

# Mental foramen as an indicator of patient's gender, panoramic study in Qassim province, Saudi Arabia

## Abstract

**Introduction:** Gender can be determined by numerous pieces of the skeleton structure. Mental foramen is one of the mandibular components that can demonstrate the gender.

**Aim of the study:** to assess patient's gender by analysis of mental foramen on panoramic radiograph in Qassim region.

**Method and material:** A retrospective study was performed on 400 panoramic radiographs. 200 males and 200 females were included in this study. Panoramic radiograph machine was used in this study is (Soredex-cranex x- ray machine). Several lines measured in this study related to the mental foramen: 1-The distance from the alveolar crest of the mandible to the superior margin of mental foramen 2-The distance from the superior margin of mental foramen to lower border of the mandible 3-The distance from inferior margin of mental foramen to lower border of mandible. 4-The distance from inferior margin of mental foramen to alveolar crest of the mandible. Statistical analysis of the obtained data was carried out using Statistical Package for Social the Sciences (SPSS) version 21.0. Chi-square test was applied to find the significant value and  $P \leq 0.05$  was considered as a significant value.

**Result:** The average mean values in males were higher compared to females. When comparing right and left sides of the same individual, the values were similar in both groups except the distance from inferior margin of mental foramen to lower border of mandible in females left side which was higher than right side.

**Conclusion:** Based on the data collected in this study, an increased value was seen for males on all parameters related to the mental foramen when compared to females. Whereas the mean value of right and left sides of the same individuals were similar related to the two groups. The distance from inferior margin of mental foramen to lower border of the mandible showed a significant difference among females in Qassim province, Saudi Arabia.

**Keywords:** mental foramen, mandible, mental nerve, sex determination, panoramic study

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Masad Almutairi,<sup>1</sup> Ghaida Ali Alsuliaman,<sup>2</sup> Eman Abdulbaset Alnamnakani,<sup>3</sup> Ahmed Ali Alfawzan,<sup>4</sup> Abdullah Mohammad Aldayel<sup>5</sup>

<sup>1</sup>General Dental Practitioner, Qassim, KSA

<sup>2</sup>BDS, University of Hail, Hail, KSA

<sup>3</sup>Consultant Orthodontist, Prince Sultan Military Medical City, KSA

<sup>4</sup>Department of Preventive Dentistry, College of Dentistry in Ar Rass, Qassim University, KSA

<sup>5</sup>Consultant Orthodontic, King Saudi University, KSUMC, KSA

**Correspondence:** Abdullah Mohammad Aldayel, Consultant Orthodontic, King Saudi University, KSUMC, Riyadh, KSA, Email amaldayel@ksu.edu.sa

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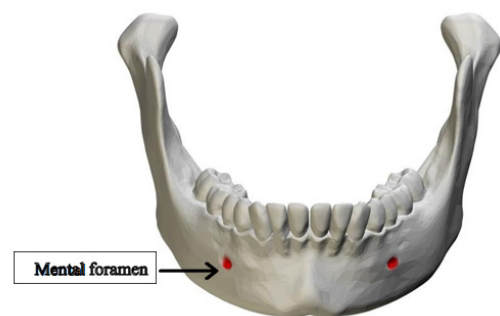
## Introduction

In the field of measurable humanities and criminological dentistry, recognizing males from females by investigating the morphological attributes of bone is significant in the fields of physical and scientific human sciences. Gender can be determined by numerous pieces of the skeleton. Mandible is one of them. Mandible structure is the lower jaw of the facial skeleton which holds the lower teeth set up.<sup>1,2</sup> It is stronger and durable structure for gender determination due to the presence of dens layer of compacted bone.<sup>3</sup> Moreover, forensic anthropologists and dentist generally utilizes morphological highlights of the mandible for gender assurance.<sup>4</sup> There are numerous parameters of mandible that can be utilized for gender assurance of obscure skeleton. One of the mandibular components that can demonstrate supportive for gender assurance is mental foramen. The mental foramen appears beneath the first and second premolar roots in adults (Figure 1). In the newborn, it is found in the lower border of the mandible. During aging, the mental foramen migrates to the mid-zone between the superior and inferior borders of the mandible.<sup>5</sup> In old age, it is usually appearing near the superior border of the mandible. In a panoramic radiograph, the mental foramen can be easily identified by dentists.

## Methods and materials

A retrospective study was performed on 400 panoramic radiographs which were collected for diagnostic, periodontal, surgical, or orthodontic purposes from department of oral diagnosis, medicine and radiology in college of dentistry in Qassim University.

Single radiograph machine was used in this study (Soredex cranex x ray machine). The x-ray machine properties were (tube potential 70 kV, tube current 10 Ma with exposure time 17.6 seconds).



