Rehabilitation of an extensive anterior explantation defect—A case report

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This article illustrates the surgical and prosthetic rehabilitation of an extensive defect in the area of a mandibular lateral incisor following explantation of a dental implant. Bone and soft tissue defects existed after removal of the implant. Guided bone regeneration, a subepithelial connective tissue graft, and gradual pontic contouring were used to attempt correction of the defect. The missing tooth was replaced by a single-retainer, all-ceramic, resin-bonded fixed partial denture. The gingival contours were reestablished, but without complete regeneration of the interdental papillae. This article describes the use of several regenerative techniques in the treatment of dental defects and underscores the difficulty of complete correction of papilla deficiencies. *(Quintessence Int 2011;42:539–545)*

Key words: all-ceramic resin-bonded fixed partial denture, esthetic zone, explantation implant loss, hard tissue defect, pontic contouring, soft tissue defect

The placement of oral implants has become commonplace in dentistry, with indications ranging from single-tooth replacement to full-arch rehabilitation. Despite very high survival rates, implant losses do occur, which may lead to challenging defects if they are in the esthetic zone. Untreated defects may lead to esthetic and functional problems such as moist speaking and increased food impaction.[1] Therefore, defects should be surgically corrected when possible, and remaining deficiencies need to be addressed in the prosthetic rehabilitation.

Studer et al[2] proposed a classification for localized alveolar ridge defects that takes quality and quantity of the defects into account and also presented a prognosis for the complete surgical rehabilitation of a given defect. This classification has been summarized in Table 1. An alveolar ridge defect, depending on its size, may be corrected by using bone grafts, guided bone regeneration with nonresorbable or resorbable barriers, various soft tissue augmentation techniques, or a combination of several techniques.[3] Large defects may require multiple surgeries, leading to long treatment times and uncertain outcomes. Selection of treatment protocol requires knowledge of the available techniques and the experience of the surgeon, especially with regard to the results that can be achieved with a particular technique.

The following report presents the treatment of an alveolar ridge defect using multiple surgeries, gradual tissue shaping using pontic contouring, and prosthetic rehabilitation with an all-ceramic resin-bonded fixed partial denture (RBFPD).

CASE REPORT

A 32-year-old man presented to our clinic asking for the replacement of the mandibular right lateral incisor. Dental history revealed that the tooth had been extracted 12 months prior due to a root fracture that occurred in a sports-related accident. Six weeks prior to presentation at the clinic, the patient had an implant placed in the area of the mandibular right lateral incisor. Two

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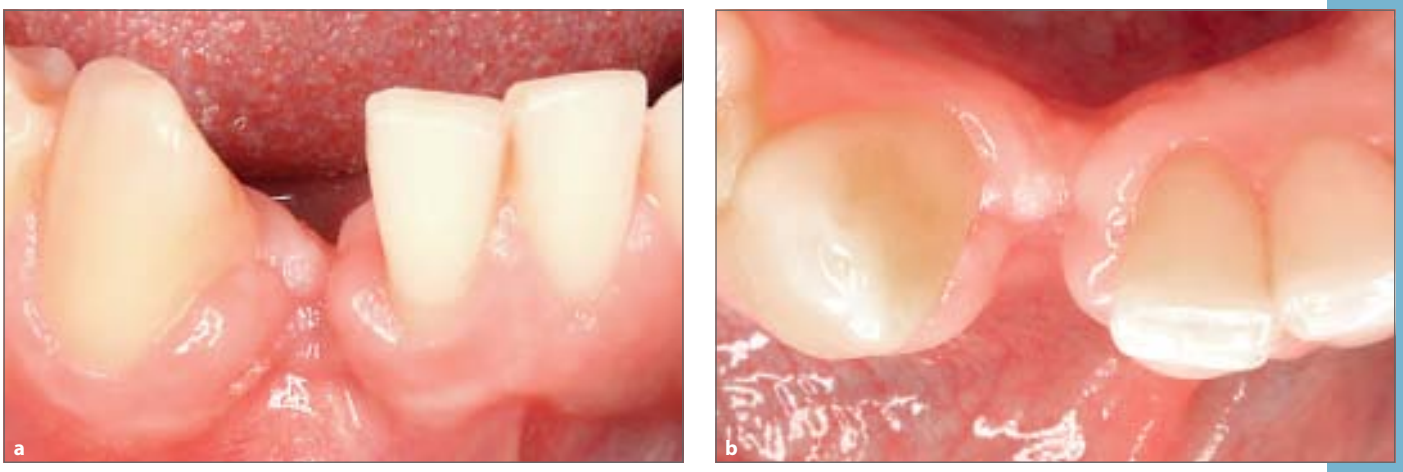

