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Özgün Araştırma Makalesi

A Retrospective Evaluation of Mental Nerve, Mental Loop, and Incisive Canal in a Group of Patient Population

Bir Grup Hasta Popülasyonunda Mental Sinir, Mental Lup ve İnsiziv Kanalın Retrospektif Olarak Değerlendirilmesi

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ABSTRACT

Objective: 3-dimensional radiographic evaluation of the intraforaminal area are crucial to prevent complications during surgical procedures. This study aimed retrospectively to determine incidence of different shapes of the foramen, and presence of the anterior loop with aid cone beam computed tomography (CBCT).

Material and Method: This retrospective study was performed on 176 patients whose CBCT images indicated were used. The shape and location of the mental foramen; distance between the mental foramen (MF) and mandibular incisive canal (MIC); length of the alveolar crest, basis, buccal, and lingual sides; and MIC length were evaluated based on the images.

Results: The anterior loop was observed in 42.2% of patients. No significant sex dependence was found in terms of MF localization status and MF shape (p> 0.05). The mean distance of the anterior loop was 4.8±1.4 mm on the right side and 4.5±1.2 mm on the left side. The MIC was observed in all images. The mean length of MIC was 6.3±3.8 mm on the right side and 6±3.4 mm on the left side.

Conclusion: Clinicians should be aware of the importance of preoperative evaluation of the intraforaminal area. Therefore, it is beneficial to use CBCT imaging techniques for preoperative planning.

Keywords: Cone-beam computed tomography; Mandibular nerve; Mental foramen

ÖZET

Amaç: Oral bölgede yapılan cerrahi prosedürlerden sonra komplikasyonları önlemek için intraforaminal bölgenin 3-boyutlu radyografik değerlendirilmesi kritik önem taşımaktadır. Bu çalışmada konik ışınlı bilgisayarlı tomografi (KIBT) taraması ile foramen görülme sıklığı ve mental sinirde anterior lup varlığının belirlenmesi, insisiv sinir uzunluğunun retrospektif olarak değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntem: Bu retrospektif çalışma, 2017-2018 yılları arasında farklı nedenlerle KIBT görüntüleri kullanılan 176 hastayı içermektedir. Alınan görüntülerde mental foramenin (MF) şekli ve lokasyonu, mental sinir ve mandibular insisiv kanalın alveolar kreste, basise, bukkal ve lingual sınırlara olan uzaklığı, mandibular insisiv kanalın uzunluğu değerlendirildi.

Bulgular: Tüm hastalar arasında %42.2 oranında anterior lup görüldü. MF lokalizasyon durumu cinsiyet bakımından bir farklılık görülmemiştir ve MF şekli açısından anlamlı bir fark bulunamamıştır (p> 0.05). Ortalama anterior lup mesafesi sağ tarafta 4.8±1.4 mm, sol tarafta 4.5 ± 1.2 mm bulunmuştur. Tüm görüntülerde mandibular insisiv kanal izlenmiştir. Ortalama mandibular insisiv kanal uzunluğu sağ tarafta 6.3±3.8 mm, sol tarafta 6±3.4 mm'dir.

Sonuç: Klinisyenler intraforaminal bölgenin ameliyat öncesi değerlendirilmesinin öneminin farkında olmalıdır. Bu nedenle, KIBT görüntüleme tekniklerini kullanarak ameliyat öncesi planlama yapmakta fayda vardır.

Anahtar Kelimeler: Konik ışınlı bilgisayarlı tomografi; Mandibular sinir; Mental foramen

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INTRODUCTION

The inferior alveolar nerve, mental nerve arising from the mental foramen (MF), and mandibular incisive canal (MIC) are important anatomic landmarks for surgical procedures in the mandible.[1] The inferior alveolar nerve ascends usually forward and returns before leaving the MF which is termed as a mental loop. Following the inferior alveolar nerve leaves from the MF, it is divided into branches of mental and incisive nerves.[2] Although the interforaminal area is considered as a safe region for surgical procedures, including implant placement, grafting procedure, and genioplasty, it is controversial due to the presence of the mental loop and MIC in this anatomical region.[3] Preoperative planning and radiographic evaluation are of utmost importance to avoid the postoperative sensorial disturbances. The preoperative evaluations include the preoperative determination of the exact location and the shape of the mental nerve and MIC.[4] Periapical and panoramic radiographs are insufficient to evaluate the interforaminal region and variations in the mental nerve. The conventional radiographic techniques transform a three-dimensional (3D) structure into a two-dimensional plane. However, these transformation causes magnification and distortion leading to the misinterpretation of images and landmarks.[4,5] On the other hand, cone beam computed tomography (CBCT) offers some advantages to clinicians and patients, such as showing coronal, sagittal, and axial planes; low radiation dose; and low cost. Therefore, this method is useful in evaluating the localization of anatomical structures.[6]

