

# Mental Foramen Location among Iraqi Population: Cross Sectional Study

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## ABSTRACT

**Purpose:** As it is part of the mandible and a vital transmission structure, it is crucial to explore and examine the Mental Foramen (MF) in various populations and races.

**Materials and Methods:** Orthopantomograms were examined, and the MF was identified. The MF was traced on transparent paper. A line was drawn from the apex of the 1st premolar to the 2nd premolar using a ruler, and it formed a vertical plane. Two horizontal planes were drawn on the longitudinal axis of the 1st premolar and 2nd premolar by using a ruler.

**Results:** The horizontal plane in females was as follows: in position 1, (R=5.14%), (L=8.08%); in position 2, (R=51.4%), (L=51.4%); in position 3, (R=31.23%), (L=31.6%); and in position 4, (R=13.23%), (L=8.82%). The location of the MF in the vertical plane in females was above (R=1.47%), (L=2.2%), at (R=8.08), (L=8.82%), and below (R=90.4%), (L=88.9%). The location of the MF in the horizontal plane in males was as follows: in position 1, (R=1.62%), (L=3.25%); in position 2, (R=56.9%), (L=56.9%); in position 3, (R=27.6%), (L=30.8%); and in position 4, (R=13.82%), (L= 8.94%). The location of the MF in the vertical plane in males was above (R=2.43%), (L=1.62%), at (R=15.4%), (L=16.2%), and below (R=82.11%), (L=82.11%).

**Conclusion:** The most common location of the MF in males in the horizontal plane was position 2, and in the vertical plane, it was below the vertical plane.

**Keywords:** Mental nerve; Dental implant; Inferior dental nerve; Anesthesia; Sensory nerve

## INTRODUCTION

Avoiding vital structures is one of the goals of any oral surgery. Various types of surgery may involve the Mental Foramen (MF) area, either the soft tissue or the hard tissue or combined soft and hard tissue. With the evolution of dental implant surgeries that need to place implants in front of the MF, especially in complicated cases that need to explore the MF first [1]. Site rehabilitation with a bone graft before implant placement involves forming an extensive flap that may extend to the MF area [2,3]. Periostium scoring to achieve tension-free flap closure in guided bone regeneration may harm the mental nerve when the MF is positioned more coronally. Many studies report mental nerve damage that may vary from neurotmesis and axiontmesis to neuroparaxia, which is dependent on the severity of nerve damage [4-6]. These types of nerve damage may alter the lower lip sensation from parathesia and disthesia to hyperthesia, which may affect patient lifestyle and cause

medico-legal issues for the operator [7,8]. Many previous studies have shown that the position of the MF (horizontal and vertical plane) varies from one race to another [9,10]. Some research has shown that the location of the MF is not sex dependant [11,12]. Most studies showed the horizontal position of the MF between the root apices of the lower first and second premolars [13]. Other studies have shown that the MF is below the lower second molar, such as in Chinese races or populations. A small percentage of the population has an MF below the first premolar, below the first molar, mesial to the first premolar or below the canine [14-17]. This study tried to identify the MF location among an Iraqi population using orthopantomograms.

## MATERIALS AND METHODS

This survey was a descriptive cross-sectional study to identify the position of the MF in relation to the apices of the premolars in panoramic radiographs. A total of 815 panoramic radiographs were

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Received: October 28, 2021; Accepted: November 11, 2021; Published: November 18, 2021

Citation: AL-Juboori MJ, Crespo DP, Adnan FK, Zainy ZA, Kodadada ZS (2021) Mental Foramen Location among Iraqi Population: Cross Sectional Study. Dentistry. 11:606.

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collected from Orthopantomogram (OPG) centers in Baghdad. The collected panoramic radiographs fulfilled the inclusion and exclusion criteria stated below:

#### Inclusion criteria

1. Patient age eighteen and older
2. Film should show no radiographic exposure and processing artifacts
3. Only the Iraqi population was included

#### Exclusion criteria

4. Unreadable and poor quality OPG
5. Teeth loss, especially missing lower canines. Patients were excluded when mesial premolar drift occurred
6. Presence of supernumerary teeth in the area of the interdental foramen area
7. Presence of periodontal disease in mandibular dentition that may have caused mesial drift of the teeth
8. Patient dental history involving orthodontic treatment
9. Presence of teeth crowding and spacing in the mandibular dentition

The selected OPGs were examined using an X-ray viewer, and the MF was identified by a magnifying glass. A sheet of transparent paper was superimposed on the panoramic film, and the MF was traced on transparent paper by using a fine blue marker pen. A line was drawn from the apex of the 1st premolar to the 2nd premolar using a ruler, and it formed the vertical plane. Two horizontal planes were drawn on the longitudinal axis of the 1st premolar and 2nd premolar using a ruler (Figures 1 and 2).



**Figure 1:** Longitudinal axis of the 1st Premolar using a ruler

The horizontal position of the MF was recorded as follows:

- Position 1: In line with the 1st premolar
- Position 2: Between the 1st and 2nd premolars
- Position 3: In line with the 2nd premolar
- Position 4: Between the 2nd premolar and the 1st molar

The vertical position of the MF was recorded as follows:

- Above the vertical plane
- At the vertical plane
- Below the vertical plane

#### RESULTS

A total of 259 OPGs were selected from 815 OPGs based on the

inclusion and exclusion criteria. For females, the number of OPG



**Figure 2:** Longitudinal axis of the 2nd Premolar using a ruler

films was 142, while for males, the number was 117. The location of the MF in the horizontal plane in females was as follows: in position 1, (n=7, R=5.14%), (n=11, L=8.08%); in position 2, (n=70, R=51.4%), (n=70, L=51.4%); in position 3, (n=41, R=31.23%), (n=43, L=31.6%); and in position 4, (n=18, R=13.23%), (n=12, L=8.82%) .

