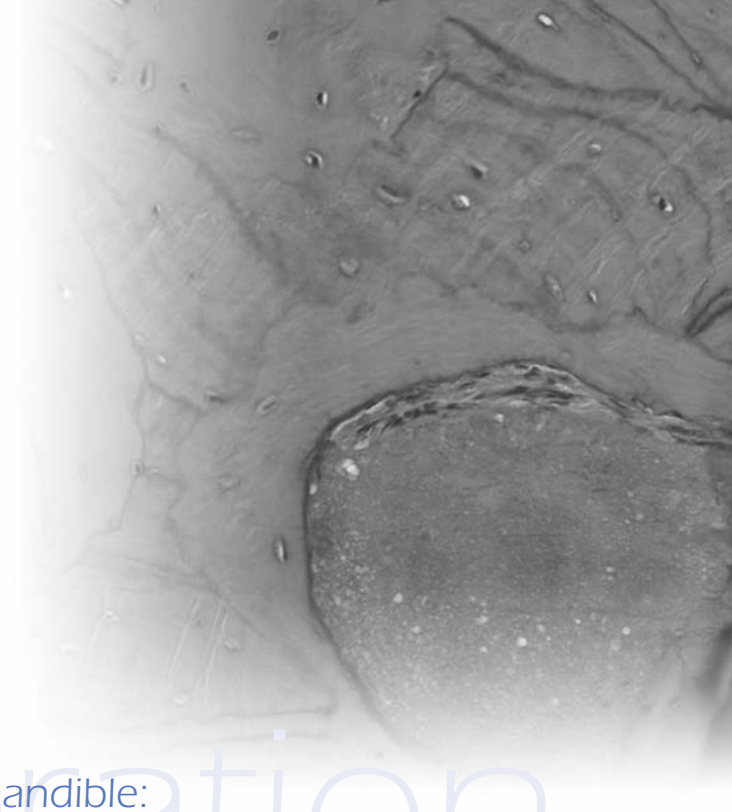


regeneration

Regeneration of the anterior mandible: A clinical case presentation

John Lupovici, DDS

Although autogenous bone has long been considered to be the gold standard for restoring deficient alveolar bone, a number of drawbacks have been associated with its use. Alternative grafting materials have developed, along with techniques for maintaining existing soft tissue and bone. This article briefly reviews these developments. A clinical treatment is also presented in which a new xenograft material was used in combination with a cross-linked, cell-occlusive membrane to restore a severely resorbed edentulous mandible in preparation for placement of dental implants.

Key Words: regeneration, bone grafting, grafting materials, xenograft

Introduction

An estimated 1,260,000 dental bone-grafting procedures were performed in the United States in 2006, and that number is expected to grow by more than 15% annually.[1] As hard-tissue reconstruction has become an increasingly routine part of dental surgical care, demand for suitable grafting materials has increased. Such materials must satisfy various regulatory requirements and meet clinicians' expectations for safety and effectiveness. Ideally, they should be biocompatible, easy to procure, resorbable, osseoconductive, osseoinductive, and cost-effective.

In response to these considerations, autografts, allografts, alloplasts, and xenografts have all become acceptable alternatives for filling and regenerating bone defects. However, autograft material may be difficult to obtain in sufficient quantity, and its harvest poses risks of pain, complications, and morbidity.[2-7] Morever, high resorption rates and limited viability have been reported.[8-11] Allograft bone, while more easily obtainable, may lack osseoinductivity (depending upon its source and processing).[12-14] Alloplasts typically lack osseoinductivity, and may have variable resorption rates.

Xenografts constitute the fourth category of commonly used bone-grafting materials, with porous bovine-derived material—the most popular xenograft variety. This biocompatible material may eliminate the need for a second surgical site and may serve as an effective regenerative matrix for a variety of indications prior to implant placement. Numerous researchers have reported a high degree of osseoconductivity,[15-22] and bovine bone particles are well incorporated within newly regenerated grafted bone, according to histological findings. It has been argued that the slow resorption profile of bovine-derived bone may contribute to increased stability of the regenerated bone.[23]

Traditionally most xenograft used in oral regenerative procedures has been unsintered. Such material undergoes a multi-step process of annealing (up to 300 degrees Celcius), followed by treatment with organic solvents such as sodium hydroxide.[24] However, a second type of bovine-derived bone, used since 1989 as a bone-replacement material in the fields of orthopedic and skull surgery, has recently been introduced into the field of oral regeneration. This material uses a process known as sintering to remove all pathogenic components and organic components from the bovine bone. The bovine bone is heated to more than 1200 degrees Celcius, yielding a highly crystalline material containing small amounts of calcium oxide resulting from decomposition of the original carbon content. The sintered bovine bone incorporates its native macroporosities, as well as preserves its microposity of the original bone.

The following clinical case presentation illustrates the use of sintered xenograft particles in combination with a resorbable collagen membrane to regenerate an edentulous mandible.

