

Proper Diagnosis and Management of Dental Smile Esthetics from Periodontal Perspective: Literature Review

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Abstract

An esthetic smile is a common cosmetic concern in the dental field. Excessive gingival display (EGD), also called gummy smile (GS), is one of the main complaints related to an unsatisfying dental smile; it is said to be present when the gingival display exceeds 4 mm. The dental smile is achieved by a harmonious relationship between the size, shape, arrangement, and color of the anterior teeth; lip framework; and gingival contour. Altered passive eruption (APE) is characterized by short square-shaped teeth occurring when the gingiva covers the crown of the teeth excessively. Altered passive eruption is one of the causes of GS along with maxillary lip length, bony maxillary excess, hyperactive upper lip, anterior dentoalveolar extrusion, and vertical maxillary excess. There are various options for periodontal management of EGD, such as surgical or laser gingivectomy, esthetic crown lengthening, forced eruption, lip repositioning surgery, use of Botox, or a combination of these. The aim of this paper is to review main etiologies and for proper diagnosis before the clinician can settle on the management. Dental professionals should also outline the principles of an acceptable esthetic smile, which should be the target of each GS correction procedure.

Keywords: Gummy smile, Excessive gingival display, Lip repositioning.

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INTRODUCTION

Excessive gingival display (EGD) in a smile is a point of concern for many patients and may result in psychological and social discomfort and cause functional limitations [1]. EGD may lower the self-esteem of individuals and may further affect their social lives. According to the American Academy of Periodontology, EGD is a mucogingival deformity that requires intervention by a periodontist and the use of different correction approaches according to the etiology and cause. In this review, we present a literature review on etiologies and diagnosis of EGD related to dental smile and therefore proper management from periodontal perspective.

Management of Excessive Gingival Display

According to Andijani and Tatakis, a patient is considered to have EGD when the gingival display is greater than 4 mm [2]. However, it is essential to consider the etiology and the patient's complaints as well as expectations to establish an accurate diagnosis and a corresponding appropriate treatment plan. The diagnosis varies for each patient and is determined by the etiology of the deformity. Therefore, proper diagnosis and management of the dental smile is the responsibility of dental professionals, which requires

assessment, identification of the etiology, determination, and eventual treatment. The societal esthetic high smile line reveals a continuous gingival band and also exposes the entire cervico-incisal length of the maxillary incisors, according to Andijani and Tatakis [2]. EGD is believed to vary based on cultural acceptance as well as gender, as a high smile is more prevalent in women than in men. The esthetic smile is determined by the harmonious relationship between the gingival scaffold, the lip framework, and the teeth [3].

Gingival Contour

Irregular gingival displays are common even in individuals with good oral health [1]. Continuity and harmony of the gingival margin are, however, important for the esthetic smile. The gingival display deformity is corrected using various procedures including additive and reductive techniques through periodontal surgical procedures [4]. Soft tissue grafting and gingivectomy are used for this condition.

The Lip Framework

The lip defines the esthetic frame. A low lip line covers the teeth partially while a higher upper lip exposes a larger portion of the gingival margin [3]. According to Andijani and Tatakis, an asymmetrical or

shorter upper lip and hypermobile upper lip (HUL) are common in lip-related etiologies of EGD and non-satisfactory dental smile [2]. Garber and Salama reported that a gingival exposure of 1–3 mm is considered acceptable in Western culture, and reconstruction of the smile is not necessary [3]. This is in line with the conclusions of the research conducted by Andijani and Tatakis [2].

Smile Analysis

Muscles Associated with Smiling

The smile is often formed in two stages. The first stage occurs when the upper lip rises to the nasolabial fold. This happens due to contraction of the levator muscles, which originate in the fold and insert into the center of the upper lip. Simultaneously, the medial muscle bundles cause the lip to rise up displaying the anterior teeth up to the 1st premolars while the lateral muscle groups rise to display the posterior teeth, either up to the 2nd premolars or molars. The lip then meets with resistance at the nasolabial fold and cheek fat, limiting the smile to either the 2nd premolar or 2nd molar posteriorly. The second stage of smiling occurs by further raise of the lip and fold by three muscles groups: levator labii superioris muscles of the upper lip, which originate in the infraorbital region; zygomaticus major muscles; and superior fibers of the buccinators. Often, the final stages of smiling are accompanied by squinting. This is due to contraction of the peri-ocular musculature to support maximum upper lip elevation through the fold [5].

