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Implants in the Aesthetic Zone

Clinical Guidelines

INTRODUCTION

The customary statistic to cite for single-tooth dental implant survival in the long-term (5 years and more) is 95%.¹ This figure does not necessarily presuppose factors related to patient satisfaction such as cleansibility, mouth feel (ie, adherence to contours of adjacent natural teeth), confidence in use of the implant, or aesthetics.² For an implant to be functional as well as aesthetically pleasing, 2 criteria must be satisfied: the implant body must be fully encased in bone and well integrated, and the implant prosthesis must be as biomimetically shaped and positioned as possible. Osseointegration relies on the existing bone morphology. If sufficient width or height of bone is not present to ensure initial primary stability, implant placement should be aborted in lieu of ridge augmentation. Minor defects within the envelope of bone that still allow for primary stability of the fixture may be corrected effectively with peri-implant guided bone regeneration.³ Indeed, ample bone lets the surgeon to place the

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implant in the most favorable restorative location, which is itself determined by the aesthetic demand and opposing occlusion; the positional priorities of a molar differ from those of a maxillary incisor.^{4,5} The bony architecture also contributes to the mucosal drape around the implant. A buccolingually wide ridge that has high peaks in the interdental areas buttresses the soft tissue, establishing a cosmetic effect. A single anterior implant, for example, requires at least 2 mm of buccal bone present, as well as minimum distance of 3 mm between it and any adjacent tooth to resist recession and support papilla development respectively.^{6,7} An inherently thick gingival biotype further supplements an organic appearance and helps to combat recession, thus masking the implant body and prosthetic margins.⁸ Various methods to enhance soft tissue may be employed at any step during the implant process; however, these therapies, tend to generate somewhat unpredictable results, and in the end, mucosal form is probably most contingent upon that of the bone.^{9,10} Lastly, the curves of the restoration, especially its emergence profile from the implant platform, may guide the shape of the soft-tissue profile.^{11,12} For this reason, the authors recommend a 3-month period of provisionalization prior to proceeding with the final restoration during which the dentist can reshape at will the interim crown to sculpt the peri-implant mucosa.¹³ The clinical case described herein involved aesthetic replacement of a failing maxillary central incisor with an implant using a carefully considered process based on the principles outlined above.

Table. Conservative Treatment Algorithm for Aesthetic Implant Placement

1. Extraction and socket preservation
 2. Minimum 3-month healing period (depending on size of the bony defect)
 3. Implant placement and additional ridge augmentation as needed
 4. Minimum 3-month healing period
 5. Implant uncovering and guided gingival growth therapy
 6. One-month healing period
 7. Temporization with screw-retained restoration
 8. Minimum 3-month healing period during which interim prosthesis may be modified
 9. Final restoration
- Total treatment time: minimum 10 months**



Figure 1. Initial periapical radiograph showing the hopelessly fractured root (tooth No. 8). To stabilize the severely mobile coronal portion of No. 8, a lingual wire splint was bonded onto the maxillary anterior teeth by the restorative dentist.

