Disease Recurrence following Reconstructive Procedures: a 6- to 8-year Follow-up Observational Study

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Purpose: The aims of the present study were to determine (i) the long-term disease recurrence in intraosseous defects that had undergone an open flap debridement (OFD) procedure with or without enamel matrix derivative (EMD); and (ii) whether and to what extent clinical changes recorded on teeth treated with surgery were similar at sites involved or adjacent to the intraosseous defect.

Materials and Methods: Eleven patients contributing twelve reconstructed intraosseous defects were retrospectively recruited and included for analysis. Immediately before surgery, at 12 months post-surgery and at long-term examination (6–8 years post-surgery), probing pocket depth (PPD) and clinical attachment level (CAL) were recorded at the test site (representative of the reconstructed intraosseous defect) and the control site (representative of an adjacent non-reconstructed site) of each tooth treated with surgery.

Results: All patients received monthly professional maintenance up to 12 months after surgery, and every 6 months or less frequently thereafter. In test sites, CAL varied from 5.4 ± 0.8 mm at 12 months to 6.5 ± 1.0 mm at the long-term examination. PPD increased from 3.7 ± 0.4 mm at 12 months to 4.3 ± 0.6 mm at the long-term examination, the changes being not statistically significant. When PPD and CAL changes from 12 months to the long-term examination were compared between test and control sites, no significant differences were found.

Conclusions: Within its limitations and considering the limited sample size, the present study indicates that (i) the attachment gain that has been achieved by means of a surgical reconstructive procedure (based on OFD with/without EMD) may be mostly maintained over a 6–8 year follow-up period; and (ii) the extent of disease recurrence, as assessed by attachment loss and pocket deepening, was similar at sites involved or adjacent to the intraosseous defect.

Key words: disease progression, disease recurrence, intrabony defect, maintenance therapy, reconstructive surgery

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Data from clinical studies have shown the effectiveness of open flap debridement (OFD) in the treatment of periodontal intraosseous defects (Rosling et al, 1976; Meador et al, 1985; Renvert et al, 1985). Moreover, recent systematic reviews indicate the availability of different reconstructive options, producing comparable and more favourable clinical improvements in hard and soft tissue parameters of healing response (i.e. clinical attachment gain, pocket reduction and bone fill) when compared to OFD procedures (Trombelli et al, 2002a; Trombelli, 2005).

The long-term clinical modifications of reconstructed intraosseous defects have been reported for different procedures, including autogenous bone grafts and bone substitutes (Nabers, 1984; Galgut et al, 1992; Flemmig et al, 1998), guided tissue regeneration (Cortellini and Tonetti, 2004) and enamel matrix derivative (EMD) (Sculean et al, 2004; Heden and Wennstrom, 2006). Overall, these studies seem to indicate a stable periodontal condition, in terms of attachment loss and pocket depth, of teeth that have undergone a reconstructive procedure in well-maintained

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patient cohorts. However, due to limited information on long-term outcomes, it is unclear whether the stability of periodontal support and tooth survival are affected by the additional application of reconstructive devices/biomaterials. In particular, no data are at present available indicating whether and to what extent the site-specific susceptibility to disease recurrence (in terms of post-surgery attachment loss and pocket deepening) is somewhat different at sites that had received or not received a reconstructive procedure.

Therefore, we designed the present retrospective study with the aim of: (i) assessing the long-term disease recurrence in intraosseous defects that had undergone an OFD procedure with or without EMD; and (ii) determining whether and to what extent clinical changes recorded on teeth treated with surgery were similar at sites involved or adjacent to the intraosseous defect. The hypothesis to be tested was: did a site that is topographically-related to a reconstructed intraosseous lesion have a similar disease recurrence over time with respect to an adjacent site which was not topographically related to the defect?

MATERIALS AND METHODS

Study population

Patients were retrospectively selected from a pool of patients affected by chronic periodontitis who had undergone a reconstructive procedure for periodontal intraosseous defects at the Research Centre for the Study of Periodontal Diseases, University of Ferrara, Italy. Ethical approval was granted from the institution and written informed consent from all patients was gained.

