Original Article

Patients' Satisfaction of Smile Line Beauty after Maxillofacial and Oral Surgery

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Abstract

Introduction: The aim of this study was to assess various smile line problems and treatments and to assess the patients' satisfaction after treatment. **Methods:** This cross-sectional study assessed patients who had smile line problems. Various smile line problems included vertical maxillary excess (VME), muscle hyperactivity, gingival hyperplasia, short lip, bimaxillary protrusion, asymmetric muscle hyperactivity, maxillary canting, and tooth deformity. All patients filled out a questionnaire one year after the procedures for 23 assessments of satisfaction. The level of satisfaction was evaluated using a visual analog scale (VAS): 0-3 dissatisfaction, 4-7 acceptable, and 7-10 desirable. **Results:** One-hundred thirty-seven patients were included in this study. The highest level of satisfaction was noted in patients who had tooth deformity, VME with passive eruption, and gingival hyperplasia or passive supra-eruption (7.75±0.46, 7.66±0.72, and 7.50±0.55, respectively). The lowest level of satisfaction was noted in patients who had asymmetric muscle activity, muscle hyperactivity, and VME+ muscle hyperactivity (4.25±0.96, 4.33±0.78 and5.00±1.09, respectively). **Conclusion:** Patients with soft tissue problems of the smile line may have low 41satisfaction especially when temporary treatments such as botulinum toxin are used for treatment. Surgery of the hard tissues may result in moderate to high satisfaction in patients with smile line problems.

Keywords: Smiling, Face, Esthetics, Facial Muscles

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Introduction

An attractive smile is one of the main concerns with regard to facial esthetics. Facial attractiveness is important for social interactions. It affects mating, personality presentations, kinship opportunities, employment prospects, and performance (1). In the other hand it was proved that orthodontic surgeries can improve the oral-health related quality of life of the patients (2). Smile problems are among the main reasons for patients referring to oral and maxillofacial surgeons (3). An esthetically beautiful smile depends on many components such as tooth size, shape, position, and colour. Additionally, the amount of gingival show, lip position, and skeletal harmony play an important role in the smile line (4).

Skeletal components of smile line problems consist of vertical maxillary excess (VME), maxillary protrusion or retrusion and maxillary rotation (yaw and roll), which can be associated with occlusal canting and an asymmetric smile. Soft tissue components include a short upper lip, hypermobility of the upper lip, and unilateral hypomobility of facial muscles due to facial nerve palsy (5). Periodontal conditions can also influence the smile line by a delayed passive eruption and gingival hyperplasia (6). Treatment of smile line problems requires a proper differential diagnosis and sometimes collaboration between various specialties such as oral and maxillofacial surgeons, orthodontists, dentists, and prosthodontists. There are few studies in the oral and maxillofacial literature regarding smile line problems and patients' satisfaction after treatment.

The study purpose is to address the following question: Among the patients who have various smile problem and undergo different treatments, which treatments are associated with a higher satisfaction rate? So, the aim of this study was to assess various smile line problems, related treatments, and level of satisfaction of patients postoperatively.

Materials and Methods

The authors designed a cross-sectional study. The sample was derived from the population of patients referring to our oral and maxillofacial surgery clinic between September 1, 2015 and April 30, 2017. The study was approved by the committee of the medical ethics group of Shahid Beheshti University of medical sciences. Patients eligible for study inclusion had smile line problems. Patients 50 were excluded from the study enrolment if they had had previous maxillofacial trauma or orthognathic surgery or previous cosmetic procedures for the lips or teeth. All subjects signed a consent form for participation in the study.

An excessive smile was defined as more than 3 mm of the gingival show upon smiling. Maxillary canting required treatment if it was more than 4 degrees (7).

The muscle hyperactivity was defined as when the subjects' upper lip translated more than 12 mm from repose to full smile.

The short lip was defined as when the upper lip was less than 20 mm in females and 22 mm in males (6).

The vertical maxillary excess was defined as a long lower face in comparison with the upper face, excessive incisor show at rest, excessive gingival display on full smile, and interlabial incompetency in absence of short or hypermobile lips(8). If patients had dentoalveolar inclination of both maxillary and mandible anterior teeth leading to the protrusion of the lips or facial convexity, they were considered as having bimaxillary protrusion (9).

All patients with VME underwent LeFort I osteotomy for maxillary superior repositioning. In patients with VME with gingival hyperplasia, gingivectomy was conducted in association with LeFort I osteotomy. Patients with VME and muscle hyperactivity received botulinum toxin three months after surgery. Patients with VME and gingival hyperplasia underwent LeFort l osteotomy with gingivectomy. Patients with VME and short lip received LeFort l osteotomy and V-Y plasty.

Patients with muscle hyperactivity received botulinum toxin. Patients who had 36 tooth deformity received composite restorations by restorative dentists. Patients with bimaxillary protrusion or maxillary canting underwent bimaxillary osteotomy. Patients who had gingival hyperplasia or passive eruption underwent gingivectomy. In asymmetric muscle activity, patients received unilateral botulinum toxin injection. In patients with short lip, V-Y plasty was done.

