The thickness of posterior buccal attached gingiva at common miniscrew insertion sites in subjects with different facial types

Özer Alkan[a] and Yeşim Kaya[b]
Ankara and Van, Turkey

Introduction: The purpose of this study was to assess the thicknesses of maxillary and mandibular posterior buccal approximal attached gingiva at common miniscrew insertion sites, which has critical importance in determining miniscrew length, in subjects with different facial types. **Methods:** One hundred seventy-four subjects with no transversal skeletal discrepancy were included in this study. The facial types of these subjects were evaluated in the sagittal and vertical directions. In the sagittal direction, the subjects were assigned into 3 groups: skeletal Class I, II, and III. Also, each of these groups was divided into subgroups in the vertical direction: low angle, norm, and high angle. Transgingival probing was used to measure the thickness of the buccal attached gingiva. **Results:** The thickness of the buccal attached gingiva between the second premolar-first molar ranged from 1.18 ± 0.33 to 1.46 ± 0.28 mm and from 1.28 ± 0.30 to 1.58 ± 0.37 mm in the maxilla and mandible, respectively. The thickness of the buccal attached gingiva between the first-second molars ranged from 1.31 ± 0.41 to 1.60 ± 0.62 mm and from 1.36 ± 0.43 to 1.72 ± 0.52 mm in the maxilla and mandible, respectively. In terms of the thicknesses of the buccal attached gingiva of second premolar-first molar and first-second molars, no statistically significant difference was found between subjects with different facial types. **Conclusions:** It was determined that the thicknesses of maxillary and mandibular posterior buccal approximal attached gingiva varied between 1.18-1.72. At this point, the insertion of miniscrews of 7-8 mm in length was recommended for maxillary and mandibular posterior buccal regions, in order to obtain adequate insertion depth. (Am J Orthod Dentofacial Orthop 2019;156:800-7)

Anchorage, which is an important factor in achieving treatment goals in orthodontics, is defined as resistance to unwanted tooth movements.[1,2] In the past, extraoral and intraoral appliances were commonly used for anchorage reinforcement.[2,3] However, anchorage loss was observed with the use of intraoral appliances, and extraoral appliances do not provide reliable anchorage without patient cooperation.[3] For this reason, skeletal anchorage reinforcement methods such as a dental implant, miniplate, and miniscrew have become widespread.[2,3]

The advantages of miniscrew, compared with miniplates and dental implants, are small size, availability of many inserting regions in the oral cavity, low cost, and easy insertion and removal.[3,4] However, during the use of miniscrew, complications including inflammation and infection of the soft tissue, injury to the adjacent structures and lack of initial stability can be observed.[5,6] Among these, the lack of initial stability is related to many factors such as the angulation of miniscrew to the bone, insertion torques, facial types, insertion sites, quality and quantity of cortical bone, length of miniscrew, and thickness of the gingiva.[1,5,6]

The insertion depth of the miniscrew, which is recommended to be a minimum of 6 mm, is more important than the quality and quantity of cortical bone or its location for initial stability.[5,7,8] In addition, the body of scholarly research demonstrates that the length of the miniscrews inserted in the interradicular space varied between

[a]From the Department of Orthodontics, Faculty of Dentistry, Yıldırım Beyazıt University, Ankara, Turkey.
[b]Department of Orthodontics, Faculty of Dentistry, Yüzüncü Yıl University, Van, Turkey.
All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and none were reported.
Address correspondence to: Yeşim Kaya, Department of Orthodontics, Faculty of Dentistry, Yüzüncü Yıl University, P.O. Box: 65050, Van, Turkey; e-mail, yesimkaya82@hotmail.com.
Submitted, September 2018; revised and accepted, December 2018.
0889-5406/$36.00

https://doi.org/10.1016/j.ajodo.2018.12.024

6-12 mm.[8,9] Therefore, the thickness of the gingiva at the miniscrew insertion sites have become an important factor in determining the length of the miniscrew.[5]

The thickness of the gingiva may vary because of the anatomical sites in the mouth and seems to be influenced by age, gender, development and growth, tooth shape and position, and facial types.[10,11] In addition, it has been determined that the interradicular space between maxillary and mandibular second premolar-first molars and first-second molars are the most appropriate anatomical sites for miniscrew insertion.[8,12,13]

This study aimed to investigate the thickness of the buccal approximal attached gingiva at common miniscrew insertion sites, which have critical importance in determining miniscrew length, in subjects with different facial types. Although some studies have evaluated the thicknesses of maxillary and mandibular posterior buccal approximal attached gingiva with different measurement techniques,[5,14,15] no study in the literature has evaluated it in subjects with different facial types. The alternative (H_1) hypothesis was that the thicknesses of posterior buccal approximal attached gingiva vary based on different facial types.

