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Original Article

INVESTIGATION OF THE HORIZONTAL AND VERTICAL DISTANCES USING CONE BEAM COMPUTED TOMOGRAPHIC IMAGES BETWEEN THE SAGITTAL MIDLINE, THE MENTAL FORAMEN, AND THE MANDIBULAR INFERIOR BORDER: A RETROSPECTIVE STUDY

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ABSTRACT

Objectives: *The aim of this study was to determine the distance amongst the Abbottabad population's inferior border & mental foramen & the sagittal midline of the jaw.*

Materials and Methods: *Using Planmeca (3D) software, the distance amongst the mental foramen & the sagittal midline & the inferior border of the jaw was calculated from a sum of 100 CBCT images. The study was carried out at Abbottabad International Medical & Dental College Abbottabad.*

Results: *Males showed a greater mean distance from the MF to the inferior border of the mandible (13.67 ± 0.53 mm) compared to females (12.72 ± 0.36 mm), which was statistically significant (p = 0.002). Subjects older than 45 years had a larger mean distance (13.67 ± 0.46 mm) than those aged 18–45 years (13.46 ± 0.37 mm; p = 0.006). However, the distance between the MF and the sagittal midline showed no significant difference across gender (p = 0.30) or age groups (p = 0.56).*

Conclusion: *It was discovered that males and those between the ages of 18 and 45 had a considerably larger mean distance amongst the inferior border of the mandible & the mental foramen.*

Key words: *Mental Foramen, Mandible inferior border, Sagittal Midline, CBCT*

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INTRODUCTION

The bilateral mental foramen is a funnel designed opening with a narrow base with a large tip. The mental nerve exoduses the mental canal through this foramen. Depending on the ethnicity, its diameter can range from 1.8 to 5.1 mm, with an average of 3 mm[1]. The neurovascular bundle that leaves through the mental foramen may be injured as a result of clinical operations such as the elevation of bone surgery, mucoperiosteal flaps, & local anesthetic performed closer to the mental foramen, tumors, & cysts. Thus, understanding the MF's anatomy is essential to preventing those accidents[2]. Male and female individuals had significantly different MF locations. It is often seen at the mandibular first & second premolar level in females and at the second premolar level in male patients. The MF is located

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at the same spot on the left and right sides. Depending on the specific surgical treatment, information from CBCT can be used to decrease postoperative complications like paresthesia[3]. Using CBCT, the precise location, size, and shape of the MF are 3.66 mm. In the Brazilian population, it measured 3.63 mm on a panoramic radiograph[4]. There is a notable disparity between male and female brain foramen measurements, according to several experts. The placement of the MF was found to be consistent with the second premolar, while the distance between the bottom (inferior) border of the mandible and the mental foramen varied among groups[5].

There is a noticeable variation between the two genders' MF distances from the inferior border of the mandible on the left & right sides; males have a higher MF void from the inferior border of the mandible (12.9 mm) than females (12.0 mm)[6]. The mean distances between MF and the sagittal midline of the mandible in men & women are on both sides, as well as based on age groups, differ negligibly[7].

Distances from MF to the inferior border of the mandible vary statistically significantly among four age groups: 25–40, 41–55, and 56 and older[8]. Thus far, the ethnicity of the patient has an impact on the site of the mental foramen. Numerous techniques, including as computed tomographic imaging, panoramic radiography, and macroscopic examination of dry skulls, can be used to conclude the position of the mental foramen. At the moment, CBCT is the most precise and safe technique. This technique uses a conical ionizing radiation beam to provide high-resolution cross-sectional pictures in the front, sagittal, and transverse planes. Accurate evaluation and identification of further anatomical variations are made possible by CBCT, which offers three-dimensional pictures that aid in learning about maxillofacial structures[1,5,7].

This current research study anticipated to determine and compare the distances between the mental foramen, the inferior border of the mandible, and the sagittal midline across different age and gender groups using CBCT images.

MATERIALS AND METHODS

A retrospective, cross-sectional investigation, conducted using CBCT scans of 100 participants of both sexes from February 2024 till December 2024. The sample was collected using a non-probability sampling approach. Subjects included were aged from 18 to 60 years and had no mandibular fractures or diseases in sagittal midline, in the mental foramen, or lower (inferior) border of the jaw. The participants were contacted via phone calls for permission. The package utilized is Planmeca Romexis 3D. Data was acquired from the Abbottabad International Medical & Dental College, Abbottabad after approval from IRB of the institution vide No. ERC/AIMI/2024/13. The CBCT equipment employed has a radiation dosage of 1822 mGy.cm2, a cone diameter of five mm, a power of 120 kV & a radiation length of nine secs.

The voids from the MF to the lower (inferior) border of the mandible, as well as the sagittal midline of the jaw, were assessed independently on the left & right sides using the Planmeca romexis program 3 dimension (3D). The mean voids from MF to lower (inferior) border of mandible were computed to females & males between the age 18 and 60. They were subsequently evaluated. The same computations were performed for the mean voids of MF to the sagittal midline of the mandible in females & males, as well as two age clusters, the means were evaluated. It should be mentioned that the apical portion of the mental foramen was used to measure all distances. Both the left and right sides were measured. Next, we calculated the mean of the two age clusters & the gender.

