

The "Gummy Smile" CHALLENGE

A Novel Multidisciplinary Approach

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Abstract

The interdisciplinary treatment of excessive gingival display (i.e., a "gummy smile") can be very challenging, particularly when the patient has high esthetic expectations. To achieve the optimal predictable clinical outcome, adequate diagnosis, treatment planning, staging, and execution of the periodontal and restorative procedures are essential. The purpose of this article is to introduce a new protocol that facilitates and reduces the number of clinical steps to treat a gummy smile, while ensuring maximum comfort for the patient throughout the treatment and maximum esthetics at its conclusion.

Key Words: gummy smile, excessive gingival display, crown lengthening, lip repositioning, veneers

Disclosures: The authors did not report any disclosures.

Learning Objectives

After reading this article, the participant should be able to:

1. Understand the etiology of gummy smiles and their treatment limitations.
2. Evaluate the consequences of various methods of sequencing treatment for a patient with a gummy smile.
3. Implement a new protocol for achieving maximum esthetics and patient comfort when treating a gummy smile.



“Careful diagnosis and treatment planning, combined with a meticulous execution of the treatment steps, help to ensure a predictable outcome with results that are esthetically and functionally satisfactory.”

Introduction

Gummy Smile

An esthetically pleasing smile comprises many factors, including balanced upper and lower lip lines, healthy gingivae, correct anatomy, and well-proportioned teeth.¹ The amount of gingival display also plays an important role in a smile's attractiveness.² Excessive gingival display, also known as "gummy smile," affects approximately 10% of the population between the ages of 20 and 30.³ It is more prevalent among women and decreases with age due to loss of muscle tone in both the upper and lower lip.⁴

Causes and Treatments

Gummy smile can be caused by hypermobility of upper lip elevator muscles, altered passive eruption, accentuated vertical maxillary growth, maxillary denoalveolar extrusion, and/or a thin upper lip.⁵ It is extremely important to determine the etiology of the gummy smile before deciding on the treatment plan, to establish realistic treatment expectations for the patient.

Different treatment methods have been developed to decrease gingival display. Several authors have described preventing the muscles responsible for gingival display from contracting by injecting botulinum toxin, although this is considered as a temporary solution.⁶⁻⁹ Another approach is to increase the crown length, which consequently decreases the gingival display.¹⁰⁻¹² Removing a strip from the upper labial mucosa (i.e., "lip repositioning"), which diminishes the upper lip mobility, has also been suggested as an alternative treatment.¹³⁻¹⁵ Cases with multiple etiologies require more than one technique to achieve desirable outcomes. For example, some studies have reported using the lip repositioning method associated with gingivectomy to treat excessive gingival display.^{16,17}

The traditional approach for cases that require restorations and crown lengthening is to perform the surgical procedure three to six months prior to the restorative treatment, the main reason being possible postoperative position changes of the gingival margins.¹⁸ However, this can cause problems for some patients who might not easily accept having exposed roots for such a long period of time, due to sensitivity and poor esthetics. To avoid this, temporary restorations can be inserted at the time of surgery. Nevertheless, problems can occur during the healing process, such as provisional material discoloration, staining, chipping, or even decementation of the temporary restorations. These situations are especially complicated when the patient finds it hard to come to

appointments due to a busy schedule or distance and travel logistics, not to mention the chair time needed to fix them.

The authors propose a novel approach to decrease the time needed to accomplish treatments that involve crown lengthening and restorations. The objective of this protocol is to achieve long-term predictable results while increasing patient comfort.

Case Report

Chief Complaint, Examination, and Findings

The patient, a fashion photographer in her early 30s, presented with the chief complaint that her gums showed too much when she smiled. She also had frequent chipping on two anterior composite restorations (Figs 1-7).

A comprehensive extraoral and intraoral examination was conducted. The patient's dental history included orthodontic treatment, extraction of #5, #12, #21, and #28; composite restorations on #2, ##7-9, #18, and #19; and amalgam restorations on ##30-32. An esthetic evaluation, which included mounted models, radiographs, and photographs, was also performed. Her health history was unremarkable and there were no contraindications to surgical treatment.

Findings were as follows:

- excessive maxillary gingival display
- filtrated and chipped composite restorations on #8 and #9
- dental midline canted in relation to the facial midline
- occlusal and gingival plane not parallel to the interpupillary line
- unattractive proportions of the anterior teeth
- discolored teeth
- labial line asymmetry.

Treatment Options

The patient's gummy smile was determined to be muscular, skeletal, and dentogingival in origin. Following the guidelines described by Garber and Salama,¹⁹ she could be classified as having degree 1 of vertical maxillary excess (2 to 4 mm of gingival display). The treatment alternatives proposed were orthodontics only, orthodontics and periodontics, or periodontics and restorative dentistry.¹⁹

Treatment Sequence

The patient declined to undergo orthodontics again. Therefore, it was decided that the best option would be to combine restorative treatment with porcelain veneers; and periodontal treatment, including crown lengthening and lip repositioning.

