Section: Anatomy



Original Research Article

A STUDY ON THE MORPHOMETRY OF THE MENTAL FORAMEN AND ACCESSORY MENTAL FORAMEN AT GAUHATI MEDICAL COLLEGE, ASSAM

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ABSTRACT

Background: The mental foramen (MF) of the mandible is an important anatomical landmark, transmitting mental nerve and vessels. Its accurate localization is essential in dental anaesthesia, implant placement, and maxillofacial procedures. Variations in position of Mental foramen, along with presence of accessory mental foramen, may alter clinical outcomes by increasing risk of failed anaesthesia or nerve injury **Materials and Methods:** A cross-sectional analytical study conducted on 50 dry human mandibles obtained from Department of Anatomy, Gauhati Medical College. The mental foramen and accessory mental foramen identified on external surface of the mandible. Their position was measured in relation to superior and inferior borders, symphysis menti, posterior border of ramus, and adjacent teeth using a digital vernier calliper and thread method. Classification of Mental Foramen done according to Tebo and Telford. Data analyzed using mean, standard deviation, and p-value. **Result:** The mental foramen was predominantly located in Type IV position (between the first and second premolars), followed by Type III position (in line with the second premolar). Type II and Type V positions were uncommon, while Type I and Type VI positions were not observed. The mean distance from the mental foramen to the symphysis menti was 26.84 ± 1.90 mm on the right and 27.28 ± 2.24 mm on the left. The mean distance from the posterior border of the ramus was 68.23 ± 1.80 mm on the right and 67.07 ± 1.95 mm on the left. The mean distances from the superior border were 12.98 ± 1.69 mm on the right and 12.69 ± 1.31 mm on the left, while those from the inferior border were 11.56 ± 1.73 mm and 11.34 ± 1.02 mm, respectively. An accessory mental foramen was observed in 1 out of 50 mandibles (2%). No statistically significant bilateral differences were observed in the distances from the superior border ($p = 0.340$), inferior border ($p = 0.441$), and symphysis menti ($p = 0.292$). However, a statistically significant bilateral difference was noted in the distance from the posterior border of the ramus ($p = 0.0026$). Intra-side comparisons demonstrated statistically significant differences between the superior and inferior border measurements and highly significant differences between the symphysis menti and posterior border measurements on both sides. **Conclusion:** The mental foramen was predominantly located in the premolar region, with Type IV being the most frequent position, followed by Type III. Minor bilateral asymmetry was observed, particularly in its relationship with the posterior border of the ramus. Although accessory mental foramina were rare, their identification is clinically important to prevent incomplete anaesthesia and iatrogenic neurovascular injury during dental and maxillofacial procedures. The findings emphasize the importance of individualized anatomical assessment and careful preoperative imaging.

INTRODUCTION

Initially, the term maxillae was used for both the upper and lower jaw. The word "mandible" and its components were described by Andreas Vesalius in "De humani corporis fabrica".[1] One of the important anatomical landmarks of the mandible is the mental foramen. It is located on the ventrolateral aspect of the body of the mandible. The mental foramen transmits the mental nerve and vessels. In adults, it lies at an average of 2.5cm (range 2-3cm) from the midline of the face, between the apices of the roots of mandibular teeth 4 and 5 (range teeth 3-6). Most foramina usually lie either level with or inferior to the apex of the root of the tooth. Any foramen that is in addition to the mental foramen is considered an Accessory Mental Foramen. Accessory mental foramina, if present, are mainly situated posterior or inferior to the main mental foramen.[2] The study of the variations of the position of the mental foramen and the accessory mental foramen helps us to give a proper regional nerve block and preoperative planning for mandible implant procedures, mandible reconstructive procedures.

Aims And Objectives

- To determine the position of the Mental foramen
- Identify and document Accessory Mental Foramen, if any present.

MATERIALS AND METHODS

A cross-sectional analytical study was done on 50 dry mandibles sourced irrespective of age and sex from the Department of Anatomy, Gauhati Medical College, Assam, India. The mental foramen and the accessory mental foramen were identified on the external surface of the mandible below the 1st and 2nd premolar teeth. The position of the mental foramen was studied along the vertical plane from the superior and inferior borders of the mandible and along the horizontal plane from the mental symphysis and posterior border of the ramus of the mandible by using a woollen thread and vernier calliper. The position of the mental foramen about the lower canines, premolars, and molars was studied using a calibrated scale.

