Immediate Reconstruction of Failed Implants in the Esthetic Zone Using a Flapless Technique and Autogenous Composite Tuberosity Graft

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We describe a technique for immediate reconstruction of bone after removal of failed dental implants in the esthetic region to optimize the esthetic outcome of retreatment. We conducted a study of 16 consecutive patients in whom the bony defect resulting from implant removal was immediately reconstructed with a combined autogenous bone and soft tissue graft harvested from the maxillary tuberosity. After a healing period of 3 months, implants were inserted. At 1 year after placement of the definitive restoration, no implants had been lost, the peri-implant tissues were healthy, the aesthetics scored with the pink esthetic score were favorable, and the patients were satisfied. With this technique, it appears that immediate reconstruction of the hard and soft tissue components with a combined bone-soft tissue graft after removal of an implant is a feasible treatment option, from the perspective of both patients and professionals. It expedites rehabilitation, reduces morbidity, and results in a favorable esthetic outcome.

Single-tooth implant placement in the esthetic zone is a highly reliable treatment option for replacing failing teeth.1 Despite the high implant survival rates in the short, medium, and long-term, some implants will fail and require replacement.2 Other circumstances can also compromise the dental implant outcome. For example, poor positioning in the esthetic region will make it very difficult or even impossible to achieve a satisfactory esthetic outcome of the fixed denture prosthesis.3 If such an implant requires removal, the condition of the remaining bone and soft tissue will often be severely compromised. Thus, obtaining a satisfactory esthetic result becomes even more challenging.

To prepare the site of a failing implant, preimplant surgery consisting of local ridge augmentation has been commonly performed to enable replacement of the implant. Immediate reconstruction after removal of failing implants has often been challenging owing to the size of the defect that results from implant removal. To optimize the conditions for implant placement in the esthetic zone, immediate reconstruction of these defects with a composite tuberosity graft might be favorable.4,5 Such an approach would
shorten the treatment period and reduce morbidity, because a separate bone augmentation surgery would not be necessary. In this technical note, we describe a method to immediately reconstruct a site with failing implants in the esthetic zone. We also describe the outcomes of a study using this technique in 16 consecutive patients.

**Technical Note**

A cone beam computed tomography (CBCT) scan was made to assess the peri-implant bone volume in the area with the failing implant (Fig 1). In addition, a provisional removable partial denture with an ovate pontic shape was fabricated. Clasp retainers were added to prevent deleterious apicocoronal movement of the provisional restoration.

At 1 day preoperatively, the patients started prophylactic antibiotic therapy (amoxicillin 500 mg, 3 times daily for 7 days, or clindamycin 300 mg, 4 times daily, in the case of amoxicillin allergy). Oral disinfection consisted of a 0.2% chlorhexidine mouthwash, 2 times daily for 7 days. With the patient under local anesthesia (articaine with epinephrine), the implant crown was removed, and the sulcus around the implant was incised. Next, the failing implant was removed using the least traumatic method possible, without flap reflection and using an implant-retrieval device (Implant Removal Kit; Biomet 3i, Palm Beach Gardens, FL; Fig 2). If the implants were already mobile, they were removed with forceps. Maximum effort was taken to preserve the integrity of the remaining bone wall. Immediately after removal of the implant, the bony defect was carefully cleansed using a curette and sterile gauze to remove any remaining granulation tissue. Next, the bony walls were probed in the apicocoronal and mesiodistal directions to assess the degree of bone loss and confirm the anatomic shape of the defect using a bone sounding technique with a periodontal probe. A remaining crestal width after removal of the implant of less than 3 mm in the horizontal direction indicated that not enough bone remained at the palatal site to allow for immediate implant placement with adequate primary stability. In such cases, reconstruction was required.

After this assessment, the inner site of the bony defect was exposed using a round bur to create a bleeding bone surface and open the cancellous bone. A combined bone-soft tissue graft was then harvested from the maxillary tuberosity. An incision was made on the buccal side of the top of the ridge in the maxillary tuberosity region. Adjacent to the area with the incision, the combined bone-soft tissue graft was harvested with a trephine burr (diameter 4.6 mm; Figs 3, 4). Next, a mucoperiosteal flap was raised in the tuberosity region to harvest additional bone particles. The wound was closed in primary fashion with Vicryl 4-0 (Ethicon, Johnson & Johnson, Amersfoort, The Netherlands). The thickness of the mucosa on top of the graft was 3 to 4 mm (Fig 4). To reconstruct the area from which the implant had been removed, the additionally harvested bone particles were placed into the socket after the combined bone-soft tissue graft has been carefully inserted into the socket (Fig 5). This sequence of procedures aimed at widening of the future implant site and preserving the vascularization. Fixation of the bone-soft tissue graft was ensured by suturing the firm soft tissue layer on top of the graft with Ethilon 4-0 (Johnson & Johnson) to the labial and palatal gingiva.