The present study aimed to determine the location, size, and shape of the mental nerve, distance from MF to borders, incidence of different shapes of foramen, and presence of anterior loop in the mental nerve. The length and diameter of the incisive nerve were determined with CBCT scanning, and the correlation among age, sex, and dentition status were evaluated. The hypothesis of this study was whether the evaluation of the interforaminal area with CBCT would provide better details to prevent sensory disturbances and complications.

MATERIAL AND METHOD

This retrospective study was performed on patients referred to a private radiology center from the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Ankara Yıldırım Beyazıt University for various dentomaxillofacial problems. The ethical committee of Ankara Yıldırım Beyazıt University approved the study protocol. (Date: 28.08.2018 decision no: 47).

176 of patients whose CBCT images involved both mental foramens were included in the present study. CBCT images of patients who presented with pathologies including defects, lesions, and cysts in the mandibular interforaminal region; history of any surgical procedure in the mandibular interforaminal region and/or any type of bone disease; and low image quality due to artifacts were excluded from the study.

DICOM data of mandible images obtained with an FOV of 16 x 8 and 200-μm voxel size taken with an HDX Will Dentri-S brand/model (HDX Will Corp. Seoul, Korea) CBCT device from patients who applied to the imaging center for any purpose were used. The dose for patient imaging was selected by a competent radiology technician as 70–100 kVa and 7–10 mA in accordance with the patient's height/weight status. DICOM data were evaluated by a single competent user with the aid of a 3D viewer (CS 3D imaging Software; Carestream Health Inc., NY, USA). The average evaluation time was 30 minutes, with a rest interval of not less than 10 minutes between each case. The study time should not be more than 1 h in a session, and the rest interval should be at least 10 min.

Following the recording of the demographic data of the patients, the presence of teeth in the MF region and the localization of the MF were noted. MF location was recorded as follows:

(1) mesial to the first premolar, (2) aligned with the first premolar, (3) between the premolars, (4) aligned with the second premolar, (5) between the premolar and molar, and (6) aligned with the first molar. The vertical localization of MF was recorded as follows: (1) coronal of apex, (2) apex, (3) apical of the apex. The shape of the MF was noted as oval or round. The width of MF, the distance of MF to the alveolar crest, and the buccal and inferior borders of the mandible in the axial section were also noted. Additionally, the distance of MF to the genial tubercle was recorded from the coronal section of the images.

The exit of the inferior alveolar nerve from MF are classified into three types [7]. In type 1 classification, the anterior loop is lacking and usually the mental nerve continues in a Y-shape, which is as wide as the main branch of the inferior alveolar nerve. In type 2 classification, the anterior loop is lacking, and the mental nerve continues in a T shape perpendicular to the main branch of the inferior alveolar nerve. In type 3 classification, as the mental nerve rises from the mandibular canal, it runs forward, then turns back, and forms an anterior loop (Fig. 1). When an anterior loop was present, its length was measured and recorded. Besides, the diameter of the MIC and the distance between its first and last appearances were measured from the axial sections of the related image. The distances between the terminated point of MIC and the buccal bone surface, alveolar crest, and basis of the mandible were noted. Besides, the distances between the cementoenamel junction and the MIC were measured in the case of a tooth.

Statistical analysis

The data were analyzed using IBM SPSS 22.0 Software (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 22.0., NY, USA). Initially, the Shapiro–Wilk test was used for evaluating whether the variables were distributed normally. Due to the non-normal distribution of the data, the Mann–Whitney U test was used for comparisons between groups. The chi-square test was used for analyzing the association between categorical variables. The significance level was determined as $p < 0.05$.

