Identification and management of passive eruption

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Excessive gingival display can affect the total esthetics of a smile, becoming the focus instead of the frame of the smile. This can be the result of passive eruption of the gingival complex as the teeth erupt.1,2 The condition of delayed or altered passive eruption exists when the gingival complex remains positioned coronal to the cementoenamel junction with the attachment on the enamel instead of the cementum of the root, giving the appearance of short clinical crowns.3

Crown lengthening is critical to the success of creating a smile that is harmoniously balanced with its surrounding facial features.4 Patients who clinically display too much gingival tissue and short teeth require a thorough diagnosis and treatment plan to provide a predictable esthetic outcome.5 If a patient has altered passive eruption (APE) of the maxillary anterior teeth either secondary to orthodontic treatment or without orthodontic treatment, but the patient has completed facial growth,6 then the practitioner must first correct the gingival levels with either a gingivectomy or esthetic crown lengthening procedure before the placement of veneers or crowns. Thus ensuring that the eventual gingival margins of the maxillary anterior teeth will be at their correct level relative to the adjacent anterior teeth.7

Understanding altered passive eruption

In a human mouth absent of periodontal disease, the osseous structure roughly follows the scalloped parabolic contour of the cemento-enamel junction (CEJ), from facial to interproximal at an average distance of 2 to 3 mm.8

In addition, the average interproximal bone height is 5 mm coronal to the facial crest of bone.9 Because the soft-tissue topography is usually determined by the underlying hard tissue, this osseous “scallop” usually results in a gingival scallop of 5 mm.10

Examination of the peri-apical radiographs or periodontal vertical late-wings will allow the clinician to ascertain the position of the alveolar bone relative to the CEJ of the teeth to determine whether the crest of bone (COB) is 2 to 5 mm apical to the CEJ, allowing for biologic bone (cob) is 2 to 3 mm apical to the CEJ, a condition referred to as APE.11,12

Bone sounding involves using a periodontal probe to locate the CEJ and determine whether it can be felt within the gingival sulcus or only when the probe penetrates through the base of the sulcus.13,14 These visual findings are coupled with the clinical information obtained by “bone sounding.” Bone sounding is an essential step in the overall assessment of the periodontal support of the anterior dentition. The apical aspect of the periodontal probe when placed coronal to the CEJ, results in the tip of the probe being an average of 1.5 mm more coronal to the COB. This additional 1.5 mm, with the average length for esthetic clinical crowns, including the height of contour of the gingival margin, where there is a “normal” periodontium, with no loss of bone or periodontal attachment due to periodontal disease.15

Anatomic considerations act as parameters when practitioners perform esthetic gingival re-contouring. A useful guide can be fabricated by modifying the mounted diagnostic casts so that the waxed modification reflects the ideal tooth proportions desired in the final result, based on the guidelines previously published by Chiche and Pinaud.16 These guidelines suggest that the average length for esthetically pleasing maxillary central incisors is 10–12 mm.17 These guidelines for the length of the central incisors, along with the recommended width-to-length ratio of 75 to 80 percent,18 should be kept in mind when reconstruing the gingival tissues so as not to leave the teeth too long or too short.8,19

After proportions are achieved on the central incisor proportions, practitioners should focus on the height of contour of the gingival margin on the centrals (zenith).20,21 The proper placement of the gingival zenith should be at the average, 5 mm coronal to the level of the crest of bone, being more coronal on the body of the tooth and creating the appearance of a short, clinical crown.19 Bone sounding involves using a periodontal probe to locate the CEJ and determine whether it can be felt within the gingival sulcus or only when the probe penetrates through the base of the sulcus.13,14

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Fig. 2: Wide band of heavily pigmented attached gingiva with passive eruption of the anterior teeth.

Fig. 3: Transapical stent that has been scalloped at the desired gingival height to act as a surgical template.

Fig. 4: Section made at the desired gingival height to provide proper length-to-width ratios of the anterior teeth being treated. Note width of attached gingiva that will remain.

Fig. 5: The right half of the anterior has been treated with a gingivectomy to act as a comparison of the length-to-width ratios that were present before and after treatment.

Fig. 6: Immediately following gingivectomy of the anterior maxillary teeth to correct the passive eruption and provide better length-to-width ratios.

Fig. 7: Patient smiling immediately following gingivectomy showing less gingival display and better length-to-width ratios.

Fig. 8: The patient two weeks post treatment showing better esthetics with less gingival display and a reduction in the gingival pigmentation.