Finally, a removable partial denture was placed immediately after reconstruction of the region from which the implant had been removed. The patients were instructed not to brush the surgical site but to rinse it gently with a 0.12% (wt/vol) chlorhexidine di gluconate mouthwash twice a day. They were advised to avoid any activities that might compromise the site. The sutures were removed after 1 week.

After 3 months, a pedicled mucoperiosteal flap was raised to expose the alveolar ridge, after which the implant was placed in accordance with the requirements of the manufacturer using a surgical template. The template design was based on a restoration-driven approach with indications for correct 3-dimensional implant placement in its ideal position. If buccal fenestrations occurred, these were covered with autogenous bone harvested with a bone scraper in the area adjacent to the implant and an organic bovine bone (Geistlich Bio-Oss; Geistlich Pharma AG, Wolhusen, Switzerland). The bovine bone was placed as a layer over the bone graft and covered with a membrane (Geistlich Bio-Gide; Geistlich Pharma AG).

During the healing phase, the patients wore a removable partial denture that did not interfere with the wound. The implants were uncovered after 3 months. Next, a screw-retained provisional restoration with an adequate emergence profile was fabricated and placed to guide and shape the peri-implant tissue before definitive restoration. All patients were given detailed oral hygiene instructions with an emphasis on how to clean the peri-implant region. The provisional restoration was replaced by the final all-ceramic restoration after ~3 months.

**Results**

The technique was evaluated in 16 consecutive patients (6 men and 10 women; mean age 31.7 ± 4 years, range 19 to 53) with a failing implant in the esthetic zone. In all cases, the CBCT scan revealed extensive bone resorption on the labial side of the implant that had exceeded one half of the implant length. Bone
sounding revealed that all patients had an extensive osseous defect of the buccal bone wall side, ranging from 6 to 10 mm from the top of the mucosa. No complications were observed during the surgical procedure, and wound healing was uneventful.

At implant placement, 3 months after reconstructing the area from which the implant had been removed, sufficient bone was available in all cases to insert the implants with adequate initial stability (>45 N/cm) and appropriate length (≥10 mm). In 15 of 16 patients, at least 2 mm of buccal bone was available labial from the implant. In the remaining patient, a small dehiscence of the implant had occurred on the buccal site (2 to 3 mm) of the implant. In accordance with the protocol, this dehiscence was covered with autologous bone and an organic bovine bone.

At the 1-year evaluation of placement of the definitive restoration, no implants had been lost (Fig 6).
The peri-implant soft tissues were healthy, and no pockets deeper than 3 mm were present on the approximal, buccal, and palatal sides. The mean mesial and distal bone resorption at 1 year after placement of the definitive crown was $0.21 \pm 0.11$ and $0.23 \pm 0.13$ mm, respectively. No marginal bone loss exceeding 1 mm was observed at the mesial or distal aspects of any of the implants. The esthetic pretreatment and 12-month pink esthetic score (PES) was significantly greater than the pretreatment PES (Table 1), indicating a favorable result. All patients were satisfied with the results and reported a mean satisfaction score of $8.3 \pm 0.3$ on a 10-point scale.

**Discussion**

Immediate reconstruction of the soft tissues and bone in the area of a removed implant was associated with favorable implant retreatment outcomes, with no implant loss, good peri-implant health, and satisfactory esthetics.

In the published data, the survival rates after reimplantation at sites in which implants had previously failed were lower than those involving placement of implants in bone in which the implants had not been.
failed. The standard approach to remove failing implants often requires invasive surgery, which compromises the soft tissues and damages the surrounding bone. Thus, preimplant surgery is needed to allow for reliable implant replacement. These conditions are often accompanied by rather high morbidity, increased treatment costs, delayed prosthesis delivery, and objections from patients regarding the proposed treatment plan. Using the presented technique, the morbidity and costs can be reduced and treatment time shortened, with a very favorable treatment outcome.

When replacement of implants is indicated, the first implants must be removed with as little trauma as possible. Traumatic maneuvers should be minimized, and the soft tissue should be spared. Removal of implants using a high torque wrench where possible appears to be the most elegant technique with the greatest predictability for insertion of another implant.

