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Evaluation of the alveolar bone and lingual concavity in the posterior mandibular region based on cone-beam computed tomography data

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Abstract

Aim: The objective of this study is to evaluate the morphology of the alveolar bone in the posterior mandibular region and its relationship with age and sex.
Methodology: In the present study, the reports of 500 patients over 18 years of age who were admitted to our faculty with an existing second premolar and missing first molar and who underwent cone-beam computed tomography (CBCT) imaging were randomly selected and retrospectively evaluated. In the study, alveolar crest types, the buccolingual width of the alveolar crest, crest height, lingual concavity depth, and lingual concavity angle were measured.
Results: U-type crest was detected in 47.8% of 500 individuals evaluated using CBCT. The mean depth of the lingual concavities was 2.36 ± 1.11 mm, and the mean angle of the lingual concavities was 61.09 ± 11.33°. No statistically significant relationship was found between age and alveolar crest width, alveolar crest height, lingual concavity depth, and lingual concavity angle. No significant difference was found between genders in terms of lingual concavity depth, whereas alveolar crest width, alveolar crest height, and lingual concavity angle were significantly higher in males.
Conclusion: The alveolar crest height, alveolar crest width, and lingual concavity angle of edentulous crests in the mandibular first molar region were statistically significantly higher in males compared with females. It can be beneficial to evaluate gender-related differences using CBCT to prevent complications before performing implantation and other oral surgical procedures in the related region.

Keywords: Alveolar bone, alveolar crest, lingual concavity, submandibular fossa, implant, cone-beam computed tomography

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Introduction

Implantation treatments are becoming widespread day by day, and as they are doing so, complication rates are also increasing. In this context, a detailed presurgical evaluation of the implant regions to minimize complication rates has gained importance (1).

The lingual concavities in the posterior mandibular region are areas that should be evaluated in detail before surgery. The lingual concavities are the concave anatomical formations located in the lingual part of the mandibular corpus, molar area partly involving the submandibular gland and underneath the mylohyoid line. Many critical anatomical structures, such as arteries and nerves, are present around the lingual concavities related to implant surgery. When planning a surgical procedure in the mandibular molar region, the determination of the localizations of the mentioned anatomical structures and the examination of bone morphology in this area are important for preventing complications (2).

The lingual concavities diffusely located in the posterior mandibular region cannot be detected by two-dimensional radiographs. Increased concavity depth limits implant height and diameter, and it increases the risk of lingual plate perforation. Perforation may lead to unfavorable consequences ranging from implant loss to life-threatening serious complications (3).

Two-dimensional radiographic imaging techniques provide no information about bone width. Manual palpation of the alveolar bone can provide limited information about lingual concavities. Therefore, using three-dimensional imaging techniques is necessary for examining the height, buccolingual width, and morphology of the bone and the relationship of the implant site with the tooth root and neighboring anatomical structures in detail (4).

The objective of the present study is to examine the height and width of the alveolar bone and the frequency of lingual concavities in the posterior mandibular region using CBCT data and to evaluate the results in terms of age and gender to provide guidance for implant planning.

Materials and Methods

Patient Selection

The present study was approved by the Ethics Committee of Dicle University Faculty of Dentistry (Decision no. 2022-24). In our study, the CBCT imaging reports of 500 individuals (258 males and 242 females between 18 and 73 years of age) were retrospectively examined. The CBCT images of all the patients were obtained utilizing a three-dimensional CBCT device (I-CAT®, Model 17-19, Imaging Sciences International, Hatfield, PA, USA) in our university hospital. When positioning patients, the guide light of the device was placed according to the sagittal plane of the patient, the horizontal line was set parallel with the ground and the Frankfort plane, and the voxel size was adjusted to 0.3 mm for CBCT images. The CBCT images, obtained with a 120 kVp and 5 mA current, were reconstructed in 8-9 seconds.

