Bone block, implant, split-thickness flap, reconstruction and restoration

Restoring a single-tooth space

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This article describes a case where a missing maxillary first molar was restored. The vertical and horizontal dimensions of the alveolar ridge as well as a bony fenestration into the maxillary sinus required pre-restorative bone augmentation. The mucosa was mobile and recessed; it was dislocated buccally to obtain keratinized soft tissue in the peri-implant region.

A 29-year-old male patient was referred to our office for restoration of the missing tooth 16. The patient's medical and dental history was normal. The third molars were absent; several teeth have been restored with adequate fillings. The occlusion was stable and normal. The periodontal tissues were free of inflammation. Tooth 16 had been extracted several years previously. A perforation of the maxillary sinus had been closed with a buccal advancement flap according to *Rehrmann*. Because the oral mucosa had been extensively mobilized at the time, the alveolar ridge at the site was covered with mobile mucosa, reaching all the way to the palatal side at the time of the baseline examination (Fig. 1). A vertical and horizontal (mesial) osseous defect was diagnosed radiologically (Fig. 2).

Fig. 1 Clinical baseline situation. A buccal advancement flap according to Rehrmann had been created several years previously.

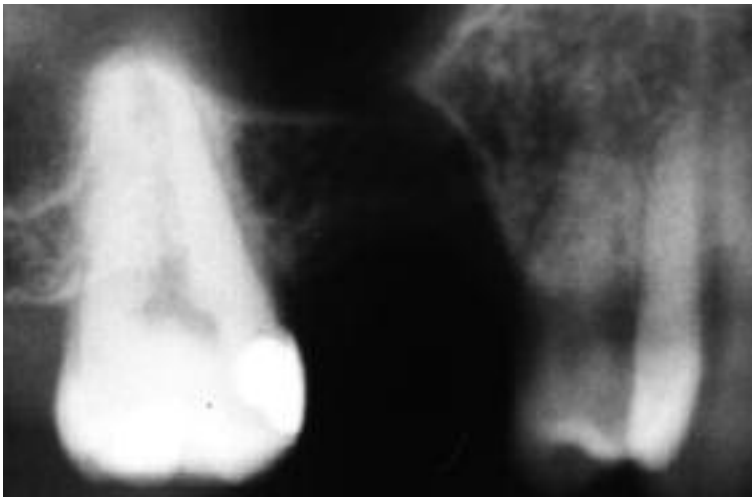


Fig. 2 Radiograph of initial situation.

Treatment plan

Following the clinical examination, radiographic and photographic case documents were assembled and diagnostic casts mounted in an articulator. Having been duly informed about available treatment alternatives, the patient agreed to the following treatment plan:

- Harvesting of a bone block at site 48 for vertical and horizontal ridge augmentation (to be used in combination with BioOss and BioGide)
- First healing phase (three months)
- Implant insertion at site 16 with concurrent buccal relocation of the soft tissue using a split-thickness flap
- Second healing phase (three months)
- Insertion of a healing abutment
- Delivery of a metal-ceramic crown

Fig. 3 A bone block was piezosurgically harvested at site 48.

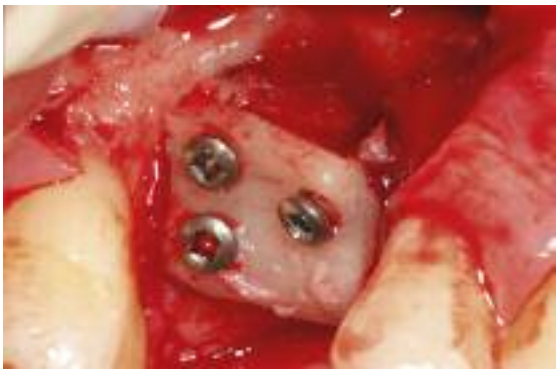


Fig. 4 The bone graft was secured in place with three screws.

Fig. 5 Control radiograph following the fixation.

Fig. 6 A small pin and bone substitute were used to stabilize the membrane.

Fig. 7 The graft completely covered the site and was secured by a palatal suture.

Fig. 8 The suture was free of tension and impervious to saliva.

Treatment protocol

A bone block was harvested piezosurgically at site 48 (Fig. 3) after an extensive flap had been prepared at site 16 to accommodate this bone block. When the bone was exposed at the implant site, the pre-existing perforation of the maxillary sinus turned out to be covered with soft tissue only. To maximize the contact area with the bone at the augmentation site, the bone block was prepared appropriately. The graft was secured with three screws (OsteoMed) (Figs. 4 and 5). A membrane (BioGide) was buccally anchored using two bone pins (Friatec). The remaining undercuts were filled with a bone substitute (BioOss) (Fig. 6). The membrane foil was secured palatally with a 6-0 Gore-Tex suture (Fig. 7), whereupon the mucosal flap was mobilized so the graft could be covered without tension and sealed to prevent saliva from entering (Fig. 8).

Fig. 9 The alveolar ridge prior to reentry.

Fig. 10 The screws were removed and ...

