

EVALUATION OF MENTAL AND MANDIBULAR FORAMEN FOR AGE AND SEX DETERMINATION IN DENTAL ORTHOPANTOMOGRAMS

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ABSTRACT

Introduction: The present study was designed to explore the sexual dimorphism existing in vertical measurements of mental and mandibular foramina on panoramic image to aid in gender determination in different age groups.

METHOD: The study group comprised a total of images 100 panoramic radiographs of randomly selected dentulous patients (50 males and 50 females) attending the outpatient clinics of the Karnavati School of Dentistry, obtained for endodontic, periodontic and orthodontic purposes. The study population was divided into five age groups; 20-29 years, 30-39 years, 40-49 years, 50-59 years, and 60-69 years. Four measurements (D1, D2, D3 and D4) were taken (in cm) for localisation of mental and mandibular foramina in relation to lower border of mandible on both sides of mandible. Statistical analysis of the recorded data was carried out.

RESULT: The present study population consisted of total 100 patients, 50 males and 50 females and divided into 5 age groups (20-29yrs, 30-39yrs, 40-49yrs, 50-59yrs, 60-69yrs). When comparison of mean values between male and female patients was done, the overall values of mean for D1, D2, D3, and, D4 was statistically significantly higher in males as compared to females in all the age groups. While comparing the mean values of all the parameters right and

left sides of mandible the results revealed that there was no significant difference. Age wise analysis didn't reveal any significant correlation between the age and all the parameters in the present study.

CONCLUSION: Results of study revealed difference in the distances from mental and mandibular foramina to the lower border of mandible in between the gender so there is existence of definite sexual dimorphism. This method is applicable in mass disaster where mandibular fragments are available in forensic dentistry.

KEYWORDS: OPG, Mental Foramen, Mandibular Foramen, Sex Determination.

Introduction

Gender determination plays a significant role in forensic dentistry. Analysis of morphological features of bone is a familiar approach used in forensic dentistry for gender determination. Among the parts of the skull, mandible is of utmost importance as being strongest and well preserved bone than the other bones in human body and also exhibiting sexual dimorphism for many anatomical structures such as inter-canine distance, angle of mandible, bigonial width and position of mental foramen and mandibular foramen. The stable position of mandibular foramen and mental foramen in relation to lower border of mandible, can aid in gender and age determination¹. In addition, knowing the exact location of both the foramina permits for precise local anesthesia and preventing any damage to the nerves in surgical procedures like flap operations, mandibular osteotomy, periapical surgery and cyst enucleation. Different radiographic research methods performed to determine the accurate location of both foramina demonstrated that the panoramic image depicts the least error for the same. It is the most preferable diagnostic modality being simplest and cheapest method².

Aims and Objectives

The present study was designed to explore the sexual dimorphism existing in vertical measurements of mental and mandibular foramina on panoramic image to aid in gender determination in different age groups.

Material and Methodology

Clinical and radiographic parameters:

The study group comprised a total of 100 panoramic radiographs of randomly selected dentulous patients (50 males and 50 females) attending the outpatient clinics of the Karnavati School of Dentistry, obtained for endodontic, periodontic and orthodontic purposes. The study population was divided into five age groups; 20-29 years, 30-39 years, 40-49 years, 50-59 years, and 60-69 years. High quality panoramic radiographs depicting the clear outlines of both mandibular and mental foramina along with the lower borders of mandible were included in the present study.



Figure 1: Vertical Linear parameters measured on the image of panoramic radiograph

Radiographs with bone pathologies, odontogenic and non-odontogenic pathologies, history of trauma, pathological fractures, congenital anomalies and history of orthognathic or maxillofacial surgeries as well as presence of artifacts or distortion of images and non-visualisation of mandibular and mental foramina were excluded from the study.

The following measurements were taken (in cm) for localisation of mental and mandibular foramina in relation to the lower border of the mandible on both sides of the mandible.

D1: Vertical distance from the lower most border of the mental foramen to the lower most borders on the base of the mandible.

D2: Vertical distance from the most superior point on the mental foramen to the lower border of the mandible.

D3: Vertical distance from the lower most border of the mandibular notch to the upper most border of the mandibular foramen.

D4: Vertical distance from the lower most border of the mandibular notch to the inferior border of the mandibular ramus.

Statistical analysis of the recorded data was carried out.

