Content available at: https://www.ipinnovative.com/open-access-journals

IP International Journal of Maxillofacial Imaging

Journal homepage: www.ijmi.in

Original Research Article

A cone-beam computed tomographic analysis to determine location and dimensions of the mental foramen in dentate individuals of population based in Navi Mumbai metropolitan region

Varun V Jaiswar[1]*, Anuradha G Mohite[1], Jyoti B Nadgere[1], Janani V Iyer[1]

[1]Dept. of Prosthodontics and Crowns and Bridges, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India

Abstract

Aim and Objective: The purpose of the present study was to radiographically determine the position and size of the mental foramen, its distance from adjacent teeth and mandibular borders, the angulation of the mental canal, by using CBCT.

Material and Methods: 137 CBCT scans (78 females and 59 males) were evaluated that meet the inclusion criteria. The DICOM data was analyzed in CS3D software. X-slice (sagittal view): position of the MF related to long axis of adjacent teeth, height of MF (craniocaudal distance), length of MF (mesiodistal distance), shortest distance from MF to adjacent root. Y-slice (coronal view): course of the mental canal (MeC) in the vertical plane, angulation of MeC to buccal bone surface, distance from superior margin of MF to alveolar bone crest, distance from inferior margin of MF to lower border of mandible. Descriptive statistics like frequency (n) & percentage (%) of categorical data, mean & Standard deviation of numerical data in each group/subgroup was depicted.

Result: Mental foramen in most subjects was present mesial to the second premolar (61.3%). The anterior loop was present in 35.8%. There was a non-significant difference in the horizontal and vertical length of MF among various age groups. Angulation of MF increased with age; however, the difference in the angulation among various age groups was non-significant. The difference among various age groups was non-significant. There was a non-significant difference in the position of mental foramen according to the second premolar among various age groups.

Conclusion: Application of CBCT analysis empowered a detailed determination of the size, position and shape of the mental foramen in relation to the adjacent anatomical structures on a representative group of Navi Mumbai patients. The results obtained may contribute to guidelines for dental procedures including dental surgery, anesthesia and most importantly for implantology in the second premolar region with regards to the location of mental foramen according to the sex and age of patients.

Keywords: Mental foramen, Position, Dentate individual.

Received: 02-01-2025; **Accepted:** 14-06-2025; **Available Online**: 30-09-2025

1. Introduction

The mental foramen (MF) is an important landmark at the outer surface of the mandible in the area below the premolars. The clinician must be aware of the position when considering regional anesthesia, incisions, flap elevation, and osteotomy in the vicinity of the MF.[1] The mental foramen is an important landmark when considering placing implants in the foramen region of the mandibular arch. Differences in its location, the number of foramens, and the possibility that an anterior loop of the mental nerve may be present mesial to the mental foramen need to be considered prior to preparing an osteotomy in this region.[1,2]

Mental nerve represents one of the terminal branches of the mandibular nerve and divides into three branches supplying the lower lip, cheeks, chin, and the vestibular gingival of mandibular incisors.[2,3] Anatomy of the mandibular nerve is well established, some anatomic variations have been reported which must be taken into consideration to avoid clinical complications. One of these

*Corresponding author: Varun V Jaiswar
Email: dentfitstudio@gmail.com

https://doi.org/10.18231/j.ijmi.17814.1759221746

variations is the accessory mental nerve, which passes through small foramina in the area surrounding the MF known as accessory mental foramina (AMF).[4,5]

The accessory mental nerve is a relevant anatomic structure in dental practice with particular importance for the placement of dental implants. The incidence of permanent sensory disturbance to the lower lip after dental implant surgery in the MF area is reported to range from 7 to 10%.[5] Sensation disturbance and severe pain may result if accessory mental nerve or mental nerve is entirely or partially damaged, and may lead to complications with significant impact on patients' quality of life.[5,6]

An issue of large debate in implant dentistry remains the so-called anterior loop (AL), an extension of the mandibular canal mesial to the MF and curving backward before exiting the MF. Prevalence and mesial extension of the AL appear to be highly dependent on the study method.[7] With regard to the location of the MF, there is considerable anatomic variation in the vertical and sagittal planes. Ethnic differences of MF location have been reported by many authors.[7,8]

The objective of the present study is to radiographically determine the position and size of the mental foramen, its distance from adjacent teeth and mandibular borders, the angulation of the mental canal, the mesial extension of the AL by using CBCT.

