

Smile analysis following orthognathic surgery

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Abstract

Aim: This study compared the different views between orthodontists and oral maxillofacial surgeons, as for smile analysis in patients subjected to orthognathic surgery. **Methods:** Thirty individuals who had undergone orthognathic surgery and had a minimum postoperative period of 6 months were selected. Posttreatment frontal smile photographs were obtained and examined. Smile features were recorded by 4 professionals (2 orthodontists and 2 surgeons) and the agreement between them was assessed. **Results:** The subjective analysis of smile as well as the observation of incisal and gingival exposure showed a statistically significant agreement percentage between the two groups. Nevertheless, no agreement was seen between the surgeons, while evaluating the buccal corridor and the parallelism between the incisal edge of antero-superior teeth and the lower lip. Significant agreement percentage (60%) was seen only between the orthodontists regarding the smile arch parallelism. **Conclusions:** Professionals must be alert as for facial analysis, mainly in terms of smile harmony, so that the orthognathic surgery will satisfactorily reestablish the facial esthetics in all the parameters outlined.

Keywords: smile, esthetics, harmony, interdisciplinary analysis.

Introduction

Facial esthetics is a rather subjective concept among individuals, influenced by the characteristics imposed by their society, as parameters to perceive beauty. Among these concepts, smile is essential in the definition of a harmonious face¹⁻³.

Smile usually translates a state of soul, confirming that man is the only living being endowed with emotional intelligence, capable of expressing his feelings in a unique fashion.

Most people seeking dental assistance wish to improve their facial esthetics and specially their smile, to be inserted in the society they belong to. Thus, the orthodontist must be skilled to recognize the therapeutic goals in an individualized form, so as to reestablish facial harmony within patients' expectations.

Currently, a pleasant smile, mainly influenced by the beauty standards imposed by the media, is characterized by the presence of bulky, perfectly aligned and leveled teeth in the dental arch⁴. In this context, individuals presented with dentofacial deformities and skeletal alterations related to malocclusion, quite often have an unpleasant smile. Hence, orthognathic surgery plays an important role in the reestablishment of facial harmony and the stomatognathic system.

The static analysis of smile defines as ideal the presence of the smile arch, which is established through the relation of parallelism between the curvature of upper incisors and canines and the border of the lower lip. Furthermore, the exposure of upper incisors must present a minimum of 80% of their length, at 2 mm of the inserted gingiva⁵⁻⁶.

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As it is widely implicit that facial harmony is an individual and subjective characteristic, this work is justified for questioning the differences as far as the smile analysis of patients subjected to orthognathic surgery is concerned, between orthodontists and oral maxillofacial surgeons, unaware that the patients had undergone orthognathic procedures. The present study aimed at answering the following question: what are the differences in the view of orthodontists and oral maxillofacial surgeons about the smile of patients who had undergone orthognathic surgery.

Material and methods

The research project was reviewed and approved by the Research Ethics Committee of FUNEC's Dental School (Protocol #0000030).

Thirty patients (11 males and 19 females; mean age: 24.7 years; range: 19 to 52 years) who had undergone orthognathic surgery and had a minimum postoperative period of 6 months were selected. Posttreatment frontal smile photographs were obtained with the patients positioned with Frankfurt's plane parallel to the ground and maintaining a spontaneous smile for a thorough analysis. All photographs were taken by a single researcher and were standardized by keeping the patient at a distance of 1.5 m from the digital camera (D-40; Nikon, Tokyo, Japan). Using Adobe Photoshop (Adobe Systems, San Jose, CA, USA), the images were cropped to include only the limits of the upper and lower lips (Figure 1), according to the reviewed literature³⁻⁹, aiming to eliminate the possible interference of other facial imbalances in the assessment by the examiners.

A form was made for the subjective assessment of the smile, checking its pleasantness, exposure of upper incisors at smiling, gingival exposure, the presence of the buccal corridor and parallelism obtained through the relation of upper incisors with the lower lip border (Figure 2).

Afterwards, the same photographs (n=30) were entered in the Microsoft Office PowerPoint 2007 software, displayed in 30 slides, according to Forms (1 to 30). The images were printed in *gloss paper* and sent for assessment by 4 examiners (2 orthodontists and 2 oral maxillofacial surgeons), who were not informed whether or not the individuals in the study had undergone orthognathic surgery. Only the gender and age were informed. The data were described by absolute (n) and relative (%) frequencies. Agreement percentage and Kappa statistics were used to verify the interexaminer agreement and all calculations were performed in the 13.0 SPSS (SPSS Inc., Chicago, IL, USA) software.

