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ORIGINAL ARTICLE

Evaluation of Morphologic and Morphometric Characteristics of the Mental Foramen and Anterior Loop in a Turkish Subpopulation Using Cone Beam Computed Tomography

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ABSTRACT

Objective: Before a surgical intervention in the mandibular interforaminal area, it is important to have a full understanding of the anatomy of the mandibular anterior segment. The evaluation of anatomical structures, variations and pathologies is performed with radiological imaging methods. Today, cone beam computed tomography (CBCT) is an imaging method which offers all the features necessary for this. In addition to its importance in surgical applications, it is also valuable in terms of anatomical studies thanks to the reliability of its measurements and the fact that it allows for a three-dimensional evaluation. The mental foramen and anterior loop are some of the most significant anatomical structures in the lower jaw. The aim of this study was to determine the characteristics of mental foramen according to age and gender in a Turkish population and to evaluate anterior loop length and the frequency of anterior loop. **Methods:** In this retrospective study, CBCT images from 148 patients (89 females and 59 males) were examined. Images of the mental foramen and interforaminal area of patients who were over 18 years of age were included in the study, while images with mandibular pathology and without occlusal closure to at least premolar teeth were excluded. Linear measurements of the mental foramen were repeated three weeks later by the same observer. Descriptive statistics (mean, standard deviation) and the Kolmogorov-Smirnov, Kruskal-Wallis, Mann-Whitney U, ANOVA tests and the t-test were used to evaluate the data. **Results:** The morphological and morphometric features of the mental foramen, which is a characteristic structure in mandibular bone, were determined. No statistically significant difference was found between the age groups in the morphometric characteristics of the mental foramen, but a statistically significant difference was found according to gender. The most frequently detected oval shape and P3, and P4 positions were similar to the other studies conducted in Turkish populations. The prevalence of anterior loop was 58%. **Conclusion:** Detailed preliminary analysis focusing on anesthesia and surgical interventions is important in order to avoid possible complications.

Key words: anterior loop, cone beam computed tomography, mental foramen

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INTRODUCTION

The mental foramen (MF) is one of the most significant features on the lower jaw because of its localization and neurovascular structures. It is usually located between the root tips of the mandibular premolars. The mental nerve is a terminal branch of the inferior alveolar nerve that emerges from the MF.[1,2] The mental nerve provides innervation to the skin and mucosa of the lower lip, the skin of the chin, the vestibule of the gingiva, and the lower incisors. Mental nerve anesthesia is frequently applied in tooth extraction, root canal treatment, and periodontal treatments, as well as in implant surgery, periapical surgery, trauma cases, and plastic/reconstructive surgery. Further, anatomical variations such as MF localization, accessory MF, the presence of anterior loop (AL), and mandibular incisive canal are important in this region, especially for implant planning, osteotomies, orthognathic treatment, and other surgical interventions. Therefore, the anatomy of the region must be known in order to avoid potential local anesthesia or surgical complications.[3,4]

The MF is oval or round. In the literature, it has been reported that the more common form of the MF differs according to populations. In addition, a study observed that it can develop irregular borders with increasing age.[5] When the position of the MF position, it is most commonly found at the position of the second premolar at the level of the long axis or between the long axes of the two premolars.[4] However, MF localization may differ according to gender and ethnicity.[6] In addition to analyses based on these morphological signs, analyzing the MF using morphometry gives reliable results in disciplines such as anthropology and when determining gender.[7]

How the neurovascular structures exit from the last part of the mandibular canal, called the mental canal, differs. The three common exit types are the straight loop, vertical loop, and the AL. Clinically, the AL is more important than the straight and vertical outlet types.[8] The AL is the curvature formed when the mental nerve returns to the foramen after giving the mandibular incisor branch in the anterior part of the MF.[9] Several studies have evaluated the prevalence of the AL with various imaging methods and reported widely different rates, such as 7%, 34%, 55%, and 88%.[10-13] Because of the limitations of two-dimensional imaging methods, three-dimensional systems, such as cone beam computed tomography (CBCT), are preferred for the evaluation of MF exit type and the AL.[9]

Panoramic radiography is frequently used in dentistry because of its innate advantages, such as accessibility and cheapness, the possibility of evaluating two jaws on the same image, and the emission of low-dose radiation according to the CBCT. However, panoramic radiographies have limitations including the degree of magnification, superposition, distortion, and the inability to comprehensively scan the anatomical structure and variations.[14,15] Conversely, CBCT is an advanced digital imaging technique that can be used to create cross-sectional images of a region of interest and for three-dimensional evaluation. Studies that have checked the accuracy of measurements taken from CBCT images and cadaver sections have reported that CBCT images show very low rates of magnification. In addition, CBCT can be used to determine the relative quality of the bone, and the desired viewing area can be selected.[15]

This study aimed to determine the morphological and morphometric characteristics of the MF and evaluate the prevalence and lengths of the anterior loop in a Turkish subpopulation using CBCT images.

