Reconstruction of Supracrestal Alveolar Bone Lost As a Result of Severe Chronic Periodontitis. Five-Year Outcome: Case Report

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This patient presented with generalized severe chronic periodontitis. Conventional periodontal therapy would have left her compromised esthetically and anatomically, with growing interdental "black triangles." This prompted the authors to try to reconstruct the maxillary alveolar bone that had been lost in the previous three decades because of untreated periodontitis. To maintain the level and quality of the gingival margin, open flap surgery was performed in the maxilla soon after scaling and root planing. To gain access to the roots and bone surfaces, a flap was raised by intrasulcular incisions and the modified and simplified papilla preservation technique. After debridement, the root surfaces were conditioned and enamel matrix proteins were applied. Bovine bone mineral was placed in the infrabony defects and supracrestally (buccally, lingually, and interdentally) to help regenerate the lost alveolar bone. In addition, the defects around the maxillary anterior teeth were covered with a membrane. To prevent shrinkage of the gingiva, suspensory sutures were placed on the right central incisor and both left incisors so that the anterior flap would be positioned approximately 3 mm coronally. After surgery, the patient was advised to apply 1% chlorhexidine gel twice a day and to avoid brushing the surgical site for 4 weeks. Professional maintenance care was administered twice a week for 2 months and the patient was instructed to maintain a liquid diet for 4 weeks. The treatment outcome was evaluated clinically and radiographically at regular intervals for 5 years postsurgically. Periodontal conditions were stable and fulfilled the patient's desire to eliminate the pockets without compromising esthetics, particularly in the maxillary anterior. (Int J Periodontics Restorative Dent 2006;26:425–431.)

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Periodontal regeneration refers to the restoration of bone, cementum, and periodontal ligaments to their original states before damage from periodontal disease occurs. A complex series of biologic events, which includes cell mitogenesis, chemotaxis, adhesion, and differentiation of the periodontal tissues, is believed to be important in the regeneration of the periodontium. Therefore, surgical techniques that combine the benefits of agents directed at each of the periodontal tissues to be regenerated are likely to provide the most favorable outcome.

Enamel matrix proteins (EMPs) are thought to be important in the development of dental tissues, including the formation of cementum, periodontal ligaments, and alveolar bone.[1] EMPs enhance proliferation of and protein production by human periodontal ligament cells in vitro.[2] They have been used for periodontal regeneration in animals[3] and humans.[4] Reports of patient studies have shown that periodontal regeneration is achieved with EMPs at the histologic level.[5,6] In clinical trials, EMPs were found to be effective when used as an adjunct to surgical

Fig 1 *Condition at baseline. The patient came for treatment wishing to preserve her esthetic appearance as much as possible through periodontal treatment and to keep her teeth for the rest of her life.*

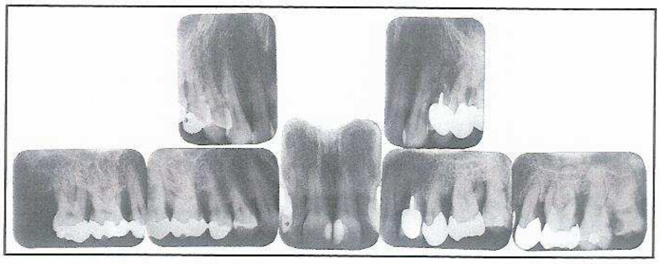


Fig 2 *Pretreatment radiographs (1998). Note the severity of infrabony and supracrestal atrophy (both anteriorly and distally).*

management of infrabony and furcation defects.[7,8]

Whereas the use of EMPs is a novel concept in periodontal regeneration, bone grafting is a well-established technique. The positive effects of bone grafts and bone substitutes on the outcome of periodontal regenerative procedures are well documented.[9] Bovine porous bone mineral (BPBM) is a xenograft that has been shown to enhance the results of oral surgery and periodontal regenerative procedures. The material is prepared by protein extraction from bovine bone, which yields a porous structure similar to human cancellous bone and enhances bone formation. Bone formation with BPBM has been documented in sinus lift procedures[10,11] and around endosseous implants.[12] Hutchens[13] found that BPBM effectively helped to reduce probing depths and improve attachment levels. Camelo[14] reported complete periodontal regeneration in humans with a bilayer collagen membrane combined with BPBM.

The combination of bone grafting materials and EMPs to promote wound healing is thought to produce a synergistic effect,[15–18] because of its application of two distinct wound healing principles together in one clinical situation. Whereas grafting materials are osteoconductive and/or osteoinductive and serve as space makers, EMPs work at the periodontal ligament level to promote the formation of new cementum and the development of a new functional unit.

