

Guided Tissue Regeneration in Severe Periodontal Defects in Anterior Teeth.

Case Reports

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FOUR CONSECUTIVE CHRONIC, SEVERE PERIODONTAL BONE DEFECTS in anterior teeth were treated by guided tissue regeneration, using a polytetrafluoroethylene periodontal membrane. The root surface was not specifically conditioned, and osseous grafts were not used. However the membrane was manipulated so that space under it was maintained. This was accomplished by painting the outer surface of the membrane with butyl-cyanoacrylate, so that it became rigid. The membranes were removed after 4 weeks and a bone-like tissue was found in all cases. The clinical results suggest that there was a relationship between the amount and quality of the new tissue and the volumetric characteristics of the available space. *J Periodontol* 1995; 66:295-300.

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Some years after publication of the Nyman et al. article¹ describing the formation of a new periodontal attachment following the use of a Millipore membrane, guided tissue regeneration (GTR) appears to be an effective method of treatment of selected periodontal defects.² Furthermore, the biological principles on which GTR are based³ have made its use possible in dental implants^{4,5} and also as a method to increase or preserve the bone in edentulous areas of both maxilla.⁶ To achieve these results, enough space must be created and maintained between the membrane and the zone from which the new tissue originates. However, the membranes presently used in GTR procedures are soft and, depending on defect morphology, are prone to collapse once the surgical flap has been positioned and sutured, even when the flap is not under undue tension. To obviate this problem, different filling materials, like hydroxyapatite, have been utilized as space-keepers; however, some authors do not believe it is desirable to use foreign materials in GTR procedures.⁷ With the same concept of creating and maintaining space in mind, other authors have proposed different suturing techniques, so that the membrane has a tent-like shape.⁸

In other cases, the membrane is maintained in the desired position and shape with the aid of screws fixed to the bone.⁶ In this article, four consecutive cases of periodontal defects in anterior teeth are presented. They were treated with GTR

using a technique that apparently facilitates the maintenance of adequate space between the membrane and the underlying tissues.

CASE 1

A 12-year-old girl was sent to the periodontist because of the extreme mobility and progressive extrusion of the upper central incisors. The condition occurred shortly after the placement of two elastics at the gingival level, placed in an attempt to close a central diastema. At the time of the first periodontal examination, the elastics could not be found; however they were then located and removed from intrabony defects after a muco-periosteal flap was raised (Fig. 1). The affected teeth were not scaled and the flap was replaced and sutured. Five weeks after surgery, orthodontic treatment was initiated, in order to intrude both incisors and establish a functional occlusion.

Four months later, a passive maxillary vestibular arch was placed, and 3 months later a flap was again elevated. It was then observed that the cortical bone level had not changed, but the previous intrabony defect had disappeared, and a horizontal defect was now present at the level of the facial aspect of both incisors. Then, an expanded polytetrafluoroethylene periodontal membrane[†] was placed covering both teeth, and sutured (Fig. 2). Due to the width the surface and the convexity of the exposed roots, the membrane was in closed contact with the roots. To avoid closed contact, and in order to create enough space between the

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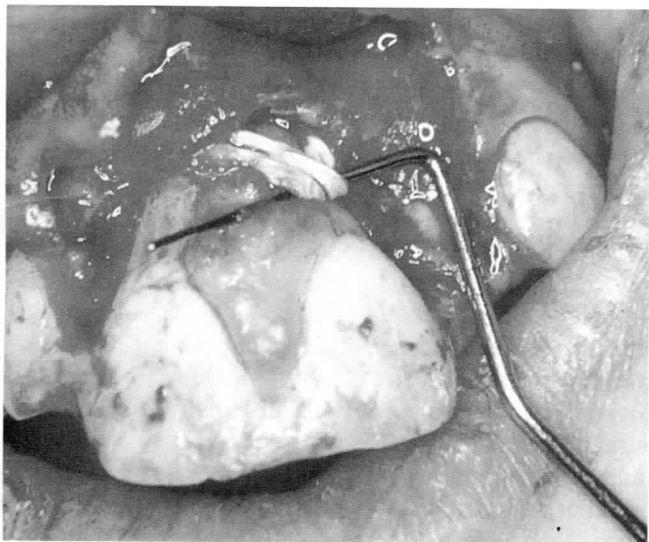


Figure 1. Two orthodontic elastics are being removed, still partially hidden into the intrabony lesion.

