Periodontal Regenerative Therapy Using Enamel Matrix Derivative for Treatment of Generalized Severe Chronic Periodontitis: A 2-year Case Report

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Received 26 April, 2018/Accepted for Publication 13 July, 2018
Published Online in J-STAGE 15 March, 2019

Abstract

Here, we describe the treatment course and 2-year follow-up in a case of multiple deep intrabony defects treated with periodontal regenerative therapy. The patient was a 50-year-old woman presenting with the chief complaint of mobile teeth in the maxillary molar region. Examination at her initial visit revealed sites with a probing depth of ≥7 mm in the molar region. Radiographic examination revealed generalized bone resorption. Angular bony defects were evident in the molar region. Initial periodontal therapy was commenced based on a clinical diagnosis of generalized chronic periodontitis. At re-evaluation, an improvement was observed in periodontal conditions. Periodontal regenerative therapy with enamel matrix derivative was performed on teeth #13, 15, 24, 27, 33, 35, 37, 46, and 47. Following re-evaluation, a removable partial denture was used to replace teeth #26 and 45, and the patient placed under supportive periodontal therapy. Periodontal conditions have remained stable. Careful supportive periodontal therapy needs to be continued, however, to monitor and treat sites requiring further attention, including those with furcation involvement.

Key words: Generalized chronic periodontitis — Periodontal regeneration — Enamel matrix derivative

Introduction

Periodontitis is an infectious disease caused by periodontal pathogenic bacteria present in the subgingival plaque biofilm¹⁶. It is an irreversible disease in which the periodontal tissue is gradually destroyed as inflammation progresses, ultimately leading to the loss of teeth.

If still only mild, periodontitis can be successfully tackled by early treatment focused on its cause. If moderate or severe, however,
more advanced treatment is necessary, which may involve periodontal surgery\textsuperscript{11}. A number of studies have investigated the effect of periodontal regenerative therapies, and the results have been favorable. One such therapy, which uses enamel matrix derivative (EMD; Emdogain\textsuperscript{®} Gel, Straumann, Basel, Switzerland), has now been used for over 20 years, and various degrees of clinical resolution have been reported with this approach\textsuperscript{8,9,17,22,23}.

This report describes the treatment course and 2-year follow-up in a case of multiple deep intrabony defects treated with periodontal regenerative therapy using EMD.

Case Presentation

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

1. Clinical assessment and diagnosis

In May 2014, a 50-year-old woman was referred to the Clinic of Conservative Dentistry at Tokyo Dental College Suidobashi Hospital with the chief complaint of mobile teeth in the maxillary molar region. The patient had been receiving regular dental check-ups since her early 30’s, but in 2013 she began to experience pain in the molar area. Her local dentist extracted teeth #26 and 45 and replaced them with a removable denture. The patient chose a removable denture at this point to avoid preparation of the teeth. Figure 1 shows the oral view obtained on her first visit to our department, which revealed clear evidence of gingival inflammation in the region of the maxillary molars. Bone tori were also observed in the molar regions of both the maxilla and mandible. The results of the periodontal examination are shown in Fig. 2. Fifty-three percent of sites had a probing depth (PD) of $\geq 4$ mm, and 7% a PD of $\geq 7$ mm. The clinical attachment level (CAL) was $4.1 \pm 1.8$ mm. Bleeding on probing was observed at 44% of sites. The level of plaque control as assessed in accordance with the O’Leary Plaque Control Record (PCR)\textsuperscript{15} was 54%. Radiographic examination (Fig. 3) revealed horizontal and vertical bone loss in...
teeth #13, 15, 16, 24, 25, 27, 33, 35, 37, 46, and 47. Semi-standardized radiographs were taken using film holders with customized occlusal stents as described previously\(^{10}\). Measurements were obtained from the radiographs using the Schei Ruler Technique\(^{20}\). The degree of change in tooth axis height between the cemento-enamel junction and the bottom of the bone defect was defined as linear alveolar bone growth, and the percentage of bone fill was calculated by dividing linear bone growth by bone defect depth at baseline. Baseline values were deemed to be those obtained at immediately after initial periodontal therapy. The mean value of percentage of bone loss at this point was 38.3 ± 11.7%.

The patient’s oral health (OH)-related quality of life (QoL) was assessed using a OHRQL instrument\(^{19}\) as a patient-reported measure of outcome. The total OHRQL score of the patient on her initial visit was 11.

The clinical diagnosis was generalized chronic periodontitis\(^{1}\).

2. Treatment plan
1) Initial periodontal therapy
   Oral hygiene instruction, quadrant scaling, and root planing (SRP)
2) Re-evaluation
3) Surgical periodontal therapy (for sites with PD of ≥4 mm)
Clinical Procedures and Outcomes

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

1) Initial periodontal therapy
   After obtaining informed consent for the proposed treatment plan, the patient received oral hygiene instruction and consecutive quadrant-based SRP. Re-evaluation revealed a reduction to 18% in the PCR score. A reduction was also observed in the percentage of sites with a PD of ≥4 and ≥7 mm, to 35 and 6%, respectively. The total OHRQL score was 16.

2) Periodontal surgery
   As deep and wide intrabony defects were observed in teeth #15, 24, 27, 33, 35, and 37, regenerative therapy with EMD was supplemented with autogenous bone grafting (Fig. 4). The defects in teeth #13, 46, and 47 were narrow, however, so only regenerative therapy with EMD was performed. Open flap debridement was performed on teeth #16 and 17.