Patient selection and surgical procedures have been previously reported (Trombelli et al, 2002b). Briefly, the subjects, presenting at least one intraosseous defect with probing pocket depth ≥ 6 mm and a radiographic depth of the defect ≥ 4mm at the time of initial visit, were treated by means of a reconstructive procedure based on OFD with or without EMD. All surgical procedures were performed from November 1998 to June 2000. After surgery, the patients were placed on monthly recall visits, including supragingival tooth cleaning, until 12-month re-evaluation. Then, the patients were supported with instructions about the recommended frequency of the supportive periodontal therapy (SPT) sessions, and referred to their general dentists for the long-term periodontal maintenance. After 6–8 years following the surgical procedures, patients were recalled for a periodontal re-evaluation. For simplicity, we will refer to this evaluation as 'long-term examination'.

Clinical recordings

Immediately before surgery (baseline), at 12-month post-surgery and at the long-term examination, probing pocket depth (PPD) and clinical attachment level (CAL) were recorded at 6 aspects (mesiobuccal, midbuccal, distobuccal, mesiolingual, midlingual, distolingual) of the teeth that had undergone surgery.

Probing measurements were performed by using a manual pressure sensitive probe (at approximately 0.3 N force) with 1 mm increments (UNC 15, Hu-Friedy, Chicago, IL, USA). Measurements were rounded to the nearest mm.

Frequency of maintenance sessions (i.e. number of professional recalls per year) received by the patients after the 12-month re-evaluation was recorded.

Experimental sites

For each tooth that had received the reconstructive procedure, the following experimental sites were selected for the analysis:

Test site: one of the 6 aspects of the tooth which
1) was more topographically related to the intraosseous defect and
2) presented the largest CAL value at the time of presurgery recordings. In other words, the test site was considered representative of the intraosseous defect.

Control site: one of the 6 aspects of the tooth which
1) was not topographically related to the intraosseous defect,
2) presented a PPD ≤ 4 mm, and
3) was included in the surgical flap.

The control site was usually selected as opposite to the test site: i.e. if test site was the mesiobuccal, control site was distolingual. When PPD in control site was > 4 mm, a defect adjacent to the buccal/lingual site was alternatively selected. In other words, the control site was considered representative of a non-reconstructed site.

Statistical analysis

The intraosseous defect was regarded as the statistical unit. Due to limited sample size, and since 12-

month CAL gain and PPD reduction were similar between OFD and OFD+EMD treatment groups (results not shown), data related to both OFD and OFD+EMD treated defects were pooled for the analysis. Test and control sites were used for comparison and statistical analysis of clinical variables. Data were expressed as mean ± standard error. Intra- and inter-site comparisons were performed by Wilcoxon rank sum test and Mann-Whitney U-test for dependent and independent parameters, respectively. The level of significance was set at 5%.

RESULTS

Patient and defect characteristics

Eleven patients, eight females and three males, mean age 52.4 years (range: 41–64 years), volunteered to participate in the study. Ten patients contributed one defect, one patient contributed two defects.

Five patients with 5 defects had received OFD, five patients with 5 defects had received OFD+EMD, one patient with 2 defects had received both treatments. Nine defects were on single-rooted teeth, 3 defects were on multi-rooted teeth with no furcation involvement (all first maxillary premolars).

None of the patients was diabetic at baseline and at long-term examination. At baseline, nine patients had never smoked and two patients were smokers (daily tobacco consumption > 10 cigarettes/day). At long-term examination one smoker had quit smoking 5 years after surgery and one smoker had reduced his daily tobacco consumption to 5 cigarettes/day.

Four patients were long-term re-examined between 6.1 and 7.0 years after surgery, seven patients between 7.1 years and 7.5 years. In terms of frequency recall during the maintenance phase, one patient reported to have received a professional session (including supra/sub-gingival scaling and oral hygiene instructions) every 2 months, two patients every 6 months, six patients at yearly intervals and two patients less frequently.

Clinical recordings

Baseline, 12 months and long-term characteristics of the experimental sites are reported in Fig 1. Baseline PPD was 7.5 ± 0.3 mm and 2.3 ± 0.3 mm in test and control sites, respectively, and baseline CAL was 9.1 ± 0.5 mm and 3.5 ± 0.3 mm in test and control sites, respectively. Differences in PPD and CAL were statistically significant between sites ($p < 0.001$).