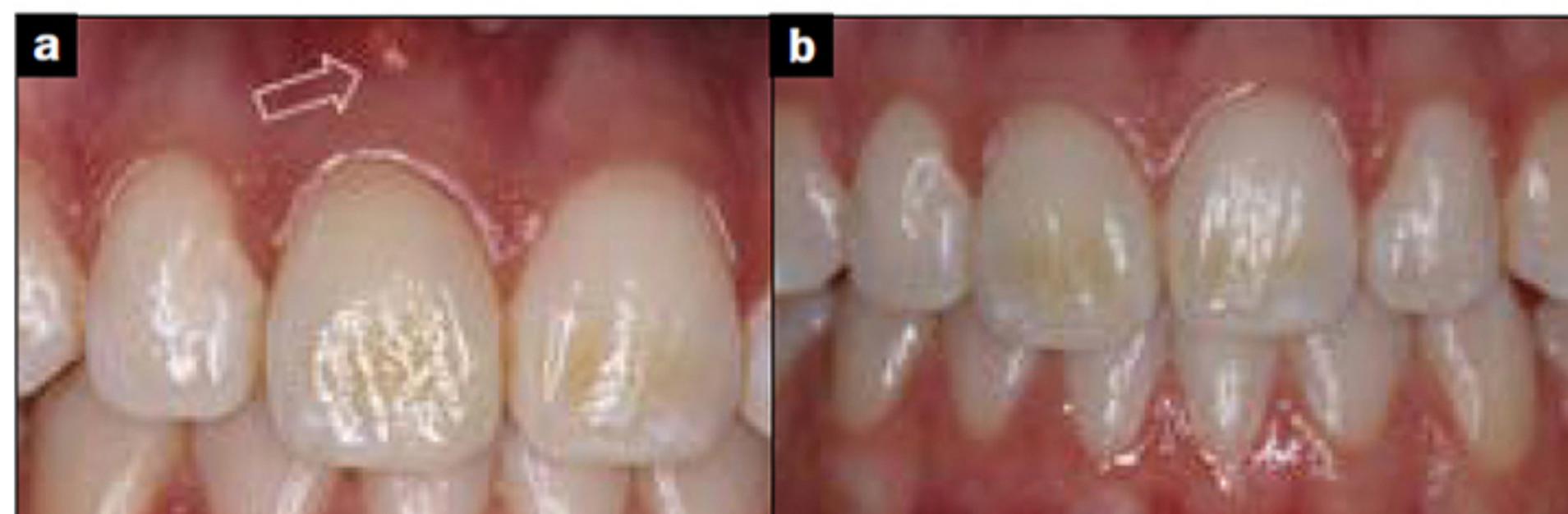


Figure 2a. A buccal fistula was seen upon initial clinical presentation (white arrow).

Figure 2b. The patient possessed a thin and highly scalloped gingival biotype.



Figure 3. The normal smile-line of the patient clearly displayed marginal contours of No. 8 and adjacent papilla.

CASE REPORT

Diagnosis and Treatment Planning

A medically stable 20-year-old female presented with her maxillary right central incisor (tooth No. 8) completely hori-



Figure 4a. The fractured coronal portion of No. 8 was analyzed after its extraction.



Figure 4b. The total loss of buccal plate due to trauma to and subsequent infection of No. 8 was obvious at the time of extraction.



Figure 5. Socket preservation with mineralized bone allograft (Puros Cortical Particulate Allograft [Zimmer Biomet]) was performed to restore the lost buccal plate and extraction defect.



Figure 6. An absorbable membrane (OsseoGuard [Zimmer Biomet]) was placed on top of the allograft to aid in guided bone regeneration.



Figure 7. The extraction and socket preservation of site No. 8 was sutured. Primary closure of the vertical release was obtained; secondary intention healing was planned for the coronal aspect of No. 8.



Figure 8. The grafted extraction site healed well after 4 months. The papilla appeared intact and crestal tissue seemed coronally oriented.

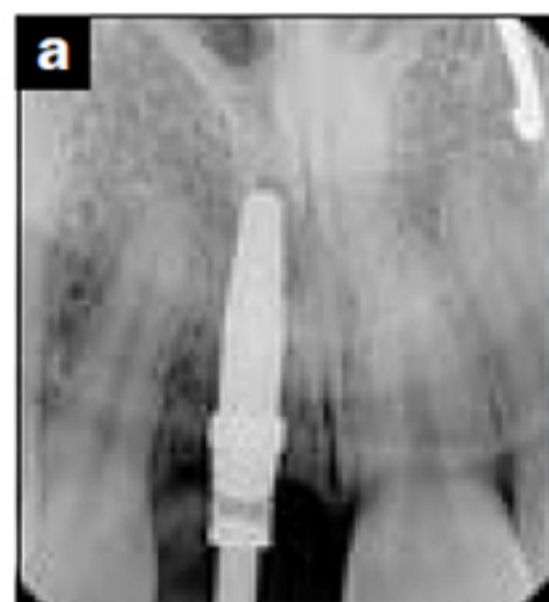


Figure 9a. The osteotomy site was prepared. There was adequate apico-coronal height and mesio-distal width of bone. The bony crests at the adjacent teeth remained undisturbed.