RESULTS

In this study, 24 out of 200 patients were excluded within the scope of the inclusion and exclusion criteria due to lesions in the relevant region (n=4), partial images (n=9) and deficiency in image quality (n=11). A total of 348 hemimandibles of 176 patients were evaluated. Of the included patients, 107 (60.8%) were women, and 69 (39.2 %) were men (age range: 17–81 years; 45.2 ± 16.1 years) (Table 1).

72.2% and 73.9% of all patients had teeth on the right and left sides of the mandible, respectively. The rounded shape of the MF was recorded in the 57.3% of mandibles, while the oval shape of the MF was noted in the 42.7% of the mandibles. The most frequent horizontal position of the MF was between the long axes of the mandibular first and second premolars which observed in 54.3% of the hemimandibles. The most frequent vertical position of the MF was inferior to the apex of premolars (79%). No significant differences were found between the right and left sides of mandibles in terms of either the position or the shape of MF. 60 sides of mandibles had type 1 mental nerve paths, 141 had type 2 mental nerve paths, and the anterior loop was observed in 147 sides, thus recorded as type 3. No significant difference was observed between the right and left sides ($p > 0.05$) (Table 2).

Table 1. Demographic characteristics of patients

Measurements	n	%		
Male	69	39.2		
Female	107	60.8		
Total	176	100		
	n	**Mean**	**Min**	**Max**
Age	176	45.2 ± 16.1	17	81

Also, no significant differences were found in the vertical and horizontal locations of the MF, the type description of directional paths of mental foramen, and dentate/edentulous ratios between the sexes. Although the rounded shape of the MF was more common in men and the oval shape of the MF was more common in women; these trends did not reach statistical significance (Table 3).

The mean distance of MF to the midline was recorded as 23.1 ± 2.6 mm on the right side and 22.8 ± 2.5 mm on the left side. The mean height of MF was 2.8 ± 0.8 mm on the right side and 2.9 ± 0.8 mm on the left side. The mean distance of MF to the alveolar crest was 11.5 ± 3.3 mm and 11.6 ± 3.2 mm on the right and left sides, respectively. The mean distance of MF to the basis of the mandible was 11.6 ± 2.7 mm and 11.8 ± 2.6 mm on the right and left sides, respectively. The mean distance of MF to the lingual plate was 5.2 ± 1.9 mm on the right side and 5.3 ± 1.9 mm on the left side. No significant difference was found between the right and left sides for these variables ($p > 0.05$) (Table 4). The mean length of the anterior loop was 4.8 ± 1.4 mm (ranged from 2.2 mm to 10.8 mm) on the right side and 4.5 ± 1.2 mm on the left side in table 4.

Table 2. Demographic characteristics of MF.

Measurements		Right mandiblen (%)	Left mandiblen (%)	Total n (%)	P value
The "type" description of directional paths of mental foramen	Type 1	33 (18.8%)	27 (15.7%)	60 (17.2%)	
	Type 2	69 (39.2%)	72 (41.9%)	141(40.5%)	0.732*
	Type 3	74 (42%)	73 (42.4%)	147 (42.2%)	
Dentate/Edentulous	Dentate	127 (72.2%)	128 (73.9%)	255 (73.1%)	0.617*
	Edentulous	49(27.8%)	45 (26%)	94 (26.9%)	
MF horizontal location	First premolar mesial	1 (0.6%)	0	1 (0.3%)	
	First premolar	5 (2.8%)	6 (3.5%)	111 (3.2%)	
	Between first and second premolars	92 (52.3%)	97 (56.4%)	189 (54.3%)	
	Second premolar	74 (42%)	67 (39%)	141 (40.5%)	
	Between second premolar and first molar	4 (2.3%)	2 (1.2%)	6 (1.7%)	-
MF vertical localization	Coronal of apex	3 (1.7%)	0	3 (0.9%)	
	Apex level	32(18.3%)	38 (22.1%)	70 (20.2%)	
	Apical of the apex	140 (80%)	134 (77.9%)	274 (79%)	0.164*
MF shape	Round	102 (58.3%)	97 (56.4%)	199 (57.3%)	
	Oval	73 (41.7%)	75 (43.6%)	148 (42.7%)	0.722*