Inclusion criteria of the study:

1. Adequate diagnostic quality for the CBCT image
2. Patients over 18 years of age
3. Patients with existing second premolar and a missing first molar
4. Patients with a crest height of at least 12 mm from the mandibular canal to the crest ridge and a crest width of at least 3.5 mm

Exclusion criteria of the study:

1. Patients below 18 years of age
2. Patients with a crest height of less than 12 mm from the mandibular canal to the crest ridge and a crest width of less than 3.5 mm
3. Patients with any developmental or pathological conditions in the posterior mandibular region (tumors, cysts, fractures, or malformations)
4. CBCT images of inadequate diagnostic quality
5. Images with motion artifacts
6. Images in which the mandibular canal could not be identified
7. CBCT images not showing the complete field of view

The evaluation of the alveolar bone and lingual concavities based on CBCT data

The measurements taken based on coronal tomographic sections in the mandibular first molar region were as follows:

- Buccolingual width 2 mm over the mandibular canal (Wb)
- Buccolingual width 2 mm beneath the crest ridge (Wc)
- The distance from the crest ridge to the Wb line (Ubc)

The crest types were classified according to the definitions established by Chan et al. (5). According to the coronal tomographic images, the crests in which the buccal and lingual bone layers were parallel were grouped as P-type crests, the crests with lingual undercut and concavity were grouped as U-type crests, and the crests with expansion toward the alveolar canal were grouped as C-type crests.

In U-type crests, measurements were also taken to evaluate concavity depth, concavity angle, and the distance from the “P” point which is the most prominent point of the lingual wall, to the enamel-cement border of the 2nd premolar and inferior mandibular border in the lingual plate.

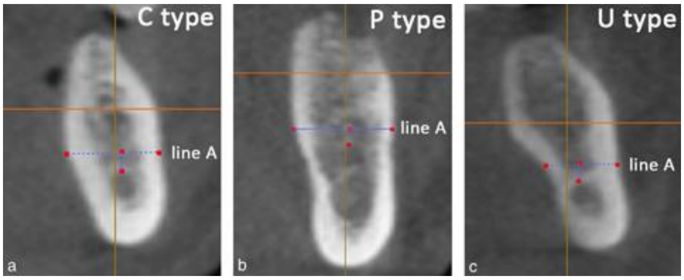

Figure 1. Cross-sectional posterior mandibular morphology is classified into three types (Crest types): (a) C Type, (b) P Type, and (c) U Type. Line A was a 2 mm coronal reference line to IAN (3).

The horizontal distance (concavity depth) between point (A)—the intersection point of horizontal line (A) passing through 2 mm over the mandibular canal and lingual wall—and point (P), the most prominent lingual bone wall

The vertical distance between point (P) and the enamel-cement border (Vp)

The vertical distance between point (P) and the inferior mandibular border (Vb)

The angle (concavity angle) between lines (A) and (B), which connects points (A) and (P), were measured.