Figure 9b. The newly formed labial plate entirely covered the implant body.

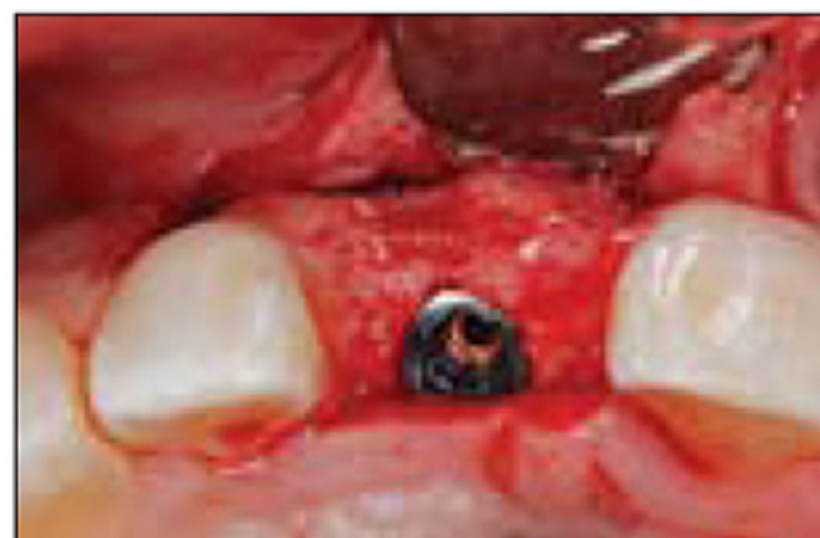


Figure 10. Looking from an occlusal direction, the buccal bone overlying the implant appeared somewhat thinner and uneven in areas.



Figure 11. Autogenous bone collected during osteotomy preparation was placed over the buccal aspect to bulk up the ridge. An absorbable membrane was subsequently situated over the graft (not shown).



Figure 12. Suturing achieved complete primary closure over the implant and graft site.



Figure 13. The site appeared well-healed after 3 months with relatively intact papillae and coronally positioned crestal mucosa.



Figure 14a. Exposure of the implant was performed, and a healing abutment with an initial height of 4.0 mm was placed (Encode [Zimmer Biomet]).



Figure 14b. The 4.0-mm tall healing abutment was replaced with a 2.0-mm tall one (EP [Zimmer Biomet]) in order to accomplish guided gingival growth and further coronally augment the mucosa.



Figure 14c. Periapical radiograph of the No. 8 implant and 4.0-mm tall healing abutment depicted satisfactory bone fill and fixture positioning.

zonally fractured at mid-root following endodontic treatment (Figure 1). A fistula was present on the buccal gingiva of No. 8 (Figure 2a). No. 8 was deemed to be hopeless. The mucosal biotype was classified as thin with a highly scalloped contour, and the marginal bone was predicted to be very thin (Figure 2b). The average thickness of the labial bone overlying a maxillary central incisor hovers around or slightly less than 1.0 mm.¹⁴ In patients with a thin and aggressively scalloped biotype, the buccal plate may be even narrower.^{15,16} Considering that it was fractured and infected, the maxillary incisor in this case presumably had a loss of the labial ridge. In order to

take advantage of and preserve the blood supply/healing capacity of the patient, a predictable, conservative treatment algorithm using atraumatic techniques, early-stage grafting, sufficient healing periods, and meticulous provisionalization shaping was followed (Table). For a young patient with a normal smile-line that displayed peripheral contours of the teeth, the maintenance of the soft-tissue profile including papilla around the dentition and future implant was essential and warranted use of established approach (Figure 3). An expedited tactic involving flapless surgery, immediate implantation, and immediate temporization was a tempting alternative, but based on

