Healing of two and three wall intrabony periodontal defects following treatment with an enamel matrix derivative combined with autogenous bone.

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Abstract

BACKGROUND: There are still limited data on the outcomes of regenerative periodontal surgery using a combination of an enamel matrix protein derivative (EMD) and autogenous bone (AB).

AIM: To evaluate the healing of deep intrabony defects treated with either a combination EMD+AB or EMD alone.

MATERIALS AND METHODS: Forty patients with advanced chronic periodontitis, with one deep intrabony defect, were randomly treated with either EMD+AB (test) or EMD (control). Clinical assessments were performed at baseline and at 1 year after treatment. The primary outcome variable was relative attachment level (RAL).

RESULTS: Healing was uneventful in all patients. The test sites showed a reduction in the mean probing pocket depth (PPD) of 5.6 +/- 0.9 mm (p<0.001), a gain in the mean RAL of 4.2 +/- 1.1 mm (p<0.001) and a gain in the mean probing bone level (PBL) of 3.9 +/- 1.0 mm (p<0.001). The control group displayed a mean PPD reduction of 4.6 +/- 0.4 mm (p<0.001), a mean RAL gain of 3.4 +/- 0.8 mm (p<0.001) and a mean PBL gain of 2.8 +/- 0.8 mm (p<0.001). RAL gains of > or =4 mm were measured in 90% of the test defects and in 55% of the controls. PBL gains of > or =4 mm were obtained in 85% of the test defects and in 25% of the control ones. The test treatment resulted in statistically higher PPD reductions, RAL gains and PBL gains compared with the control (p<0.01).

CONCLUSIONS: Within their limits, the present results indicate that: (i) at 1 year after surgery, both therapies resulted in statistically significant clinical improvements compared with baseline and (ii) although the combination of EMD+AB resulted in statistically significant higher soft and hard tissue improvements compared with treatment with EMD, the clinical relevance of this finding is unclear.
Reconstructive periodontal therapy with simultaneous ridge augmentation. A clinical and histological case series report.


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Abstract

Treatment of intrabony periodontal defects with a combination of a natural bone mineral (NBM) and guided tissue regeneration (GTR) has been shown to promote periodontal regeneration in intrabony defects. In certain clinical situations, the teeth presenting intrabony defects are located at close vicinity of the resorbed alveolar ridge. In these particular cases, it is of clinical interest to simultaneously reconstruct both the intrabony periodontal defect and the resorbed alveolar ridge, thus allowing insertion of endosseous dental implants. The aim of the present study was to present the clinical and histological results obtained with a new surgical technique designed to simultaneously reconstruct the intrabony defect and the adjacent located resorbed alveolar ridge. Eight patients with chronic advanced periodontitis displaying intrabony defects located in the close vicinity of resorbed alveolar ridges were consecutively enrolled in the study. After local anesthesia, mucoperiosteal flaps were raised, the granulation tissue removed, and the roots meticulously scaled and planed. A subepithelial connective tissue graft was harvested from the palate and sutured to the oral flap. The intrabony defect and the adjacent alveolar ridge were filled with a NBM and subsequently covered with a bioresorbable collagen membrane (GTR). At 11-20 months (mean, 13.9+-3.9 months) after surgery, implants were placed, core biopsies retrieved, and histologically evaluated. Mean pocket depth reduction measured 3.8+-1.7 mm and mean clinical attachment level gain 4.3+-2.2 mm, respectively. Reentry revealed in all cases a complete fill of the intrabony component and a mean additional vertical hard tissue gain of 1.8+-1.8 mm. The histologic evaluation indicated that most NBM particles were surrounded by bone. Mean new bone and mean graft area measured 17.8+-2.8% and 32.1+-8.3%, respectively. Within their limits, the present findings indicate that the described surgical approach may be successfully used in certain clinical cases to simultaneously treat intrabony defects and to reconstruct the resorbed alveolar ridge.

Artikel frei einsehbar unter PubMed Central:

⇒ http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2491434/?tool=pubmed
Clinical and histologic evaluation of granular Beta-tricalcium phosphate for the treatment of human intrabony periodontal defects: a report on five cases.


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Abstract

BACKGROUND: The aim of the study is to clinically and histologically evaluate the healing of advanced intrabony defects treated with open flap debridement and the adjunct implantation of granular beta tricalcium phosphate (beta-TCP).

