

Evaluation of Position and Symmetry of Mental Foramen on Digital Panoramic Radiographs: A Retrospective Study

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Abstract

Background: The mental foramen is an important anatomical landmark located on the anterolateral surface of the mandible, and it transfers the mental nerve and vessels. Knowledge of the position of the mental foramen is important both when administering regional anaesthesia and performing periapical surgery in the mental region of the mandible. **Aim:** The aim of this study was to determine the position and symmetry of the mental foramen on a digital orthopantomogram (OPG) among the Nalgonda population. **Materials and Methods:** A total of 400 digital OPGs taken by the Rotograph evo OPG machine of both genders were analysed retrospectively. The position of the mental foramen was recorded according to criteria given by Wei Cheong Ngeow and Yosuf Yuzawati. The symmetrical or asymmetrical position of the mental foramen was also recorded. **Results:** The most common position in the current study for the right side was position 4 (n = 202; 50.5%) followed by position 3 (n = 102; 25.5%), position 5 (n = 82; 20.5%), position 2 (n = 8; 2%), position 1 (n = 4; 1%) and the least common was position 6 (n = 2; 0.5%) and the most common position of mental foramen for left side was position 4 (200;50%) followed by position 3 (n = 132; 33%), position 5 (n = 60; 15%), position 1 and 2 (n = 4; 1%) and the least common was position 6 (n = 0; 0%). The mental foramen was symmetrical in 250 patients (62.5%) and asymmetrical in 150 patients (37.5%). For the symmetrically placed mental foramina, the most common location was position 4 (n = 126; 50.4%) followed by position 3 (n = 76; 30.4%), position 5 (n = 42; 16.8), position 6 (n = 4; 1.6%), position 2 (n = 2; 0.8%), position 1 (n = 0; 0%). **Conclusion:** In the present study, it was found that the most common position of the mental foramen in the given population in both males and females was below the second premolar, followed by between two premolars. It was symmetrical in 62.5% of OPG's. The current study was limited to evaluating the position and symmetry of the mental foramen relative to mandibular teeth in a small sample of the Nalgonda population in Telangana state using digital panoramic radiographs. In further studies, utilizing a larger sample size for evaluation of the mental foramen using advanced imaging modalities would be required for a more precise identification of the mental foramen.

Keywords: Mental Foramen, OPG, Position, Symmetry

Introduction

The mental foramen is a bilateral opening located on the buccal cortex of the mandible, close to the premolar area. Anatomically, the mental foramen is oval in shape and the average size is 4.6mm horizontally and 3.4mm vertically¹. The mental foramen marks the termination

of the mandibular canal and transmits mental vessels that supply soft tissues of the lower jaw and the mental nerve, a branch of the inferior alveolar nerve that innervates the lower lip, buccal vestibule, gingiva mesial to the mandibular first molar and anterior aspects of the chin on the ipsilateral side of the mandible². In clinical procedures, anaesthesia of the mental nerve

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could be effectively obtained if the mental foramen was adequately located. The knowledge of the mental foramen is important in endodontic procedures, especially for premolars; the treatment of fractures related to the parasymphyseal region of the mandible; osteotomies required for orthognathic surgeries; mandibular implant placement and the construction of complete dentures in the mandible³. The mental nerve, if traumatized during surgical procedures, could lead to transitory or permanent sensory, thermal and tactile changes. When a permanent injury is encountered, the patient will experience paresthesia or anaesthesia on the affected side of the mandible. Therefore, accurate information regarding mental foramen location and orientation is very important⁴.

As the position of the mental foramen cannot be clinically visualized or palpated, radiography is mandatory for its localization. Panoramic radiography is a widely used technique because it has the advantage of providing the image of both jaws on a single film in a short period of time with a relatively low radiation dose and at a lower cost if compared to more sophisticated techniques. This technique can offer information about the location of the mental foramen in both vertical and horizontal dimensions⁵. As the position of the mental foramen has been reported to differ in different population⁶⁻¹³, this study aimed to determine the position and symmetry of the mental foramen on a digital orthopantomogram (OPG) among the Nalgonda population.

