

Assessment of the esthetic smile in a sample of Iraqi population

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ABSTRACT

Background: The aim of the present study is to evaluate the esthetic smile in sample of Iraqi adults and to assess the gender differences.

Materials and Methods: 100 persons (50 males and 50 females) had class I normal dental and skeletal selected for this study. Clinical examination and digital photograph with posed smile were performed for each individual. Six linear soft tissue parameters in each photograph using AutoCAD program 2011.

Five visual and four quantitative evaluations of the smile were studied for each subject. The smile arch and index, buccal corridor spaces (BCSs) were studied. Descriptive statistics of the measurements were calculated. Independent student's t-tests were used to evaluate the gender differences.

Statistics: Descriptive statistics and Standard error of each measurement was calculated. Independent sample t-tests were used to compare the measurements of male and female subjects. Chi square used for visual measurements.

Results and conclusion: The average smile, parallelism of the upper incisal curve with the inner curvature of the lower lip, 1:1 ratio of the widths of nose and upper cupid were higher in females than males while in smile curve arch line without touching the lower lip the opposed and 2nd premolars are the most common display in both groups. Females showed higher than five smile index indicate a constant well balanced smile in females than in males, Females showed a well-balanced expression with posed smile, A medium buccal corridor in both females and males.

Key words: Smile, esthetics. (J Bagh Coll Dentistry 2013; 25(3):168-175).

INTRODUCTION

Facial attractiveness has been suggested to have an influence on personality development and social interaction ⁽¹⁻³⁾. The smile plays an important role in facial expression. Facial attractiveness and smile aesthetics are strongly related to each other. Individuals mainly focus on another person's eyes and mouth during interpersonal interaction ⁽⁴⁾, and the smile ranks second only to the eyes as the most important feature in facial attractiveness ⁽⁵⁾. Therefore, an attractive, well-balanced smile is a highly regarded treatment objective, along with creating a functional occlusion.

Saver ⁽⁶⁾ emphasized the importance of the soft tissue profile, including the smile, to evaluate the diagnosis, treatment planning and the mechanics in orthodontic cases. Although an esthetic smile has been studied in dentistry ⁽⁷⁾, recently, the detailed evaluation of how soft tissue profiles are related to the smile arch, smile index and buccal corridor have not only been studied in orthodontic treatment ⁽⁸⁻¹⁰⁾. More recently, there are several researches to support that the minimal buccal corridor constitutes a preferred esthetic smile by orthodontist ⁽¹¹⁻¹⁵⁾. However, there is a difference in evaluating an esthetic smile by dentists, orthodontists and laypersons ⁽¹⁶⁻¹⁸⁾.

An attractive smile depends not only on components such as tooth size, shape, colour, and position but also on the amount of visible gingivae and the framing of the lips ⁽¹⁹⁾.

A 'gummy' smile results from a combination of factors such as vertical maxillary excess, increased overjet, increased overbite, a short upper lip, and a short incisor crown length ⁽²⁰⁾. However, Peck *et al.* ^(21,22) reported that upper lip length and incisor crown length did not appear to be associated factors.

What is beautiful or attractive to dental professionals, based on their experience and training, may not agree with the perceptions of other individuals ⁽²⁴⁾. Shaw *et al.* ⁽²⁵⁾ and Prah Andersen ⁽²⁶⁾ reported that dental professionals are conditioned to take an overly critical view of any deviation from normal occlusion. Although many orthodontists and surgeons have the opinion that a gummy smile is unattractive ^(21,22), the perception of the same for dental students as young adults may differ.

Tjan and Miller ⁽⁷⁾ divided the smile line into three types: a high smile line, revealing the complete maxillary incisors and a continuous band of the gingiva; an average smile line, revealing 75–100 per cent of the maxillary incisors; and a low smile line, revealing less than 75 per cent of the maxillary incisors. Excessive gingival display can severely detract from an attractive smile. Although, in western society, it has been suggested that no more than 2 mm of the maxillary gingiva should be visible when a person smiles ⁽²³⁾, there has been no scientific evidence to support this view in the Asian community, particularly in Iraqi population.

The aim of this study was to evaluate an esthetic smile in sample of Iraqi adults and to evaluate the gender differences.

