Implants

as a **Contingency Plan for Restorative Failures**

Development of Gingival Architecture Around an Implant Using a Screw-Retained Provisional

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Abstract

Even when dentists execute proven principles and use contemporary techniques optimally, the oral environment, cyclic loading, and thermal cycling cause materials or structures to fail.[1] Implant dentistry enables dentists to limit the extent of their restorations and plan for one-tooth or fixed partial dentures of just three or four units, limiting the extent of replacing failures in contingency plans.

To illustrate this, the following article presents a case involving the failure of a single central tooth in a patient with a high smile line; moderate gingival display; and a thin, high scalloped biotype.[2,3] The case also demonstrates that pink esthetics are just as important as white, and that gingival health and architecture are critical to making restorations "transparent."

While grooming soft tissue is not essential to achieving gingival esthetics,[4] the technique simplifies fabricating the definitive restoration for the technician by eliminating the question of gingival architecture. The purpose of this case study is to demonstrate a technique to groom the soft tissue around an implant by developing the gingival architecture with the emergence profile of a screw-retained provisional as previously described in the literature.[5]

Key Words: screw-retained provisional, temporary abutment, subgingival contours, emergence profile, laboratory communication

Introduction

As an overview of the screw-retained provisional technique, the Fürhauser pink esthetic score defines the soft tissue goals for this phase in fabricating the provisional.[6] The restorative dentist utilizes a screw-retained provisional as a soft tissue management tool to groom the gingival tissue, and to develop the emergence profile and gingival architecture. The technique involves developing subgingival contours with the provisional to mimic the root of the tooth. The shape of the root portion of the implant-supported restoration supports the soft tissue and helps to create the scalloped height and form. While the papillary height is primarily achieved by interproximal bone levels on adjacent teeth,[7] the provisional assists with papillary form and tip height. The cylindrical shape of the soft tissue with the healing abutment in place is compressed and molded into the scalloped shape found around a tooth with the emergence profile of the provisional. Once the provisional is fabricated, the tissue is compressed by screwing the provisional temporary abutment down to the fixture abutment junction of the implant.

Case Report

Patient History

The patient, a 52-year-old Caucasian female, was first seen in April 1998 because she was unhappy with the appearance of her all-ceramic crowns (the restorations had been placed in 1989). The treatment plan in 1998 involved the replacement of the restorations due to deteriorating luting resin that had become discolored at the margins due to poor marginal integrity **(Fig 1)**. The crowns were sectioned and the preparations were refined to create proper space for movement of light through more modern ceramic material to replicate the optical effects of natural teeth.[8] A horizontal fracture line was evident due to discoloration at the margin level of tooth #9 **(Fig 2)**. The previous root canal in #9 was retreated by an endodontist prior to impression making for the definitive restorations. A direct orange hue composite was placed on the axial wall of the preparation to neutralize the dark area at the margin so that all-ceramic restorations could be utilized without opaquers. Opaquers in restorations drive down the value of the underlying tooth structure. The all-ceramic definitive restorations were bonded in 1999 using a three-step total-etch technique, and the patient accepted the esthetic outcome **(Fig 3)**.

Figure 1: Original all-ceramic restorations were placed in 1989. Restorations were failing in 1998 due to excessive marginal gap and degradation of composite resin cement.

Figure 2: Horizontal fracture of #9 led to discoloration that was masked with an orange-colored composite resin. Eventually, this tooth developed a necrotic pulp and underwent root canal therapy, apicoectomy, and extraction.

Figure 3: Replacement of definitive all-ceramic restorations in 1999.

Diagnosis

In 2006, the patient had an abscess of the root canal treatment associated with #9 that discolored the mucosa. An oral surgeon performed an apicoectomy that created scar tissue in the mucosa. In 2010, the patient developed a 12-mm probing depth in an isolated area on the palatal side of #9. The tooth was diagnosed as fractured. Due to a very thin and dehisced buccal plate of bone, extraction with bone grafting of the socket utilizing mineralized freeze-dried bone (MinerOss, BioHorizons; Birmingham, AL) and a membrane (Biomend Extend, Zimmer Dental; Carlsbad, CA) was performed by an oral surgeon. A transitional treatment partial was fabricated for esthetics during healing of the dento-alveolar bone. Because the patient had a thin biotype of tissue, an immediate implant was ruled out to allow for multiple grafts, if needed. The ridge was allowed to heal for six months prior to implant placement **(Fig 4)**.

