

Treating the “Gummy Smile” with Aesthetic Crown Lengthening

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The presence of a “gummy smile” can be bothersome for patients and clinicians alike. Approximately, 10% of patients have excessive gingival display when smiling with its presentation more common in women than men (Tjan et al., 1984; Silberberg, 2009). Ideally, when an individual smiles, the gingival display of the maxillary anterior teeth should not exceed 2-3 mm above the cervical area of the tooth (Allen, 1988; Kokich, 1996). Patients, although unaware of these ideal proportions, consider 4 mm or more of gingival display to be unaesthetic (Kokich, 1999). Thus, this is not merely a frivolous issue.

When attempting to treat the “gummy smile”, one must first identify its etiology. Excessive gingival display can be a consequence of a skeletal deformity that results in vertical maxillary excess, dentoalveolar extrusion, a short or hypermobile upper lip, altered or delayed passive eruption and plaque or drug induced gingival overgrowth (Chu, 2004; Kokich, 1996; Robbins, 1999; Silberberg, 2009).

In this case report, we will focus on altered/passive eruption and describe the importance of a combined treatment approach between the periodontist and restorative dentist. When a tooth initially erupts, it undergoes a process of active eruption. This involves the movement of the tooth towards the occlusal plane until it contacts an opposing tooth. Following this active process and into early adulthood, passive eruption occurs. During passive eruption there is continued exposure of the clinical crown as the gingiva moves apically

toward the level of the Cementoenamel Junction (CEJ). Altered or delayed eruption results when either active and/or passive eruption is compromised (Chu, 2004; Gargiulo, 1961). When this occurs, clinicians may attempt to lengthen the patient’s clinical crown(s). Clinical crown lengthening is “a surgical procedure designed to increase the extent of supragingival tooth structure for restorative or esthetic purposes by apically positioning the gingival margin, removing supporting bone, or both” (AAP glossary of periodontal terms, 2001). As is highlighted in the case presented below, this treatment modality for altered passive eruption, even in presence of other etiological factors contributing to excessive gingival display, can result in satisfactory improvements for the patient without the need for more traumatic orthognathic and/or lip surgeries.

Thus, performing aesthetic crown lengthening starts with an understanding of the aesthetic zone, that is the maxillary anterior dentition. A comprehensive clinical examination must assess clinical crown length, anatomic crown length, keratinized gingiva height and location of the alveolar crest. These findings, combined with an understanding and application of ideal maxillary teeth dimensions (i.e. the golden proportions) should be used to tailor the periodontist’s treatment approach. This will determine the extent of gingival excision with or without osseous reduction that is required (Allen, 1988; Kokich, 1996). Gingival margins of central incisors are symmetric and 1 mm apical to the lateral incisor margins. The maxillary canines are also 1 mm apical to lateral incisors and even with the central incisors. A horizontal line connecting

Treatment for the Gummy Smile or Altered Passive Eruption (Coselet et al, 1977)