MATERIAL AND METHODS

The study comprised 108 females (mean age: 17.47 ± 4.10 years) and 66 males (mean age: 16.64 ± 2.80 years) all of whom presented to the Department of Orthodontics, Faculty of Dentistry at Van Yüzüncü Yıl University, between June 2017 and June 2018. Informed consent of the participants in the study was obtained. The study protocol was approved by the Ethics Committee of Faculty of Medicine, of Van Yüzüncü Yıl University (B.30.2.YYU.0.01.00.00/33).

The inclusion criteria included no previous orthodontic treatment, no transversal skeletal discrepancy, no systemic disease and related medication, no antibiotics medication within the last 6 months, no pregnancy and lactation, and no history of fixed or removable prosthodontic restorations. Subjects with gingival swelling, destructive periodontal disease, severe posterior crowding, permanent teeth extraction, and ectopically positioned teeth were not included in this study.

Periodontal evaluation of the subjects was performed from the mesial and distal surfaces of all teeth, using a periodontal probe (PQW7 Williams; Hu-Friedy, Chicago, Ill; Fig 1). Plaque index,[16] gingival index,[17] and probing pocket depth were recorded.

For assigning the subjects to a facial type, lateral cephalometric radiographs taken with the Sirona Orthophos XG imaging system (Bensheim, Germany) were used. All images were obtained under standard conditions; the teeth were in centric occlusion with relaxed and closed lip position, the Frankfurt horizontal plane parallel to the floor and the sagittal plane at right angles to the path of the X-ray. Then, these images were traced digitally with NemoCeph NX 2005 (Nemotec, Madrid, Spain) program by one investigator (Y.K.).

ANB angle was examined as to whether the subjects belonged to the skeletal Class I, II, or III groups, in the sagittal direction. Then, each of these groups was evaluated according to SN/GoGn angle for assigning the subjects to low angle, norm, and high angle groups in the vertical direction. A total of 9 groups were created. 2.65 ± 1.63° and 31.66 ± 5.25° were accepted as norm values for ANB and SN/GoGn angles, respectively.[18]

The thicknesses of buccal approximal attached gingiva were examined from the interradicular space between the second premolar-first molars and first-second molars, in the maxilla and mandible. The measurements were performed 4-6 mm apical from the cementoenamel junction in the maxilla and as apical as possible in the mandible, with transgingival probing under topic anesthesia (Xylocaine spray, Vemcain 10% lidocaine; Vem, Istanbul, Turkey; Fig 2).

A 10-mm endodontic spreader (G-Star Medical, Guangdong, China) with silicon stopper was perpendicularly positioned to the long axis of the interradicular space and inserted into the soft tissue until feeling resistance of the alveolar bone. After the silicon stopper was adjusted to be in contact with the gingiva, the endodontic spreader was carefully removed. The penetration depth between the tip of the endodontic spreader and silicon stopper was registered using a digital caliper with 0.01-mm sensitivity (Mitutoyo Corporation, Kanagawa, Japan).

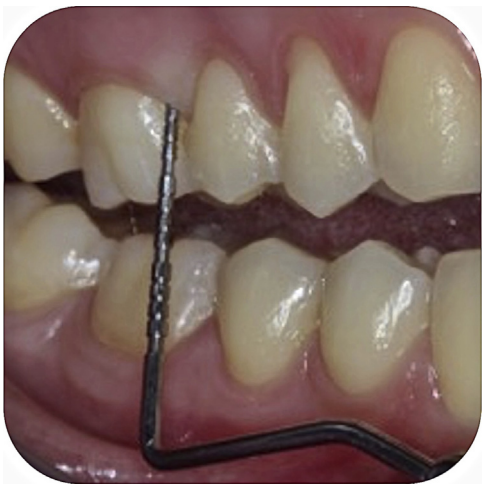

Fig 1. Pocket probing depth measurement using a periodontal probe.