There was obvious severe buccal plate resorption due to the fracture and subsequent infection.

available evidence, aesthetic success in the long term (more than about 2 years) was judged to more consistent using staged treatment.¹⁷⁻¹⁹

Clinical Protocol

Tooth No. 8 was extracted as atraumatically as possible after elevating a labial full-thickness flap with a single vertical release made at the distal of tooth No. 7 (avoiding an incision bisecting the papilla or directly over root surface) to access the site com-

pletely. There was obvious severe buccal plate resorption due to the fracture and subsequent infection (Figure 4). Socket preservation with mineralized bone material (Puros Cortical Particulate Allograft [Zimmer Biomet]) and an overlying absorbable membrane (OsseoGuard [Zimmer Biomet]) was performed to regenerate the ridge and maintain the height of bone to the interproximal level of the adjacent teeth (Figures 5

continued on page 94

Implants in the Aesthetic Zone...

continued from page 92

and 6). Care was taken to avoid coronal overfill and dense packing of the bone graft material to facilitate vascular infiltration into the socket; the socket was filled to roughly 75% to 80% of its height. A resorbable collagen plug (CollaPlug [Zimmer Biomet]) was used to cover the bone graft, and the extraction site was sutured with 4-0 expanded polytetrafluoroethylene (ePTFE) (GORE-TEX [Gore]) to achieve secondary intention healing (Figure 7). The vertical incision was primarily closed with 5-0 plain gut suture with a C-6 needle (Ethicon [Johnson & Johnson]). An interim removable partial denture was delivered to the patient and adjusted to relieve any pressure at the surgical site. The site healed for 4 months (Figure 8). The soft-tissue profile at 4 months was well-contoured and amenable to an aesthetic outcome (coronally oriented). Papillae were present, and no detectable labial soft-tissue recession was noted.

Implant placement proceeded without complication. A full-thickness flap was created with one vertical release made at the distal of tooth No. 7 to permit visualization. Socket preservation created suitable bone for straightforward and optimal placement of a 4.0-mm diameter x 11.5-mm long implant (Osseotite Tapered Certain [Zimmer Biomet]): 3.0 mm mesio-distally from the implant platform to each adjacent tooth, less than 3.0 mm apico-coronally from the platform to the cemento-enamel junctions of the adjacent teeth, and in the buccolingual dimension, slightly palatal positioning of the implant shoulder to the point of emergence of adjacent teeth (approximately 1.0 to 1.5 mm to the lingual) to accommodate a screw-retained provisional restoration (Figures 9 and 10).⁴ Primary stability was attained, and there were no dehiscences or fenestrations; in some areas, however, the ridge labial to the implant body appeared thin or uneven. To create a thick, uniform buccal plate, autogenous bone harvested via low-speed drilling at 75 rpm without water during osteotomy preparation was placed on the bone labial to the implant, and a resorbable membrane (OsseoGuard) was laid over the graft material (Figure 11).²⁰ Primary closure was achieved with a 4-0 ePTFE suture over the crest and 5-0 plain gut