METHODS

This study was approved by the Non-Interventional Clinical Research Evaluation Commission of the

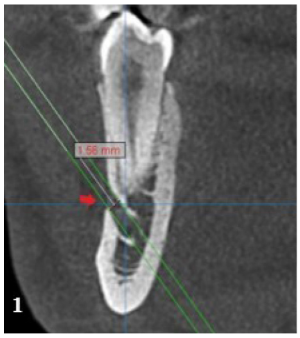

Figure 1. Vertical diameter of mental foramen (MF) on cross-sectional slice (the distance between the green lines is indicated by the red arrow).

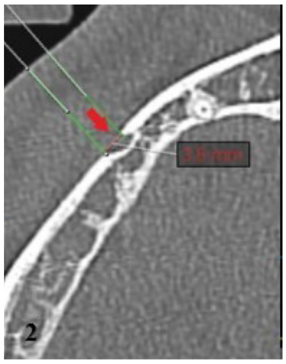

Figure 2. Horizontal diameter of mental foramen (MF) on axial slice (the distance between the green lines is indicated by the red arrow).

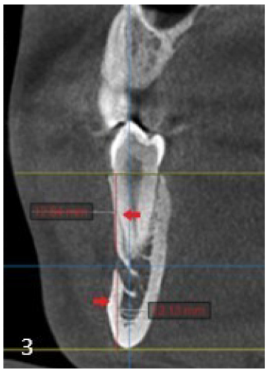

Figure 3. Distances of the mental foramen (MF) to the most apical and coronal point of the mandible on the cross-sectional slice (the red lines are indicated by the red arrows).

Ethics Committee of the Faculty of Dentistry, Selcuk University before it commenced (2017/16). The material studied comprised the CBCT scans of 148 individuals, and these images were obtained from the archives of the Department of Oral and Maxillofacial Radiology, Faculty of Dentistry, Selcuk University. The inclusion criteria were patients over the age of 18, images with MF and AL region on both sides, and images in which the resolution allowed the region and presence of all teeth up to the first molar on both sides of the mandible and maxilla to be examined. Images with mandibular pathology and low quality were excluded from this study. The study included 148 patients (59 males and

89 females) between the ages of 18-65 and evaluated 296 hemimandible images. The images of the patients were divided into three groups according to their age (<30, 30≤... <45, 45≤...).

The CBCT images were obtained using an Instrumentarium Dental (Palo DEx Group Oy, Nahkelantie, Tuusula, Finland). The acquisition parameters for the CBCT images were 89 kV and 4-12 mA, and the slice thickness was 0.5 mm. Multiplanar reconstruction was performed according to these parameters. The same oral and maxillofacial radiology specialist twice examined axial, sagittal, coronal, cross-sectional CBCT slices and panoramic views at three weeks' interval. Before all measurements and evaluations were performed, the midline of the image was arranged perpendicular to the horizontal plane, the occlusal plane parallel to the horizontal plane. The parameters examined were as follows:

- Shape of MF (oval or round)
- Position of MF (according to its relation with mandibular premolars)
- Vertical and horizontal dimensions of MF
- Distances of the MF to the most apical and coronal point of the mandible
- AL prevalence and length

The vertical dimension of the MF and the measurements of the distances from the MF to the most coronal and apical point of the mandible were performed on the cross-sectional sections, while the measurements of the horizontal diameter of the MF were made on the axial section (Figure. 1, 2, 3). Sagittal, axial, cross-sectional sections were used to determine the position of the anterior-posterior direction of the MF relative to the teeth in the region.