2. Materials and Methods

The retrospective analysis was based on 137 mandibular scans performed in CBCT center during the time period from January 2023 to January 2024. This retrospective observational study was done abiding to the STROBE guidelines (Strengthening the Reporting of Observational Studies in Epidemiology) after the ethical approval from the IEC (Institutional Ethics Committee) of Dental College. CBCT scanned data from the database of 2 centers located in Navi Mumbai was taken from January 2023 to January 2024. The scans were included according to the inclusion and exclusion criteria. The scans used in the present study were selected from the CBCT database and were not taken specifically for the study. The CBCT scans were captured using the Carestream CS9600 system. All images were taken according to the standard protocol. The exposure parameter (120 Kvp, 3- 7mA, 20 sec). For each CBCT scan, the DICOM (Digital Imaging and Communications in Medicine). The field of view (FOV) was standard, capturing the entire mandible and the inferior part of the maxilla. DICOM files were processed using an implant planning software (Care Stream 3D imaging software). The measurements were obtained on the transverse sections of the selected teeth with the use of Care Stream 3D imaging software. The distance between the obtained transversal sections was 1.0mm. The CBCT scans were evaluated by measuring the following parameters.

X-slice (sagittal view): position of the Mental Foramen (MF) related to long axis of adjacent teeth, height of MF (craniocaudal distance), length of MF (mesiodistal distance) (**Figure 1**), shortest distance from MF to adjacent root (**Figure 2**). It will be classified according to: Tebo and Telford classification for location of mental foramen (**Figure 3**), Horizontal location of the MF was classified into 6 groups: (1) MF is between the canine and first premolar, (2) MF is at the level of the first premolar, (3) MF is between the first and second premolars, (4) MF is at the level of the second premolar, (5) MF is between the second premolar and the first molar, (6) MF is at the level of the first molar. Vertical relationships between MF and root apices of the lower premolars were classified into three types. (1) MF was located inferior to the level of the apex, (2) MF was located at the level of the apex, (3) MF was located superior to the level of apex. As given by Fishel et al (**Figure 4**), 2) Y-slice (coronal view): course of the mental canal (MeC) in the vertical plane, angulation of MeC to buccal bone surface, distance from superior margin of MF to alveolar bone crest, distance from inferior margin of MF to lower border of mandible (**Figure 5**).

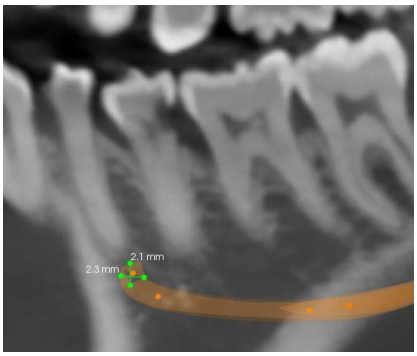

Figure 1: Height of MF (craniocaudal distance), length of MF (mesiodistal distance)

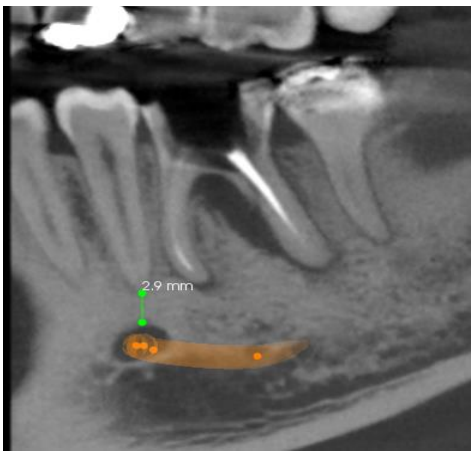

Figure 2: Shortest distance from MF to adjacent root

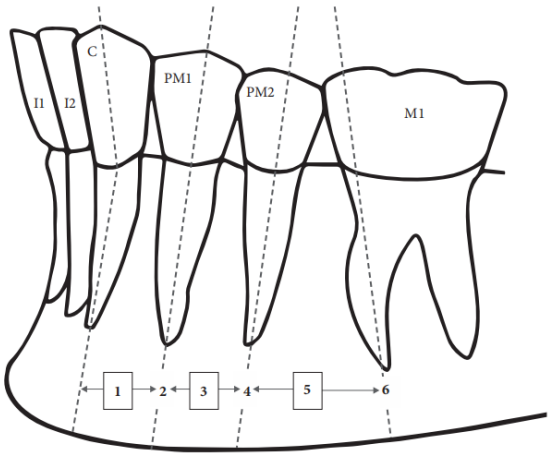

Figure 3: Tebo and Telford classification[9]

