ORIGINAL ARTICLE

Turk Endod J 2021;6(3):87–91
doi: 10.14744/TEJ.2021.08208

Determining the mental foramen location in a Turkish population: A cone beam computed tomography study

Sadullah Kaya,[1] Gizem Akın Tartuk,[1] Mehmet Eskibağlar,[1] Merve Yeniçeri Özata,[1] Seda Falakaloglu[2]

[1]Department of Endodontics, Dicle University Faculty of Dentistry, Diyarbakır, Turkey
[2]Department of Endodontics, Afyonkarahisar Health Sciences University Faculty of Dentistry, Afyonkarahisar, Turkey

Purpose: Mental foramen (MF) is defined as the gap generally located between the first and second premolars on the outer surface of the mandible. The well-defined MF location has been considered to be extremely important for dental procedures. Thus, this study primarily aims to identify the MF location among the Turkish population based on gender using cone beam computed tomography (CBCT).

Methods: In this study, sagittal, axial, and coronal CBCT images of 200 patients (120 males, 80 females) were retrospectively scanned, and the MF locations of the teeth were separately evaluated for the right and left mandible.

Results: As per the examined images, it was determined that the prevalence of MF between the first and second premolar teeth (right mandible: 47%, left mandibular: 52.5%, female: 49.4%, male 50%) is higher compared to other locations.

Conclusion: This CBCT study enabled the identification of the MF location for the Turkish population. This data can contribute to dental procedure applications, such as mental nerve anesthesia, endodontics, and implantology.

Keywords: CBCT, cone beam computed tomography, mental foramen.

Introduction

The mental foramen (MF) is known to enable the mandibular nerve alveolar branch to protrude from the mandibular body. The alveolar nerve is called the mental nerve after leaving this foramen (1). This nerve then supplies sensation to the teeth after the foramen, lower lip, and gum in the buccal mucosa (2); however, it is reported that the location of MF varies between different races (1–4). The correct identification of the MF location is important both for diagnostic and clinical procedures (4). The MF might cause an incorrect diagnosis of a radiolucent lesion on the apical region of mandibular premolars (5).

Anatomic variations of MF can be identified through clinical applications and radiographic methods (6–8). Conventional radiographic techniques reduce the 3D structure into a 2D plane. Magnification in the image and anatomic structure superposition can pose a challenge to interpreting this image (7,8). Additionally, increased bone density

Cite this article as: Kaya S, Akın Tartuk G, Eskibağlar M, Yeniçeri Özata M, Falakaloglu S. Determining the mental foramen location in a Turkish population: A cone beam computed tomography study. Turk Endod J 2021;6:87-91.
Correspondence: Sadullah Kaya. Department of Endodontics, Dicle University Faculty of Dentistry, Diyarbakır, Turkey.
Tel: +90 506 – 427 39 42 e-mail: sadullahkaya@hotmail.com
Submitted: July 02, 2021 Accepted: July 14, 2021
©2021 Turkish Endodontic Society

could pose a challenge in the identification of MF in conventional radiography. Therefore, cone beam computed tomography (CBCT), which enables the 3D imaging of anatomic structures, was used (8–10).

In this study, CBCT images were evaluated to assess the MF location in a Turkish population in relation to gender.

Materials and Methods

This study was initiated with the protocol no of 2021-28 after the approval of Dicle University, Faculty of Dentistry Ethical Board. In this study, data obtained from the CBCT of 200 patients (120 males, 80 females) from the last 2 years were retrospectively examined. Patients with any bone disease, skeleton asymmetry, or trauma were not included in this study. The nine-inch perspective was used for the CBCT images. The voxel thickness was 0.3 mm and isotropic. The axial images were exported in the DICOM file format and evaluated with iCATVision software.

The relationship between the MF location and the long axis of the teeth was assessed in the axial, sagittal, and coronal sections. According to the location, the scoring was as follows: I- in front of the first premolar, II- in line with first premolar tooth, III- between the first and second premolar teeth, IV- in line with the second premolar tooth, V- between the second premolar and first molar, and VI- in line with the first molar (Fig. 1).

Statistical Analysis

Relationships between MF and teeth were analyzed using Pearson's chi-square test. All statistical analyses were performed using SPSS version 20.0 software (IBM Corp. Armonk, NY, USA), and $\alpha = 0.05$ was considered to be statistically significant.

Results

Relation I and relation VI were not observed in both the right and left mandible (0%). The other relations were found on the right to be as follows: II, 2.5% and III, 47% and IV, 35.5% and V, 15%. The other relations found on the left mandible were as follows: II, 5.5%; III, 52.5%; IV, 31.5%; and V, 10.5% (Table 1).

