Periodontal Regenerative Therapy with Enamel Matrix Derivative in Patient with Chronic Periodontitis: A 3.5-year Follow-up Report

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Abstract

Here, we report periodontal treatment including regenerative therapy in a patient with generalized chronic periodontitis. The patient was a 53-year-old woman who presented with the chief complaint of gingival swelling and tooth mobility in the right maxillary molar region. An initial examination revealed 36% of sites with a probing depth of ≥4 mm and 16.7% with bleeding on probing. Radiographic examination revealed vertical bone resorption in #15, 24, 27, 34, 37, 45, and 47. Horizontal resorption was noted in other regions. The clinical diagnosis was moderate chronic periodontitis. Initial periodontal therapy consisted of plaque control, scaling, and root planing together with treatment for caries. Occlusal adjustment of premature contact sites was performed after suppression of inflammation. Periodontal regenerative therapy using enamel matrix derivative was performed on #15, 24, 34, 45, and 47. Other sites with residual periodontal pockets were treated by open flap debridement. Tooth #27 was extracted due to a bone defect exceeding the root apex; #37 was extracted due to frequent acute symptoms following periodontal surgery. Following re-evaluation, the patient was placed on supportive periodontal therapy. Periodontal regenerative therapy improved vertical bone resorption. This improvement has been adequately maintained over a 3 years 6 months period. Additional care is necessary, however, to further improve the patient’s oral health-related quality of life during supportive periodontal therapy.

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

The purpose of periodontal treatment is to remove the cause of periodontal disease, regenerate periodontal tissue, recover occlusal function, and create an environment in which management of oral hygiene is easy. Periodontitis destroys gingival fibrils and periodontal ligament fibers, which results in absorption of alveolar bone. This weakens support for the dentition that is normally provided by periodontal tissue. Bone defects due to absorption of alveolar bone are classified either as horizontal, or as angular or intrabony. Intrabony defects are often associated with occlusal trauma. Such defects can also occur where occlusal force is normal, however, due to abnormalities in the cementum, such as exfoliation. The distance between adjacent teeth, a depression in the root surface, and anatomical factors may also result in intrabony defects. Currently, various regenerative therapies are available for the treatment of intrabony defects due to periodontitis. One example is the use of enamel matrix derivative (EMD), which is derived from porcine tooth buds and is currently available in a commercial formulation (Emdogain® Gel, Biora AB, Malmö, Sweden). Enamel matrix derivative has been applied in various types of periodontitis-induced defect, and the results have demonstrated its ability to encourage periodontal regeneration. Here, we report successful periodontal regenerative therapy with EMD for intrabony defects due to chronic periodontitis.

Case Presentation

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

1. Baseline examination

In August 2011, a 53-year-old woman visited the Clinic of Conservative Dentistry at Tokyo Dental College Chiba Hospital with the chief complaint of gingival swelling and tooth mobility in the molar region. The general health of the patient was good.

She had first become aware of periodontal disease approximately 10 years earlier. She had a history of caries treatment, and had received regular check-ups every 3 months at a local dental office. Her dentist referred her to our clinic for the treatment of periodontitis. Figure 1 shows an oral view obtained at her first visit. Gingival inflammation and subgingival calculus were mostly evident in the molar region. Lingual inclination was observed in #31. Premature contact was observed in #15 and 45.

The results of the periodontal examination are shown in Fig. 2. They revealed that 36% of sites had a probing depth (PD) of ≥4 mm, and 10.1% a PD of ≥7 mm. Bleeding on probing (BOP) was observed at 16.7% of sites. The level of plaque control as assessed by the O’Leary plaque control record (PCR) was 23%. Radiographic examination (Fig. 3) revealed angular bone defects in #15, 24, 27, 34, 37, 45, and 47; and widening of the periodontal ligament space in #15. The diagnosis of furcation involvement was Degree I for #37. 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 was 23.

2. Diagnosis

The clinical diagnosis was moderate chronic periodontitis. A treatment plan was presented to the patient and her consent to the proposed plan obtained.

Clinical Procedures and Outcomes

1. Treatment plan

1) Initial periodontal therapy

This comprised oral hygiene instruction, quadrant scaling and root planing (SRP), caries treatment of #16, 17, 26, 27, 36, 37, 46, 47, and occlusal adjustment for #15 and 45.

2) Reevaluation

3) Periodontal surgery

Periodontal surgery for sites with a PD of
Fig. 1  Oral view at first visit

Fig. 2  Periodontal examination at first visit

Fig. 3  Radiographic view at first visit
August 2011  Initial periodontal therapy
· Plaque control
· Quadrant SRP
· Occlusal adjustment (#15, 45)
· Caries Treatment (#16, 17, 26, 27, 36, 37, 46, 47)

August 2012  (Reevaluation)
Surgical periodontal therapy
· Open flap debridement (#14, 16, 17, 25, 26, 35, 36, 37, 44, 46)
· Regenerative therapy with Emdogain® Gel (#15, 24, 34, 45, 47)
· Extraction (#27 and 37)

June 2014 to present  (Reevaluation)
Supportive periodontal therapy
· Oral hygiene instruction
· Professional tooth cleaning

SRP: scaling and root planing

≥4 mm. Periodontal regenerative therapy with EMD for #15, 24, 27, 34, 37, 45, and 47.
4) Reevaluation
5) 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 #16, 17, 26, 27, 36, 37, 46, 47. Occlusal adjustment was implemented for #15 and 45.
2) Reevaluation
Subsequent reevaluation revealed a reduction in the PCR score to 13%, and a decrease to 16.7 and 3% for sites with a PD of ≥4 and 7 mm, respectively. The OHQRL total score was 13. Closed pockets were observed in 70.3% of the teeth, and BOP in 24.1%. These results were judged to be “insufficient” according to the criteria for the success of non-surgical periodontal therapy.

