Original Article

Periodontal Parameters in Different Dentofacial Vertical Patterns

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ABSTRACT

Objective: To assess periodontal parameters in a Jordanian population in individuals with three different facial types.

Materials and Methods: Forty-five dental students (ages 20–26 years) with short, average, and long face heights were divided into three equal groups. The plaque index, gingival index, gingival thickness, width of keratinized gingiva, and width of attached gingiva were measured in each group. Occlusal factors, including the dynamic occlusion and the presence or absence of premature contacts were recorded. Differences among the three groups were assessed using Student's *t*-test, chi-square test, and analysis of variance (ANOVA) test.

Results: No differences were present in the plaque index, gingival index, gingival attachment, width of attached and keratinized gingiva and gingival thickness between the subjects in the three groups studied. None of the subjects in the long face group had canine guidance dynamic occlusion.

Conclusions: There were no differences in the periodontal parameters between the different dentofacial vertical patterns, but there was a difference in the canine guidance dynamic occlusion.

KEY WORDS: Periodontal; Vertical

INTRODUCTION

Periodontal tissues can withstand forces as long as they are within their adaptive capacity.[1] However, when occlusal forces exceed the adaptive capacity of periodontal tissues, injury results causing occlusal trauma. Occlusal trauma is defined as injury resulting in tissue changes within the attachment apparatus because of occlusal forces.[2]

To determine a cause-and-effect relationship between occlusal trauma and periodontal disease, several animal studies have been carried out. Polson and co-workers[3–6] used a squirrel monkey model, while Lindhe, Svanberg and Ericsson[7–10] used a beagle dog model. In both models, excessive jiggling forces accompanied by healthy gingiva resulted in hypermobility and bone resorption. They concluded that occlusal trauma does not initiate gingivitis or attachment loss, but in the presence of plaque and periodontal disease, occlusal trauma may play a role in the progression of periodontal disease.

It is generally accepted that there is a relationship between occlusal forces and facial morphology. Three basic types of facial morphology exist: short face, average, and long face. Long face has excessive vertical facial growth. It is usually associated with anterior open bite and an increased sella-nasion (SN)/mandibular plane angle, gonial angle, and maxillary/mandibular planes angle.[11–12] Short face has reduced vertical growth. It is usually accompanied by deep anterior overbite, reduced facial heights, and reduced SN/mandibular plane angle.[13] Between the two types lies the average face.[14] The relationship between bite force and craniofacial morphology has been investigated.[15–18] The mean bite force in the molar region was twice as great for average face subjects as compared with long face subjects, while short face subjects had still higher maximum forces than the normal face subjects.[16]

To our knowledge, no study has been reported exploring the relationship between facial morphology and periodontal health. Therefore, this study would be the first to investigate the relationship between facial

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Table 1. Distribution of Subjects, Mean, and Standard Deviation for Age in the Three Groups Studied

	Number		Age		
	Female	Male	Male	Female	Total
Group 1					
Short face	5	10	22.1 ± 0.7	21.6 ± 0.9	22.0 ± 0.8
Group 2					
Average face	8	7	22.5 ± 1.0	21.8 ± 0.9	22.1 ± 1.0
Group 3					
Long face	9	6	21.6 ± 2.2	20.4 ± 0.2	20.9 ± 1.4

height and periodontal health. The aim of this study was to compare periodontal parameters among subjects with different vertical facial heights.

MATERIALS AND METHODS

Three hundred sixty dental students at Jordan University of Science and Technology were screened, and 45 subjects (23 male and 22 female) were divided into three equal groups. The age of the subjects ranged between 20–26 years, with a mean age of 22 ± 0.8, 22.1 ± 1.0, and 20.9 ± 1.4 in Groups 1, 2, and 3, respectively. Gender and age distribution are shown in Table 1.

The objectives and methodology were explained for all participants and written consents were obtained. The subjects were divided into three groups based on maxillomandibular planes angle (Max/Mand) and degree of anterior overlap.

Group 1 included 15 short-faced students with deep anterior overbite.
Group 2 included 15 average faced students with normal overbite, which served as a control group.
Group 3 included 15 long faced students with anterior open bite.

Subjects included in this study had Class I skeletal pattern, no previous orthodontic treatment; no missing posterior teeth other than third molars; no large carious cavities or filling in permanent first molars and no posterior crossbites. The clinical examination was performed at Jordan University of Science and Technology Dental Teaching Center.