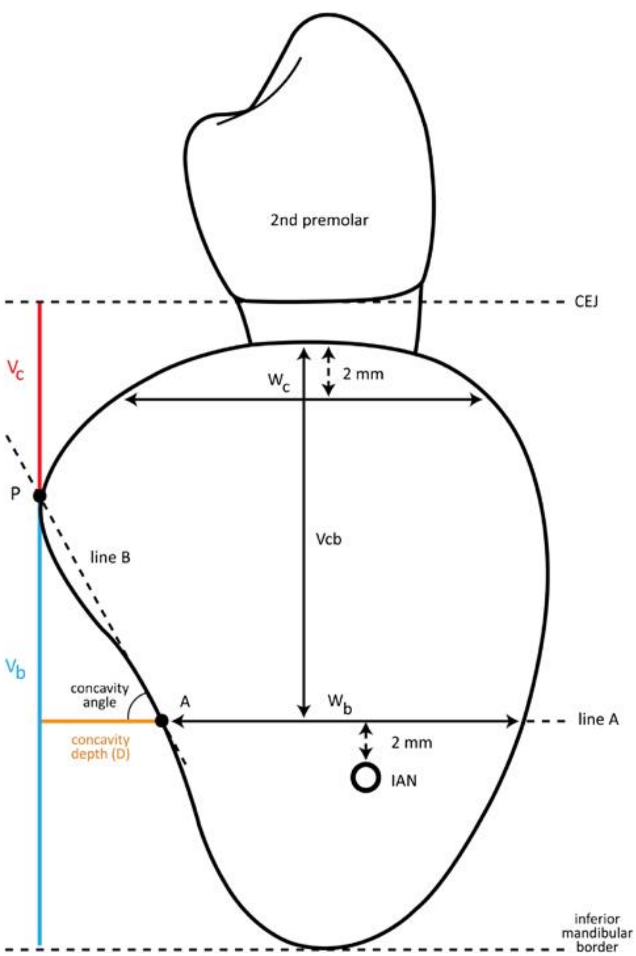

Figure 2. A schematic presentation of mandibular size and lingual concavity measurements (5).

Statistical analysis

The analysis was conducted using SPSS 21.0 software (IBM Corp., Armonk, NY, USA).

The Shapiro-Wilk and/or Kolmogorov-Smirnov tests were used to assess the variables' distribution normality due to the number of units. The significance level was 0.05; the variables were non-normally distributed when $p < 0.05$, whereas when $p > 0.05$, they were normally distributed.

When the variables were non-normally distributed, the Mann-Whitney U test was used for two-group comparisons, while comparisons among more than two groups were performed using the Kruskal-Wallis H test. The post hoc multiple comparison test was employed to analyze the differences between the groups identified by the Kruskal-Wallis H test. The relationships between the non-normally distributed variables were evaluated using Spearman's correlation coefficient, while the Pearson correlation coefficient was utilized to evaluate the relationships between the normally distributed variables. The significance level was set at 0.05 for the results evaluation the results. It was accepted that there was a statistically significant difference at $p < 0.05$ but not at $p > 0.05$.

Results

Of the study participants, 38% were aged 35 years or younger, while 62% were aged over 35 years. The study population was 51.6% male and 48.4% female. In terms of crest type, 33.4%, 18.8%, and 47.8% of individuals had C-type, P-type, and U-type crests, respectively (Table 1).

Table 1. Frequency distribution table.

		n	%
Age group	35 years old and under	190	38
	Over 35 years old	310	62
	Total	**500**	**100**
Sex	Male	258	51.6
	Female	242	48.4
	Total	**500**	**100**
Type of crest	C	167	33.4
	P	94	18.8
	U	239	47.8
	Total	**500**	**100**

The mean age was 42.07 years. Mean Wc, mean Wb, mean Ubc, mean Ubc, mean angle, mean depth, mean Vc, and mean Vb were 6.29 mm, 10.56 mm, 13.95 mm, 61.09 mm, 2.36 mm, 13.49 mm, and 16.64 mm, respectively (Table 2).

Table 2. Parameter distribution table.

	n	Mean	Median	Min	Max	Sd
Age	500	42.07	44	18	73	14.08
Gc	500	6.29	6.1	2.6	12.3	1.95
Gb	500	10.56	10.6	4.5	17.7	2.17
Ubc	500	13.95	13.8	7.8	22.8	2.82
Angle	239	61.09	62.7	34.2	84.6	11.33
Depth	239	2.36	2.1	0.6	6.6	1.11
Vc	239	13.49	13.2	3.9	21.5	3.66
Vb	239	16.64	15.9	8.9	29.7	4.06