*Pearson chi-square test

Table 3. Demographic characteristics of MF for men and women

Measurements		Right mandible		Left mandible		P value
		Male n (%)	Female n (%)	Male n (%)	Female n (%)	
The "type" description of directional paths of mental foramen	Type 1	13 (18.8%)	20 (18.7%)	14 (21.2%)	13 (12.3%)	0.786† 0.269‡
	Type 2	25 (36.2%)	44 (41.1%)	27 (40.9%)	45 (42.2%)	
	Type 3	31 (44.9%)	43 (40.2%)	25 (37.9%)	48 (45.3%)	
Dentate/Edentulous	Dentate	46 (66.7%)	81 (75.7%)	48 (71.6%)	80 (75.5%)	0,137† 0.818‡
	Edentulous	23 (33.3%)	26 (24.3%)	19 (28.4%)	26 (24.5%)	
MF horizontal location	First premolar mesial	0	1 (.9%)	0	0	
	First premolar	3 (4.3%)	2 (1.9%)	5 (7.6%)	1 (.9%)	-
	Between first and second premolars	37 (53.6%)	55 (51.4%)	32 (48.5%)	65 (61.3%)	
	Second premolar	27 (39.1%)	47 (43.9%)	27 (40.9%)	40 (37.7%)	
	Between second premolar and first molar	2 (2.9%)	2 (1.9%)	0	0	
MF vertical localization	Coronal of apex	1 (1.5%)	2 (1.9%)	0	0	
	Apex level	15 (22.1%)	17 (15.9%)	14 (21.2%)	24 (22.6%)	0.583† 0.975‡
	Apical of the apex	52 (76.5%)	88 (82.2%)	52 (78.8%)	52 (78.8%)	
MF shape	Round	42 (60.9%)	60 (56.6%)	42 (63.6%)	55 (51.9%)	0.576† 0.131‡
	Oval	27 (39.1%)	46 (43.4%)	24 (36.4%)	51 (48.1%)	

*Pearson chi-square test-† Right, ‡ Left

The MIC was visible in all CBCT images. The mean distance from MIC to the alveolar crest was recorded as 15.6 ± 4.4 mm and 15.6 ± 4.3 mm for the right and left sides, respectively. The mean distance from MIC to the basis of the mandible was recorded as 9.1 ± 2.6 mm and 9.3 ± 2.3 mm on the right and left sides, respectively. The mean distance from MIC to the buccal plate was 3.46 ± 1.42 mm on the right side and 3.18 ± 1.22 mm on the left side. The mean length of MIC was 6.3 ± 3.8 mm (ranged from 0.2 to 20) on the right side and 6 ± 3.4 mm (ranged from 0.2 to 21.9) on the left side. No statistically significant differences were observed in the related variables of MIC between the right and left sides (Tables 4).

The distances from the MF to the alveolar crest on the right side (p = 0.009) and the distance from the MF to the basis of the mandible on both sides were found to be significantly higher in men in table 5 (p = 0.001, p = 0.004).

Table 4. Differences in MF distance, loop distance, and incisive canal between right and left sides.