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MATERIALS AND METHODS

Sample

The sample of the study composed of 100 Iraqi adult subjects with an age ranged between 18-30 years. They were selected from Colleges of Medicine and Dentistry- University of Baghdad. The sample was classified into two groups, group 1 50 female and group 2 50 male.

Criteria of the sample selection

The entire sample was Iraqi Arab subjects with an age ranged between 18 and 30 years old with no previous orthodontic, orthopedic, or facial surgical treatments. All had full permanent teeth regardless the third molars with no or minor spacing or crowding and Class I skeletal, molars, canines and incisors classification⁽²⁷⁾.

Methods

1. History and clinical examination

Each subject was asked to seat comfortably on the dental chair and asked information about the name, age, origin, medical history, the history of facial trauma and orthodontic treatment. Then they were asked to look forward horizontally (Frankfort plane parallel to the floor) for clinical examination (extra-orally and intra-orally) to check their fulfillment of the required sample selection.

2. Standardization of the Photographs

- The camera (Sony CyberShot H 50, 9.1 Mega pixels, 15 X optical zoom, Sony Corporation, Nagoya, Japan) was fixed in position with a tripod.
- The distance between the camera and the subject was measured from the tripod's column to the ear rods (fig.1).
- The blue background, 0.95 m wide and 1.10 m high, behind the subject was made of a piece of cloth⁽²⁸⁾.
- Two flash lights, with two umbrellas to diffuse and soften the light, were used.
- A ruler was placed on the adjustable plastic nasal stopper part of the cephalostat, to be used later for magnification correction^(14,29).

3. Photographical Technique

The subject was seated on a stool and his head was fixed with the aid of the cephalostat. The Frankfort horizontal plane was parallel to the floor^(30,31). The digital camera was set on manual exposure shooting. The subject was asked to close in centric occlusion, smile and say word "cheese" to obtain an ideal lip-tooth presentation at smile⁽³²⁾.

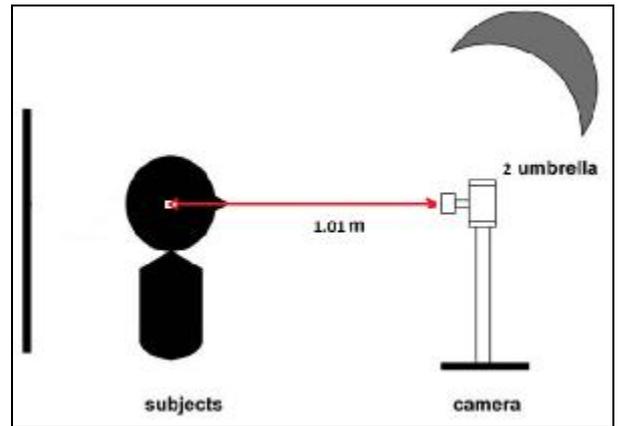


Figure 1

4. Measuring techniques

- The photographs were imported to the AutoCad program.
- Magnification correction was done.
- After that, identification of landmarks was made, and measurements were determined.

Soft Tissue Landmarks, Figure 2:

- chilion (ch):** a point located at each angle of mouth and selected to be on same level with stomion^(33,34)
- stomionsuperius (stos):** The lower most point on the vermilion border of the upper lip⁽³⁰⁾.
- Stomioninferius (stoi):** the upper most point on the vermilion border of the lower lip⁽³⁰⁾.

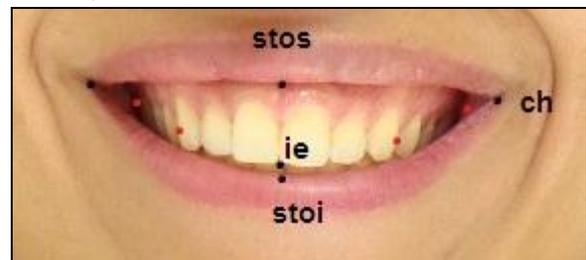


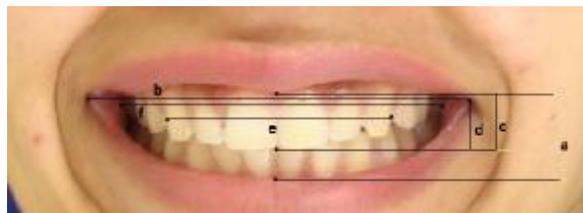
Figure 2

Lines, Figure 3 and 4:

