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Clinical Outcome of Surgical Periodontal Therapy:
A Short-term Retrospective Study


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Abstract

This study aimed to investigate retrospectively the outcome of surgical periodontal therapy. Periodontal surgeries implemented at General Dentistry, Tokyo Dental College Suidobashi Hospital during the period of April 2010 through March 2012 were subjected to data analysis. After initial periodontal therapy, 17 clinicians performed a total of 138 periodontal surgeries in 80 patients with moderate to advanced periodontitis (31 men and 49 women; mean age 54). Cases (sites) operated were as follows: open flap debridement = 102, periodontal regenerative therapy = 29 (17 for intrabony defects, 12 for furcation involvements) and periodontal plastic surgery = 7. Enamel matrix derivative or bone graft was used for regenerative therapy. Clinical data were analyzed focusing on the comparison between open flap debridement and regenerative therapy. At 5 months after open flap debridement, mean reduction in probing depth (PD) and gain in clinical attachment level (CAL) was 3.9 mm (range 1.0–9.0) and 2.3 mm (range 1.0–9.0), respectively. The corresponding values with regenerative therapy were 4.0 mm (range 0–8.0) and 2.8 mm (−1.0–6.0), respectively. At sites with initial PD ≥ 8 mm, a significantly greater gain in CAL was obtained with the regenerative therapy than with flap surgery (mean CAL gain 4.3 mm vs. 2.9 mm, p<0.05). Periodontal surgery performed in our clinical setting demonstrated a favorable short-term outcome. Our data suggest the efficacy of regenerative therapy, in particular for the treatment of deep pockets.

Key words: Periodontal surgery — Periodontitis — Periodontal regeneration — Enamel matrix derivative
**Introduction**

The collective evidence from numerous clinical trials demonstrates a consistency of clinical response in the treatment of chronic periodontitis by non-surgical periodontal therapy\(^2\). In order to treat moderate to advanced periodontitis, surgical intervention is often indicated after initial periodontal therapy\(^1\). In the treatment of deep pockets, periodontal surgery often results in greater pocket reduction and clinical attachment gain\(^10\). Data from controlled clinical studies have shown that periodontal regenerative therapies may lead to an additional gain of clinical attachment level (CAL) when compared with open flap debridement alone\(^4,5,21\).

In treatment planning, selection of cases and types of surgery should be based on the scientific evidence and established clinical guidelines. It is equally important to consider the feasibility of implementing the treatment recommendations in one’s own practice setting. Previously, we have reported the profile of surgical periodontal therapy at Tokyo Dental College Suidobashi Hospital\(^8\). We found that the initial periodontal therapy implemented prior to surgery was effective in improving the periodontal condition of patients. However, the actual outcome of periodontal surgery performed was yet to be evaluated. Also, given the reported clinical efficacy of periodontal regenerative therapy, we felt it was imperative to evaluate the outcome in our own clinical setting. In the present study, we aimed to evaluate the outcome of periodontal surgeries, focusing on the comparison of two different surgical modalities; open flap debridement and regenerative therapy.

**Materials and Methods**

1. **Participants**

   Study participants were selected from the patient population at General Dentistry, Tokyo Dental College Suidobashi Hospital: a clinical diagnosis of moderate to advanced periodontitis\(^7\) was made in all patients selected. Written informed consent was obtained from the participants. This study was approved by the institutional review board of Tokyo Dental College (No.357).

2. **Procedure**

   After collection of full medical and dental histories, a periodontal examination was carried out. The following baseline clinical parameters were recorded: probing depth (PD) was measured using a Williams probe (#2, YDM, Higashi Matsuyama) with an approximate force of 0.25 N and rounded to the nearest millimeter. Clinical attachment level was measured from the cemento-enamel junction to the apical depth of periodontal probe penetration. Probing depth and CAL were registered at 6 sites. Bleeding on probing (BOP) was recorded as the presence or absence of bleeding following measurement of PD. Tooth mobility was recorded using the Miller index\(^14\). Presence of furcation involvement was assessed by the Lindhe & Nyman classification\(^15\). The presence or absence of supragingival dental plaque was recorded by the O’Leary Plaque Control Record (PCR)\(^16\).

   Prior to surgical intervention, all patients received initial periodontal therapy consisting mainly of standard oral hygiene instructions, scaling and root planing. For those who smoke, attempts were made to provide smoking cessation care.

