Guided Gingival Growth

Improving Aesthetics During Second-Stage Surgery

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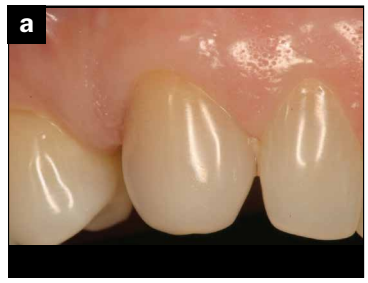

Figure 1a. Preoperative photo of tooth No 6. Satisfactory soft-tissue form and health were present.

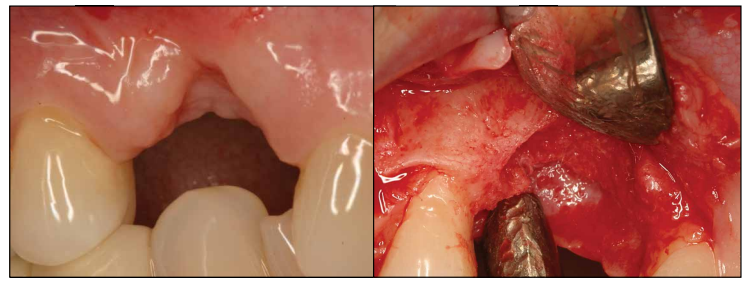

Figure 2. Tooth No. 6 was removed without bone grafting at the time of extraction. The result was bone loss and a labial soft-tissue deformity.

Figure 3. Site development was necessary to rebuild the bone prior to implant surgery. The defect measured 10.0 mm vertically at the buccal plate, extending 9.0 mm buccolingually at the ridge crest. Guided bone regeneration was required.

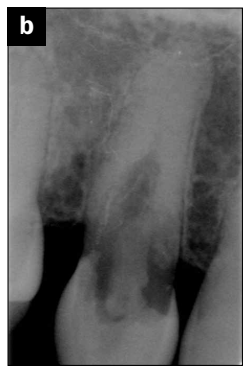

Figure 1b. Radiograph demonstrates internal resorption of tooth No. 6. The prognosis was hopeless and extraction with eventual implant replacement was recommended.

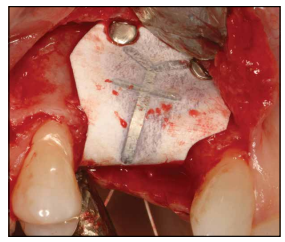

Figure 4. Ridge reconstruction was accomplished with a cancellous particulate allograft (Puros [Zimmer Biomet]) in conjunction with a titanium-reinforced expanded polytetrafluoroethylene (Ti-reinforced ePTFE) membrane stabilized with titanium tacks.

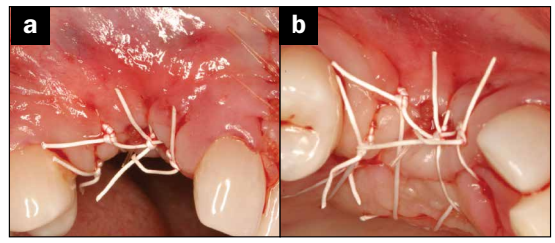

Figure 5a. Two vertical incisions and a periosteal release were made to achieve primary closure with ePTFE sutures at the crestal incision and 5-0 gut sutures at the vertical incisions.

Figure 5b. Occlusal view of closure at the time of surgery.

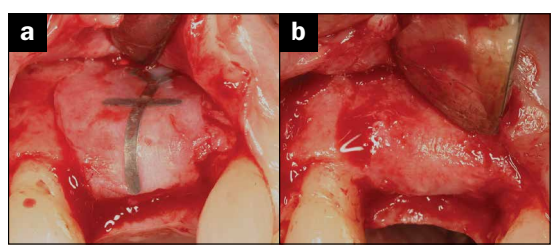

Figure 6a. Healing 6 months following bone graft surgery. The Ti-reinforced ePTFE membrane was still present. No signs of infection were present, and the site healed well.

Figure 6b. The e-PTFE membrane was removed, exposing the augmented bony ridge. Compare to **Figure 3**.

