

Study for Determination of Sex Using Mental Foramen: An Institutional Based Study**Jitendra Kumar Gupta¹, Mahipal Nehra¹, Rakesh Kumar¹, Arun Sharma^{1*}, O. P. Saini², Manoj Garg³**¹*PG Resident, Department of Forensic Medicine and Toxicology, Sardar Patel Medical College, Bikaner, Rajasthan, India*²*Professor & Head, Department of Forensic Medicine and Toxicology, Sardar Patel Medical College, Bikaner, Rajasthan, India*³*Assistant Professor, Department of Forensic Medicine and Toxicology, Sardar Patel Medical College, Bikaner, Rajasthan, India***Received: 06-01-2021 / Revised: 28-03-2021 / Accepted: 01-04-2021****Abstract**

Background: Identification of human skeletal remains is an important part of forensic analysis. In adult skeleton, sex determination is the first step, followed by age and stature as age and stature are sex dependent. The present study was conducted to determine sex using mental foramen.

Materials and Methods: A present study was conducted to determine sex using mental foramen. A total of 70 panoramic radiographs were examined and selected retrospectively. 140 mental foramina were analyzed for the study. 140 mental foramina were located in the panoramic radiographs and traced. The measured distances were tabulated and analyzed. Statistical analysis of the data was done using SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). **Results:** In the present study a total of 70 consisted of 35 males and 35 females panoramic radiographs were examined and selected retrospectively. Superior tangent to the Lower border of the mandible (SL) was measured. The mean and standard deviation in males was 18.21 ± 3.12 mm on the right side and 18.10 ± 3.45 mm on the left side. The mean and the standard deviation in females was 14.32 ± 2.01 mm on the right side and 15.02 ± 2.11 mm on the left side. Inferior tangent to the Lower border of the mandible (IL) was also measured. The mean and standard deviation in males was 14.91 ± 2.98 mm on the right side and 14.54 ± 3.25 mm on the left side. The mean and the standard deviation in females was 12.24 ± 1.45 mm on the right side and 12.65 ± 1.64 mm on the left side. **Conclusion:** The present study concluded that mean values of SL and IL were significantly higher in males when compared to females. There was no significant difference between the measurements of right and left sides of both males and females. Therefore, mental foramen can be used as a marker for sexual dimorphism.

Keywords: Mental Foramen, Sexual Dimorphism, Panoramic Radiographs, Forensic.

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Introduction

Bone is a structurally important dynamic tissue which provides mechanical support for movement, supports viscera and determine the size and shape of the body.

Bone lesions are diverse in size, gross and histological features and range from innocuous to rapidly fatal lesions which are diverse in nature. It is critical to diagnose these tumors and tumor like lesions correctly, stage them accurately and treat them appropriately, so that the patients not only survive but also maintain optimal function[1]. Conventional radiographs usually are the basic means of evaluating skeletal lesions as they are inexpensive and easily available. Radiological diagnosis of any bone lesion takes into account the site of lesion, borders, type of matrix, type of bone destruction, number of lesions and the nature and extent of soft tissue involvement[2].

Distinguishing males from females and the differences in ethnic groups by analyzing the morphological characteristics of bone is important in the fields of physical and forensic anthropology. The

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mandible is the strongest bone in the human body and persists in a well-preserved state longer than any other bone[1]. Therefore, the use of morphological features of the mandible is a common approach used by anthropologists and forensic dentists in the determination of sex. The radiographs are indispensable tools that also aid in forensic investigations. The utilization of radiographs for identification is valuable if sufficient antemortem records are available. Radiographically, MF appears as either round, oblong, slit-like or very irregular radiolucent area which is partially or completely corticated. MF is located in the body of mandible midway between the inferior and alveolar margins. Panoramic radiographs (orthopantomogram [OPG]) show bilateral location MF, mandibular foramen, ramus, angle, and body of the mandible. OPG allows more accurate location of the MF in both horizontal and vertical dimensions[3]. Hence, the morphological features of the mandible are commonly used by forensic specialists in determining sex. Sex determination from skeletal remains is an important aspect of the osteologic analysis of a given population[4,5]. Due to the stable relation of mental and mandibular foramen with the base of the mandible they are used as a reference in morphometric analysis[6]. The present study was conducted to determine sex using mental foramen.

Materials and methods

A present study was conducted to determine sex using mental foramen. Before the commencement of the study ethical approval was taken from the Ethical Committee of the institute. A total of 70 panoramic radiographs were examined and selected retrospectively. 140 mental foramina were analyzed for the study. A distinct mental foramen free of any radiographic artefact were included in the study. Distorted images, unidentifiable mental foramen and the presence of artifacts were excluded from the study. 140 mental foramina were located in the panoramic radiographs and traced. Two tangents – one superiorly and one inferiorly were drawn to the traced mental foramen. Similarly, the lower border of the mandible was traced. Perpendiculars from the tangents were drawn to the lower border and the distances (in mm) between them were measured (SL and IL) in both right and left sides. The measured distances were tabulated and

analyzed. Statistical analysis of the data was done using SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA).

Results

In the present study a total of 70 consisted of 35 males and 35 females panoramic radiographs were examined and selected retrospectively. Superior tangent to the Lower border of the mandible (SL) was measured. The mean and standard deviation in males was 18.21 ± 3.12 mm on the right side and 18.10 ± 3.45 mm on the left side. The mean and the standard deviation in females was 14.32 ± 2.01 mm on the right side and 15.02 ± 2.11 mm on the left side. Inferior tangent to the Lower border of the mandible (IL) was also measured. The mean and standard deviation in males was 14.91 ± 2.98 mm on the right side and 14.54 ± 3.25 mm on the left side. The mean and the standard deviation in females was 12.24 ± 1.45 mm on the right side and 12.65 ± 1.64 mm on the left side.

