6.7 Early Implant Placement, Contour Augmentation, and Autologous Connective-Tissue Graft Using a Tunneling Technique to Replace an Upper Incisor with Generalized Gingival Recession

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Variations in soft-tissue volume, evidenced either by an overabundance (Evian and coworkers 1993; Levine and McGuire1997; Dolt and Robbins 1997) or by a deficiency of soft or hard tissue can complicate implant-supported rehabilitations in the esthetic zone (Lorenzana 2008; Lorenzana and coworkers 2009). The present case illustrates the replacement of a failing upper left lateral incisor complicated by generalized severe gingival recession in the esthetic zone.

Presenting complaint

A healthy 66-year-old woman was referred for a consultation to evaluate the replacement of tooth 22 with an implant-supported restoration. The patient reported a history of previous endodontic treatment on tooth 22 and multiple class V composite restorations provided to address gingival recessions throughout the anterior sextant. The tooth had recently fractured and was deemed non-restorable by her restorative dentist (Dr. Jason Gillespie), who had temporarily bonded tooth 22 to the adjacent teeth to immobilize the fractured segment. The patient was subsequently referred for evaluation for an implant-supported restoration at site 22 and treatment of multiple gingival recessions on the maxillary and mandibular anterior teeth. A review of her anamnesis yielded a history of breast cancer and controlled hypertension, with no known drug allergies.

The patient presented with excellent oral hygiene (full-mouth plaque score under 10%), and the full-mouth probing chart did not reveal any pockets deeper than 4 mm.

Analysis of her smile revealed a medium, symmetrical smile line, with only the interdental papillae visible at full smile. In addition, mild crowding was evident, with tooth 21 slightly overlapping tooth 11. The patient expressed no interest in orthodontic therapy. Tooth 22 was discolored and slightly displaced following its fracture (Fig 1).

Fig 1 Medium lip line when smiling, exposing the papillae throughout the anterior sextant. Upper lip obscuring the gingival margins of the central incisors.

The anterior retracted view revealed a thin gingival phenotype with triangular-shaped teeth and elongated papillae (Fig 2). Discoloration of tooth 22 was evident, together with a thin band of attached gingiva bordering the multiple gingival recessions affecting teeth 13 to 23. Teeth 13, 22, and 23 had class V bonded composite restorations, where the recessions measured from 3 to 5 mm across the maxillary and mandibular sextants.

A focused view of tooth 22 more clearly illustrated the lack of soft tissue on the buccal aspect and the continued retraction of the gingival margin past the margin of the class V restoration (Fig 3). Such an observation indicates ongoing recession. In an intact dentition, this situation should be treated by augmenting the gingival volume and addressing the factors contributing to the progression of the recession, including occlusal trauma, destructive hygiene habits, or inadequate restorative interventions.

The initial periapical radiograph of tooth 22 revealed a silver-point endodontic restoration within a long root and a clearly visible fracture line. In addition, the root of tooth 22 was not centered within the proposed implant site, being instead close to tooth 12. Finally, a distal curve at the apical end of the root was visible, indicating a potentially complicated extraction (Fig 4).

The patient was referred for a preoperative cone-beam computed tomography (CBCT) that demonstrated an adequate base of bone apical and palatal to the root apex to allow engagement of the native alveolar bone by the implant following the extraction of the tooth (Fig 5). However, the buccal bone plate was not visible until approximately midway down the root, corroborating the advanced gingival recession observed clinically. Finally, the CBCT indicated possible internal root resorption of tooth 22.

Fig 2 Retracted view. Thin gingival phenotype with generalized maxillary and mandibular gingival recessions.

Fig 3 Focused view. Fractured tooth 22 showing discoloration of the tooth, 4.5 mm of recession and a class V composite restoration.

Fig 4 Periapical radiograph. Fracture extent and previous endodontic treatment with a silver-point filling and apical root curvature.

