Facial expressions and the smile are key components for nonverbal communication. The smile has an important role in the determination of the first impression of a person.\(^1\)

An esthetic or pleasing smile is composed of 3 primary components: \(^2\) the teeth, lip framework, and the gingival scaffold. An ideal esthetic and pleasing smile presents the following characteristics (Fig 1)\(^3,4\): (1) minimal gingival exposure, (2) symmetric display and harmony between the maxillary gingival line and upper lip, (3) healthy gingival tissue filling the entire interproximal spaces, (4) harmony between the anterior and posterior segments (gradation principle)\(^5\), (5) teeth in correct anatomy and proportion (form and position), (6) proper color and shade of the teeth, and (7) lower lip parallel to the incisal edges of the maxillary anterior teeth and to the imaginary line going through the contact points of these teeth.

The description excessive gingival display, commonly called gummy smile, is used when there is an overexposure of the maxillary gingiva during a smile\(^6\) (Fig 2). In severe cases, the overexposure is also seen in repose of the mouth and lips (Fig 3). In most cases, the more the gingival tissues are displayed during the smile, the more unesthetic the smile appears.\(^7\) The prevalence of excessive gingival display is 10% of the population between the age of 20 and 30 years, and it is seen more in women than in men.\(^8\) The incidence of this condition gradually decreases with age as a consequence of dropping of the upper and lower lips, which in turn leads to a decrease in exposure of the maxillary incisors and an increase in exposure of the mandibular incisors.\(^9,10\)

**Excessive gingival display—Etiology, diagnosis, and treatment modalities**

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Extensive exposure of the gingiva during a smile, called excessive gingival display, may be a point of concern for both patients and clinicians. Patients often present to the dental clinic seeking a solution to their “gummy” appearance. A clinician must fully understand the various factors involved in this situation, to provide patients with an appropriate answer. Thorough examination followed by the right diagnosis is imperative for achieving an esthetic and predictable result in the treatment of such situations. The aim of this article is to discuss the various aspects of excessive gingival display and its etiology and to present the current solutions that exist in the literature. *(Quintessence Int 2009;40:809–818)*

**Key words:** altered passive eruption, diagnosis, etiology, excessive gingival display, gummy smile, vertical maxillary excess (VME)

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When analyzing a smile, one must bear in mind that a certain amount of gingival exposure during a smile is considered esthetically pleasing, which gives the expression of a youthful look. When analyzing a smile, one must bear in mind that a certain amount of gingival exposure during a smile is considered esthetically pleasing, which gives the expression of a youthful look. (Fig 4).

**DIAGNOSIS**

For a correct diagnosis, a thorough examination must be performed.

**Facial examination**

Facial symmetry and proportions in both frontal and lateral views. Assessment of facial symmetry is made with respect to the interpupillary line. This horizontal line divides the face into equal halves.

Accessory horizontal lines are the ophriac line (a line going through the eyebrows) and the commissural line. These lines should be parallel to the interpupillary line, thus creating an overall harmony of the face. These lines can be used as a reference for orienting the incisal plane, the occlusal plane, and the gingival contour. A line perpendicular to the interpupillary line should divide the face into 2 symmetrical parts.

Face height is usually analyzed by dividing the face into thirds. The middle and lower thirds are more involved in the esthetic consideration of the patient. When measured in repose, these two thirds should be equal. The lower third can be further divided by the stomion into upper one-third and lower two-thirds (Fig 5).
Upper lip length at rest (Fig 6). Upper lip length is measured from the subnasale to the lower border of the upper lip. The average lip length is 20 to 24 mm in young adults and tends to increase with age.

Display of maxillary central incisors at rest. Maxillary central incisor display at rest, on average, is 3 to 4 mm in young women and 2 mm in young men and tends to decrease with age.

Amount of gingival exposure during rest, speech, smile, and laughter. During an extensive smile, the upper lip should rest at the level of the midfacial gingival margins of the maxillary anterior teeth.

Smile line. This term expresses the position of the upper lip relative to the maxillary incisors and gingiva during a natural full smile. A high smile line reveals the entire crown of the tooth and an abundant amount of gingiva (excessive gingival display). In the average smile line, 75% to 100% of the crowns is revealed with the interproximal gingiva. A low smile line is when less than 75% of the crowns is revealed (Fig 7). A low smile line is predominantly a male characteristic, whereas a high smile line is predominantly a female trait.