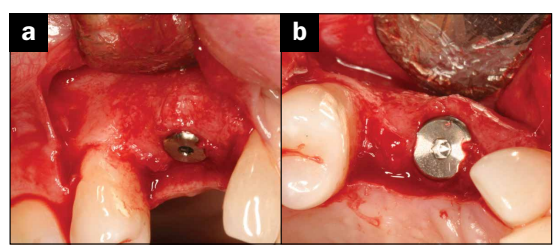

Figure 7a. A 4-mm x 11.5-mm OSSEOTITE Certain Implant (Biomet 3*i*) was placed in ideal prosthetic position.

Figure 7b. Occlusal view of the implant at the time of placement. Bone regeneration allowed for adequate bone in all dimensions. There was 2 mm of bone buccal to the implant.

INTRODUCTION

Notorious for its complexity, ideal aesthetic implant rehabilitation nevertheless may be approximated by following, in order, certain guidelines (Table 1).[1-7] Foremost, adequate bone must exist (or be built) to allow for proper implant positioning in 3 dimensions. All other cosmetic criteria rely on the hard-tissue architecture for physical (buttressing) and biological (blood supply, cell progenitors) support; thus, if the ridge morphology is lacking, one should not expect a perfect mucosal or prosthetic silhouette. That said, subsequent maneuvering of the soft tissue and interim crown may compensate for small shortcomings in the volume of bone, or further hone the ultimate appearance of the implant restoration. In patients with long papillae, high smilelines, and/or elevated expectations, however, an optimal result may *not* be possible, *even with tissue enhancement*. The clinician needs to gauge and convey to each patient the individualized, realistic goals of treatment prior to its commencement.

This short case report article focuses on a soft-tissue augmentation modality performed during second-stage surgery (Figures 1 to 16).

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CASE REPORT

A modification of an approach introduced by Stein and Nevins[8] (our version of guided gingival growth [GGG]) was performed by making a palatally oriented crestal incision, raising a full-thickness flap, replacing the cover screw with a temporary healing abutment (THA), and then covering the THA fully (or partially) with what is essentially an apically positioned flap (or at least a labially positioned one), which is secured with secondary intention.[8] The healing abutment acts as a strut beneath the flap, creating a protected dead space on the buccal side of the implant for tissue regeneration.

Following the formation of a clot, connective tissue fills the gap and creates supportive

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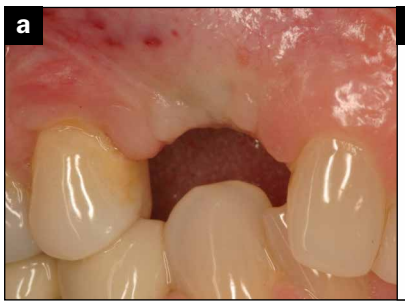

Figure 8a. Soft-tissue healing at 3 months after implant placement. Soft-tissue augmentation was necessary in order to idealize gingival aesthetics.

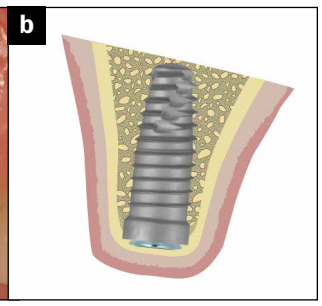

Figure 8b. Diagram of the bony and soft-tissue anatomy the day of second-stage surgery.

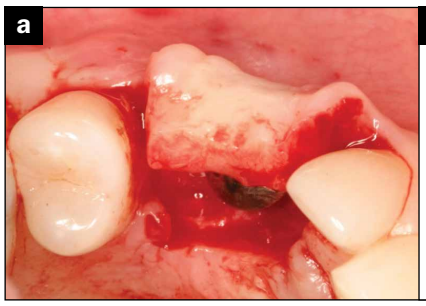

Figure 9a. Occlusal view of second-stage surgical procedure, demonstrating guided gingival growth (GGG). An initial crestal incision bridging the palatal line angles of the teeth adjacent to the dental implant was created. A full-thickness flap was reflected and elevated to the buccal line angles of the adjacent teeth. The implant was exposed, and the cover screw was replaced with a 2.0-mm tall temporary healing abutment.

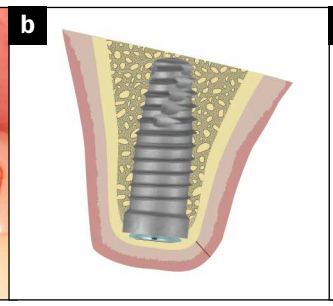

Figure 9b. Diagram of the initial palatal incision. The incision should be made palatal to the platform of the implant. This allows for movement of the occlusal and palatal tissue in a buccal direction.