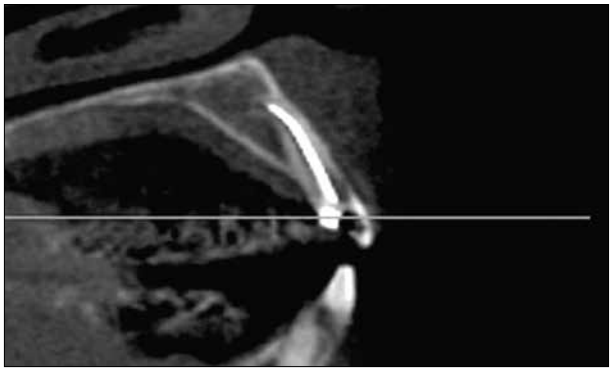

Fig 5 CBCT image. Adequate bone available apically to secure the fixture but with 50% buccal bone loss.

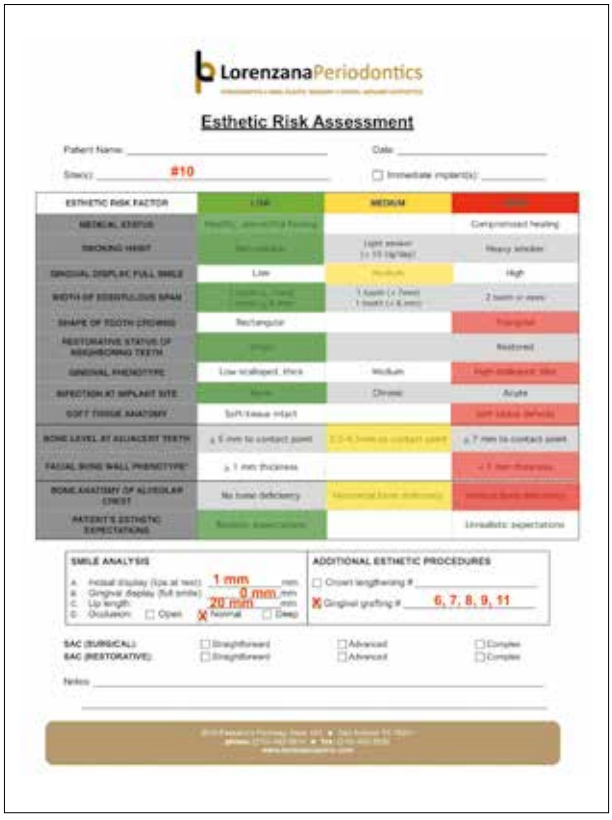

Fig 6 Esthetic Risk Assessment, Smile Analysis and SAC form in use at the author's private practice.

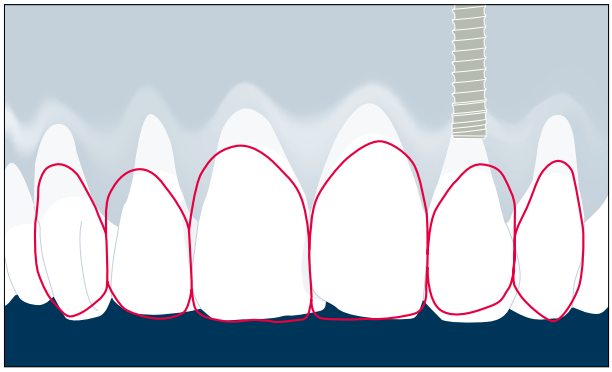

Fig 7 Crown dimension outlines. Desired outcome following treatment. Implant shoulder was positioned 3 to 3.5 mm apical to the desired gingival margin.

A complete risk assessment was performed using a customized Esthetic Risk Assessment form. This form incorporates the recently updated Esthetic Risk Assessment table (Martin and coworkers 2017) as well as a brief smile analysis, the expected additional esthetic procedures that could impact the implant position or the overall esthetic outcome, and, finally, assignment of the appropriate SAC level (Fig 6). Upon completion, this form was shared with the patient and the restorative team.

Multiple elevated risk factors were identified, including triangular-shaped teeth, a thin phenotype, soft tissue defects, a facial bone wall phenotype of less than 1 mm thickness, and a vertical bone deficiency along the buccal aspect due to the gingival recession. A medium lip line and expected horizontal extraction defect contributed to the medium risk factors. Gingival grafting of teeth 13, 12, 11, 21, and 23 was expected. Finally, the patient was assigned complex surgical and advanced restorative SAC classifications.

