e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2025; 17(1); 408-410

Original Research Article

Sexual Dimorphism of the Mental Foramen: A Study on its Role in Sex Determination

Nawal Kumar Singh[1], Anand Kumar[2], Kumar Shubhendu[3], Mansi Priya[4], Pratima Kumari[5]

[1]Assistant Professor, Department of Forensic Medicine & Toxicology, Shree Narayan Medical Institute & Hospital, Saharsa, Bihar, India

[2]Senior Resident, Department of Forensic Medicine & Toxicology, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, India

[3]Assistant Professor, Department of Forensic Medicine & Toxicology, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, India

[4]Bachelor of Dental Surgery, Department of Dentistry, Shakuntala Dental Clinic, Bairia, Muzaffarpur, Bihar, India

[5]Assistant Professor, Department of Botany, B.R. Ambedkar Bihar University, Muzaffarpur, Bihar, India

Received: 27-11-2024 / Revised: 25-12-2024 / Accepted: 27-01-2025

Corresponding Author: Pratima Kumari

Conflict of interest: Nil

Abstract:

Background: Sexual dimorphism in skeletal features offers critical insights for forensic and archaeological sex determination. The mental foramen, a notable feature of the mandible, has been studied for its potential in distinguishing between male and female specimens.

Methods: This observational study examined 50 mandibular specimens (25 male and 25 female) from the Department of Forensic Medicine and Toxicology, RIMS, Ranchi, to determine sex variations in mental foramina location, size, and number. Measurements were gathered over six months with accurate digital callipers.

Results: The study demonstrated significant sexual dimorphism in the mental foramen location and size. In males (52%), it was aligned with the second premolar and in females (48%), between the first and second. Male foramen was average 3.2 mm, larger than females (2.8 mm). No significant difference was seen in the foramina number between sexes.

Conclusion: The mental foramen's location and size are potential reliable indicators for sex determination in skeletal remains. Future research with larger and more diverse samples could further validate these findings.

Keywords: Sexual Dimorphism, Mental Foramen, Forensic Anthropology, Sex Determination

Introduction

Sexual dimorphism refers to the differences in size, shape, and appearance between males and females of the same species, in addition to differences in their reproductive organs [1]. The jaw and skull show the human anatomical features that exhibit these variances. One such feature that has attracted attention because of its potential use in forensic anthropology and sex determination is the mental foramen, a small opening in the anterior region of the jaw that allows the passage of the mental nerve and arteries [2,3]. Research suggests that the number, size, and location of mental foramina may vary between males and females, offering a trustworthy marker of sexual dimorphism. It is crucial to correctly identify the sex of skeletal remains to assist in the identification of unidentified human remains in forensic cases [4].

Due to its relatively intact state in skeletal remains, the mental foramen serves as a significant marker in these anthropological assessments. This work aims to explore the sexual dimorphism of the mental foramen in detail, focussing on the differences in position, size, and quantity among the sexes [5,6].

The study aims to assess the mental foramen's efficacy as a trustworthy indication for sex determination in both archaeological and forensic contexts by examining these traits in a varied population sample.

Materials and Methods

Study Design: This observational study was conducted to assess the sexual dimorphism of the mental foramen in sample specimens. The investigation was designed to compare the variations

in the location, size, and number of mental foramina between male and female mandibular specimens.

Sample Size and Selection: Due to its relatively intact state in skeletal remains, the mental foramen serves as a significant marker in these anthropological assessments. The study was conducted on 50 mandibular specimens (25 male and 25 female) in the Department of Forensic Medicine and Toxicology, RIMS, Ranchi, This work aims to explore the sexual dimorphism of the mental foramen in detail, focussing on the differences in position, size, and quantity among the sexes [5,6].

Study Duration: The study was carried out over a six-month period, starting from 1st January 2018 to 30th June 2018.

Data Collection: Each specimen was systematically analyzed for the following parameters:

1. **Location of the Mental Foramen:** Determined relative to the mandibular teeth, measured from the symphysis menti to the anterior border of the foramen.
2. **Size of the Mental Foramen:** Measured using digital calipers, with dimensions recorded in millimeters.
3. **Number of Foramina:** Noted for the presence of single or multiple foramina on each side of the mandible.

Statistical Analysis: For analysis, data were input into a statistical software program. For every variable, descriptive statistics like mean, standard deviation, and range were computed. The significance of the differences between male and female specimens was assessed using inferential statistics, such as the t-test and the chi-square test. For every test, a p-value of less than 0.05 was deemed statistically significant.

Results

Significant variations in the traits of the mental foramen that imply sexual dimorphism were found in the study's investigation of 50 mandibular specimens (25 male and 25 female). The sexes differed greatly in where the mental foramen was located. In males, the foramen most frequently found parallel to the second premolar's longitudinal axis (52% of male specimens), while in females, it was most frequently found parallel to the axis connecting the first and second premolars (48% of female specimens). Sexual dimorphism was also evident in the size of the mental foramen, with male individuals often having bigger foramina. Male specimens had an average mental foramen size of 3.2 mm, whereas female specimens had an average of 2.8 mm. There was a statistically significant change ($p < 0.05$).

About the quantity of foramina, a greater percentage of male specimens (24%) had multiple foramina than female specimens (16%), albeit this difference was not statistically significant ($p > 0.05$). These results imply that although the location and size of the mental foramen in males and females can be observed to differ, the quantity of foramina in skeletal remains is not a reliable indicator of sex.