Results

Regarding the oral maxillofacial surgeons, surgeon 1 considered that 5 (16.7%) patients had a pleasant smile and 25 (83.3%) patients had an unpleasant smile. Surgeon 2 considered that 4 (13.3%) patients had a pleasant smile and 26 (86.7%) had an unpleasant smile. Thus, 76.67% of the characteristics analyzed were consistent between the professionals (Table 1).



Fig. 1. Posttreatment frontal smile photograph for analysis.



Fig. 2. Form elaborated for facial analysis at smiling.

- 1-Smile: Pleasant, Unpleasant
- 2-Exposure of upper incisors during smiling: Normal, Excessive, Deficient
- 3-Upper gingival exposure on smiling: Normal, Excessive, Deficient
- 4-Buccal corridor: Normal, Large, Narrow
- 5-Relation between upper incisors and the border of lower lip: Parallelism, No parallelism

Regarding the orthodontists, orthodontist 1 classified 15 (50%) smiles as pleasant and 15 (50%) as unpleasant, while orthodontist 2, considered that 20 (66.7%) patients

Table 1. Smile assessment by the two surgeons.

Surgeon 2	Surgeon 2					
	Pleasant		Unpleasant		Total	
	n	%	n	%	n	%
Pleasant	1	3.3	4	13.3	5	16.7
Unpleasant	3	10.0	22	73.3	25	83.3
Total	4	13.3	26	86.7	30	100.0

% agreement = 76.67%; kappa = 0.09

had a pleasant smile and 10 (33.3%) had an unpleasant smile. Thus, the agreement percentage was 56.67% (Table 2).

Table 2. Smile assessment by the two orthodontists.

Orthodontist 1	Orthodontist 2					
	Pleasant		Unpleasant.		Total	
	n	%	n	%	n	%
Pleasant	11	36.7	4	13.3	15	50.0
Unpleasant	9	30.0	6	20.0	5	50.0
Total	20	66.7	10	33.3	30	100.0

% agreement = 56.67%; kappa = 0.13

In the assessment of upper incisor exposure during the spontaneous smile, surgeon 1 classified 7 (23.3%) patients with a deficient exposure, 6 (20%) patients with an excessive exposure, and 17 (56.7%) with a normal exposure. Surgeon 2 classified 9 (30%) patients with a deficient exposure, 7 (23.3%) with an excessive exposure, and 14 (46.7%) with a normal exposure. The agreement percentage between these professionals was 76.67% (Table 3). Orthodontist 1 identified 6 (20%), 4 (13.3%) and 20 (66.7%) patients as having deficient, excessive and normal exposure of the upper incisors during the spontaneous smile. For orthodontist 2, 6 (20%) patients had normal exposure, 4 (13.3%) had an excessive exposure, and 20 (66.7%) had normal exposure. These data represent 80% agreement between these examiners (Table 4).

As for gingival exposure while smiling, surgeon 1 identified 12 (40%) individuals with deficient exposure, 5 (16.7%) with excessive exposure, and 13 (43.3%) with a normal exposure. Surgeon 2, however, found the same proportion for deficient, excessive and normal gingival exposure while smiling (10 patients/33.3%). In this case, the agreement percentage was 73.33% between the surgeons (Table 5). For orthodontist 1, 6 (20%), 3 (10%) and 21 (70%) patients had deficient, excessive normal exposure, respectively. Orthodontist 2 classified 11 (36.7%) individuals with deficient gingival exposure, 1 (3.3%) with excessive exposure, and 18 (60%), with normal exposure. The agreement between them was 76.67% (Table 6).

Regarding the buccal corridor, surgeon 1 considered that 3 (10%) patients had a large buccal corridor, 13 (43.3%) had a normal buccal corridor, and 14 (46.7%) had a narrow buccal corridor. Surgeon 2 identified 10 (33.33%) patients with a large buccal corridor, 19 (63.3%) with a normal corridor, and 1 subject (3.3%), with a narrow buccal corridor. With this discrepancy, the agreement percentage was 33.33% (Table 7).

Table 3. Assessment of upper incisor exposure by the two surgeons.