This case report describes the use of EMPs in combination with a BPBM with or without a resorbable membrane in an attempt at supracrestal augmentation to regenerate alveolar bone lost as a result of periodontitis. Although the chances of new bone formation supracrestally are generally poor, experience in the past has shown that organized filler material halts the progress of periodontitis when combined with good oral hygiene. This helps to achieve what is most important for the patients—ie, to avoid compromise of esthetics, particularly in the anterior maxilla.

Method and materials

The patient, a 46-year-old woman, presented with generalized severe chronic periodontitis (Figs 1 and 2). She was otherwise healthy, with no contraindications to periodontal therapy, and did not smoke. Probing depths and clinical attachment levels were measured. Initial therapy consisted of oral hygiene instructions. Scaling and root planing were performed, and systemic antibiotics (amoxicillin + clavulanic acid, 1 g

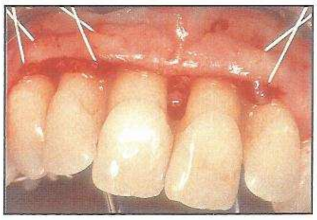
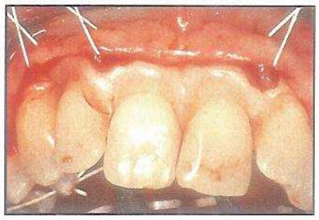


Fig 3 (left) *To provide adequate access, Gore-Tex sutures were tied to the cheek retractor to keep the surgical area free of mucosa. EDTA was applied.*

Fig 4 (right) *Emdogain is applied.*



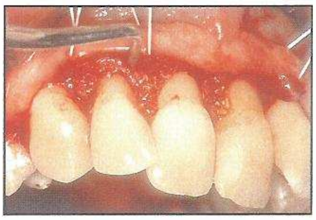
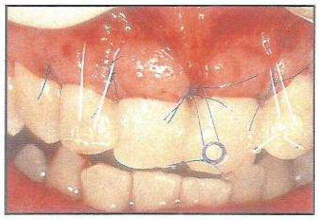


Fig 5 (left) *The bone lost infracrestally and supracrestally is replaced with BPBM (Bio-Oss). Anteriorly, a BPBM graft is covered with a PerioGuide membrane.*

Fig 6 (right) *To compensate for postoperative shrinkage, the buccal end of the flap is advanced coronally and secured with suspensory sutures.*



twice daily; Augmentin, GlaxoSmithKline) were prescribed.[19] To preserve the level and quality of the gingival margin, open flap surgery was begun along the premolars and molars 5 days after scaling and root planing. To control mobility and promote stabilization, the anterior and left maxilla were splinted extracoronally with a methyl methacrylate monomer (Super C Ortho Composite Liquid, AMCO).

Surgical procedure

Surgery was performed first around the posterior teeth. After local anesthesia was achieved with lidocaine hydrochloride (Neoxylestesin Forte, 3M ESPE), the modified[20] and the simplified[21] papilla preservation flaps were used and mucoperiosteal flaps were elevated. The root surfaces were first treated with Emdogain (Straumann) following the manufacturer's instructions. The missing bone was reconstructed subcrestally and supracrestally with BPBM (Bio-Oss, Osteohealth). The site was closed with horizontal mattress sutures and interdental sutures (Gore-Tex P5K17, W. L. Gore).

After 6 weeks, the operated sites had healed well. Therefore, at this time supracrestal augmentation was performed in the anterior maxilla. An access flap was raised with the modified papilla preservation technique. After Ethylenediaminetetraacetic acid (EDTA) and EMPs were applied (Figs 3 and 4), the missing infrabony and supracrestal bone in the region between the right canine and the left lateral incisor was packed with BPBM buccally, lingually, and interdentally (Fig 5) and covered with a bioresorbable membrane (PerioGuide, Geistlich Pharma) as described by Kotschy and Muenzker.[22] This technique was used to vertically augment the entire area of horizontal bone loss in the anterior maxilla. A horizontal periosteal incision was made, and the mucoperiosteal flap was placed coronally with suspensory sutures on the right lateral incisor and both left incisors (Prolene EH7472, Ethicon and Gore-Tex P5K17, W. L. Gore) (Fig 6).