Fig 7 illustrates the desired treatment outcome by outlining the ideal gingival margin positions of teeth 13 to 23. By establishing the goal of a more ideal, coronally positioned augmented gingival margin, the desired three-dimensional implant position 3 to 3.5 mm apical to the desired new gingival margin can then be determined.

Treatment options

Several treatment options were considered to create the desired result, including:

1. Extraction of tooth 22 with ridge preservation site 22, plus simultaneous autologous connective-tissue grafting of adjacent sites 13 – 23
2. Extraction of tooth 22 with collagen plug placement, healing for 6 to 8 weeks, followed by early (Type 2) implant placement, GBR and autologous or allogeneic connective-tissue grafting of the adjacent sites 13 – 23
3. Orthodontic extrusion of tooth 22, followed by immediate implant placement, GBR and autologous or allogeneic connective-tissue grafting
4. Extraction of tooth 22 with ridge preservation, simultaneous autologous connective-tissue grafting of the adjacent dentition 13 – 23, and fabrication of a fixed partial denture or Maryland bridge

While all four options are reasonable, Option 3 could be immediately discarded, since the patient had stated at the initial visit that orthodontic treatment was not an option for her. Of the remaining possibilities, Option 2 was chosen because it could be completed within a shorter time frame.

Tooth 22 was removed using minimally traumatic techniques to preserve the soft tissue and surrounding alveolar bone (Fig 8). Briefly, a powered periotome (Powertome 100S, Westport Medical), was utilized to separate the tooth from the alveolus, then the tooth was delivered with traditional forceps. Following atraumatic extraction of the tooth, a collagen plug was placed within the socket and secured with a 5-0 chromic gut suture (Ethicon, Somerville, NJ, USA). No incisions and no tissue trauma or displacement were present following extraction. The root was sectioned from tooth 22 and the crown was bonded to the adjacent teeth as a provisional restoration during the healing phase.

Six weeks after the extraction, the soft tissues at site 22 were completely healed and healthy, with most of the previously observed recession defect resolved. The patient was at this point deemed ready to proceed with implant placement, GBR, and soft-tissue augmentation (Fig 9).

The bonded provisional restoration was removed to expose site 22 prior to surgery (Fig 10). The tissues were confirmed to be healthy, with a significant gain in volume that would allow for primary closure after the surgical procedure.

Fig 8 Tooth 22 removed with collagen plug in place.

Fig 9 Healing of site 22 with bonded provisional in place at four months.

Fig 10 Site 22 prior to surgery. Complete epithelialization of site 22 at four months, ready for implant placement and GBR.

Fig 11 Soft tissue harvested from the tuberosity region distal to tooth 17.

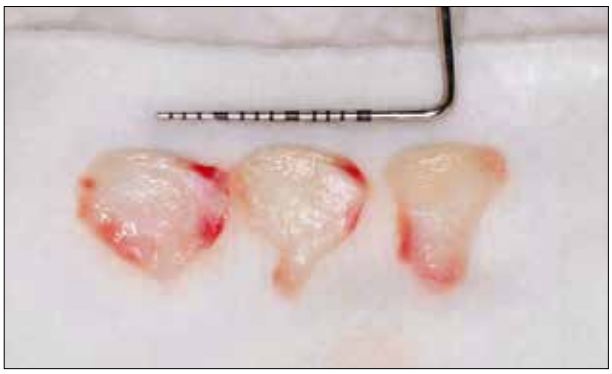

Fig 12 Tuberosity graft sectioned into three 1- to 1.5-mm sections.

Fig 13 Additional soft tissue was harvested from the palate. All of the harvested soft tissue is shown.

Figures 11 and 12 show the tissue harvested from the tuberosity distal to tooth 27 followed by careful sectioning of the tissue to create ideal tissue-graft thickness of 1 to 1.5 mm.

Additional tissue was obtained from the left palatal vault through a single-incision technique (Lorenzana and Allen 2000). The total tissue harvested is shown in Fig 13.

Following reflection of a full-thickness flap, an implant (Bone Level Narrow CrossFit, diameter 3.3 mm, length 14 mm; Institut Straumann AG, Basel, Switzerland) was placed in the correct three-dimensional position as planned, with the implant shoulder positioned 3 mm away from the gingival margin (Figs 14 and 15).

Fig 14 The selected implant in the corrected three-dimensional position before GBR and soft-tissue grafting.