Surgeon 1	Surgeon 2							
	Deficient		Excessive		Normal		Total	
	n	%	n	%	n	%	n	%
Deficient	6	20.0	0	0.0	1	3.3	7	23.3
Excessive	0	0.0	5	16.7	1	3.3	6	20.0
Normal	3	10.0	2	6.7	12	40.0	17	56.7
Total	9	30.0	7	23.3	14	46.7	30	100.0

% agreement = 76.67%; kappa = 0.62

Table 4. Assessment of upper incisor exposure by the two orthodontists

Orthodontist 1	Orthodontist 2							
	Deficient		Excessive		Normal		Total	
	n	%	n	%	n	%	n	%
Deficient	5	16.7	0	0.0	1	3.3	6	20.0
Excessive	0	0.0	2	6.7	2	6.7	4	13.3
Normal	1	3.3	2	6.7	17	56.7	20	66.7
Total	6	20.0	4	13.3	20	66.7	30	100.0

% agreement = 80%; kappa = 0.6

Table 5. Assessment of gingival exposure by the two surgeons.

Surgeon 1	Surgeon 2							
	Deficient		Excessive		Normal		Total	
	n	%	n	%	n	%	n	%
Deficient	8	26.7	3	10.0	1	3.3	12	40.0
Excessive	0	0.0	5	16.7	0	0.0	5	16.7
Normal	2	6.7	2	6.7	9	30.0	13	43.3
Total	10	33.3	10	33.3	10	33.3	30	100.0

% agreement = 73.33%; kappa = 0.60

Table 6. Assessment of gingival exposure by the two orthodontists.

Orthodontist 1	Orthodontist 2							
	Deficient		Excessive		Normal		Total	
	n	%	n	%	n	%	n	%
Deficient	6	20.0	0	0.0	0	0.0	6	20.0
Excessive	0	0.0	1	3.3	2	6.7	3	10.0
Normal	5	16.7	0	0.0	16	53.3	21	70.0
Total	11	36.7	1	3.3	18	60.0	30	100.0

Orthodontist 1 considered 7 (23.3%) patients with a large buccal corridor, 15 (50%) with a normal buccal corridor, and 8 (26.7%), with a narrow buccal corridor. For orthodontist 2, 3 (10%), 24 (80%) and 3 (10%) patients had large, normal and narrow buccal corridor, respectively. Thus, the agreement percentage was 43.33% (Table 8).

Regarding the parallelism between the relation of the upper incisor with the border of the lower lip, surgeon 1 identified 3 (10%) subjects with parallelism and 27 (90%) without. According to surgeon 2, 17 (56.7%) subjects presented parallelism, while 13 (43.3%) did not. The agreement percentage between them was 40% (Table 9). Orthodontist 1 classified 20 (66.7%) subjects as having parallelism in this analysis, and 10 (30%) as not having, orthodontist 2 identified 28 (93.3%) subjects with parallelism, and 2 (6.7%) without, reaching an agreement of 60% between them (Table 10).

Table 7. Assessment of the buccal corridor by the two surgeons.

Surgeon 1	Surgeon 2							
	Increased		Normal		Reduced		Total	
	n	%	n	%	n	%	n	%
Large	1	3.3	2	6.7	0	0.0	3	10.0
Normal	3	10.0	9	30.0	1	3.3	13	43.3
Narrow	6	20.0	8	26.7	0	0.0	14	46.7
Total	10	33.3	19	63.3	1	3.3	30	100.0

% agreement = 33.33%; kappa = 0.02

Table 8. Assessment of the buccal corridor by the two orthodontists.

Orthodontist 1	Orthodontist 2							
	n		%		n		%	
Large	1	3.3	6	20.0	0	0.0	7	23.3
Normal	2	6.7	11	36.7	2	6.7	15	50.0
Narrow	0	0.0	7	23.3	1	3.3	8	26.7
Total	3	10.0	24	80.0	3	10.0	30	100.0

% agreement = 43.33%; kappa = -0.03

Table 9. Assessment of the relation between the upper incisor and the lower lip, by the two surgeons.

Surgeon 1	Surgeon 2					
	Parallelism		No parallelism		Total	
Parallelism	1	3.3	2	6.7	3	10.0
No parallelism	16	53.3	11	36.7	27	90.0
Total	17	56.7	13	43.3	30	100.0

% agreement = 40%; kappa = -0.08

Table 10. Assessment of the relation between the upper incisor and the lower lip, by the two orthodontists.