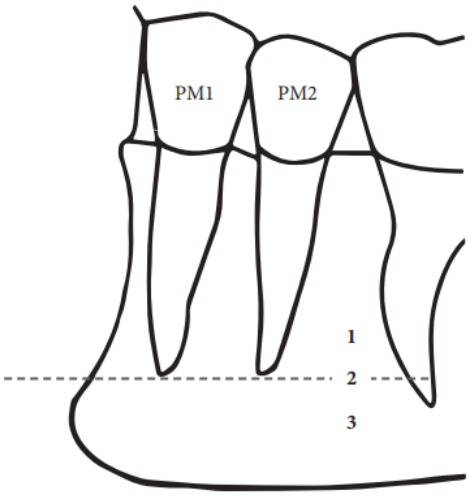

Figure 4: Fishel et al. Classification[10]

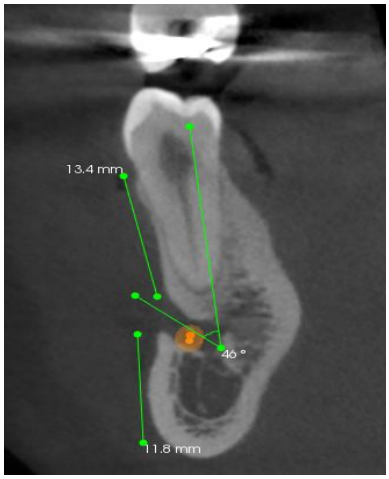

Figure 5: Angulation of the mental foramen and distance from superior margin of MF to alveolar bone crest, distance from inferior margin of MF to lower border of mandible

Anterior loop of the mental nerve will be evaluated for its presence and course and will be classified according to: Solar et al, Type I - the AL is not noticeable, and the anatomy is Y-shaped, and no loop is found, Type II - the AL is absent, and the anatomy is T-shaped, Type III - the AL is noticeable, and the anatomy is Y-shaped (**Figure 6**). The data was collected by a single primary examiner. The radio-graphic measurements was be done by the same primary examiner.

Data collected will be compiled on to a MS Office excel worksheet & will be subjected to statistical analysis using an appropriate package like SPSS software. Descriptive statistics like frequency (n) & percentage (%) of categorical data, mean & Standard deviation of numerical data in each group/subgroup will be depicted. Frequency (n) & percentage (%) of various categories in each group/subgroup will be compared using Chi square test, Fisher exact test, Mann Whitney test, One-way ANOVA test and Kruskal Wallis test.

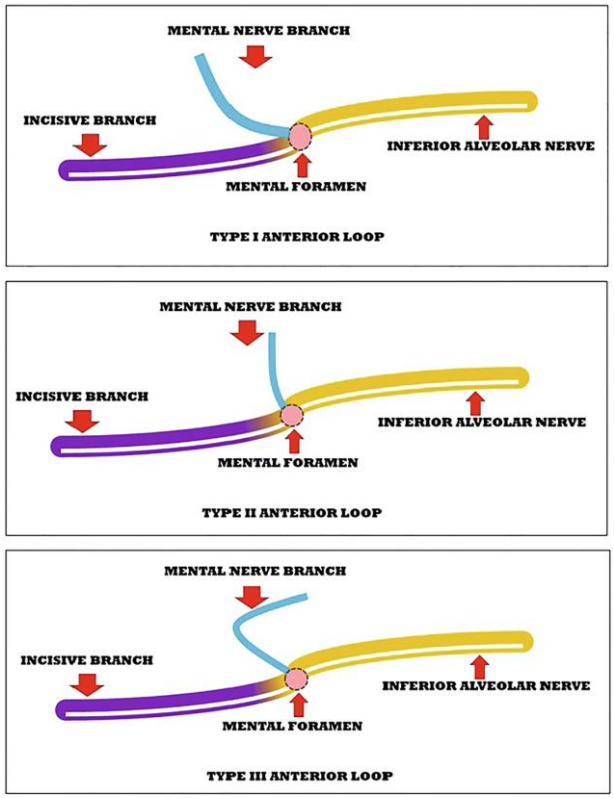

Figure 6: Classification for anterior loop of mental nerve[11]

3. Results

In the study period, total 782 CBCT scans were taken of the mandible. Of which, 137 were selected for the study (78 females and 59 males). The distribution of the patients was as follows: <20 years – 18 patients, 20-45 years – 101 patients, 45-60 years – 14 patients, >60 years – 4 patients. **Table 1** presents the descriptive details of the dimensions of mental foramen. Mental foramen's average horizontal and vertical lengths were 2.95mm and 2.84mm, respectively. The average angulation was 42.39°. The distance of the foramen from the superior and inferior margins of the mandible were 11.34mm and 12.20mm respectively. The distance of the foramen from 2nd premolar was 4mm.