**Figure 1** An image illustrating the position of the mental foramen beneath the first and second premolars

In this study, the dental intern, who made the measurement, marked 8 landmarks in 10 panoramic radiographs, 5 panoramic radiographs from each gender which were selected randomly to assess the repeatability of examiner (4 marks in each side of panoramic radiograph). A month later, the same dental intern repeated same landmarks and measurement for the same 10 panoramic radiographs. Using the G-reliability coefficient, it was found a good repeatability ( $G = 0.98$ ).

**Inclusion criteria:**

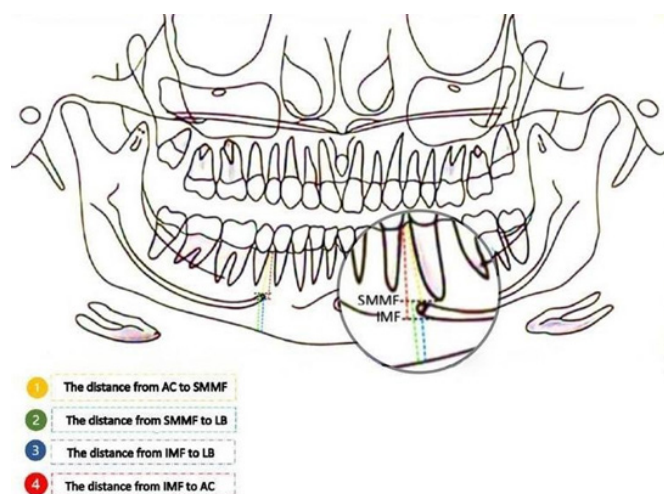
- Patient should be above 12 year old
- Presence of premolars teeth
- No evidence of bone resorption in premolar region
- Visible mental foramen

**Exclusion criteria:**

- Patient less than 12 year old
- Missing of premolars teeth
- Distortion images
- Crowding

Four parameters lines made in millimeters (mm) use in this study related to the mental foramen (Figure 2):

- The distance from the alveolar crest of the mandible (AC) to the superior margin of mental foramen (SMMF)
- The distance from the (SMMF) to lower border of the mandible (LB)
- The distance from inferior margin of mental foramen (IMF) to (LB)
- The distance from (IMF) to (AC)



**Figure 2** The diagram shown four lines represent the measurement related to the mental foramen

**Bioethical consideration**

Ethics committee approval was not needed. As usual protocol, all patients or parents signed an informed consent form for any radiographic exposure procedure in college of dentistry in Qassim University.

**Results**

The data has been subjected to statistical analysis. In this study, we used SPSS to find mean values using unpaired t-test the difference between males and females with  $P < 0.05$  was considered as statistical significance.

In this study, the first parameter shows the difference in vertical distance from alveolar crest to superior margin of mental foramen in

males and females. In the right side, the mean value was 18.02 mm in males whereas 16.67 mm in females. However, it was 18.08 mm in males and 16.78 mm in females on the left side (Table 1).

**Table 1** A comparison of vertical distance between AC to SMMF in both males and females

	Mean	Standard deviation	F value	P value
Male right side	18.02 mm	2.13	6.54389	*P <0.01
Female right side	16.67 mm	2.01		
Male left side	18.08 mm	2.36	5.97939	*P <0.01
Female left side	16.78 mm	1.98		

(\*) shows a very highly significance difference between the males and females

The second parameter shows the difference in vertical distance from the superior margin of mental foramen to lower border of the mandible in both groups. In the right side, the mean value was 15.44 mm in males whereas 13.05 mm in females. However, it was 15.20 mm in males and 12.55 mm in females on the left side (Table 2).

**Table 2** A comparison of vertical distance between SMMF to LB of mandible in both groups

	Mean	Standard deviation	F value	P value
Male right side	15.44 mm	1.7	12.9295	*P <0.01
Female right side	13.05 mm	1.96		
Male left side	15.20 mm	2.01	14.0297	*P <0.01
Female left side	12.55 mm	1.81		

(\*) shows a very highly significance difference between the males and females

The third parameter shows the vertical distance from inferior margin of mental foramen to alveolar crest in both groups. In the right side, the mean value was 20.87 mm in males whereas 19.05 mm in females. However, it was 21.3 mm for males and 19.2 mm for females on the left side (Table 3).

**Table 3** A comparison of vertical distance between IMF to AC in both groups

	Mean	Standard deviation	F value	P value
Male right side	20.87 mm	1.73	6.7642	*P <0.01
Female right side	19.05 mm	1.87		
Male left side	21.3 mm	1.93	6.6436	*P <0.01
Female left side	19.2 mm	1.83		

(\*) shows a very highly significance difference between the males and females

The fourth parameter describes the vertical distance from inferior margin of mental foramen to lower border in both groups. In the right side, the mean value was 12.70 mm in males whereas 10.53 mm in females. However, it was 12.50 mm in males and 10.55 mm in females on the left side (Table 4).