The location of the MF in the vertical plane in females was above (n=2, R=1.47%) (n=3, L=2.2%), at (n=11, R=8.08%) (n=12, L=8.82%), and below (n=123, R=90.4%) (n=121, L=88.9%) .

The common location of the MF in females in the horizontal plane was position 2, and in the vertical plane, it was below the vertical plane. The location of the MF in the horizontal plane in males was as follows: in position 1, (n=2, R=1.62%), (n=4, L=3.25%); in position 2, (n=70, R=56.9%), (n=70, L=56.9%); in position 3, (n=34, R=27.6%), (n=38, L=30.8%); and in position 4, (n=17, R=13.82%), (n=11, L=8.94%). The location of the MF in the vertical plane in males was above (n=3, R=2.43%) (n=2, L=1.62%), at (n=19, R=15.4%) (n=20, L=16.2%), and below (n=101, R=82.11%) (n=101, L=82.11%). The common location of the MF in males in the horizontal plane was position 2, and in the vertical plane, it was below the vertical plane. The positions of the MF in the vertical and horizontal planes of the mandible are illustrated in (Tables 1 and 2).

**Table 1:** Position of MF in the horizontal plane

	Position 1	Position 2	Position 3	Position 4	Total
Female right	7	70	41	18	136
Female left	11	70	43	12	136
Male right	2	70	34	17	123
Male left	4	70	38	11	123

**Table 2:** Position of MF in the vertical plane

	Above	At	Below	Total
Female right	2	11	123	136
Female left	3	12	121	136
Male right	3	19	101	123
Male left	2	20	101	123

#### DISCUSSION

The location of the MF varies among individuals and may be related to race. Some research has shown that the location of the MF is not sex dependent. Normally, the MF is located below the interval between the two premolars [18]. However, many studies have shown that there are variations in the position of the MF in

different populations, especially those of different races [19]. Our study was conducted in the Arab race (Iraqi), and the data showed that the most common position for the MF was between the first and the second premolars on the right and left sides (54%), followed by within the long axis of the 2nd premolar (31%); thus, these two positions accounted for 85% of the cases. This result indicates that the MF is located more posteriorly, which yields a good interforamena distance for placing more implants in this area. As previous studies showed, the largest interforamina distance was found in African individuals [20] and this was confirmed by a recent study that found the location of the MF to be distal to the 2nd premolar [21].

According to Al-juboori et al. the location of the MF in the Malaysian population (consisting of Malaysian, Chinese, and Indian individuals) lies between the 1st and 2nd premolars (R=51.9%), (L=57.1%). Additionally, the AlJuboori et al study revealed that there was no significant difference between females and males in terms of mental location, which is in accordance with previous studies. Wang et al. Reported that the most common location of the MF among a Chinese population was apical to the 2nd premolar (59%). Shankland reported on a study on an Asian Indian population, and the most common location of the MF was apical to the 2nd premolar (75.4%). Oguz et al. studied the location of the MF in Turkish young adult male dry skulls. The authors demonstrated that the most common location of the MF was located below the root of the second premolar in 61.76% on the right sides and in 50% on the left sides of the mandible [22].

Some of the studies located the MF with 2D radiographs, such as OPGs, while most of the recent studies used 3D radiographs, such as Cone Beam Computerized Tomography (CBCT). If we consider the concept that the position of the MF varies among races, we can conclude that there are significant differences between the 2D vs. 3D radiograph results for the same race [23]. Studies using CBCT conducted on African, Caucasian, Chinese and Latin populations have shown that the MF is in line with the second premolars [24-26]. In 2D images, such as OPGs, various magnifications in various anatomical regions have been approved [27]. In addition, OPGs capture the image at different angles, which may result in variation of the MF location from the actual location [28]. A study was conducted by Alsoleihat et al [29]. on an Arab population using 3D CBCT imaging. The results of this study are in accordance with our findings, *i.e.*, that the majority of MF positions are between the 1st and 2nd premolars, followed by positioning in line with the 2nd premolar. Most of the studies relate the position of the MF to the position of the teeth apices, such as the lower first and second premolars and the first molar. The importance of the findings of such studies are irrelevant in edentulous patients and require additional anatomical landmarks to be related to, especially in cases of implant placement. Regarding the vertical position of the MF, our study located it below the apices of the premolars in the majority of the OPGs, which is in accordance with other studies [30]. This vertical position gives more space for the surgeon to extend the flap more apically, place longer implants and perform premolar apicectomy. The use of 2D images from OPGs and the small sample size were limitations in this study. Therefore, the authors recommend that future studies utilize 3D cone-beam computed tomography with larger sample sizes.

## CONCLUSION

Given the limitations of this study, the common location of the MF in the horizontal plane was position 2, and in the vertical plane, it

was below the vertical plane for both male and female sexes. The second common position of the MF in the horizontal plane was position 3 for both sexes.

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