3) Treatment for recovery of oral function
   A removal partial denture was fabricated for teeth #26 and 45. The patient chose a removable denture again to avoid preparation of the teeth.

4) Supportive periodontal therapy
   (SPT) or maintenance

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Table 1 Treatment process

| Date               | Description                                                                 |
|--------------------|-----------------------------------------------------------------------------|
| May 2014           | Initial periodontal therapy                                                 |
|                    | • Oral hygiene instruction                                                  |
|                    | • Full-mouth scaling and root planing (SRP)                                |
| January 2014       | (Re-evaluation) Surgical periodontal therapy                                 |
|                    | • Regenerative therapy with enamel matrix derivative and autogenous graft   |
|                    |   (#15, 24, 27, 33, 35, and 37)                                            |
|                    | • Regenerative therapy with enamel matrix derivative (#13, 46, 47)         |
|                    | • Open flap debridement (#16 and 17)                                       |
| September 2015     | (Re-evaluation) Treatment for recovery of oral function                     |
|                    | • Removable partial denture (#26 and 45)                                   |
| November 2015 to present | Supportive Periodontal Therapy                                                |
|                    | • Oral hygiene instruction                                                  |
|                    | • Professional tooth cleaning                                               |

Fig. 4 During regenerative therapy for #24 after EMD combined with autogenous bone
At re-evaluation, an improvement in gingival inflammation and PD was confirmed. The patient’s periodontal condition was judged to be stable, and she was placed in a recall system for SPT. The total OHRQL score was 8, showing an improvement from the score at her initial visit. This improvement may have been due to improved tooth mobility and bleeding during brushing.

At the time of writing this report, 2 years have passed since commencement of SPT, and periodontal conditions have remained stable (Fig. 5–7). Change in PD, CAL, and bone fill at 1 year (1Y) and 2 years (2Y) were assessed after periodontal treatment (Fig. 8–10). Statistical analysis was performed using a software package (InStat version 3.10 for Windows, GraphPad Software, La Jolla, CA, USA). The Friedman test, Dunn’s multiple comparison test, and Wilcoxon matched pairs signed-rank test were used. Statistical significance was defined as a p-value of less than 0.05. At 1Y postoperatively, a significant improvement was observed in PD in comparison with at her initial visit (p<0.001). An improvement from at her initial visit was also
observed at 2Y (p<0.001) (Fig. 8). At 1Y post-operatively, a significant improvement was observed in CAL from at baseline (p<0.001). An improvement from at baseline was also observed at 2Y (Fig. 9). At baseline, the mean percentage of bone loss was 38.3 ± 11.7%. Bone fill at 1Y and 2Y was 38.1 ± 14.5% and 46.3 ± 18.5%, respectively. The difference in values at 1Y and 2Y was statistically significant (Fig. 10).

**Discussion**

No significant difference in clinical outcome has been reported between guided tissue regeneration and EMD therapy⁵. Enamel matrix derivative can be applied in a wide range of cases, including those where the defect encompasses either one or two walls, where the defect spans multiple teeth, where it is in proximity to the root of the tooth, and where there is only either little or thin keratinized gingiva. An earlier study found that application of EMD to narrower defects of 22° or less yielded a larger increase in CAL than with defects of 36° or more⁶. Therefore, in the present case, sites at #13, 46, and 47 received EMD only, as they were considered to be narrow. On the other hand, sites with a wider defect width (#15, 24, 27, 33, 35, and 37) received EMD supplemented with autogenous bone graft. One earlier study reported that the combination of EMD and autogenous bone graft resulted in a reduction in postsurgical recession and an increase in the proportion of defects showing a substantial gain in CAL⁶. The results of the present study showing that this combination was effective support this earlier finding.

The mean value of the primary endpoint, gain in CAL, was 3.1 mm at 1Y. This value is
equivalent to the value (3.2 mm) reported in a meta-analysis on the management of 317 angular bone defects with EMD during an observation period ranging from 6 months to 1 year\(^{12}\) and that (3.1 mm) reported in a multi-center study\(^{21}\). In the present study, the mean value was 3.1 mm at 2Y. This was comparable to that (3.2 mm) reported in our previous smaller-scale retrospective study\(^5\) and other studies\(^7,21\).

Earlier studies reported that postoperative bone fill was 65% at 4 months\(^9\), 20.5 ± 49.1% at 6 months\(^{14}\), and 74% at 1 year\(^4\). It is possible that this variation may depend on the form of the bone defect, so care must be taken in interpreting the results. Heijl \textit{et al.} observed a mild increase in bone fill until 36 months\(^9\). In the present case, also, a significant increase was observed in bone fill between 1Y and 2Y, which supports earlier findings\(^9,22\).

In the present case, the OHRQL score showed no marked improvement after initial periodontal therapy. This finding was not consistent with those of our earlier reports\(^15,18,19\). In addition, interest in oral health may increase as a result of undergoing periodontal therapy. In the present study, surgical procedures also improved the OHRQL score, which remained stable during SPT. This indicates that careful SPT is effective in maintaining awareness of the importance of OHRQL.

In the present case, the patient was given instruction on use of an interdental brush for the remaining maxillary left molars, which showed furcation involvement as confirmed during SPT.

In summary, the present case demonstrates that favorable periodontal conditions can be achieved by periodontal treatment including periodontal tissue regeneration treatment under an adequate level of plaque control. Careful SPT will be continued in this patient.

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