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.3

Patients who clinically display too much gingival tissue and short teeth require a thorough diagnosis and treatment plan to provide a predictable esthetic outcome.4 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,5 then the practitioner must first correct the gingival levels with either a ginvectomy 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.6

Understanding altered passive eruption

In a human mouth absent of periodontal disease, the osseous structure roughly follows the scalloped parabolic contour of the cementoenamel junction (CEJ), from facial to interproximal at an average distance of 2 to 3 mm.7,8

In addition, the average interproximal bone height is 5 mm coronal to the facial crest of bone.9 Because this 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 width.11

However, where the COB is coronal to the CEJ, a condition results that is referred to as APE.1,12

In this situation, the gingival margin will usually be located, on 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.14 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.15

Additionally, the periodontal probe is also used to feel for the COB. This value is expressed as a numerical distance in millimeters, revealing the distance between the COB and CEJ to ascertain whether there is sufficient biologic width.16 In a normal, non-diseased human periodontium, the COB is 2 to 3 mm apical to the CEJ.17

In addition to the gingival margin on the facial aspect of the teeth, in non-diseased dentition, the interproximal papilla between teeth with no bone loss due to periodontal disease is approximately 4.5 mm coronal to the interproximal crest of bone. The mid direct facial is about 1.5 mm more coronal to the COB. This additional 1.5 mm, with the 5 mm average osseous scallop from the CEJ, results in the tip of the papilla being an average of 4.5 mm coronal to the facial free gingival margin, where there is a “normal” periodontium, with no loss of bone or periodontal attachment due to periodontal disease.

Anatomic considerations act as parameters when practitioners perform esthetic gingival recontouring. A useful guide can be fabricated by modifying the mounted diagnostic casts so that the waxes modification reflects the ideal tooth proportions desired in the final result, based on the guidelines previously published by Chiche and Pannain.18

These guidelines suggest that the average length for esthetically pleasing maxillary central incisors is 10–12 mm.18 These guidelines for the length of the central incisors, along with the recommended width-to-length ratio of 75 to 80 percent,19 should be kept in mind when reconstruing the gingival tissues so as not to leave the teeth too long or too short.20

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).21 The proper placement of the gingival zenith should be at the...
peak of the parabolic curvature of the gingival margin, which for the central incisors, cuspids and bicuspids, should specifically be located slightly distal to the middle of the long axis on these teeth. This gives the centrals, cuspids and bicuspids the subtle distal root inclination, which is paramount for the scaffold of a beautiful smile.

The zenith for the lateral incisors is located at the midline of the long axis of the tooth. Furthermore, the height of the gingival crest for the lateral incisors should be 1 mm shorter than the gingival margins of the adjacent teeth (centrals and cuspids). Finally, the gingival tissues should be manipulated to have a resulting “knife-edge” gingival margin.28 When the presence of short clinical crowns and crestal bone levels approximating the CEJ has been determined, a diagnosis of APE can be made through the maxillary arch.

The practitioner can then fabricate an esthetic guide that can be placed over the patient’s existing teeth to enable both the practitioner and patient to visualize what the smile would look like with the gingiva in a modified, more esthetic position.29 The central incisors should demonstrate midline symmetry, as well as the correct 75 to 80 percent width-to-length ratio. In addition, the incisal smile line follows the curvature of the lower lip.4 The newly established periodontal smile line should show a reduction of the gummy smile and make the smile more esthetically appealing and harmonious with surrounding facial features.27

Gingival levels should be assessed relative to the projected incisal edge position. A predictable method of determining the proper gingival positions is to determine the desired tooth size relative to the projected incisal edge position. The practitioner should remember that the incisal edge should not be positioned using the relative position of the gingival margin to create the proper tooth size. This is because the gingival margin can move with eruption or recession.28 It is also paramount when establishing the proper position of the maxillary anterior teeth for an optimal esthetic outcome to assess the levels of the interdental papillary tissues and their position relative to the crown length of the maxillary incisors.

Gingivectomy and gingivoplasty for esthetic soft-tissue correction. Traditionally, scalpels and periodontal knives (Orban and Kirkland) were utilized to sculpt soft tissue when gingivectomy was the treatment being used to improve esthetics.30 These provided precise incisions, but the resulting raw, bleeding surfaces complicated postoperative healing. Monopolar electrosurgery, another option, requires a dry field during treatment and this may increase tissue inflammation during the initial healing period and subsequent tissue shrinkage.

“Charring” of the tissue margins at surgery has also been reported with monopolar electrosurgery and may be a result of the need for operating in a dry field and the high wattage needed to overcome resistance between the cutting tip located intraorally and the grounding plate located a distance away on the body.31 Bipolar electrosurgery was developed to overcome the obstacles associated with monopolar electrosurgery. True bipolar electrosurgery as used today in dentistry is a cross-over from neurosurgery, which requires delicate incisions in wet fields with no neural heat generation. The Bident Bipolar surgical unit (Synergistics, King of Prussia, Pa.) transfers those neurowsurgical requirements to the dental environment, allowing intraoral soft-tissue surgery to be performed with air-cooled, non-bleeding incision margins.32 This eliminates marginal shrinkage related to tissue inflammation and provides a more comfortable postoperative period for the patient.

