

A Morphometric Assessment of the Position of Mental Foramen in Dried Edentulous Human Mandible and its Clinical Significance

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Received: 20-11-2022 / Revised: 22-12-2022 / Accepted: 11-01-2023

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Conflict of interest: Nil

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, ESIC Medical College and Hospital, Bihta, Patna, Bihar, India for six months 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 meckels cartilage near the future mental foramen. Meckels 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, ESIC Medical College and Hospital, Bihta, Patna, Bihar, India 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 midline (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 midline (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 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 anaesthetic 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 paraesthesia, hypoesthesia, hyperaesthesia, dysaesthesia, or anaesthesia 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. [24]

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.

References

1. Williams PL, Banister LH. Collins Grays Anatomy in Skeletal system.
2. Shankland 2nd WE. The position of the mental foramen in Asian Indians. The Journal of oral implantology. 1994 Jan 1;20(2):118-23.
3. Wang TM, Shif C, Liu JC, Kuo KJ. A clinical and anatomical study of the location of the mental foramen in adult Chinese mandibles. Cells Tissues Organs. 1986;126(1):29-33.
4. Ngeow WC, Yuzawati Y. The location of the mental foramen in a selected Malay population. Journal of oral science. 2003;45(3):171-5.
5. Wang TM, Shif C, Liu JC, Kuo KJ. A clinical and anatomical study of the location of the mental foramen in adult Chinese mandibles. Cells Tissues Organs. 1986;126(1):29-33.
6. Agthong S, Huanmanop T, Chentanez V. Anatomical variations of the supraorbital, infraorbital, and mental

- foramina related to gender and side. *J Oral Maxillofac Surg.* 2005; 63(6): 800–804.
7. Amorim MM, Prado FB, Borini CB, et al. The mental foramen position in dentate and edentulous Brazilian's mandible. *Int J Morphol.* 2008; 26(4): 981–987.
 8. Apinhasmit W, Chompoonong S, Methathrathip D, et al. Supraorbital notch/foramen, infraorbital foramen and mental foramen in Thais: anthropometric measurements and surgical relevance. *J Med Assoc Thai.* 2006; 89(5):675–682.
 9. Greenstein G, Tarnow D. The mental foramen and nerve: clinical and anatomical factors related to dental implant placement: a literature review. *J Periodontol.* 2006; 77(12): 1933–1943.
 10. Paraskevas G, Mavrodi A, Natsis K. Accessory mental foramen: an anatomical study on dry mandibles and review of the literature. *Oral and maxillofacial surgery.* 2015 Jun;19(2):177-81.
 11. Toh H, Kodama J, Yanagisako M, et al. Anatomical study of the accessory mental foramen and the distribution of its nerve. *Okajimas Folia Anat Jpn.* 1992; 69(2-3): 85–88.
 12. Haghaniifar S, Rokouei M. Radiographic evaluation of the mental foramen in a selected Iranian population. *Indian Journal of dental research.* 2009 Apr 1;20(2):150.
 13. Moiseiwitsch JR. Position of the mental foramen in a North American, white population. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology.* 1998 Apr 1;85(4):457-60.
 14. Moogala S, Sanivarapu S, Boyapati R, Devulapalli NS, Chakrapani S, Kolaparthi L. Anthropometrics of mental foramen in dry dentate and edentulous mandibles in Coastal Andhra population of Andhra Pradesh State. *Journal of Indian Society of Periodontology.* 2014 Jul;18(4):497.
 15. Chung MS, Kim HJ, Kang HS, Chung IH. Locational relationship of the supraorbital notch or foramen and infraorbital and mental foramina in Koreans. *Cells Tissues Organs.* 1995; 154(2):162-6.
 16. Gershenson A, Nathan H, Luchansky E. Mental foramen and mental nerve: changes with age. *Cells Tissues Organs.* 1986;126(1):21-8.
 17. Balcioglu HA, Kocaelli H. Accessory mental foramen. *North American journal of medical sciences.* 2009 Nov;1(6):314.
 18. Singh SK, Gopinathan K, Bhalla U, Chhabra S. Variations in the position and number of mental foramen in mandibles of North Indian population. *J Anat Soc India.* 1992;41(1):47-51.
 19. Zografos J, Mutzuri A. Incidence of double mental foramen in a sample of Greek population. *Odontostomatologike proodos.* 1989 Dec 1;43(6):521-3.
 20. Mbajiorgu EF, Mawera G, Asala SA, Zivanovic S. Position of the mental foramen in adult black Zimbabwean mandibles: a clinical anatomical study. *The Central African journal of medicine.* 1998 Feb 1;44(2):24-30.
 21. Sankar DK, Bhanu SP, Susan PJ. Morphometrical and morphological study of mental foramen in dry edentulous mandibles of South Andhra population of India. *Indian Journal of Dental Research.* 2011 Jul 1;22(4):542.
 22. Mraiwa N, Jacobs R, van Steenberghe D, Quirynen M. Clinical assessment and surgical implications of anatomic challenges in the anterior mandible. *Clinical implant dentistry and related research.* 2003 Dec;5(4):219-25.
 23. Xie Q, Wolf J, Soikkonen K, Ainamo A. Height of mandibular basal bone in dentate and edentulous subjects. *Acta Odontologica Scandinavica.* 1996 Jan 1;54(6):379-83.

24. How to Cite V, A., Rajakumar S., & Rajagopal G. Possible steroidal effect of *Boswellia serrata* and homeostasis of Histidine – HDC- Histamine in

Psoriasis. *Journal of Medical Research and Health Sciences*, 2022; 5(11): 2324–2328.