Periodontal Regenerative Therapy with Enamel Matrix Derivative and Autogenous Bone Graft in Patient with Chronic Periodontitis: An 18-month Follow-up Report

Kouki Yoshikawa, Atsushi Saito and Sachiyo Tomita

Department of Periodontology, Tokyo Dental College, 2-9-18 Kanda-Misakicho, Chiyoda-ku, Tokyo 101-0061, Japan

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Abstract

We report a case of generalized chronic periodontitis requiring periodontal treatment including regenerative therapy. The patient was a 57-year-old man who presented with the chief complaint of gingival swelling and mobile teeth in the right maxillary molar region. An initial examination revealed 55.3% of sites with a probing depth of ≥4 mm and 24.0% with bleeding on probing. Radiographic examination revealed vertical bone resorption in teeth #16, 17, 25, 26, 37, and 45; horizontal resorption was also noted in other areas. Based on a clinical diagnosis of severe chronic periodontitis, initial periodontal therapy consisting of plaque control, scaling and root planing, and caries treatment was performed. Both #16 and 17 were extracted due to bone resorption extending as far as the root apex. A removable partial denture was placed for #16 and 17, and a provisional restoration for #25 and 26. Surgical periodontal therapy was subsequently performed at selected sites. Periodontal regenerative therapy using enamel matrix derivative (EMD) with autogenous bone graft (ABG) was performed on #25 and 26. Other sites with residual periodontal pockets (#31, 32, 33, 36, 37, and 41) were treated by open flap debridement. Following reevaluation, full metal crowns (#25 and 26) and the removable partial denture were placed for #16, 17, 46, and 47. After further reevaluation, the patient was placed on supportive periodontal therapy (SPT). Periodontal regenerative therapy using EMD with ABG resulted in improvement in vertical bone resorption. This improvement has been adequately maintained over an 18-month period. The patient has continued to have some minor problems in occlusal contact and guidance following active therapy, however. Therefore, additional care will be necessary to maintain stable periodontal conditions during SPT.

Key words: Chronic periodontitis — Intrabony defects — Periodontal regenerative therapy — Enamel matrix derivative — Supportive periodontal therapy
Introduction

The main cause of periodontal disease is bacterial infection and the immune response to it. If left untreated, the ensuing inflammation will persist, leading to the further destruction of periodontal tissues. The objectives of periodontal treatment include control of bacterial plaque biofilm and risk factors, regeneration of lost periodontal tissue, and the recovery of oral function.

Initial periodontal therapy is the most important element of treatment aimed at reducing periodontal pathogens. If residual periodontal pockets or bone defects are found on reevaluation following non-surgical therapy, they will need to be treated by surgical periodontal therapy. Multiple surgical approaches for treating intrabony defects have been shown to be effective in improving clinical and radiographic parameters, such as clinical attachment level (CAL) and bone defect depth. A number of types of regenerative therapy have been proposed for the treatment of periodontitis with intrabony defects. One well-established method is the use of enamel matrix derivative (EMD), which has been shown to affect cell attachment, spreading, proliferation, and survival, and the expression of growth factors, cytokines, extracellular matrix molecules, and certain molecules that modulate bone remodeling. Enamel matrix derivative has been applied to various periodontal defects, and the results have demonstrated its ability to encourage periodontal regeneration. One study found that periodontal surgery with osseous autografts increased cementumogenesis at the graft sites and variation in parallel or functional orientation of the periodontal ligament in these areas. In addition, the combination of EMD and autogenous bone graft (ABG) resulted in statistically significant higher soft and hard tissue improvements compared with treatment with EMD alone. Combination EMD and ABG therapy reduced post-operative recession and increased the proportion of defects with substantial CAL gain.

Here, we report a case of periodontal regenerative therapy with EMD and ABG in a chronic periodontitis patient with intrabony defects that has been successfully followed up for over 18 months.

Case Presentation

Written informed consent was obtained from the patient for inclusion in this report.

1. First visit examination

In July 2015, a 57-year-old man visited the Clinic of Conservative Dentistry at the Tokyo Dental College Suidobashi Hospital with the chief complaint of gingival swelling and mobile teeth in the right maxillary molar region. The general health of the patient was good.

Although he had a history of endodontic treatment, he had none of periodontal treatment. In 2014, however, he noticed mobile teeth and gingival swelling in the molar area. Figure 1 shows an oral view obtained at his first visit. Visual examination revealed general gingival inflammation and calculus. Premature contact was observed in tooth #16.