METHODS: Five patients, each displaying advanced combined 1- and 2-wall intrabony defects around teeth scheduled for extraction or root resection, were recruited. Approximately 6 months after surgery, the teeth or roots were removed together with a portion of their surrounding soft and hard tissues and processed for histologic evaluation.

RESULTS: The mean probing depth (PD) was reduced from 10.8 +/- 2.3 mm presurgically to 4.6 +/- 2.1 mm, whereas a mean clinical attachment level (CAL) gain of 5.0 +/- 0.7 mm was observed. The increase in gingival recession was 1.2 +/- 3.2 mm. The histologic evaluation indicated the formation of new cellular cementum with inserting collagen fibers to a varying extent (mean: 1.9 +/- 0.7 mm; range: 1.2 to 3.03 mm) coronal to the most apical extent of the root instrumentation. The mean new bone formation was 1.0 +/- 0.7 mm (range: 0.0 to 1.9 mm). In most specimens, beta-TCP particles were embedded in the connective tissue, whereas the formation of a mineralized bone-like or cementum-like tissue around the particles was only occasionally observed.

CONCLUSION: The present data indicates that treatment of intrabony periodontal defects with this beta-TCP may result in substantial clinical improvements such as PD reduction and CAL gain, but this beta-TCP does not seem to enhance the regeneration of cementum, periodontal ligament, and bone.

Does periodontal tissue regeneration really work?


Bosshardt DD, Sculean A.

⇒ kein Abstract erhältlich

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Abstract

BACKGROUND: Bone replacement grafts (BRG) are widely used in the treatment of periodontal osseous defects; however, the clinical benefits of this therapeutic practice require further clarification through a systematic review of randomized controlled studies.

RATIONALE: The purpose of this systematic review is to access the efficacy of bone replacement grafts in proving demonstrable clinical improvements in periodontal osseous defects compared to surgical debridement alone.

FOCUSED QUESTION: What is the effect of bone replacement grafts compared to other interventions on clinical, radiographic, adverse, and patient-centered outcomes in patients with periodontal osseous defects?

SEARCH PROTOCOL: The computerized bibliographical databases MEDLINE and EMBASE were searched from 1966 and 1974, respectively, to October 2002 for randomized controlled studies in which bone replacement grafts were compared to other surgical interventions in the treatment of periodontal osseous defects. The search strategy included screening of review articles and reference lists of retrieved articles as well as hand searches of selected journals.

INCLUSION CRITERIA: All searches were limited to human studies in English language publications.

EXCLUSION CRITERIA: Non-randomized observational studies (e.g., case reports, case series), publications providing summary statistics without variance estimates or data to permit computation, and studies without BRG intervention alone were excluded.

DATA COLLECTION AND ANALYSIS: The therapeutic endpoints examined included changes in bone level, clinical attachment level, probing depth, gingival recession, and crestal resorption. For purposes of meta-analysis, change in bone level (bone fill) was used as the primary outcome measure, measured upon surgical re-entry or transgingival probing (sounding).

MAIN RESULTS: 1. Forty-nine controlled studies met eligibility criteria and provided clinical outcome data on intrabony defects following grafting procedures. 2. Seventeen studies provided clinical outcome data on BRG materials for the treatment of furcation defects.

REVIEWERS' CONCLUSIONS: 1. With respect to the treatment of intrabony defects, the results of meta-analysis supported the following conclusions: 1) bone grafts increase bone level, reduce crestal bone loss, increase clinical attachment level, and reduce probing depth compared to open flap debridement (OFD) procedures; 2) No differences in clinical outcome measures emerge between particulate bone allograft and calcium phosphate
(hydroxyapatite) ceramic grafts; and 3) bone grafts in combination with barrier membranes increase clinical attachment level and reduce probing depth compared to graft alone. 2. With respect to the treatment of furcation defects, 15 controlled studies provided data on clinical outcomes. Insufficient studies of comparable design were available to submit data to meta-analysis. Nonetheless, outcome data from these studies generally indicated positive clinical benefits with the use of grafts in the treatment of Class II furcations. 3. With respect to histological outcome parameters, 2 randomized controlled studies provide evidence that demineralized freeze-dried bone allograft (DFDBA) supports the formation of a new attachment apparatus in intrabony defects, whereas OFD results in periodontal repair characterized primarily by the formation of a long junctional epithelial attachment. Multiple observational studies provide consistent histological evidence that autogenous and demineralized allogeneic bone grafts support the formation of new attachment. Limited data also suggest that xenogenic bone grafts can support the formation of a new attachment apparatus. In contrast, essentially all available data indicate that alloplastic grafts support periodontal repair rather than regeneration. 4. The results of this systematic review indicate that bone replacement grafts provide demonstrable clinical improvements in periodontal osseous defects compared to surgical debridement alone.