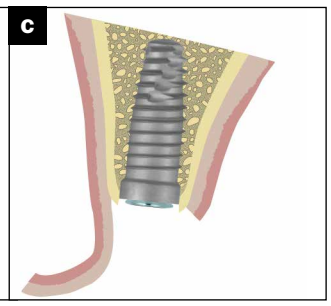

Figure 9c. Diagram of full-thickness flap reflection.

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mucosa. For GGG, use of a 2- or 3-mm tall healing abutment is sufficient, and it is preferable to position the edge of the flap to cover at least half if not all of the THA. This ensures adequate blood supply and curtails exposure of the bone, which could stimulate resorption. Note that GGG is used for minor soft-tissue deficits. Indeed, positioning of the flap edge very close to the labial border of the healing abutment (or beyond apically) may be counterproductive, as this exposes much of the ridge around the palatal and interproximal aspects of the implant, which may lead to hard- and soft-tissue recession around the fixture and the adjacent teeth, especially in the papillary sites.

Positioning of the flap edge very close to the labial border of the healing abutment may be counterproductive....

When utilized as recommended, the amount of buccal augmentation achieved by GGG as seen from the occlusal aspect may be up to 3 to 4 mm, though this may vary based on the height of the THA and existing mucosal thickness. Because there are no vertical incisions made in the technique, the level of keratinized mucosa expansion as seen from the labial view is limited, but may be at least 1.0 mm. The apicocoronal height of soft tissue attained at the time of surgery may simply equal the THA height plus the thickness of the newly positioned mucosa, but the final dimension reached after restoration is

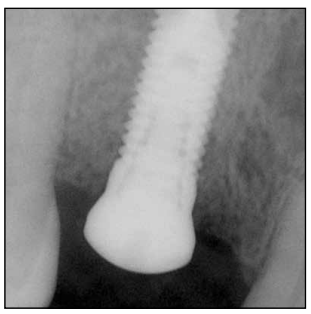

Figure 10. Radiograph of the 2.0 mm temporary healing abutment (THA) immediately after its placement at second-stage surgery. The abutment was beneath the palatal flap.

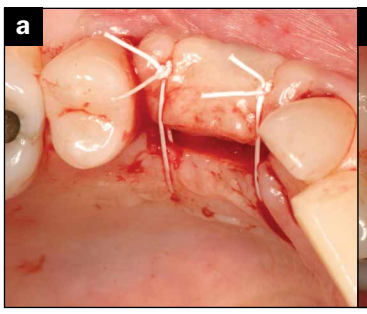

Figure 11a. Two ePTFE sutures were employed to position the flap buccally above the temporary healing abutment. Second intention closure was performed in order to let the gap fill with connective tissue to support the new alignment of the flap.

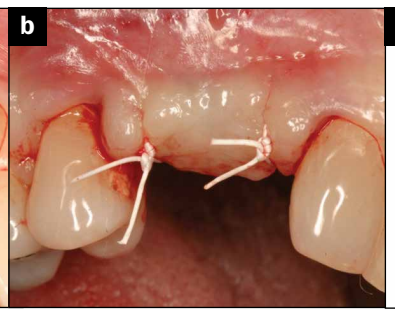

Figure 11b. Buccal view of the flap immediately after suturing. A vertical increase of height was observed immediately.

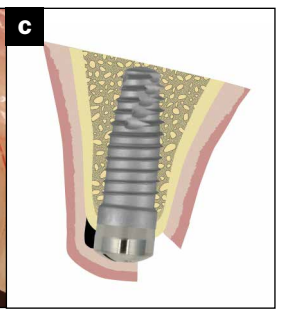

Figure 11c. Diagram of the flap at the time of suturing during GGG. The elevated tissue should be positioned over the THA, which bulks tissue buccally as well as elevates it vertically. The buccally located black space between the flap and the THA is the created dead space that fills with blood immediately following the positioning of the flap. The blood clot is surrounded by bone, the abutment, and the connective tissue from the flap; the site is thus amenable to tissue regeneration.

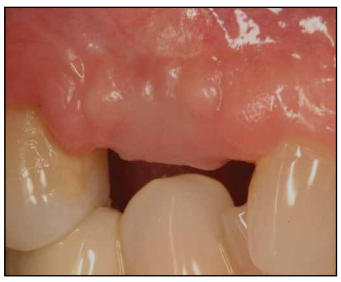

Figure 12. Four weeks following second-stage GGG surgery, a 4.0-mm increase in vertical soft-tissue height was observed. More than adequate gingival soft tissue was achieved.

