ABSTRACT

Information on the knowledge of the mental foramen is important in clinical dentistry. The present study was undertaken to determine the most common position of mental foramen in randomly selected Indian population. Total 204 panoramic radiographs were evaluated, among them 184 were studied in terms of site, gender differences, symmetry of location, shape, distance from midline and continuity of the foramen with the canal and remaining 20 were considered as unidentified type. Total 368 mental foramen were evaluated, among them 242 (65.76%) were symmetrical distribution and 126 (34.24%) were asymmetrical in distribution. The most common position for mental foramen (n = 242) relative to the teeth in the sample was between first and second premolar (n = 235, 63.86%). Same findings were observed in both sexes (male n = 130, 70.66% and female n = 105, 57.06%). The second most common position was in line with second premolar (n = 97, 26.36%). The most common shape of foramen is round (n = 178, 48.37%) followed by oval shape (n = 131, 35.60%). Most of the foramen were separated from the inferior alveolar canal (n = 197, 53.53%) and average distance from the midline is 28.44 mm in male and 26.89 mm in female.

Keywords: Mental foramen, Location, Panoramic radiographs, Mental nerve.


Source of support: Nil

Conflict of interest: None declared

INTRODUCTION

The mental foramen is defined as the entire funnel-like opening in the lateral surface of the mandible at the terminus of the mental canal,¹ which is anterior limit of inferior alveolar canal.² Anatomically, the mental foramen is the opening of mental canal, a branch of mandibular canal.¹ Wall of the mental foramen is made up of cortical bone. The density of the foramen’s image varies, as does the shape and definition of its border.² Knowledge of the position of the mental foramen is important both when administering regional anesthesia, performing periapical surgery, dental implant surgery and endodontic treatment in mandible.⁴ Foramen may occasionally be misdiagnose as a radiolucent lesion in the apical area of the mandibular premolar teeth.⁵ It also aids in interpreting anatomical landmarks in oral pathology and forensics.⁶ The horizontal position has been reported from the apex of canine to the apex of the mesiobuccal root of the first mandibular molar.⁷ The most common location of the mental foramen is in align with the second premolar followed by between the first and second premolar.⁸

Panoramic radiography is the most preferred diagnostic modality as it allows a more accurate localization of the mandibular foramen in both a horizontal and vertical dimension.⁴ As the bone density increases, the mental foramen becomes more difficult to identify on panoramic radiographs.⁹

According to Yossue and Brooks, the radiographic appearance of the mental foramen can be classified as continuous, separated, diffuse and unidentified type.¹,³,⁴,¹⁰ The horizontal position of the foramen has also been studied by measuring the mean distance of foramen from symphysis menti.¹¹ This study was undertaken to determine the shape and position of mental foramen in a selected Indian population using orthopantomograms. Symmetry and shape of foramen along with continuity of inferior alveolar canal was also studied. Same parameters were also studied in relation to sex.

MATERIALS AND METHODS

A total of 204 orthopantomogram of selected male and female patients originally taken for various dental purposes in the Department of Oral Medicine and Radiology of Dharmsinh Desai University in the year of 2010 were used for the study. All radiographs were exposed at 66 kV and 16 mA for 17.6 seconds with an orthopantomograph Kodak 8000c. All orthopantomogram were of dentate patient with erupted 1st and 2nd premolar and 1st molar. Films free from radiolucent and radiopaque lesions in lower arch were studied. All panoramic radiographs where the mental foremen could not be identified where excluded from the study. These were considered to be those cases classified as unidentified type of mental foramen. Radiographs were read by two observers who had been calibrated by the principle investigators and their readings were repeated with a random sample of 50 radiographs which were re-examined by second investigator.

The position of the image of the mental foramen in relation with the apices of teeth was recorded as follows:

- Position 1: Situated anterior to the first premolar
- Position 2: In line with the first premolar
- Position 3: Between the first and second premolar
- Position 4: In line with second premolar
- Position 5: Between second premolar and first molar
- Position 6: In line with first molar
Reading was obtained from both left and right sides of mandible.

The mental foramen, inferior alveolar canal, midline and occlusal plane were traced on a white tracing paper using a lead pencil. The position of the mental foramen was recorded in line with the longitudinal axis of a tooth using the edge of a metal ruler. If the mental foramen was large, or was between two teeth, the position of mental foramen was indicated by drawing an imaginary line parallel to the long axis of the teeth (Fig. 1) and it was reported on the basis of gender and symmetry or asymmetry.

Horizontal distance between the center of the mental foramen and symphysis menti was also measured and mean distance is calculated.

Continuity of the foramen was studied as per Yosue and Brooks classification which recognized the appearance of the mental foramen as follows:

- Type 1: Mental canal is continuous with the mandibular canal
- Type 2: Foramen is distinctly separated from the mandibular canal
- Type 3: Diffuse with distinct border of foramen
- Type 4: Unidentified group.

