate the accurate radiographic location of the mental foramen and its prevalence by gender and different age groups.
Methodology: This Cross-sectional study was conducted at dental department at ISRA University Hospital Hyderabad, from September 2014 to Feb 2015. We studied 70 patients. All patients > 18 years age and both sex and presence of the canine, first premolar, second premolar and first molar in the images were included. Detailed patients' history was taken and detailed clinical examination was done. Patients were subject to relevant investigation panoramic digital images. All the data was recorded in the proforma.
Results: Out of total 70 patients included in ~~this~~ study 30 were male (42.85%) and 40 females (57.14%); with male to female ratio of 1:1.3. The mean age was 22+3.20 years. Mental foramen on radiographic were visible below first premolar in 35(50%) cases followed by mental foramen at below 2nd premolar in 30(42.85 %) cases and below first premolar in 5(7.14%) cases. Variation in the inferior alveolar canal observed. Variation in the inferior alveolar canal was Bifid canal only in two patients.
Conclusion: Mental foramen on radiographic were visible below first premolar 50%, below 2nd premolar 42.85% and below first premolar in 7.14%. While no significant relationship was found with gender and age.
Keywords: Mental foramen fluoride, mandibular canal

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Introduction

The mandibular or inferior alveolar canal (IAC) is a vital osseous framework preset in mandible, which allows the neurovascular bundle passage, as well as the trigeminal nerve's mandibular division and inferior alveolar nerve (IAN). The IAN is vital for normal function of the sensory system in the lower third of the face. The IAC begins at the mandibular foramen, in the middle third of the ascending ramus and ends in the mental foramen usually below the apex of the second premolar or between the first and second premolars.[1] As the IAN proceeds anteriorly in the mandibular canal, it traverses the mandible from the lingual to the buccal side. The path of the IAC is divided into four sectors: Ramus, angle, body and the mental sector.[2] Radiographic images are considered a vital diagnostic aid during evaluation and treatment planning. Radiographically, the mental foramen is presented as an oval radiolucency in the premolar region; however, accurate localization of the mental foramen and the IAC on the radiographic images is not always possible.[3]

It is among the regions for a lateral surgical procedure to the skull base. Deviations in maxillary vessels and mandibular nerves and its branches can lead to neurovascular disturbance that can cause numbness, headache and regional pain.[4] Accurate identification of the mental foramen is important for both diagnostic and clinical procedures. There are various tools of assessment of inferior dental canal including cone beam computed tomography, CT scan, orthopantomography.[5,6]

Panoramic radiography is a curvature topographic plane method that enables wide coverage of oral constructions with low radiation exposure (around 10 % of complete mouth radiographs), but significant drawbacks that

involve low image resolution, elevated distortion and phantom picture presence.[7,8,9]

In Mandibular Canal (MC), different anatomical variations may occur as being bifid or trifid due to embryological development defects.[10] It was reported that MC might have different anatomic configurations in the horizontal plane, the MC crosses from the lingual to the buccal side of the mandible or the midway between the buccal and lingual cortical plates of bone by the first molar,[11] panoramic radiography has been found to be sufficiently accurate in measuring the vertical bone depth of the mandible.[12]

Devastation to bundles of mandible nerves is frequently the result of surgical defects during orthodontics and these structures are often not identified.[13] Determination of the location and configuration of the inferior alveolar nerve and related anatomical structures is critical so as to minimize the risk of damage.[14] The purpose of the study is to evaluate radiographic location of the mental foramen to evaluate the various patterns of these structures, and its correlation with the age and gender among the local population because correct assessment of Inferior alveolar canal may help surgeons and implantologists in treatment planning.