All subjects reported tooth-brushing one to two times daily with regular dental visits. The periodontal condition was recorded using the following parameters and indices measured on the buccal surfaces of all permanent canines, all premolars, and all permanent first molars:

Plaque index (PI) was measured as described by Silness and Löe.[19]
Gingival index (GI) was measured as recommended by Löe and Silness.[20]
The periodontal probing depth (PD) was defined as the distance from the free gingival margin to the bottom of gingival sulcus or the pocket.
The clinical attachment level (CAL) was defined as the distance from the cementoenamel junction (CEJ) to the bottom of the gingival sulcus or the pocket.
Keratinized gingival (KG) width was defined as the distance from the free gingival margin to the mucogingival junction.
Attached gingival (AG) width was defined as the distance from the bottom of the gingival sulcus or the pocket to the mucogingival junction.
The gingival thickness was recorded as:
Thin: the outline of periodontal probe is showing through gingiva.
Adequate: the outline of periodontal probe is not showing through gingiva.

Subjects were examined in a dental chair using a sterile dental mirror and periodontal probe. A standardized Michigan 0 periodontal probe with William's markings (Diatech, Diatech Dental AC, Heerbrugg, Switzerland) was used in measuring periodontal pockets, clinical attachment level, and the keratinized and attached gingival widths. The occlusal examination included dynamic occlusion and presence of premature contact. The dynamic occlusion was classified into canine guidance or group function occlusion. Canine guidance occlusion is defined as upon lateral mandibular movements the only tooth-to-tooth contact is between the canines of the working side. Group function occlusion was defined as lateral mandibular movements producing multiple posterior teeth on the working side contacting their antagonists. Alginate impressions were taken for each student together with a wax bite record and poured the same day by an orthodontic technician. The number of tooth wear facets and teeth in contact were detected on the dental casts.

To allocate subjects to their groups, lateral cephalograms were taken for each participant in centric occlusion with lips in repose and Frankfort plane horizontal according to natural head position, using an Orthoslice 1000 C (Trophy, Marne La Vallee Cedex 2, France) cephalostat at 64 KV, 16 mA, and 0.64 seconds exposure. Cephalograms were traced manually and analyzed using the following angular and linear measurements (Figure 1):

SNA: angle between sella – nasion – Point A
SNB: angle between sella – nasion – Point B
ANB: angle between Point A – nasion – Point B
Maxillary/mandibular planes angle (MM angle): angle between maxillary and mandibular planes
Posterior face height: distance from Ar-Go
Total anterior face height (TAFH): distance from Na-Me

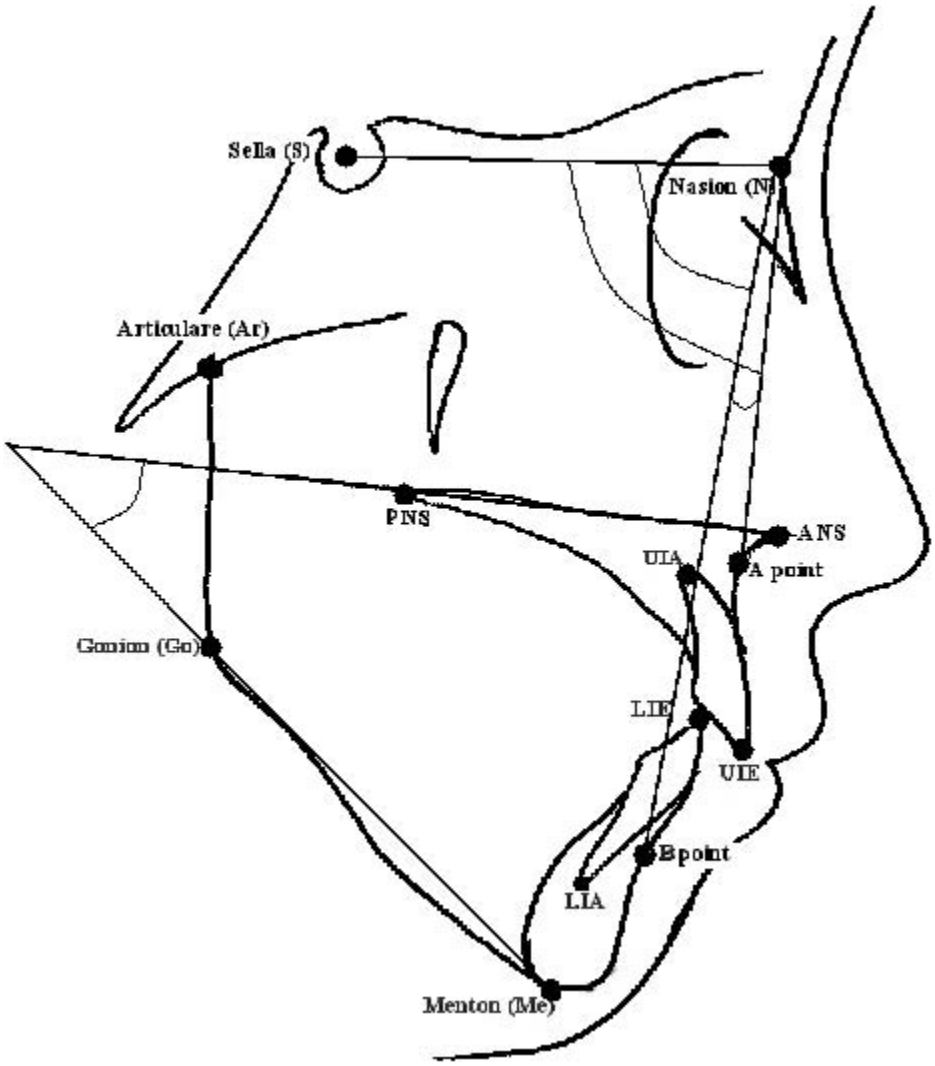

Figure 1. Cephalometric points and planes.