Mental foramen in most subjects was present mesial to the 2nd premolar (61.3%). The anterior loop was present in 35.8% of subjects of which type 2 (According to

classification given by Solar et al 1994) was most common (65.3%). Position 3 was most common for both horizontal and vertical locations (According to Tebo and Telford's classification). **Table 2** presents the descriptive details of the position of mental foramen. Mental foramen in most subjects was present mesial to the 2nd premolar (61.3%). The anterior loop was present in 35.8% of subjects of which type 2 was most common (65.3%). Position 3 was most common for both horizontal and vertical locations.

There was a non-significant difference in the position of mental foramen according to the 2nd premolar among various age groups. Also, there was a non-significant difference in the type of anterior loop among various age groups. For horizontal location, the position 3 was most common among <20, 20-45 & >60 age groups and position 5 was most common among 45-60 age group. For vertical location, the position 3 was most common among all the age groups. **Table 3** compares the dimensions of mental foramen according to different age groups. There was a non-significant difference in the horizontal and vertical length of MF among various age groups. Angulation of MF increased with age; however, the difference in the angulation among various age groups was non-significant. Similarly, the distance of MF from the superior and inferior margins of the mandible increased with age; however, the difference among various age groups was non-significant. Distance from 2nd premolar was greatest among the subjects with age greater than 60 years.

Kruskal Wallis test and One-way ANOVA test was used for statistical analysis. There was a non-significant difference in the position of mental foramen according to the 2nd premolar among males and females. Also, there was a non-significant difference in the type of anterior loop among males and females. For horizontal & vertical locations, the position 3 was most common among males and females. **Table 4** compares the position of mental foramen according to different age groups. There was a non-significant difference in the position of mental foramen according to the 2nd premolar among various age groups. Also, there was a non-significant difference in the type of anterior loop among various age groups. For horizontal location, the position 3 was most common among <20, 20-45 & >60 age groups and position 5 was most common among 45-60 age group. For vertical location, the position 3 was most common among all the age groups, Chi-square test was used.

Mental foramen's average horizontal and vertical lengths were 2.95mm (range 1.60mm – 6.20mm) and 2.84mm (range 1.40mm – 5.70mm), respectively. The average angulation was 42.39^0(range 23° – 67º). The average distance of the foramen from the superior and inferior margins of the mandible were 11.34mm (range 6.40mm – 15.60mm) and 12.20mm (range 8.30mm – 16.30mm) respectively. The average distance of the foramen from 2nd premolar was 4mm (range 0mm – 9.40mm). There was a non-significant difference in the horizontal and vertical length of MF among various age groups. Angulation of MF increased with age; however, the difference in the angulation among various age groups was non-significant. Similarly, the distance of MF from the superior and inferior margins of the mandible increased with age; however, the difference among various age groups was non-significant. Distance from 2nd premolar was greatest among the subjects with age greater than 60 years. There was a non-significant difference in the horizontal and vertical length of MF among male and female subjects. **Table 5** compares the dimensions of mental foramen according to gender. There was a non-significant difference in the horizontal and vertical length of MF among male and female subjects. Angulation was lesser among males; however, the difference in the angulation between males and females was non-significant.

The difference in the distance from superior and inferior margins among males and females was non-significant. Distance from 2nd premolar also did not differ significantly among males and females, Mann Whitney test and One-way ANOVA test were used. Angulation was lesser among males; however, the difference in the angulation between males and females was non-significant. **Table 6** compares the position of mental foramen according to gender. There was a non-significant difference in the position of mental foramen according to the 2nd premolar among males and females. Also, there was a non-significant difference in the type of anterior loop among males and females. For horizontal & vertical locations, the position 3 was most common among males and females.

The difference in the distance from superior and inferior margins among males and females was non-significant.

