Original Article

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Morphometric Analysis of the Mental Foramen from Bony Landmarks in Dry Human Mandibles

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Abstract

Introduction: Mental foramina are located bilaterally in the antero-lateral aspect of the body of mandible. It transmits mental nerve, and vessels. The location, shape, size, direction and number of mental foramen in human mandibles are subject of variation. Aims and Objective: To establish the location, shape, size, direction and incidence of mental foramen (MF) in dry human mandibles. **Subjects and Methods**: One hundred dry human mandibles of unknown age and sex were selected randomly. Shape, size, position of MF with respect to tooth and other anatomical landmark were determined. Paired t-test was used for specific statistical analysis. **Results:** In most cases (61%), the MF was oval in shape & situated below the apex of second premolar (58% on right side and 69% on left side). Various parameters investigated were, the horizontal distance between (1) base of mandible and MF was 12.24 mm on right and 12.26 mm on the left, (2) alveolar margin and MF was 13.95 mm on right and13.75 mm on left (3) symphysis menti of mandible and MF was 26.71 mm on right and 26.49 mm on left, (4) posterior border of mandible and MF was 65.34 mm on right and 65.68mm on left. **Conclusion:** By the knowledge of position, shape, size, direction and distance of the mental foramen from various landmarks and the presence of the accessory foramen may be of much use to surgeons.

Keywords: Anatomy, Mandible, Premolar, Nerve.

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Introduction

Mental foramina are located bilaterally in the antero-lateral aspect of the body of mandible. It transmits mental nerve, and vessels. Mental nerve is a branch of inferior alveolar nerve, which carries general sensation from the lower lip and the labial mucosa. Inferior alveolar nerve branches into the mental nerve and incisive nerve near the mental foramen. Mental nerve ultimately leaves the mandible through the mental foramen (MF) and the incisive nerve, which remains within the bone, supplies the mandibular incisors and canine teeth.[1] Position of MF varies among racial groups and genders.[2,3] The most common position of the MF is in-line with the longitudinal axis of the 2nd pre-molar tooth followed by a location between the 1st and second pre-molar teeth.[1]

MF lies midway between the upper and lower borders of mandible in adult and come to lie near to the superior border after teeth are lost. It is directed anteriorly before the fusion of mandible and directed posteriorly after 2-3 years of age.[4] The shape of mental foramen varies from round in most of the cases to oval in fewer cases.[5] The presence and variations of accessory mental foramen is also reported by different researchers.[6,7]

Mental foramen is an important landmark at the time of surgical intervention in the mental region of mandible and during local anesthesia. The knowledge of the position of MF is also important fracture reduction and mandibular surgery. The mental nerve could be injured during surgical procedures, resulting in paraesthesia or anesthesia. Generally the mental foramen is difficult to locate as it cannot be clinically visualized and palpated.[8]

Subjects and Methods

The study was designed and performed in department of Anatomy, at ANMMCH, Gaya. The study was approved by institutional research committee. The study included 100 dry human mandibles of unknown age and sex. All the samples were stored in a well ventilated and dry condition. Bones with clean surface and without any damage were selected. Mandibles of children whose mental foramen is near to the inferior border and that of old age with resorbed alveolar crest were excluded. The number, shape and direction of mental foramen were determined by visual examination. The size and location was examined with the help of digital vernier caliper and their mean value was obtained. Location

of MF was marked by using following parameters:
(1) Distance from inferior border of the mandible to MF
(2) Distance from alveolar margin to MF
(3) Distance from symphysis menti to MF
(4) Distance from posterior border of the ramus of mandible to MF.

The position of MF was noted in relation to mandibular tooth. The postero-superior, superior, lateral, antero-superior, posterior or anterior direction of the opening of MF recorded by previous researchers was verified in this study by inserting a probe into the foramen. Paired 't'-test was used to compare the mean value of right and left sides of mandible.

Results

One hundred dry human mandibles of unknown age and sex were examined for the presence of mental foramen. Mental foramen was present bilaterally in all the hundred samples.

Shape of MF

On right side it was oval in 61% of mandibles and round in 39% of mandibles. Similarly on left side it was oval in 50% and round in 50% of mandibles.

Size of MF

Mean horizontal diameter was 3.01 mm on right side and 2.88 mm on left side with range of 1.01-5.02 mm. Horizontal diameters between right and left side was statistically significant (P=0.044). Mean vertical diameter was 2.29 mm on both right and left side with range of 0.99-4.03 mm.

Frequency of the position of MF in relation to mandibular teeth socket

The most frequent position of MF in relation to the tooth was in line with the longitudinal axis of 2nd premolar for both right (58%) and left (69%) sides. The second common position was in between the first and second premolar teeth as described in [Table 1].

Position of mental foramen

Position of mental foramen in relation to various parameters like horizontal distance from (1) base of mandible and MF was 12.24 mm on right and 12.26mm on the left, (2) alveolar margin and MF was 13.95 mm on right & 13.75 mm on left (3) symphysis menti of mandible and MF was 26.71 mm on right and 26.49 mm on left, (4) posterior border of mandible and MF was 65.34 mm on right and 65.68 mm on left been described in [Table 2]. There was no signifcance difference between the position of MF on left and right side of mandible which was compared by using paired t test.