Treatment Plan

A surgical guide was fabricated from a cast of the diagnostic wax-up, and a second cast of the edentulous ridge was made after the extraction and bone graft healed. The decision was made not to utilize cone beam computed tomography (CBCT), based upon the previous bone graft, the location of the implant, and lack of critical structures in the area of the surgical site. The proposed implant site was placed ideally on the cast in all four critical dimensions: facial-palatal,[9] mesial-distal,[10] vertical depth,[11-14] and rotational timing by the restorative dentist. During surgery, the surgical guide only was partially utilized for implant positioning in the mesial-distal and vertical depth dimensions **(Figs 5 & 6)**. The surgeon had to decide, at the time of surgery, the rotational timing. In addition, the surgeon altered facial angulation from the surgical guide at the time of surgery due to available bone. The change in facial angulation during surgery makes a case for computer-guided[15] implant planning even for more routine cases as described in this case study. The change in facial angulation causes the access hole to pass through the facial of the provisional. The surgeon was asked to place the access hole—either palatal or facial—to the incisal edge, but not through the incisal edge, to simplify masking the access hole during the provisional phase. The surgeon placed a 3.8 x 12.0 mm endosseous tapered titanium implant with Laser-Lok, resorbable blast texturing, and an internal connection (Tapered Internal TLR3812, BioHorizons, Birmingham, AL). The surgeon also placed a 3.5 x 3.0 mm healing abutment (PYRHA3, BioHorizons) at the time of surgery. After three months of implant healing and a healing abutment in place, the process was initiated to fabricate a provisional on the implant.

Figure 4: Post extraction of #9 after failed endodontics and periapical surgery. Bone grafting was performed to rebuild the dento-alveolar ridge.

Figure 5: Implant placement to manage implant biologic width after the bone graft healed in three months.

Figure 6: A 3-mm tall healing abutment with periodontal probe indicating approximate correct vertical depth of the fixture abutment junction 2 to 3 mm apical to the anticipated facial free gingival margin.

Fabricating a Screw-Retained Provisional

The healing cap must be removed and either an impression of the implant position needs to be fabricated, or the temporary abutment can be placed intraorally directly on the implant. In this case, we chose to fabricate the provisional on the cast. A maxillary cast of #9 was fabricated from an impression of the implant utilizing an open tray, hexed impression coping (PYNDC, BioHorizons), and an implant analog (PYIA, BioHorizons). The desired emergence profile was carved around the implant site. An opposing cast also was fabricated to verify the occlusal contacts. A diagnostic wax-up was made of the definitive contour of the proposed restoration, and a silicone index (Sil-Tech, Ivoclar Vivadent; Amherst, NY) of the tooth contour was fabricated and adapted in a pressure pot at 2.5 bars of pressure. The silicone index was filled with Bis-GMA provisional composite resin (Telio C S C&B, Ivoclar Vivadent) to make a shell **(Fig 7)**. The shell was contoured to fill the edentulous space by removing excess material, giving consideration to incisal edge position, mesial-distal contacts, and overall length of the tooth to mimic the contralateral tooth; and to develop the correct intrinsic proportion and occlusion **(Figs 8 & 9)**. The shell also was hollowed out to enable it to fit over a hexed provisional abutment: a 3-in-One abutment, a hexed titanium temporary abutment or a PEEK temporary abutment (PYRTA, BioHorizons).

Temporary Abutment

The temporary abutment should be selected based upon the needs of the case. Metal abutments are better if the provisional is going to be in the mouth for an extended period of time or if the provisional will be utilized as the impression coping to transfer the emergence profile. The plastic temporary coping creates a more esthetic provisional as there is no metal to mask with opaquers.

The temporary abutment selected was secured on an implant analog (PYIA) on the cast or intraorally **(Fig 10)**. The provisional abutment was prepared like a tooth to fit within the confines of the definitive contour of the shell. Then the shell was fitted over the temporary abutment to make sure it could fit in its proper orientation and that occlusion was unimpeded by the temporary abutment **(Fig 11)**. The axis hole of the temporary abutment was filled with gutta percha, which was used not only to prevent blocking the access hole with composite but also because of its orange color, which makes it easy to find the axis hole when drilling through the shell after bonding the

Figure 7: Silicone index of the proposed restoration's definitive contour filled with Bis-GMA composite provisional material.

Figure 8: Gross removal of excess provisional shell material with an acrylic bur.

