Ridge augmentation is commonly associated with implant dentistry. The need to regenerate bone has become important for implant placement. However, prior to the use of implants, and still today, there are many other situations where ridge augmentation can be important. Restoration of deformed edentulous ridges prior to fixed prosthetics is still a valuable and necessary therapy.

Long pontics, pink porcelain, and acrylic resin flanges on removable partial dentures can be used to restore deformed edentulous areas. However, none of these will produce an ideal result. As the results of cosmetic dentistry improve, various techniques have been developed to restore deformed ridges. This has permitted placement of more ideal fixed restorations. In situations where implants are not going to be placed, regenerating the missing bone is not required. However, there is no contraindication to regenerating bone, assuming the bony contour remains stable. In the early 1980s, Langer and Calagna proposed a technique to restore deformed edentulous ridges.

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The goal of this case report was to evaluate the use of an acellular dermal matrix for soft tissue ridge augmentation. The technique used was a modification of the procedure proposed by Langer and Calagna and involved reflecting a partial-thickness pedicle, placing an acellular dermal matrix, and covering the acellular dermal matrix with the pedicle. The increases in the quantity of tissue obtained were adequate to permit placing an esthetic fixed restoration in four of the five cases treated. In one of the five cases, the acellular dermal matrix became exposed and partially sloughed. This resulted in less of an increase in tissue than in the other cases. Histologic evaluation of this case showed that the entire acellular dermal matrix did not slough; part of the acellular dermal matrix was incorporated into the result. The use of an acellular dermal matrix for soft tissue ridge augmentation is a clinically valuable technique. (Int J Periodontics Restorative Dent 2003;23:87–92.)

Soft Tissue Ridge Augmentation with an Acellular Dermal Matrix

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It involved raising a partial-thickness pedicle flap, grafting the area with a connective tissue graft, and then closing the pedicle over the connective tissue graft. They reported successful ridge augmentation with this technique.

The major limitation when using this technique is the size of the connective tissue graft that can be obtained. It has been suggested that when there is inadequate donor tissue, a soft tissue augmentation is contraindicated. The goal of this study was to evaluate the use of a connective tissue graft substitute for soft tissue ridge augmentation.

Acellular dermal matrix has been used to achieve root coverage. Additionally, acellular dermal matrix has been suggested as a replacement for free gingival grafts in gingival augmentation. However, there are conflicting reports in this area. This study evaluated the use of an acellular dermal graft as a replacement for a connective tissue graft to augment edentulous ridges.

**Method and materials**

Five patients with deformed edentulous ridges were included in this study. The mean age was 45.2 years (range 26 to 62 years, standard deviation [SD] 14.8). There were one man and four women. All were treatment planned for fixed prosthetics. In three patients, the ridge deformity was a single central incisor. In the other two patients, the ridge defect involved both central incisors. All patients were in good health, with no contraindications for periodontal surgical therapy.

Informed consent forms were signed by the patients. Preoperative photographs were taken (Figs 1 and 2). The procedure was accomplished in a similar manner to that described by Langer and Calagna. A partial-thickness flap was reflected by sharp dissection in the area of the deformed edentulous ridge. Vertical incisions were placed. The dissection was continued to a point where it seemed that the pedicle could be repositioned over an adequate-sized graft placed in the edentulous space (Fig 3). The acellular dermal matrix was hydrated, as suggested by the manufacturer, in two saline washes. In three of the cases, the acellular dermal matrix was folded on itself so only the connective tissue side was exposed. The material was folded or rolled until an adequate-sized piece of material was obtained. The excess was trimmed off and discarded (Fig 4). The graft was secured into the ridge defect with 5-0 gut sutures or 5-0 poliglecaprone 25 sutures (Monocryl, Ethicon/Johnson and Johnson) (Fig 5). In the other two cases, the material was folded, as above, so only the connective tissue side of the acellular dermal matrix was exposed. The material was cut into pieces to fit into the edentulous ridge defect. The pieces were then individually sutured into the defect with 5-0 gut sutures or 5-0 poliglecaprone 25 sutures.

In the cases treated, there were up to eight layers of acellular dermal matrix sutured into the defect. The pedicle was sutured over the acellular dermal matrix with 5-0 poliglecaprone 25 sutures or polyglactin 910 sutures (Vicryl, Ethicon/Johnson and Johnson) (Fig 6). Primary closure was obtained in all cases. No dressings were used. However, in all cases, the provisional restorations were relieved so that no pressure was applied to the grafted area.