The direction of exit of the MF was postero-superior in 65%, followed by superior of the mandibles as shown in [Table 3].

Incidence of accessory mental foramen

Presence of accessory mental foramen (AMF) was observed in 6 out of 100 mandibles. Out of six mandibles, three AMF were present on the right and three on the left side. Interestingly, none of the mandibles had bilateral accessory mental foramen.

Table 1: Frequency of the position of mental foramen in relation to mandibular teeth socket

Position	Right side %	Left side %
Below apex of second premolar	8	69
Between first and second premolar	33	19
Below apex of first premolar	2	4
Between second premolar and first molar	5	5
Below first molar	2	2

Table 2: Location of mental foramen

Characteristics	Mean±SD (mm)		p value	t value
	Right side	Left side		
Distance from base of mandible (D1)	12.24±1.30	12.26±1.23	0.882	−0.149
Distance from alveolar margin (D2)	13.95±1.73	13.75±1.83	0.085	1.738
Distance from symphysismenti (D3)	26.71±1.96	26.49±2.11	0.124	1.553
Distance from the posterior border of ramus of mandible (D4)	65.34±4.71	65.68±4.24	0.177	−1.360

Table 3: Orientation of mental foramen

Characteristic	Right side	Left side
Posterosuperior	65%	65%
Posterior	6%	10%
Superior	26%	23%
Anterior	2%	0%
Anterosuperior	1%	2%

Discussion

The proper identification of exact location of mental foramen is important in both diagnostic and surgical procedure.[8] Anatomically, the mental foramen is the opening of the mandibular canal. This study showed that the most common position of the MF was below the apex of second premolar, which was similar with some studies.1,6 Some authors have mentioned that the most common position of mental foramen is between the apices of mandibular first and second premolar 10-11 but this was found to be second common position in this study supported by the study of Dipti A. Nimje et al.[1,11-12]

The position of the mental foramen varies depending on various factors like symmetry of mental triangle, morphology and maturity of the human mandible, bone remodeling activity and anthropologic features of the facial skeleton in different populations. In this study, majority of mental foramina were oval in shape i.e., 55.5% and only 44.5% had rounded shaped which was similar to study conducted by Siddiqui AU et al,[13] Shaik HS et al,[14] and Eboh DE.[1]

In contrast to this study Singh R et al,[6] found 6% oval and 94% round mental foramen. In the study by Ilayperuma I et al,[15] mean transverse diameter of mental foramen on right side was 3.26 mm and on left side 3.41 mm while the mean vertical diameter was 2.45 mm on right side and 2.60 mm on left side. In the study of Agrawal DR et al,[9] findings were as, mean transverse diameter on right side 3.33 mm and on left side 3.25 mm and mean vertical diameter on right side 2.15 mm and on left side 2.13 mm. In this study mean

transverse diameter was found to be 3.11 mm on right side and 2.88 mm on left side. The mean vertical diameter was 2.29 mm on both right and left side, which was in consistent with the study of Dipti A. Nimje et al.[12] Direction of opening of the mental foramen was postero superiorly in majority of the subjects (65%). This was in agreement with previous studies Deepa Rani & Sandeep and Udhaya et al.[9,16]

In the present study the distance from base of mandible to the mental foramen (D1) was12.24±1.30 mm on right side and 12.26±1.23 mm on left side. The distance between mental foramen and alveolar margin (D2) was 13.95±1.73 mm on right side and on left side it was13.75±1.83 mm. The distance between mental foramen and symphysismenti (D3) was 26.71±1.96 mm on right side and on left side it was 26.49±2.11 mm. The distance between mental foramen and posterior border of ramus of mandible (D4) was 65.34±71 mm on right side while on left side it was 65.68±4.24 mm. These data were similar to the findings of Dipti A. Nimje et al.[12] The findings of Singh R et al (2010),[6] differs from the present study.

In this study six accessory mental foramina were found. Three AMF on the left side and three on the right side, which indicates 3% on the right side and 3% on the left side with 6% of total incidence. Imada et al,[17] also studied in 100 mandible and found six accessory mental foramen, three on right and left side. The findings of Shukla RK et al,[18] in 96 mandibles a single accessory mental foramen was identified in 4.17% of the sample 7 reported 6.62% of the mandibles possessed accessory mental foramina. Naitoh Munetaka et al,[19] said the accessory mental foramen was observed in 7% of patients. These findings were similar with the present study. This study shows no significant difference between the position and morphometry of mental foramen on right and left side of the mandible compared by using paired t test. The findings of this study were similar to that the study carried out by Dipti A. Nimje et al.[12]

Conclusion

The present study adds information to the literature concerning the location and morphology of mental foramen. The most common location of the MF in this study is below second premolar but many reported between first and second molar. The presence of accessory mental foramen is less. The findings obtained from this study is similar to that of different researchers different parts of India. But the knowledge of both mental foramen and accessory mental foramen helps the surgeon to avoid paresthesia and hemorrhage during surgical intervention and helps for better patient care.

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