Figure 9: Refining the shell contour and free gingival margins to establish intrinsic proportion with a soft-flex disc.

shell to the abutment in the following step **(Fig 12)**. It is also easy to remove the gutta percha from the axis hole with a hot endodontic instrument that is cooled intraorally with water, allowing the gutta percha to be pulled out quickly. This enables the restorative dentist to unscrew the provisional easily, and screw it back into position later when making alterations to the provisional.

The shell that is within the proper dimensions for the tooth is fused to the temporary abutment by filling it with unfilled resin and a hybrid composite resin (Heliobond & Tetric EvoCeram, Ivoclar Vivadent) in order to position it in the proper orientation and cure it into place **(Fig 13)**. Once the provisional shell is cured to the temporary cylinder, it has to be removed from the mouth or cast to develop the root shape of the provisional that ultimately grooms the soft tissue. A round carbide bur is used to cut through the shell and the hybrid composite to locate the screw access hole, as previously described.

As the composite material is removed, the orange color of the gutta percha serves as a target to locate the access hole **(Fig 14)**. The gutta percha also prevents composite from filling the screw access hole. The gutta percha is removed by placing an endodontic hot instrument into it. The dental assistant then cools it rapidly with water. The gutta percha is lifted out of the access hole **(Fig 15)** to allow a driver to be placed into the screw head and the provisional removed. The provisional comes off the cast or out of the patient's mouth, and can either be placed on an implant analog or on a special handle designed for various manufacturers' implant systems. The subgingival contour of the provisional remains unfinished and has many voids **(Fig 16)**. The root form of the provisional needs to be developed with a flowable composite (Tetric EvoFlow), and gives proper soft tissue support to mimic the root of a tooth **(Figs 17-19)**. Then, the provisional can be placed intraorally to compress and blanch the soft tissue, essentially pushing it into the shape for the proper emergence profile for the tooth. The soft tissue is like a wet sponge that is compressed to alter its form and push the fluid to other spaces. The provisional is used as a matrix to shape the tissue during healing similar to creating ovate pontic sites.[16] Here we are aiming for similar gingival heights of the soft tissue, similar scalloped form, and papillary type height, compared with the contralateral tooth.

Evaluation, Modification, and Definitive Bonding

After approximately a month of soft tissue grooming, the provisional may be removed and the tissue evaluated **(Figs 20 & 21)**. If the goals of developing soft

Figure 10: Hollow grinding provisional shell to fit over abutment.

Figure 11: Gutta percha in access hole of provisional abutment adjusted for incisal/occlusal reduction on cast carved with ideal emergence profile. The technique may be performed intraorally without pre-carving the tissue.

Figure 12: Passive fit of provisional shell over prepared abutment for intrinsic proportion, occlusion, interproximal contacts, incisal position, and free gingival margin.

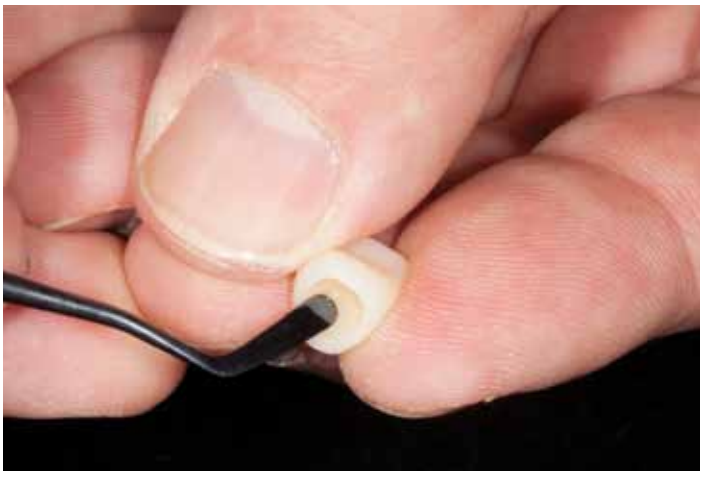

Figure 13: Hybrid resin Bis-GMA composite placed in the provisional shell prior to seating on provisional abutment and curing into position.

Figure 14: Gutta percha in the access hole creates an orange "target" through the provisional shell when searching for the access hole with a 2-mm endodontic shank-length round bur, when fabricating the screw-retained provisional.