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Abstract

BACKGROUND: Regenerative periodontal therapy aims to predictably restore the tooth's supporting periodontal tissues and should result in formation of a new connective tissue attachment (i.e. new cementum with inserting periodontal ligament fibres) and new alveolar bone. Histologic evidence from preclinical models has demonstrated periodontal regeneration following treatment with barrier membranes, various types of grafting materials or a combination thereof. However, it is still not clear to what extent a combination of barrier membranes and grafting materials may additionally enhance the regeneration process compared with barrier membranes alone, grafting materials alone or open flap debridement.

OBJECTIVES: To review with a systematic approach all preclinical (i.e. animal) studies presenting histologic support for periodontal regeneration using the combination of barrier membranes and grafting materials.

MATERIAL AND METHODS: Based on a focused question, an electronic and manual search was conducted for animal studies presenting histological data for the effect of the combined use of barrier membranes and grafting materials on the treatment of periodontal defects. A systematic approach was followed by two independent reviewers including eligibility
criotateria for study inclusion, outcome measures determination, screening method, data extraction, data synthesis and drawing of conclusions.

RESULTS: Ten papers completely fulfilling the inclusion criteria were selected. All relevant data from the selected papers were extracted and recorded in separate tables according to the types of periodontal defects treated (i.e. supra-alveolar defects, intrabony defects, furcation defects and fenestration defects) with the combination of barrier membranes and grafting materials. Most studies have demonstrated periodontal regeneration following the combination approach. Most studies demonstrated superior histologic healing following the combination of barrier membranes and grafting materials than following open flap debridement. Histologically superior healing following the combination of barrier membranes and grafting materials when compared with barrier membranes alone or grafting materials alone were only obtained in non-contained two wall intrabony and supraalveolar defects.

CONCLUSION: Within its limits the present analysis indicates that: (a) The combination of barrier membranes and grafting materials may result in histological evidence of periodontal regeneration, predominantly bone repair. (b) No additional benefits of combination treatments were detected in models of three wall intrabony, Class II furcation or fenestration defects. (c) In supra-alveolar and two wall intrabony (missing buccal wall) defect models of periodontal regeneration, the additional use of a grafting material gave superior histological results of bone repair to barrier membranes alone. (d) In one study using a supra-alveolar model, combined graft and barrier membrane gave a superior result to graft alone.

The use of Emdogain® in periodontal and osseous regeneration

(in German)

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Abstract

The goal of regenerative periodontal therapy is the reconstitution of the lost periodontal structures (i.e. the new formation of root cementum, periodontal ligament and alveolar bone). Results from basic research have pointed to the important role of an enamel matrix protein derivative (EMD) in periodontal wound healing. Histological results from experiments in animals and from human case reports have shown that treatment with EMD promotes periodontal regeneration. Moreover, clinical studies have indicated that treatment with EMD positively influences periodontal wound healing in humans. The goal of the current overview is to present the clinical indications for regenerative therapy with EMD based on the existing evidence.

Artikel frei einsehbar in der SSO

Ten-year results following treatment of intra-bony defects with enamel matrix proteins and guided tissue regeneration.


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Abstract

BACKGROUND: Surgery utilizing an enamel matrix protein derivative (EMD) or guided tissue regeneration (GTR) has been shown to promote periodontal regeneration. Aim: To evaluate the 10-year results following treatment with EMD, GTR, EMD+GTR, and open flap debridement (OFD).

MATERIAL AND METHODS: Thirty-eight patients out of an initial group of 56 participants were treated with one of the four modalities. Results were evaluated before surgery, at 1 year, and at 10 years. Primary outcome variable was CAL change.

