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Research Article

A study on Morphometry of Mental Foramen in Adult dry Mandibles.

**Dr. G Manoj Kumar Reddy¹, Masarapu Appala Konda Satish², Dr. V. C. Balaji³,
Dr. Shaik Hussain Saheb⁴**

Associate Professor, Department of Anatomy, Government Medical College, Kadapa.
Research scholar, Department of anatomy, Bareilly international University, Bareilly.
Assistant professor, Department of Dental Surgery, GMC, Adoni, Kurnool, Andhra Pradesh.
Assistant Professor, Department of Anatomy, GMC, Kadapa.

Corresponding Author: Dr. Shaik Hussain Saheb

*Assistant Professor, Department of Anatomy, GMC, Kadapa.

Email ID- anatomyshs@gmail.com

Abstract

Background: The mental foramen is located in the body of the mandible, midway between the alveolar and inferior margins. It is usually in line with the longitudinal axis of the lower first premolar, second premolar, or first molar tooth. The average size of the mental foramen on the right side is 2.79 mm, and the average size on the left side is 2.57 mm. The shape of the mental foramen was described as oval or rounded. It transmits mental nerves, arteries, and veins. The mental nerve is a branch of the inferior alveolar nerve which supplies sensation to the lower lip, labial mucosa, lower canines, and premolars. The most useful injection for anaesthetizing the mandibular teeth is the inferior alveolar nerve block.

Materials and Methods: In present study we have used 150 mandibles, used only undamaged and clean mandibles. The mean transverse diameter, mean longitudinal diameter, the mean distance between symphysis menti and foramen on right and left side, the mean distance between mental foramen and alveolar margin on right and left side, the mean distance between mental foramen and lower border of mandible on right and left side were measured. We have collected data and calculated mean and expressed the form of Mean±SD.

Results: We have observed the shape of mental foramen, it was oval in 75% of cases. We have observed the location of mental foramen, it was found 76.84% in line with the longitudinal axis of the second molar teeth, 15.66% was present in between first and second molar teeth. In relation with location the mean distance between symphysis-menti and foramen was 27.52±6.18mm on right side and left side it was 31.42±4.26mm. It was found that, the mean transverse diameter was 3.84±1.26mm and the mean longitudinal diameter 3.26±1.18mm.

Conclusion: Morphometric evaluations of the mental foramen are important for dentists, surgeons, and anaesthetists because the correct localization of the mental foramen is critical for procedures such as periapical surgery, incision and flap thickness, and local anaesthetic administration.

Keywords: Mental Foramen, Mandible, Mental Nerve, Inferioralveolar nerve.

***Author for correspondence:** Email: anatomyshs@gmail.com

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Introduction

The mental foramen is an important anatomical landmark to facilitate surgical, local anaesthetic, and other invasive procedures for dental surgeons performing periapical surgery in the mental region of the mandible. Its location and the possibility that an anterior loop of the mental nerve may be present mesial to the mental foramen and need to be considered before any surgery in the foramina area to avoid any nerve damage. The mental foramen is situated bilaterally on the anterolateral aspect of the mandible, down to the alveolar margin. The mental nerve and vessels emerge through the mental foramen and supply sensory innervation and blood supply to the soft tissues of the chin, lower lip, and gingiva[1,2].

Knowledge about mental foramen is required to avoid post-operative complication in mental region like neuro-sensory disturbances, paralysis, haemorrhage, altered sensation, orofacial pain, atypical neuralgia. Its knowledge is also required in surgical procedures like apical curettage of mandibular premolars, amalgam filling, periodontal surgery, to avoid injury to neurovascular bundle. The level of difficulty to locate and palpate mental foramen externally increased due to lack of specific anatomical landmark. Ranging from maxillofacial to oral surgeries, knowledge about distance between surrounding structure and mental foramen is essential to fulfil successful procedure. Dental implant is one of the great achievements in dentistry, due to its capability to restoring natural function of missing teeth without damaging surrounding tissue. Success of it revolves around availability of bone. The mental foramen is always at danger throughout the implant procedure. To maintain a safety margin, it is necessary to study the surrounding region of the mental foramen before proceeding with surgical treatments, especially with the rising tendency of orthognathic surgery in the mental region[3,4,5,6,7]. The precise knowledge on the variations in the position, shape, and the size of the mental foramen and the presence of the accessory mental foramen would be of much use for dental surgeons while they do surgical procedures on the mandible, such as the curettage of the premolars, filling procedures, dental implants, Root Canal Treatments, orthognathic surgeries, etc. It is also essential to have an effective and a successful anaesthesia during nerve blocks, prior to the surgical procedure. Inadvertent damage to the mental nerve may lead to complications such as temporary or permanent paresthesia of lip and chin region, hemorrhage, and postoperative pain.