   Based on re-evaluation performed at 3 to 4 weeks after initial therapy, a further treatment plan with alternatives was presented and informed consent to the proposed surgical intervention obtained from each patient. Surgical interventions were performed as necessary. Meticulous supragingival professional tooth cleaning was performed biweekly for the first 6 weeks postsurgically. Thereafter, patients were recalled once a month. They received supportive periodontal therapy or maintenance. Re-evaluation was performed at approximately 5 months after surgery.
3. Measures

A surgical record form was used to assess the profile and outcome of surgical periodontal therapy. The form contained the following items: patient demographics, systemic condition, smoking status, surgery type and sites, and periodontal parameters of the surgical site. For this record, a surgical site showing the deepest PD was usually selected by each clinician. The form was to be filled out by each clinician who performed surgery during April 2010 through March 2012.

4. Data management and statistical analysis

Each patient contributed one to multiple defects; therefore individual site was regarded as the statistical unit. The data were compiled by creating a computerized file and were retrospectively analyzed after databases were stripped of all patient identifiers and a unique code number was used for each subject. The primary outcome was CAL. For the analysis of sites with open flap debridement or regenerative therapy, the non-parametric Friedman Test with post test was used to assess changes in quantitative data over time (baseline vs. post initial therapy vs. post surgery). The Mann-Whitney U test was used to assess the difference in CAL gain values between two different treatments. The Fisher’s exact test was used to test the association between different treatments and incidence of CAL gain ≥ 4 mm.

Software packages (InStat version 3.10 for Windows and Prism 5.04, GraphPad Software, La Jolla, CA, USA) were used for the statistical analysis. A p value of less than 0.05 was considered statistically significant.

Results

1. Number of surgery and patient demographics

Seventeen clinicians performed a total of 138 periodontal surgeries in 80 patients. The patients comprised 31 men and 49 women (Table 1). The mean age was 53.9 years. None of them had serious or uncontrolled systemic diseases. Seven and half % of the patients (5 men and 1 woman) were current smokers and number of years smoking ranged from 13 to 30 years. One patient agreed to stop smoking during initial periodontal therapy. The others refused to receive formal smoking cessation care, but they refrained from smoking at least on the day of surgery.

2. Types of surgery and surgical sites

Open flap debridement was the most frequently performed surgery, comprising 74% of total surgical events. In 29 cases of periodontal regeneration, enamel matrix derivative (EMD; Emdogain® Gel, Straumann Japan, Tokyo) was used in 28 cases and a bone substitute containing atelocollagen and bovine hydroxyapatite particles (Boneject, Koken, Tokyo) in 1 case. No guided tissue regeneration was performed. In 7 cases of periodontal plastic surgery, 1 case was ridge augmentation, 2 cases were root coverage, 3 were crown lengthening and 1 case was apically repositioned flap.

Upper and lower molar regions comprised 78% of the surgical sites. Furcation involvement was found in 44 cases.
3. Changes in periodontal parameters

1) Probing depth and clinical attachment level

At sites that received open flap debridement or regenerative therapy, the mean PD value of 7.5 mm at initial examination was statistically significantly reduced to 6.6 mm after initial therapy (Fig. 1a). Subsequent surgical intervention significantly reduced the PD value to 3.5 mm from both baseline and after initial therapy.

In contrast, the difference in CAL values between baseline (8.3 mm) and after initial therapy (7.9 mm) was not significant (Fig. 1b). Surgical intervention, however, significantly reduced the CAL value to 5.9 mm from both baseline and after initial therapy.

2) Bleeding on probing

Mean prevalence of BOP-positive sites at initial examination was 84% (Table 1). It was reduced to 60% after initial therapy, and further reduced to 16% after surgery.

3) Tooth mobility

There was no significant difference in tooth mobility between therapy intervals (p = 0.205).

4. Comparison of CAL gains between treatments

Mean CAL gain for the sites treated with open flap debridement was 2.3 mm (SD 2.2; range –1.0 to 9.0 mm) and that for the sites treated with regenerative therapy was 2.8 mm (SD 2.1; range –1.0 to 6.0 mm).

The variability in the change of CAL between baseline and after surgery is illustrated in Table 2, in which the outcome data are stratified according to the magnitude of change. The proportion of defects demonstrating a CAL gain ≥4 mm increased from 32% for open flap debridement to 50% for regenerative therapy. One defect from open flap debridement and one defect from regenerative therapy demonstrated loss of attachment (1 mm). In these two cases, one had an advanced 1-wall defect and the other exhibited tooth fracture. When the association between the two treatments and the incidence of CAL gain ≥4 mm was assessed, a
A statistically significant difference was found ($p = 0.0214$). The regenerative therapy was associated with having a CAL gain $\geq 4$ mm.