Gingival margin outline. In patients with excessive gingival display, any irregularities and disharmony in the alignment of the gingenval margin may have a significant effect on smile esthetics. Harmony should exist between the gingival line in the anterior and posterior segments. The outline of the gingival margins should be parallel to both the incisal edges and the curvature of the lower lip. The gingival margins of the maxillary central incisors and the canines should be symmetric and in a more apical position than those of the lateral incisors. Chiche and Pinault considered symmetry of the gingival margins at the midline (central incisors) to be essential, while more laterally a certain amount of asymmetry is permissible.

Intraoral examination

Occlusal plane. The occlusal plane should be evaluated by comparing it to the anatomical landmarks in the same way determined during fabrication of complete dentures. The occlusal plane should closely coincide with the imaginary line connecting the commissures of the lips and two-thirds the height of the retromolar pad. In this way, during a smile, there is mild exposure of the tips of the mandibular canines and premolars.

Harmony of the dental arches. The anterior (incisal part) and posterior segments should be in harmony with one another and have no major discrepancies.

Anatomy, proportions, and color of the teeth. Lombardi pointed out the importance of the proportions between width and length in the dimensions of individual teeth. A comparison between the anatomic crown height (incisal edge to cementoenamel junction [CEJ]) and the clinical crown height (incisal edge to free gingival margin) will help determine whether short clinical crowns are a result of incisal wear or of a coronal position of the gingival margin over the teeth.
Periodontal examination. The width and thickness of the keratinized attached gingiva must be measured, as well as probing depth, clinical attachment level, and crestal bone level with respect to the CEJ. The position of the free gingival margins relative to the CEJ is another important issue. The periodontal biotype may influence the reaction of the gingival tissues to periodontal therapy and surgery. There are 3 periodontal biotypes: thin and scalloped, normal, and thick and flat. This information has a crucial influence on the treatment strategies and decisions.

A correct diagnosis of excessive gingival display performed according to all the above-mentioned issues allows the clinician to select the proper treatment modality and achieve a clinical result that satisfies both patient and operator.

ETIOLOGY OF EXCESSIVE GINGIVAL DISPLAY AND TREATMENT MODALITIES

Plaque-/drug-induced gingival enlargement

This is a condition in which the enlarged gingival tissues are covering the clinical crowns, creating an unesthetic appearance (Fig 8). It is most often related to dental plaque and inflammation but can be associated with medication such as phenytoin, cyclosporine, and calcium channel blockers. Treatment of this condition should focus on meticulous oral hygiene. Sometimes, periodontal surgery will be needed to eliminate the excessive amount of soft tissues.

Altered/delayed passive eruption

Passive eruption is a normal condition in which the gingival margins recede apically to the level of the CEJ after the tooth has erupted completely. In cases in which the gingival margins fail to recede to the level of the CEJ, the condition is named altered passive eruption. Because the gingival tissues are positioned coronal to the CEJ, the teeth appear short and square (Fig 9).

This condition may involve multiple teeth or an isolated tooth. The incidence of altered passive eruption in the general population is about 12%. The physiologic condition of passive eruption may continue even in the third decade of life; therefore, the diagnosis of altered passive eruption must be made with respect to age.

The alveolar crest may be at the level of the CEJ or 1 to 2 mm apical to it, as exists in a healthy condition. Parallel radiography will help determine the level of the alveolar crest interproximally, and probing to bone (sounding) will determine its level facially and orally.

A classification for altered passive eruption was suggested by Coslet et al:

- Type 1A—excessive amount of keratinized gingiva with normal alveolar crest–to–CEJ relationship
- Type 1B—excessive amount of keratinized gingiva with osseous crest at the CEJ level
- Type 2A—normal amount of keratinized gingiva with normal alveolar crest–to–CEJ relationship
- Type 2B—normal amount of keratinized gingiva with osseous crest at the CEJ level
Altered passive eruption may be resolved with periodontal surgery. The selected surgical procedure depends solely on the type of altered passive eruption.

**Anterior dentoalveolar extrusion**
Overereuption of the maxillary incisors with their dentogingival complex leads to a more coronal position of the gingival margins and excessive gingival display. This condition may be associated with tooth wear at the anterior region (compensatory incisor overereuption) or with anterior deep bite. In cases with deep bite, there is usually a discrepancy in the occlusal plane between the anterior and posterior segments (Fig 10).