In test sites, the reconstructive procedure resulted in a significant CAL increase and PPD reduction at 12 months post-surgery ($p < 0.001$ with respect to baseline for both comparisons). Control sites did not reveal any significant changes in both CAL and PPD from baseline to 12 months post-surgery. Baseline to 12-month changes in CAL and PPD were significantly different in test and control sites ($p = 0.0001$).

In test sites, CAL varied from 5.4 ± 0.8 mm at 12 months to 6.5 ± 1.0 mm at long-term examination ($p > 0.05$). In control sites CAL varied from 3.3 ± 0.3 mm at 12 months to 5.0 ± 0.9 mm at long-term examination ($p = 0.05$). The patient-specific values of CAL change between 12-months and the long-term examination in test and control sites are shown in Fig 2. PPD increased from 3.7 ± 0.4 mm at 12 months to 4.3 ± 0.6 mm at long-term examination in test sites, and from 2.2 ± 0.3 mm at 12 months to 3.5 ± 0.8 mm at long-term examination in control sites. PPD change was not statistically significant at both test and control sites. When PPD and CAL changes (12 month to long-term examination) were compared between test and control sites, no significant differences were found.

DISCUSSION

The present retrospective study was designed in order to assess (i) the long-term disease recurrence in intraosseous defects that had received an OFD procedure with or without EMD; and (ii) whether and to what extent clinical changes recorded on teeth treated with surgery were similar at sites involved or adjacent to the intraosseous defect. The results of the study indicate that (i) the attachment gain that has been achieved by means of a surgical reconstructive procedure (based on OFD with/without EMD) may be mostly maintained over a 6–8 year follow-up period; and (ii) the extent of disease recurrence, as assessed by attachment loss and pocket deepening, was similar at sites involved or adjacent to the intraosseous defect.

Surgical treatment resulted in substantial 12-month CAL gain and PPD reduction in sites corresponding to the intraosseous defect, whereas there were only minor changes in the clinical attachment and sulcus depth at sites that were distant from the defect but included in the surgical flap (Fig 1). The effectiveness of the reconstructive approach (OFD with and without EMD) in terms of CAL gain and PPD reduction was in agreement with previous studies on treatment options for intraosseous defects (Trombelli,

