

“ The myriad causes of a gummy smile are rarely if ever confined exclusively to the maxillary anterior region. ”

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Perceptions of a *Gummy Smile*

Myths and Realities of Esthetic Crown Lengthening

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Key Words: esthetic crown lengthening, gingivectomy, ostectomy, periodontal surgery, biphasic approach, lasers, bone contouring

Introduction

Within the first few seconds of meeting someone, we make up to 11 subjective judgments—on everything from credibility to professional desirability to sophistication to trustworthiness—about that person based chiefly upon nonverbal cues, among which smiling is paramount.¹ What do we think of a gummy smile? More important, how does the person with the gummy smile feel about it? Excessive gingival display, defined clinically as the display of any mucosa above the tooth margin when smiling (but not perceived as unattractive by laypeople until 3 to 6 mm shows), draws attention to the mouth.²⁻⁴ The gummy appearance may upset facial harmony and distort dental proportions, engendering anxiety and embarrassment in the affected person while smiling or laughing. As a result he or she may suppress those expressions, which in turn affects an onlooker's perception of the person. Correction of a gummy smile returns the facial, periodontal, and dental contours to physiologic norms and hopefully restores psychological equanimity. Esthetic crown lengthening helps to rectify many cases of excessive gingival display; the following discussion addresses a few of the fallacies surrounding this treatment modality.

Myth

A gummy smile is caused predominantly by excess gingival tissue.

Reality

If a clinician observes a gummy smile, he or she must then ask two questions: *Why does it exist?* and, *What else exists?* A number of conditions affect the perception of excessive gingival display; these can be categorized as skeletal, alveolar, muscular, dental, and periodontal in origin.^{5,6}

Skeletal: Vertical maxillary excess, a state in which there is an elongated middle third of the face.

Alveolar: Supraeruption of the anterior maxilla and/or possibly enlarged alveolar processes, accentuates gingival display.^{7,8} Nasal protrusion and mandibular retrognathia further highlight this visual.

Muscular: Sometimes the upper lip is able to compensate for osseous prominence, but in the case of muscular hypertonicity resulting in strong labial retraction or a naturally short lip, masking skeletal issues is not viable.⁹ Indeed, these muscular features in a person with regular osseous anatomy may generate a gummy smile.

Dental: Any situation in which there are or there appear to be shortened teeth will upset the optical mucosa-to-tooth ratio. Caries and traumatic fracture truncate tooth length. Protrusive (anterior) bruxism also diminishes the clinical crown height, and thus the observer detects more gingiva relative to tooth structure. The body attempts to offset this attrition by dentoalveolar extrusion; this entails the coronal migration of not only the teeth but also the periodontal housing, including the gingival margin, exaggerating the dominance of the soft tissue.¹⁰ Just the illusion of less tooth structure even when none exists as seen in severe labial inclination of normal-height maxillary incisors and canines gives rise to a gummy façade, at least when the patient is perceived straight on.¹¹ Perhaps less obviously, aberrations of posterior teeth also contribute to a gummy smile. Premolars and molars that are missing, tipped, or otherwise in infraocclusion from attrition, abrasion, erosion or trauma lead to non-coincident anterior and posterior occlusal planes. This may introduce a deep overbite and subsequent pronounced gingival exposure.^{10,12}

Periodontal: Sources of gingival overgrowth include periodontal disease (gingivitis and periodontitis); poor plaque control in the presence of orthodontic appliances; hereditary gingival fibromatosis; systemic illness; and use of specific anticonvulsant, antihypertensive, and immunosuppressive medications.⁸ In a separate periodontal phenomenon, the natural

apical migration of the gingiva during tooth eruption is incomplete; there is no hypertrophy or hyperplasia, yet the soft tissue margin remains coronally positioned on the tooth surface, leading to a short clinical crown height and comparative surfeit of gum tissue.¹³ This altered passive eruption may involve a bone-to-cemento-enamel junction (CEJ) relationship that is normal (alveolar crest lies 1.5 mm apical to the CEJ) or abnormal (alveolar crest is at the level of the CEJ).¹⁴

A gummy smile frequently stems from numerous simultaneously occurring factors (Figs 1-17). There may or may not be superfluous (hyperplastic or hypertrophic) gingival tissue. Rather, the presence of certain traits compounds the mirage of too-small teeth engulfed by mucosa. The primary clinician consults with an orthodontist, oral surgeon, periodontist and/or prosthodontist to determine all core etiologies of excessive gingival display. Problem management eliminates or at least diminishes the impact of each contributing factor.