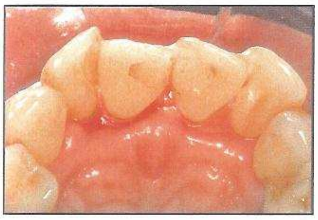


Fig 7 *Flap closure along the right incisors is suboptimal palatally, leaving the collagenous PerioGuide membrane exposed.*

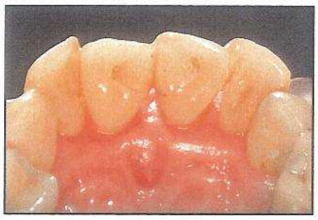


Fig 8 *By 4 months, the mucosa had healed uneventfully.*

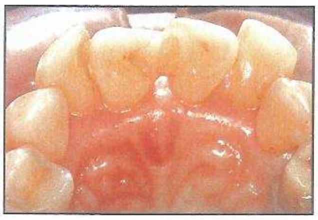


Fig 9 *Clinical situation 2 years later. Note the absence of any tissue loss despite the exposure of the collagen membrane for several weeks.*

Postsurgical care

To minimize trauma to the marginal tissues, the patient was instructed to avoid mechanical oral hygiene at the operated site for at least 4 weeks and advised to apply chlorhexidine gel (Dentsply/DeTrey) twice a day. Antibiotics were not administered after surgery. The patient was advised to maintain a liquid diet for 4 weeks to prevent trauma to the healing tissues. The supportive care program included professional supragingival polishing and scaling and oral hygiene reinforcement twice a week for 2 months. Periodontal probing and/or subgingival re-instrumentation of the surgically treated sites were avoided to allow for undisturbed healing for 6 months.

Primary wound closure occurred around all teeth except on the palatal aspect of both right incisors (Fig 7). Although the membrane had been exposed for approximately 3 months at this site, the clinical outcome was the same as in the regions that healed primarily (Figs 8 and 9).

Clinical assessment

Clinical data were recorded immediately before surgery (baseline) and at 1, 2, 3, 4, and 5 years postsurgery. These included:

- Probing pocket depth, measured from the gingival margin to the tip of the probe.
- Clinical attachment level, measured from the cementoenamel junction to the bottom of the pocket.
- Full-mouth bleeding scores; sites that bled within 60 seconds after probe insertion were rated as positive.

Measurements were taken at eight points on every tooth.

Radiographs

Radiographs (right-angle views using Eggen templates) were obtained at baseline (immediately before surgery) (see Fig 2) and at regular intervals for 5 years postsurgery.

Results

Probing depths in the maxilla averaged 4.46 mm at baseline and 2.55 mm after 5 years (Fig 10). This is equivalent to a reduction of 1.91 mm over 5 years. Clinical attachment levels in the maxilla averaged 5.48 mm at baseline versus 3.20 mm after 5 years. This represents a mean gain of 2.28 mm.

Radiographs showed that the original natural anatomy of the alveolar bone had been restored following the grafting procedure. The graft remained stable at 5 years after surgery (Figs 11 and 12).

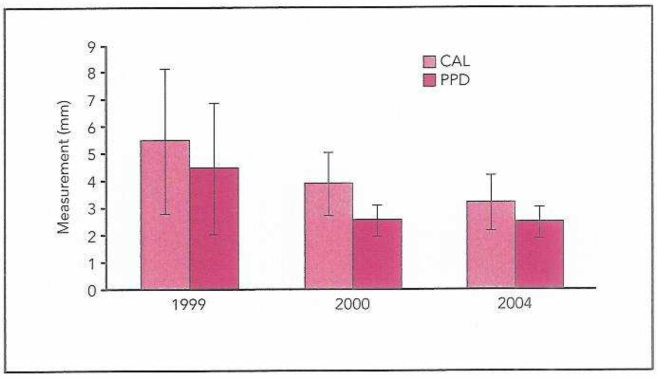


Fig 10 *Mean pocket depths and clinical attachment levels. 1999 = baseline, immediately after surgery; 2000 = 1-year postsurgical examination; 2004 = 5-year postsurgical examination.*

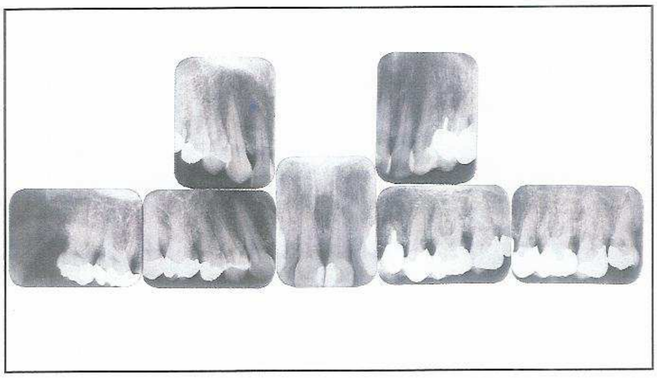


Fig 11 *Immediate postoperative radiographs. The natural original anatomy of the alveolar bone was restored with BPBM (Bio-Oss).*