- interlabial distance at the midline between stos point and stoi point.
- outer commissure width between right and left chilion.
- distance between the most inferior point of the upper lip (stos) and the incisal edge of upper incisors.
- distance perpendicular to the upper incisal edge from the outer commissure width.
- upper cuspid width at most buccal points of upper canines
- inner commissure width It is the distance between right and left inner commissural line which passes through the mucosa overlying the buccinators muscle where it inserts with the orbicularis oris muscle fibers at the modiolus.

g. and h, left and rightside BCS.

i, space between interlabial gap (area measurement).



a. ILD, b. OCW, c. distance between stoma and IE, d. distance perpendicular to the upper IE from the OCW, e. ICD, f. ICW

Figure 3



g. left BCS, h. right BCS, i. ILG

Figure 4

Measurements

- 1- **Smile index:** It represents the smile zone, obtained by dividing the outer inter-commissural width by the inter-labial gap (b/a)⁽³⁵⁾.
- 2- **Gingival exposure:** obtained by dividing the distance between stomion superius and the incisal edge of upper incisors by the outer inter-commissural width (c/b) or distance perpendicular to the upper incisal edge from the outer commissure width by the outer inter-commissural width (d/b).
- 3- **Buccal corridor width (BCW):** the distance between the outer and inner commissural widths.^(29,35)
- 4- **Buccal corridor linear ratio (BCLR):** calculated by dividing inter canine distance on outer commissural widths.^(51,53)
- 5- **Buccal corridor space (BCS):** as the distance between the lateral junction of the upper and lower lips and the distal points of the canines during smiling.⁽¹⁵⁾ Or as a space between the inner commissure and the lateral surface of the upper posterior teeth ($g+h/i$ %)⁽⁵³⁾.

Five visual and three quantitative evaluations of each posed smile were made.

I. The five visual evaluations of a smile were

1. Tjan's smile classification, Tjan⁽⁹⁾ made an indicator of esthetic evaluation in oral morphology. According to him, a smile was classified into three different categories: (1) low smile (upper incisors appear less than 75%); (2) average smile (75–100% of incisor

appearance and gingiva); (3) high smile (100% teeth appearance and full gingival, called a "gummy smile").

2. Position of the upper incisal curve relative to touching the lower lip either touching or not touching or slightly covered by lower lip.

3. Parallelism of the upper incisal curve with the lower lip, parallel or straight or reversed.

4. The number of teeth displayed in a smile.

5. The relationship between the widths of the nose and upper cuspid.

II. The three quantitative evaluations of a smile were:

1. Smile index = b/a
2. Gingival exposure (c/b , or d/b) in Fig. 3
3. Buccal corridor; width, linear ratio and space ($g + h/i$ %), in Figs. 4.

Statistical analysis

Descriptive statistics and Standard error of each measurement was calculated. Independent sample t-tests were used to compare the measurements of male and female subjects. Chi square used for visual measurements.

RESULTS

I. Visual evaluations of a smile (Table 1);

1. Tjan's smile classification. Female Group of 54 samples, 14.2% had an average smile, 13.3% had a low smile and 20.4% a high smile. While for male group of 59 samples, the average smile was 9.7%, 22.1% had a low smile and 20.4% a high smile, with no significant differences between males and females.

2. Position of the upper incisal curve. In Female Group out of 54 samples, 34 (30.1%) showed an incisal curve of the upper anterior teeth without touching the lower lip. In 11 (9.7%) subjects these teeth touched the lower lip and in 9 (8%) they were slightly covered by the lower lip. While in male group out of 59 samples, 47 (41.6%) showed an incisal curve of the upper anterior teeth without touching the lower lip. In 6 (5.3%) subjects these teeth touched the lower lip and in 6 (5.3%) they were slightly covered by the lower lip, with no significant differences in chi square test.

3. Parallelism of the upper incisal curve. In Female Group out of 54 samples, 38 (33.6%) showed parallelism of the upper incisal curve with the inner curvature of the lower lip. 10 (8.8%) subjects had a straight rather than a curved or reversed line and 6 (5.3%) in reversed line. While for male group out of 59 samples 31 (27.4%) showed parallelism of the upper incisal curve with the inner curvature of the lower lip. 18 (15.9%) subjects had a straight rather than a curved or reversed line and 10 (8.8%) in reversed line.

4. Number of teeth displayed. The range of teeth displayed in a present posed smile is 9 ± 0.15 in female and 10 ± 0.21 in male samples, with no significant differences.

