

The positions and directions of the mental foramina of dry mandibles in Bangladesh

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Abstract

Background: The mental foramen is an important anatomical and clinical landmark for undertaking a successful mental nerve block during different clinical and surgical procedures. **Objectives:** This study aimed to document the positions and directions of the mental foramina in dry mandibles from Bangladesh. **Materials and methods:** In this cross-sectional observational study, 150 mental foramina in 75 dry mandibles were analysed to ascertain the directions and positions of mental foramina in the adult Bangladeshi population. Visual inspection of the two premolars and the 1st molar teeth were used to establish the location of the mental foramen. The directions were determined by drawing a measured box around the foramen and inserting a long thin broomstick into the foramen from the lateral side of the mandible. **Results:** The percentages of the positions of the mental foramina were found between the 1st and 2nd premolars (25.33%), below the apex of the 2nd premolar teeth (53.33%), and between the 2nd premolar and the 1st Molar teeth (21.33%). The mental foramina's direction was noted towards the posterior (12%) and posterosuperior (88%). **Conclusion:** The study of the mental foramen will be helpful for surgeons to localise the mental neuro vasculature when planning the mental nerve block and for modern surgical procedures requiring a detailed and precise study of the morphology and morphometry of the area.

Keywords: Mandible, mental foramen, position, direction

Introduction

The end of the mandibular canal is represented by the mental foramen, a rounded or oval aperture on the mandible's anteromedial side.



Fig 1. The mental foramen

The inferior alveolar nerve and artery, which have already passed through the mandibular canal, emerge through the mental foramen as the mental nerves and vessels that supply the lower teeth, lip, gingiva, and lower face (1, 2). The mental foramen is typically situated parallel to the 2nd premolar tooth or between the apexes of the 1st and 2nd premolar teeth (3, 4). It's common to see variations in the mental foramen's direction (4, 5, 6).

The position and direction of the mental foramen facilitate surgical, local anaesthetic, and other invasive oral and maxillofacial surgeries. Periodontal surgery, lower tooth flap procedures, mandibular premolar apical curettage, retrograde amalgam fillings, surgical orthodontics, and other treatments involving the lower lip all depend on the precise location of the mental foramen. However, the mental foramen is typically hard to find, as there is no precise anatomical marking that can be used clinically or palpated externally. For example, while performing apical curettage on mandibular premolars, dentists must consider how the lower premolars and the body of the ramus relate to the mental foramen to avoid damaging the mental nerve. Understanding the anatomy of this region is essential for performing an effective nerve block and avoiding injuries to the neurovascular bundles. Injury to the mental nerve may result in temporary

or permanent (thermal and tactile) alterations in the regions it innervates (7, 8, 9). This study aimed to evaluate the positions and directions of the mental foramen in Bangladeshi people to help with surgical interventions and anaesthetic block procedures.

Materials and Methods

This cross-sectional observational study was conducted in the Department of Anatomy, Ad-din Akij Medical College, Khulna, Bangladesh from January 2021 to July 2021. Total 75 dry adult mandibles from the Bangladeshi population, irrespective of their sex, all of which matched our criteria for inclusion in the study (i.e., good occlusion and adequate lower dentition), were selected from a total of 145 mandibles obtained for the project (5, 10). Before taking the measurements, Each mandible was positioned on a horizontal plane where it made the maximum contact with its lower border, and pressure was applied vertically on the molars (10, 11).

Using a visual inspection, the front margin of the mental foramen was checked for its position with the lines extending downward from the 1st and 2nd premolar and 1st molar teeth. Concerning those lines, Tebo and Telford (12). classified the positions into six categories as follows:

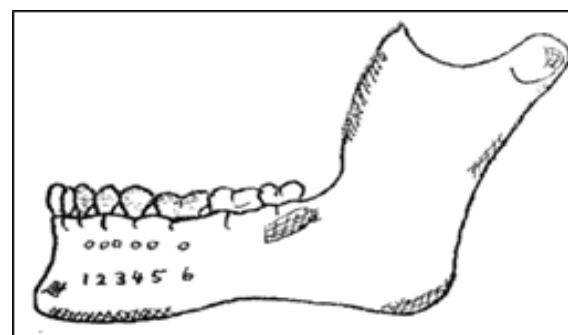


Fig 2. Illustrates the position of the mental foramen to the lower teeth (Adopted from Tebo and Telford)