Table 1: Location of the Mental Foramen

Sex	Location concerning teeth	Percentage
Male	In line with the longitudinal axis of the second premolar	52%
Female	Between the first and second premolars	48%

Table 2: Average Size of the Mental Foramen (in mm)

Sex	Average Size (mm)
Male	3.2
Female	2.8

Table 3: Incidence of Multiple Foramina

Sex	Multiple Foramina	Percentage
Male	Present	24%
Female	Present	16%

Discussion

The findings of this study advance our knowledge of the mental foramen's sexual dimorphism and its potential application in forensic and archaeological contexts for sex determination. Other research suggests that differences in the size and location of the male and female mental foramen can be used to accurately predict sex in human skeletal remains. The results of this investigation provide credence to this notion. According to the study, men frequently have a larger mental foramen than women, and this foramen is more likely to line up with the second premolar's longitudinal axis. Since males had more bone density and muscular attachments than females, these findings are consistent with evidence from studies such as Cutright et al. (2003) and Agthong et al. (2005), which also indicated that males had larger foramina, indicating robust mandibular characteristics [7,8].

Our analysis revealed no discernible difference in the incidence of multiple foramina between the sexes, which is in contrast to other studies that suggest a higher prevalence of multiple foramina in men (Ngeow & Yuzawati, 2003) [9]. This discrepancy could be caused by group-specific genetic or environmental factors that impact mandibular development, highlighting the need for regional studies to identify consistent patterns of sexual dimorphism. Studies in a variety of populations, including Silva et al. (2007) in Brazilian communities and Kaur et al. (2015) in North Indian people, have shown similar trends in the size and position of the mental foramen [10,11].

There have been some recorded geographical and ethnic differences, nevertheless. These differences demonstrate how important it is to consider population-specific data when applying these findings in actual forensic scenarios. Future research could focus on expanding the sample size and including a more diverse demographics to enhance the generalisability of these findings [12]. By employing sophisticated imaging techniques, such as 3D tomography, to acquire more precise evaluations of the characteristics of the mental foramen, the accuracy of sex determination methods could be further increased. Moreover, examining the genetic basis for the formation of the mental foramen could provide additional insight into the underlying factors that contribute to its sexual dimorphism [13].

Additionally, using machine learning algorithms to analyse the patterns and correlations in large datasets may enable the creation of automated systems for quick and accurate sex determination from skeletal remains. These methods would be very useful in archaeological and forensic investigations. In conclusion, more research and technological advancement are needed to properly harness the mental foramen's potential in a range of beneficial applications, even though it exhibits promise as a sex determination marker [14,15].

Conclusion

Sexual dimorphism was discovered in the mandibular specimens' mental foramen, indicating its potential application in forensic and archaeological sex determination. The second premolar was in line with the enlarged mental foramina of males. Even though numerous foramina did not identify sex, the study validated the significance of the mental foramen as an anatomical landmark. Future research should use more sophisticated imaging technologies to refine these findings and broaden the demographic diversity of sample populations. By enabling accurate sex identification from skeletal remains for legal and historical documents, these findings may enhance forensic inquiry.

References

1. Phillips JL, Weller RN, Kulild JC. The mental foramen: 3. Size and position on panoramic radiographs. J Endod. 1992;18(7):383-6.
2. Green RM. The position of the mental foramen: a comparison between the first and second dentition. Dentomaxillofac Radiol. 1987;16(1): 39-42.
3. Yosue T, Brooks SL. The appearance of mental foramina on panoramic and periapical radiographs. I. Evaluation of patients. Oral Surg Oral Med Oral Pathol. 1989;68(3):360-4.
4. Sawyer DR, Kiely ML, Pyle MA. The frequency of accessory mental foramina in four ethnic groups. Arch Oral Biol. 1998;43(5):417-20.
5. Toh H, Kodama J, Yanagisako M, Ohmori T. Anatomical study on the positional relationship between the mental foramen and the mandibular teeth. Oral Surg Oral Med Oral Pathol. 1992;74(6):768-75.
6. Gershenson A, Nathan H, Luchansky E. Mental foramen and mental nerve: changes with age. Acta Anat (Basel). 1986;126(1):21-8.
7. Cutright B, Quillopa N, Schubert W. An anthropometric analysis of the key foramina for maxillofacial surgery. J Oral Maxillofac Surg. 2003;61(3):354-7.
8. Agthong S, Huanmanop T, Chentanez V. Anatomical variations of the supraorbital, infraorbital, and mental foramina related to gender and side. J Oral Maxillofac Surg. 2005;63(6):800-4.
9. Ngeow WC, Yuzawati Y. The location of the mental foramen in a selected Malay population. J Oral Sci. 2003;45(3):171-5.
10. Silva RF, Prado FB, Caputo IGC, Devito KL, Botacin PR. Assessment of the mental foramen location in Brazilian population through cone beam computed tomography. J Oral Maxillofac Res. 2007;8(4):e5.
11. Kaur S, Rai R, Jain K. Morphometric analysis of mental foramen in human mandibles of South Indian population. Morphologie. 2015;99(2):56-63.
12. Mbajiorgu EF, Mawera G, Asala SA, Zivanovic S. Position of the mental foramen in adult black Zimbabwean mandibles: a clinical anatomical study. Cent Afr J Med. 1998;44(1):24-30.
13. Santini A, Land M. A comparison of the position of the mental foramen in Chinese and British mandibles. Acta Anat (Basel). 1990;137(3):208-12.
14. Hauser G, Schonca R. Septa within the mental foramen. Review of the literature and presentation of 3 cases. J Anat. 1989;165:187-93.
15. Oguz O, Bozkir MG. Evaluation of the location of the mental foramen in a current Turkish population. Ann Dent. 2002;61(1):45-9.