When the results were evaluated for the 2 halves of the mandible regardless of location according to gender, relation I and relation VI were not observed in both males and females (0%). The other relations found for males were as follows: II, 5%; III, 50%; IV, 32.5%; and V, 12.5%. The other relations found for females were as follows: II, 2.5%; III, 49.4%; IV, 35%; and V, 13.1% (Table 1).

Discussion

In clinical applications, it is extremely important to determine the location of the MF to apply a safe treatment without causing any mental nerve injuries during oral surgical operations. Additionally, a good assessment of the

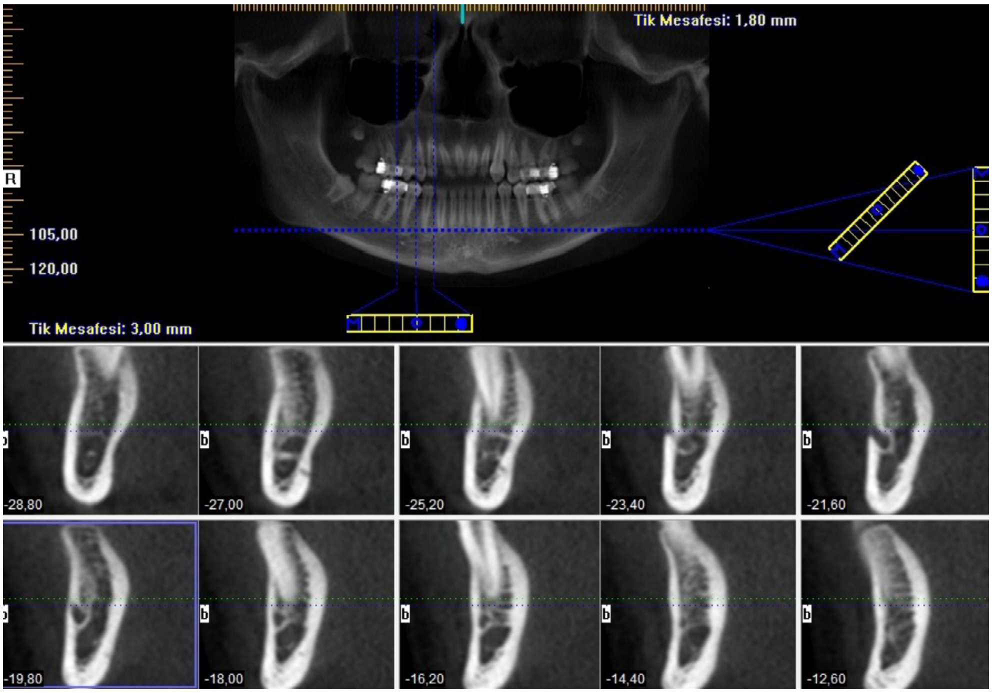

Fig. 1. Determining mental foramen location using cross-sectional images.

Table 1. Frequency and percentages of relationship between mental foramen and teeth depending on location and gender

	I	II	III	IV	V	VI	Test Statistics	p
Location								
Right [n = 200 (%)]	0 (0)	5 (2.5)	94 (47)	71 (35.5)	30 (15)	0 (0)	4.924[a]	0.177
Left [n = 200 (%)]	0 (0)	11 (5.5)	105 (52.5)	63 (31.5)	21 (10.5)	0 (0)		
Gender								
Male [n = 240 (%)]	0 (0)	12 (5)	120 (50)	78 (32.5)	30 (12.5)	0 (0)	1.716[a]	0.633
Female [n = 160 (%)]	0 (0)	4 (2.5)	79 (49.4)	56 (35)	21 (13.1)	0 (0)		

[a]Pearson Chi-square test.

mental foramen location is important for endodontic procedures, diagnosis, and legal procedures.

The MF location has been investigated for various populations and age groups in different ways. The majority of previous studies (11–13) conducted to evaluate the MF location preferred the skull. With the expansion of radiographic imaging systems, researchers have begun to use periapical and panoramic radiography (14,15); however, some studies (16,17) have shown that periapical and panoramic radiography have certain limitations in terms of correctly identifying the MF location. For this type of radiography, distortion or magnification might cause differences in length measurements. Additionally, incorrect patient positioning and the inability to ensure standardization in positioning for panoramic radiography can limit the use of these systems (18). In recent years, CBCT technology has become one of the most commonly preferred imaging systems in the dentistry field due to sensitive anatomic and pathological formation measurements, extraordinary image quality, and the elimination of magnifying and distortion errors in the measurements (19,20). The CBCT imaging method was used to determine the MF location in this study, which was conducted on a Turkish population.

It was observed that the MF's main location was between the first and the second premolars (right mandible, 47%; left mandible, 52.5%; female, 50%; and male, 49.4%). There was no statistically significant difference between the right and left mandible or for the female and male genders.