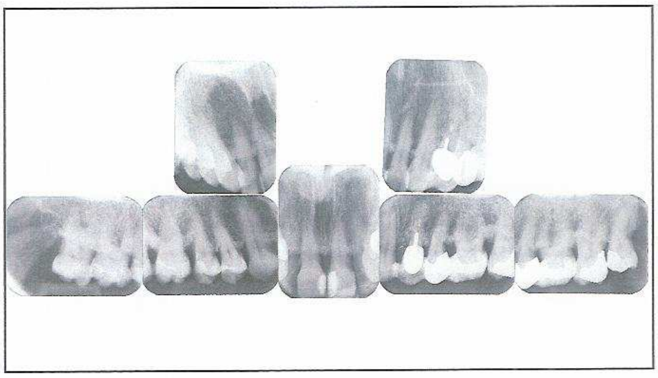


Fig 12 *Radiographs obtained 5 years after conservative and surgical periodontal treatment. The BPBM graft is stable, albeit somewhat sintered. All structures are normal, with no signs of irritation or inflammation.*

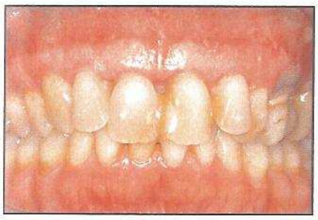


Fig 13 *Clinical situation 5 years posttreatment. The patient's desire to preserve esthetics while eliminating the pockets was fulfilled. The outcome is stable and the structures are normal, without any signs of irritation or inflammation.*

Fig 14 *Detail of anterior maxilla.*

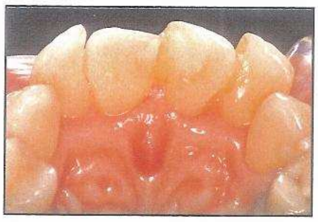


Fig 15 *Palatal view of anterior maxilla. Note normal-looking tissue, which shows no signs of irritation or inflammation around the right incisors and matches the tissue quality around the left incisors.*

Discussion

This case report illustrates that bone grafting with BPBM with or without a bioresorbable membrane in combination with EMPs can significantly improve clinical attachment levels and help to augment supracrestal bone.

Reduction of pocket depths is critical in the clinical success of periodontal regenerative procedures. Although reductions in the pocket depth are not equivalent to successful regeneration, postoperative pocket depth has a direct impact on the maintenance of the site treated, because effective maintenance requires shallow sulci. In the present case, the mean pocket depth was reduced to less than 3 mm.

Clinical attachment gain is an important sign of periodontal regeneration and, therefore, a desirable outcome of reconstructive periodontal surgery. The clinical attachment gain in the present case was 2.43 mm after 5 years. The nature of the apical stop of the probe is unclear: Regeneration of the periodontal ligament or a long epithelial junction with the organized BPBM are potential factors, along with many others. However, this is of no interest to the patient whatsoever, and extraction of a tooth solely for histologic evaluation is ethically unjustifiable.

Caution should be exercised when interpreting the significance of postoperative pocket depth and attachment level measurements. Pocket depths and clinical attachment levels are evaluated by inserting a periodontal probe into a sulcus or pocket. Probe penetration into a pocket is determined by several factors, including probing force, probe diameter, and gingival tone. To exclude the potential impact of probing force as much as possible, probing was always done by the same dental hygienist. Whereas an improvement in clinical variables may reflect a gain in attachment, it should be remembered that grafting may modify gingival tissue consistency and therefore impede probe penetration without necessarily producing a gain in tissue attachment. However, a gain in supracrestal material that appears to be bone (unverified because of lack of patient consent to a probe excision) can be confirmed on radiographs.

Admittedly, this case report has limitations, because it does not provide any clues about the histologic characteristics of the newly formed tissues and the nature of the attachment between the newly formed bone and the previously diseased root surface. It has been shown that attachment can potentially be gained with either EMPs[5,6] or with BPBM and a collagen membrane,[14] but the predictability of this outcome is still uncertain.

To the authors' knowledge, there is no evidence in the literature of attempts at regenerating lost bone supracrestally. Those reports that are available invariably deal with infrabony defects. After gathering all the data accumulated in previous decades on regeneration of bone in infrabony defects, the authors decided with the patient's consent to attempt a combination of infrabony and suprabony reconstruction. The clinical outcome after 5 years justified the effort (Figs 13 to 15).

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