The results of the periodontal examination are shown in Fig. 2. It was found that 55.3% of sites had a probing depth (PD) of ≥4 mm and 3.3% a PD of ≥7 mm. Bleeding on probing (BOP) was observed in 24.0% of sites. The level of plaque control as assessed by the O’Leary plaque control record (PCR) was 65%. Radiographic examination (Fig. 3) revealed vertical bone defects in #16, 17, 25, 26, 37, and 45, and widening of the periodontal ligament space in #16 and 17. Furcation involvement was Degree 1 for #26 and 36, and Degree 2 for #16 and 17. As a measure of patient-reported outcome, oral health-related quality of life (QoL) was assessed using an oral health-related QoL instrument (OHRQL). The total OHRQL score in this patient was 32.

2. Diagnosis

The clinical diagnosis was severe general-
Regenerative Therapy with EMD and ABG

Fig. 1 Oral view at first visit

Fig. 2 Periodontal examination at first visit
ized chronic periodontitis. A treatment plan was presented to the patient and his consent to the proposed plan obtained.

3. Clinical procedure and outcomes

1) Treatment plan

(1) Initial periodontal therapy

This comprised oral hygiene instruction, quadrant scaling and root planing (SRP), caries treatment for #11 and 21, and extraction of #16 and 17. A removable partial denture was planned for #16 and 17. A provisional restoration was planned for after removal of an ill-fitting prosthesis from #25 and 26.

(2) Reevaluation

(3) Periodontal surgery

Periodontal surgery for sites with a PD of ≥4 mm was planned. Sites with a PD of ≥6 mm and sites with bone defects were predicted to still show a large PD after initial periodontal therapy. Open flap debridement for #14, 15, 31, 32, 33, 34, 35, 36, 37, 41, 42, and 45, and periodontal regenerative therapy with EMD and ABG for #25 and 26 were planned.

(4) Reevaluation

(5) Treatment for recovery of oral function

Full metal crowns (#25, 26) and a removable partial denture (#16, 17, 46, 47) were planned.

(6) Reevaluation

(7) Supportive periodontal therapy (SPT) or maintenance

2) Treatment process

An outline of the treatment process is shown in Table 1.

(1) Initial periodontal therapy

After obtaining informed consent for the proposed treatment plan, instruction was given on maintaining oral hygiene and quadrant SRP performed. Caries treatment was performed for #11 and 21. Extraction was implemented for #16 and 17. The removable partial denture was placed for #16 and 17. A provisional restoration was placed after removal of the ill-fitting prosthesis from #25 and 26.

(2) Reevaluation

Subsequent reevaluation revealed a reduction in the PCR score to 16.7%. Sites with a PD of ≥4 mm decreased to 14% and those with a PD of ≥7 mm to 0%. The total OHRQL score was 22. At reevaluation, closed pockets, were observed in 50.7% of the teeth; BOP was seen in 12.0%; and the plaque score was 16.7%. These results led to treatment being considered incomplete, in accordance with the criteria for the success of non-surgical periodontal therapy.

(3) Periodontal surgery

The need and options for periodontal sur-
Surgery based on these findings were explained to the patient. Open flap debridement was subsequently implemented for #31, 32, 33, 36, 37, and 41 to reduce periodontal pockets. After consultation, the patient chose to receive EMD therapy for intrabony defects. Subsequently, regenerative therapy with Emdogain® Gel and autogenous bone graft (#25, 26).

(4) Reevaluation
(5) Treatment for recovery of oral function

Restorative treatment was implemented at 6 months postoperatively. Full metal crowns (#25, 26) and the removable partial denture (#16, 17, 46, 47) were placed. In addition, #26 and 37 were functionally occluded.

(6) Reevaluation

An improvement was observed in gingival inflammation and PD at reevaluation. The patient’s level of plaque control was good (PCR < 20%). Various levels of improvement were observed radiographically at those sites selected for regenerative therapy. Resolution of tooth mobility was observed in #13, 14, 15, 22, and 45. Periodontal conditions were judged to be stable, and the patient was placed in a recall system for SPT. The total OHRQL score was 12, indicating an improvement in QoL from at first visit.

(7) Supportive periodontal therapy

During 18 months of SPT, pockets with a PD of 4 mm were found in #26 (Fig. 6), but the periodontal condition remained stable in most of the teeth (Fig. 5 and 7). A 3.5-mm gain in average clinical attachment was observed among the teeth treated with EMD and ABG (Fig. 8). Occlusion was frequently examined to control occlusal trauma during SPT.