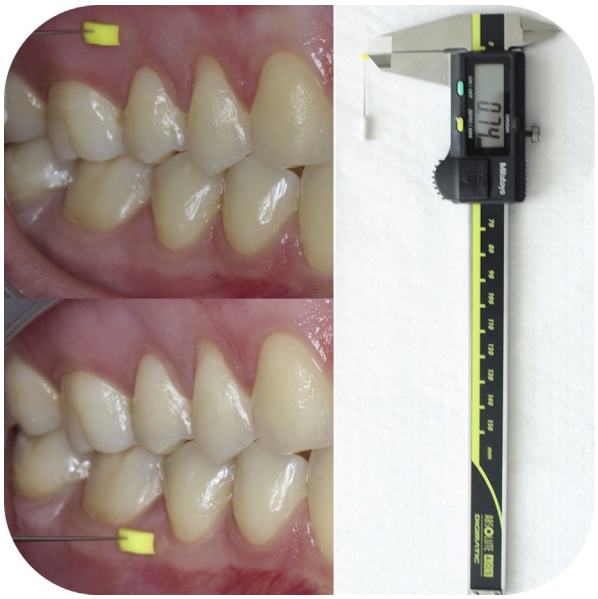

Fig 2. Measurements of the thicknesses of maxillary and mandibular buccal approximal attached gingiva.

For each region, all measurements were repeated twice at 10-minute intervals by the same investigator (Y.K.). After the arithmetical mean of these 2 measurements, the gingival thickness of each region was determined. Spearman's correlation coefficient was used to evaluate the intraexaminer agreement and was high (0.932; $P < 0.001$).

Statistical analysis

Descriptive statistics for the considered parameters were presented as mean, standard deviation (SD), and minimum and maximum values. Factorial variance analysis (2-way ANOVA) was performed to determine whether there was any difference concerning different facial types in the sagittal and vertical direction. Following the factorial variance analysis, Duncan multiple-range test was performed to determine significant differences among the groups in case of significant P values. All statistical analyses were carried out using SPSS software for Windows software (version 22.0; IBM, Armonk, N.Y.) and the level of statistical significance was set at 5%.

Because the SD ranged from 0.2-1.0 in previous studies, we considered the SD to be 0.8. Furthermore, for the 5% type I error, the effect size and Z value were assumed to be 0.4 and 1.96, respectively. Based on this information, the sample size was found to be minimum 15.4 ($\cong 15$) according to the equation of sample size calculation ($n = Z^2\ \sigma^2/d^2$).

RESULTS

The plaque index, gingival index and probing pocket depth measurements used in the periodontal evaluation were not statistically significant between the groups (Table I). Also, in terms of the ANB and SN/GoGn angles, no statistically significant difference was found between the different vertical classifications in the same sagittal group and the different sagittal classifications in the same vertical group, respectively (Table II).

In the maxilla, generally, males had significantly thicker buccal approximal attached gingiva than females, except for right second premolar-first molars. However, in the mandible the thickness of buccal approximal attached gingiva showed no significant difference between females and males (Table III).

There was no statistically significant difference between the right and left sides of the same jaw in the

Table I. Plaque index, gingival index, and probing depth measurements

		Vertical classification						
		Low angle		*Norm*		*High angle*		
	Skeletal classification	*n*	*Mean ± SD*	*n*	*Mean ± SD*	*n*	*Mean ± SD*	P *value*
Plaque index	Skeletal Class I	20	1.09 ± 0.14	20	1.15 ± 0.28	20	1.08 ± 0.10	0.491
	Skeletal Class II	20	1.16 ± 0.35	20	1.10 ± 0.12	20	1.21 ± 0.31	0.488
	Skeletal Class III	18	1.20 ± 0.22	18	1.16 ± 0.21	18	1.25 ± 0.26	0.563
	P value		0.364		0.690		0.081	
Gingival index	Skeletal Class I	20	0.43 ± 0.50	20	0.41 ± 0.48	20	0.44 ± 0.58	0.362
	Skeletal Class II	20	0.37 ± 0.43	20	0.43 ± 0.57	20	0.31 ± 0.41	0.750
	Skeletal Class III	18	0.28 ± 0.37	18	0.30 ± 0.43	18	0.58 ± 0.55	0.69
	P value		0.121		0.720		0.317	
Probing depth (mm)	Skeletal Class I	20	1.68 ± 0.47	20	1.75 ± 0.42	20	1.97 ± 0.30	0.187
	Skeletal Class II	20	1.77 ± 0.40	20	1.95 ± 0.30	20	1.73 ± 0.54	0.244
	Skeletal Class III	18	1.67 ± 0.44	18	1.70 ± 0.34	18	1.75 ± 0.57	0.884
	P value		0.222		0.182		0.232	