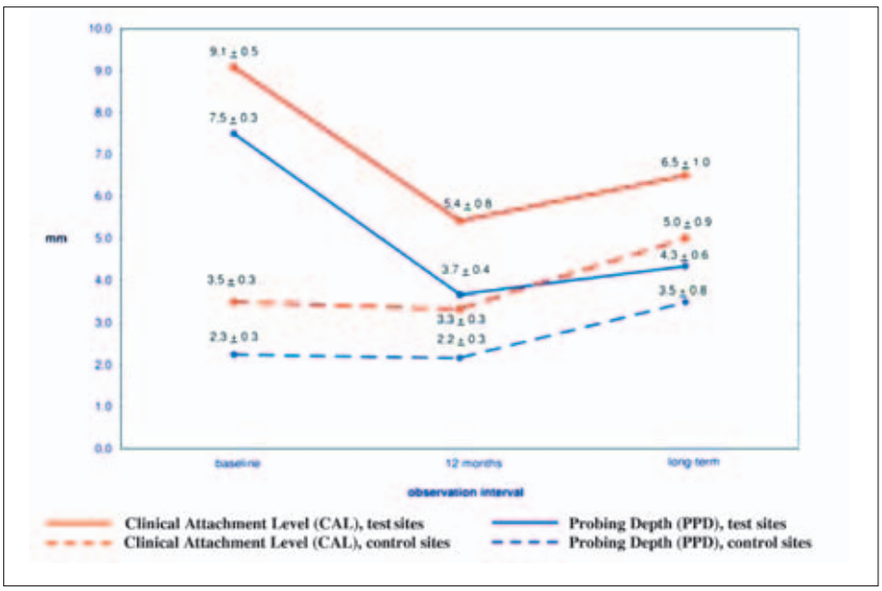
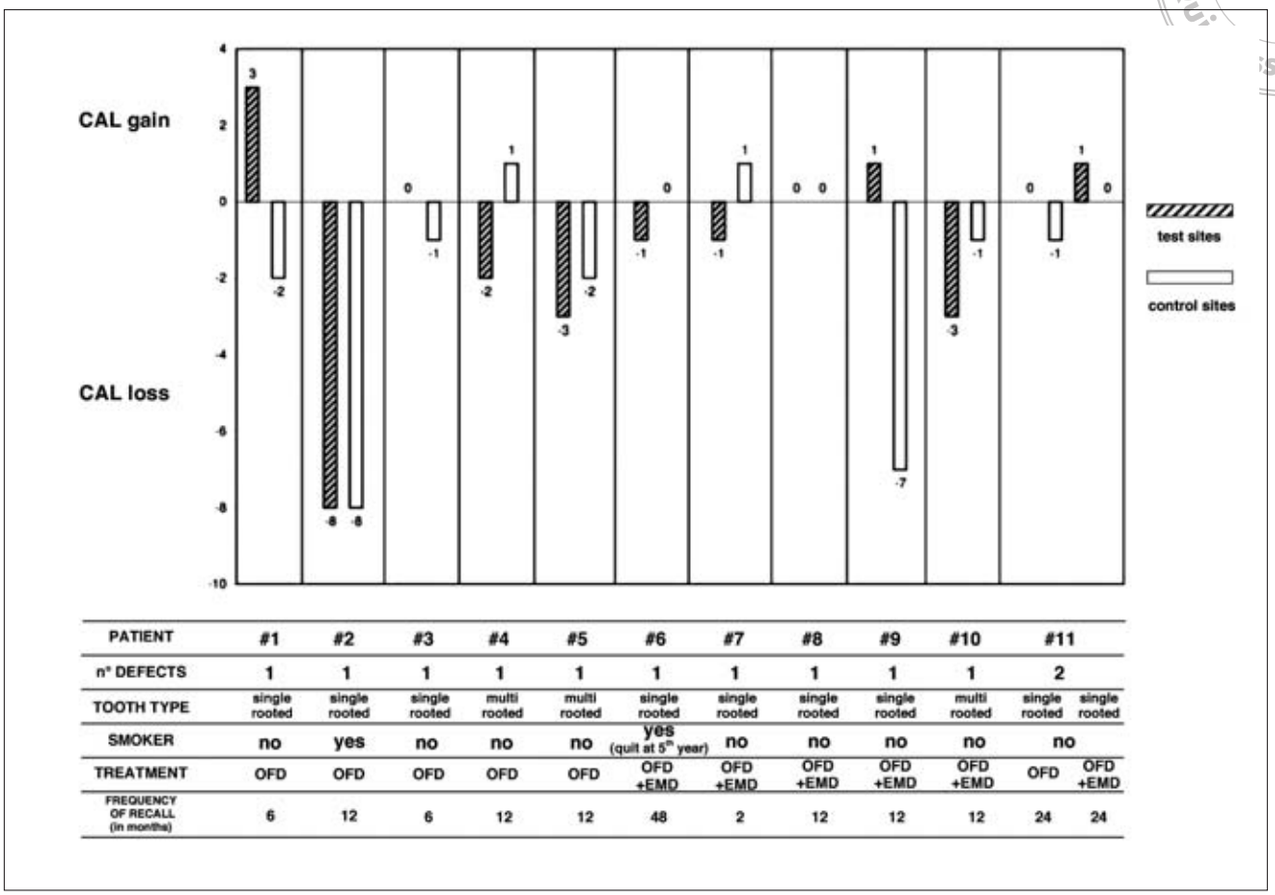


Fig 1 Baseline, 12-month and long-term clinical attachment level (CAL) and probing pocket depth (PPD) (in mm; mean ± standard error).

2005). On the other hand, the effects of the surgical trauma on control sites were consistent with those reported in randomised controlled clinical trials and systematic reviews where the effect of surgical treatment at sites with different pocket depth was evaluated (Knowles et al, 1979; Knowles et al, 1980; Pihlstrom et al, 1981; Pihlstrom et al, 1983; Westfelt et al, 1985; Heitz-Mayfield et al, 2002; Yilmaz et al, 2003).

