The Association of Guided Bone Regeneration and Enamel Matrix Derivative for Suprabony Reconstruction in the Esthetic Area: A Case Report

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This case report presents the correction of severe alveolar ridge atrophy due to congenital and iatrogenic factors. Implants that compromised the natural adjacent teeth and overall esthetics for this young patient were removed and replaced after significant vertical bone and soft tissue regenerative procedures. A treatment combination of bone graft particles, a nonresorbable membrane, and enamel matrix derivatives was used. Significant and stable improvement in esthetics was achieved 12 months after final prosthetic restoration, demonstrating the ability of such a combined treatment to correct the esthetic deformity, improve the health of the adjacent natural teeth, and allow for successful implant treatment. (Int J Periodontics Restorative Dent 2015;35:767–772. doi: 10.11607/prd.2297)
achieved up to the bone peak adjacent to the defect (the so-called infrabony component). No predictable treatment for suprabony tooth attachment loss has been documented.

Enamel matrix derivatives (EMD) are well-known for their ability to induce periodontal regeneration. Infrabony periodontal defects, anatomical situations where bony walls and tooth surface have by themselves a space-maintaining feature, can be successfully treated by means of EMD alone or in conjunction with a bone grafting material.

The goal of the combination of V-GBR technique, with its space maintaining and wound stability characteristics, and the regenerative potential of EMD is to achieve suprabony periodontal regeneration together with vertical bone regeneration over the osseous peaks (ie, clinical and esthetic results that are not achievable with standard therapies).

The purpose of this case report is to present the combination of EMD and V-GBR to treat an esthetically demanding clinical situation where supracrestal bone and periodontal regeneration were key factors for a successful therapy.

Case presentation

A healthy 24-year-old female patient who was congenitally missing the maxillary lateral incisors had previously completed orthodontic and implant therapy. The patient presented with significant esthetic concerns due to iatrogenic loss of papilla combined with the ridge defects present prior to previous implant placement. Severe recession was observed, in particular on teeth 11 and 13, as was disrupted soft tissue architecture (Fig 1a). A complex treatment plan was developed to address the problems associated with these malpositioned implants and the lack of adequate bone and soft tissue.

It was explained to the patient that the severe periodontal attachment loss affecting the adjacent teeth on the right side could jeopardize the final esthetic results of the vertical bone augmentation procedure at site 12. One prospective solution was the extraction of teeth 11 and 13 and the reconstruction of the residual ridge. Considering the young age of the patient and the healthy condition of the teeth, the most conservative approach was desirable.

The first step was the fixture removal at the sites of teeth 12 and 22. A flapless surgery using an implant retrieval tool (Nobel Biocare) was performed under local anesthesia (articaine 40 mg/ml with adrenaline 1:100,000 [Pierrel]). After 4 weeks, the severe soft and hard tissue loss was evident at the right healed site (Figs 1b and 1c) and was confirmed by a cone beam computed tomography scan (Fig 2).

Six months after implant removal, the vertical bone augmentation was first performed on the right side; the left side was operated on 4 weeks later. In both surgeries, the patient was sedated by an anaesthesiologist with diazepam (intravenous infusion, 10 mg, every 45 min) and antibiotic prophylaxis with amoxicillin (per os/1000 mg/1 hour before surgery) and local anesthesia were administered.

A midcrestal incision was made in the edentulous area and continued intrasurally to the adjacent proximal teeth. Two vertical buccal incisions were made and a full thickness flap was elevated. The dental roots were carefully scaled and planed, and the bone surface was curetted to remove all residual

Fig 1 (a) Baseline intraoral examination showing implant at site 12 with severe soft tissue recession on adjacent teeth. (b) Vestibular and (c) occlusal views of the clinical aspect 4 weeks after implant removal at site 12.
soft tissue and perforated with a tungsten round bur to expose the medullary spaces to provide blood for bone regeneration (Fig 3). A tenting screw (Screw Maxi 1.5 × 11 mm, Omnia) was positioned on top of the ridge and left to protrude out of the bone surface in a way that the anticipated bone height resulted at the original level of the bone peaks of the adjacent teeth (Fig 4a). A reinforced e-PTFE membrane (Gore-Tex Regenerative titanium reinforced TR6Y membrane, W.L. Gore & Associates) was properly shaped and fixed by two pins (Frios, Dentsply) to the palatal bone wall (Fig 4b). EMDs (Emdogain 0.15 ml, Straumann) were applied on exposed root surfaces after conditioning them with ethylenediaminetetraacetic acid (EDTA) for 2 minutes. Autogenous bone harvested with a disposable cortical bone collector (Safescraper, Meta) from the maxillary bone surface apical to the defect and deproteinized bovine bone mineral (Bio-Oss, Geistlich) were used in a 3:1 ratio as grafting material to fill the defect in both horizontal and vertical dimensions (Fig 4b). The membrane was then fixed with two bone-fixation pins on the buccal bony wall, covering and stabilizing the grafting material. A minimum distance of 1 mm was left between the membrane borders and the adjacent roots (Fig 5a). A single periosteal incision was made at the base of the buccal flap to ensure a tension-free primary wound closure. Before suturing, a connective tissue graft harvested from the palate was positioned at the top of the reconstructed ridge (Fig 5b). Internal mattress and interrupted e-PTFE sutures were used to achieve soft tissue closure. A luted resin-bonded prosthesis was placed as provisional restoration, with a minimum distance of 2 mm between the pontic and the mucosa. Additional
medications delivered intravenously included: ketorolac 10 mg, tramadol 50 mg, metoclopramide 10 mg, and dexamethasone 8 mg. Prescribed postoperative care included 6 days of antibiotic therapy with amoxicillin (per os/1000 mg/bds) and 14 days of local antiseptic therapy with chlorhexidine 0.20% (oral rinse/tds).

