

Periodontal Regeneration – Intrabony Defects: A Consensus Report From the AAP Regeneration Workshop

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Background: Treatment of intrabony defects is an important therapeutic goal of periodontal therapy. The goal of this consensus report was to critically appraise the evidence for the available approaches for promoting periodontal regeneration in intrabony defects. In addition to evaluating the effectiveness of new regenerative approaches for intrabony defects, recommendations for future research were defined for this area.

Methods: A systematic review was conducted using computerized searches of PubMed and Cochrane databases, supplemented with screening of references in original reports, review articles, and a hand search in selected journals. All searches were focused on regenerative approaches with histologic evidence of periodontal regeneration (proof of principle), clinical trials, and case reports. For purposes of analysis, change in intrabony defect fill was considered the primary outcome variable, with change in clinical attachment as a secondary outcome. The SORT (Strength of Recommendation Taxonomy) grade was used to evaluate the quality and strength of the evidence. During the consensus meeting, the group agreed on the outcomes of the systematic review, pertinent sources of evidence, clinical recommendations, and areas requiring future research.

Results: The systematic review, which was conducted for the consensus conference, evaluated the effectiveness of the use of biologics for the treatment of intrabony defects. Enamel matrix derivative (EMD) and recombinant human platelet-derived growth factor-BB (rhPDGF-BB) with β -tricalcium phosphate were shown to be efficacious in regenerating intrabony defects. The level of evidence is supported by multiple studies documenting effectiveness. The clinical application of biologics supports improvements in clinical parameters comparable with selected bone replacement grafts and guided tissue regeneration (GTR). Factors negatively affecting regeneration included smoking and excessive tooth mobility.

Conclusions: Periodontal regeneration in intrabony defects is possible on previously diseased root surfaces, as evidenced by a gain in clinical attachment, decreased pocket probing depth, gain in radiographic bone height, and overall improvement in periodontal health. These clinical findings are consistent with available histologic evidence. Clinical improvements can be maintained over long periods (>10 years). Although bone replacement grafts have been the most commonly investigated modality, GTR, biologics, and combination therapies have also been shown to be effective. Future research should emphasize patient-reported outcomes, individual response differences, and emerging technologies to enhance treatment results.

Clinical Recommendations: Early management of intrabony defects with regenerative therapies offers the greatest potential for successful periodontal regeneration. The clinical selection and application of a regenerative therapy or combination of therapies for periodontal regeneration should be based on the clinician's experiences and understanding of the regenerative biology and technology. This decision-making process should take into consideration the potential adverse influence of factors, such as smoking, poor oral hygiene, tooth mobility, and defect morphology, on regeneration. Management should be coupled with an effective maintenance program for long-term success. *J Periodontol 2015;86(Suppl.):S105-S107.*

KEY WORDS

Guided tissue regeneration, periodontal; periodontitis; tissue engineering.

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GENERAL SUMMARY OF TOPICS COVERED

Periodontal regeneration has been defined as the formation of new cementum, alveolar bone, and a functional periodontal ligament on a previously diseased root surface.¹⁻³ This systematic review focused on therapies that had published evidence of histologic periodontal regeneration and randomized controlled trials (RCTs).⁴

Consistent good-quality patient-based evidence indicates that EMD and rhPDGF-BB with β -tricalcium phosphate scaffold can provide comparable regenerative results as found with previously reviewed regenerative approaches, such as GTR, anorganic bovine bone matrix, and DFDBA (Table 1). Currently, the largest body of evidence is available to support DFDBA as a predictable material for periodontal regeneration of intrabony defects.¹

The consensus group agreed that evidence is available to support the clinical application of the combination of two or more regenerative therapies (i.e., bone replacement grafts, GTR, and biologics) (Table 1).

Although additional therapies are available for use by the clinician, including mineralized FDBA, autogenous bone graft, root conditioning, minimally invasive surgery, and combined approaches, the evidence is weaker, and future research should focus on these treatment modalities (Table 1).

Outcomes of periodontal regeneration in intrabony defects are negatively affected by smoking and poor oral hygiene (Table 2).