At sites with baseline PD $\geq 8$ mm, mean CAL gain amounted to 2.9 mm for the open flap debridement whereas the value (4.3 mm) was significantly higher for the regenerative therapy (Fig. 2).

Among 6 smokers, 5 received open flap debridement and presented a mean CAL gain of 1.9 mm (range 1–6 mm) after surgery. One received regenerative therapy and demonstrated a mean CAL gain of 1.0 mm (range 0–2 mm).

**Discussion**

In the present study, surgical interventions (open flap debridement or regenerative therapy) yielded improvements in periodontal parameters such as PD, CAL and BOP. For these patients, periodontal surgery performed following the initial periodontal therapy seemed to have an added impact on their periodontal conditions. In a systematic review of the effect of surgical or non-surgical debridement for the treatment of chronic periodontitis $^10$, it was shown that when sites with initial PD $> 6$ mm were treated by open flap debridement, there was significantly more CAL gain than with the scaling and root planing at 12 months following treatment. Our data, although short-term, were consistent with this finding. In a longitudinal study, Kaldahl et al. $^{20}$ found no differences in PD reduction between sites treated by modified Widman and root planing by the end of year 3 in 5- to 6-mm sites and by the end of year 5 in $\geq 7$-mm sites. It is thus important to longitudinally evaluate clinical outcomes in surgical patients.

Since its introduction, EMD has demonstrated the ability to encourage periodontal regeneration in both animal studies and clinical trials $^{7,9,13,23}$. Although clinical results are often dependent upon the dimension and morphology of the defect $^6$, mean CAL gain (2.8 mm) observed for sites with regenerative therapy appeared to be comparable to that reported in our previous study $^{18}$ and others $^{13,20}$. An increase in the proportion of defects demonstrating a CAL gain $\geq 4$ mm was also observed for regenerative therapy when compared to open flap debridement. For the sites with initial PD $\geq 8$ mm, significantly greater CAL gain was observed for regenerative therapy than open flap debridement. These findings need to be interpreted with caution as this was not a case-controlled study. However, our results suggest that the efficacy of regenerative therapy in the treatment of deep pockets.

The basis for successful use of the EMD material is the precipitation of protein along the root surface in the osseous defect. It is therefore logical to assume that a limiting factor for success would include the ability to contain the EMD adjacent to the affected root surface $^6$. Froum et al. $^6$ designed a clinical decision tree based on biologic principles of regeneration. For deep and well-contained defects, the sole use of EMD is recommended, and for moderate to deep non-contained intraosseous defects, EMD with bone graft is indicated. A similar recommendation was presented in a clinical guideline by the Japanese Society of Periodontology $^{11}$. In the present study, no combination therapy was performed. The reasons for this may include the following: (1) condition of the defect

Fig. 2 Comparison of CAL gain between sites with OFD ($n = 50$) and REG ($n = 12$) (baseline PD value $\geq 8$ mm)

Data shown as box-and-whiskers plot with minimum, maximum, median and 25th and 75th percentiles (*$p = 0.031$, Mann-Whitney U test).
did not call for bone grafting; (2) difficulty in harvesting autogenous bone; (3) unavailability of appropriate synthetic bone material. Furthermore, we could not classify the cases based on the type of defects. A detailed analysis of defect type is necessary for a better understanding of the validity of our clinical decision making.

Due to the small number of patient samples, we did not perform a statistical comparison of clinical outcome between smokers and non-smokers. However, a comparably modest value for CAL gain observed for smokers was within our expectations, since smoking has been associated with significantly compromised healing response following periodontal surgery, especially regenerative therapy. We advised the patients that their smoking habit might result in poorer healing during the course of treatment.

There are some limitations to our study. We only analyzed surgical cases that were reported and registered by the clinicians. No attempts were made to analyze hospital records in order to search unreported surgical cases. Also, the periodontal parameters were measured by each clinician who performed surgery; therefore a certain degree of inter-examiner variation or bias is expected.

Within these limitations, surgical periodontal therapy performed during the observation period was considered to be effective in improving periodontal parameters in patients with moderate to advanced periodontitis. For the clinical resolution of deeper periodontal pockets, regenerative therapy, represented by EMD therapy, appears to offer an added advantage over open flap debridement.

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