Because the patient lived in a different country and it was not easy for her to travel to our office, she requested an optimized sequence of treatment to decrease the number of appointments. The treatment was sequenced as follows:

1. diode laser gingivectomy, final preparation, final impression, and provisional restorations
2. after 10 days, insertion of final veneers
3. after 1 month, full thickness flap elevation and bone recontouring
4. one week after Step 3, asymmetric lip repositioning.



Figure 1: Patient's smile at presentation.



Figure 2: Close-up smile, frontal view.



Figure 3: Close-up smile, right lateral view.



Figure 4: Close-up smile, left lateral view.



Figure 5: Retracted frontal view.



Figure 6: Retracted right lateral view.



Figure 7: Retracted left lateral view.

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Treatment

Gingivectomy, impressions, and provisionals:

Having determined the causes of the patient's gummy smile, we used the Digital Smile Design (DSD) approach²⁰ to preview the corrections needed (Fig 8). Once the desired outcome was achieved digitally, we transferred those calibrated measurements onto a wax-up to guide us through the surgical and restorative treatment (Fig 9). Several silicone indexes were fabricated (Zetalabor, Zhermack SpA; Badia Polesine [RO], Italy). First they were used to guide the incisal and buccal reduction that had been determined in the DSD. Then an indirect mock-up (Luxatemp, DMG America; Englewood, NJ) was conducted; this would be used both as a surgical guide for the gingivectomy and also for the provisional veneers (Fig 10). With the mock-up in place and following the gingival scallop defined by this prototype, very subtle incisions were marked with a #15C scalpel (Hu-Friedy; Chicago, IL) (Fig 11). The mock-up was then removed (Fig 12) and the gingivectomy was performed using a diode laser (Picasso Lite, AMD Lasers; Indianapolis, IN) following the above-mentioned incisions (Fig 13). Final veneer preparation was achieved (Fig 14) and final impressions were made (Impregum, 3M ESPE; Seefeld, Germany).

Achieving adequate hemostasis at the time of final impressions is of paramount importance.²¹ The use of the diode laser to perform the gingivectomy, along with temporary gingival retracting paste (Expasyl, Kerr; Orange, CA) and hemostatic agents (Viscostat Clear, Ultradent Products; South Jordan, UT; and Superoxol, Henry Schein; Melville, NY) ensured the stability of the soft tissues during impression and provisional restoration delivery.

After final impressions, bite registration was recorded (Regisil 2X, Dentsply Sirona; Salzburg, Austria) and stump shade images were taken. A spot-etch technique was used to cement the temporary restorations. The provisional restorations were refined and polished, particularly in the gingival margin area, to ensure proper healing of the gingival tissues (Fig 15). The patient received home care instructions to control possible inflammation during the healing process. At this time, deliberate invasion of the biologic width was achieved (Tables 1 & 2).

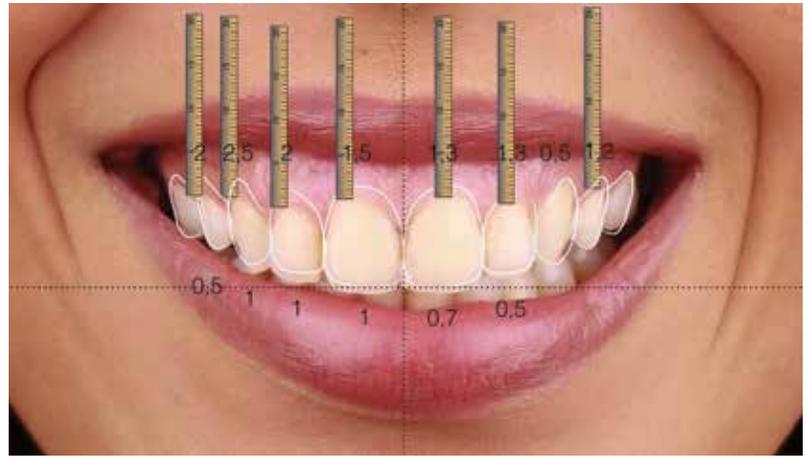


Figure 8: DSD.



Figure 9: Calibrated wax-up based on DSD.



Figure 10: Mock-up.



Figure 11: New gingival margin incisions following mock-up.



Figure 12: Mock-up removal for gingivectomy.



Figure 13: Diode laser gingivectomy.



Figure 14: Final preparation prior to final impression.



Figure 15: Provisional veneers with planned invasion of the biologic width.