Measurements		n	Mean	Median	Minumum	Maksismum	P value
MF midline distance	Right mandible	176	23.1 ± 2.6	23	17.8	30.2	
	Left mandible	176	22.8 ± 2.5	22.8	15.2	30.3	0.414¶
	Total	352	23.0 ± 2.5	22.8	15.2	30.3	
MF height	Right mandible	176	2.8 ± 0.8	2.8	.8	4.9	
	Left mandible	176	2.9 ± 0.8	2.8	1.4	5	0.274¶
	Total	352	2.0 ± 0.8	2.8	.8	5	
MF to crest distance	Right mandible	176	11.5 ± 3.3	11.8	1.3	19.9	
	Left mandible	176	11.6 ± 3.2	11.8	1.5	18.7	0.768¶
	Total	352	11.5 ± 3.2	11.8	1.3	19.9	
MF to basis distance	Right mandible	176	5.2 ± 1.9	5	1.3	14.2	
	Left mandible	176	5.3 ± 1.9	5.1	1.4	14	0.567¶
	Total	352	5.3 ± 1.9	5	1.3	14.2	
MF to lingual side Distance	Right mandible	176	5.2 ± 1.9	5	1.3	14.2	
	Left mandible	176	5.3 ± 1.9	5.1	1.4	14	0.567¶
	Total	352	5.3 ± 1.9	5	1.3	14.2	
Loop distance	Right mandible	176	4.8 ± 1.4	4.5	2.6	10.8	
	Left mandible	176	4.5 ± 1.2	4.3	2.2	7.6	0.378¶
	Total	352	4.7 ± 1.3	4.4	2.2	10.8	
Incisive diameter (first seen)	Right mandible	176	1.8 ± 0.5	1.8	0.7	3.3	
	Left mandible	176	1.7 ± 0.6	1.7	0.7	3.5	0.101¶
	Total	352	1.7 ± 0.6	1.8	0.7	3.5	
Incisive diameter (last seen)	Right mandible	176	1.06 ± 0.28	1	0.5	2	
	Left mandible	176	1.06 ± 0.3	1	0.4	2.4	0.746¶
	Total	352	1.06 ± 0.29	1	0.4	2.4	
Incisive to crest distance	Right mandible	176	15.6 ± 4.4	16.1	2.6	27	
	Left mandible	176	15.6 ± 4.3	16	3.4	26.6	0.849¶
	Total	352	15.6 ± 4.3	16	2.6	27	
Incisive to basis distance	Right mandible	176	9.1 ± 2.6	9	2.4	23.4	
	Left mandible	176	9.3 ± 2.3	9	4.2	14.5	0.497¶
	Total	352	9.2 ± 2.5	9	2.4	23.4	
Incisive to buccal side distance	Right mandible	176	3.46 ± 1.4	3.3	1	12.6	
	Left mandible	176	3.18 ± 1.2	3.1	1.1	6.5	0.093¶
	Total	352	3.32 ± 1.3	3.2	1	12.6	
Incisive canal length	Right mandible	176	6.3 ± 3.8	5.3	.2	20	
	Left mandible	176	6 ± 3.4	5.2	.2	21.9	0.667¶
	Total	352	6.2 ± 3.6	5.2	.2	21.9	

¶Mann–Whitney U test

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Table 5. Differences between men and women in terms of MF distance, loop distance, and incisive canal.

Measurements			n	Mean	Median	Minumum	Maksimum	P value
MF midline distance	Right mandible	Male	69	23.4 ± 2.5	23.5	18.7	29.2	0.195¶
		Female	107	22.9 ± 2.6	22.7	17.8	30.2	
	Left mandible	Male	66	23.3 ± 2.4	23.1	18.7	30.3	0.074¶
		Female	106	22.5 ± 2.5	22.4	15.2	28.9	
MF height	Right mandible	Male	69	2.9 ± 0.9	2.9	0.8	4.9	0.211¶
		Female	107	2.8 ± 0.7	2.7	1.5	4.7	
	Left mandible	Male	66	3 ± 0.8	3	1.7	5	0.502¶
		Female	106	2.9 ± 0.7	2.8	1.4	5	
MF to crest distance	Right mandible	Male	69	12.3 ± 3.4	12.4	2	19.9	0.009¶
		Female	107	11 ± 3.1	11.3	1.3	17.1	
	Left mandible	Male	66	12.1 ± 3.1	12.3	1.8	17.7	0.101¶
		Female	106	11.2 ± 3.2	11.6	1.3	18.7	
MF to basis distance	Right mandible	Male	69	5.2 ± 2.3	12.9	5.3	17.6	0.001¶
		Female	107	5.2 ± 1.6	11.5	4.1	16.6	
	Left mandible	Male	66	5.3 ± 2.2	13.1	5.6	16.5	0.004¶
		Female	106	5.3 ± 1.7	12	4.3	16.6	
MF to lingual side distance	Right mandible	Male	69	4.9 ± 1.1	4.6	1.3	14.2	0.353¶
		Female	107	4.7 ± 1.5	5.1	1.5	9.5	
	Left mandible	Male	66	4.6 ± 1.1	4.8	1.4	14	0.565¶
		Female	106	4.5 ± 1.2	5.3	2.1	9.4	
Loop distance	Right mandible	Male	30	2 ± 0.5	4.8	3	7.1	0.181¶
		Female	41	1.7 ± 0.5	4.2	2.6	10.8	
	Left mandible	Male	26	1.7 ± 0.6	4.6	2.2	6.7	0.653¶
		Female	47	1.6 ± 0.6	4.2	2.8	7.6	
Incisive diameter (first seen)	Right mandible	Male	67	1.07 ± 0.3	2	0.7	3.1	0.083¶
		Female	107	1.06 ± 0.2	1.7	0.8	3.3	
	Left mandible	Male	66	1.09 ± 0.3	1.8	0.8	3.5	0.067¶
		Female	106	1.04 ± 0.2	1.6	0.7	3.2	
Incisive diameter (last seen)	Right mandible	Male	65	16.6 ± 4.3	1	0.5	2	0.929¶
		Female	107	15 ± 4.3	1	0.6	2	
	Left mandible	Male	66	15.9 ± 4.5	1	0.5	2	0.225¶
		Female	106	15.5 ± 4.2	1	0.4	2.4	
Incisive to crest distance	Right mandible	Male	66	16.6 ± 4.3	17.5	6.2	27	0.026¶
		Female	107	15 ± 4.3	15.2	2.6	23.7	
	Left mandible	Male	66	15.9 ± 4.5	16.5	7.8	26.6	0.622¶
		Female	106	15.5 ± 4.2	15.9	3.4	25.3	
Incisive to basis distance	Right mandible	Male	66	9.8 ± 2.7	9.3	5.2	23.4	0.015¶
		Female	107	8.7 ± 2.5	8.9	2.4	16.9	
	Left mandible	Male	66	9.7 ± 2.1	9.8	5.9	14.4	0.083¶
		Female	106	9.1 ± 2.4	8.9	4.2	14.5	
Incisive to buccal side distance	Right mandible	Male	64	3.4 ± 1.1	3.4	1	7.5	0.558¶
		Female	105	3.4 ± 1.5	3.2	1.6	12.6	
	Left mandible	Male	66	3.2 ± 1.2	3.1	1.2	6.4	0.394¶
		Female	106	3.1 ± 1.2	3.1	1.1	6.5	
Incisive canal length	Right mandible	Male	66	6.8 ± 4.6	5.2	0.5	20	0.788¶
		Female	107	6.1 ± 3.2	5.5	0.2	18.6	
	Left mandible	Male	65	6.4 ± 3.6	5.4	1.8	18.1	0.375¶
		Female	105	5.8 ± 3.2	5.2	0.2	21.9	