At long-term examination, 1.1 mm of attachment loss was detected in test sites. This finding is partly in contrast with other studies on long-term clinical changes after periodontal regenerative procedures involving OFD with/without EMD (Sculean et al, 2004; Heden and Wennstrom, 2006). In those studies only minor periodontal alterations (CAL loss ranging from 0.3 mm to 0.5 mm for Sculean et al trial; mean CAL gain of 1.1 mm for Heden and Wennstrom case series) were found at the 5-year recall with respect to the 1-year recall. Differences in the severity of disease recurrence among studies could be partly ascribed to variable follow-up periods, as well as dental professionals involved and frequency of recall sessions during maintenance. In the present study, the inclusion of patients who had undergone a SPT with an irregular frequency at recall sessions may have accounted for the amount of CAL loss experienced by both test and control sites after 12-months post-surgery. This observation seems to be reinforced when considering the extent of CAL loss reported by other studies on different reconstructive procedures in patients who were regularly maintained over time (Cortellini et al, 1996; Flemmig et al, 1998; Heden and Wennstrom, 2006). On the other hand, a progressive periodontal breakdown rate in periodontal sites treated with surgery was reported in non-regularly maintained patients (Bostanci and Arpak, 1991; Kocher et al, 2000; Rosling et al, 2001; Cortellini et al, 1996). Cortellini et al (1996) reported that patients experiencing substantial attachment loss at 5 years following a reconstructive procedure showed deteriorating oral hygiene, did not comply with the recall system, and smoked.

In the present study, defects that had been treated with either OFD alone or OFD plus EMD were pooled-for analysis. OFD- and EMD-treated defects may present clinical as well biological differences after the healing phase. In particular, sites treated with OFD may be healed by a long junctional epithelium with limited, if any, periodontal regeneration in the most apical part of the defect (Bowers et al, 1989); whereas EMD-treated defects may have healed with true periodontal regeneration, including new bone, cementum and periodontal ligament formation (Yukna and Mellonig, 2000). Differences in the healing response between treatments may have resulted in varying long-term recurrence pattern. At present, limited evidence is available indicating that long-term CAL loss is similar in defects treated with OFD with and without EMD (Sculean et al, 2004). Therefore, further longitudinal studies comparing the stability of clinical attachment achieved with different reconstructive procedures are



PATIENT	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	
n° DEFECTS	1	1	1	1	1	1	1	1	1	1	2	
TOOTH TYPE	single rooted	single rooted	single rooted	multi rooted	multi rooted	single rooted	single rooted	single rooted	single rooted	multi rooted	single rooted	single rooted
SMOKER	no	yes	no	no	no	yes (quit at 5th year)	no	no	no	no	no	
TREATMENT	OFD	OFD	OFD	OFD	OFD	OFD +EMD	OFD +EMD	OFD +EMD	OFD +EMD	OFD +EMD	OFD	OFD +EMD
FREQUENCY OF RECALL (in months)	6	12	6	12	12	48	2	12	12	12	24	24

Fig 2 Patient-specific distribution of CAL change (in mm) in test and control sites after the 12-month examination.

needed to assess whether and to what extent the severity of recurrence may be affected by differences in the reconstructive approach.

Although the long-term deficient maintenance of our patients may have represented a limitation in assessing the long-term stability of the reconstructive outcome, this study could provide insight on the extent of recurrence of periodontal breakdown in sites that were associated or not associated with an intraosseous lesion. The present results showed a similar extent of CAL loss in test and control sites after the 12-month observation. This similar pattern of disease progression may be partly due to an improvement in patient-specific and site-specific periodontal prognosis after surgical treatment (Cortellini and Tonetti, 2004). The reconstructive procedure, in fact, was part of a general surgical and non-surgical treatment planning that aimed to reduce pocket depths at the intraosseous lesion as well as in the entire dentition. It has been demonstrated that an increased number of residual deep pockets (≥ 6 mm) following initial cause-related therapy and the presence of a pocket of 5 mm or more represent a risk predictor for further attachment loss on a patient- and tooth-basis, respectively (Claffey et al, 1990; Claffey and Egelberg, 1995). The elimination of patient and local risk factors for periodontitis progression may have, at least in part, affected the patient/tooth susceptibility to progressive periodontal breakdown.

Within its limitations and considering the limited sample size, the present study provides information on the long-term disease recurrence in surgically reconstructed intrabony defects. The results seem to indicate that (i) CAL gain that has resulted from a surgical reconstructive procedure can be maintained long-term, and (ii) a similar pattern of periodontal breakdown is observed at sites that are topographically related to the bony lesion as well as at adjacent sites.

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