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CE — CLINICAL APPLICATION

Table 1. Bone Sounding Before Laser Gingivectomy

Tooth #	3	5	6	7	8	9	10	11	12	14
Probing depth (mm)	3	4	4	4	4	4	5	4	4	3

Table 2. Bone Sounding After Laser Gingivectomy

Tooth #	3	5	6	7	8	9	10	11	12	14
Probing depth (mm)	3	2	2	2	2.5	2.5	3	3	4	3

Insertion of final veneers: Ten days after the previous appointment, the patient returned for insertion of the final veneers (Figs 16 & 17). The temporary restorations were removed under local anesthesia and any remaining bonding material was removed from tooth surfaces and interproximal spaces. After the veneers were tried in with water and checked for appropriate fit, the intaglio of the layered lithium disilicate restorations (IPS e.max Press, Ivoclar Vivadent; Schaan, Liechtenstein) was conditioned for adhesive cementation following manufacturer instructions. Localized bleeding was controlled with the previously mentioned hemostatic agents and partial isolation was achieved with a retractor (Optragate, Ivoclar Vivadent). The veneered teeth were etched (Ultra-Etch, Ultradent) for 15 seconds and rinsed with water for 30 seconds. A desensitizing adhesive (Gluma Comfort Bond + Desensitizer, Heraeus Kulzer GmbH; Hanau, Germany) was applied prior to the bonding agent (Optibond Solo Plus, Kerr). After light-curing for 20 seconds, a flowable composite (LuxaFlow B1, DMG America; Englewood, NJ) was used to cement the veneers. Any excess cement was removed with brushes and floss to ensure the proper healing of the tissues. A final check of the occlusion was done with articulating paper (AccuFilm, Parkell; Edge-wood, NY).

Full thickness flap elevation and bone recontouring: Because the biologic width was voluntarily invaded by the restorations, osseous recontouring had to be performed to reestablish the adequate parameters for gingival health and stability. One month after insertion of the final veneers (Fig 18), the bone was sounded around the veneered teeth and a full thickness flap was raised to allow us to remodel the excessive bone around the restored teeth (Fig 19). The veneers' margins guided precisely the amount of bone that needed to be removed (2.5 to 3 mm from the veneer margin to the bone margin) (Fig 20). After bone remodeling, the root surface was scaled to avoid tissue regrowth. Vertical mattress sutures (5-0 polypropylene, Hu-Friedy) were employed, leaving the knots on the palatal aspect to improve the patient's esthetics (Fig 21).



Figure 16: Temporaries and gingival tissues after 10 days.



Figure 17: Lithium disilicate final restorations.



Figure 18: Smile one month after veneers were inserted. Note localized inflammation due to violation of the biologic width.



Figure 19: Full thickness flap for bone visualization. Note the deliberate invasion of the biologic width by the margin of the restoration.



Figure 20: After bone recontouring for biologic width reposition.



Figure 21: Full thickness flap reposition with vertical mattress suture.

Asymmetric lip repositioning: This surgery was performed one week after the crown-lengthening procedure, following the LipSta technique protocol.²² The patient returned two weeks later; healing was uneventful, with no pain, infection, or paresthesia. Stitches from both surgeries were removed two weeks after the previous intervention (Figs 22 & 23).

After both of the surgical procedures, the patient was prescribed ibuprofen 600 mg every 8 hours for 5 days and 0.12 % chlorhexidine digluconate rinse every 12 hours for 2 weeks. The patient was advised to use cold compresses and limit lip movement for the first few days after the surgical lip repositioning. A one-year postoperative photograph (Fig 24) shows stable margins and gingival tissues. The final images show a significant reduction in gingival display, addressing the patient's chief concern (Figs 25 & 26).

Discussion

The treatment of excessive gingival display is challenging and requires a multidisciplinary approach with accurate planning. The current study proposes a new protocol for the staging of the restorative phase and the crown-lengthening surgical procedure. Previous studies proposed an anticipated restorative phase

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Figure 22: The tissue was removed via a partial thickness dissection with tissue removal from first molar to first molar.



Figure 23: Final suturing with polyglycolic acid resorbable sutures.



Figure 24: One-year postoperative gingival margins.



Figure 25: One-year postoperative full-face smile.



Figure 26: One-year postoperative close-up smile.

immediately after the resective surgery.^{23,24} Delivering immediate temporaries the same day as the crown lengthening was found to be beneficial for the patient, since it avoided showing the unesthetic gingival recession in the anterior quadrant during the healing period. It was also found to be useful for the clinician, because it allowed easier access and identification of the preparation margins that would guide precisely the amount of bone remodeling needed.