Table II. Cephalometric measurements

		Vertical classification						
		Low angle		Norm		High angle		
	Skeletal classification	n	Mean ± SD	n	Mean ± SD	n	Mean ± SD	P value
ANB angle	Skeletal Class I	20	3.99 ± 7.58[b]	20	2.70 ± 0.85[b]	20	2.93 ± 0.84[b]	0.622
	Skeletal Class II	20	6.01 ± 1.13[a]	20	5.63 ± 1.01[a]	20	7.03 ± 1.90[a]	0.321
	Skeletal Class III	18	−1.12 ± 1.62[c]	18	−1.19 ± 1.51[c]	18	-1.32 ± 0.89[c]	0.148
	P value		0.001*		0.001*		0.001*	
SN/GoGn angle	Skeletal Class I	20	24.06 ± 2.65[f]	20	32.71 ± 1.67[e]	20	41.14 ± 4.88[d]	0.001†
	Skeletal Class II	20	25.21 ± 1.85[f]	20	33.52 ± 1.61[e]	20	39.90 ± 3.25[d]	0.001†
	Skeletal Class III	18	25.16 ± 2.14[f]	18	32.18 ± 2.28[e]	18	40.44 ± 3.94[d]	0.001†
	P value		0.212		0.970		0.631	

Mean values with same subscript are not significantly different from each other.
*Significant difference [a, b, c] between the saggital classification (I, II, II) in same vertical group (low, normal, and high); †Significant differences [d, e, f] between the different vertical classifications (low, normal, and high) in the same sagittal group (I, II, II).

thickness of the buccal approximal attached gingiva. The thickness of buccal attached gingiva between the second premolar-first molar ranged from 1.18 ± 0.33 to 1.46 ± 0.28 mm and from 1.28 ± 0.30 to 1.58 ± 0.37 mm in the maxilla and mandible, respectively. Also, the thicknesses of buccal attached gingiva between the first-second molars ranged from 1.31 ± 0.41 to 1.60 ± 0.62 mm and from 1.36 ± 0.43 to 1.72 ± 0.52 mm in the maxilla and mandible, respectively. No statistically significant difference was found between the subjects with different facial types, in the gingival thicknesses of buccal attached gingiva between the maxillary and mandibular second premolar-first molar and first-second molars (Tables IV and V).

DISCUSSION

During insertion, miniscrews are placed close to the dental roots for both soft and hard tissues by perforating the gingiva, periost, cortical, and cancellous bone.[19] Maximum initial stability is achieved when adequate length of miniscrew is inserted in a site with the thickest cortical bone and thinnest soft tissue.[14,15,19] The thickness of the gingiva may vary because of the anatomical sites in the mouth and seem to be influenced by the facial types.[10] This study aimed to investigate the thicknesses of the buccal attached gingiva between the maxillary and mandibular second premolar-first molar and first-second molars at common miniscrew insertion sites, in subjects with different facial types.[8,12,13]

The thickness of the cortical bone is higher in the mandible than the maxilla, in the posterior region of the jaw than the anterior region, and the low angle subjects than the high angle subjects.[20,21] Also, the thickness of the cortical bone is maximal at 4-6 mm away from the cementoenamel junction in the maxilla and increased gradually in the apical direction in the mandible.[12,14,20] However, miniscrews inserted within alveolar mucosa cause gingival tissue inflammation, resulting in failure, although miniscrews inserted within attached gingiva show >90% success rate.[8,22] In a study that did not include subjects with severe skeletal discrepancy and high mandibular plane angle, the buccal approximal gingival thicknesses of all teeth from the central incisors to molars were evaluated by transgingival

Table III. Thickness of maxillary and mandibular buccal attached gingiva

			Females		Males		
			n	Mean ± SD	n	Mean ± SD	P value
Maxilla	Right	2nd premolar-1st molar	108	1.22 ± 0.30	66	1.30 ± 0.29	0.100
		1st molar-2nd molar	108	1.36 ± 0.41	66	1.48 ± 0.30	0.040
	Left	2nd premolar-1st molar	108	1.27 ± 0.33	66	1.47 ± 0.34	0.001
		1st molar-2nd molar	108	1.37 ± 0.44	66	1.51 ± 0.31	0.025
Mandible	Right	2nd premolar-1st molar	108	1.37 ± 0.37	66	1.40 ± 0.34	0.597
		1st molar-2nd molar	108	1.51 ± 0.42	66	1.55 ± 0.35	0.540
	Left	2nd premolar-1st molar	108	1.41 ± 0.45	66	1.44 ± 0.31	0.602
		1st molar-2nd molar	108	1.60 ± 0.44	66	1.66 ± 0.39	0.398

Table IV. Thickness of maxillary buccal attached gingiva between second premolar and first molar and between first molar and second molar