5. Width of the nose and upper cuspid. 30.1% of female Group and 10.6% of male Group were close to a 1:1 ratio between the widths of the nose and upper cuspid, with significant differences.

II. Quantitative evaluations of smiles (Table 2).

1. Smile index (b/a). The mean was 5.77 in female Group and 5.93 in male Group. There was no significant difference between both groups at $p > 0.05\%$ (Fig. 3).

2. Upper gingival exposure (c/b or d/b). The calculation of g/b, i.e. the mean of the exposure was 0.15 in female Group and 0.13 in male Group, which was significantly different at $p > 0.01\%$. For the calculation of f/b, the mean was 0.15 for female Group and 0.14 for male Group, which was not significantly different ($p > 0.05\%$) (Fig. 3).

3. Buccal corridor width (BCW), linear ratio (BCLR) and space (BCS). The BCW was calculated by the distances between OWC and ICW, the study showed a higher mean value in males 5.24 than in females 4.93 with no significant differences between right and left and in genders while BCLR (e/b%) was calculated by the ratio of the maxillary cuspid distance and the outer commissure distance. The mean was 60.15% for female and 58.68% for male with no significant differences. BCS Volume (space) analysis (g + h/i%) of BC showed a mean of 15.83% in female Group and 16.28% in male Group. There was no significant difference between groups.

DISCUSSION

A well-balanced smile, which is based on the balance among teeth, lips, dentition and the jaw, is one of the important factors to get a quality orthodontic treatment^(6,8,9). According to psychological, anatomical and anthropological points of view, smiles are classified into either commissure, cuspid or complex smiles,⁽³⁵⁻³⁷⁾ based on smile studies in which evidenced based dentistry could be standardized. Smiles are classified in two groups. One is an unposed smile, which is an active smile induced unconsciously in response to a happy emotion. The other is a posed smile which is a passive smile induced in response to a conscious emotion. The difference between both smiles is that the active lip posture in a posed smile is reproducible⁽³⁸⁻⁴⁰⁾. The reliability of a posed smile's reproducibility is quite high (93–98%)⁽³⁸⁾.

Tjan⁽⁹⁾ made an indicator of esthetic evaluation in oral morphology. According to him, a smile was classified into three different categories: (1) low smile (upper incisors appear less than 75%); (2) average smile (75–100% of incisor appearance and gingiva); (3) high smile (100% teeth appearance and full gingival, called a ‘‘gummy smile’’). He found 68.9% of subjects showed an average smile, 20.5% a low smile and 10.6% a high smile. The average smile is ideal in Caucasian^(8,22,32,36-38). In the present study, 14% of female Group showed an average smile, 13% a low smile and 23% a high smile. Male Group showed 10% an average smile, 22% a low smile and 23% a high smile, with no significant differences between male and female.

Peck et al⁽²¹⁾ and Tjan and Miller⁽⁷⁾ found that low smile lines are a predominantly male characteristic (2.5 to one male to female) and a high smile line is predominantly female (two to one female to male).

While in present study (1.6 to one male to female) in case of low smile and higher in female (1.4 to one female to male) for average smile and the same in high smile in male and female which is different from that found in Peck, and this is may be due to difference in ethnics groups.

When looking at the smile arc (parallel, flat, and reverse), we found that approximately (61%) of the total sample had parallel smile arc. This disagrees with Maulik and Nanda⁽⁴¹⁾ who both found the flat smile arc to be most frequent in their subjects, and agree with the findings of Tjan et al⁽⁷⁾ and Dong et al,⁽⁴²⁾ who both found the parallel smile arc to be most frequent in their subjects. This difference could be due to the smile arc measurement process, which can be considered subjective. Great care was taken to keep the measurement and data-gathering processes as standardized and objective as possible. For example, to obtain natural head position, the subjects were asked to look straight forward as if they were looking at their eyes in a mirror⁽⁴³⁾. Another objective was to compare the smile arc between the sexes. We found a statistically no significant difference between them with higher parallel smile in female than male and lower for flat and reverse smile. This agrees with Maulik and Nanda⁽⁴¹⁾. Tjan⁽⁴⁰⁾ also studied the relationship between touching behavior of upper incisors and the lower lip, which effects a smile's balance^(18,38). Although he reported 57.8% of subjects (female) showed lip-incisor touching, while in Murakami et al.,⁽⁴⁵⁾ orthodontic treated patients and magazine models showed 63 and 60% non-touching to the lower lip which is quite different to his finding,