No statistically significant relationship was present between age and the Wc, Wb, Ubc, angle, depth, and Vb values ($p > 0.05$). There was a statistically significant relationship between age and the Vc values ($p < 0.05$). This correlation was positive and weak (r = 0.154). The Vc values also increased with age. A statistically significant relationship was present between the Wc and Wb, Ubc, angle, depth, and Vb values ($p < 0.05$). This correlation was positive and weak (r = 0.378). The Wb, Ubc, angle, depth, and Vb values increased with the Wc values. There was a statistically significant relationship between the Wc and Vc values ($p < 0.05$). This correlation was negative and weak (r = –0.187). The Vc values decreased as the Wc values increased. No statistically significant relationship was present between the Wb and Ubc, angle, depth, Vc, and Vb values ($p > 0.05$). A statistically significant relationship was present between Ubc and depth values (p>0.05). A statistically significant relationship was present between the Ubc and angle, and the Vc and Vb values ($p < 0.05$). This correlation was positive and weak (r = 0.359). The angle values increased with the Ubc values. There was a statistically significant relationship between the angle values and the depth and Vc values ($p < 0.05$). The correlation was negative and weak (r = -0.252). The depth values decreased as the angle values increased. A statistically significant relationship was present between the angle and Vb values ($p < 0.05$). This correlation was positive and moderate (r = 0.567). The Vb values increased with the angle values. There was a statistically significant relationship between the depth and Vc values ($p < 0.05$). A negative and weak correlation was found (r = –0.332). The Vc values decreased as the depth values increased. A statistically significant relationship was present between the depth and Vb values ($p < 0.05$). This correlation was positive and weak (r = 0.313). The Vb values increased with depth. There was a statistically significant relationship between the Vc and Vb values ($p < 0.05$). This correlation was negative and moderate (r = -0.538). The Vb values decreased as the Vc values increased (Table 3).

Table 3. Results of the correlation analysis of the parameter relationships.

		Age	Gc	Gb	Ubc	Angle	Depth	Vc
Gc	r	-0.067						
	p	0.137						
	n	500						
Gb	r	0.016	378**					
	p	0.727	**0.001**					
	n	500	500					
Ubc	r	-0.079	198**	0.03				
	p	0.076	**0.001**	0.504				
	n	500	500	500				
Angle	r	-0.059	.160*	0.071	.359**			
	p	0.361	**0.013**	0.276	**0.001**			
	n	239	239	239	239			
Depth	r	-0.017	.129*	-0.084	0.109	-.252**		
	p	0.79	**0.047**	0.196	0.094	**0.001**		
	n	239	239	239	239	239		
Vc	r	.154*	-.187**	-0.006	.205**	-.305**	-.332**	
	p	**0.017**	**0.004**	0.929	**0.001**	**0.001**	**0.001**	
	n	239	239	239	239	239	239	
Vb	r	-0.042	.386**	0.05	.306**	.567**	.313**	-.538**
	p	0.518	**0.001**	0.443	**0.001**	**0.001**	**0.001**	**0.001**
	n	239	239	239	239	239	239	239

No statistically significant difference was present between age groups in terms of the Wc, Wb, angle, depth, Vc, and Vb values ($p > 0.05$). There was a statistically significant difference between the groups' Ubc values ($p < 0.05$). The Ubc values for individuals over 35 years of age were significantly lower than those of participants aged 35 years and younger (Table 4).

Table 4. Analysis results of differences between age groups by parameter.