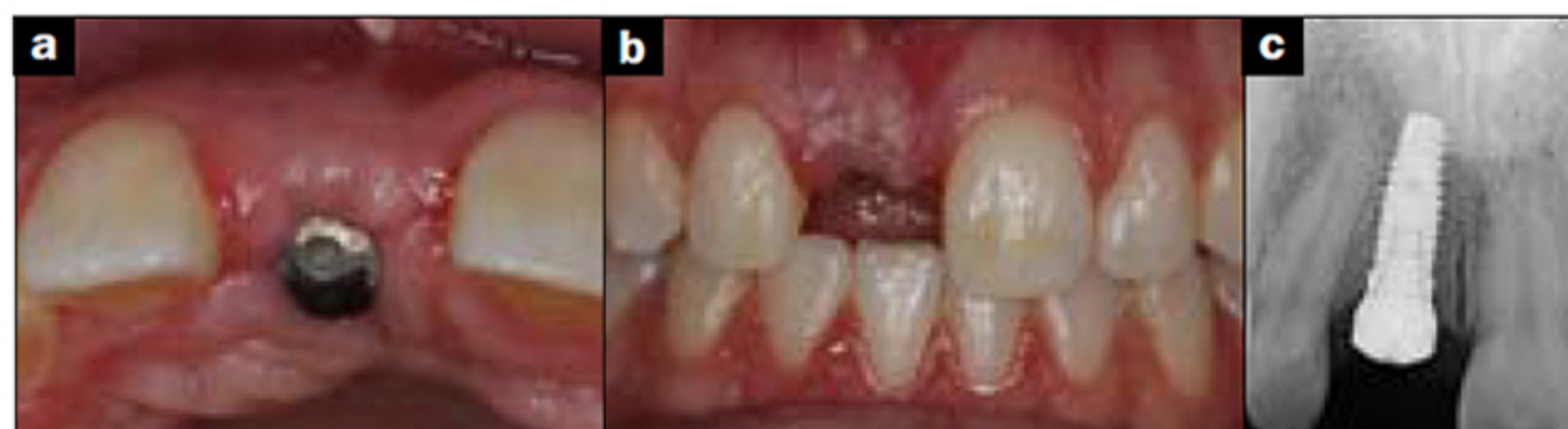


Figure 15a. Three weeks after uncovering of the implant, soft tissue approximated and even edged over the 2.0-mm-tall healing abutment.

Figure 15b. Facial view of the guided gingival growth in progress.

Figure 15c. The periapical radiograph taken 3 weeks after implant exposure demonstrated stable peri-implant and proximal bone.

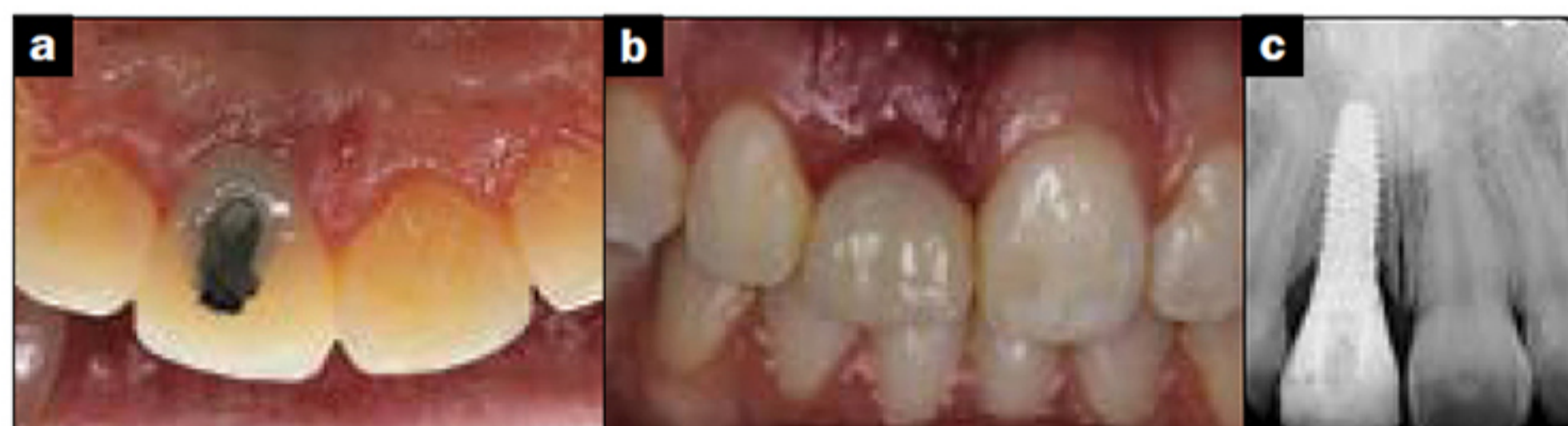


Figure 16a. Provisionalization of implant 3 months after exposure. The screw access hole of the interim prosthesis (PreFormance temporary cylinder [Zimmer Biomet]) aesthetically located on the lingual due to the ideal location of the implant shoulder.

