Craniofacial Features of Gummy Smile in a Syrian Adult Population

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Abstract

Objective: is to obtain a full understanding for the craniofacial features in a sample of Syrian patients presented having gummy smiles.

Methods: Fifty-seven adults (15 males and 42 females) with more than 2 mm of gingival display during posed smiling were randomly selected at the Department of Orthodontics. Lateral cephalometric radiographs were obtained and analyzed. Fourteen cephalometric variables were calculated and compared to those related to a group of Class I skeletal patients employing two-sample t tests.

Results: In this group of gummy smile patients, the skeletal relationship was found to be slightly Class II (ANB: $\bar{x}$ =4.5°) whereas the vertical variables indicated a posterior rotation of the mandible compared to the normal group (B Angle: $\bar{x}$ = 29.2, $\bar{x}$ = 21.35; respectively, p-value<0.001).

Conclusions: the planning of the treatment should be adjusted according to the individual craniofacial features of every patient in order to achieve the best result.

Keywords: Gummy smile, Craniofacial features, Cephalometric.

Introduction

What a significant role for the smile nowadays – for the smile is the most notable facial feature of the human race - has a tangible influence on social relations such as mating success, even kinship ties, not to forget the community evaluations, performance, employment prospects, and other sides of life.[1,2,3]

According to people nowadays, aesthetics has the most attention of all, this is why the attractive smile became very considerable, and especially for those who seek orthodontic care.

Several etiologic factors are proposed in this literature, those factors include: skeletal, gingival, and muscular factors, which may occur in combination or alone [4-5]. Although vertical maxillary dental and/ or skeletal excess or gingival problems from delayed passive eruption have been treated in the orthodontic field [6-7-8].

Females are reported of having twice the abnormality in this regard more than males as

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gummy smiles prevail in both genders[9].Smiles were classified by many authors in accordance to the relationship of the lower border line of the upper lip to the upper gingival margin and incisors [10].

Whoever, we can facilitate the treatment planning in the regard of the gummy smile throughout understanding the craniofacial morphologic features amongst the patients.

Some results consented while others contradicted as we scrutinized different subject groups, reference standards, and measurement variations in previous studies.

Several subjects are specified in this study to correlate the variables included, this aims to create an omniscient view of the craniofacial features throughout samples of Syrian patients presented in the regard of the gummy smile.

MATERIALS AND METHODS

The database of referred patients to the Orthodontic Department between July 2011 and June 2012 was reviewed and those with a preliminary diagnosis of 'gummy smile' were recalled for further clinical assessment. 210 patients were invited to visit the Orthodontic Department and 197 patients attended (i.e. a response rate of 93.8%). Upon clinical examination, 124 patients were found suitable for inclusion in this study. The inclusion criteria for this project were: (1) gingival display of more than 2 mm during posted smiling, (2) age greater than 16 and less than 35 years, (3) no previous orthodontic or surgical treatments, (4) no obvious craniofacial abnormality or asymmetry.

However, a *priori* sample size calculation revealed that 58 patients were required to detect a difference of 4 degrees in the N-S:Go.Me angle between the two groups under the following assumptions: (1) α=0.05, (2) power=0.90, (3) two-sample t test, (4) SD of the Y-axis angle 6.57 from a previous study [11].Therefore, a simple random sampling was performed based on resultant sampling frame of 124 patients.

The purpose of this research project was explained for each candidate. Patients' informed consents were obtained. Upon acceptance to participate, a frontal-view photograph was taken using the posed smiling condition as well as a standardized digital cephalometric radiograph in centric occlusion. The frontal-view photograph was used to confirm the clinical impression of the presence of a 'gummy smile'. Quality assurance procedures performed by the author before commencing data analysis revealed that one record was unsatisfactory with regard to image contrast and anatomical features' sharpness and therefore was excluded (i.e. the total number of records was 57).

The lateral cephalometric analysis comprised fourteen variables (Table 1 for their definitions). A special cephalometric program Viewbox® (Version 4.0.0.98, d HAL Software, Kifissia, Greece) was used by the author. Landmarks were identified under standardized conditions of monitor light and peripheral lighting. Figure 1 shows the positions of these landmarks. Data were exported as Excel files (Office Excel 2007, Microsoft Corporation, Redmond, Washington, USA) for further statistical analysis.