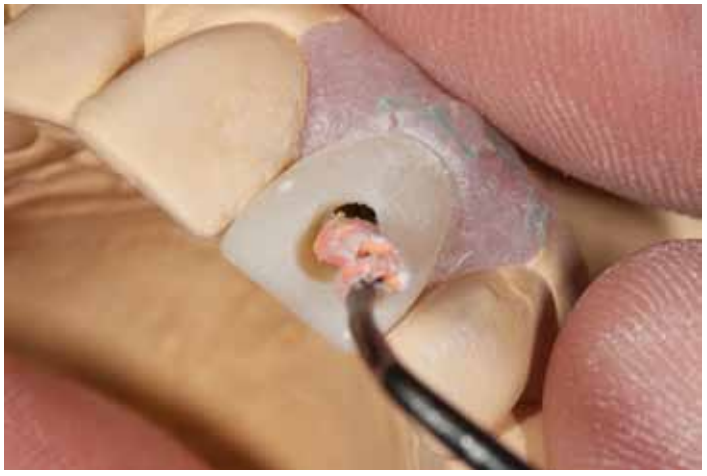

Figure 15: Gutta percha is easily removed by using an endodontic hot instrument pushed into the gutta percha and rapidly cooled with water.

Figure 16: Screw-retained provisional removed from the cast or intraorally to reveal lack of emergence profile when seated on an implant analog or handle. In the mouth, the contour deficiency has collapsed tissue in the area bounded by the free gingival margin of the provisional shell apical to the fixture abutment junction.

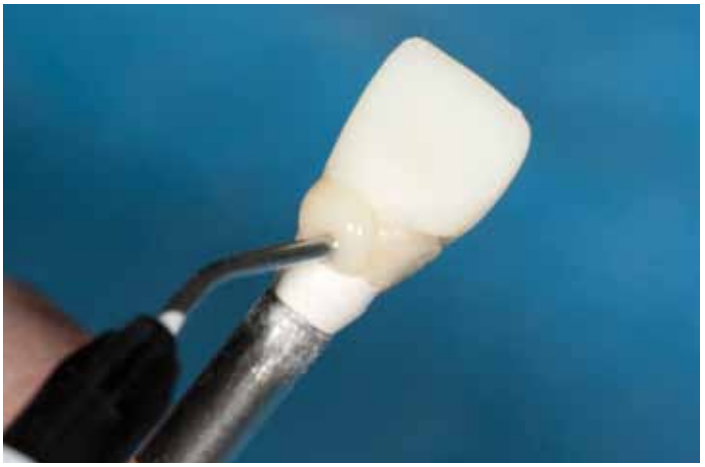

Figure 17: Flowable composite developing subgingival emergence profile to groom, support, and shape soft tissue.

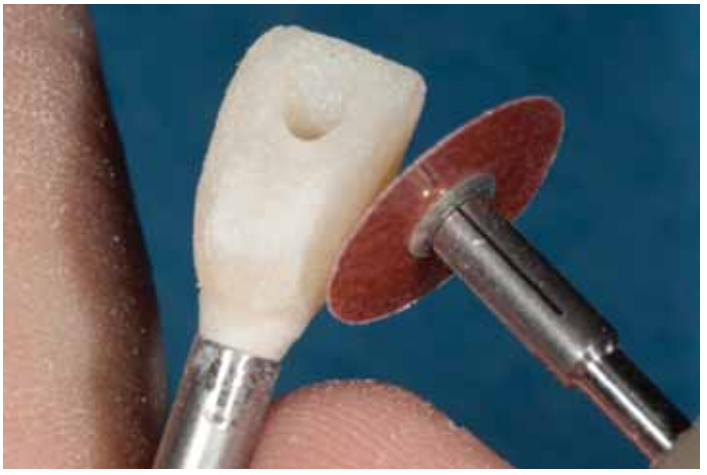

Figure 18: Definitive emergence profile contoured after curing flowable composite resin.