RESULTS: Treatment with EMD yielded a mean CAL gain of 3.4+/−1.0 mm (p<0.001) and 2.9+/−1.4 mm (p<0.001) at 1 and 10 years, respectively. GTR resulted in a mean CAL gain of 3.2+/−1.4 (p<0.001) at 1 year and 2.8+/−1.2 mm (p<0.001) at 10 years. Mean CAL gain in the EMD+GTR group was of 3.3+/−1.1 mm (p<0.001) and 2.9+/−1.2 mm (p<0.001) at 1 and 10 years, respectively. Treatment with OFD demonstrated a mean CAL gain of 2.0+/−1.2 mm (p<0.01) at 1 year and 1.8+/−1.1 mm (p<0.01) at 10 years. Compared with OFD, the three regenerative treatments resulted in statistically significant (p<0.05) higher CAL gain, at both 1 and 10 years. The CAL change between 1 and 10 years did not present statistically significant differences in any of the four groups.

CONCLUSION: The present results indicate that the clinical outcomes obtained with all four approaches can be maintained over a period of 10 years.

Five-year results of a prospective, randomized, controlled study evaluating treatment of intra-bony defects with a natural bone mineral and GTR.

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Abstract

BACKGROUND: Treatment with a natural bone mineral (NBM) and a guided tissue regeneration (GTR) has been shown to promote periodontal regeneration. However, until
now there are only very limited data on the long-term clinical results following this regenerative technique.

AIM: To present the 5-year results of a prospective, randomized, controlled clinical study evaluating the treatment of deep intra-bony defects either with open flap debridement (OFD) and a combination of an NBM and GTR (test) or OFD alone (control).

METHODS: Nineteen patients diagnosed with advanced chronic periodontitis, and each of whom displayed one intra-bony defect, received randomly the test or the control treatment. Results were evaluated at baseline, at 1 and at 5 years following therapy.

RESULTS: No statistically significant differences in any of the investigated parameters were observed at baseline between the two groups. At 1 year after therapy, the test group showed a reduction in mean probing depth (PD) from 9.1+/-1.1 to 3.7+/-0.8 mm (p<0.001) and a change in mean clinical attachment level (CAL) from 10.4+/-1.3 to 6.4+/-1.2 mm (p<0.001). At 5 years, mean PD and CAL measured 4.3+/-0.8 and 6.7+/-1.6 mm, respectively. At 5 years, both PD and CAL were statistically significantly improved compared with baseline (p<0.001) without statistically significant differences between the 1- and 5-year results. In the control group, mean PD was reduced from 8.9+/-1.3 to 4.9+/-1.2 mm (p<0.001) and mean CAL changed from 10.6+/-1.4 to 8.8+/-1.5 mm (p<0.01). At 5 years, mean PD and CAL measured 5.6+/-1.1 and 9.1+/-1.3 mm, respectively, and were still statistically significantly improved compared with baseline (p<0.01). No statistically significant differences were found between the 1- and 5-year results. The test treatment, at both 1 and 5 years, yielded statistically significantly higher CAL gains than the control one (p<0.01). Compared with baseline, at 5 years a CAL gain of > or =3 mm was found in nine defects (90%) of the test group but in none of the defects treated with OFD alone.

CONCLUSIONS: It was concluded that (i) treatment of intra-bony defects with OFD+NBM+GTR may result in significantly higher CAL gains than treatment with OFD, and (ii) the clinical results obtained after both treatments can be maintained over a period of 5 years.

Guided tissue regeneration for periodontal infra-bony defects.

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Update of:


Abstract

BACKGROUND: Conventional treatment of destructive periodontal (gum) disease arrests the disease but does not usually regain the bone support or connective tissue
lost in the disease process. Guided tissue regeneration (GTR) is a surgical procedure that specifically aims to regenerate the periodontal tissues when the disease is advanced and could overcome some of the limitations of conventional therapy.

OBJECTIVES: To assess the efficacy of GTR in the treatment of periodontal infra-bony defects measured against conventional surgery (open flap debridement (OFD)) and factors affecting outcomes.

SEARCH STRATEGY: We conducted an electronic search of the Cochrane Oral Health Group Trials Register, MEDLINE and EMBASE up to April 2004. Handsearching included Journal of Periodontology, Journal of Clinical Periodontology, Journal of Periodontal Research and bibliographies of all relevant papers and review articles up to April 2004. In addition, we contacted experts/groups/companies involved in surgical research to find other trials or unpublished material or to clarify ambiguous or missing data and posted requests for data on two periodontal electronic discussion groups.