Myth

Limiting treatment to periodontal surgery in the anterior esthetic zone is often sufficient.

Reality

The myriad causes of a gummy smile are rarely if ever confined exclusively to the maxillary anterior region. Accordingly, definitive therapy almost always necessitates several specialties and involves a full arch or all teeth. Patient-based restrictions (e.g., financial thresholds, chairside availability, health concerns, general motivation) inevitably compromise the ideal treatment plan, but this does not render acceptable an incomplete diagnosis or preclude formulation of a multidisciplinary treatment plan. After unearthing every possible influence on the gingival display, the practitioner constructs an optimal plan, which can be pared back or reconfigured depending upon any patient constraints. Most importantly, the patient must understand that any deviation from the ideal may not fully remedy the problem. A quick fix may be a fleeting one as well, especially in the presence of ongoing ailments. Treatment begins only when the patient has realistic expectations.

The amount of excessive gingiva a patient expresses hints at the major underlying causes and suggests treatment strategies. The provider, however, must use the width range seen only as a clue to what category of deformity could be present and not as diagnostic gospel. For instance, bilateral gingival display of 8 mm or greater in a patient with a uniform anterior and posterior occlusal plane may signify a skeletal aberration (i.e., vertical maxillary excess) and merit LeFort I surgery.⁸ This does not mean that other features like a short lip, tooth malposition, caries, attrition, periodontal inflammation, or altered passive eruption are not meaningful or should not be addressed. Instead, this level of gumminess warns the dentist that a skeletal component is highly probable, necessitating further, deeper orthognathic inquiry. On the other hand, a relatively mild gingival display of 2 to 4 mm in the presence of a deep overbite related to a discrepancy between the anterior and posterior occlusal planes implies a strong dentoalveolar element to the cause; therapy might incorporate intrusion of the anterior teeth and/or uprighting of the posterior teeth, though other modalities must be considered after comprehensive diagnosis.¹⁵



Figure 1: Patient at initial presentation. A component of vertical maxillary excess existed. The patient exposed a wide band of keratinized gingiva from molar to molar upon smiling. Orthognathic surgery was recommended but was not pursued.



Figure 2: Relaxed smile view shows exposure of at least 1 mm to 3 mm of gingiva from #3 to #14.



Figure 3: Wide smile view shows mild asymmetry between right and left gingival contours, at least 4 mm to 6 mm of gingival display from #3 to #14, and severe generalized attrition with subsequently shorter clinical crowns from #3 to #14.



Figure 4: The maxillary midline is shifted to the patient's right compared to the frenum, and there exists a discrepancy between the maxillary and mandibular midlines.

“The amount of excessive gingiva a patient expresses hints at the major underlying causes and suggests treatment strategies.”



Figure 5: Digital imaging of a more ideal smile (Dickerman Dental Prosthetics; Sharon, MA). Clinical crowns have been lengthened. Note that the maxillary midline remains offset toward the patient's right.



Figure 6: Wax-up of ideal tooth proportions based upon the digital imaging. Note the increase in the overbite and tooth height from molar to molar.



Figure 7: Compared to the untreated mouth (upper model), the idealized mouth (lower model) has more gingival symmetry, less prominence of the buccal mucosa, and longer clinical crowns.



Figure 8: Initial full-thickness reflection of the maxillary tissue. The alveolar crest is greater than 2 mm from the CEJ at the buccal aspect but less than 2 mm from the CEJ interproximally.