Data were entered and analyzed using IBM SPSS Statistics for Windows, Version 27.0 (IBM Corp., Chicago, USA). Descriptive statistics, including mean and standard deviation (SD), were computed for all quantitative variables. Independent samples t-test was applied to compare the mean distances between males and females, and between the two age groups (<45 years and >45 years). A p-value of less than 0.05 was considered statistically significant. The results were presented in tabular form, showing mean values, standard deviations, t-values, and corresponding p-values.

RESULT

51 females and 49 men, 58 people between the ages of 18 and 45, and 42 subjects older than 45 made up the study. Males' mean distances from the MF to the lower (inferior) border of the mandible were 13.52 mm and 13.81 mm, respectively, whereas females' mean distances were 12.69 mm and 12.75

mm. The mean distance for males and females, when comparing the average of both sides, was 14.66 mm and 13.72 mm, separately (Table 1).

When comparing the two age groups, the mean distance was 13.67 mm for those over 45 and 13.36 mm for those between 18 and 45. The mean distances for the right & left sides were 14.40 mm and 14.54 mm for the 18–45 age group, and 13.60 mm and 13.76 mm for the over-45 age group (Table 2).

The average distance amongst the two sides was 24.43mm for males and 24.69mm for females. The mean distance, broken down by age group, was 24.62 mm for those aged 18 to 45 and 24.57 mm for those over 45 (Table 3).

The average distances amongst the MF and the sagittal midline of the mandible were 25.03 mm for the male's right side and 24.01 mm for the female's left, compared to 25.08 mm and 24.49 mm for the female (Table 4). No significant differences were observed in the distance from the mental foramen to the sagittal midline between genders or age groups.

DISCUSSION

CBCT scans are the most reliable method for assessing the variability in the mental foramen's position and morphology[8]. Studies on various populations have reported differences in distances based on gender and age groups, which align with the findings of the current study[9-12]. Computed tomography scans, which are thought to be the most dependable technique for examining the variability in the position and form of the MF, revealed a striking fluctuation within the MF's location[13]. Using 193 CBCT scans, Bulut et al. conducted research on the Turkish population in 2021[14] to measure the voids of MF from the inferior border of the jaw on the left & right sides of both sexes. The study results presumed a significant variation amongst the voids of MF from the lower (inferior) border of mandible on right & left side amongst 2 genders ($P < 0.05$). This is in harmony with the current study.

Soheilifar et al. (2016)[15] examined the voids amongst the MF and the inferior border of the mandible in 210 CBCT images of the Iranian population in

Table 1: Male and female comparison of the distance (in mm) between the inferior border of the mandible and the most apical portion of the mental foramen

Gender	Number	Right Side (mm)	Left Side (mm)	Mean ± SD (mm)	t-value	p-value
Male	49	13.52	13.81	13.67 ± 0.53	3.876	0.002*
Female	51	12.69	12.75	12.72 ± 0.36	—	—

*Statistically significant difference between genders ($p < 0.05$).

Table 2: Comparison shows the distance (in mm) between the inferior border of the mandible and the most apical portion of the mental foramen.

Age Group (years)	Number	MD*	SD**	t-value	P-Value
< 45	58	13.46	±0.37	2.68	0.006
> 45	42	13.67	±0.46		

*Mean of Distances ** Standard Deviation

Table 3: Male and female evaluation of the distance (in mm) among the sagittal midline of the jaw and the most apical portion of the mental foramen

Gender	N	MD*	SD**	t-value	P-Value
Male	49	24.43	±0.23	0.050	0.30
Female	51	24.69	±0.30		

*Mean of Distances ** Standard Deviation

Table 4: Assessment of the distance in mm amongst the sagittal midline of the jaw and the mental foramen in individuals aged 45 and older

Age Group (years)	N	MD*	SD**	t-value	P-Value
Male	49	24.52	±1.07	0.67	0.56
Female	51	24.79	±0.93		

*Mean of Distances ** Standard Deviation

both genders and discovered a statistical difference. Conversely, when the mean distance amongst MF & the sagittal midline was taken into account, there was an insignificant difference. The distance of MF to the bottom (inferior) edge of the mandible on the right & left sides was shown to differ significantly in studies of CBCT scans of various groups conducted by Shokri et al. in 2021[16] and Safi et al. in 2022[17]. In contrast to the current study findings males had a higher mean distance. When the mean void from MF to inferior border of mandible was taken into account, the results were identical to those of a study conducted in 2024 by Alali et al[18], which examined 115 CBCT scans of a Middle Eastern population and discovered a significant difference amongst females & males as well as among the subjects under & over 45 years of age. Like the current study, He et al. (2014)[19] conducted research on the Chinese population by analyzing 210 CBCT scans and came to the conclusion that males had a larger mean void amongst the MF & the bottom (inferior) border of the mandible. Like the current study, Puri et al. (2020)[20] and Key et al. (2021)[21] did a study on CBCT scans of various populations and found that males and females had varied MF to lower (inferior) boundary of mandible mean distances.

CONCLUSION

Males and individuals between age 18–45 years showed significantly greater distances between the mental foramen and the inferior border of the mandible, while no significant variation was observed relative to the sagittal midline across age or gender. These findings provide essential anatomical reference data that can enhance accuracy in anaesthesia administration, implant placement, and other mandibular surgical procedures.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
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AUTHORS' CONTRIBUTION

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Conception or Design:	TM, GA, AI, MF, HA, N
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All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.