		Age group						Mann-Whitney U testi		
		n	Mean	Median	Min	Max	Sd	Mean Rank	z	p
Gc	35 years and under	190	6.35	6.3	2.6	12.3	1.81	257.44	-0.841	0.4
	Over 35 years old	310	6.26	6.05	2.6	12	2.03	246.25		
	Total	500	6.29	6.1	2.6	12.3	1.95			
Gb	35 years and under	190	10.44	10.55	4.5	17.7	2.28	244.38	-0.741	0.459
	Over 35 years old	310	10.63	10.6	4.6	16.5	2.11	254.25		
	Total	500	10.56	10.6	4.5	17.7	2.17			
Ubc	35 years and under	190	14.27	14	9	22.8	2.95	268.08	-2.131	**0.033**
	Over 35 years old	310	13.75	13.75	7.8	22	2.73	239.73		
	Total	500	13.95	13.8	7.8	22.8	2.82			
Angle	35 years and under	89	61.07	63	34.2	84.3	10.72	121.42	-0.244	0.807
	Over 35 years old	150	61.1	62.6	38	84.6	11.71	119.16		
	Total	239	61.09	62.7	34.2	84.6	11.33			
Depth	35 years and under	89	2.61	2.2	0.8	6.6	1.41	126.04	-1.042	0.298
	Over 35 years old	150	2.21	2.1	0.6	4.5	0.86	116.42		
	Total	239	2.36	2.1	0.6	6.6	1.11			
Vc	35 years and under	89	12.9	12.	3.9	20.4	3.86	109.46	-1.816	0.069
	Over 35 years old	150	13.85	13.8	5.2	21.5	3.51	126.25		
	Total	239	13.49	13.2	3.9	21.5	3.66			
Vb	35 years and under	89	16.8	16	11	29.7	4.48	120.16	-0.027	0.978
	Over 35 years old	150	16.54	15.9	8.9	27	3.8	119.91		
	Total	239	16.64	15.9	8.9	29.7	4.06			

There was a statistically significant difference between genders in terms of the Wc, Wb, Ubc, angle, and Vb values ($p < 0.05$). The females' Wc, Wb, Ubc, angle, and Vb values were significantly lower than those of the males. No statistically significant difference was present between genders in terms of the depth and Vc values ($p > 0.05$; Table 5).

There was a statistically significant difference between crest types in terms of Wc values ($p < 0.05$). The Wc values of the C-type crests were statistically significantly lower than those of the U- and P-type crests, while the Wc values of the U-type crests were significantly lower than those of the P-type crests. A statistically significant difference in Wb values ($p < 0.05$) was present between crest types. The Wb values of the U-type crests were statistically significantly lower than those of the P- and C-type crests. There was a statistically significant difference in the Ubc values ($p < 0.05$) of the crest types. The Ubc values of the C-type crests were significantly lower than those of the U-type crests (Table 6).

Table 5. Analysis results of differences between genders by parameter.

		Sex						Mann Whitney U test		
		n	Mean	Median	Min	Max	Sd	Mean Rank	z	p
Gc	Man	258	6.8	6.4	2.7	12.3	1.96	286.82	-5.806	**0.001**
	Woman	242	5.76	5.5	2.6	10.4	1.78	211.78		
	Total	500	6.29	6.1	2.6	12.3	1.95			
Gb	Man	258	10.84	11	4.6	17.7	2.28	270	-3.117	**0.002**
	Woman	242	10.26	10.3	4.5	16.5	2.02	229.71		
	Total	500	10.56	10.6	4.5	17.7	2.17			
Ubc	Man	258	14.54	14.3	9.1	22.8	2.88	278.63	-4.498	**0.001**
	Woman	242	13.32	13.3	7.8	21	2.62	220.51		
	Total	500	13.95	13.8	7.8	22.8	2.82			
Angle	Man	120	63.63	63.85	38.6	84.6	10.18	133.43	-3.016	**0.003**
	Woman	119	58.53	57.5	34.2	84.3	11.89	106.46		
	Total	239	61.09	62.7	34.2	84.6	11.33			
Depth	Man	120	2.37	2.1	0.6	6.6	1.2	119.09	-0.204	0.838
	Woman	119	2.34	2.1	0.7	5.5	1.03	120.92		
	Total	239	2.36	2.1	0.6	6.6	1.11			
Vc	Man	120	13.64	13.8	5.2	21.5	4.03	122.09	-0.469	0.639
	Woman	119	13.35	12.9	3.9	19.5	3.26	117.89		
	Total	239	13.49	13.2	3.9	21.5	3.66			
Vb	Man	120	18.21	17.7	12	29.7	4.16	146.63	-5.983	**0.001**
	Woman	119	15.05	14.4	8.9	24.5	3.27	93.14		
	Total	239	16.64	15.9	8.9	29.7	4.06			

Table 6. Analysis results of the differences in crest types by parameter.

