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the tunnel technique

Procedure for bone grafting before implant placement: a case study

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INTRODUCTION

Bone grafting before implant placement has become a routine procedure over the last 20 years. A 5-year survival rate of up to 98.3% for implants placed in grafted bone has been reported. Autologous bone grafts are considered the gold standard.

However, the success rate of the grafting procedure may be influenced by various risk factors. A particular challenge is posed by an extensive graft of the alveolar ridge, with relatively high complication rates of up to 20% being reported, most commonly dehiscence. More serious complications such as dehiscence or mobilization of the graft were observed in one third of smokers compared to a complication rate of only 7.7% for non-smokers. Complications such as flap necroses, dehiscence and resorption are frequently soft-tissue complications.

A tension-free wound closure is a key factor in the success of bone grafts. Periosteal incisions are a common technique for flap extension. However, too many relief incisions in the periosteum may also result in an excessively thin or stretched wound flap. This type of soft-tissue management may result in perforation or flap necrosis above the bone graft.

In 1987 Härle reported on a tunneling access in connection with a technique for preprosthetic jaw ridge grafting in the mandibular side-tooth region with bone replacement materials. In the clinical experience of the authors the use of a tunneling technique for preparation without a crestal incision can present an alternative with autologous bone grafts to conventional surgical procedures with a trapezoid flap design.

MATERIAL AND METHOD

Medical history

The 59-year-old patient, a smoker, presented with partial dentition in her lower jaw. Her general health was good with health status P1 in the ASA classification system (www.asahq.org). The second premolar and the first and second molar on the left side of the lower jaw were missing. The remaining alveolar projection showed a serious horizontal and vertical defect (Fig. 1). The treatment plan initially proposed grafting the three-dimensional defect with autologous bone from the ramus region of the lower jaw on the same side to enable placement of two implants of appropriate diameter to support a fixed restoration. A panoramic x-ray was taken before the surgical procedure to show the anatomy of the donor region and the grafted region (Fig. 2).

SURGICAL PROTOCOL

The patient was treated under intravenous sedation. Infiltration anesthesia with 4% Articain and 1:100 000 epinephrine was administered (Ultracain forte™, Aventis Pharma). Antibiotics with augmentan (1 g) was administered during surgery to prevent infection. Antibiotics were administered orally for a period of 14 days after the surgical procedure.

Nimesulid 300 mg (Aulin™, 300 mg, Roche) was prescribed for two to three days to relieve postoperative pain. The patient was instructed to use an antiseptic mouthwash containing chlorhexidine (2 %) three times a day for two weeks.
Two vertical mucoperiosteal incisions were made mesially and distally at the grafting site. The distal incision corresponds with the mesial relief incision of the access flap at the donor site. Tunnel preparation of the soft tissue was carried out at the graft site from the mesial incision to the distal incision without relief incisions in the periosteum to establish access to the remaining alveolar ridge (Fig. 4). The dissection of the soft tissue from the local bone was extended approximately 10 mm lingually and 25 mm buccally from the alveolar ridge. A block of bone for grafting was removed from the rising ramus of mandible with a diamond disk (Frios MicroSaw, Dentsply Friadent, Mannheim). The graft was divided sagittally (Fig. 5). The buccal cortical section of the graft was trimmed and fitted to the defect. It was fixed with two osteosynthesis screws, which maintained a distance from the existing bone (Fig. 6). The remaining graft was made into particles and used to fill the space between the graft and the underlying bone (Fig. 7). The incisions were closed with resorbable sutures (Resorba 4-0, 5-0). After surgery a panoramic x-ray was taken (Fig. 8).

The soft tissue had healed 10 days after surgery. The sutures were removed 14 days after surgery. A vestibuloplasty was conducted 16 weeks after the bone graft and two Xive implants, diameters 3.8 and 4.5 mm, (Dentsply Friadent, Mannheim) were successfully placed at the planned positions (Fig. 9 and 10). An additional minimal crestal graft was placed cervically in region 35 with bone harvested while preparing the implant site. A bone shield membrane was placed and fixed with Frios

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membrane tacks. The wound was closed in accordance with the vestibuloplasty after Kasanjian (Fig. 11) to establish stable soft-tissue conditions in the region of the implant site (Fig. 13). The positions of the implants were checked with a panoramic x-ray image (Fig. 12). The implant was uncovered 12 weeks later (Fig. 14). At this stage the crestal pre-implant bone was discovered to have regenerated well clinically (Fig. 15). After the soft tissue had healed (Fig. 16) the newly regenerated alveolar process (Fig. 17 and 18) is visible and two metal-ceramic crowns were cemented to titanium abutments (Fig. 18 and 19). A clinical and x-ray examination was conducted one year after the restoration. The soft-tissue conditions were stable and showed no signs of inflammation. The x-ray showed no signs of peri-implant bone resorption, with the crestal bone still at the same level as the implant shoulder (Fig. 20).

DISCUSSION

The advantage of the technique described here is the minimally invasive biological application with two key factors:

1_Blood circulation in soft tissue unimpaired
2_Biomechanical properties of soft tissue unimpaired

Flap necrosis and wound dehiscence are the two major problems in bone grafting surgery. They both contribute to uncovery of the graft with subsequent infection of the surgical site and failure of the surgical procedure. The soft-tissue complications are frequently the result of damaged blood circulation resulting from inadequate planning, insufficient flap extension or excessive surgical trauma.

Soft tissue is frequently stretched or even overstretched to cover the additional volume of the graft. In many cases an incision is made in the periosteum to enlarge the flap extension.

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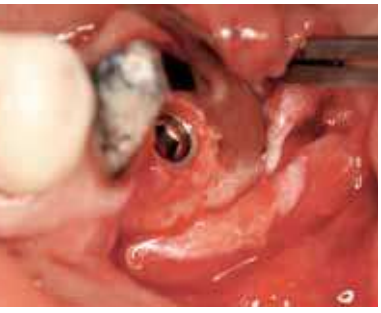

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However, this can cause overstretching and excessively thin tissue. This reduces the mechanical quality and the blood circulation. The great advantage of the flap design with the tunnel technique is the ability to avoid the crestal incision. This technique retains the blood circulation and does not damage the tissue. This is particularly important for patients with vascular problems, such as smokers, diabetics and patients with scar tissue. ■

Literature can be requested from the authors.

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