Methodology

This cross-sectional study was conducted at dental department at ISRA University Hospital Hyderabad. Study duration was six months, from September 2014 to Feb 2015. Patients aged 18 years or more with diagnostic quality images with adequate density and comparison, permanent dentition, second premolar, first premolar, canine presence and first molar in the illustrations, images with significantly reduced positioning defects and no or negligible superimposition of constructions and both sexes were included. Patients presence of radiolucent or radiopaque lesions in the body of the mandible, anywhere in the area extending from the right third molar region to the left third molar region, patients with implant on posterior mandible like bone platting and patients with missing left or right mandibular first molars or incisors, or who had jaw fracture or bone pathologies were excluded. Only high-quality radiographs were selected to evaluate the MF in detail. Radiographs with distortion of images, presence of artifacts, or presence of any pathologies were excluded from the study. Various appearances of mental foramen were identified on the panoramic radiographs. All the data was entered in the profroma. After collection of data the analyses was conducted by using Statistical Package for Social Science (SPSS) software, Version 18.

Results

Out of 70 patients included in this study 30 were male (42.85%) and 40 females (57.14%); with male to female ratio of 1:1.3. (Table No:I).

Table No I: Age and gender distribution of patients (n=70)

Age of patients Years	No. of patients (n=70)	Percentage (%)
18-30 years	39	55.71%
31-40 years	12	17.14%
41-50 years	12	17.14%
51-60 years	7	10%
Total	70	100.0%
Gender		
Male	30	42.85%
Female	40	57.14%
Total	70	100.0%

Means Age 22+3.20 years,
Male:Female Ratio = 1:1.3

There was wide variation of age ranging from a minimum of 18 years to 60 years. The mean age was 22±3.20 years (Table No:I).

In our study mental foramen on radiographic were visible below first premolar in 32(45.71%) cases followed by mental foramen at below 2nd premolar in 27(38.57%)

Table No II: Position of mental foramen on radiographic According Gender (n=70)

Position of the mental foramen	No. of Male (n=30)	No. of Female (n=40)	Total (n=70)	P Value
In line with first premolar	12(17.14%)	20(28.57%)	32(45.71%)	
In line with 2nd premolar	11(15.71%)	16(22.85%)	27(38.57%)	
Between 1st & 2nd Premolar	3(4.28%)	3(4.28%)	6 (8.57%)	
Not visible	4(5.71%)	1(1.4%)	5(7.14%)	0.003
Between the 2nd premolar and mesio-buccal root of first molar	0(0)	0(0)	0(0)	
In line with the mesio-buccal root of first molar	0(0)	0(0)	0(0)	

Table No III: Position of the mental foramen on radiographic According age distribution

Age of patients Years	No. of patients (n=70)	Position of mental foramen	
		Position	No. of patients
18-30 years	39(55.71%)	Below first premolar	22
		Below 2nd premolar	12
		Between 1st & 2nd Premolar	3
		Not visible	2
		Between the 2nd premolar and mesio-buccal root of first molar	0
		In line with the mesio-buccal root of first molar	0
31-40 years	12(17.14%)	Below first premolar	5
		Below 2nd premolar	04
		Between 1st & 2nd Premolar	1
		Not visible	2
		Between the 2nd premolar and mesio-buccal root of first molar	0
		In line with the mesio-buccal root of first molar	0
41-50 years	12(17.14%)	Below first premolar	5
		Below 2nd premolar	5
		Between 1st & 2nd Premolar	1
		Not visible	1
		Between the 2nd premolar and mesio-buccal root of first molar	0
		In line with the mesio-buccal root of first molar	0
51-60 years	7(10%)	Below first premolar	1
		Below 2nd premolar	4
		Between 1st & 2nd Premolar	1
		Not visible	1
		Between the 2nd premolar and mesio-buccal root of first molar	0
		In line with the mesio-buccal root of first molar	0

cases, Between 1st & 2nd Premolar 6 (8.57%) and Not visible 5(7.14%) (Table No: II).

There was no significant association found in locational of foramen according to age and gender, p-values were quite insignificant. (Table No: II and III).

Discussion

Precise assessment of bone morphology and size is essential for pre-operative scheduling of mandibular implantation. The selected implant size relies on the accessible bone's width and height and place of the mandibular canal. The edentulous alveolar ridge's physiological absorption will decrease the gap between the mandibular canals's cortical and the bone crest. The measurements acquired in periapical and panoramic radiographs do not exactly match the truth. It was possible to lateralize the mandibular canal yet not inevitably in the center of the mandible structure, needing a particular pre-operative radiological assessment for better handling.