		Tip of crest						Kruskal-Wallis H test		
		n	Mean	Median	Min	Max	Sd	Mean Rank	H	p
Gc	C	167	5.49	5.4	2.6	10.8	1.64	188.57	79.946	**0.001**
	P	94	7.62	7.8	2.7	11.1	1.64	354.97		
	U	239	6.34	6.1	2.6	12.3	1.97	252.68		
	Total	500	6.29	6.1	2.6	12.3	1.95	C-U C-P U-P		
Gb	C	167	11.09	11	4.6	17.7	2.07	287.72	22.811	**0.001**
	P	94	10.75	10.6	6.3	14.4	1.75	263.13		
	U	239	10.11	10.2	4.5	15.9	2.3	219.52		
	Total	500	10.56	10.6	4.5	17.7	2.17	U-P U-C		
Ubc	C	167	13.19	13	7.8	18.3	2.46	213.95	16.915	**0.001**
	P	94	14.06	13.8	9	22	2.81	257.19		
	U	239	14.43	14	8	22.8	2.96	273.41		
	Total	500	13.95	13.8	7.8	22.8	2.82	C-U		

Discussion

Implantation treatments are becoming more widespread every day, which also increases complication rates. Consequently, radiographic implant evaluation has gained importance. Dentistry employs two- and three-dimensional radiographic imaging techniques prior to implant operations (1). Panoramic radiographs—from which horizontal measurements of vertical bone size and baseline evaluation at varying degrees of magnification (depending on the imaging device brand and imaging techniques) can be taken—are not ideal for implant dentistry use because they cannot provide three-dimensional images and present low-quality diagnostic images due to distortion and magnification (6).

Although bone amount and anatomical localization for implant insertion can be visualized using panoramic and periapical radiographs, three-dimensional evaluation by sectional images is a more preferable choice for implant success. The implant angle—the buccolingual width of the existing alveolar bone and vertical size with a higher accuracy rate compared to conventional two-dimensional radiographies—can be measured using sectional tomographic imaging (7).

The size and localization of lingual concavities are measured by performing mucosa and bone thickness measurements using an osteometer; palpating the lingual region and taking two-dimensional radiographs do not provide consistent data. CBCT use is recommended for evaluating critical anatomical structures, such as lingual concavity and mandibular nerve, before implant operations because these imaging techniques have higher resolutions, provide reliable three-dimensional data, and clearly visualize anatomical variations (8, 9).

Complications such as lingual plate perforations, nerve injuries, and hemorrhage may occur in the mandibular molar edentulous spaces during implant preparation, depending on the lingual concavities' depth and anatomical obstacles, such as the mandibular nerve and concavities (10).

Lingual concavity perforation, a commonly seen anatomical structure during implant treatment, may cause complications. Infection, dehiscence, fenestration, soft tissue inflammation, and mouth floor hemorrhage may develop after perforation. A hemorrhage in the floor of the mouth may be life threatening if the retropharyngeal region is affected. Therefore, mandibular morphology should be evaluated using three-dimensional CBCT images prior to implant placement in the posterior mandible. The implant should be placed appropriately with the mandibular morphology to improve implant planning and treatment, prevent complications, and avoid buccal and lingual plate perforations (11, 12).

In our study, edentulous mandibular first molar crests were distributed into three groups according to the morphology in their coronal tomographic sections. Lingual cortical plates were classified as P-type crests if they were parallel, C-type crests if there was expansion toward the mandibular canal, and U-type crests if there was lingual concavity. Crest morphology is a factor that directly affects lingual plate perforation. The perforation risk for the U-type crests was higher than for the P- and C-type crests (3, 13).