Fig 1 *(a)* Labial view of the defect after soft and hard tissue healing (Seibert Class III, severe horizontal, severe vertical). The mesial and distal papillae are reduced in height. *(b)* Incisal view.

Table 1 **Semiquantitative classification of localized alveolar ridge defects in the vertical and horizontal dimensions**

Defect size (mm)	Designation	Prognosis
< 3	Mild vertical defect	+
3–6	Moderate vertical defect	+/–
> 6	Severe vertical defect	–
< 3	Mild horizontal defect	++
3–6	Moderate horizontal defect	+
> 6	Severe horizontal defect	+/–

++, very good; +, good; +/–, average; –, questionable.

Table 2 **Development of the soft tissue defect during treatment**

	Initial situation (mm)	After guided bone regeneration (mm)	After subepithelial connective tissue graft (mm)	After pontic creation (mm)
Vertical	–9.0	–4.5	–3.0	–3.0
Horizontal	–6.0	–3.0	–2.0	+1.0

weeks after placement, an infection developed and the implant was removed.

Clinical examination of the patient revealed severe vertical (9 mm) and horizontal (6 mm) defects in the area where the implant had been placed and removed[2] (Tables 1 and 2, Fig 1). Analysis using cone beam computed tomography (CT) revealed that the bone level on the distal side of the mandibular right central incisor was 8 mm apical of the bone level on its mesial side. The vitality test of the mandibular right central incisor and canine was positive, and periodontal probing did not reveal elevated probing depths (≤ 3 mm). A tooth-supported provisional restoration was fabricated that consisted of an acetate matrix and a single prosthetic tooth, replacing the mandibular right lateral incisor.[4] The tooth-supported restoration was chosen to eliminate pressure on the gingival tissue and presumably minimize further gingival recession.

Reconstruction of the hard and soft tissue defect was planned using a three-step approach: guided bone regeneration, connective tissue grafting, and gradual contouring of the pontic.

The first step involved the hard tissue treatment. Full-thickness flaps were prepared labially and lingually, exposing the defect area. Using a piezosurgical device (Piezosurgery 3, Mectron), a 7 × 12 × 3 mm monocortical block graft was harvested from the chin and fixed on the perforated receptor site using two bone-fixation screws (3i