In the current study male to female ratio was 1:1.3. However, study of Ngeow WC et al[15] reported that male to female ratio was 1.06:1 which higher from this study.

Changes must also be taken into account in the position of mandibular foramen with age. The mandibular foramen's location with age was defined in this regard, taking into account distinct landmarks. Kilarkaje et al.[16] reported that the distance between the mandibular foramen and different landmarks, (i.e., the head of the mandible, third molar, anterior border of the ramus, angle of the mandible, symphysis menti and lowest point on the mandibular notch), gradually increased with advancing age. Moreover, compared to the occlusal plane and the alveolar crest plane the mandibular foramen was described moving upward with age[17]. In the present study, a minimum of 18 years to

60 years. The mean age was 22+3.20 years, maximum number of cases was seen in 2nd and 3rd decade and least number was seen in 6th decade and onwards. In the study conducted by Ngeow WC et al[15] and state that More than half (58.1%) of the subjects aged 20 – 29 years and gradually reduced to only 15 percent of subjects aged 50 and above.

The mandibular canal is an anatomical structure used as reference to surgical approaches in the jaws. Extractions of third molars, implant placement, orthognathic surgery, reduction and fixation of fractures in various areas of the mandible are examples of procedures performed in close proximity to this canal, what increases the risk of injury to the inferior alveolar nerve[18]. It is important to measure bone volume to avoid injuries in the alveolar inferior nerve resulting from implant surgery. The trajectory of the mandibular canal at the site of implant placement may alter sensation of the lower lip due to inferior alveolar nerve injury and it is one of the most serious complications of mandibular implant surgery.[19,20] In our study mostly patients were Type I Visible superior and inferior borders in 38(54.28%) cases followed by Type II Visible superior and invisible inferior borders in 15(21.42 %) cases, Type III Visible inferior and invisible superior borders in 10(14.28%) cases and Type IV Invisible superior and inferior borders in 7(10%). However the study of Neves FS et al[19] state that differences between males and females regarding mandible width and height, mandibular canal width and height, distance of the mandibular canal to buccal, lingual, superior and inferior cortical plates of the mandible and the distance of the mandibular canal to the higher point of the alveolar ridge are present. The height of the mandible in males was significantly higher when compared to females ($p<0.05$). However, the mandibular canal width in females was significantly higher when compared to males ($p<0.05$). The width of the mandible and the distance of the mandibular canal to the higher point of the alveolar ridge were higher in females, but not statistically significant.

The mental foramen is an important landmark when considering placing implants in the foraminal region of the mandibular arch. Differences in its location, the number of foramina, and the possibility that an anterior loop of the mental nerve may be present mesial to the mental foramen need to be considered prior to preparing an osteotomy in this region.

In this study mental foramen on radiographic were visible in 35(50%) cases followed by mental foramen at below 2nd premolar in 30(42.85%) cases and below first premolar in 5(7.14%). The mental foramen's location in the horizontal plane. It is usually located by the apex of the second mandibular premolar or between the apices of the premolars. Minor variations may be race related. For instance, among Chinese subjects, the mental foramen is usually located apical to the second premolar [21], whereas in Caucasian subjects, it is usually found between the premolars.[22] Juodzbalys G et al[23] observed that the mandibular incisive canal, mental foramen and associated neurovascular bundles exist in different locations and possess many variations. Individual, gender, age, race, assessing technique used and degree of edentulous alveolar bone atrophy largely influence these variations. It suggests that the clinicians should carefully identify these anatomical landmarks, by analyzing all influencing factors, prior to their implant surgical operation. It can be concluded that the foramen's location is not constant in the horizontal or vertical planes. Furthermore, the finding that it may be coronal to the apex of the root needs to be considered when performing immediate placement of dental implants in sockets. In our study observed Variation in the inferior alveolar canal were Bifid canal only in two patients.

Conclusion

Mental foramen on radiographic were visible below first premolar in 50%, below 2nd premolar in 42.85% and below first premolar in 7.14%, while no significant relationship found with gender and age. This study is an attempt to localize superior and inferior borders in our population in order to avoid injury during the maxillofacial surgery or during dental implant procedures. More studies should be conducted on this variation.

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