The classification developed by Tellford was used to evaluate the position of the MF:

- Position 1: MF is between the long axis of the canine and the first premolar
- Position 2: MF is at the level of the long axis of the first premolar
- Position 3: MF is between the first and second premolars
- Position 4: MF is at the level of the long axis of the second premolar
- Position 5: MF is between the second premolar and first molar
- Position 6: MF is at the level of the long axis of the first molar (Figure. 4).

To evaluate AL, sagittal, axial, cross-sectional sections, and panoramic images were used together. In cases with AL, the length of AL was determined by measuring the distance between the most anterior point where the inferior alveolar nerve curves in the bone and the most anterior point of the MF. When measuring AL length, the method of multiplying the number of AL sections detected in the image with the section thickness can be used. Alternatively, measurements can be made using axial or panoramic sections. In our study, measurements were made on axial sections, and other methods were used as supplements. When examining the beginning and end boundaries of the AL, a single section is not sufficient (Figure. 5, 6).

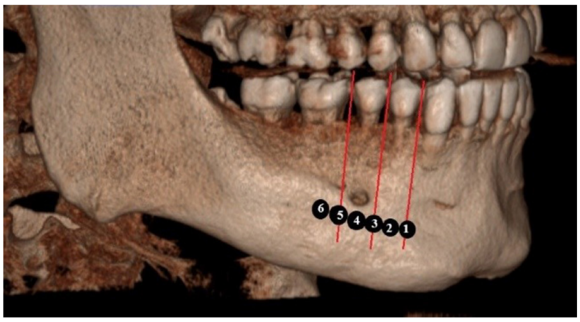

Figure 4. Position of mental foramen (MF) according to Tellford classification.

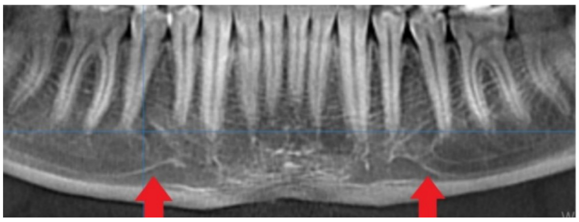

Figure 5. The anterior loop (AL) on panoramic reconstruction image.

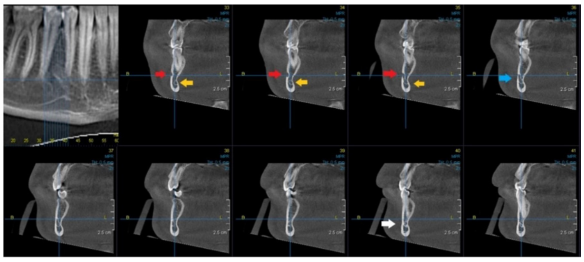

Figure 6. The anterior loop (AL) length on cross-sectional slices (red arrow: mental foramen (MF); yellow arrow: mandibular canal; blue arrow: section where mandibular canal curvatures superiorly; white arrow: section with distal border of anterior loop and beginning of mandibular incisive canal).

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) program, version 22. The research aimed to investigate the differences between the independent groups, and the sample size was calculated at a 95% confidence level using the G*Power-3.1.9.2 program. As a result of the analysis, with $\alpha = 0.05$ and a standardized effect size of 0.5611 obtained from a previous study (Çaglayan et al.[16] (Table 1; 11.19 ± 2.64 and 12.68 ± 2.67)), the minimum sample size for the main group was calculated as 51 with a theoretical power of 0.80 theoretical power.

Descriptive analyses were performed for the evaluations of the AL, the position and shape of the MF, and all measurements according to the gender, age, and right-left side groups. The intra-class correlation test was

Table 1. Distribution of the shape and position of the mental foramen by gender and side.

Shape	Female		Male	
	Right N (%)	**Left N (%)**	**Right N (%)**	**Left N (%)**
Round	12 (13.5)	24 (27.0)	20 (33.9)	14 (23.7)
Oval	**77 (86.5)**	**65 (73.0)**	**39 (66.1)**	**45 (76.3)**
Position 1	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.7)
Position 2	1 (1.1)	6 (6.7)	1 (1.7)	2 (3.4)
Position 3	**48 (53.9)**	**47 (52.8)**	24 (40.7)	**26 (44.1)**
Position 4	32 (36.0)	27 (30.3)	**30 (50.8)**	**25 (42.4)**
Position 5	6 (6.7)	8 (8.98)	4 (6.8)	5 (8.5)
Position 6	2 (2.2)	1 (1.16)	0 (0.0)	0 (0.0)

performed for the compliance of the values measured twice by the same observer. Since the compatibility between the two measurements was observed ($p > 0.05$), the means of the first and second measurements were used for analysis. The Mann-Whitney U test and t-test were used to compare the MF values measured for differences between gender and sides, while the Kruskal-Wallis and ANOVA tests were used for any difference by age group. To examine differences in the mean AL length by gender or side, two-sample t-tests were used.