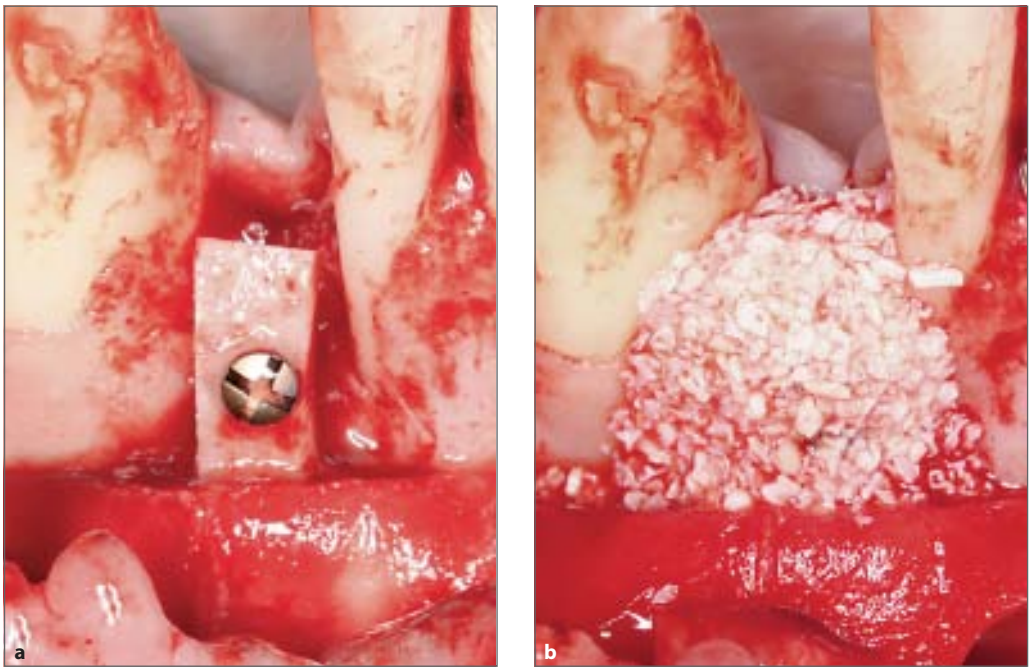

Fig 2 *(a)* To rehabilitate the bone defect, an autologous bone block graft was harvested from the chin and fixed to the receptor site with two titanium screws. Note the extensive vertical bone loss distal to the mandibular right central incisor. *(b)* A xenogenic bone substitute material was placed around the block graft.

Fig 3 Clinical status 4 months after guided bone regeneration. The defect was reduced; however, there was still a substantial horizontal deficiency.

Osseotite System, Biomet 3i). A xenogenic bone substitute material (Bio-Oss, Geistlich) was placed around the bone graft; the bone grafts were then covered with a collagen membrane (Bio-Gide, Geistlich). The buccal flap was released by a periosteal dissection and closed in a tension-free manner (Figs 2 and 3).

After 4 months of uneventful healing, a subepithelial connective tissue graft was placed to further enhance the soft tissue in the area of the defect. This was accomplished by making a lingually placed paracrestal incision and elevating split-thickness flaps both labially and lingually. A 1.5-mm connective tissue graft was harvested

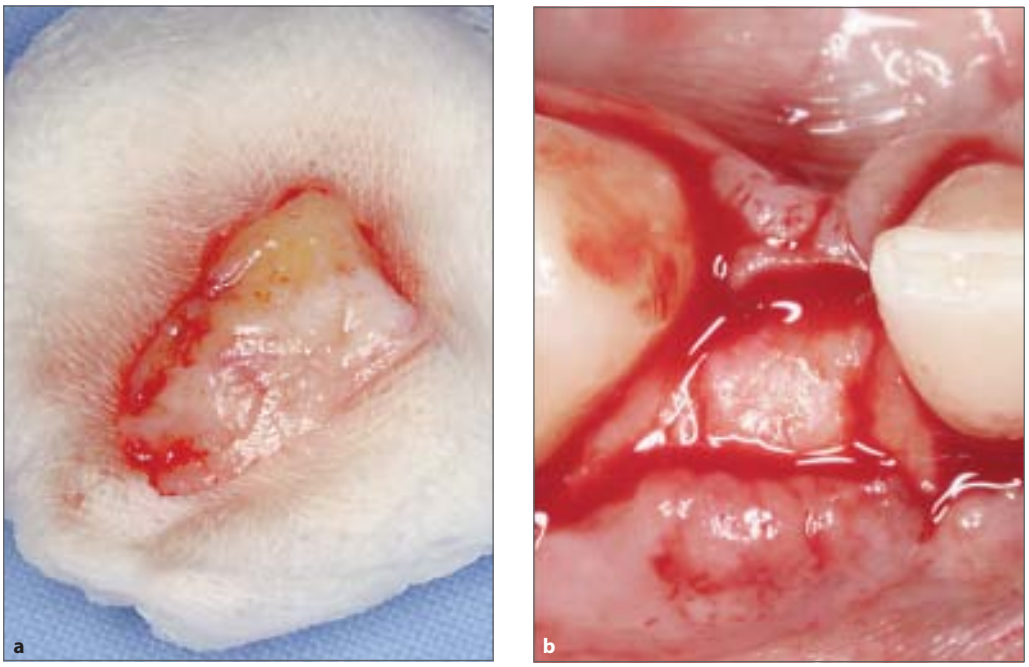

Fig 4 *(above left and above right)* Four months after guided bone regeneration, a subepithelial connective tissue graft was performed. *(a)* A 1.5-mm connective tissue graft was harvested from the premolar region of the right palate. *(b)* The graft placed in the receptor site using a split-thickness pouch technique.