Table 1: Descriptive details of dimensions of mental foramen

Variable	Mean ± SD	Median (IQR)	Min - Max
Horizontal length	2.95 ± 0.91	2.70 (0.90)	1.60 – 6.20
Vertical length	2.84 ± 0.86	2.70 (1.0)	1.40 – 5.70
Angulation	42.39 ± 8.94	42.00 (12)	23 – 67
Distance from Superior margin	11.34 ± 1.96	11.30 (2.5)	6.40 – 15.60
Distance from Inferior margin	12.20 ± 1.82	12.10 (2.80)	8.30 – 16.30
Distance from the second premolar	4.00 ± 2.27	3.90 (3.10)	0 – 9.40

Table 2: Descriptive details of the position of mental foramen

Variable	Category	n	%
Position	Below 2nd PM	32	23.4
	Distal to 2nd PM	21	15.3
	Mesial to 2nd PM	84	61.3
Anterior loop (present/absent)	Absent	88	64.2
	Present	49	35.8
Anterior loop type	Type 2	32	65.3
	Type 3	17	34.7
Horizontal location	Position 2	4	2.9
	Position 3	69	50.4
	Position 4	32	23.4
	Position 5	32	23.4
Vertical location	Position 1	2	1.5
	Position 2	24	17.5
	Position 3	111	81

PM: Premolar

Table 3: Comparison of dimensions of mental foramen according to different age groups

Variable	<20 (n=18)		20-45 (n=101)		45-60 (n=14)		>60 (n=4)		p-value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Horizontal Length	3.23	0.73	2.91	0.92	2.76	0.76	3.65	1.71	0.106#
Vertical Length	2.79	0.75	2.84	0.91	2.95	0.73	2.85	0.58	0.840#
Angulation	39.56	7.64	42.58	9.49	44.07	6.83	44.25	4.19	0.362#
Distance from Superior margin	10.86	1.97	11.36	2.05	11.75	1.24	11.78	2.03	0.596¥
Distance from Inferior margin	12.08	1.35	12.21	1.92	12.27	1.86	12.13	1.20	0.991¥
Distance from 2nd premolar	4.51	2.10	3.76	2.20	4.26	2.59	6.78	2.17	0.072#

#Kruskal Wallis test; ¥ One-way ANOVA test

Table 4: Comparison of position of mental foramen according to different age groups

Category		<20	20-45	46-60	>60	p-value
Position						
Below	n	4	26	2	0	0.339
	%	22.20%	25.70%	14.30%	0.00%	
Distal	n	1	15	3	2	
	%	5.60%	14.90%	21.40%	50.00%	
Mesial	n	13	60	9	2	
	%	72.20%	59.40%	64.30%	50.00%	
Anterior loop						
Type 2	n	0	25	6	1	0.428
	%	0.00%	64.10%	75.00%	100.00%	
Type 3	n	1	14	2	0	
	%	100.00%	35.90%	25.00%	0.00%	
Horizontal location						
Position 2	n	1	1	1	1	0.132
	%	5.60%	1.00%	7.10%	25.00%	
Position 3	n	11	52	4	2	
	%	61.10%	51.50%	28.60%	50.00%	
Position 4	n	3	24	4	1	
	%	16.70%	23.80%	28.60%	25.00%	
Position 5	n	3	24	5	0	
	%	16.70%	23.80%	35.70%	0.00%	

Table 4 Continued….						
Vertical location						
Position 1	n	0	2	0	0	0.798
	%	0.00%	2.00%	0.00%	0.00%	
Position 2	n	4	19	1	0	
	%	22.20%	18.80%	7.10%	0.00%	
Position 3	n	14	80	13	4	
	%	77.80%	79.20%	92.90%	100.00%	

Table 5: Comparison of dimensions of mental foramen according to gender

Variable	**Male (n=59)**		**Female (n=78)**		**p-value**
	Mean	**SD**	**Mean**	**SD**	
Horizontal Length	3.09	1.01	2.86	0.82	0.336#
Vertical Length	2.98	0.97	2.74	0.75	0.301#
Angulation	41.41	9.16	43.13	8.75	0.192#
Distance from Superior margin	11.51	2.24	11.22	1.73	0.391¥
Distance from Inferior margin	12.38	1.94	12.06	1.72	0.314¥
Distance from 2nd premolar	4.07	2.31	3.94	2.25	0.553#