Figure 9: Esthetic and functional crown lengthening was performed via a biphasic method. An osteotomy from #3 to #14 was performed. Significant midfacial reduction was achieved to idealize the buccal heights of contour and allow for biologic width health. As the patient had long roots, copious palatal bone, and coronally oriented proximal alveolar tissue, the crown-to-root ratio was favorable. No gingival resection or repositioning occurred.



Figure 10: The flap was sutured without apical repositioning, using expanded polytetrafluoroethylene. The gingival contour closely approximates the presurgical configuration.



Figure 11: Ten days after osteotomy, the site appears to be healing well. There is no significant change in the mucosal drape.



Figure 12: Second-stage gingivectomy of #3 to #14 was completed to lift the periodontal drape coronally.



Figure 13: Ten days after the gingivectomy, the gingival contour demonstrates enhanced symmetry and remains apically positioned.



Figure 14: Relaxed smile view of final restoration four months after gingivectomy. There is no gingival display coronal to the crown margins.



Figure 15: The wide smile view reveals the final restoration of #3 to #14 four months after gingivectomy. Much-improved crown heights are seen. The patient continued to display a 2 mm to 3 mm band of gingiva upon smiling, but it was not important to her. She was very pleased with the new esthetics.



Figure 16: Frontal view three years after the final restoration. The gingiva remains healthy and positionally stable.

Resolution of a gummy smile often involves some degree of periodontal surgery in the cosmetic zone to elongate teeth. Typically, it helps to correct a 2 mm to 7 mm width of excess gingiva.⁸ Esthetic crown lengthening via periodontal contouring is versatile—it can either refine results achieved by other means or be the major solution. As long as contraindications (e.g., vertical maxillary excess, malpositioned teeth, anticipated poor crown-to-root ratio, anticipated poor restorative emergence profile, active inflammation, non-restorable teeth) do not exist, periodontal surgery is a potential monotherapy. If the case calls for prosthetic rehabilitation, crown lengthening may contribute to both beauty and function since the stability of new restorations relies on establishment of adequate coronal retention and a healthy biologic width.¹⁶⁻¹⁸

Myth

Bone contouring during esthetic crown lengthening is seldom necessary.

Reality

The periodontal anatomy dictates the exact type of contouring required.¹⁴ Basically, redundant volumes of soft tissue or bone warrant surgical shaping, especially if the patient has an inherently thick biotype that encourages tissue rebound.^{19,20} A disproportionately wide band of keratinized mucosa justifies gingivectomy. As it removes any pigmented layers of mucosa, an externally beveled gingivectomy in particular benefits the patient by removing unwanted racial, amalgam-related, or other-source coloration, though discoloration may return over time.^{21,22} Excessive gingival display of mostly non-keratinized tissue, however, supports use of an apically positioned flap as opposed to resection to maintain the narrow band of attached gingiva.

The need for ostectomy depends upon three factors: the distance between the alveolar crest and the CEJ, the presence of exostoses or otherwise unsightly bony morphology, and the need for any prosthetics. If a normal or greater alveolar crest-to-CEJ distance (at least 1.5 mm) exists and no prosthetic rehabilitation is planned, gingival manipulation alone suffices. Bone contouring is required whenever the bony crest lies at the CEJ, which happens in some altered passive eruption scenarios when hard tissue protuberances occur, or crowns are proposed. Coronally located bone but-

REALITIES

- **A number of conditions affect the perception of excessive gingival display; these can be categorized as skeletal, alveolar, muscular, dental, and periodontal in origin.**
- **The myriad causes of a gummy smile are rarely, if ever, confined exclusively to the maxillary anterior region. Accordingly, definitive therapy almost always necessitates several specialties and involves a full arch or all teeth.**
- **Resolution of a gummy smile often involves some degree of periodontal surgery in the cosmetic zone to elongate teeth.**
- **The periodontal anatomy dictates the exact type of contouring required.**
- **The major advantage of laser therapy over traditional scalpel and bur treatment is its ability to induce immediate hemostasis.**
- **A variety of conditions can lead to a gummy smile. The astute clinician discerns and resolves each of the contributing factors. Commonly, esthetic crown lengthening is a meaningful part of this resolution.**
- **The judicious application of periodontal surgery results in correction of excessive mucosal display that is predictable and long lasting. Normalized dentogingival and orofacial proportions may restore the patient's emotional harmony and confidence.**