Fig 15 Occlusal view of implant 22 placed within the alveolar envelope, on the palatal aspect of the alveolar socket.

Specialized tunneling instruments were employed to elevate the tissue (Allen End-Cutting Intrasulcular Knife, Allen Periosteal Elevator Anterior, and Allen Arrowhead Knife; Hu-Friedy, Chicago, IL, USA), creating a tunnel-bed preparation from tooth 13 to 21 (Fig 16). A periodontal probe was used to verify the continuity of the tunnel preparation.

The larger connective-tissue graft was carefully guided into the tunnel and secured with circumferential 5-0 chromic gut sutures over teeth 13 to 21 (Fig 17). Additional soft tissue was secured over tooth 23 in a similar manner. GBR was then performed over implant 22 in the manner reported by Buser and coworkers (2008), with autologous bone chips placed over the implant followed by xenograft derived from deproteinized bovine bone mineral (Bio-Oss; Geistlich, Wolhusen, Switzerland). Finally, a dual layer of non-crosslinked collagen membrane (Bio-Gide; Geistlich) was applied over the bone grafts.

Flap closure was accomplished with 6-0 monofilament nylon suture (Ethilon; Ethicon) applied as sling sutures over the soft-tissue grafting sites, and horizontal mattress and interrupted sutures over the GBR site (Fig 18). With the extra soft tissue created following removal of tooth 22 during the early healing phase, tension-free primary closure was more easily achieved.

The postoperative radiograph confirmed the ideal position of the dental implant, away from the adjacent roots and any vital structures (Fig 19).

The two-week follow-up photograph illustrates uneventful healing, with complete root coverage already evident at the soft-tissue grafting sites (Fig 20). A bonded provisional restoration was once more employed during the healing phase.

Fig 16 Completed tunnel preparation. Continuity verified with a periodontal probe within the tunnel.

Fig 17 Completed GBR procedures. Soft-tissue grafts in place.

Fig 18 Completed closure of the surgical site.

Fig 19 Radiograph taken immediately at the end of the procedure, confirming the implant position.

Fig 20 Two-week postoperative situation. Excellent healing and adaptation of the soft tissues.

Fig 21 Four-month situation. Tissue maturation prior to uncovering.

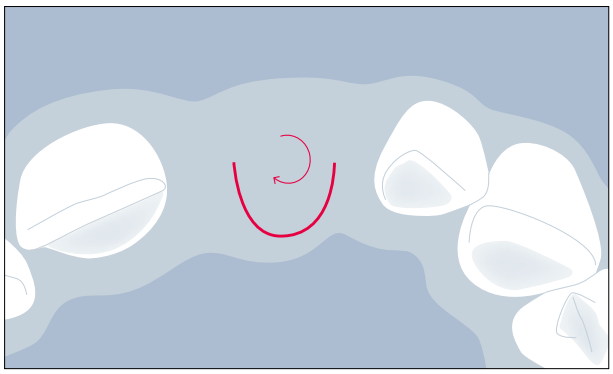

Fig 22 Incision design for uncovering.

Fig 23 Tissue directly over the implant, de-epithelialized and with the incision completed.

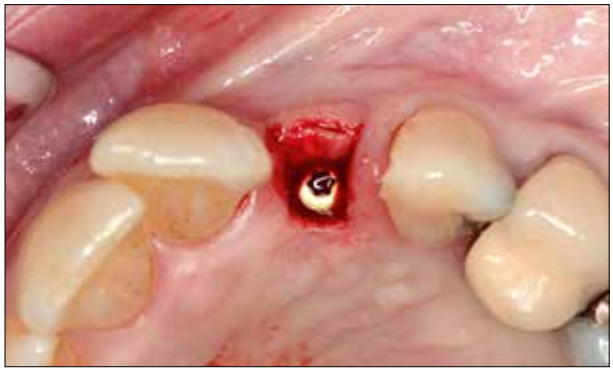

Fig 24 Tissue pedicle rotated buccally, exposing the cover screw.

At four months, the soft tissues had matured and the implant was ready for uncovering (Fig 21). Although an adequate band of keratinized mucosa was already present, uncovering of the implant provides an additional opportunity to create additional soft-tissue volume on the buccal aspect of the implant in preparation for provisionalization and tissue shaping.