Table 6: Comparison of position of mental foramen according to gender

Category		**Male**	**Female**	**p-value**
Position				
Below	n	15	17	0.341#
	%	25.40%	21.80%	
Distal	n	6	15	
	%	10.20%	19.20%	
Mesial	n	38	46	
	%	64.40%	59.00%	
Anterior loop				
Type 2	n	15	17	0.135¥
	%	78.90%	56.70%	
Type 3	n	4	13	
	%	21.10%	43.30%	
Horizontal location				
Position 2	n	1	3	0.515#
	%	1.70%	3.80%	
Position 3	n	29	40	
	%	49.20%	51.30%	
Position 4	n	12	20	
	%	20.30%	25.60%	
Position 5	n	17	15	
	%	28.80%	19.20%	
Vertical location				
Position 1	n	2	0	0.229#
	%	3.40%	0.00%	
Position 2	n	9	15	
	%	15.30%	19.20%	
Position 3	n	48	63	
	%	81.40%	80.80%	

#chi-square test; ¥ Fisher exact test

4. Discussion

The study has determined the mental foramens size and location, the distance between the mental foramen and the adjacent anatomical landmarks using CBCT in the population based in Navi Mumbai metropolitan region. Previous studies about mental formen were performed by using cadavers, recently CBCT imaging has gained popularity in the dental field due to its enhanced image quality. Radiographic measurements of the mental foramen is important in many dental procedures.[8-13]

Position of the mental foramen, in the current study, the mental foramen was located mesial to the second premolar root in between the two premolars (61.3%) next highest was below the root apex of the second premolar (23.4%). These findings are similar to many studies that are been published on mental foramen.[16,19,23,26-29] No differences were seen between males and females. Distance between mental foramen and 2nd premolar root apex, from an immediate implant surgical point of view, the distance between the mental foramen and the root apex is very important to avoid injury to the nerve bundle and to obtain primary stability of the implant.[5,12,17,19] Primary stability in immediate implant cases in the mandibular premolar region is gained from the apical bone below the root apex.[4,6,13,15-17] In the current study, the mean distance of the mental foramen from the root apex of the second premolar was 4.00 ± 2.27 mm with a range of 0 – 9.40 mm. According to different age groups in the study, <20 years, 20-45 years, 45-60 years, >60 the mean distance was 4.51mm, 3.76mm, 4.6mm and 6.78mm respectively (p-value = 0.072[#]). Gender vise the distance was greater in males 4.07±2.31mm compared to females 3.94±2.95mm. A CBCT scan is always recommended for precise presurgical implant planning.[15,8,17,19]

Size of mental foramen, the mean horizontal measurement of the mental foramen was 2.95 ± 0.91mm with a range of 1.60 – 6.20mm, the mean vertical measurement of the mental foramen was 2.84 ± 0.86mm with a range of 1.40 – 5.70mm. Distance from mental foramen to the alveolar crest is a constantly changing value due to crestal bone loss and alveolar bone resorption. The mean distance from mental foramen to the alveolar crest was 11.78mm (range, 6.40 – 15.60mm). There was no significant difference between the distances in males and females. On the other aspect, distance from the mean distance from mental foramen to the inferior border of the mandible was 12.20 ± 1.82mm (range, 8.30 – 16.30mm) this distance was greater than the superior margin.

In the present study, angulation of the long axis of the emerging mental foramen canal was less then 90°. The mean angulation was 42.39 ± 8.94° with a range of 23 – 67°. Anterior loop was present in 35.8% of the cases. In this 65.3% had a type 2 anterior loop. The presence of anterior loop has a low frequency in the Navi Mumbai based population.

5. Conclusion

For the first time in Navi Mumbai population CBCT imaging is used to accurately determine the location and shape of the mental foramen in relation to the adjacent anatomical landmarks. The proximity of the mental foramen should be considered during implant surgical procedures in the mandibular posterior region. The results that are obtained from this study may contribute in forming guidelines for implant surgery and dental surgeries in the mandibular posterior region.

6. Source of Funding

None.

7. Conflict of Interest

None.