The PESs reported in the present study were lower than those from other studies with implants placed in noncompromised areas. Belser et al described a mean PES of 7.8 ± 0.88 after a follow-up of 2 to 4 years after early, single-implant placement. Slagter et al reported a mean PES of 7.5 ± 1.59 at 1 year after immediate implant placement and provisionalization. In our case series, the PES before treatment was rather low owing to the patients’ compromised oral condition; thus, it could be expected that the PESs after retreatment would be slightly lower than those reported in the previously cited studies. Although the level of the buccal bone and buccal gingiva improved, the proposed method is not suitable for regaining the height of already compromised mesial or distal papilla. The shape of the mesial and distal papilla is directed by the height of the proximal bone level of the adjacent teeth.

Stabilization of a bone graft in a localized buccal wall defect is the most challenging aspect underlying bone healing in reconstructed areas. Therefore, careful manipulation of bone in the peri-implant bone defect is essential, given that stabilization of the graft is achieved by its juxtaposition between the bone defect borders. da Rosa et al reported a technique for reconstructing the buccal bone wall

<table>
<thead>
<tr>
<th>PES</th>
<th>Before</th>
<th>After 12 mo</th>
<th>Difference</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>4.75 ± 2.15</td>
<td>6.38 ± 2.13</td>
<td>+1.63 ± 1.75</td>
<td>.002</td>
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<tr>
<td>Mesial papilla</td>
<td>1.19 ± 0.54</td>
<td>0.94 ± 0.57</td>
<td>−0.25 ± 0.58</td>
<td>.104</td>
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<td>Distal papilla</td>
<td>1.13 ± 0.50</td>
<td>1.00 ± 0.73</td>
<td>−0.13 ± 0.62</td>
<td>.432</td>
</tr>
<tr>
<td>Curvature of facial mucosa</td>
<td>0.75 ± 0.78</td>
<td>1.50 ± 0.63</td>
<td>+0.75 ± 0.93</td>
<td>.006</td>
</tr>
<tr>
<td>Level of facial mucosa</td>
<td>0.94 ± 0.93</td>
<td>1.50 ± 0.73</td>
<td>+0.56 ± 0.89</td>
<td>.023</td>
</tr>
<tr>
<td>Root convexity, soft tissue color and texture</td>
<td>0.75 ± 0.93</td>
<td>1.44 ± 0.73</td>
<td>+0.69 ± 0.87</td>
<td>.007</td>
</tr>
</tbody>
</table>

Data presented as mean ± standard deviation.

Abbreviation: PES, pink esthetic score.

and facial mucosa resulting from removal of a failing tooth with a dental implant combined with a triple graft (cancellous and cortical bone and soft tissue graft) as a single-stage procedure. In our technique, however, autologous tuberosity bone was used to reconstruct the labial bone after removal of an implant. The bone graft consisted of a thin cortical bone layer on top of a core with cancellous bone. The predominantly spongious properties of this graft enabled easy shaping of the graft to the required dimensions beneath the periosteal layer. In addition, fixation with a screw was not required, because the graft can be compressed into the space created by removal of the implant.

The limitations of the proposed technique include difficulty of access to the donor site, especially in patients with a small mouth opening or a third molar present. Another limitation is the poor availability of tuberosity bone and soft tissue when large defects require reconstruction. In such cases, bone grafts harvested from the retromolar area can be used in combination with a soft tissue graft from the palate or tuberosity region placed on top of the grafted area as a seal. In our technique, the bone graft was compressed in the defect and healed without any complications. As stated, another reason for our favorable results was that no mucoperiosteal flap had to be raised when removing the implant and reconstructing the area. Sealing of the socket with soft tissue also prevents shrinkage-related displacement of the marginal gingival and arrests the natural process of scar shrinkage. This keeps the papillary tissue in the vertical plane, counteracts migration of the mucogingival junction, and stabilizes the position of the marginal crest of dentogingival fibers for subsequent use as a soft tissue channel accommodating the implant-supported restoration.

Finally, for implants in crucial sites such as the anterior maxilla, 2 prerequisites for a good long-term prognosis, including esthetics and phonetics, are a good quality and quantity of alveolar bone at the implant site and precise surgical execution using a restoration-driven approach. The technique we have described enables faster treatment with favorable soft and hard tissue conditions.

Acknowledgments

We thank Charles Frink for correcting the English grammar of our report.

References