Bone formation by enamel matrix proteins and xenografts: an experimental study in the rat ramus.

Donos N, Bosshardt D, Lang N, Graziani F, Tonetti M, Karring T, Kostopoulos L.


Abstract

The aim of this study was to evaluate whether the use of enamel matrix proteins with or without the use of deproteinized bovine bone influences bone formation when used as an adjunct to guided bone regeneration (GBR). Twenty rats, divided into four groups of five animals each, were used in this study. Group A1: A hemispherical PTFE capsule was placed empty on the lateral aspect of the mandibular ramus (GBR). At the contralateral side of the jaw, the capsule was filled with an enamel matrix derivative (EMD) before its placement. The healing period was 60 days. Group A2: The animals were treated in the same manner as in Group A1 but with a healing period of 120 days. Group B1: The animals were treated in the same manner as in Group A1 with the difference that deproteinized bovine bone mineral (DBBM) particles were packed in the capsule. At the contralateral side of the jaw, the capsule was filled with a mixture of EMD and DBBM. The healing period was 60 days. Group B2: The same treatment as in B1 but with a healing period of 120 days. The histological analysis revealed that in Groups A1 and A2 newly formed bone was covering a significant part of the empty capsules (GBR). The use of EMD in the capsule did not offer any added benefit to the use of the capsule alone in terms of new bone formation. At Groups B1 and B2, the presence of DBBM and/or EMD did not positively affect the amount of new bone formation. It can be suggested that neither the application of EMD nor the use of DBBM or the combination of EMD and DBBM results in enhanced amounts of bone formation in comparison with the GBR procedure alone.

Effect of GBR in combination with deproteinized bovine bone mineral and/or enamel matrix proteins on the healing of critical-size defects.

Donos N, Lang NP, Karoussis IK, Bosshardt D, Tonetti M, Kostopoulos L.


Abstract

OBJECTIVES: To evaluate the effect of guided bone regeneration (GBR) in combination with or without deproteinized bovine bone mineral (DBBM) and/or an enamel matrix derivative (EMD) on the healing of critical-size calvarial defects.

MATERIAL AND METHODS: Forty rats were used. In all animals, a standardized critical-size calvarial defect was created surgically. The animals were randomly allocated into 4 groups of 10 animals each. Group A: One calvarial defect was left untreated, while the galeal and the
cerebral aspect of the contralateral defect were covered with a bioresorbable membrane (GBR). Group B: One calvarial defect was filled with EMD, while the contralateral defect was treated with GBR and EMD. Group C: One defect was filled with DBBM, while the contralateral defect was treated with combination of GBR and DBBM. Group D: One defect was filled with DBBM combined with EMD, while the contralateral defect was treated with combination of GBR, DBBM and EMD. The healing period was 4 months. Five specimens from each group were macerated and the length, the width and the vertical dimension (thickness) of the remaining defect were evaluated by a stereomicroscope. The remaining specimens in each group were analyzed histologically.

RESULTS: The defects of the macerated specimens that were left untreated or were treated only by EMD, DBBM and combination of EMD and DBBM did not present predictably complete healing of the defects. All the defects where GBR was applied alone or combined with DBBM and/or EMD presented always complete healing (P<0.05). The combined use of GBR with EMD and/or DBBM did not offer any significant advantage above GBR alone in terms of healing of the length and the width of the defect. However, the vertical dimension of the defect was significantly higher (P<0.05) in the GBR-treated specimens of Groups C and D. The histological analysis supported these findings.

CONCLUSION: The predictability of bone formation in critical-size defects depends mainly on the presence or absence of barrier membranes (GBR). The combined use with deproteinized bovine bone mineral and/or enamel matrix proteins did not significantly enhance the potential for complete healing provided by the GBR procedure.

The effect of enamel matrix derivative (Emdogain) on bone formation: a systematic review.

Rathe F, Junker R, Chesnutt BM, Jansen JA.