Presurgical evaluation of the anatomical variations in the mental foramen and anterior loop prevents these complications. In endodontic treatments, anatomical details about the position of the mental foramen are beneficial for successful root canal therapy. They help dentists accurately locate the mental nerve’s canal and thoroughly clean and fill the root canals in the affected teeth. In orthodontics, the position of the mental foramen can guide the orthodontist in planning the movement of teeth and aligners, especially in cases of lower anterior tooth retraction. Being aware of the proximity of the mental foramen allows the orthodontist to design treatment plans that do not interfere with the neurovascular bundle[8,9,10,11]. The present study conducted to find the morphological and morphometric analysis of mental foramen.

Materials and Methods

In present study we have used 150 mandibles, which were collected from department of Anatomy, GMC, Kadapa. We have collected mandibles and examined for damage, we have used only undamaged and clean mandibles. We have measured following measurements and recorded. The mean transverse diameter, mean longitudinal diameter, the mean distance between symphysis menti and foramen on right and left side, the mean distance between mental foramen and alveolar margin on right and left side, the mean distance between mental foramen and lower border of mandible on right and left side were measured. We have collected data and calculated mean and expressed the form of Mean±SD.

Results

We have observed the shape of mental foramen, it was oval in 75% of cases(Figure 1). We have observed the location of mental foramen, it was found 76.84% in line with the longitudinal axis of the second molar teeth, 15.66% was present in between first and second molar teeth. The mean distance between mental foramen and alveolar margin was 15.44±4.46mm on right side and 14.24±4.14mm on left. The mean distance between mental foramen and lower border of mandible was 12.62±3.24mm on right side and 14.16± 2.84mm on left. It was found that, the mean transverse diameter was 3.84±1.26mm and the mean longitudinal diameter 3.26±1.18mm. In relation with location the mean distance between symphysis-menti and foramen was 27.52±6.18mm on right side and left side it was 31.42±4.26mm(Table 1).

Table 1. Showing the multiple measurements of Mental foramen.

Measurement	Right Side	Left Side
The mean distance between mental foramen and alveolar margin	15.44±4.46mm	14.24±4.14mm
The mean distance between mental foramen and lower border of mandible	12.62±3.24mm	14.16± 2.84mm
In relation with location the mean distance between symphysismenti and foramen	27.52±6.18mm	31.42±4.26mm
The mean transverse diameter of foramen	3.84±1.26mm	
The mean longitudinal diameter of foramen	3.26±1.18mm	

Figure 1. Mandibles showing the mental foramen(Oval and round shape)



Discussion

The mental foramen is an opening found bilaterally on the anterolateral aspect of the mandible, it can be round or oval. From the point of view of embryology, the mental foramen does not complete its development until the 12th week of gestation, which happens after the mental nerve branches into fascicles. The jawbone begins its formation once it is found. The inferior alveolar nerve and its branches are complete, so the mental foramen and accessory mental foramen formed in the same time range[12,13,14]. The precise identification of the position of the mental foramen is important in both diagnostic and clinical procedures of the mandible. Clinically, the mental nerve bundle emerging from the mental foramen may get injured during surgical procedures with resulting paresthesia or anesthesia along with its sensory distribution.⁹ Anatomically, the mental foramen is the opening of the mental canal[1,15]. The accurate identification of the mental foramen is of significant clinical importance for successful local anaesthesia injection during dental treatments in the premolars area. Dentists must be aware of the variations in the mental foramen morphological and morphometric characteristics to prevent potential pre- and post-treatment complications[16].

In present study oval shape mental foramen found in 75% of cases. The mean distance between mental foramen and alveolar margin was 15.44 ± 4.46 mm on right side and 14.24 ± 4.14 mm on left. The mean distance between mental foramen and lower border of mandible was 12.62 ± 3.24 mm on right side and 14.16 ± 2.84 mm on left. It was found that, the mean transverse diameter was 3.84 ± 1.26 mm and the mean longitudinal diameter 3.26 ± 1.18 mm. In relation with location the mean distance between symphysis-menti and foramen was 27.52 ± 6.18 mm on right side and left side it was 31.42 ± 4.26 mm. our results were in agreement with previous studies.