References

1. von Arx T, Friedli M, Sendi P, Lozanoff S, Bornstein MM. Location and dimensions of the mental foramen: a radiographic analysis by using cone-beam computed tomography. *J Endod*. 2013;39(12):1522–8. https://doi.org/10.1016/j.joen.2013.07.033.
2. Zmyslowska-Polakowska E, Radwanski M, Ledzion S, Leski M, Zmyslowska A, Lukomska-Szymanska M. Evaluation of size and location of a mental foramen in the Polish population using cone-beam computed tomography. *Biomed Res Int*. 2019;2019:1659476. https://doi.org/10.1155/2019/1659476.
3. Alyami OS, Alotaibi MS, Koppolu P, Alosaimy A, Abdulghani A, Swapna LA, et al. Anterior loop of the mental nerve in Saudi sample in Riyadh, KSA. A cone beam computerized tomography study. *Saudi Dent J*. 2021;33(3):124–30. https://doi.org/10.1016/j.sdentj.2020.03.001.
4. Phillips JL, Weller RN, Kulild JC. The mental foramen: 1. Size, orientation, and positional relationship to the mandibular second premolar. *J Endod*. 1990;16(5):221–3. https://doi.org/10.1016/s0099-2399(06)81674-2.
5. Greenstein G, Tarnow D. The mental foramen and nerve: clinical and anatomical factors related to dental implant placement: a literature review. *J Periodontol*. 2006;77(12):1933–43. https://doi.org/10.1902/jop.2006.060197.
6. Kumar V, Hunsigi P, Kaipa BR, Reddy R, Ealla KK, Arun Kumar CB, et al. Radiographic localization of mental foramen in Northeast and South Indian ethnic groups of Indian population. *J Contemp Dent Pract*. 2014;15(6):766–9. https://doi.org/10.5005/jp-journals-10024-1614.
7. Muinelo-Lorenzo J, Suárez-Quintanilla JA, Fernández-Alonso A, Varela-Mallou J, Suárez-Cunqueiro MM. Anatomical characteristics and visibility of mental foramen and accessory mental foramen: panoramic radiography vs. cone beam CT. *Med Oral Patol Oral Cir Bucal*. 2015;20(6):e707–14. https://doi.org/10.4317/medoral.20585.
8. Parnami P, Gupta D, Arora V, Bhalla S, Kumar A, Malik R. Assessment of the horizontal and vertical position of mental foramen in Indian population in terms of age and sex in dentate subjects by pano-ramic radiographs: a retrospective study with review of literature. *Open Dent J*. 2015;9:297–302. https://doi.org/10.2174/1874210601509010297.
9. Tebo HG, Telford IR. An analysis of the variations in position of the mental foramen. *Anat Rec*. 1950;107(1):61–6. https://doi.org/10.1002/ar.1091070105.
10. Fishel D, Buchner A, Hershkowith A, Kaffe I. Roentgenologic study of the mental foramen. *Oral Surg Oral Med Oral Pathol*. 1976;41(5):682–6. https://doi.org/10.1016/0030-4220(76)90325-x.