After 6 months of healing, regenerated sites maintained closure over the membrane with harmonic hard and soft tissue architecture (Figs 6a and 6b). To avoid tissue contraction, a submarginal approach was selected for membrane removal, in a way that would preserve as much of the regenerated marginal periodontal tissues as possible. Two horizontal incisions in the vestibular fornix and two on the palatal mucosa were made at the height of the fixation pins inserted during the augmentation surgeries. Pins were identified and removed; the membrane was mobilized at both sides and pulled out through the vestibular incision. An opeculectomy was made in the crestal area of teeth 12 and 22, and the tenting screws were removed. The papillae mesial to the canine and distal to the central incisor were not elevated or disturbed. A connective tissue graft, harvested from the palate, was then inserted through the same submucosal tunnel created to remove the nonresorbable membrane and fixed at the crestal area by a resorbable suture (Fig 7). RhPDGF-BB was injected under the mucosa, and the horizontal incisions were sutured with continuous sutures.

At suture removal we could appreciate no change in soft tissue in terms of volume or recession.

Four weeks after membrane removal, two machined implants (iMAXpro, iRES) were placed using a flapless one-stage technique. (Again, keeping the marginal periodontal tissue intact during surgery was a key factor.) Bone was classified by the surgeon as type 4 following Cawood and Howell classification. Implant primary stability was obtained through an insertion torque of 40 Ncm at both sides and confirmed by an implant stability quotient (ISQ) measurement of 69 for the right implant and 67 for the left.

The prosthetic loading took place 4 months after implant placement. The definitive zirconia crown was inserted 8 months later (Figs 8a and 8b).
Clinical and radiographic aspects of site 12 at the 12-month follow-up are presented in Fig 10.

**Discussion**

In this case report, a patient affected by severely atrophic partially edentulous ridge in the esthetic zone was treated. Loss of attachment at adjacent teeth was evident at the initial phase. Given the young age of the patient, the first priority was to be as conservative as possible. Teeth 11 and 13 were kept, and a V-GBR was performed despite the absence of mesial and distal bone peaks, which are considered essential factors for predictable results. A combination of regenerative procedures was selected to maximize the regenerative potential of the defective site. Tenting screws and titanium-reinforced dense polytetrafluoroethylene (d-PTFE) membrane were used as space-making devices. This membrane has been recently tested in V-GBR procedures with successful results.12,13

Bone volume reconstruction and supraborony periodontal regeneration were performed at the same time. Bone volume reconstruction and supraborony periodontal regeneration were performed at the same time.

Periosteal incision of the buccal flap and a connective tissue graft allowed primary intention wound closure, protecting the underlying regenerative process. No exposure during the healing period was observed.

When the nonresorbable membrane and the tenting screw needed to be removed, a submarginal approach, RhPDGF-BB infusion, and a subepithelial connective tissue graft procedure were performed all together to enhance soft tissue healing and maximize the volume stability in the regenerated sites.15,16

After 1 year of follow-up, the radiographic examination showed good hard tissue stability. At clinical examination, harmonic soft tissue architecture surrounded both the
implant-supported restoration and the adjacent teeth.

Case reports surely have limitations in demonstrating technique predictability, but they can provide a proof of concept for further investigation. This article reports on how the combination of two principles in periodontal and bone regeneration can lead to esthetic and clinical results that are normally not considered a goal of our therapies. Further investigation should be done to assess the predictability of such a regenerative procedure in achieving satisfactory esthetic rehabilitation.

Another limitation of this study is the unknown quality of the regenerated tissue adjacent to the root surfaces. Because of the clinical efficacy of the first surgery, no more flaps were elevated; hence, the histological presence of new periodontal ligament is questionable.

Conclusions

V-GBR for the treatment of atrophic alveolar ridge is still a therapeutic option that only a small number of clinicians feel comfortable proposing to their patients. A combination of regenerative procedures such as that performed in the present study can be used in less demanding situations to achieve predictable results in a higher percentage of cases. Further studies are recommended to better understand the potential and limitations of this new approach.

Acknowledgments

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References