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RADIOGRAPHIC STUDY TO CORRELATE MENTAL FORAMEN PARAMETERS AND GENDER. A HOSPITAL BASED STUDY ON NEW DELHI POPULATION.

Dental Science

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ABSTRACT

Aim: Gender identification of unidentified skeletal remains is a challenging task for any forensic dentist. This study is intended to find a correlation between the analysis of mental foramen and the gender in New Delhi population which can be extrapolated.

Materials and Methods: One hundred orthopantomographs were selected in which the mental foramen was identified as separate type. Tangents were drawn to the superior and inferior borders of the mental foramen and perpendiculars were drawn from the tangents to the lower border of the mandible (S-B and I-B). Statistical analysis was done on the data obtained.

Results: The mean values of S-B and I-B were significantly greater in males than in females. The difference in distances of the right and left side mental foramina from the midline in both the males and females were non-significant.

Conclusion: The analysis of mental foramen can be used in gender determination as evidenced by this retrospective study on orthopantomographs.

KEYWORDS

Forensic dentistry, Gender identification, mental foramen, , orthopantomograph

Introduction

Gender determination by analyzing the morphological characteristics of the skeletal remains is important in the fields of forensic medicine and forensic dentistry. The mandible being the strongest bone in the human body is well preserved longer than any other bone[1] The use of morphological features of the mandible is therefore a common approach used by the experts of forensic medicine and forensic dentistry in gender determination.[2] There is a need for population-specific standards as skeletal characteristics vary by population.[3] The mental foramen on the mandible is one of the stable anatomical landmarks on the entire skull.[4] It is a funnel-like opening in the lateral surface of the mandible directed outward, upward and posteriorly at the terminus of the mental canal near the apices of premolars and transmits mental vessels and nerves.[5] The panoramic radiographs of the skull are indispensable tools that finds its application in forensic anthropology whose accuracy is based on the quality of the radiographs. The mental foramen is fairly well depicted on panoramic radiographs. It provides the ability to view the entire body of the mandible and allow a more accurate location of the mental foramen in both horizontal as well as in vertical dimensions [6]. The aim of the present study was to signify the average measurements from the superior and the inferior borders of the mental foramen to the lower border of the mandible on panoramic radiographs in determining the gender in a sample of New Delhi population.

Materials and Methods

A retrospective study was performed on the panoramic radiographs of patients aged between 16 and 50 years, which were obtained for orthodontic treatment planning, periodontal diagnosis and endodontic prognosis assessment during a period of 1 year from July 2010 to December 2010.

The radiographs were taken using the Carestream Dental CS 8100 system with tube current 6-8 mA, tube potential 60-80 KV, total filtration 2.5 mm of Aluminum, focal spot 0.3 and time 18 s[5]. Only radiographs with correct positioning and high quality where the mental foramen was identified as separate type were included in the study.(Figure 1) The exclusion criteria for the radiographs were: Distortion of images, presence of artefacts, surgical interventions, presence of any pathology, patient under 16 years and mental foramen of types other than the separate type [5]. Of the total 630 screened radiographs, 100 radiographs were selected for the analysis. The anatomical landmarks of interest were traced on a tracing sheet using a HB pencil. (Figure 2). The tangents were drawn to the superior and inferior borders of the foramen. Vernier calipers was used to measure the distances from the superior border of the mental foramen to the lower border of the mandible (S-B) and the inferior border of the mental foramen to the lower border of the mandible (I-B) (Figure 3). Statistical analysis was performed for males and females on both the right and the left sides, 95% confidence interval was applied and *t*-test was done and P value less than 0.05 was considered as significant.

Results

The average distance from the superior border of the mental foramen to the lower border of the mandible (S-B) on the right side in males was 17.650 mm, whereas it was 16.150 mm in females. On the left side, it was 17.475 mm in males and 15.787 mm in females [Tables 1 and 2]. The mean distance from the inferior border of the mental foramen to the lower border of the mandible (I-B) on the right side in males was 12.670 mm, whereas it was 11.462 mm in females. On the left side, it was 12.583 mm in males and 11.250 mm in females [Tables 3 and 4]. The comparison of S-B between males and females showed a very high significant difference ($P < 0.001$) on both the right and the left sides [Table 5]. Similarly, the comparison of I-B between males and females suggested a highly significant difference ($P = 0.0022$) on both sides [Table 6]. The comparison of S-B and I-B between the right and the left sides in males described a non-significant difference ($P = 0.67$ and $P = 0.84$) [Table 7]. In the same way, the comparison of S-B and I-B between the right and left sides in females also showed a non-significant difference ($P = 0.57$ and $P = 0.76$) [Table 8].

Discussion

The mandible being the strongest bone in the human body is highly resistant to degradation than any other bone. Therefore, mandibular characteristics are extremely useful for gender determination [1]. In spite of the fact that the alveolar bone resorption occurs above the mental foramen, the distance from the foramen to the inferior border of the mandible remains relatively constant throughout life [7] Lindh *et al.* in 1995 and Guler *et al.* in 2005 suggested that the stability of this region does not depend on resorption of alveolar process above the foramen thus suggesting that the vertical measurements in panoramic radiography are clinically applicable for the quantification of height of alveolar bone in this region.[8,9] The basal bone and mental foramen being stable landmarks, they were selected as a point of reference for this retrospective study. The ability to view the entire body of the mandible allows a more accurate location of the mental foramen in both a horizontal and a vertical dimension on panoramic radiographs [6]. Agthong *et al.* in 2005 analyzed the position of the mental foramen in several populations by using panoramic radiography.[10] Yosue and Brooks in 1989 described that the radiographic appearance of mental foramen can be classified into four types. In the continuous type, the mental canal is continuous with the mandibular canal. In the separate type, the foramen is distinctly separated from the mandibular canal and appears as a well-defined radiolucency with a distinct border of condensing bone. In the diffuse type, the foramen has an indistinct border while in the unidentified type, the foramen cannot be seen [11,12]. The separate type is easy to identify on panoramic radiograph and so only this type was selected for the present study. It was suggested by Akgul and Toygar in 2002 that in comparative analyses between genders, the morphometric study by means of panoramic radiography reveals differences and inherent alterations in the evaluated groups.[13] In the present study, the mean values of S-B and I-B were significantly high in males as compared with females, and the