Materials and Methods

A retrospective analysis of digital OPG's was done in the Department of Oral Medicine and Radiology of our institute. A Rotograph evo OPG machine was used to take all panoramic radiographs, with tube potentials of 70-90kV, tube current of 12mA, total filtration of ≥ 2.5 mmAl, a focal spot of 0.5 and a time of 15s. 400 OPG's of both genders were randomly selected that met the eligibility criteria.

Inclusion criteria were:

- Age from 18 to 60 years, these age groups are considered as there will be no further change in bone after the age of 18 years, and after 60 years, bone resorption may be seen, which leads to a change in the position and symmetry of the mental foramen.

- High-quality radiographs without any faults and artefacts.
- OPG of a male and female adult patient with permanent dentition with no significant deformity or pathology of the mandible and showing no radiographic exposure or processing artefacts.
- All mandibular teeth, from the right first molar to the left first molar, were present.
- Radiographs having bilaterally visible mental foramina taken by the same machine.

Exclusion criteria were:

- Presence of periodontal lesions.
- Patients with previous orthodontic treatment.
- Radiographs in which the lower teeth (between 36 and 46) were missing, had deep caries, root canal treatment, or various restorations were eliminated because of possible associated periapical radiolucency.
- Presence of a radiolucent/radiopaque lesion in the lower jaw anywhere in the area of the mental foramen.
- Radiographs that showed the lower canine was missing were excluded because of the possibility of mesial premolar drift.
- The position of the mental foramen was recorded according to criteria given by Wei Cheong Ngeow and Yosuf Yuzawati⁶.

Position 1: Situated anterior to the first premolar

Position 2: In line with the first premolar

Position 3: Between the first and second premolars

Position 4: In line with the second premolar

Position 5: Between the second premolar and first molar

Position 6: In line with the first molar.

A ruler was used to identify the longitudinal axis of the nearest tooth and the position of the mental foramen was indicated by drawing a line parallel to the long axis of the teeth using digital software in OPG. After evaluation of each panoramic radiograph, the location of the mental foramen on each side was recorded in the form. The location of the mental foramen was recorded on the basis of gender and symmetry or asymmetry.

Results

A total of 400 OPG's were evaluated in this study, out of which 200 were male (50%) and 200 were female (50%). In males the most common position of the mental foramen

for right side was position 4 (n = 110; 55%) followed by position 5 (n = 42; 21%), position 3 (n = 40; 20%), position 2 and 1 (n = 4; 2%), and the least common was position 6 (n = 0; 0%) and the most common position of the mental foramen for left side was position 4 (n = 100; 50%) followed by position 3 (n = 52; 26%), position 5 (n = 42; 21%), position 2 (n = 4; 2%), position 1 (n = 2; 1%) and the least common was position 6 (n = 0; 0%) (Table 1). In females the most common position of the mental foramen for right side was position 4 (n = 92; 46%) followed by position 3 (n = 62; 31%), position 5 (n = 40; 20%), position 2 (n = 4; 2%), position 6 (n = 2; 1%) and the least common position 1 (n = 0; 0%), and the most common position of the mental foramen for left side was position 4 (n = 100; 50%) followed by position 3 (n = 62; 31%), position 5 (n = 18; 9%), position 1 (n = 2; 1%) and the least common position 2 and 6 (n = 0; 0%)(Table 1).

The most common position in the present study was position 4 for right side (n = 202; 50.5%) followed by position 3 (n = 102; 25.5%), position 5 (n = 82; 20.5%), position 2 (n = 8; 2%), position 1 (n = 4; 1%) and the least common was position 6 (n = 2; 0.5%) and the most common position of mental foramen for left side was position 4 (200;50%) followed by position 3 (n = 132; 33%), position 5 (n = 60; 15%), position 1 and 2 (n = 4; 1%) and the least common was position 6 (n = 0; 0%) (Table 1).

The mental foramen was symmetrical in 250 patients (62.5%) and asymmetrical in 150 patients (37.5%). For the symmetrically placed mental foramina, the most common location was position 4 (n = 126; 50.4%) followed by position 3 (n = 76; 30.4%), position 5 (n = 42; 16.8), position 6 (n = 4; 1.6%), position 2 (n = 2; 0.8%), position 1 (n = 0; 0%) (Table 2 and Pie chart 1).