3) Periodontal surgery
The need and options for periodontal surgery based on these findings were explained to the patient. After consultation, she chose to receive regenerative therapy with EMD (Emdogain® Gel, Straumann Japan, Tokyo). Subsequently, regenerative therapy was performed on #15, 24, 34, 45, and 47 to treat deep intrabony defects (Fig. 4).

Open flap debridement was implemented for #14, 16, 17, 25, 26, 35, 36, 37, 44, and 46 to reduce periodontal pockets. Intraoperatively, #27 had to be extracted due to a bone defect exceeding the root apex. Tooth #37 was extracted due to frequent acute symptoms following periodontal surgery.
4) Reevaluation
On reevaluation, an improvement was observed in gingival inflammation and PD. 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 #15. The periodontal conditions were judged to be stable, and the patient was placed in a recall system for SPT. The total OHQRL score was 9, indicating an improvement in QoL from at
5) Supportive periodontal therapy

During 3 years 6 months of SPT, pockets with a PD of 4 mm were found in #15, 16 and 45 (Fig. 6), but the periodontal conditions remained stable in most of the teeth (Figs. 5 and 7). A 3-mm gain in average clinical attachment was observed in the teeth treated with EMD (Fig. 8). Occlusion was frequently examined to control occlusal trauma during SPT.

**Discussion**

Deposition of plaque and calculus and secondary occlusal trauma were thought to have played a major role in the progression of destruction of periodontal tissue observed in the present case. Traumatic occlusion due to bruxism or early contact promotes destruction of periodontal tissue. In such cases, therefore, it is necessary to control occlusal force, which includes removing both local factors (occlusion abnormalities such as early contact) and general factors (mental stress). In the present case, premature contact of the premolars was recognized. Therefore, occlusal adjustment was performed following the resolution of inflammation by SRP. Periodontitis can progress rapidly when occlusal trauma is present. When bone resorption extends to the apex of the root, conserving the teeth becomes extremely difficult. An increase in bone resorption and attachment loss were observed in #17 on reevaluation, necessitating extraction. Patient consent for this had not yet been obtained at this point, however, so first initial periodontal therapy was performed prior to judging whether #17 could be conserved during further surgical treatment.

It has been reported that applying EMD greatly improves clinical parameters and bone loss compared with flap surgery. No significant difference was observed between combined use of EMD and autologous bone compared with EMD alone in the treatment of intrabony defects. The results of the present case appear to support this earlier finding, in that relatively beneficial effects were obtained by treatment of both one- and two-wall defects with EMD alone. The type of osseous defect has been shown to be an important determinant in EMD treatment, however. Recent studies have reported that combinations of different regenerative therapies, such as...
as application of EMD and bone grafting materials, are effective\(^{20}\). In addition, guidelines issued by the Japanese Society of Periodontology recommend using both EMD and a bone graft when the osseous defect exceeds 4 mm in depth and 2 mm in width on dental X-ray images\(^9\). Transplantation of autologous bone together with application of a bone substitute such as EMD might further enhance regeneration of periodontal tissue in such cases. In the present case, application of EMD in a total of 5 teeth resulted in an improvement in PD at 3 years 6 months compared with at baseline (Fig. 8).

One study found a mean reduction in PD of 4.4 mm and a gain in CAL of 3.2 mm at 2 years following EMD therapy\(^4\). The results at 3 years 6 months in the present case are also in agreement with other long-term data\(^{18}\). Caution should be exercised when comparing these results, however, as the defect types and initial PD and attachment levels were different.

In the present case, an increase in radiopac-
Regenerative Therapy with EMD

ity was confirmed in the 5 sites treated with EMD after 6 months of SPT, and further improvement was also observed at 3 years and 6 months. One earlier study reported that distinct radiographical bone-fill was observed at as early as 5 months after surgery with EMD, and that further bone gain might be expected for as long as 3 years\(^8\). In the present case, 3 years have passed since periodontal surgery, indicating that no significant addition of bone is likely to occur in the future.

The risk during the maintenance phase was determined to be low according to the Periodontal Risk Assessment\(^{12}\). Several sites were found to be positive for BOP, however. Sites recognized as having BOP during SPT indicate a higher probability of periodontitis progression\(^{11}\). One study reported that maintenance scaling appeared to be important in maintaining a post-therapy decrease in mean levels of subgingival microbiota over a prolonged period of time\(^6\). Based on these earlier reports, the present patient was placed on a 3-month recall schedule for SPT and the level of oral hygiene checked each such visit.

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