**Table 4** A comparison of vertical distance from IMMF to LB of mandible in both groups

	Mean	Standard deviation	F value	P value
Male right side	12.70 mm	1.78	12.1728	*P <0.01
Female right side	10.53 mm	1.77		
Male left side	12.50 mm	1.96	13.419	*P <0.01
Female left side	12.3 mm	1.68		

(\*) shows a very highly significance difference between the males and females

The comparison of the vertical distance within the males between the left and right side shows the same P value in all measurements (Table 5).

**Table 5** A comparisons of all vertical parameters between left and right sides in males

	T value	P value
Alveolar crest to superior margin of mental foramen	0.2735	P >0.78
Superior margin of mental foramen to lower border	1.2524	P >0.21
Inferior margin of mental foramen to alveolar crest	0.1736	P >0.86
Vertical distance from inferior margin of mental foramen to lower border	1.0808	P >0.28

The comparison of the vertical distance within the females between the left and right side shows the same P value except the vertical distance from inferior margin of mental foramen to lower border of the mandible which shows slight different between both side (Table 6).

**Table 6** A comparisons of all vertical parameters between left and right sides in females

	T value	P value
Alveolar crest to superior margin of mental foramen	0.5697	P >0.56
Superior margin of mental foramen to lower border	0.3201	P <0.43
Inferior margin of mental foramen to alveolar crest	0.1873	P >0.85
Vertical distance from inferior margin of mental foramen to lower border	2.8244	*P <0.004

(\*) shows highly significance difference between the left and right sides in females

## Discussion

The mandible is a part of the skeleton that can be used to identify gender. The mandible jaw consists of a dense layer of compacted bone which make it more reliable structure for gender estimation.<sup>1,2</sup> In addition to, the mandible contributes to the determination of gender, Wichal Swoope reported in 1974 the mental foramen is stable landmark through life and bone resorption has no effect on the distance of mental foramen to lower border of mandible.<sup>6</sup> Lindh et al and Guler et al, suggested the stability of the mental foramen doesn't depend on the alveolar process resorption above the foramen. Therefore, the vertical measurements in the panoramic are clinically applicable for

the height of alveolar bone.<sup>7,8</sup> The panoramic radiograph usually used in dental clinic as it shows all of the mandible structure, the maxillary jaw component and the lower part of the maxillary sinus in one view.<sup>9</sup> Due to the ability to view the entire body of the mandible which gives better location of the mental foramen in both vertical and horizontal plans, the panoramic radiograph was selected in this study. Agthong et al, used the panoramic radiograph for analysis of mental foramen in different studies.<sup>10</sup>

In the present study, the mean value of (AC) to (SMMF) and from (SMMF) to (LB) are significantly higher in males than females, which corresponds with both studies of Mahima and Ashwinirani in Maharashtra population in India.<sup>4,11</sup> Also our study is correspondence with other studies that is conducted in different parts in the world.<sup>12,13</sup> Vodanovic study found that the mean value of inferior margin of mental foramen to lower border of the mandible does not exhibit sexual dimorphism.<sup>14</sup> The reason behind this may be due to the racial variety of the investigation population. In our study result show sexual dimorphism, which corresponds to the studies of Enlow and Amorim.<sup>14,15</sup>

All the measurement from alveolar crest to superior margin, from inferior margin to lower border mandible and from inferior margin of mental foramen to alveolar crest shows no significance difference in individuals in both side, except the distance from the inferior margin of mental foramen to inferior border of mandible in females which shows that left side was higher value. These findings corresponded with Akhilesh Chandra and Thomas studies.<sup>12,15</sup>

Therefore, both side of mental foramen landmark can be used for gender determination. In the present study, the mean value for the distance from the alveolar crest to superior margin of mental foramen is 16.67 mm in females, while it shows a highly significance difference for about +1.4 mm in males which was 18.02 mm. This value can be applied to all other parameters which used in our study and the results are corresponding with different studies conducted in different population. In this study, measurement shows that female had asymmetry due to increase the distance from (IMF) to (LB) of the mandible in the left side compare to the right side. Our findings correspond with Ilker study which show a significant and more asymmetric linear distances existed between the two halves of female's face. Ilker mention that left side of the face was most commonly dominant for asymmetry in both genders.<sup>16</sup>

## Conclusion

From this study, we can conclude that panoramic radiograph analysis can be an effective method for gender determination. An increased value was seen for males on all parameters related to the mental foramen when compared to females. Whereas the mean value of right and left sides of the same individuals were similar related to the two groups. The distance from inferior margin of mental foramen to lower border of the mandible in females left side showed a significant higher compare to right side.

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## Author's contribution

All the authors listed above have participated equally in collecting the data, analyzing the data, writing the manuscript and reviewing the article

## Conflicts of interest

The author declares no conflicts of interest.

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