		Vertical classification						
		Low angle		Norm		High angle		
	Sagittal classification	n	Mean ± SD	n	Mean ± SD	n	Mean ± SD	P value
Right								
2nd premolar-1st molar	Skeletal Class I	20	1.18 ± 0.33	20	1.22 ± 0.27	20	1.35 ± 0.29	0.146
	Skeletal Class II	20	1.25 ± 0.30	20	1.29 ± 0.36	20	1.26 ± 0.34	0.924
	Skeletal Class III	18	1.24 ± 0.25	18	1.32 ± 0.29	18	1.25 ± 0.33	0.685
	P value		0.756		0.375		0.577	
1st molar- 2nd molar	Skeletal Class I	20	1.36 ± 0.36	20	1.37 ± 0.32	20	1.45 ± 0.44	0.127
	Skeletal Class II	20	1.37 ± 0.38	20	1.58 ± 0.50	20	1.35 ± 0.32	0.334
	Skeletal Class III	18	1.32 ± 0.32	18	1.37 ± 0.25	18	1.50 ± 0.43	0.304
	P value		0.351		0.136		0.282	
Left								
2nd premolar-1st molar	Skeletal Class I	20	1.23 ± 0.36	20	1.37 ± 0.47	20	1.46 ± 0.28	0.156
	Skeletal Class II	20	1.24 ± 0.30	20	1.39 ± 0.31	20	1.27 ± 0.29	0.335
	Skeletal Class III	18	1.25 ± 0.28	18	1.41 ± 0.33	18	1.45 ± 0.37	0.181
	P value		0.354		0.955		0.110	
1st molar- 2nd molar	Skeletal Class I	20	1.31 ± 0.41	20	1.38 ± 0.29	20	1.55 ± 0.42	0.121
	Skeletal Class II	20	1.32 ± 0.42	20	1.47 ± 0.47	20	1.37 ± 0.39	0.335
	Skeletal Class III	18	1.34 ± 0.34	18	1.42 ± 0.36	18	1.60 ± 0.62	0.243
	P value		0.354		0.743		0.318	

Two-way (factorial) analysis of variance was performed (interaction is not statistically significant).

probing at 2, 4, and 6 mm from the cementoenamel junction. They concluded that comparison within interradicular sites showed no statistically significant difference in buccal approximal gingival thickness, except for the lateral incisor and canine interradicular site at the 2-mm level and the second premolar and first molar site at the 4- and 6-mm level.[22] In our study, the measurement regions were also determined to be 4-

Table V. Thickness of mandibular buccal attached gingiva between second premolar and first molar and between first molar and second molar

		Vertical classification						
		Low angle		Norm		High angle		
	Sagittal classification	n	Mean ± SD	n	Mean ± SD	n	Mean ± SD	P value
Right								
2nd premolar-1st molar	Skeletal Class I	20	1.30 ± 0.33	20	1.28 ± 0.30	20	1.54 ± 0.54	0.113
	Skeletal Class II	20	1.43 ± 0.39	20	1.46 ± 0.34	20	1.39 ± 0.40	0.833
	Skeletal Class III	18	1.48 ± 0.39	18	1.55 ± 0.35	18	1.52 ± 0.54	0.899
	P value		0.129		0.162		0.295	
1st molar- 2nd molar	Skeletal Class I	20	1.60 ± 0.52	20	1.52 ± 0.37	20	1.64 ± 0.28	0.636
	Skeletal Class II	20	1.54 ± 0.49	20	1.71 ± 0.38	20	1.61 ± 0.42	0.488
	Skeletal Class III	18	1.65 ± 0.45	18	1.68 ± 0.42	18	1.72 ± 0.52	0.904
	P value		0.792		0.259		0.686	
Left								
2nd premolar-1st molar	Skeletal Class I	20	1.29 ± 0.50	20	1.32 ± 0.24	20	1.45 ± 0.29	0.341
	Skeletal Class II	20	1.33 ± 0.37	20	1.39 ± 0.33	20	1.38 ± 0.32	0.594
	Skeletal Class III	18	1.48 ± 0.43	18	1.41 ± 0.37	18	1.58 ± 0.37	0.471
	P value		0.383		0.691		0.129	
1st molar- 2nd molar	Skeletal Class I	20	1.36 ± 0.43	20	1.48 ± 0.33	20	1.57 ± 0.27	0.117
	Skeletal Class II	20	1.42 ± 0.35	20	1.56 ± 0.41	20	1.53 ± 0.36	0.472
	Skeletal Class III	18	1.58 ± 0.66	18	1.63 ± 0.34	18	1.61 ± 0.31	0.938
	P value		0.402		0.174		0.418	

Two-way (factorial) analysis of variance was performed (interaction is not statistically significant).