Lower anterior face height (LAFH): distance from ANS-Me
Facial proportions (FP%) = LAFH/TAFH × 100%
Overbite (OB): the vertical distance between the incisal edges of upper and lower incisors
Overjet (OJ): the horizontal distance between the incisal edges of upper and lower incisors

Method Error

The reliability of the measurements was assessed by reexamining and remeasuring records for 10 subjects with an interval of 1 week. Kappa statistics[21] were used to evaluate the errors in categorical data. Results of the kappa values were above 80%, which indicates substantial agreement between readings.[22] Method errors for numerical variables were examined using Dahlberg's method error[23] and Houston's coefficients.[24] Dahlberg's error ranged between 0.1 and 0.2, and Houston's coefficients of reliability were above 90% for all the measurements, indicating good agreement.

Statistical Analysis

Data analysis was carried out using the Statistical Package for Social Science (SPSS, version 10, SPSS Inc, Chicago, Ill). Descriptive data were tabulated. The probing depth values were measured at three sites for each examined tooth and were averaged. Analysis of variance (ANOVA) was used to determine whether significant differences existed between the studied groups. LSD multiple comparison test was applied to identify which groups were different.

RESULTS

Cephalometric Radiographs

Means, standard deviations, and differences between the means for cephalometric measurements in

Table 2. Means, Standard Deviations, and Differences Between the Means for Cephalometric Measurements in the Three Groups

Cephalometric Measurements	Group 1	Group 2	Group 3	Groups 1 & 2		Groups 1 & 3		Groups 2 & 3	
	Mean ± SD	Mean ± SD	Mean ± SD	Mean Difference	*P* Value[a]	Mean Difference	*P* Value[a]	Mean Difference	*P* Value[a]
SNA, degrees	82.82 ± 2.52	82.03 ± 3.09	81.77 ± 4.49	0.79	NS	1.06	NS	0.27	NS
SNB, degrees	80.00 ± 2.81	78.67 ± 3.17	78.77 ± 5.20	1.33	NS	1.23	NS	0.10	NS
ANB, degrees	2.82 ± 0.43	3.37 ± 2.36	3.00 ± 2.49	0.55	NS	0.18	NS	0.37	NS
MM angle, degrees	18.54 ± 3.73	28.07 ± 2.20	33.90 ± 3.16	9.53	***	15.36	***	5.83	***
PFH, mm	52.14 ± 6.20	47.07 ± 5.27	47.20 ± 4.87	5.08	*	4.94	*	0.30	NS
TAFH, mm	120.07 ± 7.11	122.00 ± 6.62	125.67 ± 10.17	1.93	NS	5.60	NS	3.67	NS
LAFH, mm	64.93 ± 5.23	69.07 ± 3.90	74.40 ± 8.17	4.14	NS	9.47	***	5.33	*
LAFH/TAFH, FP%	54.04 ± 2.15	56.64 ± 2.16	59.17 ± 2.68	2.61	**	5.08	***	2.47	**
Overbite, mm	5.21 ± 0.87	3.13 ± 1.38	−2.40 ± 1.80	2.08	***	7.61	***	5.53	***
Overjet, mm	2.82 ± 1.46	2.73 ± 0.88	2.30 ± 3.14	0.09	NS	0.52	NS	0.43	NS

[a] NS indicates not significant; * $P < .05$, ** $P < .01$; *** $P < .001$.

Table 3. Means, Standard Deviations, and Differences Between the Means for Plaque Index in the Three Groups