RESULTS

A total of 148 CBCT scans from 59 men and 89 women were examined in this study. The shape of the MF was evaluated as oval or round, and it was determined that 23.6% of the 296 hemimandibles were round, while 76.4% were oval. When evaluated separately in male-female and right-left groups, the MF was most commonly found to be oval (Table 1). The most common position of the MF in both males and females on both sides were the P3 and P4 positions, respectively, female right side, P3: 53.9%; female left side, P3: 52.8%; male right side, P3: 44.1%; male left side, P4: 50.8%). The third most common position was P5, while the P1 and P6 positions were the least common (Table 1).

The vertical dimension average of the MF was determined as 2.23 mm in the males and 1.89 mm in the females, while its horizontal dimension was determined as 3.7 mm in the males and 3.32 mm in the females. The vertical and horizontal dimensions of the MF were higher in the males, and a statistically significant difference was found between the genders on both sides ($p < 0.05$) (Table 2). When we compared the right and left sides, there was no statistical difference in both dimensions in the males ($p > 0.05$) (Table 3). Although the right and left values in the vertical dimensions were close to each other, a statistical difference was found in the females (vertical diameter: $p = 0.03$, horizontal diameter: $p = 0.914$). When the distance between the MF and the most coronal point of the mandible was evaluated, this was determined to be 13.26 mm in the males and 12.29 mm in the females, while the distance between the MF and the most apical point of the mandible was 12.49 mm in the males and 12.4 mm in the females. The average values of the males were higher than those of the females on the right and left sides, and there was a statistically significant difference between the genders (right-left side: $p < 0.05$) (Table 2). There was no statistically significant difference between the right and left side values in both the male and female patients ($p > 0.05$) (Table 3). In addition, these measurements were evaluated according to age groups: under 30, 30-45, and above 45, and there was no statistically significant difference between age groups ($p > 0.05$) (Table 4).

An AL was observed in 167 (58.1%) of the 296 hemimandibles evaluated. Of these, 17 were unilateral and 75 were bilateral. An AL was found in 105 (59.9%) of the 178 female hemimandibles and in 62 (52.5%) of the 118 male hemimandibles (Table 5). Although there were more ALs in the females than in the males, there was no statistically significant difference between the genders on both sides ($p = 0.101$), (Table 6). Also, there was no difference in whether the AL was on the right or left side between the genders ($p = 0.178$) (Table 7). The lengths of the AL were found to be 2.56 mm on the right and 2.30 mm left side in the males, while these were 2.10 mm on the right and 2.226 mm on the left in the females; the maximum value measured was 5.7 mm and the minimum was 0.88 mm (Table 6). Although the average lengths determined in the male patients on both sides were higher than those of the female patients, the analysis revealed a statistically significant difference between the two genders only on the right side (right: $p = 0.011$, left: $p = 0.903$) (Table 6). In addition, the lengths of the AL did not differ statistically between the right and left sides in the females and males (females: $p = 0.190$, males: $p = 0.245$) (Table 7).

Table 2: Minimum, maximum and mean values of the mental foramen measurements on the right and left sides, and evaluation of the difference by gender

Gender	Right					Left			
	N	Mean (SD)	Min.	Max.	p	Mean (SD)	Min.	Max.	p
Vertical diameter									
Male	59	**2.248** (0.529)	1.32	**3.80**	0.000	**2.214** (0.437)	1.39	**3.29**	0.000
Female	89	1.935 (0.347)	**1.30**	2.80		1.870 (0.340)	**1.19**	3.24	
Horizontal diameter									
Male	59	**3.762** (0.813)	2.30	**6.22**	0.000	**3.641** (0.732)	2.10	**6.04**	0.000
Female	89	3.322 (0.721)	**2.00**	5.70		3.314 (0.710)	**1.90**	5.86	
Crest distance									
Male	59	**13.423** (1.976)	9.88	**20.20**	0.000	**13.086** (2.284)	**5.42**	**20.80**	0.000
Female	89	12.519 (2.139)	**8.50**	17.47		12.079 (1.951)	7.30	16.20	
Basis distance									
Male	59	**13.838** (1.433)	10.25	**17.40**	0.000	**13.979** (1.398)	10.79	**17.10**	0.000
Female	89	12.303 (1.421)	**9.10**	15.50		12.524 (1.302)	**9.64**	16.41	

(Mann-Whitney U test, t-test, $p < 0.005$)

Table 3. Evaluation of the differences in the measurements of the mental foramen for the right and left sides.