Kalender et al. (3) assessed the MF location in the Turkish population, wherein they reported that the MF is generally located between the first and second premolars and that there is no difference between the female and male genders. The researchers identified the prevalence of the MF between the two premolars at 59.8% and in line with the second premolars at 30.4%.

In another study (21) conducted on a Turkish population using CBCT, it was reported that the MF is generally located between the first and second premolars and that there was no difference between females and males regarding its location. Similarly, Gungor et al. (22) investigated the MF location in a Turkish population using panoramic radiography, wherein they reported that the prevalence of the MF between the first and second premolars was higher (71.5%) and symmetrical in 90.4% of the investigated radiography images. The results of these studies are similar to the results of the present study.

Cadaver studies (23,24) on Black and Indian populations have shown that MF prevalence is relatively higher between the second premolar and first molars (32% and 28.5%, respectively). Again, while some studies (25,26) on different races and ethnicities have shown a higher MF prevalence between the first and second premolars, other studies (12,27,28) showed a higher prevalence in line with the second premolars. These studies conducted on different populations related to mental foramen localization have indicated that there might be differences between races.

If bone dissection is not applied for cadaver studies to assess the MF location, there might be incorrect interpretations due to the distal curve of the premolar roots (28). Kqiku et al. (29) used 400 hemimandibles to identify the MF location after anatomic dissection. The researchers reported that the MF was determined between two premolars in 63% of the investigated samples. Hazani et al. (30) assessed the MF location by dissecting half the surface of 14 cadavers using loupe magnifying glass. The researchers determined that the MF was most commonly located between the first and second premolars. The data obtained in our study are supported by the results of these studies.

The CBCT images examined for this study showed no MF anterior to the first premolar and in line with the first molars. This result is in line with the results of a similar study conducted by Gungor et al. (31). Voljevica et al. (32) analyzed the mandibula and reported that there was no MF formation in line with the first molars or between the canine and first premolars. Kalender et al. (3) conducted a CBCT study and identified no MF localized anterior to the mandibular first premolar.

These studies have shown that there is no standard MF location model for different populations. According to the results of our study, the MF in a Turkish population was determined to be mostly localized between the mandibular first and second premolars. Because determining MF localization is extremely important for clinical applications, the MF location for each population should be evaluated. It is extremely important to identify the shape, size, and location of the MF for most dental procedures in the mandible. Therefore, the results obtained from this study can be beneficial for various clinicians.

Conclusion

The CBCT analysis data of MF localization for the Turkish population are supported by the data of similar studies. Although the high prevalence of the location of the MF in studies was between the mandibular first and second premolars, similar to our study, assessing the regional morphology using radiographic methods is an appropriate approach, as the MF does not have a standard location. Thus, these methods can minimize the possible complications before and during mandibular premolar region preoperative treatment planning.

Authorship Contributions: Concept: S.K.; Design: S.K.; Supervision: G.A.T.; Materials: M.E.; Data: S.F.; Analysis: M.Y.Ö.; Literature search: S.K.; Writing: G.A.T.; Critical revision: S.K.

Source of Funding: None declared.

Conflict of Interest: None declared.

Ethical Approval: The study protocol was approved by the Dicle University Faculty of Dentistry Clinical Research Local Ethics Committee (date: 28.04.2021, protocol no: 2021-28).

Informed consent: Written informed consent was obtained from patients who participated in this study.