SELECTION CRITERIA: Randomised, controlled trials (RCTs) of at least 12 months duration comparing guided tissue regeneration (with or without graft materials) with open flap debridement for the treatment of periodontal infra-bony defects. Furcation involvements and studies specifically treating aggressive periodontitis were excluded.

DATA COLLECTION AND ANALYSIS: Screening of possible studies and data extraction was conducted independently. The methodological quality of studies was assessed in duplicate using individual components and agreement determined by Kappa scores. Methodological quality was used in sensitivity analyses to test the robustness of the conclusions. The Cochrane Oral Health Group statistical guidelines were followed and the results expressed as mean differences (MD and 95% CI) for continuous outcomes and risk ratios (RR and 95% CI) for dichotomous outcomes calculated using random-effects models. Any heterogeneity was investigated. The primary outcome measure was change in clinical attachment.

MAIN RESULTS: The search produced 626 titles, of these 596 were clearly not relevant to the review. The full text of 32 studies of possible relevance was obtained and 15 studies were excluded. Therefore 17 RCTs were included in this review, 16 studies testing GTR alone and two testing GTR+bone substitutes (one study had both test treatment arms). No tooth loss was reported in any study although these data are incomplete where patient follow up was not complete. For attachment level change, the mean difference between GTR and OFD was 1.22 mm (95% CI Random Effects: 0.80 to 1.64, chi squared for heterogeneity 69.1 (df = 15), $P < 0.001$, I(2) = 78%) and for GTR + bone substitutes was 1.25 mm (95% CI 0.89 to 1.61, chi squared for heterogeneity 0.01 (df = 1), $P = 0.91$). GTR showed a significant benefit when comparing the numbers of sites failing to gain 2 mm attachment with risk ratio 0.54 (95% CI Random Effects: 0.31 to 0.96, chi squared for heterogeneity 8.9 (df = 5), $P = 0.11$). The number needed to treat (NNT) for GTR to achieve one extra site gaining 2 mm or more attachment over open flap debridement was therefore 8 (95%
CI 5 to 33), based on an incidence of 28% of sites in the control group failing to gain 2 mm or more of attachment. For baseline incidences in the range of the control groups of 3% and 55% the NNTs are 71 and 4. Probing depth reduction was greater for GTR than OFD: 1.21 mm (95% CI 0.53 to 1.88, chi squared for heterogeneity 62.9 (df = 10), P < 0.001, I(2) = 84%) or GTR + bone substitutes, weighted mean difference 1.24 mm (95% CI 0.89 to 1.59, chi squared for heterogeneity 0.03 (df = 1), P = 0.85). For gingival recession, a statistically significant difference between GTR and open flap debridement controls was evident (mean difference 0.26 mm (95% CI Random Effects: 0.08, 0.43, chi squared for heterogeneity 2.7 (df = 8), P = 0.95), with a greater change in recession from baseline for the control group. Regarding hard tissue probing at surgical re-entry, a statistically significant greater gain was found for GTR compared with open flap debridement. This amounted to a weighted mean difference of 1.39 mm (95% CI 1.08 to 1.71, chi squared for heterogeneity 0.85 (df = 2), P = 0.65). For GTR + bone substitutes the difference was greater, with mean difference 3.37 mm (95% CI 3.14 to 3.61). Adverse effects were generally minor although with an increased treatment time for GTR. Exposure of the barrier membrane was frequently reported with a lack of evidence of an effect on healing.

AUTHORS’ CONCLUSIONS: GTR has a greater effect on probing measures of periodontal treatment than open flap debridement, including improved attachment gain, reduced pocket depth, less increase in gingival recession and more gain in hard tissue probing at re-entry surgery. However there is marked variability between studies and the clinical relevance of these changes is unknown. As a result, it is difficult to draw general conclusions about the clinical benefit of GTR. Whilst there is evidence that GTR can demonstrate a significant improvement over conventional open flap surgery, the factors affecting outcomes are unclear from the literature and these might include study conduct issues such as bias. Therefore, patients and health professionals need to consider the predictability of the technique compared with other methods of treatment before making final decisions on use. Since trial reports were often incomplete, we recommend that future trials should follow the CONSORT statement both in their conduct and reporting. There is therefore little value in future research repeating simple, small efficacy studies. The priority should be to identify factors associated with improved outcomes as well as investigating outcomes relevant to patients. Types of research might include large observational studies to generate hypotheses for testing in clinical trials, qualitative studies on patient-centred outcomes and trials exploring innovative analytic methods such as multilevel modelling. Open flap surgery should remain the control comparison in these studies.
Enamel matrix derivative (Emdogain(R)) for periodontal tissue regeneration in intrabony defects.