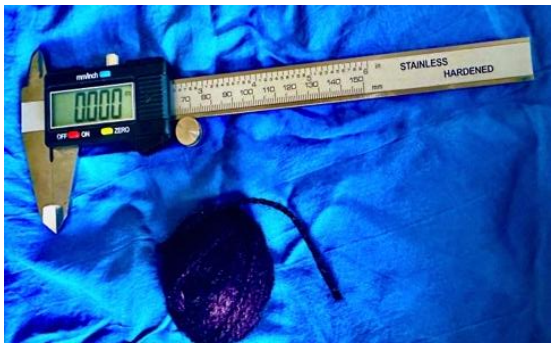


Figure 1: Equipment used for measurements

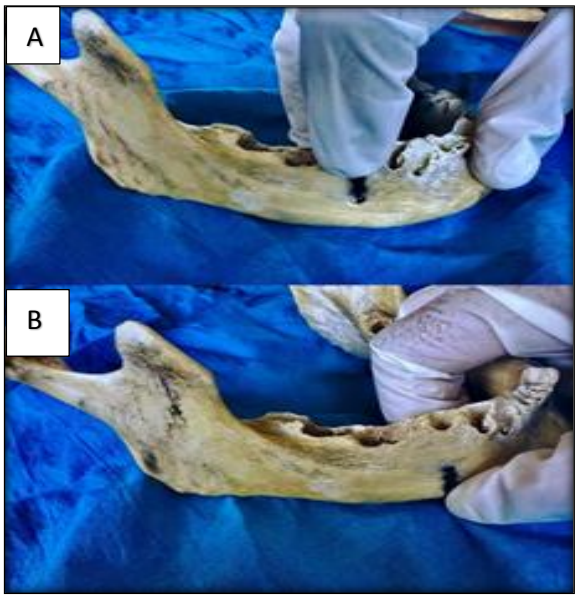


Figure 2: Measuring the position of mental foramen from a) superior border and b) inferior border of the mandible

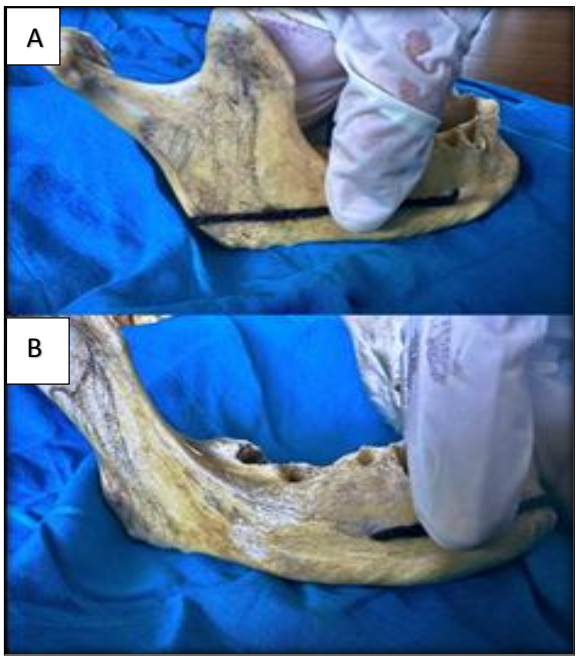


Figure 3: Measuring the position of mental foramen from a) posterior border of ramus of mandible and b) mental symphysis

Analysis of variations in position of the mental foramen according to Tebo and Telford,1950 classification.[3]

Type	Position of mental foramen
I	lying along the longitudinal axis between canine and first premolar
II	lying along the longitudinal axis of the first premolar
III	lying along the longitudinal axis between first and second premolar
IV	lying along the longitudinal axis of the second premolar
V	lying along the longitudinal axis between the second premolar and first molar
VI	lying along the longitudinal axis of first molar

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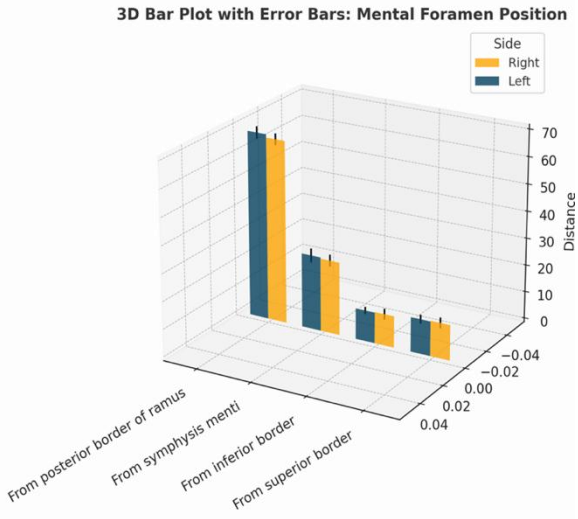
Inclusion and Exclusion Criteria

Inclusion Criteria: Normal human dry mandible collected and preserved from cadavers donated for educational or medico-legal purposes, irrespective of age and gender.

Exclusion Criteria: Damaged mandible, Mandible with fracture and mandible with deformities

RESULTS

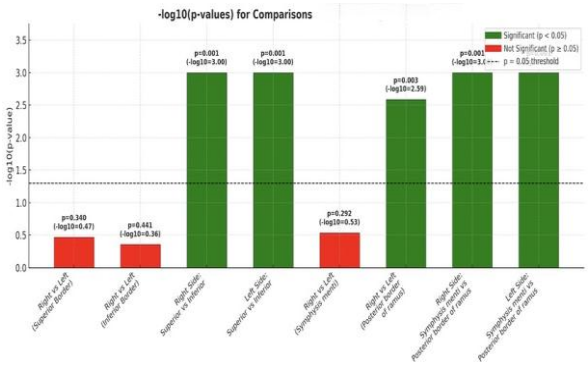
Statistical comparative analysis of the mental foramen position was done. It revealed no significant difference between the right and left sides in distance from the superior border (p = 0.340) and the inferior border (p = 0.441). Similarly, the distance from symphysis menti between sides was not statistically significant (p = 0.292). Significant side to side difference noted in the distance from posterior border of the ramus (p = 0.0026). Indicating mental foramen is lying little closer to posterior border of ramus on left side and little closer to symphysis menti on right side.