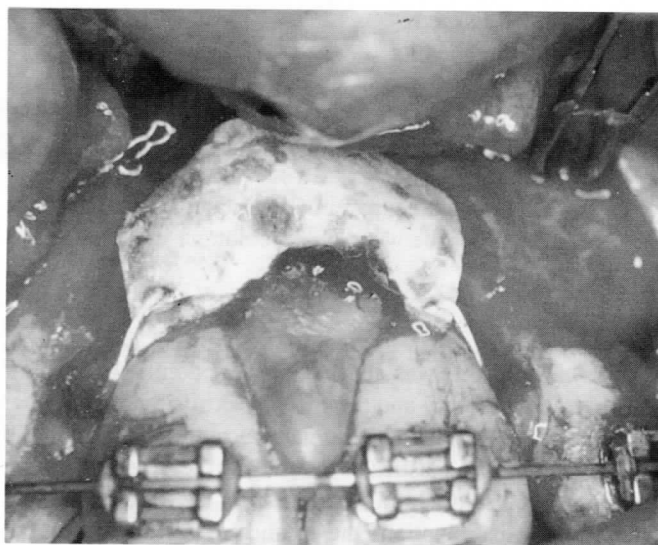


Figure 2. A membrane in place, after being sutured and treated with histoacryl. The convexity of the membrane is apparent.

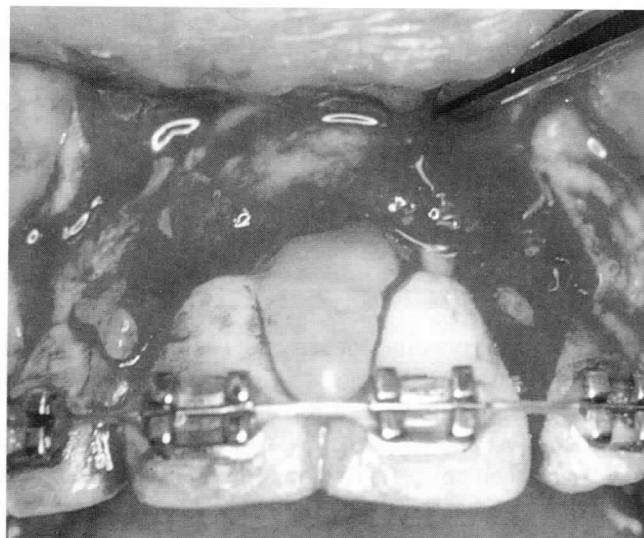


Figure 3. After 4 weeks, the membrane has been removed, and the new, hard tissue now covers the previously denuded root surface.

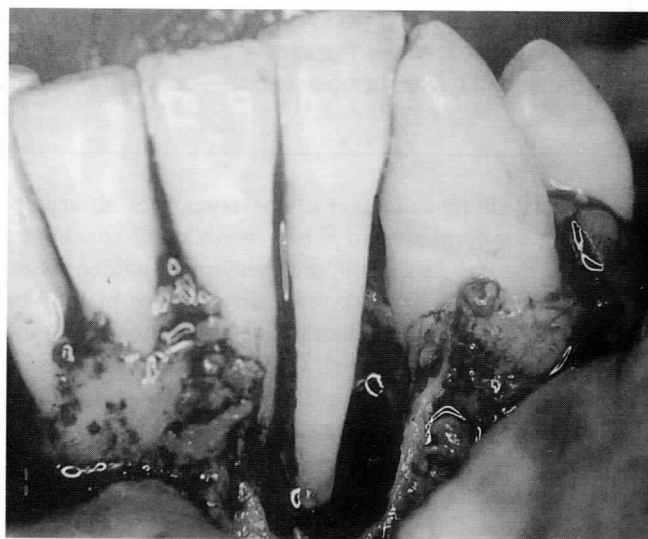


Figure 4. Chronic, deep periodontal defect in tooth #23.

membrane and the root surfaces, a small piece of gauze soaked in saline was placed under the membrane, the membrane itself was given a certain convexity, and finally its outer surface was painted with butyl-cyanoacrylate.[‡] Two minutes later the material was hard enough to allow the removal of the gauze, while the membrane remained firm and stable. The flap was then replaced, the patient was instructed to rinse twice daily with a 0.12% solution of chlorhexidine, and was placed under antibiotic therapy for the next 3 weeks. Four weeks after surgery, a new flap was reflected, and considerable effort was necessary to remove the membrane. The tissue which appeared immediately beneath was hard, and covered almost completely the previ-

ously exposed root surfaces (Fig. 3). The flap was replaced, and the sutures removed one week later.

CASE 2

A 46-year-old woman presented with advanced periodontitis. Comprehensive periodontal treatment was initiated, including oral hygiene instruction and scaling and root planing every other week for the next 4 months. Probing revealed the persistence of a deep, active lesion at the level of tooth #23, which had been treated for endo-pulpal involvement 5 months earlier. As a consequence, periodontal surgery was scheduled. Under local anesthesia, a mucoperiosteal flap was raised, the area debrided, and the root surface carefully scaled and planed (Fig. 4). A membrane was then placed and treated as reported in Case 1. Antibiotics and chlorhexidine were used as above, and the membrane

[‡]Histoacryl, B. Braun, Mesulgen AG, Germany.