Figure 17: The patient three years after final prosthetics. She remains very pleased with the esthetics.

tresses the overlying soft tissue; even if the gingiva is completely removed, it will regrow to cover the osseous aspect and reestablish the biologic width.²³ Bone resection to a position at least 2 mm away from the CEJ therefore sustains an apical mucosal position. Any tori or osseous projections should be leveled (osteoplasty) to facilitate a harmonious, less conspicuous arch form. Finally, restorative treatment compels ostectomy. A prosthetic margin that encroaches upon the epithelial and connective tissue seal around the tooth (biologic width) triggers inflammation, plaque retention, bleeding, recession, and attachment loss.²⁴⁻²⁷ Normally, there is 1 mm of epithelium and 1 mm of connective tissue attachments coronal to the alveolar crest in addition to 1 mm of gingival sulcus at the buccal aspect of the teeth.²⁸ To preserve the attachment apparatus around a crown, at least 3 mm is mandated between the restorative margin and bony crest.

Crown lengthening may be performed by both soft tissue excision and bone contouring in one surgical session or by a biphasic approach in which the bone is reduced first, followed by gingival excision at least four to six weeks later.²⁹ With conventional single-stage crown lengthening, the gingival margin may shift coronally 1 mm to 2 mm over 6 to 12 months, usually due to inadequate hard tissue removal or improper soft tissue resection.^{19,30} Allowing the soft tissue to settle into position after ostectomy or osteoplasty gives the surgeon a chance to refine the gingival drape and change the biotype as needed (from thick to thin).³¹ Prosthetic completion should be delayed at least three months after gingivectomy to allow for maturation of the attachment apparatus.³²

Myth

Laser-assisted therapy is the standard of care.

Reality

There is a dearth of controlled studies on laser-assisted crown lengthening—the literature largely consists of case reports and expert opinions that focus on its use for gingivectomy and gingivoplasty/depigmentation. The major advantage of laser therapy over traditional scalpel and bur treatment is its ability to induce immediate hemostasis.³³ With respect to esthetic crown lengthening, soft tissue lasers assist in gingivectomy-only situations (excessive keratinized mucosa with normal or apically located alveolar crest relative to the CEJ); application in any other circumstance potentially can trigger mucogingival defects or biologic width invasion.³⁴ Even if used when indicated, CO₂ and Nd:YAG soft tissue lasers notch or irreversibly roughen tooth surfaces and biomaterials; and char, melt, and sequester bone if in contact.³⁵

Hard tissue lasers based on erbium (Er:YAG and Er,Cr:YSGG) maximize bone cutting while minimizing bone necrosis.³⁶ Case reports detail flapless crown lengthening with erbium lasers for patients with mild gummy smiles.^{37,38} Here, bone sounding rather than direct visualization is used to determine the osseous morphology. A closed flap procedure thus disallows meticulous ostectomy. Raising a flap is much preferred for the sake of accuracy and outcome predictability.

Laser-assisted crown lengthening has its advantages, but too little evidence-based data exist for it to qualify as the gold standard for esthetic crown lengthening. Conventional scalpel and rotary instrument esthetic crown lengthening remains the clinical benchmark, especially when bone contouring is required.

Summary

A variety of conditions can lead to a gummy smile. The astute clinician discerns and resolves each of the contributing factors. Commonly, esthetic crown lengthening is a meaningful part of this resolution. The judicious application of such periodontal surgery (when, where, how, and in conjunction with what else) results in correction of excessive mucosal display that is predictable and long lasting. Normalized dentogingival and orofacial proportions may restore the patient's emotional harmony and confidence; a smiling person is a self-assured one.