RESULTS

Total 204 digital panoramic radiographs were analyzed, 184 showed foramen on both side. In the remaining 20 mental foramen were not identified so they were considered unidentified and excluded from study. So, total 368 foramen were studied in terms of shape, site continuity with the canal, distance from the midline and symmetry on both the side.

The patients were of the age group of 20 to 50 years. Out of 184 patients 93 were female and 91 were male.

Most common position (Table 1) for the mental foramen related to the tooth in this sample was between 1st and 2nd premolar for both right and left side (n = 235, 63.86%, Fig. 1). The second most common location was in line with the second premolar (n = 97, 26.36%). Only 5 foramens were noted in position 4 that is between 2nd premolar first molar and 3 foramens were noted in position 5 that is in line with 1st molar. Position 2 (between 1st and 2nd premolar) was also the most common position (Table 2) among the male (n = 130, 71.42%) and females (n = 105, 56.5%).

Total 242 mental foramen were symmetrical in distribution whereas remaining 126 were asymmetrical. For the symmetrically placed mental foramen (Table 3) the

![Table 1: Distribution of mental foramen according to site](image)

<table>
<thead>
<tr>
<th>Location</th>
<th>P1</th>
<th>P1^P2</th>
<th>P2</th>
<th>P2^M1</th>
<th>M1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>18</td>
<td>114</td>
<td>50</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>9.78%</td>
<td>61.96%</td>
<td>27.17%</td>
<td>0.54%</td>
<td>0.54%</td>
</tr>
<tr>
<td>Left</td>
<td>10</td>
<td>121</td>
<td>47</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>6.43%</td>
<td>65.76%</td>
<td>25.54%</td>
<td>2.17%</td>
<td>1.09%</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>235</td>
<td>97</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>7.68%</td>
<td>63.86%</td>
<td>26.36%</td>
<td>1.36%</td>
<td>0.82%</td>
</tr>
</tbody>
</table>

![Table 2: Distribution of mental foramen according to sex](image)

<table>
<thead>
<tr>
<th>Location</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Right</td>
<td>Left</td>
<td>Total</td>
</tr>
<tr>
<td>P1</td>
<td>9</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>4.89%</td>
<td>3.26%</td>
<td>8.15%</td>
</tr>
<tr>
<td>P1^P2</td>
<td>65</td>
<td>65</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>35.33%</td>
<td>35.33%</td>
<td>70.66%</td>
</tr>
<tr>
<td>P2</td>
<td>17</td>
<td>18</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>9.24%</td>
<td>9.78%</td>
<td>19.02%</td>
</tr>
<tr>
<td>P2^M1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>0.00%</td>
<td>0.54%</td>
<td>0.54%</td>
</tr>
<tr>
<td>M1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>0.00%</td>
<td>0.54%</td>
<td>0.54%</td>
</tr>
<tr>
<td>Total</td>
<td>91</td>
<td>91</td>
<td>182</td>
</tr>
</tbody>
</table>

![Fig. 1: Method of position determination](image)
most common position was position 2 (n = 176, 72.73%) followed by position 3 that is in line with the 1st premolar (n = 52, 21.49%). Thus position 3 is quite more common in asymmetrically placed mental foramen than symmetrically placed. Only 5 foramen were noted in position 4 that is between 2nd premolar and 1st molar. No foramen was noted in position 5 that is in line with 1st molar.

The asymmetrical mental foramen (Table 4) were found equally on both the side right and left that is (n = 63 on both right and left side). Position 2 again was most common on both right (n = 26, 41.27%) and left (n = 33, 52.38%) side, followed by position 3 on right side (n = 24, 38.1%) and on left side (n = 21, 33.33%). No foramen was noted in position 4 on right side (n = 0) as compared to left side (n = 3, 4.76%). Position 1 that is in line with 1st premolar was far more common on right side (n = 12, 19.04%) in comparison to left side (n = 4, 6.35%).

Majority of mental foramen were round in shape (Table 5) (n = 178, 48.37%) followed by oval shape (n = 131, 35.60%) and remaining were considered as irregular (n = 59, 16.03%). Round foramen was more common in male (n = 95, 53.37%) compared to female (n = 83, 46.63%), while oval shape were more common in female (n = 75, 57.25%) in comparison to male (n = 56, 42.75%).

The most frequent appearance of foramen (Table 6) was separated from the inferior alveolar canal (n = 197, 53.53%) followed by continuous with the canal (n = 171, 46.47%). Separated variety of mental foramen was more common on both the side as well as in both the sex.