The lingual plate perforation rate was 26.8% in a study that evaluated perforation risk during implant operations in the posterior mandible based on CBCT data in 2018. Notably, 87.5% of these lingual plate perforations occurred in U-type crests (3). In another study conducted in 2011 that used 4-mm diameter implants, the lingual plate perforation rates were 7%, 9%, and 31% in the second premolar, first molar, and second molar, respectively (14). In our study subjects, P-, C-, and U-type crests were detected at rates of 18.8%, 33.4%, and 47.8%, respectively.

Herranz-Aparicio et al. (11) found a U-type crest (crest with lingual undercut) prevalence of 68%, while Chan et al. (5) determined a 66% prevalence rate for U-type crests. Huang et al. (7) and Nickening et al. (7) obtained similar results—56.2% and 56%, respectively. The concavity frequency in edentulous crests was 60.5% in Bayrakdar and Bilgir's (1) study on 109 patients to examine 200 dentated and edentulous first molar regions. They also encountered dentated crest concavity at a rate of 77.1%. Watanabe et al. (6) determined a concavity frequency of 39%, while Megat (12) ascertained a concavity frequency of 32%. The different prevalence rates of U-type crests in various study results may be attributable to the use of varied classifications, measurement methods, study populations, and ethnicities (1).

Braut et al. examined posterior mandibles in 127 patients using CBCT and reported that lingual concavity was discovered in 42.5% of the edentulous regions and that concavity depth could be effective in 10.2% of these regions (15). Souza et al. examined the posterior mandibular region in 100 patients who lost premolar and molar teeth and measured their lingual concavity depths. They reported that the lingual concavities' depth could induce risks during implant surgery in 19% of individuals with lingual concavities. The individual with the deepest lingual concavity had a depth of 5 mm (16).

The lingual concavity perforation rate increases in parallel with increased depth and decreased angle in the lingual concavities. It has been emphasized that the perforation and complication rates increase with lingual concavities deeper than 2 mm and at an angle less than 60 degrees (17, 18). In our study, the mean depth and mean angle of the lingual concavities were 2.36 mm and 61.09 degrees, respectively. A study that examined the lingual concavities based on sectional tomographic images in 2011 (17) assessed the means of the lingual concavity depth and angle at 2.4 mm and 57.7 degrees, respectively, while the mean lingual concavity depth and mean concavity angle were found to be 3.03 mm and 63.34 degrees, respectively (17).

Parnia et al. discovered a mean concavity depth of 2.6 mm in their volumetric tomography study conducted on 100 patients using computed tomography in 2010 (19). The individual with the deepest lingual concavity had a concavity depth of 6.6 mm. Kamburoğlu et al. (20) declared the mean depths of lingual concavities in the right and left hemimandibles to be 2.26 mm and 2.24 mm, respectively. Our study aligns with the aforementioned studies.

According to our results, concavity angle, depth, Wc, Ubc and Vb values were not correlated with age. Similarly, two studies conducted in 2010 and 2021 found that concavity angle and depth were not correlated with age (1,19). However, while Panjnoush et al. (22) stated that concavity angle and depth decrease with age, Yoon et al. (23) reported that concavity depth and frequency increase with age.

In a 2021 retrospective study examining the posterior mandible, a statistically significant inverse relationship was discovered between age and crest ridge width (Wc), the width of the upper end of the canal and the vertical bone height over the canal (1). In our study, no significant relationship was determined between age and these parameters. Megat (12) encountered a negative correlation between age and Wc, Ubc, Vc and depth values, which is consistent with the study of Panjnous et al. mentioned above (22). This may result from the flattening of the "P" due to resorption associated with age. In the present study, no statistically significant difference was found between those younger than and those over 35 years in terms of lingual concavity depth.