Abstract

This systematic review focused on the question, if and to what extent enamel matrix derivative (Emdogain) [EMD]) promotes the regeneration of bone. The influence of combinations with other biomaterials was additionally evaluated. Twenty histomorphometric studies were included in this systematic review. Main results of the reviewed articles were (i) guide tissue regeneration (GTR) of infrabony defects seems to result in a higher degree of bone regeneration compared to treatment with EMD; (ii) combined therapy (GTR + EMD) of infrabony defects might not lead to better results than GTR therapy alone; (iii) there seems to be no additional benefit of combined therapy (GTR + EMD) in furcation defects over GTR therapy alone; (iv) EMD seems to lead to more bone regeneration of infrabony defects compared to open flap debridement; (v) however, EMD application might result in more bone formation when applied in supporting defects compared to nonsupporting defects; and (vi) EMD does not seem to promote external jaw/parietal bone formation in the titanium capsule model. The results of one study that suggest that EMD increases the initial growth of trabecular bone around endosseous implants by new bone induction need to be confirmed by additional research.
Effects of the enamel matrix derivative and beta-tricalcium phosphate on bone augmentation within a titanium cap in rabbit calvarium.


Abstract

In vitro studies suggest that enamel matrix derivative (EMD) affects the early stages of osteogenic maturation by stimulating bone cell proliferation. In the present study, we evaluated the effects of EMD and beta-tricalcium phosphate (beta-TCP) on bone augmentation within a titanium cap in rabbit calvaria, using 14 adult male Japanese white rabbits. The calvarium was exposed, a circular groove prepared, the marrow penetrated, and a standard hemispherical titanium cap placed in the groove. The cap was filled with a mixture of beta-TCP and EMD at the experimental site, and was filled with beta-TCP alone at the control site. At 1 and 3 months after cap implantation, animals were euthanized, and histological sections prepared. The sections were stained with basic fuchsin and methylene blue, and were examined using light microscopy. At 1 month, EMD tended to increase the amount of bone, but there was no significant difference in the amount of new tissue and mineralized bone between the experimental and control sites. The present findings indicate that the present mixture of EMD and beta-TCP does not accelerate bone formation, compared with beta-TCP alone.

Effect of platelet-rich plasma on the healing of intrabony defects treated with an enamel matrix protein derivative and a natural bone mineral.

Döri F, Nikolidakis D, Húszár T, Arweiler NB, Gera I, Sculean A.


Abstract

BACKGROUND: Regenerative periodontal surgery utilizing a combination of an enamel matrix protein derivative (EMD) and a natural bone mineral (NBM) and platelet-rich plasma (PRP) has been shown to enhance the outcomes of regenerative surgery significantly. At present, it is unknown whether root conditioning with EMD, followed by defect fill with a combination of NBM+PRP may additionally enhance the clinical results obtained with EMD+NBM.

AIM: To compare clinically the treatment of deep intrabony defects with either EMD+NBM+PRP or EMD+NBM.

MATERIAL AND METHODS: Twenty-six patients suffering from advanced chronic periodontitis, and each of whom displayed one advanced intrabony defect were randomly
treated with either EMD+NBM+PRP (test) or EMD+NBM (control). The following clinical parameters were evaluated at baseline and at 1 year after treatment: plaque index (PI), gingival index (GI), bleeding on probing (BOP), probing depth (PD), gingival recession (GR) and clinical attachment level (CAL). The primary outcome variable was CAL.

RESULTS: Healing was uneventful in all patients. At 1 year after therapy, the test sites showed a reduction in mean PD from 8.8+/-1.9 mm to 3.1+/-0.9 mm (p<0.001) and a change in mean CAL from 10.8+/-2.0 mm to 6.0+/-1.5 mm (p<0.001). In the control group the mean PD was reduced from 8.8+/-2.0 mm to 2.8+/-1.6 mm (p<0.001) and the mean CAL changed from 10.5+/-1.6 mm to 5.5+/-1.4 mm (p<0.001). CAL gains of > or =4 mm were measured in 77% (i.e. in 10 out of 13 defects) of the cases treated with EMD+NBM+PRP and in 100% (i.e. in all 13 defects) treated with EMD+NBM. No statistically significant differences in any of the investigated parameters were observed between the two groups.

CONCLUSIONS: Within its limits, the present study has shown that (i) 1 year after regenerative surgery, both treatments resulted in statistically significant PD reductions and CAL gains and (ii) the use of PRP failed to enhance the results obtained with EMD+NBM.