Results

The present study population consisted of total 100 patients, 50 males and 50 females and divided into 5 age groups (20-29yrs, 30-39yrs, 40-49yrs, 50-59yrs, 60-69yrs). When comparison of mean values between male and female patients was done, the overall values of mean for D1, D2, D3, and, D4 were statistically significantly higher in males as compared to females in all the age groups. While comparing the mean values of all the parameters right and left sides of the mandible the results revealed that there was no significant difference.

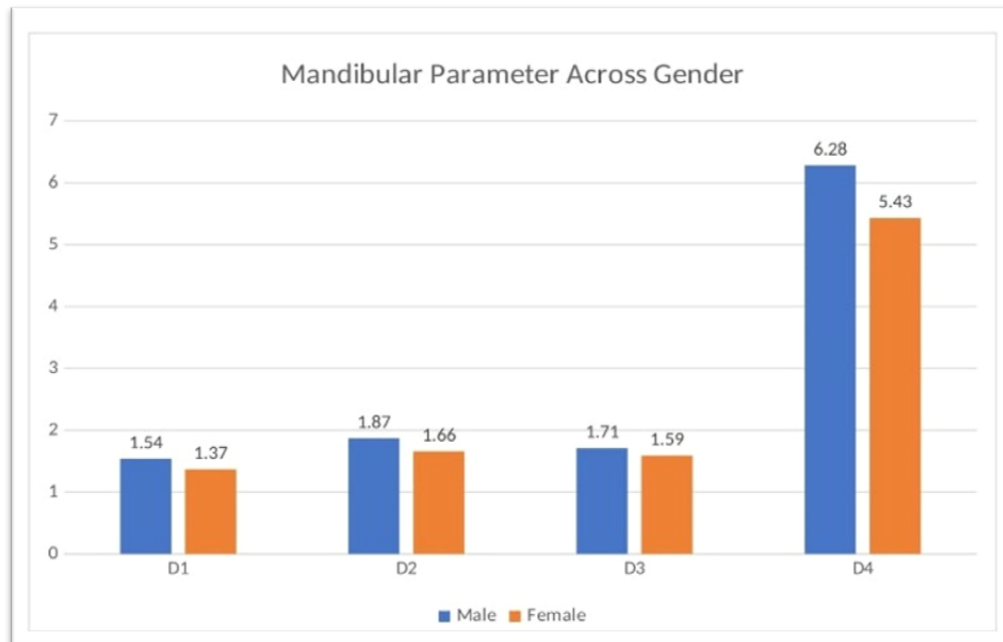


Figure 2: Mandibular Parameters across genders.

Age wise analysis didn't reveal any significant correlation between the age and all the parameters in the present study. D1 with cutoff value of 1.44 was 63% accurate and statistically significant. D2 with cutoff value of 1.79 was 77% accurate and statistically significant. D3 with cutoff value of 1.57 was 58% accurate. D4 with the cut off value of 5.79 was 81% accurate and statistically significant. Cutoff values of all the parameters were used to differentiate female gender from male gender and when tested for validity among all the parameters D4 revealed high accuracy(81%), high specificity(80%), as well as high sensitivity(82%).

TABLE 1 Age and Gender wise distribution of cases

| AGE | MALE | | FEMALE | | | |
|-------|--------|------------|--------|------------|-------|------------|
| Years | NUMBER | PERCENTAGE | NUMBER | PERCENTAGE | TOTAL | PERCENTAGE |
| 20-29 | 09 | 45% | 11 | 55% | 20 | 20 |
| 30-39 | 04 | 20% | 16 | 80% | 20 | 20% |
| 40-49 | 10 | 50% | 10 | 50% | 20 | 20% |
| 50-59 | 12 | 60% | 08 | 40% | 20 | 20% |
| 60-69 | 15 | 75% | 05 | 25% | 20 | 20% |
| TOTAL | 50 | 50 | 50 | 50 | 100 | 100 |

TABLE 2: Age wise mean values of all parameters in both genders.