Figure 16b. The mucosal margin around the temporary crown was positioned too coronally compared to that of its natural neighbors at the time of initial delivery due to the success of soft-tissue augmentation procedures.

Figure 16c. Periapical radiograph taken at the time of interim prosthesis delivery revealed satisfactory bone levels and positioning.



Figure 17. Addition of acrylic at the submarginal mid-buccal aspect of the temporary at the time of delivery was performed to spur apical migration of the marginal mucosa.



Figure 18. Three weeks after delivery of a purposefully reshaped interim prosthesis, the marginal tissue of implant No. 8 appeared to align better with that of the adjacent teeth.



Figure 19. The final crown (IPS e.max [Ivoclar Vivadent]) was delivered after 3 months of provisionalization. The prosthesis and mucosal drape around implant No. 8 blended well with the rest of the dentition.



Figure 20. Closer inspection of the No. 8 lithium disilicate crown (e.max) and soft-tissue contour revealed an appearance virtually indistinguishable from the natural teeth.

suture at the vertical incision (Figure 12). Healing occurred during the next 3 months and favorable tissue contours were realized (Figure 13).

Further refinement of soft-tissue contours was performed at the implant uncovering stage. A connecting

incision was made from palatal line angle to palatal line angle of adjacent teeth Nos. 7 and 9. A 4-mm tall, 5-mm wide CAD/CAM healing abutment (Encode [Zimmer Biomet]) was first secured, but the decision was made to let the mucosa granulate over a shorter

healing abutment to augment the volume of soft tissue via the guided gingival growth concept (Figure 14).²¹ Accordingly, the 4.0-mm tall healing abutment was replaced with a 2.0-mm tall, 5.0-mm wide one (EP [Zimmer Biomet]). Three weeks following second-stage surgery, the soft tissue appeared to have grown over the healing abutment (Figure 15).

The patient was referred back to her restorative dentist for a screw-retained, prefabricated interim abutment and crown (PreFormance temporary cylinder [Zimmer Biomet]), which would avoid iatrogenic cement-related pathology, and through dentist-driven shaping of the prosthetic contours, guide the formation of papilla and perfect the buccal silhouette as the soft tissue matured (Figure 16a). In fact, preservation and augmentation procedures during the surgical phase generated a markedly thick mucosa biotype and a coronally located soft-tissue drape around the implant, at least at the

Acrylic was added to the submarginal buccal aspect of the interim prosthesis....

mid-buccal position (Figures 16b and 16c). To maneuver the marginal tissue so that it coordinated with the curves of the natural teeth, acrylic was added to the submarginal buccal aspect of the interim prosthesis at the time of delivery (Figure 17). This convex protrusion on the provisional crown caused the soft tissue to migrate apically, and after 3 weeks, greater synchronization of the implant mucosa with the adjacent dentition was noticed (Figure 18). Subgingival acrylic was added 4 to 6 weeks after initial exposure to promote more apical movement of tissue. Further maturation of the soft tissue continued for 3 months post-second-stage surgery, after which the final impression was taken.

After 3 months of provisionalization, the patient received the final screw-retained lithium disilicate implant crown (IPS e.max [Ivoclar Vivadent]) (daVinci Dental Studios, West Hills, Calif) (Figure 19). The final restoration and mucosal morphology blended harmoniously with the natural dental and periodontal anatomy. The patient was highly satisfied with

the masticatory and visual result of the maxillary central incisor.

CLOSING COMMENTS

Proper form and function are mandates for every dental implant planned but are distinctively hard to manage in the most conspicuous cases (eg, maxillary anterior region, normal to high lip-line, thin biotype, scalloped gingival contours, young patient). Stepwise, gradual treatment that enables tissue enhancement at each interventional phase as well as allows for unrushed healing periods is not the fastest course of therapy but may grant the most opportunities for aesthetic revision, thus rendering the outcome more foreseeable. ♦

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