



## Mental Foramen in Sex Determination

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### Abstract

Identification of sex is of at most importance in forensic examination. Mandible is one of the prominent facial bones which is used in the determination of sex as it has many anatomical difference between the two sexes, one such structure is the mental foramen. This review aims at shedding light at the sexual dimorphism that exists between the male and the female gender.

**Keywords:** Mental Foramen; Mandible; Sex; Gender

### Introduction

Forensic analysis carried out in case of mass disasters includes identification of anatomical features of human skeletal remains. More specifically in identification of adults, sex determination is the prime focus which is followed by age and stature as these two features are sex determinants. Skull is the most important and dimorphic portion for sex determination after pelvis. In certain cases when complete skull is not available mandible plays a very important role in gender identification. Mandible is considered strongest bone in the skull and its anatomical features will be preserved comparatively for long time. Therefore, morphological features of mandible are used by forensic specialists in determining gender. Numerous research on cheiloscopia, figure print analysis, palatal rugae patterns, cuspid dimorphism in different populations of India [1-7].

Identification of a person in case of mass disasters using dental characteristics such as crown, root morphology, presence of decayed, missing teeth, and degree of root formation aid in identification of that person [8-10].

There are other studies where there are differences between genders in relation to the height of mandible, gonial angle, bigonial breadth, bicondylar breadth, and position of mental foramen (MF) [11-14].

### Mental foramen: a valuable anatomical landmark

Among many anatomical landmarks in human skull, the mental foramen is a stable landmark on the mandible. MF is an opening at the buccal side of the mandible bilaterally where the mandibular nerve exits the mandible near the bicuspid area along with the vessels [15]. Wical and Swoope in 1974 indicated that inspite of all the relative age changes that takes place in the mandible the distance

between the MF and the lower border of the mandible remains unchanged [5]. As mentioned earlier mental foramen which is considered a stable landmark in mandible we made an attempt to review the importance position of mental foramen in case of gender identification [14].

### Radiographic appearance of mental foramen

According to the authors, Yosue and Brooks the radiographic appearance of mental foramen can be classified into four types. In the continuous type, the MF is uninterrupted with the mandibular canal. In the separate type, the foramen is noticeably detached from the mandibular canal and is seen as a distinct radiolucency with a well-defined border. In the diffuse type, the foramen has an vague boundary while in the unidentified type, the MF is not visible [6,7].

Another classification for position of mental foramen depending on its position of the tooth [18]:

- Position 1: MF situated anterior to first premolar tooth
- Position 2: situated in line with the long axis of first premolar tooth
- Position 3: MF situated between the apices of first and second premolar teeth
- Position 4: MF situated in line with long axis of second premolar tooth
- Position 5: MF situated between the apices of second premolar and first molar teeth
- Position 6: MF situated in line with the long axis of first molar tooth.

### Why are orthopantomograms [opg] preferred over conventional periapical radiographs?

Radiographs are one of the important tools in forensics investigations and its utilisation for identification is valuable if sufficient antemortem records are available.

Panoramic radiographs (orthopantomogram [OPG]) illustrate two-pronged location of MF, mandibular foramen, ramus, angle, and body of the mandible. OPG allows frank position of the MF in two dimensions [19]. On the other hand conventional intro oral periapical radiographs cannot assess the MF bilaterally and due to its dimensions if the MF is located too apically it cannot be assessed. Panoramic radiography is a widely used technique because it has the advantage of providing, in a single film, the image of the full mandible with relatively less exposure, time, and cost. This technique can offer information about the localization of anatomic structures vertical and horizontal bony dimensions [20].

Panoramic digital radiography can be practical in forensic medicine with the employment of portable unit, this allows a rapid examination of the extra-oral structures and the dental status [2,3].

It is because of this reason we consider panoramic radiographs are much helpful and convenient to study the position of mental foramen in such cases [14,21,22].