When using the bipolar surgical unit, because the tips have two electrodes that are either straight wires or loops, one must remember that the first electrode to touch the tissue acts as the return and the second electrode does the cutting or coagulating, depending on which foot pedal is depressed. Because the bipolar surgical unit is fully isolated from ground, unlike monopolar electrosurgical units, a ground is not required. Additionally, as no grounding plate is required and resistance through the body is not an obstacle to be overcome, wattage is one-quarter of that used with monopolar electrosurgery. It is also advised by the author that when you are cutting tissue, your assistant is constantly spraying water from the air/water syringe to keep the field wet while using the high-volume evacuation. This improves efficiency with the handpiece and prevents charring.

Another benefit of the bipolar surgical unit is that even during cutting there is some coagulation that occurs, so the wound edges that result do not ooze and may interfere with any restorative procedures being performed during the same appointment.33

Case No. 1: Passive eruption
A 52-year-old female patient presented for treatment of excessive gingival display in the anterior region. The patient requested a restorative option that would provide improved esthetics (Fig. 1). Initial clinical and radiographic examination revealed a wide band of attached gingiva in the maxillary and mandibular anterior regions associated with passive eruption (Fig. 2).

Periodontal probing indicated that the depth of the sulcus on the facial of the maxillary anterior teeth was coronal to the CEJ, supporting the presence of passive eruption. Also noted was the presence of peg-shaped laterals bilaterally, which were tipped both mesially as well as palatally.

A gingivoplasty was scheduled to move the gingival margin to be equal or apical to the CEJ, and perform restorative correction of the lateral incisors. To aid in the treatment plan, the gingival margin image was modified using Adobe Photoshop (Adobe, San Jose, Calif.) to indicate the proposed gingival margin location of the maxillary lateral incisors. This was performed to determine if the proposed gingival margin would remain following gingivoplasty.

Next, the cervical area of each of the teeth to be treated in the maxillary anterior was altered on the photograph to simulate the cosmetic change in a photographic mock-up. The patient indicated that the suggested correction of the excessive gingival display would meet her esthetic concerns and she would consider placement of porcelain veneers on the maxillary lateral incisors in the future. As the mandibular passive eruption of gingiva was not apparent when smiling, the patient declined treatment of that gingival tissue.

Surgical procedures
A line was drawn on the maxillary master model indicating the intended position of the gingival margin based on width-to-length criteria. A sheet of 0.03 inch vacuum material (Raintree Essix, Metairie, La.) was thermoformed over the cast using a Druomat vacuum pressure former (Raintree Essix, Metairie, La.). After cooling, the thermoformed material was trimmed, scalloping the gingival margin to follow the line that had been placed on the master model. The edge of the tray was then colored with a black sharpie marker to make it more visible intraorally during surgery (Fig. 3).

Following administration of a local anesthetic, 4 percent Septocaine with 1:100,000 epinephrine (Septodont, New Castle, Del.), a periodontal flap was used to feel the CEJ at the mesial, distal and mid-facial aspect of each of the anterior teeth and the premolars. The vacuform surgical template was inserted and the gingivectomy of the facial was visualized in relation to the incisal gingival line.

A gingivectomy pen was used with a bipolar surgical unit to follow the facial edge of the surgical stent from teeth #4 to #8 (Fig. 4). While the clinician applied the bipolar pen, the assistant sprayed a continuous stream of water over the field, followed by high-volume evacuation and flushing of the site to keep it hydrated during the procedure.

The surgical template was removed and the outline of the proposed gingival margin was evaluated. The gingivectomy pen was used to contour the gingival margin and tooth surface and remove any tissue tags remaining on each site. A 5922 Gingivoplasty pen (Synergistics USA, King of Prussia, Pa.) was used to plane back the thick tissue at the facial aspect of the papilla to achieve normal contours and taper in the tissue. Again, water spray was used to enable intraorally during surgery to improve postoperative healing. Finally, a 5102 coagulation blade (Synergistics USA, King of Prussia, Pa.) was used in the bipolar unit on coagulation mode to seal the gingival margin. Next, the gingivoplasty pen was used to outline the desired gingival margin on the gingivoplasty surface. The right quadrant was compared to the left to ensure accuracy and the process was repeated on teeth #9 through #13 (Figs. 5–7).

Postoperative instructions
The patient was dismissed and instructed to avoid ice packs 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 satisfied 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 the canine. All areas except this spot were covered with keratinized gingiva that was still softer than what was initially present.