The patient was a 72-year-old female who presented with an ill-fitting denture following long-standing mandibular edentulism. Clinical and radiographic examination revealed a narrow alveolar ridge with significant apical undercuts (Figs. 1 and 2). The patient required pre-operative ridge regeneration to accommodate a future implant-supported overdenture.

Sintered bovine bone particles were chosen as the graft material due to their biologic and physical properties. Biologic properties include the ability to function as an osteoconductive regenerative material. The physical characteristics of bovine bone offer the additional advantage of increased compressive resistance, due to the material's inherent native structure. Regenerative attempts with other graft materials may be compromised by their inability to contend with the compressive forces delivered by an overlying denture.

Following treatment-plan acceptance, the patient was anesthetized, and a full-thickness mucoperiosteal flap was reflected (Fig. 3). Upon identification of the mental foramina, distal releasing incisions were made. Measurement of the existing ridge indicated that the width was 2-3mm wide (Fig. 4).

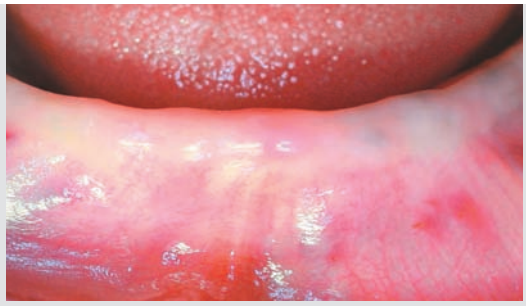


Fig. 1

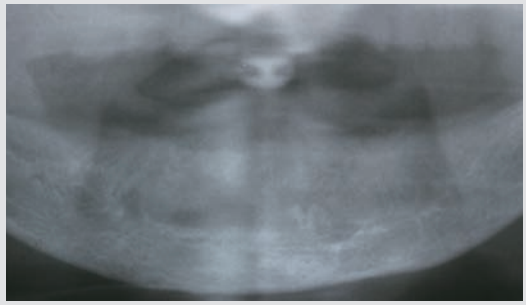


Fig. 2

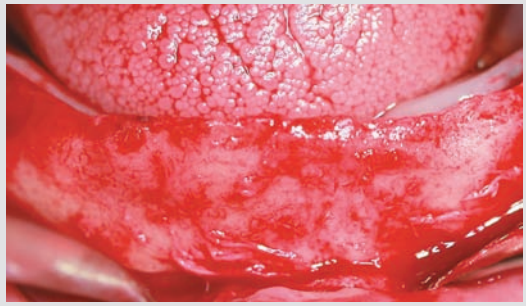


Fig. 3

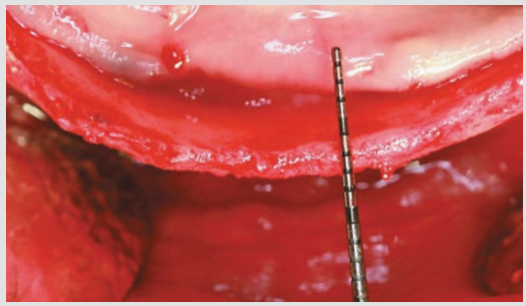


Fig. 4

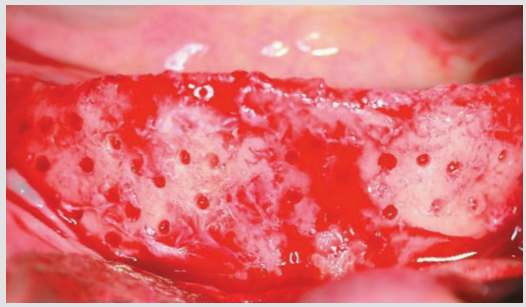


Fig. 5

Fig. 6

Fig. 7

Fig. 8

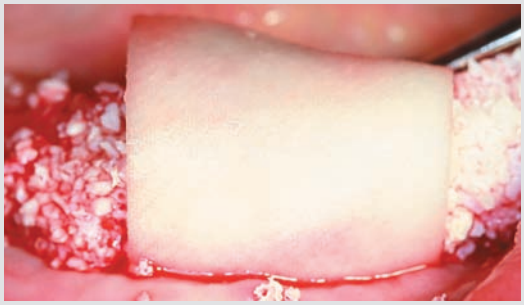


Fig. 9

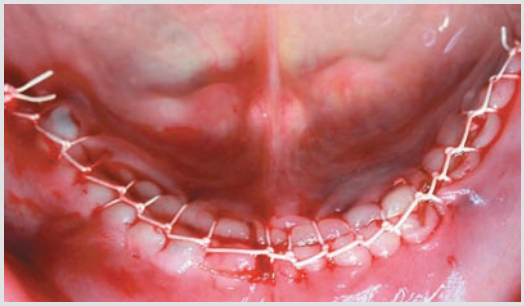


Fig.10

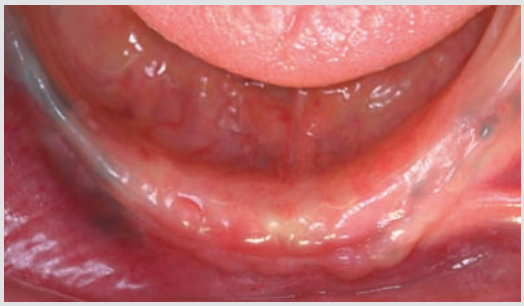


Fig.11

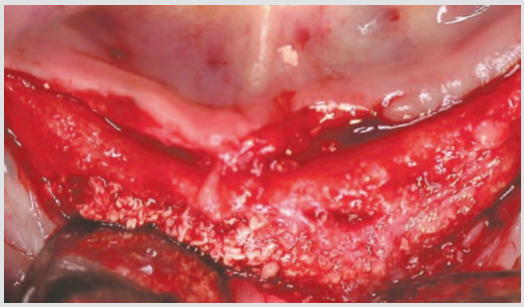
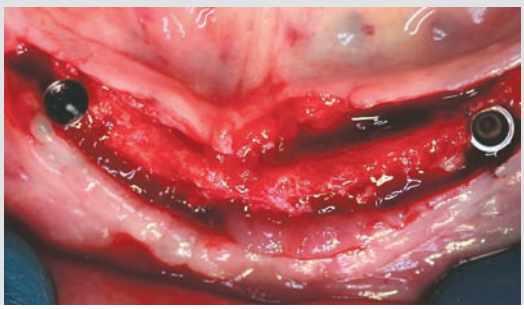


Fig.12



The residual periosteum was carefully debrided with hand instruments, and the ridge was decorticated using a high speed round carbide bur with copious irrigation (Fig. 5).

After hydration in sterile saline for five minutes, Endobon® Xenograft Granules (BIOMET ***3i***) were molded over the decorticated ridge. Excess graft material was applied to allow for the characteristic shrinkage associated with guided bone regeneration and the unavoidable compression by the denture (Figs. 6 and 7).

Graft containment was achieved by tucking cross-linked OsseoGuard® Resorbable Collagen Membranes (BIOMET ***3i***) under the facial flap and draping them over the graft (Fig. 8). Extensive periosteal releasing incisions of the buccal flap in conjunction with the initial lingual flap reflection to the floor of the mouth enabled passive primary closure. Continuous locking 4.0 Gore-Tex® Sutures (W.L. Gore & Associates, Flagstaff, Arizona, USA) secured the soft-tissue flaps (Fig. 9).

The intaglio surface of the existing denture was relieved and relined to reduce the potential compressive forces on the regenerated area, as well as to maintain primary closure. The patient was then released with analgesics and antibiotics.