- Position 1 (P1) - Anterior to the 1st premolar tooth
- Position 2 (P2) - Below the apex of the 1st premolar tooth
- Position 3 (P3) - Between two premolar teeth
- Position 4 (P4) - Below the apex of the 2nd premolar tooth
- Position 5 (P5) - Between the 2nd premolar and the 1st molar teeth
- Position 6 (P6) - Below the apices of the 1st molar tooth

A measured box was drawn around each mental foramen to detect the direction of the foramen. A vertical and horizontal line was drawn inside the measured box, dividing it into four equally smaller boxes. The vertical and horizontal lines, respectively, denote superior-inferior and anterior-posterior directions. A long thin broomstick was inserted into the foramen from the lateral part of the mandible. The measured box was visually examined to determine which way the broomstick was pointing (13).



Fig 3. Measured box around the mental foramen

The outcomes of the different directions or courses of the foramina were then divided into eight categories as follows:

- Direction 1 (D1) - Anteriorly
- Direction 2 (D2) - Antero-inferiorly
- Direction 3 (D3) - Inferiorly
- Direction 4 (D4) - Infero-posteriorly
- Direction 5 (D5) - Posteriorly
- Direction 6 (D6) - Postero-superiorly
- Direction 7 (D7) - Superiorly
- Direction 8 (D8) - Supero-anteriorly

These measurements of the position and direction of the mental foramina were carried out on both sides of the mandibles. The data was analyzed by using computer-based statistical software, SPSS 23.0.0 version (SPSS Inc, Chicago, IL, USA), and the results were compiled in the table, expressed as frequency & percentage.

Results

The mental foramen position in 40 mandibles (53.33%) was noted below the apex of the 2nd premolar teeth (P4). In 19 mandibles (25.33%), it was observed between the 1st and 2nd premolars (P3), and in 16 mandibles (21.33%) between the 2nd premolar and the 1st molar teeth (P5) (Table 1). No case was noted in positions P1, P2, and P6. This study did not reveal any variations between the foramen's position on the right or left side of the mandible. The direction of mental foramen was found postero-superiorly (D6) from its opening in

Table 1: Distribution and percentage of the mental foramina's positions.

Position	Frequency	Percentage
P1	0	0
P2	0	0
P3	19	25.33
P4	40	53.33
P5	16	21.33
P6	0	0

66 mandibles (88%). In 9 mandibles (12%) the direction was noted towards posteriorly (D5) (Table 2). The direction was the same on either side of each bone.

Table 2: Distribution and percentage of the mental foramina's directions.

Direction	Frequency	Percentage
D1	0	0
D2	0	0
D3	0	0
D4	0	0
D5	9	12
D6	66	88
D7	0	0
D8	0	0

Discussion

This study discovered that 53.33% of the mental foramina were aligned with the long axis of the 2nd premolar tooth (P4). This is in agreement with Fabian's finding of 45% in 100 Tanzanian mandibles and Haghanifer et al.'s work on an Iranian population, where 49.2% were found in line with the long axis of the (P4) (3, 14). The research conducted by Amorim et al. on adult Brazilian mandibles and Igbigbi et al. on adult Malawian mandibles are likewise comparable to this (10, 15). With a proportion of 25.33%, the site of the mental foramen between the 1st and 2nd premolar teeth (P3) was the second-most typical position identified in this study. The 3rd most common position was between the 2nd premolar and the 1st molar teeth (P5) with a

percentage of 21.33%. These results are similar to other researchers' discoveries that the mental foramen's position and orientation vary (15, 16). The causes for these anatomical variances of the mental foramen in this population could be due to inheritance, the way of evaluating the mandibles, the development of teeth, or even preservation or preparation of the specimen. There were no cases where the foramen's position on the right or left side varied. The mental foramen's direction was examined, and the findings revealed that the posterosuperior (D6) direction is the most prevalent, followed by the posterior (D5) direction. These findings also correspond with the work of Philips et al., where out of 75 adult mandibles examined, posterosuperior was the most usual mental foramen direction. The findings of the current study add to the knowledge of the mental foramen for the approach of the mental nerve and have consequences for dental professionals and maxillofacial surgeons.