The patients received routine postoperative care. Final evaluation
of the results was done at 3 to 12 months (mean 6.2 months, SD 3.5) (Figs 7 and 8). In one of the cases, after the ridge augmentation, it was necessary to remove an amalgam tattoo. A conventional epithelialized autogenous masticatory mucosa graft (free gingival graft) was used. The procedure and healing were uneventful and eliminated the amalgam tattoo. During the procedure, with the patient’s consent, samples were obtained for histologic evaluation. The surface tissue that was removed during the bed preparation for the free gingival graft was retained. A 2-mm punch biopsy was obtained. These samples were placed in 10% formalin and processed for histologic evaluation. The sections were stained with hematoxylin-eosin and Verhoeff’s stain.

**Results**

In four of the five cases (except the case with the amalgam tattoo), the patient and the clinician were satisfied with the result. The increase in the amount of tissue present was adequate to permit placing an esthetic fixed restoration. The only surgical procedure accomplished after the ridge augmentation was the free gingival graft mentioned.
above. In that case, the one with the amalgam tattoo, a portion of the acellular dermal matrix became exposed during the healing. This resulted in a partial sloughing of the acellular dermal matrix. The quantity of ridge augmentation obtained was less than the other cases. This was compensated for by making the free gingival graft thicker than normal. The final esthetics after the fixed restorations were placed were acceptable to the patient in all cases.

Histologic evaluation of the samples obtained during the free gingival graft showed that the acellular dermal matrix was incorporated into the final result. Figure 9 shows the surface layer. Figure 10, obtained with a 2-mm punch biopsy, shows the deeper areas where the graft was placed. They were stained with Verhoeff's stain and showed the three to four layers of tissue with the dark-staining elastin present (depending on the section evaluated). Since elastin is not generally seen in the gingiva, it can be assumed that these are the areas where the acellular dermal matrix was incorporated into the result. It is not known how long the elastin fibers will remain. The layers where the elastin was present had different fiber orientations than the surrounding areas. There were few inflammatory cells present, and the numbers varied between the sections evaluated.
Discussion

An acellular dermal matrix seems to be a good substitute for a connective tissue graft when attempting soft tissue ridge augmentation. In four of the five cases treated, the results with the acellular dermal matrix were adequate to restore the edentulous ridge to a point where an esthetic fixed restoration could be placed. In the one case where an adequate amount of augmentation was not obtained, the decreased augmentation was probably a result of the material becoming exposed and partially sloughing. The acellular dermal matrix was covered with the pedicle at the time of surgery. However, the pedicle was relatively thin. It is unknown if the thickness of the pedicle was a factor or if the area was traumatized during the healing. Some authors\(^{17,18}\) suggested that the thickness of the pedicle may be a factor when a coronally positioned pedicle is used for root coverage. Similarly, the author\(^{19}\) proposed that the thickness of the pedicle may be a factor when guided tissue regeneration is used for root coverage. However, it is not known if these findings apply when an acellular dermal matrix is used.

The unlimited supply of soft tissue for grafting was an advantage of this technique. In all of these cases, it would have been necessary to obtain connective tissue from both sides of the palate to obtain enough connective tissue. This would have created three surgical sites (a recipient and two donor areas). The use of the acellular dermal matrix eliminated the need for the two donor areas.

The maximum volume of acellular dermal matrix that one can use with this technique is unknown. Additionally, it is not known if the layering of individual pieces offers any advantages over simply folding or rolling the material. The orientation of the material may or may not be critical. Further study will be needed in these areas.

The major shortcomings in this study are the result of its having been completed in private practice. All surgical procedures and evaluations were completed by the author. This made a blinded evaluation impossible. In all of the cases, the greatest portion of the defect was the loss in the buccopalatal dimension. There was only a slight need for augmentation in the incisal dimension. It is unknown if the acellular dermal matrix will augment a large vertical defect. It would be interesting to know the volume by which the edentulous ridge increased as a result of the surgical procedure. However, it was not possible to calculate the volume changes in a private practice environment.

The long-term stability of the results were not addressed in this study. However, in the one case with 12 months of follow-up and the two cases with 6 months of follow-up, there was no loss of tissue bulk from the 3-month evaluation to the final follow-up. These findings are in agreement with others.\(^1\)

Based on the results of this study, the use of an acellular dermal matrix seems to be a good substitute for a
connective tissue graft when soft tissue ridge augmentation is desired. It seems to be important to completely cover the acellular dermal matrix with a pedicle and keep it completely covered during the healing period. The acellular dermal matrix eliminates the need for a palatal donor area or areas and provides an unlimited supply of material. The use of an acellular dermal matrix instead of a connective tissue graft is a clinically valuable modification of the original ridge augmentation technique proposed by Langer and Calagna.2,3

The technique can produce a good clinical result, without the need for a donor area.

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