results were in accordance with those of Thomas *et al.*, Mahima *et al.* and Catovie *et al*.[4,14,15] On the contrary, Vodanovic *et al.* found that the mean value of I-B does not exhibit sexual dimorphism.[16] The difference may be due to racial diversity of the study population. In our study, this value was also significantly high in males, which also corresponds to the studies of Enlow *et al.* and Amorim *et al* [17]. The distances (S-B and I-B) for the right and left sides of an individual showed that the values were almost similar, with a non-significant difference, and this applies for both the male and the female groups. This is similar to the study of Thomas *et al* [14]. Therefore, the distances from any of the sides can be used as a representative for gender discrimination. In the present study, the 95% confidence interval range analysis described that the S-L in males comes within the range of 16.921-18.160 mm, and in females it fall within the range of 15.041-17.032 mm. The values of I-B in males ranges between 11.944 and 13.281 mm and in females it comes within the range of 10.424 and 12.384 mm. These results suggest that if a distance above 16.921 mm for S-B and 11.944 mm for I-B is obtained on the panoramic radiograph; the gender will be male in 95% of the cases. Similarly, if a distance less than 17.032 mm for S-L and 12.384 mm for I-B is obtained, the gender will be female in 95% of the cases. The results were similar to the study conducted on a south Indian population by Mahima *et al*. in 2009. The limitations of the study were small sample size based on convenience and limited number of parameters studied.

Conclusion

Within the limitations of this retrospective study, it is concluded that the distances from the mental foramen to the lower border of the mandible can be used as a guide for gender determination in a sample of New Delhi population which can be extrapolated with 95% accuracy for which multi center studies are needed. Orthopantomograph is an efficient guide for measuring the parameters used in this study and can be considered as one of the radiographic methods of gender determination from the skeletal remains of human mandible.

Table 1: S-B Values in males

	Right side	Left side
Total measurements	60	60
Mean (in mm)	17.65	17.475
SD	2.376	2.208
Standard error mean	0.3068	0.2851
95 % CI range	17.036 – 18.264	16.905 – 18.045

Table 2: S-B Values in females

	Right side	Left side
Total measurements	40	40
Mean (in mm)	16.150	15.787
SD	2.790	3.013
Standard error mean	0.4412	0.4763
95 % CI range	15.258 – 17.042	14.824 – 16.751

Table 3: I-B Values in males

	Right side	Left side
Total measurements	60	60
Mean (in mm)	12.670	12.583
SD	2.615	2.499
Standard error mean	0.3375	0.3227
95 % CI range	11.991 – 13.342	11.938 – 13.229

Table 4: I-B Values in females

	Right side	Left side
Total measurements	40	40
Mean (in mm)	11.4625	11.25
SD	2.921	3.189
Standard error mean	0.4618	0.5041
95 % CI range	10.528 – 12.392	10.230 – 12.270

Table 5: Comparison of S-B between males and females

	t value	P value	Significance
Right	2.88	0.0048	High significance
Left	3.23	0.0016	High significance

Table 6: Comparison of I-B between males and females

	t value	P value	Significance
Right	2.16	0.033	Significance
Left	2.33	0.021	Significance

Table 7: Comparison of S-B and I-B between right and left sides in males

	t value	P value	Significance
S-B	0.42	0.67	Non-significant
I-B	0.19	0.84	Non-significant

Table 8: Comparison of S-B and I-B between right and left sides in females

	t value	P value	Significance
S-B	0.56	0.57	Non-significant
I-B	0.31	0.76	Non-significant

Figure 1: Orthopantomograph sample with mental foramen of separate type

Figure 2: Tracing of mental foramen and lower border on the mandible

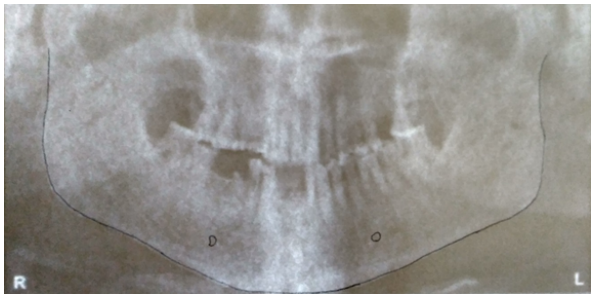
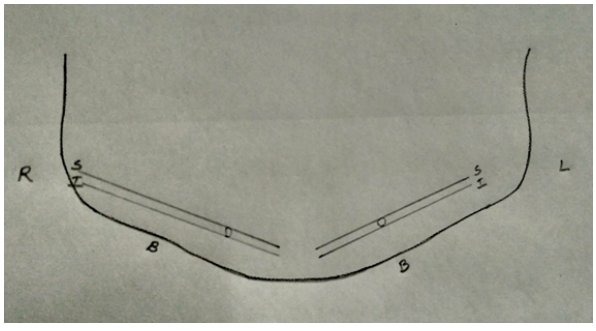


Figure 3: Marking the tangents to the superior (S) and inferior (I) border of the mental foramen to enable measurements from the lower border (B) of the mandible



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