	Group 1	Group 2	Group 3	Groups 1 & 2	Groups 1 & 3	Groups 2 & 3
	Mean ± SD	Mean ± SD	Mean ± SD	Mean Difference	Mean Difference	Mean Difference
Upper right						
First molar	1.07 ± 0.83	1.07 ± 0.70	0.80 ± 0.56	0.00	0.27	0.27
Second premolar	0.50 ± 0.76	0.53 ± 0.52	0.33 ± 0.49	0.03	0.17	0.20
First premolar	0.36 ± 0.75	0.27 ± 0.46	0.50 ± 0.65	0.09	0.14	0.23
Canine	0.29 ± 0.47	0.42 ± 0.67	0.62 ± 0.77	0.13	0.33	0.20
Upper left						
First molar	0.93 ± 0.73	1.13 ± 0.74	0.80 ± 0.56	0.20	0.13	0.33
Second premolar	0.43 ± 0.65	0.40 ± 0.51	0.60 ± 0.60	0.03	0.17	0.20
First premolar	0.14 ± 0.36	0.27 ± 0.56	0.36 ± 0.50	0.12	0.21	0.09
Canine	0.07 ± 0.27	0.31 ± 0.63	0.38 ± 0.65	0.24	0.31	0.08
Lower right						
First molar	0.57 ± 0.65	0.87 ± 0.52	0.50 ± 0.52	0.30	0.07	0.37
Second premolar	0.50 ± 0.65	0.40 ± 0.51	0.36 ± 0.63	0.10	0.14	0.04
First premolar	0.36 ± 0.63	0.53 ± 0.64	0.50 ± 0.65	0.18	0.14	0.03
Canine	0.71 ± 0.83	0.47 ± 0.52	0.64 ± 0.75	0.25	0.07	0.18
Lower left						
First molar	0.50 ± 0.52	0.53 ± 0.52	0.60 ± 0.63	0.03	0.10	0.07
Second premolar	0.57 ± 0.65	0.40 ± 0.51	0.33 ± 0.49	0.17	0.24	0.07
First premolar	0.57 ± 0.51	0.53 ± 0.52	0.36 ± 0.50	0.04	0.21	0.18
Canine	0.43 ± 0.65	0.62 ± 0.51	0.38 ± 0.51	0.19	0.04	0.23

the three studied groups are shown in Table 2. Maxillomandibular planes angle averaged 18.54 ± 3.73 in Group 1, 28.07 ± 2.20 in Group 2, and 33.90 ± 3.16 in Group 3, respectively. Overbite averaged 5.21 ± 0.87 in Group 1, 3.13 ± 1.38 in Group 2, and −2.40 ± 1.80 in Group 3, respectively.

Periodontal Examination

Plaque index. Means, standard deviations, and differences between the means of plaque index (PI) among groups are shown in Table 3. There were no statistically significant differences among the three groups.

Gingival index. Means, standard deviations and differences between the means of gingival index (GI) among groups are shown in Table 4. There were no statistically significant differences among the three groups.

Probing depth (PD). Means, standard deviations, differences between the means and *P* values for probing depths for each group are shown in Table 5. All sites had a mean probing depth of less than 3 mm. There were no statistically significant differences among groups, except for the lower right canine, where a significant difference between Group 1 and Group 3 was detected ($P < .05$).

Keratinized gingival width. Means, standard deviations, differences between means, and *P* values of the

Table 4. Means, Standard Deviations, and Differences Between the Means for Gingival Index in the Three Groups

	Group 1	Group 2	Group 3	Groups 1 & 2	Groups 1 & 3	Groups 2 & 3
	Mean ± SD	Mean ± SD	Mean ± SD	Mean Difference	Mean Difference	Mean Difference
Upper right						
First molar	1.36 ± 0.84	1.20 ± 0.94	1.00 ± 0.76	0.02	0.29	0.27
Second premolar	1.36 ± 0.84	0.73 ± 0.88	1.13 ± 0.74	0.15	0.28	0.13
First premolar	1.29 ± 0.73	0.73 ± 0.96	1.00 ± 0.78	0.14	0.07	0.07
Canine	1.00 ± 0.82	0.60 ± 0.74	0.83 ± 0.84	0.09	0.09	0.00
Upper left						
First molar	1.64 ± 0.63	1.13 ± 0.83	1.67 ± 0.62	0.11	0.24	0.13
Second premolar	1.50 ± 0.65	1.07 ± 0.88	1.33 ± 0.82	0.10	0.50	0.40
First premolar	1.36 ± 0.63	1.20 ± 0.86	1.00 ± 0.96	0.12	0.21	0.33
Canine	1.25 ± 0.75	1.20 ± 0.86	1.42 ± 0.90	0.30	0.29	0.58
Lower right						
First molar	1.43 ± 0.85	1.20 ± 0.86	1.50 ± 0.86	0.04	0.57	0.53
Second premolar	1.38 ± 0.87	1.20 ± 0.86	1.20 ± 0.86	0.23	0.50	0.27
First premolar	1.14 ± 0.77	1.07 ± 0.88	1.00 ± 0.78	0.01	0.43	0.41
Canine	1.54 ± 0.78	1.27 ± 0.80	1.00 ± 0.82	0.14	0.35	0.21
Lower left						
First molar	1.57 ± 0.76	1.00 ± 0.85	1.47 ± 0.83	0.32	0.05	0.27
Second premolar	1.36 ± 0.75	1.13 ± 0.74	1.33 ± 0.82	0.10	0.36	0.27
First premolar	1.36 ± 0.75	1.33 ± 0.82	1.00 ± 0.78	0.03	0.57	0.54
Canine	1.23 ± 0.93	1.53 ± 0.64	0.92 ± 0.79	0.10	0.43	0.54