Side	Male			Female		
	N	Mean (SD)	*p*	N	Mean (SD)	*p*
Right (vertical diameter)	59	2.248 (0.529)	0.937	89	**1.935** (0.347)	**0.030**
Left (vertical diameter)	59	2.214 (0.437)		89	**1.869** (0.340)	
Right (horizontal diameter)	59	3.762 (0.813)	0.230	89	3.322 (0.721)	0.914
Left (horizontal diameter)	59	3.641 (0.732)		89	3.314 (0.709)	
Right (crest distance)	59	13.423 (1.976)	0.227	89	12.519 (2.139)	0.169
Left (crest distance)	59	13.086 (2.284)		89	12.079 (1.951)	
Right (basis distance)	59	13.838 (1.433)	0.444	89	12.303 (1.421)	0.126
Left (basis distance)	59	13.979 (1.398)		89	12.524 (1.303)	

(Mann-Whitney U test, t-test, $p < 0.005$)

Table 4. Evaluation of the differences in the measurements of the mental foramen by age.

Side	Female							Male						
	<30		30-45		>45		*p*	<30		30-45		>45		*p*
	N	Mean	N	Mean	N	Mean		N	Mean	N	Mean	N	Mean	
Vertical diameter														
Right	35	1.940	29	1.950	25	1.909	**0.900**	20	2.189	17	2.055	22	2.450	**0.052**
Left	35	1.874	29	1.879	25	1.849	**0.926**	20	2.135	17	2.085	22	2.381	**0.061**
Horizontal diameter														
Right	35	3.323	29	3.382	25	3.247	**0.884**	20	3.838	17	3.493	22	3.901	**0.257**
Left	35	3.247	29	3.357	25	3.357	**0.772**	20	3.631	17	3.505	22	3.755	**0.567**
Crest distance														
Right	35	12.147	29	12.759	25	12.759	**0.339**	20	13.484	17	13.053	22	13.651	**0.639**
Left	35	11.760	29	12.197	25	12.387	**0.436**	20	12.735	17	13.361	22	13.192	**0.667**
Basis distance														
Right	35	12.262	29	12.389	25	12.258	**0.925**	20	13.622	17	14.215	22	13.742	**0.429**
Left	35	12.437	29	12.712	25	12.425	**0.640**	20	13.880	17	14.396	22	13.746	**0.335**

Table 5. Prevalence of the anterior loop.

	Male N (%)	Female N (%)	Total N (%)
AL Presence	62 (52.5)	105 (59.9)	167 (58.1)
AL Absence	56 (47.5)	73 (41.0)	129 (43.6)
Total	118 (100.0)	178 (100.0)	296 (100.0)

Table 6. Distribution of anterior loop and its length on the right and left side by gender.

Side	Gender	AL Presence N (%)	p	Mean (mm)	Min. (mm)	Max. (mm)	p
Right	Female	53 (65.4)	0.101	2.10	0.88	3.82	0.011
	Male	28 (34.5)		2.56	1.30	5.70	
Left	Female	52 (60.5)	0.101	2.26	1.00	3.99	0.903
	Male	34 (39.5)		2.30	1.00	4.10	

(t-test, $p < 0.005$)

DISCUSSION

The mandibular interforaminal region is known as the safe zone for surgical interventions. Applications involving the MF and its surrounding area require that this region be located in order to plan treatment, determine the course of surgical procedures, and prevent any potential complications from local anesthesia. As is widely known, the AL is most important anatomical formation that determines the distal border of any intraosseous implant that is placed in this region. In addition, determining and recording the characteristics of the region is significant in terms of ethnicity studies.[17,18] In this context, it is necessary to define the characteristic features of the MF, such as its appearance, position, dimensions, and distance from anatomical structures.