A U-shaped incision design was used over the implant to create a pedicle of soft tissue that can be displaced facially (Barone and coworkers 1999; Mühlemann and coworkers 2012). This pedicle graft was then displaced facially into a shallow pouch that was then secured with a healing cap and sutures (Fig 22).

The occlusal view of the implant site illustrates the need for additional buccal soft-tissue volume (Fig 23). First, the U-shaped incision was made and the overlying tissue de-epithelialized using a fine No. 8 diamond round bur (Brasseler, Savannah, GA, USA).

The tissue was elevated with an Orban knife, exposing the healing abutment (diameter 3.6 mm, height 2 mm) (Fig 24). The tissue was carefully tucked into the buccal aspect with a tunneling instrument (Allen Periosteal Elevator Anterior; Hu-Friedy).

The original healing cap was replaced with another healing abutment (diameter 4.8 mm, height 5 mm) to help position the rotated pedicle flap (Fig 25). Additional 5-0 chromic gut sutures were applied to further secure the area.

Fig 25 Uncovering completed with a larger healing abutment in place and sutures to secure the flap.

A provisional restoration was fabricated and delivered to initiate shaping of the peri-implant tissues (Fig 26). A follow-up radiograph was also taken at this time to verify stable bone levels around the implant (Fig 27).

A digital impression was taken. A customized zirconia abutment was designed and fabricated using CARES (Straumann). The abutment was torqued to 35 Ncm (Fig 28).

A custom stained and glazed lithium disilicate crown was fabricated and cemented using a radiopaque luting agent (IPS e.max; Ivoclar Vivadent, Schaan, Liechtenstein; and MaxCem; Kerr Dental, Orange, USA). Figure 29 shows the final restoration on the day of delivery.

The photograph taken at the three-year follow-up demonstrated stable, symmetric tissue contours, with gingival margins free of inflammation or other complications (Fig 30).

Fig 26 Provisional restoration in place.

Fig 27 Follow-up radiograph with provisional in place documenting healing of the fixture.

Fig 28 The customized CARES abutment in situ.

Fig 29 Final restoration after cementation.

Fig 30 Retracted anterior view at three years. Well-maintained soft-tissue profile.

Fig 31 Radiograph at three years. Well-maintained bone levels.

Fig 32 Full smile three years after delivery. Stable and pleasing esthetic result.

The three-year periapical radiograph documented that the emergence profile of the final restoration was in harmony with the bone profile at the implant site and continued stable bone levels were evident along the entire length of the implant, especially around the implant shoulder (Fig 31).

The patient's smile at the three-year follow-up visit clearly illustrated her satisfaction with the esthetic result (Fig 32).

Patients often present with multiple issues impacting the perceived lack of esthetics in any given partially edentulous situation. In the case presented, severe gingival recessions throughout the anterior sextant complicated the esthetic replacement of the failed tooth 22. The attachment loss at the implant site and the adjacent dentition created challenges in how to achieve the ideal three-dimensional position of the implant itself, and furthermore how to sequence the implant and soft tissue reconstructive procedures. Utilizing a type 2 delayed immediate implant placement approach facilitated the simplification of the implant/reconstructive procedure by allowing soft-tissue regrowth over site 22 prior to performing the implant placement and relevant reconstructive procedures.

Literature reviews and meta-analyses continue to confirm the subepithelial connective-tissue graft as the "gold standard" in terms of the area (Wennström 1996; Oates and coworkers 2003; Chambrone and Tatakis 2015) and long-term stability of root coverage (Hofmänner and coworkers 2012). Multiple approaches to connective-tissue grafting have been documented and examined in the literature. Tunneling of the recipient site was chosen in this case to benefit from several clinical advantages, such as the elimination of horizontal and vertical incisions, thereby conserving the blood supply to the interdental papillae, leading to faster healing, reduced scarring, better esthetics, and less post-operative discomfort (Allen A 1994; Mahn 2001; Allen E 2010).

Regardless of the treatment approach chosen for root coverage, awareness of the availability of such treatments and how to apply them can prove an invaluable asset in the complex rehabilitation of partially edentulous patients requiring dental implant treatment in the esthetic zone.