Fig. 11 ... an implant was inserted.

Fig. 12 Control radiograph following the implantation.

Figs. 13 and 14 Creation of a split-thickness flap.

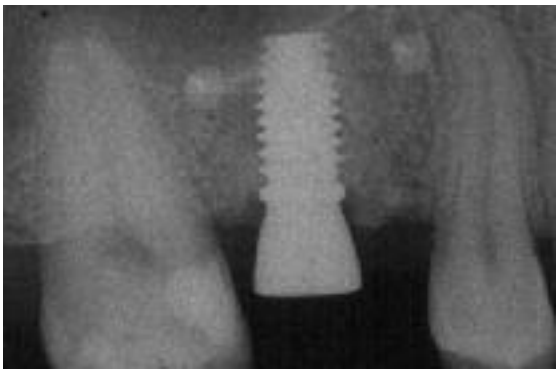
Fig. 15 The sutured internal flap ...

Fig. 16 ... and the relocated external flap.

Fig. 17 Two weeks after the procedure.

The first healing phase was uneventful (Fig. 9). The screws that held the graft in place were removed (Fig. 10), and the patient was ready for implant insertion (SIC) (Figs. 11 and 12). To improve the soft-tissue situation, a split flap was used (Figs. 13 and 14). The objectives were to cover the implant completely (Fig. 15) and to harvest keratinized mucosa on the buccal aspect of the future crown (Fig. 16). Figure 17 illustrates the situation two weeks after the surgical intervention.

A healing abutment could be connected three months later (Figs. 18 and 19). Figure 20 shows the position of the healing abutment after six weeks in situ. At the same appointment, an open-tray impression was taken for the definitive crown. The crown was fabricated conventionally (Figs. 21 to 23) and cemented with Harvard cement at delivery (Figs. 24 and 25).



Figs. 18 and 19 Connection of the healing abutment and subsequent control radiograph.

Fig. 20 The healing abutment after three months.

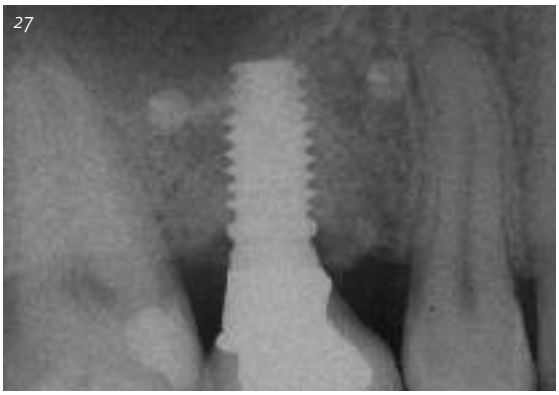
Figs. 21 to 23 The crown was fabricated using conventional methods.

Fig. 24 The definitive abutment was connected prior to the delivery of the crown.

Fig. 25 The cemented crown on the implant at site 16.

Figs. 26 and 27 At two years postoperatively, the situation was stable.

At two years postoperatively, the situation was stable. By agreement with the patient, the bone pins were left in place (Figs. 26 and 27).



Discussion

The treatment described here was comparatively tedious, including as it did multiple surgical interventions. Compared to a conventional three-unit bridge, this treatment approach has the advantage of preserving the substance of the almost intact adjacent teeth 15 and 17. Approximately 10 per cent of all prepared bridge abutments are eventually affected by endodontic complications [1]. This is a risk to be reckoned with when a single-tooth space is to be closed by a bridge.

The necessary augmentation of the alveolar ridge was performed with a combination of autologous bone and xenogeneic bone replacement material. Experimental studies have shown that a major portion of the grafted bone blocks is resorbed during healing [2]. To compensate for this resorption, the bone graft was combined with BioOss bone substitute [3]. The piezosurgical technique minimizes the risk of damaging essential anatomic structures as the bone block is harvested [4]. A comparison of the radiographs taken directly after augmentation (see Fig. 19) and at two years (see Fig. 27) indicates that the bone transplant is stable. It should be noted, however, that volume assessment is only possible by approximation on two-dimensional radiographs. Clinically, the site exhibits neither increased probing depths nor any signs of inflammation. State-of-the-art implant systems, regardless of whether they include platform switching, generally exhibit only minimal loss of module bone height [5-7]. This also turned out to be the case for the implant used here (SIC), where the bone level was stable after two years.

The baseline photograph shows the mobile mucosa covering the entire erstwhile extraction socket (see Fig. 1). The importance of the presence of keratinized mucosa at the implant neck has not been described conclusively in the literature. So far there have been no scientific data suggesting reduced success or survival rates for implants placed in mobile mucosa. However, clinical practice has demonstrated the advantages of keratinized mucosa, not least with regard of oral hygiene. It is therefore hardly surprising that the presence of mobile mucosa has been described as a risk factor in mucositis [8], although not in peri-implantitis [8,9]. In the case presented here, creation of a split flap produced a 2 to 3 mm wide zone of keratinized mucosa. ■

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