Table 5. Means, Standard Deviations, and Differences Between the Means for Probing Depth (mm) in the Three Groups

	Group 1	Group 2	Group 3	Groups 1 & 2	Groups 1 & 3	Groups 2 & 3
	Mean ± SD	Mean ± SD	Mean ± SD	Mean Difference	Mean Difference	Mean Difference
Upper right						
First molar	2.93 ± 0.71	2.69 ± 0.61	2.76 ± 0.51	0.24	0.17	0.07
Second premolar	2.67 ± 0.41	2.58 ± 0.60	2.67 ± 0.65	0.09	0.00	0.09
First premolar	2.33 ± 0.41	2.44 ± 0.53	2.18 ± 0.93	0.11	0.16	0.27
Canine	2.17 ± 0.41	2.18 ± 0.52	2.15 ± 0.63	0.01	0.01	0.03
Upper left						
First molar	2.88 ± 0.52	2.87 ± 0.63	2.93 ± 0.46	0.01	0.05	0.07
Second premolar	2.70 ± 0.36	2.76 ± 0.65	2.53 ± 0.37	0.07	0.16	0.22
First premolar	2.50 ± 0.41	2.64 ± 0.62	2.38 ± 0.64	0.14	0.12	0.26
Canine	2.31 ± 0.44	2.64 ± 0.89	2.13 ± 0.59	0.33	0.18	0.51
Lower right						
First molar	2.71 ± 0.39	2.73 ± 0.58	2.71 ± 0.64	0.02	0.00	0.02
Second premolar	2.33 ± 0.32	2.40 ± 0.42	2.48 ± 0.47	0.07	0.14	0.08
First premolar	2.31 ± 0.38	2.24 ± 0.72	2.98 ± 0.29	0.07	0.67	0.73
Canine	2.52 ± 0.41	2.43 ± 0.79	2.10 ± 0.30	0.10	0.43*	0.33
Lower left						
First molar	2.95 ± 0.75	2.82 ± 0.64	2.82 ± 0.55	0.13	0.13	0.00
Second premolar	2.55 ± 0.56	2.53 ± 0.63	2.44 ± 0.61	0.01	0.10	0.09
First premolar	2.50 ± 0.31	2.47 ± 0.56	2.31 ± 0.60	0.03	0.19	0.16
Canine	2.23 ± 0.38	2.46 ± 0.71	2.23 ± 0.32	0.22	0.00	0.23

* Significant at $P < .05$.

widths of facial keratinized gingiva (KG) are shown in Table 6. A narrow keratinized gingiva was found on the first premolars in all quadrants in the studied groups. In the lower arch, the widest KG was related to the first molars, whereas in the upper, the KG width varied between the two quadrants. However, the widths of the KG were not significantly different statistically among the three groups.

Table 6. Means, Standard Deviations, and Differences Between the Means for the Width of Keratinized Gingiva (mm) in the Three Groups

	Group 1	Group 2	Group 3	Groups 1 & 2	Groups 1 & 3	Groups 2 & 3
	Mean ± SD	Mean ± SD	Mean ± SD	Mean Difference	Mean Difference	Mean Difference
Upper right						
First molar	5.14 ± 1.10	4.73 ± 0.70	4.87 ± 0.92	0.41	0.28	0.13
Second premolar	5.07 ± 0.92	5.13 ± 1.06	5.00 ± 1.36	0.06	0.07	0.13
First premolar	4.14 ± 0.86	4.20 ± 1.15	4.36 ± 1.22	0.06	0.21	0.16
Canine	5.21 ± 1.12	4.92 ± 1.19	5.23 ± 1.30	0.29	0.02	0.31
Upper left						
First molar	4.93 ± 1.21	5.27 ± 0.88	4.80 ± 0.77	0.34	0.13	0.47
Second premolar	4.86 ± 0.86	5.20 ± 1.08	4.93 ± 1.28	0.34	0.08	0.27
First premolar	4.14 ± 0.77	4.33 ± 1.05	4.36 ± 1.28	0.19	0.21	0.02
Canine	4.71 ± 1.20	4.67 ± 1.44	4.92 ± 1.38	0.05	0.21	0.26
Lower right						
First molar	4.14 ± 0.77	4.20 ± 0.86	4.00 ± 0.88	0.06	0.14	0.20
Second premolar	3.36 ± 0.84	3.80 ± 0.94	3.79 ± 0.89	0.44	0.43	0.01
First premolar	2.86 ± 0.95	3.07 ± 0.80	2.79 ± 0.89	0.21	0.07	0.28
Canine	3.50 ± 1.34	3.40 ± 0.91	3.07 ± 0.73	0.10	0.43	0.33
Lower left						
First molar	4.43 ± 0.85	4.53 ± 0.92	4.47 ± 0.74	0.10	0.04	0.07
Second premolar	3.93 ± 0.73	4.07 ± 0.96	4.07 ± 1.03	0.14	0.14	0.00
First premolar	2.93 ± 0.73	3.07 ± 0.96	2.86 ± 0.86	0.14	0.07	0.21
Canine	3.79 ± 0.80	3.62 ± 1.04	3.31 ± 0.95	0.17	0.48	0.31