Table 1. Measurement Items and Explanation

Nr.	variable	Explanation
1	SNA	Anteroposterior position of A-point to anterior cranial base
2	SNB	Anteroposterior position or B-point to anterior cranial base
3	ANB	Anteroposterior relationship between A-point and B-point with respect to nasion
4	N-S : SPP	Maxillary inclination to the cranial base
5	N-S : Go.Me	mandibulary inclination to the cranial base
6	B Angle	Relation between maxillary and mandibulary Plane
7	N-S Ar	Relation of the mandibula to the cranial base
8	Bjork Sum.	Sum of sella(NSar), articular(SarGo) and gonial angle (arGoMe)
9	N S Gn (Y Axis)	The angle between the anterior cranial base and the most anteroposterior point (gnathion) in the center of the sella
10	Nordval Angle	Facial prominence angle
11	Jarabak Ratio	Ratio of posterior to anterior facial height
12	U:N-A	Angle between upper incisor and cranial base
13	L : Go.Me	Angle between lower incisor and cranial base
14	L : U	Interincisal angle between the upper and lower incisors

A parallel group of Syrian skeletal Class I malocclusion patients was used to which the 14 measurements were compared and contrasted[12].
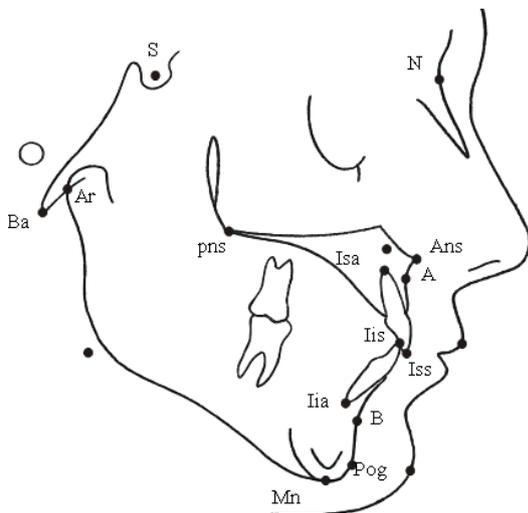
This group of patients did not present any

signs of 'gummy smile' condition.

Patients were divided retrospectively into three groups depending on the anteroposterior skeletal relationship which was assessed by the ANB angle[12]. The sample characteristics regarding the vertical and horizontal skeletal relationships are given in Table 2.

Reliability Assessment

Twenty randomly selected lateral cephalograms were retraced after a three-week interval to assess intra observer reliability using Intra class correlation coefficients (ICCs). The assessment revealed that the measurements made were highly reliable. The ICCs ranged from 0.971 to 0.993 for the 14 measurements. No systematic error was found for the evaluated 14 variables when paired t

test were used for this purpose[13].

RESULTS

When the facial growth pattern was evaluated, the vertical trend of this pattern comprised a dominant proportion, with no subject manifested with a horizontal growth pattern (Table 2). The mean values and SDs of the variables and the comparison made with normal values are given in Table 3.

There was no statistically significant differences in the mean SNA angle between the 'gummy smile' and 'normal' groups (81.1°vs. 81.7°, respectively; p-value=0.344).

Table 2. Classification and Proportion of Subjects

Total	Skeletal Class I	Skeletal Class II	Skeletal Class III	Vertical	Average	Horizontal
57	28	28	1	42	15	0

Table 3.

Measurement	Test Group		Normal Group		Sig.	P value
	Mean	SD	Mean	SD		
SNA	81.125	3.8	81.73	3.48	-	0.344
SNB	76.7	3.6	79.56	3.34	-	0.44
ANB	4.5	2.9	2.32	1.39	*	0.000
N-S: SPP	8.2	3.1	7.24	3.25	*	0.028
N-S: Go.Me	36.7	6.1	28.55	4.87	*	0.000
B Angle	29.2	6.7	21.35	4.48	*	0.000
N-S Ar	125.01	12.6	125.2	5.55	-	0.897
Bjork Sum.	397.6	7.8	388.57	4.85	*	0.000
N S Gn (Y Axis)	71.3	4.5	66.71	4.67	*	0.019
Nordval Angle	60.6	6.4	64.62	7.75	*	0.000
Jarabak Ratio	62.7	4.4	70.18	4.26	*	0.000
U: SPP	95.8	23.8	68.89	3.69	*	0.000
L: Go.Me	95.7	8.6	95.8	5.12	-	0.845
L: U	123.5	13.1	131.65	5.48	*	0.000

*P < 0.05.Sig. indicates significance;
-, not statistically significant (t-test).

The mean SNB angle ($\bar{x}$=79.5°) was greater in the normal group than that in the 'gummy smile' group ($\bar{x}$=76.7°)which was reflected in the mean ANB angle ($\bar{x}$=4.5) which was statistically different between the two groups (p-value<0.001). This indicated that patients with gummy smiles had retruded mandibles.

The following variables: N-S:SPP, N-S:Go.Me, B-angle were used to describe the vertical facial dimensions in both groups. The

mean value of the N-S: SPP angle was 8.2° in the 'gummy smile' group, which was statistically greater than that of the 'normal' group. The mean value of the N-S:Go.Me angle was 36.7° which was statistically greater than that of the 'normal' group ($\overline{x}$=28.55°; p-value < 0.001).

The mean B-angle in the 'gummy smile' group was statistically greater than that of the 'normal' group (29.2° vs. 21.35°, respectively; p-value<0.001). The results of these 3 measurements reflected the same trend of vertical growth pattern in the 'gummy smile' group with long faces and divergent facial types.