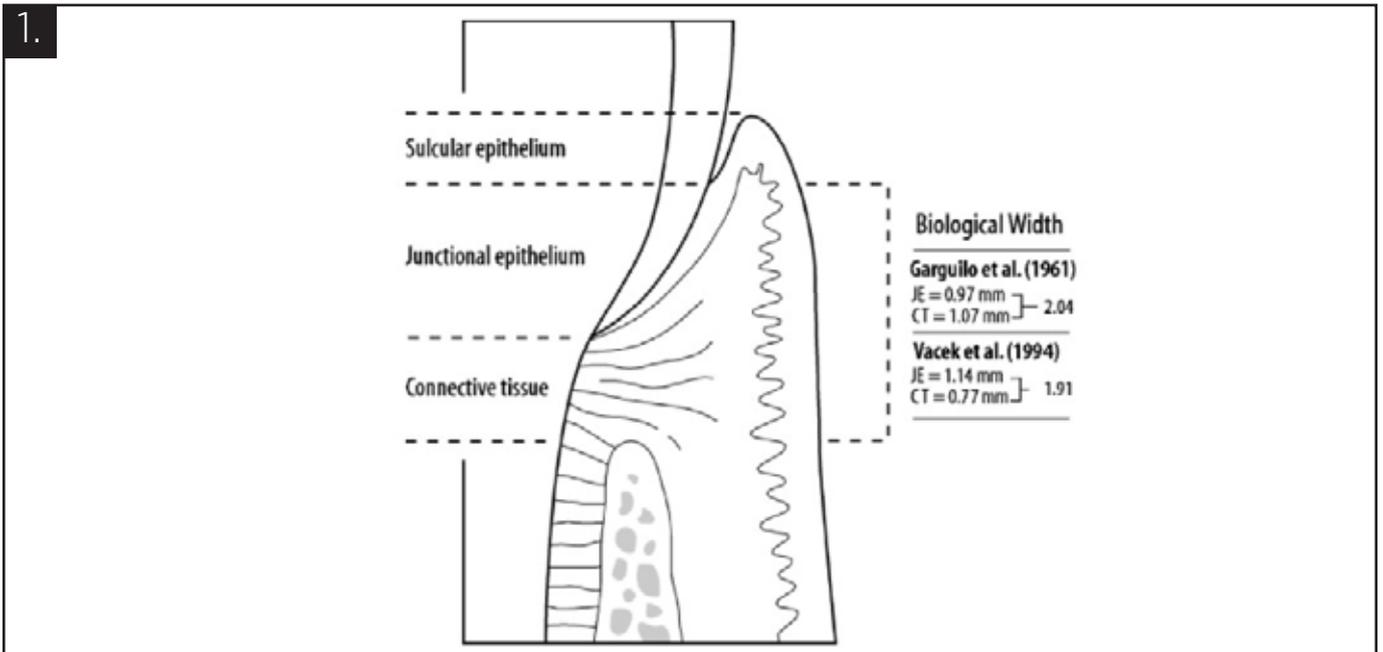
Classification	Description	Treatment
Type I – Subtype A	MGI – MGI apical to the alveolar crest resulting in a wide band KT (2-3mm) Osseous Crest – \geq 2mm from CEJ	Gingivectomy only
Type I – Subtype B	MGI–MGI apical to the alveolar crest resulting in a wide band of KT (>3mm) Osseous Crest – \leq 2mm or at the CEJ	Gingivectomy or scalloped inverse-beveled flap to the CEJ, repositioned flap with osseous resection to place osseous crest 2mm from CEJ
Type II – Subtype A	MGI – MGI coronal to the osseous crest resulting in inadequate or minimal band of KT (\leq 2mm) Osseous Crest – \geq 2mm from CEJ	Apically positioned flap. No osseous recontouring necessary
Type II – Subtype B	MGI – MGI coronal to the osseous crest resulting in inadequate or minimal band of KT (\leq 2mm) Osseous Crest – \leq 2mm or at the CEJ	Apically positioned flap with osseous resection to place osseous crest 2mm from CEJ
MGI – Mucogingival Junction, KT – Keratinized Tissue, CEJ – Cementoenamel Junction		

Using the Coslet et al. (1977) rules to determine the appropriate treatment for altered passive eruption.

the central incisors and canine gingival margins should be parallel to the interpupillary line. The apex of the gingival height of contour peaks towards the distal on the central incisors and canines compared to the middle of the lateral incisors. The lengths of the central incisor and canine crowns range from 9.4 mm (females) -10.2mm (males) up to 11-12 mm. The laterals are on average 1.5 mm shorter than the centrals (Allen, 1988; Magne et al., 2003; Sterrett et al., 1999). Ultimately, the ideal proportions in crown length should be achieved in combination with a normal physiologic smile that shows minimal gingiva apical to the central incisors and canines. Communication between the restorative dentist and periodontist is imperative, as this procedure is most commonly performed due to a patient's aesthetic concerns and often in-

cludes a restorative plan for full coverage crowns or veneers of some or all of the maxillary anterior dentition. Where crowns or veneers are planned, most cases the margins of the restorations should be at or just below the CEJ. However, if full coverage is not intended, critical care must be taken to avoid gingival reduction apical to the CEJ, thus causing iatrogenic recession and visibly exposed root surface (Allen, 1988; Allen, 1993).

Coslet and colleagues (1977) provide a detailed classification for the different forms of altered passive eruption, enabling clinicians to diagnose and treat these cases accordingly (Table 1). Type 1 and type 2 defects are based on the location of Mucogingival Junction (MGJ) in relation to the alveolar bone crest. These are further classified into Subtype



The term biologic width relates to the soft tissue attachment apparatus of the tooth. Based on Gargiulo et al. 1961 and Vacek et al., 1994 the average biologic width is 2 mm, consisting of approximately 1mm epithelial attachment and 1mm of connective tissue attachment (figure from Padbury et al., 2003).