A clinical comparison of a bovine-derived xenograft used alone and in combination with enamel matrix derivative for the treatment of periodontal osseous defects in humans.

Scheyer ET, Velasquez-Plata D, Brunsvold MA, Lasho DJ, Mellonig JT.


Abstract

BACKGROUND: Enamel matrix protein derivative (EMD) and particulate anorganic cancellous bovine-derived bone xenograft (BDX) have both shown favorable clinical results in reducing intrabony periodontal defects as compared to open flap debridement alone. These materials have shown results comparable to those obtained with guided tissue regeneration. The primary aim of the present study was to evaluate the effectiveness of EMD combined with BDX as compared to BDX alone, with a secondary aim to compare the treatment outcomes of the 2 modalities.

METHODS: Seventeen patients with paired intrabony defects and probing depths measuring > or = 5 mm who were being treated for chronic periodontitis were selected for this controlled, blinded, split-mouth study. Following non-surgical periodontal therapy, sites were randomly selected to receive either a combination of EMD and BDX (test group) or BDX alone (positive control group). Baseline and 6-month surgical reentry measurements were taken by a calibrated examiner blinded to the treatment. A paired Student t test was utilized to evaluate differences between baseline and post-treatment and between the treatment groups.

RESULTS: Favorable clinical outcomes for both hard and soft tissue measurements were achieved for both treatment groups when compared to baseline (P < 0.001). There was no statistically significant difference for any of the measured clinical parameters. Probing depth reduction for the test group and control group was 4.2 +/- 1.1 mm and 3.9 +/- 1.3 mm,
respectively (P > 0.8). Mean gain in clinical attachment levels for the test and control groups was 3.8 +/- 0.9 mm and 3.7 +/- 1.5 mm, respectively (P > 0.6). Hard tissue measurements obtained at surgical reentry were used to calculate the bone fill (BF) and percent bone fill (%BF). The BF was 3.2 +/- 1.4 mm and 3.0 +/- 1.2 mm (P > 0.6), and the %BF was 63.3 +/- 16.3% and 67.0 +/- 19.0% (P > 0.4) for the EMD + BDX and BDX groups, respectively.

CONCLUSIONS: In summary, both the particulate anorganic cancellous bovine-derived bone xenograft used alone and in combination with enamel matrix derivative are effective for the treatment of human intrabony periodontal lesions.

Clinical comparison of an enamel matrix derivative used alone or in combination with a bovine-derived xenograft for the treatment of periodontal osseous defects in humans.

Velasquez-Plata D, Scheyer ET, Mellonig JT.


Erratum in:


Abstract

BACKGROUND: The combination of bone replacement graft materials has been suggested for the treatment of periodontal osseous defects. The purpose of this study was to evaluate the effectiveness of enamel matrix derivative (EMD) combined with a bovine-derived xenograft (BDX) as compared to EMD alone in the treatment of intraosseous defects in patients with moderate to advanced periodontitis.

METHODS: Sixteen adult patients with at least 2 intrabony defects were entered in this split-mouth design study. Defects were treated with EMD alone or EMD + BDX. Reentries were performed 6 to 8 months after initial surgery. The following soft and hard tissue measurements were recorded prior to initial surgery and at reentry: probing depth (PD), gingival margin location, clinical attachment level (CAL), depth of defect, and crestal bone level. Statistical analyses were performed to determine changes in PD, CAL, fill of osseous defect, and crestal resorption. Percentages of bone fill (%BF) and defect resolution (%DR) were also calculated.

RESULTS: The most significant results were that gingival recession was greater for the group treated with EMD alone (0.8 +/- 0.8 mm) compared to EMD + BDX (0.3 +/- 0.6 mm) (P = 0.04) and bone fill was greater for EMD + BDX (4.0 +/- 0.8 mm) compared to EMD alone (3.1 +/- 1.0 mm) (P = 0.02). The measures for PD reduction, attachment level gain, crestal resorption, %BF, and %DR did not present a statistically significant difference (P > 0.10).

CONCLUSIONS: This study evaluated the performance of EMD + BDX and EMD alone. The results demonstrated that a significant improvement in clinical parameters was observed. When comparing both modalities, a statistically significant difference was only found for gingival recession and bone fill, yielding a more favorable outcome towards the combined approach.