Table 7. Means, Standard Deviations, and Differences Between the Means for the Width of Attached Gingiva (mm) in the Three Groups

	Group 1	Group 2	Group 3	Groups 1 & 2	Groups 1 & 3	Groups 2 & 3
	Mean ± SD	Mean ± SD	Mean ± SD	Mean Difference	Mean Difference	Mean Difference
Upper right						
First molar	3.14 ± 1.03	2.87 ± 0.64	3.20 ± 0.94	0.28	0.06	0.33
Second premolar	3.57 ± 0.94	3.40 ± 1.24	3.53 ± 1.25	0.17	0.04	0.13
First premolar	2.86 ± 1.10	2.80 ± 1.08	3.00 ± 1.24	0.06	0.14	0.20
Canine	3.71 ± 1.33	3.46 ± 1.05	3.85 ± 1.28	0.25	0.13	0.38
Upper left						
First molar	3.00 ± 1.18	3.13 ± 0.64	2.93 ± 0.80	0.13	0.07	0.20
Second premolar	3.07 ± 1.00	3.33 ± 1.05	3.47 ± 1.19	0.26	0.40	0.13
First premolar	2.57 ± 1.02	2.67 ± 0.90	3.00 ± 1.36	0.10	0.43	0.33
Canine	3.29 ± 1.33	3.17 ± 1.34	3.54 ± 1.39	0.12	0.25	0.37
Lower right						
First molar	2.29 ± 0.61	2.27 ± 0.70	2.21 ± 1.12	0.02	0.07	0.05
Second premolar	1.86 ± 1.03	2.07 ± 1.16	2.21 ± 0.97	0.21	0.36	0.15
First premolar	1.29 ± 0.99	1.53 ± 0.64	1.50 ± 0.94	0.25	0.21	0.03
Canine	2.00 ± 1.41	1.64 ± 0.74	2.00 ± 0.78	0.36	0.00	0.36
Lower left						
First molar	2.64 ± 0.93	2.67 ± 0.62	2.93 ± 0.70	0.02	0.29	0.03
Second premolar	2.36 ± 0.84	2.40 ± 0.74	2.47 ± 1.19	0.04	0.11	0.07
First premolar	1.43 ± 0.85	1.40 ± 0.99	1.50 ± 1.02	0.03	0.07	0.10
Canine	2.29 ± 0.91	2.08 ± 0.76	2.15 ± 0.99	0.21	0.13	0.08

Attached gingival width. Means, standard deviations, differences between means, and *P* values of the widths of facial attached gingiva (AG) are shown in Table 7. A narrow attached gingiva was found on the first premolars in all quadrants in the groups studied. In the lower arch, the widest AG was related to the first molars, whereas in the upper arch, the AG width varied between the two quadrants. However, the widths of the AG were not significantly different statistically among the three groups.

Gingival thickness. The means, standard deviations, differences between means, and *P* values of the thickness of facial attached gingiva (AG) are shown in Table 8. There were no statistically significant differences among the three groups except for the lower right first molar ($P = .045$) and lower right canine ($P = .023$).

Dynamic Occlusion. Table 9 shows the distribution of subjects according to the type of dynamic occlusion on lateral mandibular movements. In Group 1 (short face), there were 6 subjects with right-side canine guidance and 11 subjects with left-side canine guidance, while in Group 2 (normal face) there were 10 subjects with right-side canine guidance and 10 subjects with left-side canine guidance. In Group 3 (long face), there was only group-function occlusion. There was a statistically significant difference between Group 3 and the other groups.

Presence of Premature Contacts. The majority of subjects studied (84%) had no premature contacts. In Group 1 (short face), there were four subjects with premature contacts, and in Group 2 (normal face) there was one subject, while in Group 3 (long face) there were two subjects with premature contacts. No significant difference was found among the three groups ($P = .271$).