Treatment of this condition may include orthodontic intrusion of the involved teeth moving the gingival margin apically, surgical periodontal correction with or without adjunctive restorative therapy, or an interdisciplinary comprehensive treatment plan.2,12,35

**Vertical maxillary excess (VME)**
This condition involves an overgrowth of the maxilla in the vertical dimension. Many times, it appears with a long-face syndrome.12,21 An increase in facial height appears mainly in the lower half of the face, and in contrast to overereuption of the maxillary incisors, harmony of the occlusal plane between the anterior and the posterior segments is found. Because the occlusal plane is relatively lower than normal, individuals with VME will have excessive gingival display with the lower lip covering the incisal edges of the maxillary canines and premolars (Fig 11). These clinical findings may lead the clinician toward diagnosing VME, which must be confirmed with a cephalometric radiograph reading. It was found in a gummy smile group8 that the distance between the palatal plane and the incisal edge of the maxillary incisors (anterior maxillary height) was approximately 2 mm higher than in individuals without gummy smiles (Fig 12).
In cases of VME, most often, the length of the upper lip is normal, although clinically, it appears relatively short.

A classification of VME was introduced by Garber and Salama in 1996, offering 3 degrees of gingival exposure and corresponding treatment modalities (Table 1).

### Short upper lip

In this instance, the upper lip is shorter than 15 mm, measured from the subnasale to the lower border of the upper lip (Fig 13). Interestingly, a number of studies showed that in most cases of excessive gingival display, the upper lip length is normal even though the lip appears clinically short. The treatment modality recommended for this condition will be discussed ahead.

### Hyperactive upper lip

This condition represents increased activity of the elevator muscles of the upper lip during smile. According to the study of Peck et al, individuals with excessive gingival display present significantly more efficient lip-elevation musculature compared to those with average smile lines. In this study, people with a high lip line raise the upper lip an average of 1 extra millimeter, or nearly 20% more, than the reference group during a smile.

The treatment modalities recommended for short upper lip and hyperactive upper lip are similar. Plastic reconstructive surgery was the solution offered in several reports published in the 1970s and 1980s for treatment of such conditions. The first technique reported was the lip adhesion technique described by Rubinstein and Kostianovsky. In this technique, the internal connection of the upper lip is severed, and an elliptical piece of tissue is removed from the dissected area. Then, a lower connection is established between the upper lip and gingival soft tissues, about 4 mm above the free gingival margin. This procedure of reconnection restricts upper lip elevation during the smile, limiting the amount of gingival tissue exposure.

Litton and Fournier in 1979 discussed and supported this treatment modality in their work and recommended that it be used more widely. Their modification was to detach the lip muscles from the bony structures in cases of short upper lip to increase the lip length.
In 1983, Miskinyar, being disappointed with the previous technique, described the levator myectomy and partial removal technique. Ellenbogen and Swara described the implant spacer technique in 1984. These techniques were based on the same concept of transecting the levator labii superioris muscle (or part of it), one of the essential muscles participating in smile formation. According to the authors, this procedure results in a decreased elevation of the upper lip during smile. Ellenbogen and Swara offered insertion of a space maintainer (silicone, cartilage, polyamide, or turbinate bone) to prevent the muscle from reconnecting. Another important factor in the presence of such an implant spacer is its ability to limit the activity of the elevator muscles. The latter reports presented good results with a limited number of complications but had no follow-ups. A literature search conducted by the authors of this review in search of updates in this field revealed a small and nonsignificant number of current reports on these methods with no actual innovations. In a recent publication, the original lip adhesion technique was used with a follow-up of 8 months reporting good results.

Polo in 2005 offered the use of botulinum toxin injections as a new nonsurgical method for treating excessive gingival display. The toxin is injected into the area of the upper lip to decrease the elevating muscle activity, aimed in particular at the levator labii superioris muscle. The major disadvantage of this technique is the short effect of the toxin, which lasts only 3 to 6 months.

In contrast to the above-mentioned treatment options, some cases of excessive gingival display due to short or hyperactive upper lip may be treated by periodontal surgery with or without an adjunct restorative therapy.