6 mm away from the cementoenamel junction in the maxilla and as apical as possible, but within the attached gingiva in the mandible.

Different measurement techniques are used in studies evaluating the thickness of the gingiva. Among these, it has been observed that the clinician's experience is an essential factor in visual inspection,[23] the small changes cannot be correctly detected with an ultrasonic device,[24] and although the results of cone-beam computed tomography are very close to reality, they are not preferred because of radiation.[25] Besides, a study, comparing the periodontal probing with transgingival probing, concluded that the coherence was lower between the 2 techniques for teeth with gingival thickness of 0.8-1.0 mm.[26] However, the correlation between the transgingival probing and cone-beam computed tomography was found to be high in 2 separate studies comparing these 2 techniques.[27,28] For this reason, we also used transgingival probing in the measurement of gingival thickness in our study.

Conflicting results were obtained in studies evaluating the relationship between gingival thicknesses measured from different regions of the jaws using different measurement techniques based on gender. Maxillary and mandibular anterior regions were assessed in 2 studies in which the gingival thicknesses of the maxillary and mandibular anterior 6 teeth were measured from the midbuccal region using transgingival probing. Vandana and Savitha[10] stated that the difference between genders was not significant both in the maxilla and mandible, whereas Kolte et al[29] reported no significant difference between genders in the mandible but significantly greater gingival thickness in males in the maxilla.

Furthermore, the gingival thicknesses of interdental areas were evaluated in 2 other studies using ultrasonic device. Among these, Cha et al[15] compared all interdental areas and found that the difference between genders was not significant in the mandible, while it was significantly higher in males in the maxilla for 4 areas between central-lateral incisors, lateral incisor-canine, canine-first premolar, and second premolar-first molar. Parmar et al[5] assessed the gender-related differences in the gingival thickness of buccal attached gingiva at common miniscrew insertion sites. They concluded that females had thicker gingiva between the canine-first premolar in the maxilla, whereas males had between the first-second molars. In the present study, the thickness of buccal approximal attached gingiva also showed no significant difference between genders in the mandible. Moreover, in the maxilla males had significantly thicker buccal approximal attached gingiva than the females except for right second premolar-first molar.

No study in the literature has evaluated the thicknesses of maxillary and mandibular posterior buccal approximal attached gingiva in subjects with different facial types. Only 1 study of 17 female and 15 male subjects with skeletal Class I jaw base and Angle Class I malocclusion with an average mandibular plane angle has evaluated the thickness of buccal approximal attached gingiva with ultrasonic device. The result of this study shows that the thicknesses of the buccal attached gingiva between the second premolar-first molar were 1.29 ± 0.11 and 1.22 ± 0.10 mm in the maxilla and 1.14 ± 0.15 and 1.14 ± 0.17 mm in the mandible for female and male subjects, respectively. They also reported that the thicknesses of the buccal attached gingiva between the first-second molars were 1.46 ± 0.15 and 1.34 ± 0.12 mm in the maxilla and 1.50 ± 0.18 and 1.62 ± 0.20 mm in the mandible for female and male subjects, respectively.[5]

In one of our study groups, we also investigated 20 subjects with skeletal Class I jaw base with an average mandibular plane angle. Consistent with these results, the thicknesses of buccal attached gingiva between the second premolar-first molar were 1.22 ± 0.27 and 1.37 ± 0.47 mm in the maxilla and 1.28 ± 0.30 and 1.32 ± 0.24 mm in mandible. Also, the thicknesses of buccal attached gingiva between the first-second molars were 1.37 ± 0.32 and 1.38 ± 0.29 mm in the maxilla and 1.52 ± 0.37 and 1.48 ± 0.33 mm in the mandible, respectively.

In 2 separate studies conducted with Koreans, the thickness of posterior buccal approximal attached gingiva was evaluated with different measurement techniques in terms of miniscrew stability. However, no information was given about the skeletal sagittal, vertical and transversal relation of the subjects, included in these studies. Among these, Kim et al[14] concluded that the thicknesses of buccal approximal attached gingiva, in 23 cadavers at 2-, 4-, 6-, 8-, and 10-mm levels, were thinnest in the middle and thickest close to and farthest from the cementoenamel junction. They also informed that the thicknesses of buccal attached gingiva between the second premolar-first molars were 1.07 ± 0.37 and 1.02 ± 0.34 mm at 4- and 6-mm levels from the cementoenamel junction, respectively. The thicknesses of buccal attached gingiva between the first-second molars were 0.78 ± 0.30 and 0.77 ± 0.41 mm at 4- and 6-mm levels from the cementoenamel junction, respectively.