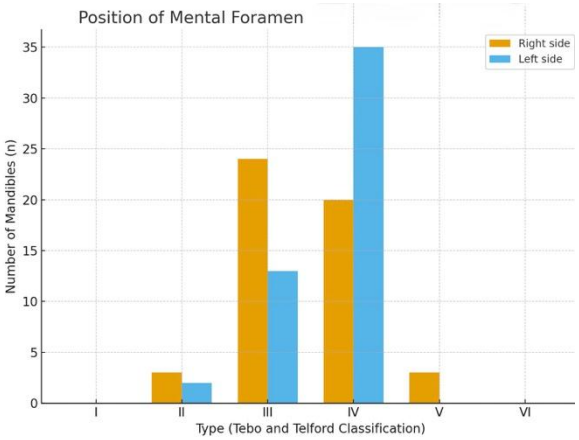
Graph 1: 3D Bar graph with error bars showing position of mental foramen from superior border, inferior border, symphysis menti & posterior border of ramus of the mandible

Intra-side comparisons on both the right and left sides was done. It revealed the distance from the superior border was significantly greater than that from the inferior border. The distance from symphysis menti showed a highly significant difference when compared with the posterior border of the ramus on both sides. The mental foramen is positioned slightly below the midpoint in the vertical dimension. In the anteroposterior plane, the mental foramen tends to be located more posteriorly on the left side compared to the right.

In the present study, the mental foramen was most frequently located in Type IV position, showing bilateral occurrence in some mandibles, followed by Type III position, which showed a right-sided predominance. Type II and V were rare, while Type I and VI were absent in the present study.



Graph 2: Bar graph showing-log10(p-value) for comparison



Graph 3: Bar graph showing position of the mental foramen in relation to lower teeth according to Tebo and Telford classification

Table 1: Position of mental foramen in relation with lower teeth

Position of mental foramen	Mean ± standard deviation (in mm)	
	Right	Left
From superior border	12.98± 1.69	12.69± 1.31
From inferior border	11.56± 1.73	11.34±1.02
From symphysis menti	26.84± 1.90	27.28±2.24
From posterior border of ramus	68.23±1.80	67.07±1.95

In the present study, an accessory mental foramen was identified in 1 out of 50 mandibles (2%). The distance between the mental foramen and the accessory mental foramen was 1.26mm. This foramen was situated at the junction of the second premolar and first molar, positioned posterosuperior to the main mental foramen. The presence of an Accessory mental foramen is clinically significant, as

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its omission can result in failed anaesthesia or iatrogenic injury during surgical procedures.[6,7]



Figure 4: Accessory mental foramen present on right side of the mandible just above and lateral to mental foramen

DISCUSSION

The predominance of Type III and IV highlights that mental foramen most frequently lies in or near the premolar region, consistent with the classic observations of Tebo and Telford (1950) and subsequent morphometric studies by Ngeow & Yuzawati (2003) Yesilyurt et al. (2008) and Sudipta et al.(2018).[1,4,5,10] The AMF location corresponds with patterns reported in anatomical and radiological studies, such as those by Al-Khateeb et al. and Katakami et al., who described the majority of AMFs lying above and behind the main foramen.[6,7]

A slight asymmetry was noted between the right and left sides, with the left mental foramen being positioned posterior and inferior. Similar side-related variations have been observed in other morphometric studies, including Prabhat et al. (2014) and Hema et al. (2015), suggesting that minor anatomical differences are common.[8,9]

Implications of the Present Study: Guidance for Local Anesthesia Administration, Prevention of Iatrogenic Injury, Radiological Interpretation, Forensic and Anthropological Applications, Training & Education

CONCLUSION

This study confirms that the mental foramen is most frequently located between the first and second premolars (Type IV) or in line with the second premolar (Type III). Morphometric analysis revealed minor but statistically significant asymmetry between sides for certain parameters, underlining the need for individualized assessment before surgical or anesthetic procedures. These findings provide valuable reference data to reinforce the importance of preoperative imaging and careful clinical practice. The study was limited by a small sample size, which may limit generalizability. Additionally, minor measurement variations, the lack of soft tissue relationships, and in vivo positional variations could not be assessed in the dry bone study, which may differ in clinical settings.

Although rare, accessory mental foramina were observed in the present study. Awareness of the variable location is essential, and careful evaluation of imaging, such as cone-beam computed tomography (CBCT), is crucial for avoiding surgical complications in the mandibular premolar region. Clinically, unrecognized AMFs can result in incomplete anaesthesia or potential neurovascular injury during procedures like implant placement, osteotomies, and periapical surgery.

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