Figure 5. After the removal of the membrane new bone-like tissue is quite apparent.

was removed 4 weeks later. It was then observed that new tissue was covering most of the area previously without bone, and that this new tissue appeared very similar to the bone adjacent to the previous defect (Fig. 5).

CASE 3

A 48-year-old woman was treated in 1983 because of advanced periodontal disease. The treatment included careful scaling and root planing and repeated oral hygiene instructions.

Four months later, periodontal surgery was carried out in two quadrants of the mouth. After healing, the patient was placed in supportive periodontal treatment every 4 months. In tooth #11, a 10 mm pocket remained with occasional episodes of activity but without significant additional loss of attachment. However, due to the persistence of the defect, it was decided to open a flap. The inflammatory tissue was carefully debrided, and the tooth surface scaled and planed (Fig. 6). Due to the extension of the lesion, two membranes[‡] were placed and the same procedure described above was performed (Fig. 7). Four weeks later, both membranes were removed, and again, a hard tissue was covering most of the previously denuded area (Fig. 8).

CASE 4

A 35-year-old man was treated in 1988 because of rapidly progressive periodontitis. The patient received several episodes of scaling and root planing. Five months later, periodontal surgery was performed in two localized areas, and thereafter the patient was placed on a 3-month recall for supportive periodontal treatment. In the course of the next three years, the patient had two episodes of periodontal activity controlled with minocycline, but activity and deep pockets persisted in tooth #6, which was used as an abutment for a bridge with obvious overhangs. Consequently,

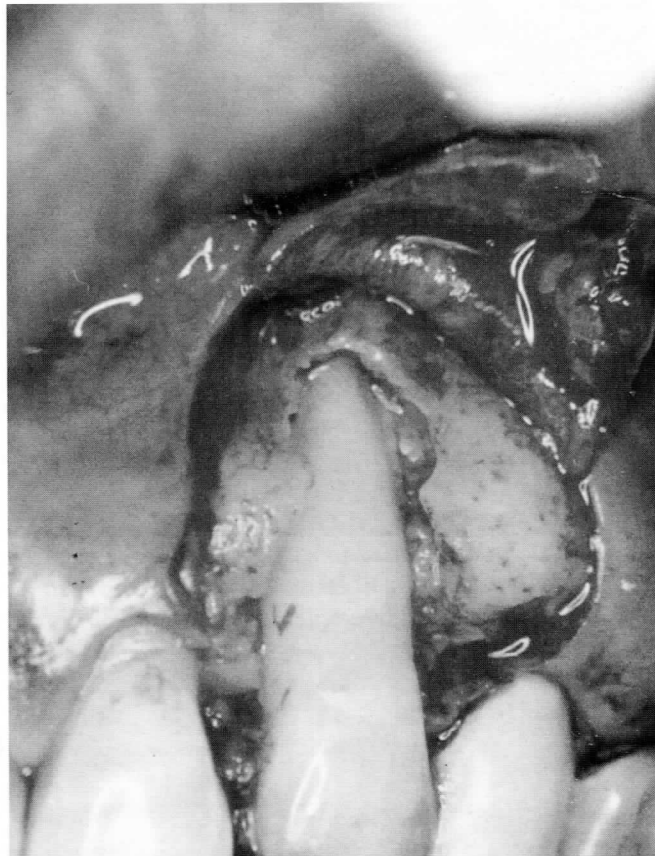


Figure 6. Clinical view of tooth #11 after debridement and root instrumentation.



Figure 7. Membranes covering the defect, after being sutured and the external surface painted with histoacryl.

a flap was raised, the granulation tissue debrided and the root surface adequately scaled and planed (Fig. 9). A membrane was then placed, sutured and treated on its outer surface with Histoacryl.

Finally, the flap was replaced to completely cover the membrane. Antibiotics and chlorhexidine were used as with



Figure 8. The new tissue now covers a significant proportion of the previously denuded root surface.



Figure 10. Four weeks later, the membrane is removed and the new tissue covers most of the previously denuded area, including the interproximal spaces.



Figure 9. Very severe periodontal defect around tooth #6, immediately before placement of a membrane.

previous cases and flap sutures were removed after one week. Three weeks later, a vestibular flap was elevated and the membrane, firmly anchored to the underlying tissue, was removed. New, hard tissue was found covering part of the previously exposed root surface, but also the interproximal spaces mesial and distal to that tooth (Fig. 10). The

flap was then replaced and sutured, and the sutures were removed one week later. After 6 months the bridge was removed and a new one with correct margins was placed.

DISCUSSION

Regeneration of the periodontium is the ultimate and ideal goal of periodontal treatment and has been the subject of much research in the last decade. This has been in part the result of pioneering work by Melcher,⁹ Nyman,¹⁰ and others showing that cells of the periodontal ligament may induce the formation of a new attachment on previously diseased root surfaces.