References

1. Yeşilyurt H, Aydinlioglu A, Kavakli A, *et al*. Local differences in the position of the mental foramen. Folia Morphol (Warsz) 2008; 67: 32–5.
2. Woodburne RT. Essentials of human anatomy. Academic Medicine 1961; 36: 556.
3. 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: 584–92. [CrossRef]
4. Phillips JL, Weller RN, Kulild JC. The mental foramen: 2. Radiographic position in relation to the mandibular second premolar. J Endod 1992; 18: 271–4. [CrossRef]
5. Kaufman E, Serman NJ, Wang PD. Bilateral mandibular accessory foramina and canals: a case report and review of the literature. Dentomaxillofac Radiol 2000; 29: 170–5.
6. Brown AA, Scarfe WC, Scheetz JP, Silveira AM, Farman AG. Linear accuracy of cone beam CT derived 3D images. Angle Orthod 2009; 79: 150–7. [CrossRef]
7. Kumar V, Ludlow JB, Mol A, Cevidanes L. Comparison of conventional and cone beam CT synthesized cephalograms. Dentomaxillofac Radiol 2007; 36: 263–9. [CrossRef]
8. Nalçaci R, Oztürk F, Sökücü O. A comparison of two-dimensional radiography and three-dimensional computed tomography in angular cephalometric measurements. Dentomaxillofac Radiol 2010; 39: 100–6. [CrossRef]
9. Connor SE, Arscott T, Berry J, Greene L, O'Gorman R. Precision and accuracy of low-dose CT protocols in the evaluation of skull landmarks. Dentomaxillofac Radiol 2007; 36: 270–6. [CrossRef]
10. Periago DR, Scarfe WC, Moshiri M, Scheetz JP, Silveira AM, Farman AG. Linear accuracy and reliability of cone beam CT derived 3-dimensional images constructed using an orthodontic volumetric rendering program. Angle Orthod 2008; 78: 387–95. [CrossRef]
11. Budhiraja V, Rastogi R, Lalwani R, Goel P, Bose SC. Study of position, shape, and size of mental foramen utilizing various parameters in dry adult human mandibles from north India. ISRN Anat 2012; 2013: 961429. [CrossRef]
12. Udhaya K, Saraladevi KV, Sridhar J. The morphometric analysis of the mental foramen in adult dry human mandibles: a study on the South Indian population. J Clin Diagn Res 2013; 7: 1547–51.
13. Ilayperuma I, Nanayakkara G, Palahepitiya N. Morphometric analysis of the mental foramen in adult Sri Lankan mandibles. Int J Morphol 2009; 27: 1019–24. [CrossRef]
14. Thakare S, Mhapuskar A, Hiremutt D, Giroh VR, Kalyanpur K, Alpana KR. Evaluation of the position of mental foramen for clinical and forensic significance in terms of gender in dentate subjects by digital panoramic radiographs. J Contemp Dent Pract 2016; 17: 762–8. [CrossRef]
15. Al-Juboori MJ, Al-Wakeel HA, Yun CM, Wen FS. Location of mental foramen among Malaysia populations: retrospective study by using orthopantomogram. World J Med Med Sci Res 2013; 1: 85–90.
16. 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: 488–92. [CrossRef]
17. 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: 27–31. [CrossRef]
18. Yim JH, Ryu DM, Lee BS, Kwon YD. Analysis of digitalized panorama and cone beam computed tomographic image distortion for the diagnosis of dental implant sur-

gery. J Craniofac Surg 2011; 22: 669–73. [CrossRef]
19. Khojastepour L, Mirbeigi S, Mirhadi S, Safaee A. Location of mental foramen in a selected Iranian population: A CBCT assessment. Iran Endod J 2015; 10: 117–21.
20. Al-Mahalawy H, Al-Aithan H, Al-Kari B, Al-Jandan B, Shujaat S. Determination of the position of mental foramen and frequency of anterior loop in Saudi population. A retrospective CBCT study. Saudi Dent J 2017; 29: 29–35. [CrossRef]
21. Çağlayan F, Sümbüllü MA, Akgül HM, Altun O. Morphometric and morphologic evaluation of the mental foramen in relation to age and sex: an anatomic cone beam computed tomography study. J Craniofac Surg 2014; 25: 2227–30.
22. Gungor K, Ozturk M, Semiz M, Brooks SL. A radiographic study of location of mental foramen in a selected Turkish population on panoramic radiograph. Coll Antropol 2006; 30: 801–5.
23. Cutright B, Quillopa N, Schubert W. An anthropometric analysis of the key foramina for maxillofacial surgery. J Oral Maxillofac Surg 2003; 61: 354–7. [CrossRef]
24. Gupta T. Localization of important facial foramina encountered in maxillo-facial surgery. Clin Anat 2008; 21: 633–40. [CrossRef]
25. Haghanifar S, Rokouei M. Radiographic evaluation of the mental foramen in a selected Iranian population. Indian J Dent Res 2009; 20: 150–2. [CrossRef]
26. Moiseiwitsch JR. Position of the mental foramen in a North American, white population. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1998; 85: 457–60. [CrossRef]
27. Green RM. The position of the mental foramen: a comparison between the southern (Hong Kong) Chinese and other ethnic and racial groups. Oral Surg Oral Med Oral Pathol 1987; 63: 287–90. [CrossRef]
28. Ari I, Kafa IM, Basar Z, Kurt MA. The localization and anthropometry of mental foramen on late Byzantine mandibles. Coll Antropol 2005; 29: 233–6.
29. Kqiku L, Sivic E, Weiglein A, Städtler P. Position of the mental foramen: an anatomical study. Wien Med Wochenschr 2011; 161: 272–3. [CrossRef]
30. Hazani R, Rao A, Ford R, Yaremchuk MJ, Wilhelmi BJ. The safe zone for placement of chin implants. Plast Reconstr Surg 2013; 131: 869–72. [CrossRef]
31. Gungor E, Aglarci OS, Unal M, Dogan MS, Guven S. Evaluation of mental foramen location in the 10-70 years age range using cone-beam computed tomography. Niger J Clin Pract 2017; 20: 88–92. [CrossRef]
32. Voljevica A, Talović E, Hasanović A. Morphological and morphometric analysis of the shape, position, number and size of mental foramen on human mandibles. Acta Med Acad 2015; 44: 31–8. [CrossRef]