Cha et al[15] investigated the thickness of buccal approximal attached gingiva adherent to the mucogingival junction with ultrasonic device in 33 female and 28 male subjects. They found that the thicknesses of the buccal attached gingiva between second

premolar-first molar were 1.09 ± 0.20 and 1.23 ± 0.32 mm in the maxilla and 1.05 ± 0.15 and 1.11 ± 0.21 mm in the mandible for female and male subjects, respectively. Also, the thicknesses of the buccal attached gingiva between the first-second molars were 1.05 ± 0.15 and 1.11 ± 0.21 in the maxilla and 1.53 ± 0.45 and 1.61 ± 0.44 in the mandible, for female and male subjects, respectively.

The results of our study conducted with subjects with different facial types except those with no transversal skeletal discrepancy show that the thicknesses of buccal attached gingiva between the second premolar-first molar ranged from 1.18 ± 0.33 to 1.46 ± 0.28 mm and from 1.28 ± 0.30 to 1.58 ± 0.37 mm in the maxilla and mandible, respectively. Also, the thicknesses of buccal attached gingiva between the first-second molars ranged from 1.31 ± 0.41 to 1.60 ± 0.62 mm and from 1.36 ± 0.43 to 1.72 ± 0.52 mm in the maxilla and mandible, respectively. In terms of the thickness of the buccal approximal attached gingiva, no statistically significant difference was found between subjects with different facial types.

A systematic review and meta-analysis evaluating the miniscrew failure rates in orthodontics reported that miniscrews of >8 mm in length have lower failure rates than miniscrews of ≤8 mm in length.[30] Furthermore, another study investigating the stability of secondarily inserted miniscrews after failure of the initial insertion reported that miniscrew length was significantly associated with stability and the success rate was significantly higher when using 8-mm miniscrews than 6-mm miniscrews.[31] In our study, it was observed that the thickness of the buccal approximal attached gingiva varied between 1.18-1.72 mm. For this reason, miniscrews of 7-8 mm in length are recommended for the maxillary and mandibular posterior buccal regions in subjects with different facial types, consistent with the previous studies' results.[5]

The fact that the subjects belonging to different age groups where the number of females and males are equal are not assessed and that only one population is assessed is the main limitation of this study. For this reason, it is suggested that a new study is conducted with different populations and more subjects where the number of females and males are equal, belonging to different age groups.

CONCLUSIONS

1. No statistically significant difference was found between the thicknesses of maxillary and mandibular posterior buccal approximal attached gingiva and different facial types.
2. The thicknesses of maxillary and mandibular posterior buccal approximal attached gingiva varied between 1.18-1.72.

REFERENCES

1. Papadopoulos MA, Tarawneh F. The use of miniscrew implants for temporary skeletal anchorage in orthodontics: a comprehensive review. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2007;103:e6-15.
2. Lim HJ, Choi YJ, Evans CA, Hwang HS. Predictors of initial stability of orthodontic miniscrew implants. Eur J Orthod 2011;33:528-32.
3. Park HS, Jeong SH, Kwon OW. Factors affecting the clinical success of screw implants used as orthodontic anchorage. Am J Orthod Dentofacial Orthop 2006;130:18-25.
4. Poggio PM, Incorvati C, Velo S, Carano A. "Safe Zones": A guide for miniscrew positioning in the maxillary and mandibular arch. Angle Orthod 2006;76:191-7.
5. Parmar R, Reddy V, Reddy SK, Reddy D. Determination of soft tissue thickness at orthodontic miniscrew placement sites using ultrasonography for customizing screw selection. Am J Orthod Dentofacial Orthop 2016;150:651-8.
6. Papageorgiou SN, Zogakis IP, Papadopoulos MA. Failure rates and associated risk factors of orthodontic miniscrew implants: a meta-analysis. Am J Orthod Dentofacial Orthop 2012;142:577-95.e7.
7. Tseng YC, Hsieh CH, Chen CH, Shen YS, Huang IY, Chen CM. The application of mini-implants for orthodontic anchorage. Int J Oral Maxillofac Surg 2006;35:704-7.
8. Deguchi T, Nasu M, Murakami K, Yabuuchi T, Kamioka H, Takano-Yamamoto T. Quantitative evaluation of cortical bone thickness with computed tomographic scanning for orthodontic implants. Am J Orthod Dentofacial Orthop 2006;129:721.e7-12.
9. Yi Lin S, Mimi Y, Ming Tak C, Kelvin Weng Chiong F, Hung Chew W. A study of success rate of miniscrew implants as temporary anchorage devices in Singapore. Int J Dent 2015;2015:294670.
10. Vandana KL, Savitha B. Thickness of gingiva in association with age, gender and dental arch location. J Clin Periodontol 2005;32:828-30.
11. Matarese G, Isola G, Ramaglia L, Dalessandri D, Lucchese A, Alibrandi A, et al. Periodontal biotype: characteristic, prevalence and dimensions related to dental malocclusion. Minerva Stomatol 2016;65:231-8.
12. Fayed MM, Pazera P, Katsaros C. Optimal sites for orthodontic mini-implant placement assessed by cone beam computed tomography. Angle Orthod 2010;80:939-51.
13. Monnerat C, Restle L, Mucha JN. Tomographic mapping of mandibular interradicular spaces for placement of orthodontic mini-implants. Am J Orthod Dentofacial Orthop 2009;135:428.e1-9.
14. Kim HJ, Yun HS, Park HD, Kim DH, Park YC. Soft-tissue and cortical-bone thickness at orthodontic implant sites. Am J Orthod Dentofacial Orthop 2006;130:177-82.
15. Cha BK, Lee YH, Lee NK, Choi DS, Baek SH. Soft tissue thickness for placement of an orthodontic miniscrew using an ultrasonic device. Angle Orthod 2008;78:403-8.
16. Silness J, Löe H. Periodontal disease in pregnancy II. Correlation between oral hygiene and periodontal condition. Acta Odontol Scand 1964;22:121-35.
17. Löe H, Silness J. Periodontal disease in pregnancy I. Prevalence and severity. Acta Odontol Scand 1963;21:533-51.
18. Basciftci FA, Uysal T, Buyukerkmen A. Craniofacial structure of Anatolian Turkish adults with normal occlusions and well- balanced faces. Am J Orthod Dentofacial Orthop 2004;125:366-72.

