

A Morphometric Study Determines the Location of Mental Foramen in Dried Edentulous Human Mandible and its Clinical Implication

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Abstract

Aim: The present study had been undertaken to determine the morphological features and morphometrics of mental foramen with reference to surrounding anatomical landmarks in both dentate and edentulous mandibles.

Methods: The present study was conducted in the Department of Anatomy, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India from January 2020 to December 2020 and 50 dried edentulous mandibles of unknown sex were selected for the study. Damaged and broken and congenitally malformed mandible was excluded. Shape of mental foramina were macroscopically observed and noted.

Results: Out of 50 mandible 20 mental foramina on right and 20 on left side were oval in shape rest were round. Most common shape of mental foramen was round (70%). The result shows no significant difference in various measurements on right and left side. Correlation between distance of MF from symphysis menti and length of mandible and its analysis shows significant positive correlation.

Conclusion: The MF plays a very important role in treatment planning and its location needs to be considered prior to placement of dental-implants, regional anesthesia, osteotomy-surgeries and during complete denture-fabrication in order to avoid MN injury and related complications.

Keywords: mandible, mental foramen, mental nerves

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Introduction

The mandible is the largest and strongest bone of the face. It develops from the first pharyngeal arch. It has a horse shoe shaped body which lodges the teeth and a pair of rami which project upwards from the posterior ends of the body and provide attachment to muscles. Each half of the mandible ossifies from only one center which appears at about the 6th week of intrauterine life in the mesenchymal sheath of Meckel's cartilage near the future mental foramen. Meckel's cartilage is the skeletal element of first pharyngeal arch. At birth, the mental foramen opens below the sockets for the two deciduous molar teeth near the lower border, this is because the bone is made up of only the alveolar part with sockets. [1]

The mental foramen is an important anatomical structure situated in Antero lateral aspect of the body of the mandible which transmits mental nerve, artery and vein. Mental nerve is a terminal branch of the inferior alveolar nerve which supplies sensory innervations to lower lip, buccal vestibule and

gingiva mesial to the first mandibular molar. Mental foramen serves as an important anatomical landmark, the orientation and position of which facilitate local anesthetic, surgical and other invasive procedures for oral and maxillofacial surgeries. [2] Its location and the possibility that an anterior loop of the mental nerve may be present mesial to the mental foramen needs to be considered before any surgery in the foramina area in order to avoid injuring of the neurovascular bundles passing through these foramina and notches. [3] The location of the mental foramen had been studied by means of direct measurement on dry mandibles or by using radiographs of dry mandibles in patients. [4]

Mental foramen is an important anatomical landmark. Knowledge of the orientation and position of it facilitate local anesthetic, surgical and other invasive procedures for oral and maxillofacial surgeries. [5] During radiographic examination the foramen may be misdiagnosed as a radiolucent

lesion in the apical area of the mandibular premolar teeth. So identification of accurate anatomical position of mental foramen is very important in periodontal surgery especially during flap surgery in lower teeth, retrograde amalgam fillings, apical curettage of mandibular premolars. Accurate location of mental foramen will facilitate the administration of local anesthesia of the terminal incisive branches of the inferior alveolar and mental nerves.

As the bone density increases the mental foramen becomes more difficult to identify on radiographs. Knowledge of the most common position of the mental foramen in the population may give additional information in the mental nerve blocks and related mandibular surgeries. So the present study had been undertaken to determine the morphological features and morphometrics of mental foramen with reference to surrounding anatomical landmarks in both dentate and edentulous mandibles.

Methods

The present study was conducted in the Department of Anatomy, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India

from January 2020 to December 2020 and 50 dried edentulous mandibles of unknown sex were selected for the study. Damaged and broken and congenitally malformed mandible was excluded. Shape of mental foramina were macroscopically observed and noted.

Various measurements were taken on both sides using digital vernier caliper.

1. Distance between anterior margin of mental foramen and mid line (symphysis menti) (D1)
2. Distance between lower margin of mental foramen and lower border of base of mandible (D2)
3. Distance between anterior margin of mental foramen and posterior border of ramus of mandible (D3)
4. Length of lower border of mandible from symphysis menti to angle of mandible (L)
5. Ratio (R) of Distance between anterior margin of mental foramen and mid line (symphysis menti) and Length of lower border of mandible from symphysis menti to angle of mandible was calculated on both sides.