References

1. Van Bavel JJ, Packer DJ, Haas IJ, Cunningham WA. The importance of moral construal: moral versus non-moral construal elicits faster, more extreme, universal evaluations of the same actions. Gilbert S, editor. PLOS One. Public Library of Science. 2012 Nov;7(11):e48693.
2. Kokich VO, Kiyak HA, Shapiro PA. Comparing the perception of dentists and lay people to altered dental esthetics. *J Esthet Dent*. 1999 Jan;11(6):311-24.
3. Kokich VO, Kokich VG, Kiyak HA. Perceptions of dental professionals and laypersons to altered dental esthetics: asymmetric and symmetric situations. *Am J Orthod Dentofacial Orthop*. 2006 Aug;130(2):141-51.
4. Rodríguez-Martínez A, Vicente-Hernández A, Bravo-González L-A. Effect of posterior gingival smile on the perception of smile esthetics. *Med Oral Patol Oral Cir Bucal*. 2014 Jan;19(1):e82-7.
5. Spear FM, Kokich VG. A multidisciplinary approach to esthetic dentistry. *Dent Clin North Am*. 2007 May;51(2):487-505, x-xi.
6. Foley TE, Sandhu HS, Athanasopoulos C. Esthetic periodontal considerations in orthodontic treatment—the management of excessive gingival display. *J Can Dent Assoc*. 2003 Jul;69(6):368-72.
7. Matthews TG. The anatomy of a smile. *J Prosthet Dent*. 1978 Mar;39(2):128-34.
8. Garber DA, Salama MA. The aesthetic smile: diagnosis and treatment. *Periodontol* 2000. 1996 Jul;11:18-28.
9. Caudill RE, Chiche GJ. Establishing an esthetic gingival appearance. In: Chiche G, Pinault A, editors. *Esthetics of anterior fixed prosthodontics*. 1st ed. Quintessence Pub.; 1994. p. 177-98.
10. Kokich V. Esthetics and anterior tooth position: an orthodontic perspective. Part II: vertical position. *J Esthet Dent*. 1993 Aug;5(4):174-8.
11. Kokich VG. Esthetics: the orthodontic-periodontic restorative connection. *Semin Orthod*. 1996 Mar;2(1):21-30.
12. Wu H, Lin J, Zhou L, Bai D. Classification and craniofacial features of gummy smile in adolescents. *J Craniofac Surg*. 2010 Sep;21(5):1474-9.
13. McGuire MK. Periodontal plastic surgery. *Dent Clin North Am*. 1998 Jul;42(3):411-65.
14. Coslet JG, Vanarsdall R, Weisgold A. Diagnosis and classification of delayed passive eruption of the dentogingival junction in the adult. *Alpha Omegan*. 1977 Dec;70(3):24-8.
15. Chandrasekharan D, Balaji SM. Intrusion of anterior teeth to improve smile esthetics. *J Maxillofac Oral Surg*. 2010 Mar;9(1):27-9.
16. Nemcovsky CE, Artzi Z, Moses O. Preprosthetic clinical crown lengthening procedures in the anterior maxilla. *Pract Proced Aesthet Dent*. 2001 Sep;13(7):581-8; quiz 589.
17. Padbury A, Eber R, Wang H-L. Interactions between the gingiva and the margin of restorations. *J Clin Periodontol*. 2003 May;30(5):379-85.
18. Oakley E, Rhyu IC, Karatzas S, Gandini-Santiago L, Nevins M, Caton J. Formation of the biologic width following crown lengthening in nonhuman primates. *Int J Periodontics Restorative Dent*. 1999 Dec;19(6):529-41.
19. Pontoriero R, Carnevale G. Surgical crown lengthening: a 12-month clinical wound healing study. *J Periodontol*. 2001 Jul;72(7):841-8.
20. Arora R, Narula SC, Sharma RK, Tewari S. Evaluation of supracrestal gingival tissue after surgical crown lengthening: a 6-month clinical study. *J Periodontol*. 2013 Jul;84(7):934-40.
21. Perlmutter S, Tal H. Repigmentation of the gingiva following surgical injury. *J Periodontol*. 1986 Jan;57(1):48-50.
22. Kaur H, Jain S, Sharma RL. Duration of reappearance of gingival melanin pigmentation after surgical removal - a clinical study. *J Indian Soc Periodontol*. 2010 Apr;14(2):101-5.
23. Wilderman MN, Wentz FM, Orban BJ. Histogenesis of repair after mucogingival surgery. *J Periodontol*. 1960;31:283-99.
24. Flores-de-Jacoby L, Zafropoulos GG, Ciancio S. Effect of crown margin location on plaque and periodontal health. *Int J Periodontics Restorative Dent*. 1989 Jan;9(3):197-205.
25. Günay H, Seeger A, Tschernitschek H, Geurtsen W. Placement of the preparation line and periodontal health—a prospective 2-year clinical study. *Int J Periodontics Restorative Dent*. 2000 Apr;20(2):171-81.
26. Schätzle M, Land NP, Anerud A, Boysen H, Bürgin W, Loe H. The influence of margins of restorations of the periodontal tissues over 26 years. *J Clin Periodontol*. 2001 Jan;28(1):57-64.