¶Mann–Whitney U test

DISCUSSION

The planning of oral surgery in the intraforaminal region, the mental foramen, mental nerve, incisive nerve, and anatomic variations should include the detailed radiographic examination to avoid postoperative complications. The anatomy of the mental nerve becomes important in cases where implants need to be placed distally as much as possible in the intraforaminal region.[3]

The findings of the current study confirmed that the preoperative evaluation of the interforaminal area with CBCT might decrease the risk of surgical complications related with MF, anterior loop, and MIC. The present study demonstrated that the shape of MF was round in 57.3% and oval in 42.7% of the evaluated sides. Also, MF was mostly observed between the first and second mandibular premolar teeth. The location of MF varied depending on the anatomic variations.[8] These results were consistent with previous findings, in which MF was found generally shaped either rounded or oval.[2,9] The present study showed no other significant differences in the shape and location of MF and distances from MF and MIC were found between sexes, apart from the distance from MF to the mandibular basis, which was significantly larger in men than in women. Similarly, Pires et al.[10] and Pereira-Maciel et al.[11] found that the distance from the border was larger in men than in women. It was related to the fact that women had smaller mandibles than men following some previous findings.[4,10,11]

In studies conducted on the Turkish population, Kaya et al.[12] reported that 28% and 34% of the anterior loop was seen on panoramic images and computed tomography scans, respectively. The anterior loop was observed in more than half of the cases (59.5%) in the study of Demir et al.[13]; however, Eren et al.[14] reported that the rate of anterior loop was 86% in their study. Haktanır et al.[15] demonstrated a loop in the continuation of the mental nerve. Arzouman et al.[16] found that the detection rate of the anterior loop on radiography was lower than anatomical measurements. The mean length of the anterior loop in the skulls was found to be 6.95 mm, while it was 3.95 mm in the panoramic radiographs.[16] Studies in which panoramic films were compared with cadaver and CBCT showed that panoramic radiographs might make the anterior loop undetectable, leading to surgical trauma and neurovascular injury. However, some studies on cadavers compared with CBCT images in this region revealed that the loop length was not more than that in CBCT images.[17] A study by Uchida et al.[18] based on cadaver samples found no significant differences in the length of the anterior loop between anatomical measurements and CBCT measurements. The mean length of the anterior loops in the present study was found as 4.7 mm. Neiva et al.[19] found that the mean length of the anterior loop was 4.13 ± 2.04 mm in cadavers.