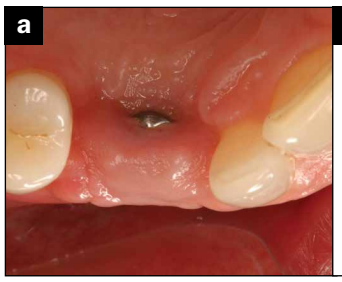

Figure 13a. Occlusal view 4 weeks following second stage surgery. The 2.0 mm THA was almost completely covered with newly formed epithelium and connective tissue. This tissue could have been buccally positioned if there was a requirement for additional soft tissue.

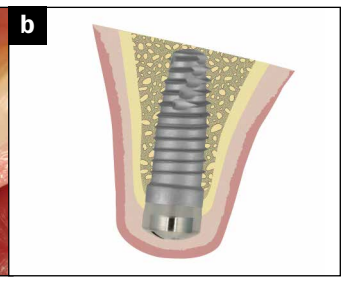

Figure 13b. Diagram of soft-tissue healing at 4 weeks after GGG. The dead space is filled in with newly formed connective tissue.

Table 1. Criteria for Aesthetic Implant Treatment[1-7]

Adequate Bone (minimum dimensions needed)	Adequate Soft Tissue	Reasonable Crown Contact Points*
● Buccal to implant: 2 mm[1] ● Lingual to implant: 1.0 mm ● Between implant and tooth: 3 to 4 mm for papillary support;[2] to at least 1.5 mm to offset natural formation of biologic width ● Between 2 implants: 3 to 4 mm to offset natural formation of biologic width; may want 5 mm to support papilla[3]	● Papillary height and buccal thickness matches surrounding teeth ● Keratinized mucosa (2 mm) on buccal for color match, resistance to inflammation, improved plaque control due to patient comfort[4,5]	● Between implant and tooth: 5 mm or less distance from contact point to crest of bone[6] ● Between implant and implant: 4 mm or less distance from contact point to crest of bone[7] **Note that the distances mentioned in this column are based on averages attained. The patient's natural papilla may be longer or shorter.*

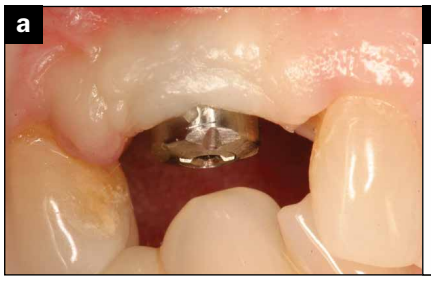

Figure 14a. A 4-mm CAD/CAM THA (Encode [Biomet 3*i*]) was placed on the implant 4 weeks after GGG. The tissue overgrowing the initial abutment was displaced buccally during placement of the longer THA. No incisions were placed. The soft tissue blanched immediately following insertion of the 4.0-mm THA (seen here) but dissipated after 5 minutes.

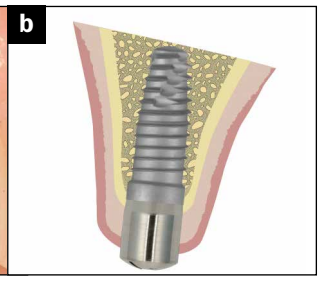

Figure 14b. Diagram of the implant immediately following placement of the longer temporary healing abutment. Compared to **Figure 9b**, there is a 2.0 to 4.0 mm increase in soft-tissue volume.

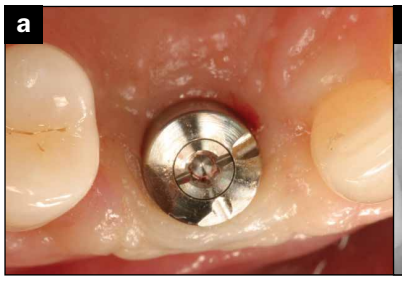

Figure 15a. Occlusal view of the 4-mm tall temporary healing abutment. Implant positioning was ideal. The buccal soft-tissue profile emulated the canine eminence.

Figure 15b. Radiograph of the 4-mm THA at the time of insertion.