Results

Table 1: Various measurements on right and left side

Parameters	Side	Mean (mm)	SD	P value	T test
Distance between MF and symphysis menti	Right	24.35	1.82	0.05	0.560
	Left	24.14	2.17		
Distance between MF and base of mandible	Right	12.28	1.82	>0.05	0.550
	Left	12.49	1.84		
Distance between MF and posterior border of ramus of mandible	Right	64.44	5.23	0.05	0.375
	Left	64.26	4.58		
Base length of mandible	Right	83.25	5.38	>0.05	0.150
	Left	83.13	4.94		

Out of 50 mandible 20 mental foramina on right and 20 on left side were oval in shape rest were round. Most common shape of mental foramen was round (70%). The result shows no significant difference in various measurements on right and left side.

Table 2: Ratio of distance between anterior margin of mental foramen from mid line and length of lower border of mandible from symphysis menti to angle of mandible

Observation	Right	Left
Mean	0.29	0.29
SD	0.021	0.022
P value	0.05	
t test value	0.555	

Correlation between distance of MF from symphysis menti and length of mandible and its analysis shows significant positive correlation.

Discussion

The mental foramen (MF) is located in the body of mandible midway between the inferior border of the mandible (IBM) and the alveolar crest (AC). The

MF morphology, morphometry and location extensively studying in dry mandibles or by using radiographies [6,8] were affected by the gender. The MF location is an important factor when considering the mental and incisive anesthetic block and surgeries in the outer premolar mandibular region.⁷ During several surgical procedures, such as genioplasty, mandibular rehabilitation after trauma,

root resection of mandibular premolars, dental implants placement and orthognathic procedures, oral and maxillofacial surgeon should be aware of the possibility to encounter an atypically placed MF in the mental area in order to prevent the MN and adjacent blood vessels damage and the resulting postoperative paresthesia, hypoesthesia, hyperesthesia, dysesthesia, or anesthesia of the teeth, the lower lip, or surrounding skin and mucosa. [9-11]

The mental foramen usually found on the anterolateral surface of the mandible which is a single circular or oval opening lies 13-15 mm superior to the inferior border of the body of mandible. [12] In most cases mental foramen is the interval between the two premolars and the apex of second premolar is the another most common site. [13] In our study, the distance from inferior margin of mental foramen and the lower border of mandible is 12.28 mm on right side and 12.49 mm on left side in edentulous human mandibles comparatively less than the study done by Srinivas Moogala et al. [14] The study done in Korean population by Chung et al. [15] reported that the average distance between the inferior border of the mandible and the center of mental foramen was 15.5 mm in males and 14.0 mm in females.

Commonly, there is single mental foramen on right and left side. In our study, any accessory mental foramen was not found. In most studies accessory mental foramen is a rare anatomical variation.[14, 16-20] Having a knowledge of accessory mental foramen for clinicians is important to prevent neurovascular complications, while doing surgical procedures, during dental implant surgery and any other surgical procedure involving the molar and premolar region.

In our study, the distance from most anterior margin of mental foramen to posterior border of ramus of the mandible (D3) on right side it is 64.44 ± 5.23 mm and left side it is 64.26 ± 4.58 mm which found less than the studies conducted by Srinivas Moogala et al. [14] and Shankar et al. [21]

In study done by Mraiwa et al. [22] showed that in dentate mandibles the MF was commonly located at a half way distance from the alveolar crest to the inferior border of mandible. The alveolar bone resorption after teeth loss, transposes the MF closer to the alveolar crest and in extreme situations the foramen might be found on the crest of the alveolar ridge. Study done by Srinivas Moogala et al.¹⁴ conclude that in dentate and edentulous human mandibles the distance from symphysis menti to the most anterior margin of mental foramen nearly same. While study by Qiufei Xie et al [23] summarizes no significant reduction in the average distance between the lower most point of the

mandibular canal and the lower border of mandible in the edentulous human.

In clinics, dental surgeons should be aware of the possibility of variation found in abnormal location of MF in the mental area in order to prevent the injury to the MN and adjacent blood vessels and the resulting postoperative sensory complication of the teeth and surrounding skin and mucosa during various dental surgery like genioplasty, vestibuloplasty, and dental implantation. To have a safety zone of 2 mm must be there between coronal aspect of nerve and implant to avoid mental nerve injury in surgery nearby mental foramina.

Conclusion

The location of the mental foramen needs to be considered before any surgical procedures in this region to avoid mental nerve injury during surgery. The position of the foramen is altered in edentulous mandibles compared with the dentate ones. The MF location is directly affected by dental status. Evaluation of the status of the alveolar ridge in edentulous mandibles is very important during the process of construction of removable dentures and dental implants placement. The morphology of edentulous mandibles increases the risk of intraoperative complications at the anterior mandible.

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