Table 1 Treatment process

| July 2015         | Initial periodontal therapy |
|-------------------|-----------------------------|
| • Plaque control  |                             |
| • Quadrant SRP    |                             |
| • Caries Treatment (#11, 12) |                      |
| • Extraction (#16, 17) |                           |
| • Treatment with removable partial denture (#16, 17) |                  |
| • Placement of provisional restoration (#25, 26) |                     |

| August 2015 (Reevaluation) | Surgical periodontal therapy |
|---------------------------|-------------------------------|
| • Open flap debridement (#31, 32, 33, 36, 37, 41) |                             |
| • Regenerative therapy with Emdogain® Gel and autogenous bone graft (#25, 26) |               |

| July 2016 (Reevaluation) | Treatment for recovery of oral function |
|-------------------------|----------------------------------------|
| • Crown restoration (#25, 26) |                                        |
| • Removable partial denture (#16, 17, 46, 47) |                              |

| February 2017 to present (Reevaluation) | Supportive Periodontal Therapy |
|----------------------------------------|-------------------------------|
| • Oral hygiene instruction              |                               |
| • Professional tooth cleaning           |                               |

SRP: scaling and root planing
Periodontal regenerative therapy for #25, 26, after debridement (a); filling of defects with EMD (b), and ABG (c); radiographic view, first visit (d), post-initial periodontal therapy (IP) (e); 18 months of SPT (f)

Fig. 4  Periodontal surgery

Oral view after 18 months of SPT

Fig. 5  Oral view after 18 months of SPT
Discussion

Initially, the patient expressed a wish to keep teeth #16 and 17. The PD was large at these sites (>7 mm), extending below the interproximal bone level as far as the furcation entrance, and bone loss (>65%) was also observed. The extraction of these two teeth was recommended in accordance with the decision-making chart for tooth extraction or conservation proposed by Avila et al. They were subsequently extracted with informed consent.

The results of the initial periodontal therapy in this patient were judged to be incomplete based on predetermined criteria for successful non-surgical therapy. Slight gingival recession was observed on the buccal side in #31 and 41 during SPT (Fig. 5). Froum et al reported gingival recession of 1.87 mm at 12 months following open flap debridement. Postoperative gingival recession presents a risk for dentinal hypersensitivity. Therefore, it may have been preferable to perform SRP for #31, 32, 33, and 41 for a second time, instead of open flap debridement.

Regenerative therapy was selected in #25 and 26 to treat vertical bone defects. It has been reported that applying EMD yielded a greater improvement in clinical parameters and bone level than flap surgery. Other studies have reported that combining EMD with other types of regenerative material,
such as bone substitute, is effective in reducing PD and increasing CAL\textsuperscript{13,18,22}. In addition, the guidelines of the Japanese Society of Periodontology\textsuperscript{9} also recommend using both EMD and bone graft material when the bone defect to be treated is $\geq 4$ mm in depth and $\geq 2$ mm in width. Reynolds et al.\textsuperscript{16} reported that intrabony defects that were narrow and mostly self-contained by two or three bony walls usually responded well to regenerative treatment with only a bone graft or biologic agent. That finding is supported by the present results, which showed that the defects responded well to different regenerative strategies, including combination therapy.

In the present case, an improvement was observed in PD (#25: 5 mm, #26: 4 mm) at 18 months compared with baseline in the teeth (#25, 26) treated with the combination of EMD and bone graft (Fig. 8). Yilmaz et al.\textsuperscript{24} reported a mean reduction in PD of 5.6 $\pm$ 0.9 mm, and a gain in CAL of 4.2 $\pm$ 1.1 mm at 1 year following combination therapy with EMD and ABG. Guida et al.\textsuperscript{7} reported a mean reduction in PD of 5.1 $\pm$ 1.7 mm and a gain in CAL of 4.9 $\pm$ 1.8 mm in a combination EMD and ABG group at 1 year. The results seen in the present case at 18 months are in agreement with these earlier findings. Caution should be exercised in comparing these results, however, as the defect types and initial PD and CAL values were different.

A poor level of plaque control is associated with compromised outcomes after regenerative surgery. In the present patient, the use of an interdental brush was recommended in addition to a standard toothbrush for #25 and 26, which had received crown restoration. We believe that this contributed to the observed improvement in PCR and BOP. The patient’s level of plaque control was good (PCR $< 20\%$) at the start of maintenance therapy. Surgical intervention improved the architecture of both the hard and soft tissues, allowing efficient cleaning by the patient. Risk during the maintenance phase was determined to be low according to the Periodontal Risk Assessment\textsuperscript{12}. The patient continued to have problems in occlusal contact and guidance, however, following active therapy. Given this situation and patient preference, the recall interval was set at 3 months. So far, the periodontal condition has remained stable.

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