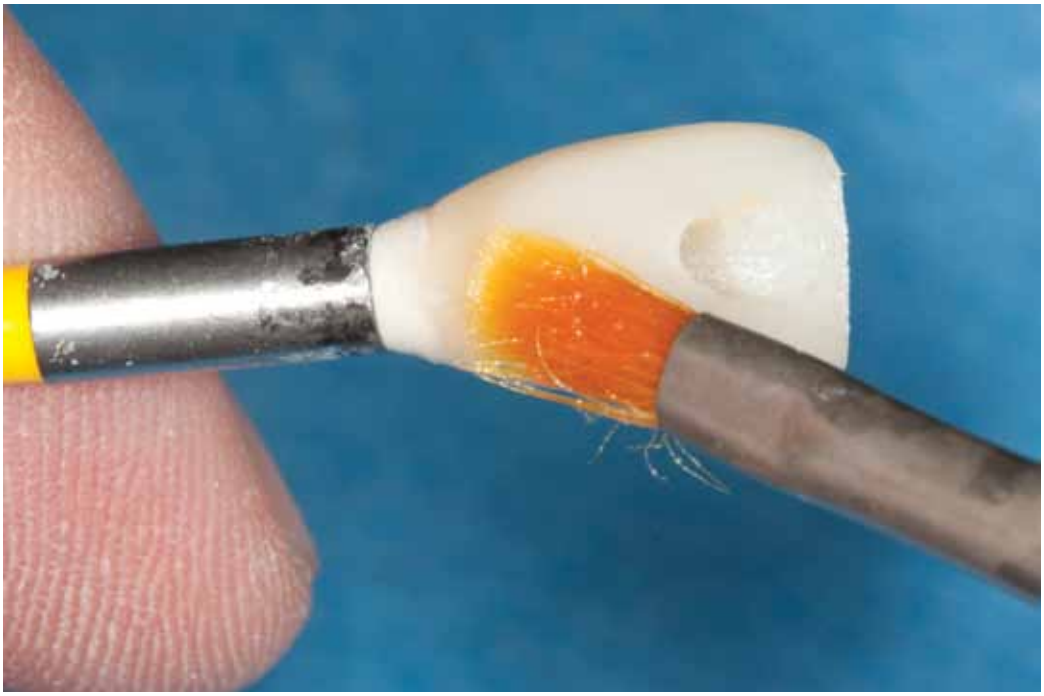

Figure 19: Unfilled resin painted on the surface and polished with a dry rag wheel to remove the oxygen-inhibited layer.

Figure 20: Screw-retained provisional utilized to displace soft tissue into desired emergence profile. Screw tightening may need to be done in increments to allow gingival tissue displacement and seat the provisional abutment. A metal or radiopaque abutment allows verification of complete seating with a radiograph. The shaping of soft tissue is possible only with screw-retained provisional restorations.

Figure 21: Free gingival margin and papillae developed after one month of soft tissue grooming with symmetry to contralateral #8. Free gingival margins/papillae that are apical to the contralateral tooth reduce support of soft tissue by reducing the facial/interproximal emergence profile. Conversely, free gingival margins/papillae that are coronal to the contralateral tooth increase support of soft tissue by increasing the facial/interproximal emergence profile.