The average distance of mental foramen from symphysis menti (Table 7) in male was 28.10 mm on right side and 28.79 mm on left side and for females the distance was 26.94 mm on right side and 26.85 mm on left side. So distance from midline is less in female than in male which is quite obvious due to small jaw size.

**DISCUSSION**

The present study provides an idea about the position, shape and symmetry of mental foramen along with distance from midline, continuity with mandibular canal and distribution according to sex in the Indian population in Kheda district, Gujarat.

The mental nerve is a terminal branch of the inferior alveolar nerve that passes through the mental foramen, supplying sensory innervation to the lower lip, buccal vestibule and gingiva mesial to first mandibular molar.1,6,8,9 Knowing the site of the mental foramen allows for accurate delivery of local anesthesia and avoidance of damage to the nerve in surgical procedure.6

We used panoramic radiographs as mental foramen is seen more consistently in panoramic radiograph than periapical view.9

In the research literature the mental foramen is frequently described as situated in the region of the second premolar in the fully developed mandible but individual variation occur occasionally.3 In our analysis of 204 panoramic radiographs we found the mental foramen positioned anywhere between long axis of first premolar to that of mesiobuccal root of first molar. This is in accordance with previous study.6,9 No case was found anterior to mandibular first premolar. Therefore that position was excluded from the study. So in present study the location of distribution of foramen was divided to five groups. That is also in accordance with previous study.6,12 Patients were selected between the ages of 20 to 50 years. As the position of the foramen was highly dependent on the presence of teeth, cases that had missing posterior teeth or with considerable drifting of teeth were excluded from study.6 Middle age group was selected because position of mental foramen changes with age and loss of alveolar bone. All the patients were having permanent set of dentition, because in mixed dentition, permanent tooth buds might obscure the mental foramen.1 According to our study, in 63.86% of cases the mental foramen was located between the first and second premolar and in 26.39% was in line with the second premolar, thus these two positions accounted for 90.25%
of cases. This is in agreement with the previous Western and Asian studies. Most studies and text books describe the location of the mental foramen as being below the apex of the second premolar or between the apices of the first and second premolar. It is in accordance with the result of early studies of some European populations.

There is considerable debate regarding the normal position of mental foramen in different population. Studies done in populations such as North Americans, Iranian, Turkish, Asian Indians, Jordanian showed that the most common location was between premolars. These findings are consistent with our studies. But studies done in other populations such as Malay, Singaporean Malays and Indians, Pakistani as well as studies done by Phillip et al and Green have indicated that foramen is most commonly positioned in line with second premolar.

Sex wise distribution of the patients showed the same result. Maximum numbers of patients in both groups were having foramen between first and second premolar. That indicates sex does not affect the mental foramen much. This is in accordance with literature. The right and left foramen were bilaterally symmetrical in position in two-third cases (or in majority of cases). This is also in accordance with literature.

Round or oval shape of mental foramen was found in 83.97% and very few foramens (16.03%) were irregular or diffuse in shape. Literature also supports this finding.

The most common radiographic appearance of foramen was separated type (separated from mandibular canal) followed by continuous type. Very few were unidentified, this findings are consistent with other result.

In our study, mean distance of mental foramen from symphysis menti on panoramic radiograph is approximately 28.5 mm in male and 27.5 in female. According to previous studies on dried mandible, the distance was recorded as 26.5 mm and 26 mm respectively. For clinical point of view distance of mental foramen to symphysis menti has significant implication. When mental foramen cannot be localized in patients, where there is absence of mandibular posterior teeth or malposition of teeth, it can be accurately localized if distance from symphysis menti is known.

**CONCLUSION**

The present study reveals valuable insights on information regarding mental foramen in selected Indian population in Kheda district Gujarat. Based on these studies, most common position of mental foramen is between first and second mandibular premolars. Average distance from midline of mandible to mental foramen is 27 mm. Majority of foramina were round or oval in shape, bilaterally symmetrical and continuous type. Knowledge of location of mental foramen is important for oral anatomist, general dentist as well as specialist dental practitioners.

**REFERENCES**


ABOUT THE AUTHORS

Priti Pragnesh Shah
Reader, Department of Oral Medicine and Radiology, Faculty of Dental Science, Dharamsinh Desai University, Nadiad, Gujarat, India

Kevin Kaushik Parikh (Corresponding Author)
Reader, Department of Oral Medicine and Radiology, Faculty of Dental Sciences, Dharamsinh Desai University, Nadiad, Gujarat, India
e-mail: drkevinkaushikparikh@gmail.com

Mona Janak Shah
Reader, Department of Oral Medicine and Radiology, Faculty of Dental Sciences, Dharamsinh Desai University, Nadiad, Gujarat, India

Faiyaz Khan
Tutor, Department of Oral Medicine and Radiology, Faculty of Dental Sciences, Dharamsinh Desai University, Nadiad, Gujarat, India