Vhatkar et al. concluded there was no significant difference between groups aged below and over 35 years in terms of lingual concavity depth in their study (24). However, Bural et al. (25) and Nilsun et al. (26) measured lingual concavity depth and reported that it was significantly higher in patients over 35 years old. Nilsun et al. concluded that higher concavity depth in this group was not associated with age, instead stating that it may be connected with the fact that the edentulousness rate is higher in those over 35 years of age compared with those under 35 years. Akın et al. evaluated the relationship between age and tooth loss. According to their statistical analysis, severity of tooth loss significantly increases with age (27). In light of such information, the different outcomes of these studies may be associated with their various populations and inclusion criteria.

In our study, Wc, Wb, Ubc, angle and Vb were found to be significantly higher in males. However, no significant difference was found between sexes in terms of Vc and concavity depth values. A significant inverse relationship was determined between angle and depth. The significantly higher Wc, Wb and Ubc values in males demonstrate that their bone morphology is more suitable for use of the ideal size implants compared with females. In our study, concavity angle was also found to be significantly higher in males. The higher concavity angle reduces the rate of lingual plate perforation and potential complications (18).

In research that examined the mandibular first molar regions for guidance in implant planning, significantly higher distance values from the horizontal line passing 2 mm over the mandibular canal to the crest ridge (Ubc) were discovered in males than females, making their results similar to those found in our study. In the same study, as opposed to our results, there was no statistically significant difference between sexes in terms of Wb and concavity angle (1). Souza et al. (16) carried out a study to evaluate the correlation between the anatomical factors, such as concavity depth, crest height and crest width, that affect implant planning for the prevention of complications in the posterior mandible, and they reported that sex had no impact on crest height and width.

In a study that evaluated the posterior mandible based on tomographic sections, the Wc value, which is the crest width 2 mm below the crest ridge, was significantly higher in males. However, there was no statistically significant difference between sexes in terms of Wb value (the crest width 2 mm over the mandibular canal) and Ubc value (the distance of the horizontal line passing 2 mm over the mandibular canal to the crest ridge) (5). Herranz-Aparicio et al. reported that sex is independent from crest ridge, width and height but the Wb value was significantly higher in males than females (11).

Additionally, Watanabe et al. (6), Megat (12) and Yoon et al. (23), who conducted a CT study on 104 patients, concluded that there was no statistically significant relationship between sex and the prevalence of concavity. However, Kamburoğlu et al. reported in their study conducted on 500 patients that males had a higher frequency of lingual concavity than females (20). Finally, Borahan et al. found that lingual concavities shallower than 2 mm were more prevalent in females (28).

In the abovementioned studies, the various methods employed by the researchers for the evaluations performed on the tomographic sections, the use of different CBCT devices and the diverse racial backgrounds of the study populations might have resulted in different study outcomes (11).

Conclusion

The use of CBCT is often preferred in dental practice to determine the appropriate implant length and angle. CBCT is also a suitable choice for the evaluation of anatomical structures, such as the dimensions of the alveolar bone, mandibular nerve and lingual concavity in the posterior region. As a result of not evaluating the posterior mandible well before implant surgery and other oral surgical procedures, complications, such as damage to the mandibular nerve, perforation of the lingual cortical layer, hemorrhage due to artery damage and numbness of the tongue from lingual nerve damage, can occur.

In order to prevent complications in the posterior mandible, it is important to know the depth, frequency and crest width and height of the lingual concavities, as well as how these variables differ depending on age and sex. The differences in the results of the studies in the literature reveal that a detailed three-dimensional radiographic evaluation is required before implant treatment for each patient.

Disclosures

Ethical Approval: Ethics committee approval was received for this study from Dicle University, Faculty of Dentistry, Research Ethics Committee, in accordance with the World Medical Association Declaration of Helsinki, with the approval number: 2022/24.

Peer-review: Externally peer-reviewed.

Author Contributions: Conception – G.D.; Design – G.D., F.İ.; Supervision - F.İ.; Materials - G.D., F.İ.; Data Collection and/or Processing – G.D., F.İ.; Analysis and/or Interpretation – G.D.; Literature Review – G.D., F.İ.; Writer – G.D.; Critical Review – F.İ.

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