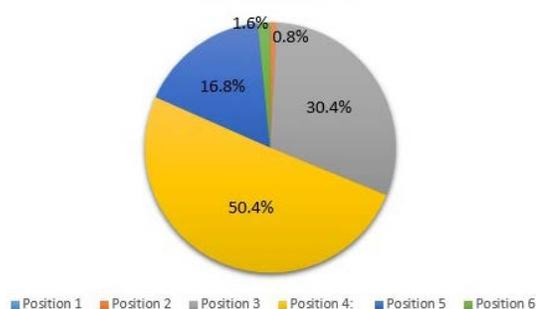
Table 1. Distribution of position of the mental foramen in males and females on both sides

Position	Male		Female		Total	
	Right side	Left side	Right side	Left side	Right side	Left side
1	4 (2%)	2(1%)	0	2(1%)	4(1%)	4(1%)
2	4(2%)	4(2%)	4(2%)	0	8(2%)	4(1%)
3	40(20%)	52(26%)	62(31%)	80(40%)	102(25.5%)	132(33%)
4	110(55%)	100(50%)	92(46%)	100(50%)	202(50.5%)	200(50%)
5	42(21%)	42(21%)	40(20%)	18(9%)	82(20.5%)	60(15%)
6	0	0	2(1%)	0	2(0.5%)	0
Total	200	200	200	200	400	400

Table 2. Position of the mental foramen by symmetry

Position	Frequency	%
1	0	0
2	2	0.8
3	76	30.4
4	126	50.4
5	42	16.8
6	4	1.6
Total	250	100

SYMMETRICAL MENTAL FORAMEN ACCORDING TO POSITIONS



Pie Chart 1. Pie chart showing position of the mental foramen by symmetry.

Discussion

In the present study, since digital panoramic radiographs from the same machine were utilized, errors and variations related to contrast film processing, etc. were minimized. Of the 400 OPG's analyzed in the present study, the most common location of the mental foramen was in line with the second premolar on the right side (n = 202; 50.5%) and on the left side (n = 200; 50%). The second most common location was between the first and second premolars on the right side (n = 102; 25.5%) and on the left side (n = 132; 33%).

Studies done by Phillips, *et al.*,⁴, Ngeow, *et al.*,⁶, Sankar, *et al.*,⁷, Ukoha, *et al.*,⁸ and Gangotri, *et al.*,⁹ showed that the mental foramen most commonly lies near the apex of the second premolar. These findings are consistent with our results. But studies done by Seema S, *et al.*,¹⁰ and by Kquiku L, *et al.*,¹¹ showed that the most common location of the mental foramen was between the two premolars.

Out of 400 OPG's evaluated in our study, the mental foramen was symmetrical in 250 patients (62.5%) and asymmetrical in 150 patients (37.5%). Knowing the site of the mental foramen allows for accurate delivery of local anaesthesia for dental procedures and the avoidance of damage to the nerve in surgical procedures such as periapical surgery, cyst enucleation, periodontal surgery such as flap operations, and mandibular bony osteotomy.

Conclusion

The mental foramen is an important anatomical landmark in the orofacial region. The position of the mental foramen varies between ethnic groups. In the present study, it was found that the most common position of the mental foramen in the given population in both males and females was below the second premolar, followed by between two premolars. It was symmetrical in 62.5% of OPG's. The current study was limited to evaluating the position and symmetry of the mental foramen relative to mandibular teeth in a small sample of the Nalgonda population in Telangana state using digital panoramic radiographs. In further studies, utilizing a larger sample size for evaluation of the mental foramen using advanced imaging modalities would be required for a more precise identification of the mental foramen.

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How to cite this article: Tejasvi M. L. A., Pokala A., Varun Sai M., Chaithanya Sree M. G., Aarthi D. and Sai Krupa M. Evaluation of Position and Symmetry of Mental Foramen on Digital Panoramic Radiographs: A Retrospective Study. J Forensic Dent Sci. 2021; 13(3):126-130.

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