Post-operative healing was uneventful, and primary closure of the regenerated site was maintained throughout the healing period. Six months later, the patient was seen for evaluation and placement of dental implants (Fig. 10). A crestal incision was made, and full-thickness periosteal flaps were reflected to reveal a sufficient gain in ridge width to support implant placement (Fig. 11).

Following the manufacturer's recommended protocol, osteotomies were performed in the two cuspid sites for placement of 4mm diameter NanoTite™ Certain® Implants (BIOMET ***3i***) (Fig. 12). Cover screws were placed into the internal interfaces of the implants and tightened by hand. A 2mm trephine core was harvested from the central incisor location, and histological evaluation revealed excellent incorporation of the Endobon Xenograft Granules. The soft-tissue flaps were closed with continuous locking sutures, and the intaglio surface of the existing denture was relieved and relined. The patient was then released with analgesics and antibiotics.

Three months later, after uneventful healing, a tissue punch was used to expose the implants. The cover screws were removed, and EP® Healing Abutments (BIOMET ***3i***) were placed. The denture was relieved over the healing abutments, and the patient was dismissed with oral hygiene instructions.

Following soft-tissue maturation at eight weeks, the patient was seen by the restorative clinician for impressions and fabrication of the definitive prosthesis. The mandibular overdenture will be retained by Locator® Abutments (BIOMET ***3i***) processed directly into the overdenture base.

Clinical Relevance

For many severely resorbed edentulous patients, being unable to wear a removable denture during healing may be a significant impediment to accepting treatment with dental implants. Treatment plans that acknowledge this psychological reality are likely to enjoy higher acceptance rates. Sintered bovine-derived bone particles used in combination with cross-linked, cell-occlusive membranes may enable clinicians to obtain successful regenerative outcomes in cases where compressive forces imposed by dentures might otherwise compromise the success of the augmentation or lead to questionable regenerative gain.

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Dr. Lupovici received his dental degree and certificate in Periodontology from New York University. While at NYU, he participated in numerous research studies, which resulted in his being awarded three Dean's Student Research Awards and receiving first place in the American Dental Association / NYU Research Day Competition. He is a Diplomate of the American Board of Periodontology and holds a faculty position at NYU in the Department of Periodontics and Implant Dentistry. His clinical research includes such topics as bone regeneration and implant dentistry; subjects on which he has published and lectured nationally and internationally. Dr. Lupovici maintains a private periodontal practice in New York City and Commack, New York.