In study of Udhaya K[17] was conducted with 90 adult dry human mandibles. In a majority of the mandibles,

the mental foramen was located at the level of the root of the 2nd premolar, midway between the inferior margin and the alveolar margin of the mandible. Most of the mental foramina were oval in shape. The orientation of the foramen was postero-superior in 83% of the mandibles. The accessory foramens were noted in five mandibles. Chappidi, Vani[18] conducted a retrospective observational study includes 500 CBCT images of the mandible. Out of 250 CBCT scans analysed, 132 scans (52.8%) were of males and 118 scans (47.2%) belonged to females. The mean size of mental foramen as measured in the sagittal sections was found to be 3.36 mm in height and 2.54 mm in length. The most common position for the mental foramen related to the mandibular teeth in this study was between first and second premolars in 310 CBCT images (62%). A majority of the mental foramen were oval in shape ($n = 346$, 69.2%) followed by round shape ($n = 154$, 30.8%). The presence of AL of inferior alveolar nerve was found in only 20% ($n = 100$) of cases. Rajshekar T[8] study conducted with 300 mandibles. The shape of foramen was oval in 72%. The location of mental foramen was found 78.65% in line with the longitudinal axis of the second molar teeth, 13.52% was present in between first and second molar teeth. There was no significance difference between the mean distance between mental foramen and alveolar margin of right and left side. This findings with agreement of present study results.

The study of Wei Cheong Ngeow[19] study results are in correlation with present study results. In their study the most common position for the mental foramen relative to the teeth in this sample was in line with the second premolar for both the right and left side (69.24%). The second most common location was between the first and the second premolar (19.57%). Rajani Singh[20] Srivastav study shown similar results in position of the mental foramen. In the present study, most common position of MF is below the apex of second premolar tooth in 68.8% of Indian mandibles. In British mandibles, it was between first and second premolars in 65% mandibles [14]. In study of

Rajashekar T[8] found the distance to the upper border was 13.6 mm on the right side and 14.62 mm on the left side. The horizontal dimension of the mental foramen was 2.93 mm on the right side and 3.14 mm on the left side. The vertical dimension was 2.38 mm and 2.64 mm on the right and left sides respectively. In study of Saravana K S[1] found the mean distance from the mental foramen to the symphysis menti in the present study was 25.52±5.03mm on the right side and 26.067±5.03mm on the left side. These findings are in agreement with present study. In study of Pokhrel, R[21] used 83 dried mandibles of known sex, 53 males and 30 females. The most common position of mental foramen was at the apex of the second premolar (48.8%) and the next was between the apices of the first and second premolars (30.1%), this pattern being the same for both sides of both sexes with no statistical significance. Accessory mental foramen was found in 7.22% sides, bilaterally in 4.81% and was more common in males and in the right side. Mean lower border, alveolar border and mental symphysis were 12.60 ± 1.63, 12.39 ± 2.32 and 26.47 ± 2.54 mm respectively, with all values being significantly higher for males; differences between the sides were statistically insignificant. Rai, R.K[22] study found the mean vertical diameters were 2.3±0.64mm on right and 2.29±0.6mm on left sides whereas the mean horizontal diameters were 2.63±0.85mm and 2.61±0.85mm on right and left sides respectively.

Zainab, H[23] study, the mean distance between the mental foramen and symphysis menti for right side was 23.21 mm±2.12 and for left side was 23.10 mm±2.41. The mean distance between mental foramen and posterior border of ramus of mandible for right side was 62.58 mm±4.23 and for left side was 63.84 mm±4.72. The mean distance between mental foramen and alveolar crest for right side was 15.23 mm±1.12 and for left side was 16.07 mm±1.01. The mean distance between the mental foramen and base of mandible for right side was 15.61 mm±1.03 and for left side was 15.98 mm±1.06. Rastogi, R[24] study found in 51.7 % cases the foramen was round in shape while in 48.3% cases it was oval. The most common position observed was on the longitudinal axis of the 2nd premolar tooth. The mean distance from symphysis menti to the medial margin of mandibular foramen was 26.08±0.66mm and 26.15±0.64mm on the right and left side respectively. The mean distance from the posterior margin of the mental foramen to the posterior border of the ramus of the mandible was 66.18±0.79mm and 66.27±0.80mm on the right and left side respectively. The mean distance from the alveolar crest to the upper margin of the mental foramen was 10.67±0.21mm and 10.71±0.18m on the right and left side respectively, and the mean distance from the lower border of the mandible to the lower margin of the mental foramen was 14.59±0.23mm and 14.64±0.20mm on the right and left side respectively.

Conclusion

The knowledge of the distances from surgically encountered anatomical landmarks in the present study provide valuable information to dental surgeons that will

facilitate effective localization of the neurovascular bundle passing through mental foramen, thus avoiding complications from local anaesthetic, surgical and other invasive procedures. Understanding the morphometry of the mental foramen is essential for clinicians, which may assist them in performing dental procedures more safely and achieving successful local anesthesia. Injury to the MF during surgical procedures can lead to clinical implications: paresthesia or anesthesia of the chin, lower lip, and gingiva from the mental foramen to the midline.

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