All patients filled out a questionnaire for satisfaction one year after the procedures. 46

The level of satisfaction was evaluated based on a visual analogue scale (VAS): 0-3 indicated dissatisfaction, 4-7 indicated acceptable outcome and 7-10 indicated desirable outcome.

Statistical analysis

The statistical analyses were performed using SPSS version 21 (SPSS Inc., IL, USA). The Chi-square test was applied to compare various deformities between males

and females. The ANOVA was used to compare patient satisfaction after treatment. The post hoc test was used for the evaluation of differences in satisfaction.

Results

One-hundred thirty-seven patients (24 males and 113 females) were included in this study. The mean age was 23.75±4.80 years. Eighty-six (62.77%) patients had

VME. Forty-three (31.4 %) patients had true VME, 21 (15.3%) had VME and muscle hyperactivity, 15 (10.9%) had VME and gingival hyperplasia and 7 (5.1%) had VME and short lip. Twelve (8.8%) patients had muscle hyperactivity, 8 (5.8%) had tooth deformity, 22 (5.8%) had bimaxillary protrusion, 7 (5.1%) had maxillary canting, 6 (4.4%) had gingival hyperplasia or passive eruption, 4 (2.9%) had asymmetric muscle activity, and 6 (4.4%) had short lip (Table I). The highest level of satisfaction was noted in patients who had tooth deformity, VME with passive eruption and gingival hyperplasia or passive eruption (7.75±0.46, 7.66±0.72 and 7.50±0.55, respectively; Table 1).

Table I: Descriptive of characteristic of study population

	problem	N	Mean (satisfaction)	Age (years)
1	True VME	43	6.93±0.83	27.55±4.42
2	gingival hyperplasia	6	7.50±0.55	20.33±1.50
3	muscle hyper activity	12	4.33±0.78	20.16±2.48
4	VME+ gingival hyperplasia	15	7.66±0.72	22.00±2.80
5	VME+ muscle hyperactivity	21	5.00±1.09	18.76±2.16
6	Tooth deformity	8	7.75±0.46	28.75±2.31
7	Maxillary cant	7	7.00±0.81	25.57±1.61
8	asymmetric muscle activity	4	4.25±0.96	20.25±0.50
9	short lip	6	5.50±1.05	23.66±4.13
10	VME +short lip	7	7.14±0.69	25.57±3.45
12	Bimaxillary protrusion	8	6.87±0.83	21.37±3.20
	Total	137	6.43±1.41	23.76±4.80

Descriptive of the study

The lowest level of satisfaction was noted in patients who had asymmetric muscle activity, muscle hyperactivity, and VME+ muscle hyperactivity (4.25±0.96, 4.33±0.78, and 5.00±1.09, respectively). The ANOVA showed a significant difference in satisfaction level of patients with various smile deformities (P=0.001).

Table II demonstrates the comparison of satisfaction rate among patients with 45 various smile deformities using the post hoc test. Figures 1-5 showed subjects with various smile problems who underwent different approaches before and after treatments.

A **B**

Figure 1: A 21-year-old female with VME and unilateral muscle hyperactivity. B: The patient after maxillary superior repositioning and unilateral botulinum toxin injection in the right side.

A B

Figure 2 A: 19-year-old female with maxillary canting and mandibular deviation to the right side. B: The patient after bimaxillary osteotomy for correction of mandibular deviation and maxillary canting.

A B

Figure 3 A: 21-year-old female with huge VME. B: The patient after maxillary superior repositioning.

A B

Figure 4 A: 26-year-old female with mild VME and muscle hyperactivity in smile. B: The patient after botulinum toxin injection in the upper lip muscles

A B

Figure 5 A: 21-year-old female with teeth deformity. B: The patient after restoration of anterior teeth and gingivectomy.

Table II: Comparison of patients' satisfaction after treatment among various smile problems.

Smile Problem		P- value	Smile Problem		P- value
True VME	gingival hyperplasia	0.001	Gingival hyperplasia	Muscle hyper activity	0.92
	muscle hyper activity	0.001		VME+gingival hyperplasia	0.30
	VME+gingival hyperplasia	0.001		VME+muscle hyperactivity	0.31
	VME+muscle hyperactivity	0.001		Tooth deformity	0.001
	Tooth deformity	0.35		Maxillary cant	0.005
	Maxillary cant	0.14		Asymmetric muscle activity	0.97
	assymetric muscle activity	0.001		Short lip	0.08
	short lip	0.008		VME+short lip	0.005
	VME+short lip	0.14		Bimaxillary protrusion	0.56
	Bimaxillary protrusion	0.001			
Muscle hyper activity	VME+gingival hyperplasia	0.15		VME+muscle hyperactivity	0.005
	VME +muscle hyperactivity	0.24		Tooth deformity	0.001
	Tooth deformity	0.001		Maxillary cant	0.02
	Maxillary cant	0.001	VME +gingival	Asymmetric muscle activity	0.35
				Short lip	0.30