A and B defects which consider the position of the bone crest in relation to the CEJ. In some cases, a simple gingival recontouring can be performed through a gingivectomy-like soft tissue excision while in more advance cases a flap procedure involving both a soft tissue discard and osseous reduction will be required. In general, the final objective is to obtain a positive osseous architecture 2-3 mm from the CEJ or proposed restorative crown margin with a minimum 3 mm of keratinized tissue remaining. This is based on an understanding of the dentogingival junction and biological width. The term biologic width relates to the connective tissue and epithelial attachment of the gingiva to the tooth surface. Based on Gargiulo et al. (1961) and Vacek et al. (1994) the average biologic width is 2 mm (Fig. 1). However, this can vary significantly between patients from 0.75 mm up to 4 mm. This variability in biological width can result in inadequate or excessive gingival reduction following surgery.

Due to this variability, close to 50% of patients can experience coronal migration or recession six months post-crown lengthening surgery (Bragger et al., 1992). As a result, a minimum six months of healing is required following crown lengthening prior to any restorative work in order to determine if any additional gingival alterations are required.

This case report highlights the importance of proper diagnosis and understanding of the etiology excessive gingival

display. The patient, a healthy 21-year-old female, presented for a periodontal consultation in January of 2017 with the chief complaint of a “gummy smile”. She had a non-contributory medical history, with no known dental allergies. The patient was not taking any medications, thus ruling out the possibility of drug induced gingival enlargement. The patient also reports undergoing two separate surgical procedures in the last five years to correct her gummy smile. She underwent periodontal surgery at the age of 17 and recalls the dentist using a “blade” for the procedure. The patient reports that her gingival contours rebounded to their original levels within one year. At the age of 18, she underwent a second procedure, except this time a laser was used to correct her gummy smile. Unfortunately, her gingival contours returned to baseline after six months. The most probable cause of treatment failure was improper diagnosis and provision of incomplete therapy.

A clinical examination identified the following factors contributing to the excessive gingival display. The patient had skeletal maxillary excess, a short upper lip and short clinical crowns with no signs of attrition (Fig. 2A, top left and middle panels). When measured from the gingival margin to the incisal edge, the canines, lateral incisors and central incisors were 6 mm, 5 mm and 7 mm respectively (Figure 2A, top right panel). The patient had a wide band of keratinized gingiva with the mucogingival junction (MGJ) of at least 3 mm



The patient had a skeletal maxillary excess, a short upper lip, short clinical crowns with no signs of attrition and a wide band of keratinized gingiva. B) Radiographs of the area identified the osseous crest to be at the level of the CEJ. C) The gingival margin was marked on the teeth with a sterile graphite marker to serve as reference. An internal bevel incision was made with a #15 blade to remove the excess gingiva to the level of the anticipated CEJ. Sulcular incisions were made at each tooth extending to the distal of the first premolars. A full thickness mucoperiosteal flap was raised by blunt dissection to fully expose osseous crest and structures. D) A periodontal probe was used to determine the extent of osseous resection required. Osseous recontouring was necessary to re-establish a 2mm zone of biologic width to prevent a relapse. Each papilla was sutured with an interrupted suture using 4-0 chromic gut.

from the gingival margin. Periapical radiographs of the area identified the osseous crest to be at the level of the CEJ (Fig. 2B.). Based on the clinical and radiographic findings, the patient was diagnosed with altered passive eruption (Coslet Classification, Type I – Subtype B). As described above (Table 1), proper treatment of this case should consist of an apically repositioned flap with osseous resective surgery to re-establish the biologic width (osseous crest is at least 2 mm from the anticipated gingival margin and CEJ). That said, it is important to note that even with proper aesthetic crown lengthening, the patient will have more than the ideal gingival display due to a skeletal maxillary excess and short upper lip. Establishing ideal gingival display requires orthognathic surgery. Furthermore, the patient has generalized spacing and would benefit from orthodontic therapy or prosthetic rehabilitation in the form of veneers or crowns following the aesthetic crown lengthening. Due to financial constraints and aversion towards orthognathic surgery, the patient opted for aesthetic crown lengthening only.