Previous Protocols

Conventional protocols discussed in the literature usually contain the following recommendations: to perform the gingivectomy, with or without osseous recontouring, before the teeth are prepared; or to place the provisional restorations either immediately after surgery—if hemostasis can be achieved—or after a minimum of two weeks to perform the final abutment preparations, only subsequent to the complete maturation of soft tissues (three to six months after the surgical phase).^{24,25}

The purpose of these protocols is to ensure the stability of the soft tissues before the beginning of the prosthetic phase. However, such protocols may not be suitable for patients with very high esthetic expectations, since they involve either a transitional phase with unesthetic gingival recession; or long-term provisionals, which are prone to staining, discoloration, and leakage.

Alternative Protocol

The study discussed here proposes an alternative protocol, the purpose of which is to provide the patient with comfortable and esthetically pleasing restorations from the very first appointment. Provisionals were delivered immediately after the gingivectomy and replaced with the final restorations 10 days after the surgery. By doing this, the patient's esthetic complaint was corrected just 10 days after treatment began. The osseous recontouring to reestablish the biologic width was performed one month after cementation of the final restorations; this helped the clinician to establish the new bone margin position very accurately.

Achieving adequate hemostasis at the time of final impressions, delivery of the temporaries, and then of the final restorations is of paramount importance. The use of the diode laser to perform the gingivectomy, combined with the use of hemostatic agents, ensured stability of the soft tissues during impression and provisional restoration delivery. Particular attention was paid to the marginal adaptation and emergence profile of the provisional restorations; properly shaped temporaries were found to be crucial for healing and stability of the soft tissues.

After two weeks of healing the soft tissues were stable enough to proceed with cementation without any surface contamination. The final cementation was carried out with the aid of hemostatic agents and partial isolation. When possible, adhesive cementation should be performed with rubber dam isolation; however, due to the reduced or absent gingival sulcus at the time of cementation, it was not possible to use the rubber dam in this case. Adhesive cementation without rubber dam has nonetheless shown excellent survival rates and low rate of complications when the correct adhesive protocol is followed.²⁶

The location and stability of the free gingival margin after the resective osseous surgery is probably this protocol's most delicate parameter. Soft tissue alterations have been documented up to 12 months after crown lengthening.¹⁸ Performing the crown lengthening after the final restoration cementation might result in unwanted recessions and exposed margins. However, having the final restorations in place at the time of the crown-lengthening procedure facilitates the osseous recontouring. The preparation margins are easily identifiable so that the crestal bone can be reduced precisely, making the reestablishment of the biologic width—and therefore the final gingival margin position—very predictable. The soft tissue healing was found to be more favorable around ceramic restorations after the open flap procedure.

It should be noted that before performing this technique, its limitations must be recognized. These include cases where interproximal bone reduction is needed, or there is severe malposition of the teeth in the arch, or very discolored roots. Appropriate case selection is critical, since the described protocol should be followed only in straightforward veneer cases with minimal or no tooth discoloration, to increase the predictability of the final result.

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Summary

The innovative surgical and prosthetic approach discussed in this article is proposed for patients with a gummy smile who have very high esthetic expectations. Careful diagnosis and treatment planning, combined with a meticulous execution of the treatment steps, help to ensure a predictable outcome with results that are esthetically and functionally satisfactory.

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The 10 multiple-choice questions for this Continuing Education (CE) self-instruction exam are based on the article *The "Gummy Smile" Challenge* by Dr. David Montalvo-Arias, Dr. Giovanni Molina Rojas, and Dr. Michael A. Apa. This article appears on pages 50-61.

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1. Which of the following would likely result in a gummy smile?
 - a. hypomobility of the upper lip's elevator muscles and altered passive eruption
 - b. accentuated vertical maxillary growth and maxillary dentoalveolar intrusion
 - c. a thin upper lip and hypermobility of the upper lip's elevator muscles
 - d. maxillary dentoalveolar extrusion and hypomobility of the upper lip's elevator muscles
2. Which of the following would decrease the amount of gingiva displayed in a full smile?
 - a. increasing muscle contraction by using botulinum toxin injections
 - b. esthetic crown lengthening
 - c. lip repositioning to increase upper lip mobility
 - d. all of the above
3. Excessive gingival display affects 10% of the population and
 - a. is more dominant in men and decreases with age.
 - b. is less dominant in women and decreases with age.
 - c. is more dominant in women and increases with age.
 - d. is more dominant in women and decreases with age.
4. What is the origin of the patient's gummy smile in the case presented?
 - a. muscular
 - b. skeletal
 - c. dentogingival
 - d. all of the above
5. In the case presented, two of the products used for tissue management during the impression phase were
 - a. Hemodent and retraction cord.
 - b. gingival retraction paste and Hemodent.
 - c. Superoxol and retraction cord.
 - d. gingival retraction paste and Superoxol.

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