respectively, which was similar to other data on Japanese females^(38,44). In present study 17% touching and 72% not touching and 13% slightly covered by lower lip with higher frequencies in female than male in both touching and slightly covered. With no significant differences. One of the Golden ratio's balanced facial profile is the 1:1 ratio of the widths of the nose and upper cuspids, as determined by Ricketts⁽³³⁾. However, he described that this relationship is not mathematically proved. In the present study 40.7% of total sample showed 1:1 ratio with higher present in female 30.1% than male 10.6% this is differ from finding of Murakami et al.,⁽⁴⁵⁾ which showed 80 and 90% of orthodontic treated patients and magazine models were close to a 1:1 ratio. Those high percentages in both Groups could be explained by a wider nose matched with a wider arch width^(46,47) than in Caucasians, as is characteristic of Japanese anterior facial profiles. In Tjan's American Caucasian study⁽⁹⁾, the highest percentage display of teeth was of the 1st bicuspid (eight teeth), which is similar to Murakami et al.,⁽⁴⁵⁾ in Japanese females showed 10% of 60 subjects a cuspid to cuspid and 90% a display of bicuspid in orthodontic treated patients and magazine models, respectively. There was no display of 1st molars in both orthodontics groups. Other studies in Japanese subjects were similar to Murakami et al.^(38,44,45). While in present study all female showed highest percentage display of teeth was of 2nd bicuspid (nine and ten teeth) about 26% than 14% was of 1st bicuspid (seven and eight teeth) and lesser percentage in 1st molar 8% (eleven and twelve teeth) and in male small percentage 1.7% showed from cuspid to cuspid and 17% of 1st bicuspid, 19% of 2nd bicuspid and 25% of 1st molar. i.e. 45% of total sample displayed from 2nd bicuspid to 2nd bicuspid. Maulik and Nanda⁽⁴¹⁾ results for the most posterior maxillary tooth visible showed that 51% of the sample displayed the maxillary second premolars; Dong et al⁽⁴²⁾ found similar results, with 57% of their sample showing maxillary second premolars. A surprising result, which did not agree with either Dong et al⁽⁴²⁾ or Tjan et al,⁽⁷⁾ was that 25% of our sample showed the maxillary first molars on smiling. Tjan et al⁽⁷⁾ found that only 4% of their subjects showed the maxillary first molars on smiling. This is a notable difference, and one of the largest differences of all variables between our study and the others. An argument could be made that this difference was due to lighting. Neither Tjan et al⁽⁷⁾ nor Dong et al⁽⁴²⁾ described in detail how they gathered their data or the lighting situation when they photographed the smiles. Assessing the

quantitative evaluation of a smile, (1) the smile index was 5.77 and 5.93 in female and male groups with no significant difference between groups. In female group, 43 out of the 54 subjects showed higher than 5.0 index values. While in male group lesser than that about 37 out of the 59 subjects only showed higher than 5.0 index values this indicate a constant, well balanced smile in female more than male, i.e. female well trained posed smile or cared more about their smile than male. (2) The amount of upper gingival exposure was studied by applying two different measurements (c/b and d/b). The two different measurements in female and male were 0.15, 0.15 and 0.13, 0.14, respectively. There was a significant difference between groups ($p > 0.01$), which indicated less movement of lips and the corner of the mouth in male. This significant difference between both measurements in male subjects indicates that a smile presents a wider inner commissure width with a pushed up corner of lips and more movement of lips than that of female. Female group showed a well-balanced expression with a posed smile more than male subjects (3) BCW, according to Krishnan et al.⁽²⁹⁾ And Ackerman and Ackerman⁽³⁵⁾. Who measured the right and left buccal corridor widths as the distances between OWC and ICW, the study showed a higher mean value in males 5.24 than in females 4.93 with no significant differences between right and left and in genders, these results similar but slightly smaller than that of Krishnan et al.⁽²⁹⁾ and Ritter et al.⁽¹⁴⁾. The difference may be related to differences in ethnic groups or in sample selection. In the present study, BCW was measured also by the Hulsey method⁽⁵¹⁾ female Group showed a mean of 60.15% and 58.68% in male group. There was a no significant difference between groups. (4) BCS was studied. BCS is quite important to evaluate an esthetic smile⁽⁸⁾. BCS had been studied half a century ago in prothodontists⁽⁴⁵⁾. Hulsey⁽⁵¹⁾ developed his own measurement of BCS based on the upper cuspid width. Ackerman and Ackerman⁽³⁵⁾ found that the corner of lips with a smile showed a difference by the way light was projected, and he classified BCSs for their inner and outer commissures. The inner commissure is an area of the inner buccal membrane of oral muscles fibers. Applying this method, Moore et al.⁽¹³⁾ studied the volume of BCS to find a good balance in a face. He classified five different types of inner and outer commissures by changing the photo's original image and got the opinion of a third party. Five classifications were narrow (28%), medium-narrow (22%), medium (15%), medium-broad (10%) and broad (2%). In the present study, BCS