| AGE GROUP | D1 | | D2 | | D3 | | D4 | |
|--------------------|---------------------|-----------------------|---------------------|---------------------------|---------------------|---------------------------|---------------------|---------------------------|
| | MALE Mean ±SD | FEMALE MEAN± SD | MALE Mean ±SD | FEMALE MEAN ± SD | MALE Mean ±SD | FEMALE MEAN ± SD | MALE Mean ±SD | FEMALE MEAN ± SD |
| 20-29 | 1.309 ±1.56 | 1.332 ±1.28 | 1.82±.2 32 | 1.68±.1 88 | 1.66±.4 98 | 1.59±.3 53 | 6.50±.9 21 | 5.54±.3 34 |
| 30-39 | 1.59±.2 12 | 1.38±.2 28 | 1.90±.1 83 | 1.67±.2 50 | 1.84±.3 16 | 1.57±.3 81 | 6.77±.3 42 | 5.72±.7 16 |
| 40-49 | 1.49±.2 70 | 1.51±.2 55 | 1.75±.1 85 | 1.73±.2 66 | 1.78±.6 56 | 1.67±.4 29 | 6.14±.5 66 | 5.26±.5 06 |
| 50-59 | 1.53±.2 55 | 1.35±.1 59 | 1.97±.2 00 | 1.62±.3 16 | 1.58±.4 34 | 1.62±.3 88 | 5.82±.5 81 | 5.47±.3 55 |
| 60-69 | 1.55±.1 96 | 1.28±.2 65 | 1.89±.2 49 | 1.51±.1 38 | 1.76±.4 03 | 1.47±.3 00 | 6.28±.5 40 | 5.42±.6 94 |
| Overall Average | 1.54±.3 41 | 1.37±.2 58 | 1.87±.2 23 | 1.66±.2 43 | 1.71±.4 70 | 1.59±.3 68 | 6.28±.6 43 | 5.43±.4 64 |

Table 3: Validity parameters of selected cut off values for all 4 parameters.

| | AUC | P VALUE | CUT OFF VALUE | SENSITIVITY | SPECIFICITY | ACCURACY(%) |
|--------|------|------------|---------------------|-------------|-------------|-------------|
| D1(cm) | .703 | .000 | 1.44 | 66% | 64% | 63% |
| D2(cm) | .800 | .000 | 1.79 | 76% | 78% | 77% |
| D3(cm) | .618 | .043 | 1.57 | 60% | 56% | 58% |
| D4(cm) | .856 | .000 | 5.79 | 82% | 80% | 81% |

Discussion

Gender determination of unknown human skeleton becomes challenging task for forensic odontology. When there is non availability of complete skull in certain cases mandible plays a pivotal role in gender determination^{3,4}. Among the anatomical landmarks on the mandible the mental foramen and the mandibular foramen are considered as stable landmarks in relation to lower border of mandible⁵.

Mental foramen is located on the buccal side of the bicuspid area of the mandible bilaterally where the mental nerve exits with the vessels^{6,7}. While the common location of mandibular foramen is just posterior part of the middle third of ramus of mandible (Poonacha et al., 2010)⁸. Radiographs are imperative tools used in forensic dentistry which is simplest and cheapest

approach for determination of age and gender compared to other biochemical and histological methods (Chandra et al 2013)⁹. Among the radiographic methods commonly used method is panoramic radiography as a single film depict the full image of mandible with relatively less time, cost, and exposure^{4,10}. Panoramic radiography can be practiced in forensic dentistry even with portable units^{6,7}. In addition it allows more accurate localization of mental foramen as well as mandibular foramen both vertically as well as horizontally¹¹. So the present study was carried out to evaluate the position of mental foramen as well as mandibular foramen on panoramic image for gender determination in various age groups.

In the present study the localization of mental foramen and mandibular foramen was presented as D1, D2, D3, and D4 in both genders at different age groups on both sides. The average values of all parameters were significantly higher in males than in the females. These results were in accordance with the results obtained by Akhilesh Chandra et al (2013)⁹, Pavitra Dave (2019)⁷ and NorriGhouse et al (2016)¹. The tension exerted by the masticatory muscles during mastication has potential inductive effect on the mandible and chiefly masticatory forces are more stronger in men as compared to women. The vertical position of both mental foramen and mandibular foramen was almost symmetrical in both the sides without any statistically significant difference. This finding was in accordance with the study carried out by NorriGhouse et al (2016)¹. Rationalizing that any one side can be utilized for sampling in the study. No statistical correlation found between the position of mental foramen as well as mandibular foramen and chronological age on both the genders. According to our analysis among all the parameters D4 was highly sensitive (82%), highly specific (80%) and highly accurate (81%). Further extensive studies are required on a large number of samples and comprehensive analysis of parameters related to both the mental and mandibular foramina for the affirmation of results.

Conclusion:

Results of our study revealed difference in the distances from mental and mandibular foramina to the lower border of mandible in between the gender so there is existence of a definite sexual dimorphism. This method is applicable in mass disaster where mandibular fragments are available in forensic dentistry.

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