Table 8. Distribution of Subjects in Each Group According to Gingival Thickness

	Group 1		Group 2		Group 3		*P*
Gingival Thickness:	Thin	Thick	Thin	Thick	Thin	Thick	value[a]
Upper right							
First molar	2	12	1	14	1	14	NS
Second premolar	8	6	2	13	5	10	NS
First premolar	7	7	5	10	6	8	NS
Canine	10	4	7	6	9	4	NS
Upper left							
First molar	0	14	0	15	1	14	NS
Second premolar	1	13	5	10	3	12	NS
First premolar	6	8	6	9	7	7	NS
Canine	9	5	8	4	8	5	NS
Lower right							
First molar	0	14	0	15	3	12	*
Second premolar	4	10	4	11	6	8	NS
First premolar	7	7	10	5	9	5	NS
Canine	13	1	10	5	14	0	*
Lower left							
First molar	0	14	0	15	2	13	NS
Second premolar	5	9	4	11	5	10	NS
First premolar	12	2	7	8	8	6	NS
Canine	13	1	12	1	12	1	NS

[a] NS indicates not significant; * $P < .05$.

Table 9. Distribution of Subjects in Each Group According to the Type of Dynamic Occlusion

	Right Side Dynamic Occlusion		Left Side Dynamic Occlusion	
	Canine Guidance	Group Function	Canine Guidance	Group Function
Group 1	6	8	11	3
Group 2	10	5	10	5
Group 3	0	15	0	15
	***		***	

*** Significant at $P < .001$.

DISCUSSION

The primary aim of this study was to analyze the effect of different facial heights on periodontal health. In order to do so, dental students were chosen, so they would have similar good oral hygiene. This selection may exclude the well-established effect of poor oral hygiene on periodontal health, which may obscure any effect of facial morphology on periodontal health. In fact, the records of plaque index and oral hygiene habits showed that all groups had comparable good oral hygiene level and low plaque index scores.

It is reported that variations in the vertical dimension of the face are more significant in identifying facial type than variations in the anteroposterior dimension.[25] A number of parameters have been used to categorize vertical facial type, including the cant of the mandibular plane,[26] cant of the palatal plane,[27] and ratios of anterior and posterior face heights.[26] In this study, maxillomandibular planes angle, facial height, and dental overbite were used to categorize the facial form. Long facial type has excessive vertical facial growth. It was suggested that patients with skeletal anterior open bite had an increased SN/mandibular plane angle, increased gonial angle, and maxillary/mandibular planes angle.[12] On the other hand, short facial type has reduced vertical growth. It is usually accompanied by deep anterior overbite. Opdebeeck and Bell[13] suggested that those patients are characterized by reduced anterior lower facial height and a reduced SN/mandibular plane angle.

Analysis of periodontal health condition in our study, represented by probing depth, clinical attachment level, plaque index, and gingival index, showed no difference between the different facial types. In all groups there were normal probing depths of less than 3 mm, and no individual exhibited attachment loss. Comparing the anatomical measurements of gingival tissues (width of keratinized gingiva, width of attached gingiva, and gingival thickness), there were no differences among the groups.

Few studies have been conducted to study the effect of facial morphology on periodontal structures. Masahiro et al[28] conducted a CT scan study on dry skulls of Asiatic Indian men. They found that the buccal cortical bone plate of the mandibular molars was

thicker in the short facial type than average or long facial types. They explained this by the higher buccally directed masticatory force in short faces that requires stronger buccal bony support, and by the more lingually inclined teeth. Another study by Masumoto et al[29] found a correlation among cortical bone thickness in the molar region, gonial angle, and Frankfort/mandibular angle. On the other hand, recently, Sato et al[30] reported a negative correlation between Frankfort/mandibular plane angle, and gonial angle on one hand, and the bone density on the buccal and basal sides of the mandibular second molar.

The findings of the current study should not be considered in major disagreement with those studies. First, regarding the periodontal health, our study is the only one to compare these parameters among different facial types, while previous studies only discussed bone thickness or density, which may or may not affect the health of the periodontium. Second, the gingival tissues were not examined in those studies. Therefore, comparison may not be fair or conclusive. On the other hand, previous studies on occlusal trauma[3–10] may partially support our results. These studies suggested that occlusal trauma does not initiate gingivitis or attachment loss, but may play a role in the progression of periodontal disease. As there was no periodontitis in our sample, we may expect similar periodontal health among the groups.

Finally, due to the young age of our sample, ranging between 20–26 years, a possible difference in periodontal health among the facial types may not be detected, and it may be that a longer time is needed for such changes to be clinically manifested. Therefore, longitudinal studies are needed to reveal such possible effects.

CONCLUSIONS

- No correlation between facial morphology and periodontal health parameters was found in this population.
- There was a difference in the canine guidance dynamic occlusion between the different dentofacial patterns.