Radiological imaging is a noninvasive evaluation method used to plan treatment of the mandible before surgical interventions. The position of the MF is determined according to the vertical and horizontal planes. Because of the resorptive changes that may occur at the crest in the vertical direction, it may not be healthy to determine the position in this direction. In the presence of missing teeth, attrition, or interface caries, mesialization of the teeth may also cause some limitations in the horizontal evaluation.[11,17,19] Hence, the patient group in this study was selected from individuals with full teeth, no large or widespread interface caries, and no ridge resorption in this region.

Güngör et al. evaluated 361 panoramic radiographs and determined that the MF was most frequently located between the two premolars (71.5%).[20] Similarly, Şekerci et al. examined 550 computed tomography images and reported the second most common position as the long axis of the second premolar tooth.[21] Yeşilyurt et al. reported the second most common position as the second premolar long axis in a study in which they examined 70 adult mandibles.[22] In 49% of the images evaluated in our study, the MF was found to be situated between the two premolars, while the second most frequent position was by the second premolar long axis (38.5%). There are several studies in the literature about the position of the MF. In a publication which compiled some of these studies, localization between the two premolars was common in North American, Brazilian, European, and Caucasian populations, while localization at the level of the second premolar was more common in Arabian, Malaysian, and African populations. In addition, in other studies, both localizations were found in Asian countries such as China and Korea and in mixed-origin societies such as India and Turkey.[4,5]

The foramen was oval in 76.4% of the images in which we evaluated the shape of the MF, and round in the remaining 23.6%. In a publication by Hasan et al., which listed the characteristic features of MF in different populations, an oval shape was dominant in many population groups.[23] In general, studies on the shape, position and symmetry of the MF have examined how these properties change, and it has been concluded that the effects of growth, development, and function are the primary factors how the MF acquires its characteristics. While no definite conclusion has been reached as to the extent to which racial characteristics, gender, geography and age affect the variability of MF properties, it has been reported that variations, such as an accessory MF or a deficiency in the MF, are related to race.[5,23] In the present study, we aimed to examine more than one feature of the MF in a limited Turkish population, in order to make it possible to compare the results from our population group with those of other groups in similar future studies.

The dimensions of the MF and its distance relative to the surrounding anatomical boundaries are morphometric features that define it. Kalender et al. reported the vertical and horizontal dimensions of the MF to be 3.6 and 3.9 mm in their study with CBCT in a Turkish patient group, and they found that while there was no difference between the sides, the values of the male patient group were higher than those of the female patients.[19] Çağlayan et al. also studied a Turkish patient group; they reported the vertical and horizontal dimensions as 3.89 mm and 3.29 mm on the right, and 3.80 mm and 3.36 mm on the left.[16] They also determined that there was no statistical difference in the changes in MF dimensions according to age group.[16] Although the values we found were close to those found in these two studies, the vertical and horizontal diameter values of the MF for the males were higher than for the females. In addition, Von Arx et al., Çağlayan et al., and Alias et al. stated in their studies that, similar to our results, the dimensions of the MF did not differ statistically by age group ($p > 0.05$).[6,16,17] In a publication by Hasan et al., which compiled the characteristics of the MF by race, the dimensions of the MF in East Asian societies were similar to the dimensions in the present study, while the values in African societies were higher.[23] This demonstrates that the specific anatomical structures of bones may differ according to racial background.

When the distances between the upper border of the MF and the coronal of the mandible, and the lower border of the MF and the apical of the mandible were evaluated, a significant difference was found between the female and male patients, as in the dimensions of the MF. However, there was no statistical difference in these distances according to age groups. Şahin et al. evaluated the images of an equal number of patients with and without teeth in young and elderly patient groups and reported that there was no change in the distance between the coronal points of the MF-mandible with increasing age.[24] When they evaluated the young and old patients by grouping them as "toothed" and "edentulous", they reported that there was a significant difference and that this distance was reduced in edentulous patients; however, they concluded that the change in distance was caused by the dental condition, not by age. When they evaluated the distance between the apical points of the MF mandible, they reported that this distance decreased in the edentulous patient group, but that this was not related to age.[24] For this reason, we excluded the dental situation in our study and selected the study group from images without tooth loss and periodontal disease. When they examined these changes by race, Alias et al. attributed the differences in morphometric measurements to the fact that individuals of different ethnic backgrounds may habitually consume different types of foods of different sizes that may need to be chewed with different degrees of force.[17]