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Update of:

Abstract

BACKGROUND: Periodontitis is a chronic infective disease of the gums caused by bacteria present in dental plaque. This condition induces the breakdown of the tooth supporting apparatus until teeth are lost. Surgery may be indicated to arrest disease progression and regenerate lost tissues. Several surgical techniques have been developed to regenerate periodontal tissues including guided tissue regeneration (GTR), bone grafting (BG) and the use of enamel matrix derivative (EMD). EMD is an extract of enamel matrix and contains amelogenins of various molecular weights. Amelogenins are involved in the formation of enamel and periodontal attachment formation during tooth development.

OBJECTIVES: To test whether EMD is effective, and to compare EMD versus GTR, and various BG procedures for the treatment of intrabony defects.

SEARCH STRATEGY: We searched the Cochrane Oral Health Group Trials Register, CENTRAL, MEDLINE and EMBASE. Several journals were handsearched. No language restrictions were applied. Authors of randomised controlled trials (RCTs) identified, personal contacts and the manufacturer were contacted to identify unpublished trials. Most recent search: February 2009.

SELECTION CRITERIA: RCTs on patients affected by periodontitis having intrabony defects of at least 3 mm treated with EMD compared with open flap debridement, GTR and various BG procedures with at least 1 year follow up. The outcome measures considered were: tooth loss, changes in probing attachment levels (PAL), pocket depths (PPD), gingival recessions (REC), bone levels from the bottom of the defects on intraoral radiographs, aesthetics and adverse events. The following time-points were to be evaluated: 1, 5 and 10 years.

DATA COLLECTION AND ANALYSIS: Screening of eligible studies, assessment of the methodological quality of the trials and data extraction were conducted in duplicate and independently by two authors. Results were expressed as random-effects models using mean differences for continuous outcomes and risk ratios (RR) for dichotomous outcomes with 95% confidence intervals (CI). It was decided not to...
investigate heterogeneity, but a sensitivity analysis for the risk of bias of the trials was performed.

MAIN RESULTS: Thirteen trials were included out of 35 potentially eligible trials. No included trial presented data after 5 years of follow up, therefore all data refer to the 1-year time point. A meta-analysis including nine trials showed that EMD treated sites displayed statistically significant PAL improvements (mean difference 1.1 mm, 95% CI 0.61 to 1.55) and PPD reduction (0.9 mm, 95% CI 0.44 to 1.31) when compared to placebo or control treated sites, though a high degree of heterogeneity was found. Significantly more sites had < 2 mm PAL gain in the control group, with RR 0.53 (95% CI 0.34 to 0.82). Approximately nine patients needed to be treated (NNT) to have one patient gaining 2 mm or more PAL over the control group, based on a prevalence in the control group of 25%. No differences in tooth loss or aesthetic appearance as judged by the patients were observed. When evaluating only trials at a low risk of bias in a sensitivity analysis (four trials), the effect size for PAL was 0.62 mm (95% CI 0.28 to 0.96), which was less than 1.1 mm for the overall result. Comparing EMD with GTR (five trials), GTR showed statistically significant more postoperative complications (three trials, RR 0.12, 95% CI 0.02 to 0.85) and more REC (0.4 mm 95% CI 0.15 to 0.66). The only trial comparing EMD with a bioactive ceramic filler found statistically significant more REC (-1.60 mm, 95% CI -2.74 to -0.46) at the EMG treated sites.

AUTHORS’ CONCLUSIONS: One year after its application, EMD significantly improved PAL levels (1.1 mm) and PPD reduction (0.9 mm) when compared to a placebo or control, however, the high degree of heterogeneity observed among trials suggests that results have to be interpreted with great caution. In addition, a sensitivity analysis indicated that the overall treatment effect might be overestimated. The actual clinical advantages of using EMD are unknown. With the exception of significantly more postoperative complications in the GTR group, there was no evidence of clinically important differences between GTR and EMD. Bone substitutes may be associated with less REC than EMD.