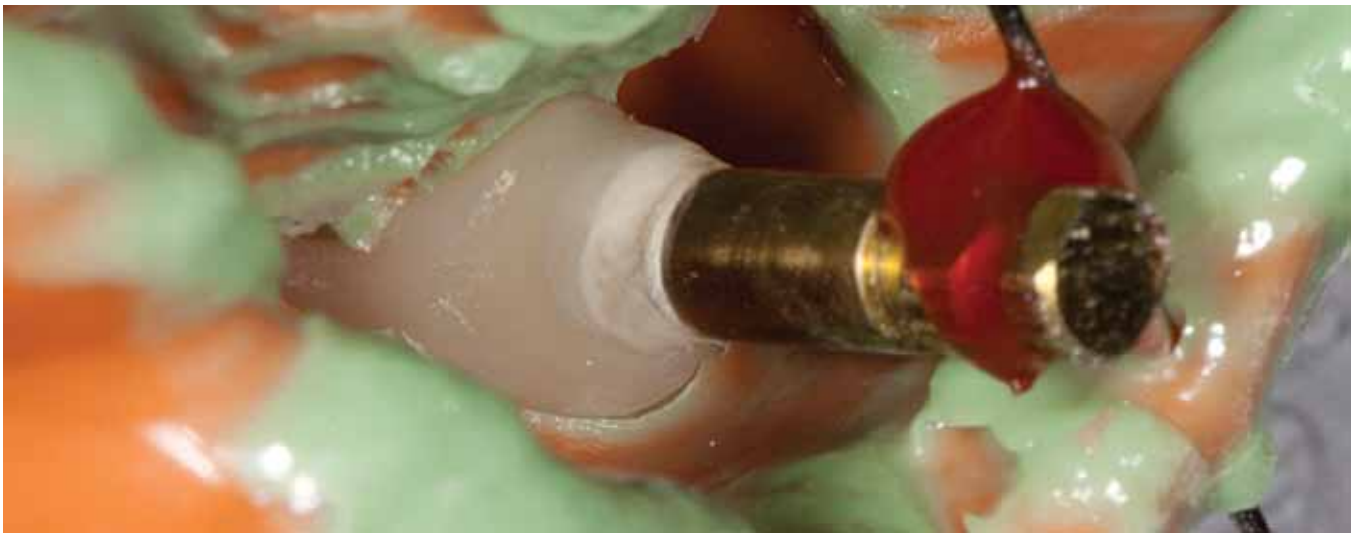

Figure 22: Emergence profile communicated to the laboratory technician by fabricating an impression of the provisional and seating provisional coated with a thin layer of petroleum jelly into the impression, secured, and poured up. An alternative technique with a custom impression coping is used if the dentist does not want to pour up the cast.

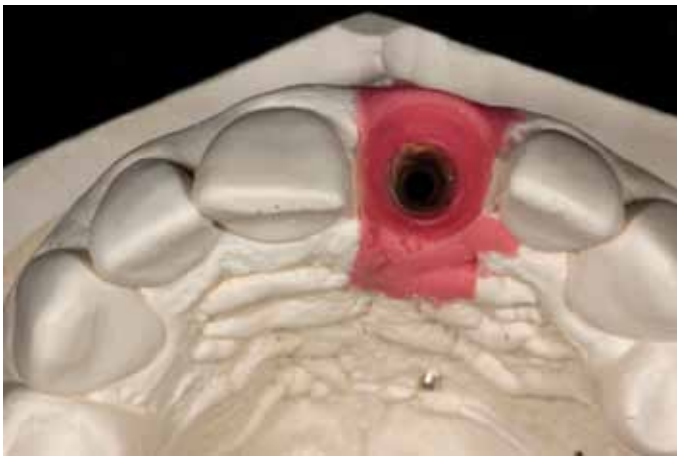

Figure 23: Cast of soft tissue emergence profile supported by the provisional or custom impression coping communicates exact support of soft tissue to replicate free gingival margin height and contour as well as papillary height.

Figure 24: Definitive restoration on cast after cast was altered with a soft tissue mask of the final soft tissue contour.

Figure 25: Custom zirconia abutment fabricated by CAD-CAM and tightened with a torque driver to the appropriate Ncm to prevent screw backout from embedment relaxation.

Figure 26: Radiograph demonstrating biologic width with bone maintained to fixture abutment junction, complete seating of abutment and crown. Excess cement must be controlled around the implant to maintain implant and soft tissue health.

Figure 27: Definitive implant restoration of #9 with acceptable esthetics by executing currently accepted biologic principles.

tissue have been reached, the provisional can be used as an impression coping or a custom impression coping may be fabricated intraorally, or by duplicating the contour of the provisional. In this case, we chose to use the provisional as the impression coping. Then, an impression was made with the provisional in place intraorally. The provisional was removed from the patient's mouth and an implant analog was screwed into the provisional. The provisional was painted with a thin layer of petroleum jelly and placed back into the impression. The implant analog was secured using an orthodontic wire and acrylic resin **(Fig 22)**. The impression was poured up with stone **(Fig 23)**. After that, the provisional was removed from the cast and placed back into the patient's mouth. The dental laboratory modified the cast to include a soft tissue mask **(Fig 24)**. A zirconia custom abutment (Aadva Zr Abutment, GC America; Alsip, IL) was fabricated to follow the same gingival contours developed in the provisional restoration and transferred to the laboratory via the above technique **(Fig 25)**. The definitive all-ceramic lithium disilicate restoration (e.max, Ivoclar Vivadent) was fabricated and tried in the patient intraorally to verify esthetics and function. The definitive restoration was bonded definitively over the screw-retained abutment with a translucent dual-cure composite resin luting cement (Variolink II, Ivoclar Vivadent) and cured. Special care was taken to prevent excess luting cement from getting around the implant **(Figs 26 & 27)**.

Summary

This case study illustrates the reality of restorative failures in a restorative dental practice. Implants play an important role in contingency plans for failed dentistry in limiting the extent of the dentistry that has to be replaced. This article has outlined a technique to manage the soft tissue to allow for ideal function and esthetics.

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