Fig 5 *(left)* Situation 2 months after the subepithelial connective tissue graft. The soft tissue was augmented on the labial side. On the lingual side, the situation was unchanged.

Fig 6 *(left)* Three months after the subepithelial connective tissue graft, gradual pontic contouring was initiated. Over a period of 4 weeks, the pontic was shaped. Note the inflammation-free mucosa and gain of soft tissue on the buccal and lingual sides.

Fig 7 The all-ceramic, single-retainer RBFPD prior to cementation.

Fig 8 The vertical component of the defect was rehabilitated to the level of the neighboring teeth. Gradual pontic contouring resulted in a natural emergence profile of the replaced tooth. The papillae could not be restored.

from the palate and placed in the recipient site; the mucosal flaps were coronally positioned and closed tension-free (Figs 4 and 5).

Gingival contouring commenced 3 months after the placement of the subepithelial connective tissue graft. An acrylic prosthetic tooth (Vita Physiodens, Vita Zahnfabrik) was ground to a conical shape and placed 3-mm deep into a surgically created pocket. The prosthetic tooth was attached to the lingual side of the central incisor using a glass-fiber ribbon (Super-Splint, Hager & Werken) and flowable composite resin (Tetric EvoFlow, Ivoclar Vivadent). After 1 week, the prosthetic tooth was removed, the apical part widened using flowable composite resin, and the tooth rebonded to the central incisor. Over a period of 4 weeks, the pontic was widened once a week to create an ovate pontic. On the first two appointments, the apical portion of the pontic was widened until it had reached a cylindrical shape. During the third and fourth appointments, the pontic was widened until it had reached the natural root anatomy of a mandibular lateral incisor, thus creating a natural emergence profile of the artificial tooth (Fig 6).

Prosthetic reconstruction consisted of a single-retainer, all-ceramic RBFPD. The preparation of the mandibular right canine consisted of a slight lingual veneer preparation with a 0.5-mm–deep balcony in the center of a proximal box preparation.[5] Following the preparation, impressions were taken (Affinis Precious, Coltène/Whaledent) and a single-retainer RBFPD with a zirconia framework was fabricated (Prettau Zirkon, Zirkonzahn; Hera Ceram Zirkonia, Heraeus Kulzer) (Fig 7). The definitive restoration was cemented with an adhesive resin cement (Panavia 21, Kuraray). Figure 8 shows the restoration after cementation.

The defect was reconstructed vertically to the soft tissue level of the neighboring teeth when viewed from the labial side. In the labio-oral dimension, a surplus of soft tissue was achieved. Reconstruction of the papillae was not achieved, however, and the pontic was therefore widened to minimize the black interdental spaces. Thus, the replaced tooth was slightly wider than the contralateral lateral incisor.