GTR has gained much popularity among the techniques which have been reported as effective in obtaining periodontal regeneration, based on its biological principles, scientific evidence, and clinical predictability when used with appropriate case selection.⁶

It is generally accepted that GTR procedures are technically sensitive and, as a consequence, every attempt must be made in order to assure adherence to all procedural guidelines. Of paramount importance is the fact, stressed by most authors, that the membrane must create and maintain a space between the root surface and the membrane itself. Otherwise, the cells from the periodontal ligament will not be physically able to differentiate and repopulate the affected root surface. The membranes used in GTR procedures are somewhat flexible. Therefore, they tend to collapse in those places where defect morphology cannot support the membrane once the soft tissue flap has been replaced and sutured. To avoid this situation, different procedures have been used to create and maintain enough space under the membrane.⁵⁻⁸ As an alternative to these techniques, but with the same goal in mind, we painted the external surface of the membrane with butyl-cyanoacrylate in order to enhance the space-making characteristics of the

ePTFE membranes. Butyl-cyanoacrylate is a biologically acceptable chemical adhesive which has been used in dentistry for a variety of treatment^{12,13} and forms a firm, hard pellicle which adheres to the surfaces to which it has been applied.

In the clinical cases here reported, the use of cyanoacrylate was justified for different reasons: 1) the need to create space; 2) to prevent membrane collapse; and 3) the facility of its use. The encouraging clinical results obtained in all these cases deserve some additional consideration. The use of cyanoacrylate on the outer surface of the membrane did not seem to harm the inner surface of the flap in close contact with it. Furthermore, when one of the membranes was studied microscopically after its removal, only remnants of butyl-cyanoacrylate could be found, suggesting that the material had been almost completely reabsorbed.

On the other hand, butyl-cyanoacrylate did not seem to interfere with the biological events taking place under the membrane. On the contrary, these events occurred without complication and, in all 4 cases, the space created during the surgical procedure was adequately maintained. Furthermore, the amount and quality of the new tissue observed after membrane removal differ from what is usually seen in GTR procedures. A soft, red tissue is observed in most of these cases, whereas in the cases here presented the new tissues have a more mature aspect, resembling the surrounding bone. This happened in all cases, in a very consistent pattern.

One can speculate that the stronger consistency of the membrane after the use of cyanoacrylate could have helped the healing process by assuring the stabilization of the wound, which seems to be of great importance in regenerative procedures.¹⁴

Some authors have presented evidence showing that the use of membranes in GTR procedures is more effective, in terms of quantity of new tissue present, when grafts of different nature are placed to fill the space between the membrane and the tooth surface. The growth of bone will be enhanced by use of such an approach.¹⁵ This could well be the situation, but it also can be speculated, based on the clinical evidence shown in this series of cases, that the amount and quality of the new tissue which grows under the membrane relates more to the amount of space available, rather than to the material placed below.¹⁶

In all the cases here presented, surgical procedures were performed in non-inflamed gingival tissues. This approach differs from what is usually advised in GTR procedures; e.g., that only initial scaling and planing should be performed prior to the regenerative procedure.¹⁷ Recent research, however, has shown that complete anti-infective therapy significantly improves the results of regenerative procedures.¹⁸

It has also been shown that when using membranes in regenerative therapy, a generous flap with periosteal incision at the base should be used.¹⁹ This also facilitates the placement of the flap in a more coronal position than it was

before surgery. This, and the lack of gingival inflammation at the time of the surgery may account for the relatively small degree of gingival recession found in these cases.

In order to keep the area as free from bacterial contamination as possible, the postoperative protocol in all these cases included the use of antibiotics for 3 weeks; i.e., amoxicillin during the first week after surgery and minocycline for the next 2 weeks, since there are indications suggesting that tetracyclines may increase collagen synthesis in osteoblasts.²⁰

A 0.12% chlorhexidine rinse was used for one week prior to membrane placement up to one week after its removal. This was done to keep the oral cavity as germ-free as possible and to minimize the chances of infection.

It should be emphasized that the cases shown here do not constitute a controlled study. As a consequence it is only possible to speculate on the true nature of the new tissue found. However, from a clinical standpoint and given its macroscopic characteristics, it is quite reasonable that the membranes, in fact, facilitated the re-formation of a new cortical plate in these severe periodontal defects. In the treatment of such defects, the butyl-cyanoacrylate simply maintained the convexity of the membrane, preventing its collapse, so that enough space for cell repopulation was easily obtained and maintained. Although controlled studies on this matter are needed, the clinical results obtained in these cases and also by other authors, suggest that most likely what could be called "the critical growing space" is a key factor in GTR techniques. If this is so, membranes which could be shaped *in situ* and hold their shape show promise.

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