As previously mentioned, in this case the short clinical crowns were caused by altered passive eruption as opposed to attrition and wear of the incisal edge. The gingival margins were located coronal to the CEJ and need to be repositioned apically at the CEJ. As such, a reduction jig or stent was not required. Conversely, if the gingival margin was at the CEJ and the short clinical crowns were caused by attrition, achieving ideal tooth proportion would only be made possible with aesthetic crown lengthening and prosthetic rehabilitation. In such a case, a wax up would be required. The wax up could then be used to create an Essix reduction stent that would allow the surgeon to determine the final and ideal position of the gingival margin and osseous crest (2 mm below the anticipated gingival margin).

The case was started by obtaining informed consent, answering all patient questions and managing the patient expectations (the patient was aware that she would still have some gingival display on smiling). She received 400 mg of ibuprofen pre-operatively and rinsed with 0.12% chlorhexi-



Comparing the pre-operative stage (Fig. 3A) and post-operative state (Fig. 3B). The patient requested to have gingival recontouring to allow for more symmetry and gingival harmony.

dine for one minute. Profound anaesthesia was obtained with the use of topical 5% lidocaine, as well as buccal and palatal infiltrations with 2% lidocaine, 1:100,000 epinephrine. The gingival margin of each tooth requiring alteration was then marked with a sterile graphite marker to serve as reference. The CEJs were identified by tactile feel using periodontal probe. When tactile feel failed to identify the CEJ, the position of the CEJ was determined using available radiographs. Next, an internal bevel incision was made with a #15 blade to remove the excess gingiva to the level of the anticipated CEJ. This was done on one side of the arch only leaving the contralateral side as a reference (Fig. 2C, left panel). A new #15 blade was used at each tooth as contact with the enamel and bone rapidly dulls the blades, thus making incisions less accurate and “clean”. Following the gingivectomy, sulcular incisions were made at each tooth extending interproximally. Each papilla was split, taking care not to extend the incisions too far toward the palate. The sulcular incisions were extended to the distal of the first premolars (Figure 2C, middle panel). A full thickness mucoperiosteal flap was raised by blunt dissection to fully expose osseous crest and structures (Fig. 2C, right panel). All granulation tissue and tissue tags were removed and any exposed root surfaces were debrided. There was minimal manipulation of interproximal papillary

tissues. Next, a periodontal probe was used to determine the extent of osseous resection required. Osseous recontouring was necessary to re-establish a 2mm zone of biologic width to prevent a relapse (Figure 2D, left panel). End cutting surgical burs, #8 and #6 round diamond burs, bone chisels and sharp scalers were used to perform ostectomy and osteoplasty. The goal of the osseous recontouring was to create a festooned buccal bone profile with a favourable positive architecture and to reposition the osseous crest 2mm from the CEJ (Fig. 2D, middle panel). Following osseous recontouring, the area was rinse with copious sterile saline and the flap apically repositioned. Each papilla was sutured with an interrupted suture using 4-0 chromic gut (Fig. 2D, left panel). The patient was provided 600mg of ibuprofen every six hours for analgesia and instructed to ice the area for 24 hours to decrease swelling. The patient was placed on a 0.12% chlorhexidine rinse (BID, 14 days) and instructed not to brush and floss the area for two weeks. Sutures were removed after 14 days and normal oral hygiene was reinstated. The patient was brought back for a three-month follow up. After three months (Fig. 3B), there was an impressive reduction in the amount of gingival display on smiling when comparing the pre-operative levels (Fig. 3A). The clinical crowns measured at the canines, lateral incisor and central incisors were 8 mm, 7 mm and 9 mm, respectively.

The patient was quite pleased with the end results. However, she did request slight adjustments to be made to gingival contours at 1.1 and 2.1 to allow for a more harmonious and symmetrical contour. This was performed using a #15c blade but could also have been done using a soft tissue laser, such as a diode laser (Fig. 3C). Soft tissue lasers do offer the advantage of rapid tissue removal, instant hemostasis and arguably reduced post-operative discomfort (Aoki, 2015). When used properly and in the right circumstances, soft tissue lasers are an excellent alternative to sharp blades for esthetic crown lengthening. That said, the reader should be cautious, as soft tissue lasers should only be used when gingivectomy/gingivoplasty is indicated and there is no indication for flap elevation and osseous recontouring. In this case report, the patient underwent two previous failed attempts at esthetic crown lengthening using both a conventional blade and a laser. The treatment failure was not due to the modality of tissue removal but rather failure to properly classify and identify the etiology of the altered passive eruption. **OH**

Oral Health welcomes this original article.

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