**Asymmetric upper lip**

In 2001, Benson and Laskin evaluated the smile in a group of 195 subjects and found 9% with asymmetric smile, due to canting of the upper lip. This asymmetry can lead to excessive and asymmetric gingival exposure. When this asymmetry appears only during a smile, (in most cases) it is uncorrectable. It is imperative to draw the patient’s attention to such an asymmetry before the onset of any comprehensive dental treatment.

A flow chart that can help determine the correct etiology of a specific excessive gingival display case is shown in Fig 14.
In general, cases of excessive gingival display may have more than one etiology and should therefore be diagnosed carefully, and an interdisciplinary treatment should be considered. It is of high importance to involve the patient throughout the process of diagnosing and treatment planning. An informed patient is a key factor to treatment success and personal satisfaction.

**TREATMENT CONSIDERATIONS**

As stressed before, proper examination and correct diagnosis must be performed before deciding whether to include periodontal surgery in the treatment. A decision has to be made on the type of surgery, with or without bone resection:

- **Gingivectomy** is indicated when there is excess keratinized soft tissue and the bone level is appropriate. Careful evaluation must take place before surgery so that adequate keratinized gingival tissues will remain after surgery. This procedure applies to cases of gingival overgrowth and altered passive eruption type 1A.

- **Apically positioned flap without osseous resection** is recommended for cases in which the bone level is appropriate but gingivectomy will leave less than 3 mm of keratinized gingival tissues. This is performed in cases of altered passive eruption type 2A.

- **Apically positioned flap with osseous resection** is recommended for all other cases where osseous resection is required. The osseous resection should bring the bone crest 2.5 to 3.0 mm away apically from the CEJ or from the definite location of the finishing line of the final restoration to achieve a physiologic biologic width.

It is imperative to evaluate the root length of the teeth before surgery. Any procedure that needs a considerable amount of bone resection will result in a relative reduction in the bony support and has a negative influence on the crown-to-root ratio; teeth mobility, and bony support. After periodontal surgery, it becomes more difficult to achieve an esthetic result with the restorative treatment. Because the remaining roots have a smaller diameter, it becomes complicated to deal with the emergence profile and the big interproximal distances that lead to the “black holes” appearance.

Restorative therapy should be planned in cases of excessive gingival display in the following situations: (1) short clinical crowns due to loss of tooth structure (ie, tooth wear); (2) existing faulty restoration or following an esthetic complaint by the patient; and (3) exposed roots as a consequence of periodontal therapy causing teeth hypersensitivity and impaired esthetics.

When planning restorative treatment after periodontal surgery, one of the important issues to be considered is soft tissue maturation. During this period, changes may occur in the coronalapical position of the free gingival margins, and thus careful observation and evaluation of tissue healing is needed before the case can be finalized. The preparation finishing line must be placed supragingivally during the healing period, avoiding any disturbance to the maturation process. In esthetic regions, a healing period of at least 6 months should be allowed following the periodontal surgical procedure for the final maturation and location of the free gingival margins. After proper healing and maturation of the tissues, final preparation of the teeth will be performed, where the finishing line is set no deeper than 0.5 mm subgingivally.

The extent of the periodontal corrective procedure for excessive gingival display depends on the patient’s display during smile and repose. Because most people (about 80%) expose the maxillary teeth from second premolar to second premolar while smiling, the surgical procedure should be performed between the first molars to achieve a harmonious smile and correct gingival contours.

Prediction of the final outcome of periodontal and restorative therapy is important in treating cases of excessive gingival display. Therefore, it is recommended to use a surgical stent during surgery. The first step is to prepare a total waxup of the teeth and
create a correct gingival contour on a study model. A surgical acrylic stent is made according to the waxup, which provides several advantages (Figs 15a and 15b): preoperative imaging of the final result in the mouth, allowing in cases of excess keratinized gingival tissues a definite incision line of the gingivectomy, guiding the osteotomy for correct osseous architecture and proper soft tissue healing, determining the flap position at the end of surgery (Fig 16), and monitoring the tissue position and maturation during follow-ups (Fig 17).

CONCLUSION

Excessive gingival display is an esthetic concern both to the patient and the clinician, especially when restoration of the anterior teeth is indicated. Understanding the etiology and treatment options is crucial in the process of treatment of a patient with a gummy smile. The principles and concepts discussed in this review will lead the clinician toward achieving an esthetic result and patient satisfaction with the performed treatment (Figs 18a and 18b).
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