Nevertheless, some studies obtained different results related to the mean length of the anterior loop.[4,12] Therefore, sufficient information was not available regarding the anterior loop distance for surgical procedures performed in the intraforaminal region. In the present study, the length of the anterior loop varied between 2.2 and 10.8 mm. In the literature, the length of the anterior loop was reported as 1–9 mm.[7,18,19] In a recent study, Gupta et al.[20] measured the length of anterior loops using CBCT; 4.7% of anterior loops on the right side and 7.4% of anterior loops on the left side were found to be longer than 8 mm. Wismeijer et al.[21] recorded sensorial disturbances of the lower lip in only 7% of the cases when performing surgery in the mandibular interforaminal area with a 3-mm safety margin to MF.

In the present study, MIC was observed in all CBCT images, which was in accordance with previous studies.[10,11,22] Mayil et al.[23] observed MIC in 94.2% with CBCT in Turkish population. Similarly, in the study by Pires et al.[10], the MIC was identified in only 11.2% of the patients with panoramic radiographs, while the reported prevalence of MIC was 83.1% with CBCT in the same sample group. Panoramic radiography was found less successful for indicating the MIC; it might be due to the smaller diameter of this anatomic feature, which was also surrounded by less cortical bone compared with the mandibular canal.[11,24]

Although panoramic radiography is a quick and easy method, it is insufficient to visualize details in the anterior of the mandible. A panoramic radiograph has a two-dimensional (2D) image; hence, information on the buccolingual direction is lacking, and images are magnified in vertical and horizontal directions.[25]

CBCT is necessary for advanced surgical procedures in the anterior mandible.[1] Vujanovic-Eskenazi et al.[5] found that CBCT was stronger in identifying the anterior loop than panoramic radiography.

In the present study, the mean MIC lengths on both sides were approximately 6 mm and ranged from 21.9 mm to 0.2 mm. Pires et al.[10] and Pereira-Maciel et al.[11] found no difference in incisive canal length between right and left sides as in this study. Pires et al.[10] found the length as 7.1 ± 4 and 6.6 ± 3.7 mm, respectively. Pereira-Maciel et al.[11] found the mean length of MIC as 9.74 ± 3.89 mm. Mayil et al.[25] observed that the length of MIC changes between 3 and 25 mm, the mean right and left length of MIC were 16.58 ± 4.17 mm and 16.46 ± 4.22 mm, respectively. Different results on the length of MIC showed that CBCT evaluation and measurements from MIC to the alveolar crest and buccal and lingual bases were mandatory before surgical interventions. In the current study the diameter of the MIC ranged from 0.4 mm to 3.5 mm which was similar with other studies.[3, 26] Rosa et al.[3] could not find a correlation between radiological and anatomical MIC diameter. The larger MIC diameter might reduce the implant–bone contact surface and affect osteointegration. In addition, larger-diameter MICs were more likely to have sensory disturbances. Therefore, it was beneficial to evaluate the diameter of MIC.[10]

The present study specified that the mean distance from MIC to the buccal cortex was 3.32 ± 1.3 mm. In accordance with our results, Gilis et al.[22] and Gomes et al.[27] found the MIC was closer to the buccal cortex than to the lingual side. Besides, Prados-Frutos et al.[2] reported that the distance of the MF to the alveolar crest was 13.4 ± 2.8 mm. Especially in grafting operations in the symphysis region, measurement should be made with CBCT to evaluate the depth and borders of the MIC.[28] The depth of the cut depends on its proximity to the MIC and the amount of cortical bone, which helps preserve anatomical structures.

CONCLUSION

Clinicians should be aware of neurovascular structures in the interforaminal region, such as the anterior loop and MIC. Measurements of anatomical structures in the intraforaminal region vary from patient to patient. Therefore, it is beneficial to use CBCT imaging and evaluate preoperatively so as to prevent injury to the neurovascular bundles. Thus, surgical complications can be avoided for both the patient and the clinician.

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