Orthodontist 1	Orthodontist 2					
	Parallelism		No parallelism		Total	
Parallelism	18	60.0	2	6.7	20	66.7
No parallelism	10	33.3	0	0.0	10	33.3
Total	28	93.3	2	6.7	30	100.0

% agreement = 60%; kappa = -0.13

Discussion

Smile assessment is a rather relevant parameter in individuals and the reestablishment of smile symmetry, the most important factor in facial esthetics, especially in patients who have undergone surgical procedures to correct dental/facial deformities⁷. Nevertheless, this analysis is quite subjective and personal, since beauty characteristics are mainly based on the cultural and socioeconomic standards of the studied population⁸. This justifies the percentage of agreement reached between the professionals, 76.67% for oral maxillofacial surgeons and 56.6% for orthodontists (Tables 1 and 2), concerning the promotion of a pleasant smile in patients subjected to orthognathic surgery.

Currently, a beautiful smile is characterized by bulky, aligned and leveled white teeth. Thus, the ideal exposure of the incisors during smiling is 75 to 100% of the crown height up to 2 mm of attached gingiva, being a little more in females than in males^{5,7}. The variability in the gingival exposure in the postoperative course of orthognathic surgeries is due to the lack of movement in the upper repositioning of the maxilla and lack of vertical growth, as well as to the presence of gingival hypertrophy or the magnitude of lip elevation at smiling⁹.

This allows classifying the exposure of incisors and attached gingiva during smile in deficient, excessive and normal, whenever within these aforementioned parameters. In the present study, the orthodontists and surgeons identified, more frequently, a normal exposure of incisors and gingiva

during smiling, with a statistically significant agreement percentage ranging from 73.3% to 80% (Tables 3-6). Thus, it is possible to state that the orthognathic surgeries have satisfactorily reestablished the smile of the individuals.

An important characteristic of smile to be assessed in the frontal aspect, is the buccal corridor, which allows evaluating the presence or not of maxillary transversal deficiency, and identifying alterations in the occlusal and transverse plane, which is consistent with the posterior asymmetry and aids in the assessment of the transversal unevenness of the maxilla^{5,10}. These are key points to be taken into account in the preoperative analysis, since these alterations will be corrected surgically for the preparation of surgical guides, aiming at a harmonious smile, postoperatively¹¹. In this aspect, the present work showed a considerable discrepancy between the professionals, whose agreement percentages were 43.33% (orthodontists) and 33.33% (surgeons) (Tables 7 and 8). On the other hand, the buccal corridor was considered normal in more than 50% of the individuals by both groups of professionals, showing that the orthognathic surgery was effective for correction of transversal alterations. This discrepancy between the professionals denotes that a thorough judgment is extremely important during facial analysis, so as to achieve unanimous esthetic results.

Facial harmony is also observed during the formation of the smile arch, which is defined by the relation of the curvature of the incisal edge of the anterosuperior teeth (incisors and canines) and the curvature of the lower lip. The curves should present a parallelism relation. Some studies have demonstrated that most patients did not accomplish the smile arch parallelism at the completion of the orthodontic treatment¹²⁻¹⁴. However, it is important that this smile pattern be accomplished, both in the orthodontic treatment and ortho-surgical one. The individuals evaluated in this research were identified with the presence of smile arch with parallelism, mostly between the orthodontists (66.7% for orthodontist 1 and 93.3% for orthodontist 2). Nevertheless, in the judgment by the oral maxillofacial surgeons, only one of the evaluators classified most patients with a smile arch in parallelism (56.7%), being that surgeon 1, identified 90% of the patients with no parallelism. Thus, dental leveling during the pre-surgical orthodontic treatment must be carefully reviewed, so as to reach this esthetic parameter, after the orthognathic surgery.

Based on the results of this work and the literature reviewed, it may be concluded that the agreement percentage among oral maxillofacial surgeons and orthodontists was significant in the following parameters evaluated: subjective smile analysis (pleasant or unpleasant) and exposure of upper incisors and gingiva during smiling. For the remaining parameters, buccal corridor and parallelism between the incisal edge of anterosuperior teeth and the border of the lower lip, no agreement was found between the groups of professionals, in their majority. A considerable agreement percentage (60%) was observed only between the orthodontists regarding smile arch parallelism. It is very important that professionals know the inherent characteristics of a pleasant smile for the ortho-surgical planning to be correctly outlined, and for effective postoperative results.

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