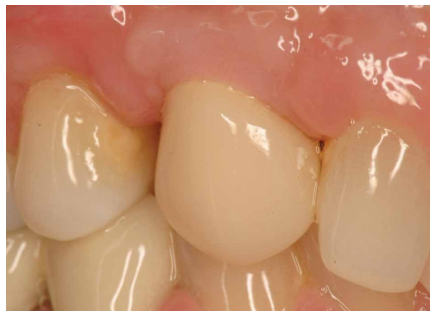

Figure 16. Permanent restoration of implant (No. 6 position) at one year after GGG. A combination of hard- and soft-tissue reconstruction was necessary in order to achieve an acceptably aesthetic outcome. Despite treatment, the final papillary height between tooth No. 5 and implant No. 6 was shorter than that seen in the pretreatment view (**Figure 1a**). (*Final restoration courtesy of Dr. Joseph Worthington, Fairfield, Conn.*)

projected to be less tall, especially at the papillary locations. There, expect one to 2 mm of augmentation from GGG in the end. Ultimately, the inherent patient biotype, implant position, and prosthetic contours influence the efficacy of GGG. The thicker the bone and mucosa are, the more predictable the outcome.

Use of GGG occurs at the second stage (fixture uncovery), but the decision to implement it may be decided upon at implant placement. If bone grafting is required at that time, and/or there is a modest lack of mucosal width (buccal, keratinized) or height present or anticipated after healing, then placement of a fixture cover screw and primary closure of the surgical site is justified. Primary closure permits undisturbed vascularization and regeneration; therefore, a better quality of tissue is available for handling at the second stage. The advantages, indications, minimum prerequisites needed, and adjunct therapies for GGG are found in Table 2. There are several alternate and more surgically complicated methods for modification of the soft tissue at the second stage, including, but not limited to, connective tissue grafting, the modified roll technique, and conventional apically positioned flaps. The long-term impacts of these procedures are questionable based on current scientific evidence. However, comparatively speaking, the connective tissue graft placement appears to be the most effective therapy, but this technique introduces greater patient morbidity.[9,10]

There are several alternate and more complicated methods for modification of the soft tissue at the second stage....

Table 2. Guided Gingival Growth (GGG) Analysis

Advantages	Indications	Minimum Criteria for Use	Adjunct Procedures for Case Idealization
● Performed during second-stage procedure (time-convenient) ● Relatively conservative surgically ● No secondary donor site	● Correct minor deficiency in buccal volume. Amount gained depends on biotype of existing mucosa (the thicker the better). May achieve up to 3 to 4 mm of augmentation based on the height of the temporary healing abutment and existing mucosal thickness. ● Correct minor deficiency in interproximal height of mucosa (papilla space). May expect 1.0 to 2.0 mm of increase in interproximal height after restoration, but 3 mm may be possible in cases of thick mucosa with significant bone support. ● Slight augmentation in keratinized mucosa (up to 2 mm).	● Primary implant stability ● Adequate bone around implant (see Table 1) ● Proper positioning of implant to allow for natural soft-tissue contours (see Table 1)	● Second GGG procedure (or use of other treatment modality) if initial attempt insufficient ● Further guidance of mucosa by prosthetic manipulation of interim crown

IN SUMMARY

GGG is a conservative, efficient, and relatively straightforward treatment for mild soft-tissue deficits. When applied within its limitations, it may be a valuable tool for aesthetic refinement around dental implants.✦

References

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Dr. Sonick, a Diplomate of the International Congress of Oral Implantology, is an internationally known authority in the field of dental implantology and periodontology. He is a frequent guest lecturer in the international program at New York University School of Dentistry and the University of Connecticut School of Dental Medicine. He is the co-editor of the multi-language textbook, *Implant Site Development*, and serves on the editorial boards of numerous journals. He can be reached at mike@sonickdmd.com.

Disclosure: Dr. Sonick reports no disclosures.

Dr. Hwang, after earning her doctorate *cum laude* from the Harvard University School of Dental Medicine, completed her periodontal residency at the University of Michigan at Ann Arbor, which honored her with the Sigurd P. Ramfjord Award for Excellence. The American Academy of Periodontology favored her with a scholarship as well as a nomination for the Dr. and Mrs. Gerald M. Kramer Scholar Award for Excellence. Dr. Hwang maintains an active membership in the American Academy of Periodontology. She practices full-time as an American Board of Periodontology-certified periodontist and implant surgeon in Ann Arbor. A lecturer and peer-reviewed journal author, she is the co-chief editor of *Implant Site Development*, a well-regarded textbook on dental implantology. She can be reached via email at mike@sonickdmd.com.

Disclosure: Dr. Hwang reports no disclosures.