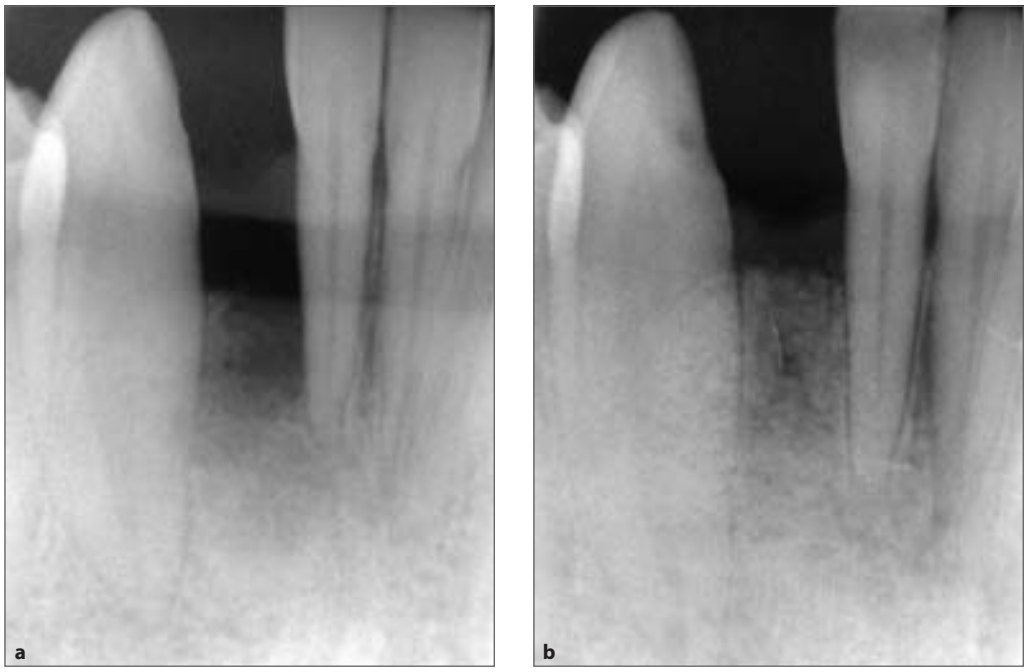

Fig 9 Radiographs of the area made *(a)* on the day the patient was first seen and *(b)* prior to cementation. Rehabilitation of the bone to its natural level was not achieved.

DISCUSSION

Alveolar ridge defects are a major challenge in the rehabilitation of partially or completely edentulous patients. Often, treatment of these cases requires multiple techniques. A staged approach is needed in treating the most severe cases. In the present case, the alveolar ridge defect was reduced by about 50% by an autologous block graft. To further enhance the soft tissue volume, a subepithelial connective tissue graft was performed. A subepithelial connective tissue graft was chosen over a free full-thickness graft since it provided greater volume gain[6] and avoided differences in gingival color. Gingival contouring, which was accomplished through gradual pontic contouring, further enhanced the soft tissue appearance and created a natural emergence profile. During pontic contouring, great care was taken not to create any downward pressure that would have led to a loss of soft tissue height. Therefore, the pontic was contoured in two phases over a period of 4 weeks. In the first phase, the pontic was widened in only the apical part until it had reached a cylindrical form. Thus, the soft tissue was expanded without the creation of downward pressure, which would have occurred during a tapered widening. In the second phase, the pontic was widened until it had reached the natural root anatomy of a mandibular lateral incisor.

The defect was rehabilitated to a large extent by enhancing both the hard and soft tissue. However, a full rehabilitation of the interdental papillae was not achieved. The presence of an interdental papilla depends on the distance between the crest of bone and the interdental contact point.[7–9] The bone defect in this patient was very extensive, making it difficult to rehabilitate the bone to its natural level in one step. Thus, the bone levels needed for the rehabilitation of the papillae were not established (Fig 9). It is not known whether a second bone augmentation would have lead to full rehabilitation of the bone level.

The prosthetic options for the replacement of a single missing tooth are a traditional fixed partial denture (FPD) supported by the teeth adjacent to the defect, an implant-supported single crown, or an RBFPD. Treatment with an FPD was ruled out, since the neighboring teeth were restoration- and caries-free. An implant-supported single crown was also excluded, since the interdental space was limited, even for an implant with a reduced diameter.[10] Further, the patient had already experienced an implant failure and was reluctant to receive a second implant. Therefore, the missing tooth was replaced with a single-retainer, all-ceramic RBFPD supported by the mandibular right canine because of its long root.

Kern reported a survival rate of 92% for single-retainer, all-ceramic RBFPDs after 5 years. In the same study, the survival rate of two-retainer all-ceramic RBFPDs was only 67%.[11] In a single-retainer, all-ceramic RBFPD, the pontic always moves with one abutment tooth, whereas in the two-retainer design, the different movements of the abutment teeth during function lead to high stress for the restoration. Another aspect supporting a single-retainer design is the occurrence of secondary caries on one of the abutment teeth of two-retainer RBFPDs after the debonding of one retainer, as this often remains unnoticed by the patient.[12]

CONCLUSION

Alveolar ridge defects provide great challenges. This case involved a severe defect of both hard and soft tissue. The patient considered the treatment a success. However, full rehabilitation of the interdental papillae was not achieved, despite the application of multiple regenerative techniques.

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