Conclusion

The recent trend of replacement of missing teeth by dental implants and the increasing frequency of orthognathic surgeries have highlighted the clinical significance of mental foramen. Variations in the mental foramen frequently go unreported and misdiagnosed. However, special attention should be paid to the location of the mental foramen to achieve an effective nerve block and prevent post-procedural neurovascular problems in the mental region. The position and direction of the mental foramen varied, as was seen in numerous other studies.

References

1. Williams PL, Bannister LH, Berry MM, Collins P, Dyson M, JE D. Gray's Anatomy:

The Anatomical Basis of Medicine and Surgery (38th edition). New York: Churchill Livingstone; 2000.

2. Bavitz JB, Harn SD, Hansen CA, Lang M. An anatomical study of mental neurovascular bundle-implant relationships. *International Journal of Oral & Maxillofacial Implants*. 1993;8(5).

3. Haghanifar S, Rokouei M. Radiographic evaluation of the mental foramen in a selected Iranian population. *Indian Journal of dental research*. 2009;20(2):150.

4. Zivanovic S. Some morphological characters of the East African mandible. *Acta Anat*. 1970;77:109-19.

5. Green R. The position of the mental foramen: a comparison between the southern (Hong Kong) Chinese and other ethnic and racial groups. *Oral Surgery, Oral Medicine, Oral Pathology*. 1987;63(3):287-90.

6. Santini A, Land M. A comparison of the position of the mental foramen in Chinese and British mandibles. *Cells Tissues Organs*. 1990;137(3):208-12.

7. Nkenke E, Schultze-Mosgau S, Kloss F, Neukam F, Radespiel-Tröger M. Morbidity of harvesting of chin grafts: a prospective study. *Clinical oral implants research*. 2001;12(5):495-502.

8. Raghoobar GM, Louwerse C, Kalk WW, Vissink A. Morbidity of chin bone harvesting. *Clinical oral implants research*. 2001;12(5):503-7.

9. Sbordone L, Menchini-Fabris G, Toti P, Sbordone C, Califano L, Guidetti F. Clinical survey of neurosensory side-effects of man-

dibular parasymphyseal bone harvesting. *International journal of oral and maxillofacial surgery*. 2009;38(2):139-45.

10. Amorim MM, Prado FB, Borini CB, Bittar TO, Volpato MC, Groppo FC, et al. The mental foramen position in dentate and edentulous Brazilian's mandible. *Int J Morphol*. 2008;26(4):981-7.

11. Yesilyurt H, Aydinllglu A, Kavakll A, Ekinci N, Eroglu C, Hacalilogullarl M, et al. Local differences of the position of the mental foramen. *Folia morphologica*. 2008;67(1):32-5.

12. Tebo HG, Telford IR. An analysis of the variations in position of the mental foramen. *The Anatomical Record*. 1950;107(1):61-6.

13. Osunwoke E, Amah-Tariah F, Sapira M, Okwuone C. Position, direction and size of the mental foramina of the mandibles of Adult Male Southern Nigerians. *Internet J BiolAnthropol*. 2012;5(1).

14. Fabian FM. Position, shape and direction of opening of the mental foramen in dry mandibles of Tanzanian adult black males. *Italian journal of anatomy and embryology Archivio italiano di anatomia ed embriologia*. 2007;112(3):169-77.

15. Igbigbi P, Lebona S. The position and dimensions of the mental foramen in adult Malawian mandibles. *West African journal of medicine*. 2005;24(3):184-9.

16. Mbajorgu E, Mawera G, Asala S, Zivanovic S. Position of the mental foramen in adult black Zimbabwean mandibles: a clinical anatomical study. *The Central African journal of medicine*. 1998;44(2):24-30.