Tooth Display Determination

Anatomical tooth size evaluation is an important factor for correctly determining whether the smile needs correction or not. Maxillary central incisors should be within 8.3 to 9.3 mm in width and 0.4 to 11.2 mm in length, and this should be confirmed by calculating the ratio and percentage (normally reported to be 75–80%). After maxillary central incisor analysis, the golden proportion is measured. This is performed by multiplying the width of the central incisor by 62% and comparing it with the width of the adjacent lateral incisor. Similar values indicate that the width of the central incisor is in golden proportion to the width of the lateral incisor. By comparing the width of the lateral incisor multiplied by 62% with that of the canine, it can be determined whether the width of the lateral incisor is in golden proportion to the width of the canine.

The golden percentage is calculated by dividing the width of each central incisor, lateral incisor, and canine by the total width of all six maxillary anterior teeth and multiplying the resulting value by 100, in order to obtain the golden percentage for each tooth. If the values from canine to canine were 10, 15, 25, 25, 15, and 10%, it indicates that the six maxillary anterior teeth are in the golden percentage [6].

Gingival Zenith Analysis

The zenith is defined as the most apical point of the gingival marginal scallop. This important landmark helps in creating the desired axial inclination of the tooth by changing the line angle position of the long axis of the tooth and has a specific spatial orientation in the apico-coronal and mesiodistal directions. The zenith of the central incisor should be at the distal third, that of the lateral incisor in the middle, and that of the cuspid in a distal position. Furthermore, it should be in the middle for the premolars and molars. With regard to the level, the zenith line should be at the same level for all teeth except lateral incisors, which should be 1 mm in a coronal direction towards the tooth [7].

Etiology of Excessive Gingival Display

In their research, Andijani and Tatakis tried to compare the prevalence of HUL among patients seeking medical assistance for a GS, and observed that the condition was present in all patients with a GS. HUL is one of the identified etiologies [2]. However, despite being the most prevalent cause, the HUL condition is often accompanied by other causes of a GS. According to Bhola *et al.*, other etiologies of a GS include a deficiency in the maxillary lip length, bony maxillary excess, altered passive eruption, and other conditions that cause enlargement of the gingival display, such as plaque [1]. Further, Silva *et al.*, added anterior dentoalveolar extrusion and vertical maxillary excess as other etiologies [8]. The HUL is considered the leading cause if the lower third of the face is proportionate and the upper lip has a standard length, as defined by dentists.

Altered Passive Eruption

This is a condition wherein the gingiva covers an excessive part of the anatomic crown, and affects the general dentofacial harmony of the individual; it is a result of failure of the gingival tissue to migrate, after completion of teeth eruption, to the cemento-enamel junction apically in the proper position (Fig-1) [3]. According to Bhola *et al.*, this condition is prevalent in 12% of the total population [1]. It can occur on several teeth or even on one tooth. Coslet *et al.*, classified altered passive eruption into four types according to keratinized tissue observed clinically as well as the level of crestal bone from the level of the cemento-enamel junction based on recent vertical bitewing radiographs and proposed options accordingly (Table-1) [9].

Bony Maxillary Excess

Bony maxillary excess (BME) can be determined by dividing the facial height into thirds at the initial examination. BME is diagnosed when the lower third of the face is longer than the remaining thirds; this results in the teeth being located farther from the skeletal maxillary base. In this situation, Garber and Salama [3] proposed an orthodontic referral and treating

the condition properly using either a combination of orthodontic, periodontic, and restorative therapy or orthognathic surgery (Table-2).

Gingival Enlargement

Gingival enlargement (GE) can occur due to microbial plaque-induced chronic inflammation in association with aggravating medications, including cyclosporine, calcium channel blockers, and phenytoin. Other factors such as age; demographic variables; genetic predisposition; oral hygiene status; pharmacokinetic variables; and hormonal, molecular, and cellular changes may influence the process and rate or recurrence of GE. Additional local plaque retentive factors, for example, orthodontic or prosthodontic appliances may be responsible for localized or generalized gingival enlargement. Finally, certain rare conditions, such as hereditary gingival fibromatosis, can be associated with either localized or generalized as well (Fig-2) [1, 10].