			hyperplasia	VME +short lip	0.02
	Asymmetric muscle activity	097			
				Bimaxillary protrusion	0.67
	Short lip	0.04			
	VME +short lip	0.001			
	Bimaxillary protrusion	0.43			
	Tooth deformity	0.001			
VME +muscle hyperactivity			Tooth deformity	Maxillary cant	0.67
	Maxillary cant	0.001		Asymmetric muscle	0.001
	Asymmetric muscle activity	0.41		activity	
				Short lip	0.005
				VME +short lip	0.67
	Short lip	0.002			
	VME +short lip	0.001		Bimaxillary protrusion	0.001
	Bimaxillary protrusion	0.06			
	Asymmetric muscle activity	0.01			
Maxillary cant			Asymmetric muscle activity	Short lip	0.11
	Short lip	0.30		VME +short lip	0.01
	VME +short	1.00			
	lip			Bimaxillary protrusion	0.58
	Bimaxillary protrusion	0.16			
	VME +short lip	0.30			
Short lip			VME +short		0.16

	Bimaxillary protrusion	0.20	lip	Bimaxillary protrusion

Discussion

An esthetic smile has three primary components: teeth, lip framework, and gingival scaffold, which are in close harmony (10). Excessive tooth show and gingival show are considered to be unattractive, and intervention is suggested for such cases (11). The most attractive smile is defined as when the upper lip is at the height of the gingival margin of the upper central incisor and the smile line provides a harmony between the arcs of the curvature of the incisal edges of the upper incisors and the upper border of the lower lip (12). Two to 4 mm of gingival show has been reported to be attractive. (13) Gingival display is defined as the amount of gingival show above the central incisor crowns and below the center of the upper lip.

Quantification of resting and dynamic tooth-lip relationship is important in smile dynamics. Due to the increasing influence of electronic and print media, patients are now cautious and knowledgeable about various aspects of the smile and esthetics. The patients are the best critics of their smile and have an idea about what they desire from treatment (14). In this study, the patients had the lowest level of satisfaction with treatments of soft tissue components such as muscle hyperactivity. The main reason for this was the essence of soft tissue treatment. Many soft tissue modifications were not permanent such as botulinum toxin injection or were not predictable. Mazzuco and Hexsel reported the general average improvement of gummy smile to be 75.09% using botulinum toxin (15). Since botulinum toxin injection is reversible, it 31constitutes an option for temporary correction of gummy smile in patients willing to undertake more invasive and definitive procedures later on. Furthermore, aging results in lip lengthening and makes this less invasive and temporary procedure 36 more appealing to the patients (16). Myotomy of the levatorlabiisuperioris muscle is another option for reduction of tooth show in patients with hyperactive smiles (17). Several techniques have been suggested for lip repositioning as a minimally invasive procedure in gummy smile patients. There are few studies to assess the stability of this approach and patient satisfaction (18, 19). In our study, the patients with pure VME had a modest satisfaction rate after LeFort I osteotomy. Tabrizi et al. (5) reported errors of prediction in VME cases with under correction (25%) and overcorrection (7.5%). Khamashta-Ledezma and Naini mentioned the soft tissue response to be more variable vertically following maxillary superior repositioning with or without V-Y closure and cinch suture (20). The Patients with tooth deformity and altered passive tooth supra-eruption had high satisfaction rates after treatment. Gottlieb described two stages of eruption, one toward the occlusal plane and one where the gingival crevice moves apically (passive eruption) (21). Gingivectomy or esthetic crown lengthening has acceptable long-term results in patients with altered passive eruption or gingival hyperplasia (22). The satisfaction rates were high in cases with VME and altered passive eruption or gingival hyperplasia in the current study. Orthodontic treatment alone or in combination with orthognathic surgery are 13 treatments of choice for correction of bi-maxillary protrusion. Orthodontic treatment often consists of extraction of the four first premolars with subsequent retraction and/or up righting of the incisors. In some moderate to severe cases of bi maxillary protrusion, orthognathic surgery may be required. Orthognathic surgery may include LeFort I osteotomy with bilateral sagittal split ramus osteotomy, upper and lower anterior subapical osteotomies or segmental osteotomies (23). Upper lip lengthening, widening of the nasal base, and deepening of the nasolabial fold may occur after surgery. It is important to gain a fine balance between preservation of some lip fullness and optimal anterior dentoalveolar retraction (24). In our study, patients with bimaxillary protrusion had a moderate to high satisfaction rate one year after osteotomies. Management of smile line is challenging and needs a proper diagnosis and multidisciplinary approach.

Conclusion

It seems that the patients with soft tissue problems in the smile line may have a lower satisfaction rate especially when temporary treatments such as botulinum toxin are used. Manipulation of hard tissues may result in a moderately higher satisfaction rate in the patients with smile line problems.

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Conflict of interest

No potential conflicts of interest were reported in this article

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