The upper incisors inclined labially when the SPP plane was used as a reference. The mean upper incisor inclination was 95.8° in the 'gummy smile' group, which was greater than that of the 'normal' group ($\overline{x}$=68.89°). The mean inter-incisal angle was found to be 123.5° in the experimental group, and smaller than that of the 'normal' group; a difference which was statistically significant. The convexity of the profile (Nordval angle) was 60.6°, which was statistically different from that of the 'normal' group.

DISCUSSION

Preceding studies suggested classification of smile according to the lower border line of upper lip[14,15,16], but as a definite kind of smile, the craniofacial features of gummy smile has never been discussed. Graber[10] pointed out that a considerable portion of gingival display was called high lip line, a 1- to 3-mm gingival exposure was called medium lip line, and only a part of teeth exposed below the upper lip was defined as low lip line. The different

craniofacial features of gummy smile in clinical practice drew our interests as their treatment planning required individualized consideration.

Excessive gingival display can be divided into several categories according to etiologic factors [17,18]. As detection of the latter needs special methods such as body anatomy or muscle activity examination; this study focused on the craniofacial features on lateral cephalometric.

The ANB angle, which shows the relative relationship between the maxilla and the mandible in the sagittal direction, was greater in the 'gummy smile' group compared to the control group. In addition, the position of the mandible (assessed by the SNB angle) indicated a posterior positioning confirming that the sagittal discrepancy (a retruded mandible and a convex profile) was an important component of the 'gummy smile' condition.

Peck et al[19] and Mackley[20] also postulated that excessive maxilla together with the protrusion of anterior alveoli results in a gummy smile. In this study, posterior maxillary inclination (N-S:SPP) was statistically greater in the experimental group compared to the control group; a finding similar to a previous study.

In the current study, the mandibular plane angle in the experimental group was statistically greater than that of the normal group. It was similar with Wu et al[11] study and it was an irrelevant component in the investigations of Singer[21] and Peck et al[19].

One of the major results in this study was

that subjects with skeletal class II malocclusion and vertical growth pattern comprised the majority of the sample. Only one patient belonged to the skeletal Class III group and none belonged to horizontal growth pattern group in the current sample. As a result, gummy smile did not only consist from the maxilla, but also definitely correlated with the relationship and location of the mandible. The two jaws contributed to the typical facial appearance in patients with a gummy smile.

This deficit of skeletal Class II and vertical growth pattern, were commend orthopedic treatment to facilitate the growth of the mandible and inhibit the vertical growth of maxilla by using a functional appliance with high pull Headgear. The application of an early skeletal treatment is to facilitate the growth of the mandible and inhibit the verticalgrowth of maxilla. For patients who have passed the growth spurt and orthopedic treatment is no longer suitable, only surgery can correct the severe skeletal discrepancy. Le Fort I osteotomy is widely used to compact the

maxilla and alleviate the long face.

In the current study, upper anterior teeth were labially inclined in the experimental group, which were consistent with the characteristics of a retruded mandible and vertical growth pattern that was reflected by increased convexity of profile in most patients with a gummy smile.

CONCLUSIONS

The morphologic features of a patient with a gummy smile can be summarized as follows:
1- Skeletal class II malocclusion and vertical growth pattern accounted for most patients with a gummy smile
2- Retruded mandible, posterior inclination the maxilla and mandible, labiallyinclined upper incisors, convexity of profile in most patients with a gummy smile werean irrelevant factors.
3- Treatment planning should be adjusted according to thecraniofacial feature of each individual patient.

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ملامح المركب القحف الوجهي عند مرضى الابتسامة اللثوية عند البالغين في المجتمع السوري

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الملخص

الهدف: هو الحصول على فهم لملامح المركب القحف الوجهي عند مرضى الابتسامة اللثوية عند البالغين في المجتمع السوري.

الطريقة: تضم عينة الدراسة 57 أشخاص بالغين (15 للذكور و42 أنثى)، تظهر لديهم الابتسامة اللثوية بأكثر من 2 مم عند الابتسامة تم اختيارهم من قسم تقويم الأسنان والفكين في جامعة دمشق، ومقارنتها مع عينة شاهدة لأشخاص ذوي معايير اطباقية وهيكلية مثالية، وتم إجراء قياسات سيفلومترية موحدة ومقارنة المجموعتين. باستخدام اختبار t-test.

النتائج: على المستوى الهيكلي وجد أن مرضى الابتسامة اللثوية يعانون من تراجع فك سفلي في المستوى السهمي ودوران خلفي في المستوى العامودي، أما على المستوى السني فلوحظ وجود بروز شفوي للقواطع العلوية، وكان نمط النمو الأفقي هو الغالب.

الاستنتاجات: أثناء التخطيط للمعالجة لابد من الأخذ بعين الاعتبار لملامح المركب القحف الوجهي عند مرضى الابتسامة اللثوية عند كل مريض بشكل منفرد للوصول لمعالجة ناجحة.

الكلمات الدالة: ملامح المركب القحف الوجهي، الابتسامة اللثوية، المجتمع السوري.