### Literature showing the importance of mental foramen in gender identification

As mentioned earlier the position of mental foramen can be used as a landmark in gender identification. The most reliable and easily identifiable aspect of mental foramen is the distance between the superior border of foramen to lower border of mandible apart from this the inferior border of mental foramen and lower border of mandible are also considered to be reliable landmark for radiological interpretations. Numerous studies have been conducted using this position and vivid results have been seen.

A study was conducted by Akhilesh Chandra, *et al.* 100 radiographs were selected for the analysis of mental foramen. Tangents were drawn to the upper and lower borders of the MF and perpendiculars were drawn from the tangents to the inferior border of the mandible (S-L and I-L). The data obtained were tabulated and subjected to statistical analysis. Results inferred that the average values of S-L and I-L were considerably higher in males than in females, whereas the distances for the right and left sides of an individual were almost analogous in both the sexes and the results were non-significant. These results were in accordance with those of Thomas, *et al.*, Mahima, *et al.* and Catovie, *et al.* [14,23,24].

Ghouse, *et al.* conducted a study with a sample which consisted of 60 patients from both genders, (30 males and 30 females) Four linear vertical measurements (D1, D2, D3, and D4) were performed on all radiographic images according to Amorim, *et al.* These measurements were done on the right and left sides of the mandible image. The following measurements were taken, D1: Vertical distance from the most inferior point on the mental foramen to the inferior

most point on the base of the mandible. D2: Vertical distance from the most superior point on the mental foramen to the superior most point of the alveolar crest. D3: Vertical distance from the most lowest point of the mandibular notch to the most superior point on the MF. D4: Vertical distance from the most lower point of the mandibular notch to the inferior edge of the mandibular ramus. Results indicated that the mean values between the two sexes i.e male and female subjects overall values for D1, D2, D3, and D4 were significantly higher in males in comparison to females. This was coinciding with the studies by Rashid and Ali, Yousue and Brooks, Freitas, Al-Khateeb, *et al.*, Amorim, *et al.*, Şahin, *et al.*, and Kılarkaje, *et al.*, Al-Mufti, *et al.* indicating that the verticle measurements from mandibular lower border and mental foramen are potent indicators for sex determination and useful in differentiating male gender from female [14,16,25-28].

Muhammad Ajmal conducted another study in which a total of 500 radiographs were taken of patients having unilateral edentulous areas. Patients aged between 30 - 70 years and were divided into 4 groups of 30 - 39, 40 - 49, 50 - 59 and 60 - 70 yrs. The distance between alveolar crest bone and superior margin of mental foramen was calculated. The results of the study indicated that the distance between the superior border of mental foramen and alveolar crest was comparatively more in males than in females indicating the importance of mental foramen in gender predilection [29].

Moni Thakur, *et al.* conducted a similar type of study but in dentulous patients and they also concluded height of the mandible and the distance from the superior margin of the mental foramen to the alveolar crest can be used to determine the gender [30].

In another study Sahni, *et al.* considered another variable that is distance between inferior (I-L) border of mental foramen and lower border of mandible along with superior border (S-L) of foramen and concluded that showed that the mean values of comparison of S-L as well as I-L in males and females were significantly higher in males as compared to females. The comparison of SL and IL on right and left side in the same patient was without any significant difference. This type of results were also in accordance with Thomas, *et al.*, Catovie, *et al.* and Akhilesh, *et al.* where there was a significant difference between the position of mental foramen in both the genders [14,23,24,31].

However, in a study conducted by Vodanovic, *et al.*, Enlow, *et al.*, Amorim, *et al.* and Akhilesh, *et al.* there was no significant difference between the genders in relation to inferior border of mental foramen. This dissimilarity could have been due to the ethnic assortment in the given inhabitants [4,14,32].

### Conclusion

Panoramic radiography can be well thought-out as an supplementary radiographic method to identify gender from the skeletal relics because it is efficient for making the proposed measurements which is predominantly key in mass disaster events, in which the jaws are obtainable in fragments. Based on the grades of this review there is a momentous variation in the distance from

both superior border and inferior border of MF to the lower border of the mandible in males and females.

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