Fig. 9: The patient four weeks post treatment showing a more natural esthetic smile.

Fig. 10: Patient presenting with old composite on the anterior teeth to mask discoloration, spacing issues and excessive gingival display.

Fig. 11: Thickness of old composite placed in an attempt to mask the underlying discolored tooth structure. Note the banded discoloration of the lower anterior teeth.
Fig. 15: Vacuform surgical stent based on the wax-up to improve esthetics. The final surgical stent was colored black to be used as a surgical guide when performing the gingivectomy (Fig. 17). Note the edges of the stent are colored black to improve visibility intraorally.

Fig. 19a, b: Comparison of before and after gingivectomy and placement of final provisional composite restoration. Note the incisal smile as well as the correct 75 to 80 percent width-to-length ratios.

Fig. 18: Patient following gingivectomy to improve the length to width ratio. The gingival tissue when gingivectomy was performed using the relative position of the gingival margin. This was performed to determine the desired tooth size and perform restorative correction of the lateral incisors. Again, water spray was used to water spray was used to cool the tissue during the procedure.

Postoperative instructions
The patient was dismissed and instructed to avoid all foods and to use warm salt water rinses three to four times daily until she presented for the follow-up appointment two weeks later. At the follow-up appointment, the patient indicated that she was experiencing no postoperative sensitivity and gingival irritation were not experienced, and the papilla was pink and healthy with the improved smile (Fig. 8). Clinical examination noted a lack of gingival inflammation except for a small spot on the papilla between the right lateral incisor and canine. The entire area except this spot was covered with keratinized gingiva that was not apparent compared to what was initially present.

At four weeks post surgery, the papilla was pink and healthy. The patient was not noted as complete (Fig. 9). The patient indicated that she was satisfied with the result.
had received comments from friends and family that she appeared to be smiling more. Additionally, she commented that she was no longer self-conscious about her smile and was indeed smiling more and would, when finances allowed, proceed with the recommended veneers on the maxillary lateral incisors.

Case No. 2: Passive eruption with spacing issues

The patient, a 40-year-old woman, presented with a history of previous direct bonding to correct moderate tetracycline discoloration of the teeth and generalized diastemas. Examination revealed an excess display of gingiva when the patient smiled, as well as bulky, chipped composite that was present. It was noted that a wide band of attached gingiva was present. Examination of the radiographs was performed. It was taken and a periodontal examination was performed. It was determined that removal of gingival inflammation was performed. It was noted to be a large amount of inflammatory response often resulting in exposure of the crestal bone and lack of healing change in the osseous surgery requires longer periods of healing because of the manipulation of the osseous crestal position and greater amounts of soft-tissue manipulation before a stable position is achieved. An additional benefit of the best BisCUt provisional is a lack of tissue bleeding after treatment that could discolor the composite that is being placed. The stent was removed and gingival margins were further refined with the gingivectomy pen. Tissue was then placed back to develop good papilla contours using a 5022 gingivoplasty pen (Synergetics). Completion of the gingival recontouring did not result in exposure of the crestal bone and non-bleeding gingival margins were noted (Fig. 16). The position of the crestal bone margin was determined through mucosal sounding with a periodontal probe. The information gathered indicated that some passive eruption issues were present and with the wide band of attached gingiva present would allow removal of 2 mm of gingival tissue and still provide a normal subgingival depth after healing. The restorative margins were placed at the new gingival margin position.

The functional mock-up stent was tried in, and the gingival pro-

Fig. 20: Patient presents with passive eruption, severe of the incisors and length equaling width with a wide band of attached gingiva.

Fig. 21: Chair proportion instrument used to match length to the width of the anterior maxillary teeth and position the initial edge where it would be had the initial finish not occurred.

Fig. 22: Patient following gingivectomy to eliminate passive eruption and achieve better length-to-width ratios.

Fig. 23: Patient following gingivectomy and placement of immediate direct resin to length of the anterior maxillary teeth and position the initial edge where it would be had the initial finish not occurred.

Fig. 24: Patient one week following gingivectomy and placement of immediate direct resin crowns showing a more esthetic smile with better length-to-width ratios.

Fig. 25: Prosthodontic patient with spacing issues.
sion was assessed. Teeth were isolated with cotton rolls and the facial and interproximal of teeth #1–3 was isolated with a 37% phosphoric acid-etchant gel for 30 seconds then rinsed and dried. Bond-1 adhesive composite active was applied to all surfaces and light cured for 20 seconds per quadrant.