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REFERENCES

1. Nanci A, Bosshardt D. Structure of periodontal tissues in health and disease. *Periodontol 2000.* 2006;40:11–28.
2. Hallmon W. Occlusal trauma: effect and impact on the periodontium. *Ann Periodontol.* 1999;4:102–107.
3. Polson AM. Trauma and progression of marginal periodontitis in squirrel monkeys II: co-destructive factors of periodontitis and mechanically produced injury. *J Periodontal Res.* 1974;9:108–113.
4. Polson AM, Meitner SW, Zander HA. Trauma and progression of marginal periodontitis in squirrel monkeys III: adaptation of interproximal alveolar bone to repetitive injury. *J Periodontal Res.* 1976;11:279–289.
5. Polson AM, Meitner SW, Zander HA. Trauma and progression of marginal periodontitis in squirrel monkeys IV: reversibility of bone loss due to trauma alone and trauma superimposed upon periodontitis. *J Periodontal Res.* 1976;11: 290–298.
6. Polson AM. The relative importance of plaque and occlusion in periodontal disease. *J Clin Periodontol.* 1986;13:923–927.
7. Svanberg G, Lindhe J. Experimental tooth hypermobility in the dog. *Odontol Revy.* 1973;24:269–282.
8. Svanberg G, Lindhe J. Vascular reactions in the periodontal ligament incident to trauma from occlusion. *J Clin Periodontol.* 1974;1:58–69.
9. Lindhe J, Svanberg G. Influence of trauma from occlusion on progression of experimental periodontitis in the beagle dog. *J Clin Periodontol.* 1974;1:3–14.
10. Ericsson I, Lindhe J. Effect of long standing jiggling on experimental marginal periodontitis in the beagle dog. *J Clin Periodontol.* 1982;9:497–503.
11. Fields HW, Proffit WR, Nixon WL, Phillips C, Stanek E. Facial pattern differences in long-faced children and adults. *Am J Orthod.* 1984;85:217–223.
12. Cangialosi TJ. Additional criteria for sample division suggested. *Am J Orthod Dentofacial Orthop.* 1989;96:24A.
13. Opdebeeck H, Bell WH. The short face syndrome. *Am J Orthod.* 1978;73:499–511.
14. Edgerton VR. Neuromuscular adaptation to power and endurance work. *Can J Appl Sport Sci.* 1976;1:49–58.
15. Ingervall B, Helkimo E. Masticatory muscle force and facial morphology in man. *Arch Oral Biol.* 1978;23:203–206.
16. Proffit WR, Fields HW, Nixon WL. Occlusal forces in normal- and long-face adults. *J Dent Res.* 1983;62:566–570.
17. Ringqvist M. Isometric bite force and its relation to dimensions of the facial skeleton. *Acta Odontol Scand.* 1973;31: 35–42.
18. Sassouni V. A classification of skeletal facial types. *Am J Orthod.* 1969;55:109–123.
19. Silness J, Löe H. Periodontal disease in pregnancy II. Correlation between oral hygiene and periodontal condition. *Acta Odontol Scand.* 1964;22:121.
20. Löe H, Silness J. Periodontal disease in pregnancy I. Prevalence and severity. *Acta Odontol Scand.* 1963;21:533.
21. Cohen JA. A coefficient of agreement for nominal scales. *Educ Psychol Meas.* 1960;20:37–46.
22. Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics.* 1977;33:159–174.
23. Dahlberg G. *Statistical Methods for Medical and Biological Students.* New York, NY: Interscience Publications; 1940: 122–132.
24. Houston WJB. The analysis of errors in orthodontic measurements. *Am J Orthod.* 1983;83:382–390.
25. Schudy FF. Vertical growth versus anteroposterior growth as related to function and treatment. *Angle Orthod.* 1964; 34:75–93.
26. Bakke M, Tuxen A, Vilmann P, Jensen BR, Vilmann A, Toft M. Ultrasound image of human masseter muscle related to bite force, electromyography, facial morphology, and occlusal factors. *Scand J Dent Res.* 1992;100:165–171.

27. Fontijn-Tekamp FA, Slagter AP, van't Hof MA, Geertman ME, Kalk W. Bite forces with mandibular implant-retained overdentures. *J Dent Res.* 1998;77:1832–1839.
28. Masahiro T, Masamitsu M, Kazutaka K. Relationship between facial types and tooth and bone characteristics of the mandible obtained by CT scanning. *Angle Orthod.* 1998;68: 557–562.
29. Masumoto T, Hayashi I, Kawamura A, Tanaka K, Kasai K. Relationships among facial type, buccolingual molar inclination and cortical bone thickness of the mandible. *Eur J Orthod.* 2001;23:15–23.
30. Sato H, Kawamura A, Yamaguchi M, Kasai K. Relationship between masticatory function and internal structure of the mandible based on computed tomography findings. *Am J Orthod Dentofacial Orthop.* 2005;128:766–773, 279–289.

Erratum

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"Periodontal Parameters in Different Dentofacial Vertical Patterns."
Ibrahim Ahmad Alzoubi
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The author's name was misspelled as Ibraheem A. Al-Zo'ubi. The correct spelling is Ibrahim Ahmad Alzoubi.