Four weeks post surgery, the patient indicated that her esthetic concerns were met and she was noted as complete (Fig. 9). The patient indicated that she...
had received comments from friends and family that she appeared to be smiling more. Additionally, she commented that a lack of tissue bleeding after gingival surgery required longer periods of healing because of the lack of heat evaporation device with her other hand. This allowed the tissue material and allowed to set.

Fig. 20: Patient presents with passive eruption, one of the initial edges and length equaling width with a wide band of attached ginviva.

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

Fig. 21: Chair proportion instrument used to match length to width and achieve better proportions; also shown is the instrument used to mark the new results.

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

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

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 ginviva when the patient smiled, as well as posterior gingival recession and discolored direct-resin restorations on the maxillary anterior teeth (Figs. 10, 11). The patient expressed a desire for a less gummy smile and an overall improvement in the esthetics.

Case No. 2: Passive eruption with spacing issues

The patient was a 40-year-old woman (Fig. 20) who presented with passive eruption, a lack of tissue bleeding after gingival surgery. She was referred to the author for evaluation and possible treatment. The patient had received comments from friends and family that she appeared to be smiling more. Additionally, she commented that a lack of tissue bleeding after gingival surgery required longer periods of healing because of the lack of heat evaporation device with her other hand. This allowed the tissue material and allowed to set.

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A full series of radiographs was taken and a periodontal examination was performed. It was noted that a wide band of attached ginviva was present. Examination of the radiographs was coordinated with intraoral probing, determined that removal of 2 mm of gingival tissue would not encroach on the crestal margin of bone and an osseous recontouring with the internal surgical approach would not be needed.

After a consultation with the patient and a discussion using the modified photograph, treatment progressed to a wax-up phase on the casts. A duplicate cast of the maxillary arch was altered to give the teeth normal thickness and eliminate the bulky composite that was present.

This was followed by application of a dentin adhesive (Bond 1, Pantron Clinical Technologies, Wallingford, Conn.) to the cast to aid in retention of the wax-up to the cast. Next, composite (SinileF, Pantron Clinical Technologies) was applied to the cast and shaped with composite instruments so that contour and tooth proportions developed.

Material was placed over the gingival aspect of the cast to position the tooth’s cervical line and all associated internal anatomy. This allowed the tissue to eliminate the palatal area of the cast. A stone cast was poured. The modified cast was tried in, and the gingival pro-
sition was assessed. Teeth were
isolated with cotton rolls and the
facial and interproximal of teeth #12
was etched with 37 percent phosphoric acid-etchant
gel for 30 seconds then rinsed
and dried. Bond-1 adhesive
was applied to all surfaces and
light cured for 20 seconds per
area.

The patient requested a very
bleaching staining and Ar-

ti-caries prophylaxis. (Protocare
Clinical Technologies) Super
Bleach dentin shade and Bleach
eugenol gel were selected for
the functional mock-up. A thin
layer of Bleach enamel shade
was seated into the stent in the
area of the incisal edge and in-
tricate design of the coronal
edge #41 (Fig. 20).

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 in-
tricate design to adapt the

teeth with finger pressure.
Each tooth was then light cured
for 20 seconds followed by
20 seconds on the incisal.
The stent was removed, leaving
the bonded functional mock-
up on the teeth, and additional
type of dentin bonding gel
was used in the adjacent
surfaces and with water to
remove the cervical
flask and provide contours with-
out any overhanging margins.
Cervical embrasures were also
opened, and definition given to
the interproximal line angles.
Occasionally, the gingiva was
brought to a centric
occlusion and lateral excurs-
ions and adjusted for proper
anterior guidance. Polishing
was accomplished using Final™
polishing paste and a cloth buff-
er (ProTegra, Gendex Dental
Clinical Technolo-
gies) (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
crown was accomplished and the
patient indicated no ir-
ritation gingivally where tissue
had a normal appearance in
the area of the stent.

Two weeks post-treatment,
the patient was instructed to
continue with the use of perio-
dontal hygiene including brushing
the area with a toothbrush and
her regular toothpaste. At 24
weeks, 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 denied for a postop-
erative examination where a lack
of inflammation was noted (Fig.
24). A four-week postoperative
treatment demonstrated a more
esthetic smile with bet-
ter width-to-length proportions
with elimination of excess gingi-
val display.

Conclusions
The teeth were then isolated
and acid etched with a 37 per-
cent 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 previ-
ously fabricated to the desired
incisal length, Artiste nano com-
posite (Pentron Clinical, Orange,
Ca.) was used to build a
substructure to its final length.

The stent was then removed
and the gingivectomy handpiece,
the assistant sprays the tissue
while suctioning with the high-
volume evacuation.

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The results of the stentation
after use of the gingivectomy
handpiece was that the gingival
margin to create a
natural knife edge. As the pa-

A full list of references is avail-
able from the publisher.

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