Gender determination is of great importance in forensic medicine and anthropology, as well as in the identification of unknown decedents, especially in criminal investigations. One of the most important aspects of forensic medicine is determining gender from fragments of jaws and teeth. Using morphological signs alone in this process is subjective and likely to be inaccurate, but methods based on measurements and morphometry give reliable results.[7] As seen in the present study, statistically significant differences were found between the morphometric measurements of the men and women. Similar to our study, Çağlayan et al. concluded that the morphometric measurements of men gave numerically higher values than those of women.[16] They stated that the reason for this was that bone development continued for a longer time in men. In addition, it is thought that the difference in the musculoskeletal development of men and women has an effect on this difference.[7]

A healthy anatomical evaluation before and after the procedure is the most important factor that ensures success in implant surgery, which is an important part of the practice of dentistry. This is the point at which radiological imaging methods are most useful.[14] Although clinicians work at a specifically defined distance from anatomical structures, it is important to determine the presence and length of the AL, as it is encountered with varying sizes. Vujanovic-Eskenazi et al. evaluated the presence and length of the Al, examining 82 panoramic radiographs and CBCT images of the same patients.[15] They reported the prevalence of AL as 36.6% on the panoramic radiographs and 48.8% on the CBCT images. In addition, in their linear measurement comparison, they showed that the image was magnified 1.87% in panoramic radiography. There was no statistical difference between the results, but they emphasized the need to define the detailed anatomy of this region at a high level and recommended CBCT imaging when planning implant placement in the interforaminal region.[15] Li et al. compiled the values for AL prevalence in previous studies using cadaver sections, panoramic radiographs, CT, and CBCT images.[25] When these values are examined, it is noteworthy that the values detected in panoramic radiographs (11%, 27%, 28%) were lower than those reported using other methods. Apostolakis et al. evaluated 320 CBCT images.[9] While the prevalence was reported as 48%, Demir et al. reported 59.5%, Filo et al. reported 69.7%.[8,9,26] Similar results were encountered in the present study when the studies performed with CBCT were compared. The prevalence of AL has been reported in a wide range in studies reviewed in the literature.[25] It is thought that the differences between the populations, as well as the different techniques studied and the number of subjects may have all had an effect in the fact that a narrower range of values has not been reported.

In our study, the mean values for AL length were 2.18 mm in women and 2.43 mm in men. While there was no difference in the length of the AL on the left side between the males and females, a statistical difference was observed on the right side. It is thought that the observation of the minimum and maximum values of AL length on the right side may have had an effect on this result. In previous studies, the ranges reported for AL length and prevalence have been very different. The longest value in the literature was reported as 11 mm by Neiva et al.[12]

Among oral interventions, the most common complications due to anesthesia or surgical procedures occur in the inferior alveolar nerve (64.4%), followed by the lingual nerve (28.8%). Complications such as pain, paresthesia, and bleeding may occur as a result of damage to the neurovascular structures carried by the mandibular, mental, and incisive canals. The incidence of permanent sensory impairment in the lower lip after dental implant placement in the interforaminal region has been reported as 7-10%. Neurosensory changes in this region are associated with the failure to identify and preserve the neurovascular bundle of the mental nerve.[27] Researchers have not established a specific distance that reliably preserves the MF, especially in implant treatment, as there may be variations in AL length. It is more reliable to determine the AL length on the preoperative CBCT image instead of at a certain distance and to evaluate the anatomy of the region in detail.[28]

Our study includes data from a limited population. Although the results cannot be generalized to the entire population, the study is important in terms of how it reveals the anatomical characteristics of the specific population examined. In addition, unlike similar studies, this study has considered the morphometric and morphological features of the MF and the structure of the AL together. This has enabled the anatomical characteristics of the given population group to be more accurately revealed.

CONCLUSION

This study examined and evaluated the morphological and morphometric features of the MF in a Turkish subpopulation. The anatomical dynamics of the region render invalid the concept of maintaining a fixed safe distance to the region when carrying out implant applications, a practice that has become more widespread in recent years. It is important for dentists to know the characteristics of the MF, not to ignore possible variations, and to use three-dimensional evaluation methods when appropriate, in order not to avoid any potential complications.

CONFLICT OF INTEREST

The authors declare that they have no competing interests as defined by Springer, or other interests that could be perceived as influencing or having influenced the results and/or discussion reported in this paper.

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