The patient requested a very white bleaching shade and Artiste® nano composite (3M Espe) was selected for the functional mock-up. A thin layer of Bleach enamel shade was applied to the areas in the incisal area of the gingival and incisal half of the coronal of teeth #1–3. Next, the Super Bleach dentin shade was placed into the stent and the facial aspect of each tooth was filled with material. The stent was then carried introradially to the enamel and adapted to the teeth with finger pressure. Each tooth was then light cured for 10 seconds followed by 30 seconds on the incisal.

The stent was removed, leaving the bonded functional mock-up on the teeth, and additional light cure was carried out. The stent was then removed and adapted with water to remove the cervical flash and provide contours without any overhanging margins. Cervical embrasures were also opened, and definition given to the interproximal line angles. Occlusal adjustment was performed to centric occlusion and lateral excursions and adjusted for proper anterior guidance. Polishing was accomplished using Final cleaner polishing paste and a cloth buffer supported by a handpiece (Pentron Clinical Technologies) (Fig. 17).

The patient was recalled 24 hours later to check soft-tissue healing and assess the occlusion. At this time, minor refinement of the functional mock-up was accomplished and the patient indicated no irri-

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tation relative to the tooth's incisal proportion (Hu-Friedy, Ill.) was used to determine width-to-length proportions (Fig. 21). The Bident Bipolar 535 gingivectomy handpiece (Synergistics, King of Prussia, Pa.) was used to remove the cervical crest in relation to the CEJ and no bone loss was evident. Local anesthetic was infiltrated into the buccal vestibule from the second premolar to second premolar. A peri-probe was introduced into the facial sulcus to support the anesthetized tissue in relation to the CEJ and no bone was noted coronal to the CEJ on the CEJ probe. The instrument for determining width-to-length proportions (Hu-Friedy, Ill.) was used to detect a high ridge where the gingival margin needed to be placed to have ideal length (Fig. 21).

The Bident Bipolar 535 gingivectomy handpiece (Synergistics, King of Prussia, Pa.) was used to remove the cervical crest on the tooth to be altered. Using the gingivectomy handpiece, the gingival margin was sculpted to ideal contours (Fig. 22). The papilla was spared to avoid the potential of creating black triangles interproximally. The resulting tissue margin after the use of the gingivectomy handpiece. The gingival ridge that needed to be tapered onto the tooth. A Bident Bipolar 535 gingivoplasty handpiece (Synergistics, King of Prussia, Pa.), also referred to as a "fishhook," is used to plasty (taper) the gingival margin to create a natural knife edge. As the papilla following a gingivectomy is often bulky faciulary, the facial aspect of the papilla is planed back to debulk the papilla with no gingival inflammation. Although the altered margins appeared red, due to the coagulation ability of the Bident Bipolar unit, no active bleeding was noted. The author recommends the use of constant irrigation during use of the Bident Bipolar surgical unit to maintain tissue hydration and eliminate tissue charring during treatment and post operative inflammation. As the practitioner uses the bipolar handpiece, the assistant sprays the air/water syringe while suctioning with the high-voltage evacuation. The teeth were then isolated and acid etched with a 37% phosphoric acid gel for 30 seconds then rinsed and dried. Bond-1 adhesive was applied to the etched tooth surface then light-cured. Using a stent previously fabricated to the desired incisal length, Artiste nano composite (Pentron Clinical, Orange, Calif.) was the length built using an enamel shade of resin and light cured. The stent was removed from each tooth and then adjusted to maintain the anterior guidance. The composite needed for the first week and to rinse with warm salt water three to four times daily for the first three days. Additionally, the patient was instructed to continue oral hygiene including brushing the area with a toothbrush and her regular toothpaste. At 24 hours, the patient was called to check on her comfort level, and she indicated no postoperative discomfort nor irritation during normal daily activities.

At one-week post surgery the patient discontinued for a postoperative examination where a lack of inflammation was noted (Fig. 24). A four-week postoperative examination demonstrated a more esthetic smile with better width-to-length proportions with elimination of excess gingival display.

Conclusions

Assessors frequently tend to ignore the gingival tissues' position relative to the tooth's incisal edge, and also in relation to the adjacent teeth, when evaluating the cosmetic aspects of patients.

Passive eruption appears to be infrequently recognized and can affect the final cosmetic result when not evaluated as part of the overall treatment.

Editorial note: The full list of references is available from the publisher.

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