27. Valderhaug J. Periodontal conditions and carious lesions following the insertion of fixed prostheses: a 10-year follow-up study. *Int Dent J.* 1980 Dec;30(4):296-304.
28. Vacek JS, Gher ME, Assad DA, Richardson AC, Giambarresi LI. The dimensions of the human dentogingival junction. *Int J Periodontics Restorative Dent.* 1994 Apr;14(2):154-65.
29. Sonick M. Esthetic crown lengthening for maxillary anterior teeth. *Compend Contin Educ Dent.* 1997 Aug;18(8):807-12, 814-6, 818-9; quiz 820.
30. Lanning SK, Waldrop TC, Gunsolley JC, Maynard JG. Surgical crown lengthening: evaluation of the biological width. *J Periodontol.* 2003 Apr;74(4):468-74.
31. Brägger U, Lauchenauer D, Lang NP. Surgical lengthening of the clinical crown. *J Clin Periodontol.* 1992 Jan;19(1):58-63.
32. de Waal H, Castellucci G. The importance of restorative margin placement to the biologic width and periodontal health. Part II. *Int J Periodontics Restorative Dent.* 1994 Feb;14(1):70-83.
33. Magid KS, Strauss RA. Laser use for esthetic soft tissue modification. *Dent Clin North Am.* 2007 Apr;51(2):525-45, xi.
34. Kao RT, Dault S, Frangadakis K, Salehieh JJ. Esthetic crown lengthening: appropriate diagnosis for achieving gingival balance. *J Calif Dent Assoc.* 2008 Mar;36(3):187-91.
35. Kilinc E, Rothrock J, Migliorati E, Drukteinis S, Roshkind DM, Bradley P. Potential surface alteration effects of laser-assisted periodontal surgery on existing dental restorations. *Quintessence Int.* 2012 May;43(5):387-95.
36. Kimura Y, Yu DG, Fujita A, Yamashita A, Murakami Y, Matsumoto K. Effects of erbium,chromium:YSGG laser irradiation on canine mandibular bone. *J Periodontol.* 2001 Sep;72(9):1178-82.
37. Lowe RA. Clinical use of the Er,Cr: YSGG laser for osseous crown lengthening: redefining the standard of care. *Pract Proced Aesthet Dent.* 2006 May;18(4):S2-9; quiz S13.
38. Flax HD, Radz GM. Closed-flap laser-assisted esthetic dentistry using Er:YSGG technology. *Compend Contin Educ Dent.* 2004 Aug;25(8):622, 626, 628-30 passim. **jCD**

“The periodontal anatomy dictates the exact type of contouring required.”



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