values of females and males were 15.83% and 16.28%, respectively. This data was similar to "medium" of Moore's classifications⁽¹³⁾. The study found the range of BCS to be 8-26%. With no significant differences between females and males this differ from findings of Maulik and Nanda⁽⁴¹⁾, who showed 12.3% in males and 10% in females with significant differences between groups. Thus, the differences between two measurements in both groups depended only on the method of measurements, sample selection and ethnic groups.

The conclusions drawn from this study were:

1. The high smile, smile curve arch line without touching the lower lip, parallelism of the upper incisal curve with the inner curvature of the lower lip, 10% display of the 1st molar, 1:1 ratio of the widths of nose and upper cuspid, common features of females group while The low smile, smile curve arch line without touching the lower lip, parallelism of the upper incisal curve with the inner curvature of the lower lip, 8% display of the 1st molar, no 1:1 ratio of the widths of nose and upper cuspid are common features of males group.
2. The average smile, parallelism of the upper incisal curve with the inner curvature of the lower lip, 1:1 ratio of the widths of nose and upper cuspid were higher in females than males while in smile curve arch line without touching the lower lip the opposed and 2nd premolars are the most common display in both groups.
3. Females showed higher than 5 smile index indicate a constant well balanced smile in females than in males
4. Females showed a well-balanced expression with posed smile
5. A medium buccal corridor in both females and males.

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Table 1. Visual evaluation of a smile

		Female		Male		X ²	P value
		Number	%	Number	%		
1	Tjan's smile classification					3.211	0.20
	Low smile	15	13.3	25	22.1		
	Average smile	16	14.2	11	9.7		
	High smile	23	20.4	23	20.4		
2	Incisal curve relative to touching the lower lip					3.943	0.139
	Touching	11	9.7	6	5.3		
	Not touching	34	30.1	47	41.6		
	Slightly covered	9	8.0	6	5.3		
3	Incisal curvature in relationship to lower lip					3.782	0.151
	Parallel	38	33.6	31	27.4		
	Straight	10	8.8	18	15.9		
	Reversed	6	5.3	10	8.8		
4	Nasal width in relation of the maxillary cuspid width					19.493©	0***
	Same	34	30.1	12	10.6		
	Not same	20	17.7	47	41.6		
5	The average of teeth displayed in a smile (a)	9 ± 0.15		10 ± 0.21		0.252 (b)	

(a) Means , standard deviation., (b)t test , (c) Continuity Correction, Computed only for a 2x2 table

Table 2. Quantitative evaluation of a smile

		Female		Male		t-test
		Mean	S.D.	Mean	S.D.	Sig.
1	Smile index	5.77	1.94	5.93	1.90	0.658*
2	Upper gingival exposure g/b	0.15	0.05	0.13	0.04	0.028**
	Upper gingival exposure f/b	0.15	0.04	0.14	0.04	0.09*
3	Buccal corridor width (BCW)					
	Rt BCW	5.06	1.23	5.51	1.56	0.092*
	Lt BCW	4.81	1.41	4.96	1.31	0.54*
4	Buccal corridor linear ratio (BCLR)	60.15	4.07	58.68	5.78	0.12*
5	Volume analysis of BCS (BCAR)					
	Right	7.85	2.13	8.17	2.61	0.48*
	Left	7.98	1.93	8.11	2.50	0.75*
	Total	15.83	3.41	16.28	4.63	0.56*

(t-test: two sided) Significant level: ***p <.001; **p > 0.01; *p >.05; N.S., not significant.