11. Solar P, Ulm C, Frey G, Matejka MA. Classification of the intraosseous paths of the mental nerve. *Int J Oral Maxillofac Implants*. 1994;9:339–44.
12. Chappidi V, Swapna LA, Dheeraj V, Nikitha GR, Kanakagiri M. Evaluation of morphometric variations in mental foramen and prevalence of anterior loop in South Indian population – A CBCT study. *J Indian Acad Oral Med Radiol*. 2019;31(2):134–9. https://doi.org/10.4103/jiaomr.jiaomr_219_18.
13. Rajkohila J, Daniel P, Ambikaipakan S, Rabi S. Morphological and morphometric analysis of accessory mental foramen in dry human mandibles of south indian population. *Indian J Dent Res*. 2018;29(1):56–60. https://doi.org/10.4103/ijdr.IJDR_146_17.
14. Bartling R, Freeman K, Kraut RA. The incidence of altered sensation of the mental nerve after mandibular implant placement. *J Oral Maxillofac Surg*. 1999;57(12):1408–12. https://doi.org/10.1016/s0278-2391(99)90720-6.
15. Wismeijer D, van Waas MA, Vermeeren JI, Kalk W. Patients' perception of sensory disturbances of the mental nerve before and after implant surgery: a prospective study of 110 patients. *Br J Oral Maxillofac Surg*. 1997;35(4):254–9. https://doi.org/10.1016/s0266-4356(97)90043-7.
16. Walton JN. Altered sensation associated with implants in the anterior mandible: a prospective study. *J Prosthet Dent*. 2000;83(4):443–9. https://doi.org/10.1016/s0022-3913(00)70039-4.
17. Uchida Y, Noguchi N, Goto M, Yamashita Y, Hanihara T, Takamori H, et al. Measurement of anterior loop length for the mandibular canal and diameter of the mandibular incisive canal to avoid nerve damage when installing endosseous implants in the interforaminal region: a second attempt introducing cone beam computed tomography. *J Oral Maxillofac Surg*. 2009;67(4):744–50. https://doi.org/10.1016/j.joms.2008.05.352.
18. 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. https://doi.org/10.1053/joms.2003.50070.
19. Yosue T, Brooks SL. The appearance of mental foramina on panoramic radiographs: I—evaluation of patients. *Oral Surg Oral Med Oral Pathol.* 1989;68:360–4. https://doi.org/10.1016/0030-4220(89)90224-7.
20. Yosue T, Brooks SL. The appearance of mental foramina on panoramic and periapical radiographs: II—experimental evaluation. *Oral Surg Oral Med Oral Pathol.* 1989;68(4):488–92. https://doi.org/10.1016/0030-4220(89)90151-5.
21. Phillips JL, Weller RN, Kulild JC. The mental foramen: part II—radiographic position in relation to the mandibular second premolar. *J Endod.* 1992;18(6):271–4. https://doi.org/10.1016/s0099-2399(06)80953-2.
22. Phillips JL, Weller RN, Kulild JC. The mental foramen: part III—size and position on panoramic radiographs. *J Endod*. 1992;18(8):383–6. https://doi.org/10.1016/s0099-2399(06)81224-0.
23. Shibli JA, Martins MC, Loffredo LC, Scaf G. Detection of the mandibular canal and the mental foramen in panoramic radiographs: intraexaminer agreement. *J Oral Implantol.* 2012;38(1):27–31. https://doi.org/10.1563/AAID-JOI-D-09-00103.1
24. Kalender A, Orhan K, Aksoy U. Evaluation of the mental foramen and accessory mental foramen in Turkish patients using cone-beam computed tomography images reconstructed from a volumetric rendering program. *Clin Anat.* 2012;25(5):584–92. https://doi.org/10.1002/ca.21277
25. Shankland WE. The position of the mental foramen in Asian Indians. *J Oral Implantol.* 1994;20(2):118–23.
26. Gupta T. Localization of important facial foramina encountered in maxillofacial surgery. *Clin Anat.* 2008;21(7):633–40. https://doi.org/10.1002/ca.20688.
27. Guo JL, Su L, Zhao JL, Yang L, Lv DL, Li YQ, et al. Location of mental foramen based on soft- and hard-tissue landmarks in a chinese population. *J Craniofac Surg*. 2009;20(6):2235–7. https://doi.org/10.1097/SCS.0b013e3181bf85f4.
28. Kqiku L, Sivic E, Weiglein A, Stadtler P. Position of the mental foramen: an anatomical study. *Wien Med Wochenschr.* 2011;161(9-10):272–3. https://doi.org/10.1007/s10354-011-0898-2.
29. Moiseiwitsch JR. Position of the mental foramen in a North American, white population. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1998;85(4):457–60. https://doi.org/10.1016/s1079-2104(98)90074-9.
30. Berge JK, Bergman RA. Variations in size and in symmetry of foramina of the human skull. *Clin Anat*. 2001;14(6):406–13. https://doi.org/10.1002/ca.1075.
31. Neiva RF, Gapski R, Wang HL. Morphometric analysis of implant-related anatomy in Caucasian skulls. *J Periodontol.* 2004;75(8):1061–7. https://doi.org/10.1902/jop.2004.75.8.1061.
32. Haktanir A, Ilgaz K, Turhan-Haktanir N. Evaluation of mental foramina in adult living crania with MDCT. *Surg Radiol Anat.* 2010;32(4):351–6. https://doi.org/10.1007/s00276-009-0572-1.
33. 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. https://doi.org/10.1016/j.joms.2005.02.016.
34. Chen JCH, Lin LM, Geist JR, Chen JY, Chen CH, Chen YK. A retrospective comparison of the location and diameter of the inferior alveolar canal at the mental foramen and length of the anterior loop between American and Taiwanese cohorts using CBCT. *Surg Radiol Anat*. 2013;35(1):11–8. https://doi.org/10.1007/s00276-012-0986-z.
35. de Oliveira-Santos C, Couto Souza PH, Berti-Couto SA, Stinkens L, Moyaert K, Rubira-Bullen IRF, et al. Assessment of variations of the mandibular canal through cone beam computed tomography. *Clin Oral Investig*. 2012;16(2):387–93. https://doi.org/10.1007/s00784-011-0544-9.

Cite this article: Jaiswar VV, Mohite AG, Nadgere JB, Iyer JV. A cone-beam computed tomographic analysis to determine location and dimensions of the mental foramen in dentate individuals of population based in Navi Mumbai metropolitan region. *IP Int J Maxillofac Imaging*. 2025;11(3):86–93.