Table 1: Comparison of SL between right and left sides in males (mm)

Sides	Right	Left
No. of samples	35	35
Mean \pm SD	18.21 \pm 3.12	18.10 \pm 3.45

Table 2: Comparison of SL between right and left sides in females (mm)

Sides	Right	Left
No. of samples	35	35
Mean \pm SD	14.32 \pm 2.01	15.02 \pm 2.11

Table 3: Comparison of IL between right and left sides in males (mm)

Sides	Right	Left
No. of samples	35	35
Mean \pm SD	14.91 \pm 2.98	14.54 \pm 3.25

Table 4: Comparison of IL between right and left sides in females (mm)

Sides	Right	Left
No. of samples	35	35
Mean \pm SD	12.24 \pm 1.45	12.65 \pm 1.64

Discussion

Panoramic radiographs are known to show greater part of maxillofacial skeleton as a continuous image, thus allowing for more accurate localization of both mental foramina in both vertical and horizontal dimensions, whereas periapical radiographs may not reveal the position of the MF if it is below the edge of the film. Moreover, comparative analysis between the right and left foramen is also difficult on other conventional radiographs[7,8].

In 1974, Wical and Swoope described that despite the alveolar bone resorption above the mental foramen, the distance from the foramen to the inferior border of the mandible remains relatively constant throughout life[9].

Studies by Morant et al. (1936), Martin (1936), and Hrdlicka (1940) (cited in Humphrey et al[10]) on mandible have proved the importance of mandible in sex determination. It was noticed that sexual differences were more in mandibular ramus height proving its significance in sex determination when compared to the body of the mandible[11].

A study conducted by Rai and Arnad in 2009 indicated that measurements of mental foramina to alveolar ridge can be useful for specifying gender[12].

Lindh et al. in 1995 and Guler et al. in 2005 also suggested that the stability of this region does not depend on resorption of alveolar process above the foramen[13,14].

Malik M et al conducted a study and found that the average values of SL and IL were found significantly higher in males than in females. But the distances for the right and left sides of a study sample were almost similar in both males and females and the results were non-significant[15].

Shanmugasundaram K et al found that the mean values of SL and IL were significantly higher in males when compared to females. There was no significant difference between the measurements of right and left sides of both males and females[16].

Conclusion

The present study concluded that mean values of SL and IL were significantly higher in males when compared to females. There was no significant difference between the measurements of right and left sides of both males and females. Therefore, mental foramen can be used as a marker for sexual dimorphism.

References

1. Hu KS, Koh KS, Han SH, Shin KJ, Kim HJ. Sex determination using nonmetric characteristics of the mandible in Koreans. J Forensic Sci. 2006;51:1376–82.
2. Sweet D. Why a dentist for identification? Dent Clin North Am. 2001;15:237–51.
3. Phillips JL, Weller RN, Kulild JC. The mental foramen: 3. Size and position on panoramic radiographs. J Endod. 1992;18:383–6.
4. Sweet D. Why a dentist for identification? Dent Clin North Am 2001;45:237-51.
5. Arnay-de-la-Rosa M, Gonzalez-Reimers E, Fregel R, VelascoVazquez J, Delgado-Darias T, Gonzalez AM, et al. Canara islands aborigine sex determination based on mandible parameters contrasted by amelogenin analysis. J Archaeol Sci 2006;11:1-8.

6. Neiva RF, Gapski R, Wang HL. Morphometric analysis of implant-related anatomy in Caucasian skulls. *J Periodontol* 2004;75:1061-7.
7. Mohamed A, Nataraj K, Mathew VB, Varma B, Mohamed S, Valappila NJ, et al. Location of mental foramen using digital panoramic radiography. *J Forensic Dent Sci* 2016;8:79-82.
8. Chandra A, Singh A, Badni M, Jaiswal R, Agnihotri A. Determination of sex by radiographic analysis of mental foramen in North Indian population. *J Forensic Dent Sci* 2013;5:52-5.
9. Wical KE, Swoope CC. Studies of residual ridge resorption. Part 1. Use of panoramic radiographs for evaluation and classification of mandibular resorption. *J Prosthet Dent* 1974;32:7-12.
10. Humphrey LT, Dean MC, Stringer CB. Morphological variation in great ape and modern human mandibles. *J Anat* 1999;195:491-513.
11. Indira AP, Markande A, David MP. Mandibular ramus: An indicator for sex determination - A digital radiographic study. *J Forensic Dent Sci* 2012;4:58-62.
12. Rai B, Arand SC. Possible identification marker in orthopantomograms. *J Sci Res* 2007; 2:82-3.
13. Lindh C, Peterson A, Klinge B. Measurements of distance related to the mandibular canal in radiographs. *Clin Oral Implant Res* 1995;6:96-103.
14. Guler AU, Sumer M, Sumer P, Bicer I. The evaluation of vertical heights of maxillary and mandibular bones and the location of of anatomic landmarks in panoramic radiographs of edentulous patients for implant dentistry. *J Oral Rehabil* 2005;32:741-6.
15. Malik M, Laller S, Saini RS, Mishra RK, Hora I, Dahiya N. Mental foramen: An Indicator for Gender Determination-A Radiographic Study. *Santosh Univ J Health Sci*. 2016 Aug 15;2:12-4.
16. Shanmugasundaram K, Prasanthi S. Sex Determination using Mental Foramen in Chennai Population. *Prof. RK Sharma*. 2019 Jan;13(1):63.

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