Deficient Maxillary Lip Length

A diagnosis of EGD due to deficient lip length can be made based on the clinical measurement of the maxillary lip length and an excessive amount of tooth display at rest (Fig-3). Maxillary lip should be measured from the subnasale to the inferior border in

the rest position with the patient seated. Previous observational studies have reported that the average lip length is 21.2 ± 2.4 mm in young adult females and around 23.4 ± 2.5 mm in young adult males; these lengths were observed to decrease as the person became older [11]. Similarly, another study based on soft tissue cephalometric analysis reported the mean maxillary upper lip length to be 20.02 ± 2.89 mm for women and 23.4 ± 3.42 mm for men of similar ages (25–40 years old) [12,13]. This situation can only be compensated by a combination of lip filler in association with gingivectomy or esthetic crown lengthening, if associated with short clinical crowns (Fig-3).

Hypermobility of the Maxillary Lip

The maxillary lip generally translates 6 to 8 mm from the repose position to the position achieved at full smile. Sometimes, this translation can be one and a half times to twice this normal distance. Excessive mobility of the upper lip is caused by hyperfunction of the lip elevator muscles, and often results in EGD. Bhola *et al.*, [1] proposed three subclasses for EGD due to hypermobile lip (Table-3) subclass 1, in which 1 to 3 mm of the gingiva is visible in the dynamic smile, and subclass 2 and subclass 3, which display 4 to 6 mm and 7 mm or more of gingiva, respectively (Fig-1).

Table-1: Cosllet's Atlered Passive Eruption Classification

Type	Crestal Bone Level	Amount of KT	Treatment of Choice
1.A	Up to 2 mm apical to the CEJ	More than 3 mm	Gingivectomy
1.B	At the level of CEJ	More than 3 mm	Gingivectomy with osseous recontouring
2.A	Up to 2 mm apical to the CEJ	Less than 2 mm	Apically positioned flap
2.B	At the level of CEJ	Less than 2 mm	Apically positioned flap with osseous recontouring

KT: Kertinized tissue; CEJ: Cemento-Enamel Junction

Table-2: Garber and Salama's Bony Maxillary Excess Classification

Degree	Gingival and Mucosal Display	Treatment Options
1	2–4 mm	<ul style="list-style-type: none"> - Orthodontic intrusion only* - Orthodontic & periodontic therapy* - Periodontic & restorative therapy*
2	4–8 mm	<ul style="list-style-type: none"> - Periodontic & restorative therapy - Orthognathic surgery*
3	> 8 mm	- Orthognathic surgery with or without adjunctive periodontic & restorative therapy to reach craniofacial harmony.

*Choice depends on the patient's preference, crown to root ratio and amount of root encased in bone.

Table-3: Bhola's Hypermobility Lip Classification

Subclass	Amount of Gingival Display	Treatment Options
1	1–3 mm	<ul style="list-style-type: none"> - LiptStaT with removal of 2–5 mm of mucosa - Botox
2	4–6 mm	LiptStaT with removal of 8–12 mm of mucosa
3	≥ 7 mm	LiptStaT with removal of 10–15 mm of mucosa



Fig-1: Excessive gingival display due to altered passive eruption



Fig-2: Plaque-induced gingival overgrowth



Fig-3: Deficient maxillary lip length

CONCLUSION

Management of the unesthetic dental smile has become a cosmetic demand which needs the corrections through surgical and dental intervention [8]; hence,

proper diagnosis and assessment of the dental smile is essential. Moreover, principles defining the acceptable esthetic smile are slowly developing and being established and may eventually become the standard

principles. Although some etiologies are more prevalent than others, the clinician should look for more than one cause for the EGD before planning the correction and management procedure, as usually the condition may be the result of a combination of several factors. Finally, determining the etiology is mandatory for making a proper diagnosis and choosing the appropriate treatment modality.

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