19. Baumgaertel S. Hard and soft tissue considerations at mini-implant insertion sites. J Orthod 2014;41:S3-7.
20. Baumgaertel S, Hans MG. Buccal cortical bone thickness for mini-implant placement. Am J Orthod Dentofacial Orthop 2009;136:230-5.
21. Ozdemir F, Tozlu M, Germec-Cakan D. Cortical bone thickness of the alveolar process measured with cone-beam computed tomography in patients with different facial types. Am J Orthod Dentofacial Orthop 2013;143:190-6.
22. Lim WH, Lee SK, Wikesjö UM, Chun YS. A descriptive tissue evaluation at maxillary interradicular sites: implications for orthodontic mini-implant placement. Clin Anat 2007;20:760-5.
23. Eghbali A, De Rouck T, De Bruyn H, Cosyn J. The gingival biotype assessed by experienced and inexperienced clinicians. J Clin Periodontol 2009;36:958-63.
24. Slak B, Daabous A, Bednarz W, Strumban E, Maev RG. Assessment of gingival thickness using an ultrasonic dental system prototype: a comparison to traditional methods. Ann Anat 2015;199:98-103.
25. Korostoff J, Al-Abdulhadi M, Stathopoulou PG. The use of cone beam computed tomography to assess periodontal biotype. Curr Oral Health Rep 2018;5:202-9.
26. Ayhan Alkan EA, Alkan Ö, Kaya Y, Keskİn S. Comparison the reliability of two different measurement techniques used to determine the gingival biotype. Turkiye Klinikleri J Dental Sci 2016;22:42-7.
27. Alves PHM, Alves TCLP, Pegoraro TA, Costa YM, Bonfante EA, de Almeida ALPF. Measurement properties of gingival biotype evaluation methods. Clin Implant Dent Relat Res 2018;20:280-4.
28. Borges GJ, Ruiz LF, de Alencar AH, Porto OC, Estrela C. Cone-beam computed tomography as a diagnostic method for determination of gingival thickness and distance between gingival margin and bone crest. ScientificWorldJournal 2015;2015:142108.
29. Kolte R, Kolte A, Mahajan A. Assessment of gingival thickness with regards to age, gender and arch location. J Indian Soc Periodontol 2014;18:478-81.
30. Alharbi F, Almuzian M, Bearn D. Miniscrews failure rate in orthodontics: systematic review and meta-analysis. Eur J Orthod 2018;40:519-30.
31. Uesugi S, Kokai S, Kanno Z, Ono T. Stability of secondarily inserted orthodontic miniscrews after failure of the primary insertion for maxillary anchorage: maxillary buccal area vs midpalatal suture area. Am J Orthod Dentofacial Orthop 2018;153:54-60.