There is additional lower-level evidence indicating that clinical outcomes may be negatively affected by

tooth mobility. Intrabony defect morphology may also affect overall regenerative outcomes and/or optimal treatment strategies. Although surgical technique and skill are critical in the success of all surgical endeavors, these relations have not been well characterized in the currently available published literature (Table 2).

Long-term clinical evidence documents the stability of the newly formed periodontal tissues within intrabony defects for >5 years.

No published studies were identified that addressed patient-reported outcomes, including discomfort, esthetics, and overall patient satisfaction with regards to the regenerative treatment of intrabony defects.

IMPLICATIONS OF REVIEW TO PATIENT-REPORTED OUTCOMES

Based on the current review of the published literature, there are limited data regarding quantifiable patient-reported outcomes. Therefore, future research must be designed to focus on reliable and validated assessment of patient-reported outcomes, including pain, esthetics, and overall patient satisfaction.

Pain (Short- and Long-Term Assessment)

Objective measures of postoperative pain evaluated in real time should be incorporated in future research designs, including modulating factors such as treatment modality, operator experience, surgical technique, and patient-related factors.

Esthetics/Patient Satisfaction

Patient-perceived esthetics may be critical to overall case acceptance and patient satisfaction with therapy. Patient-reported esthetic evaluations may be modified by intraoral treatment location, treatment modality, operator experience, surgical technique, and patient-related factors. Future research should

Table 1.
Summary of Strength of Evidence for Various Regenerative Approaches

Regenerative Approach	RCTs	Long-Term Stability	Strength of Evidence ⁵
DFDBA (demineralized freeze-dried bone allograft)	7	5 years	A
FDBA (freeze-dried bone allograft)	0	0	C (none, very limited)
Anorganic bovine bone graft	4	≤10 years	B
Combination therapy (bone replacement graft, cell-occlusive membrane, and/or biomaterials)	14	≤10 years	A
GTR	22	≤10 years	A

Grading system and recommendations were made based on SORT (Strength of Recommendation Taxonomy) grade. The grading system assigned observational studies the lowest score and RCTs the highest score: A = consistent good-quality patient-oriented evidence; B = inconsistent or limited-quality patient evidence; and C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series.⁵

Table 2.
Strength of Evidence for Patient-Based Determinants

Topic	Strength of Recommendation ⁵
Patient-centered factors	
Diabetes mellitus	C
Smoking	A
Biofilm control	C
Tooth-related consideration	
Mobility	B
Defect morphology: number of walls, width, and depth	B

Grading system and recommendations were made based on SORT grade. The grading system assigned observational studies the lowest score and RCTs the highest score: A = consistent good-quality patient-oriented evidence; B = inconsistent or limited-quality patient evidence; and C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series.⁵

focus on assessment of patient satisfaction with reliable and validated evaluation tools.

RESEARCH PRIORITIES FOR THE FUTURE

1) Considering the invasive nature of currently available histologic methods to evaluate periodontal regeneration in intrabony defects and the limitations of surrogate clinical measures, future research should focus on developing minimally invasive technologies or techniques to identify and evaluate periodontal regeneration in intrabony defects.

2) Given the limited evidence evaluating the nature of healing tissues in regenerated intrabony defects, future studies are necessary to characterize the nature of the newly formed tissues.

3) Given the paucity of current evidence evaluating the optimal clinical applications for multiple simultaneous regenerative therapies, the indications for combination regenerative periodontal therapy in intrabony defects should be determined.

4) Large-scale RCTs evaluating emerging treatment approaches, such as minimally invasive surgery and lasers, are necessary to determine their safety and efficacy.

5) Future research designs should assess patient-reported outcomes, including pain, postoperative complications, esthetics, and satisfaction, using reliable and valid evaluation tools.

6) Future studies should focus on defining the patient-related predictors of treatment outcomes (e.g., genomics, microbiome, and health status) to optimize individualized therapeutic decisions to maximize outcomes of regenerative therapies of intrabony defects.

7) Standardization of research design and clinical protocols, including outcomes reporting, biomolecular outcomes, treatment protocols, and optimal postoperative care, should be considered to reduce heterogeneity in study design and treatment outcomes.

8) Challenging clinical scenarios, including 1-wall and 0-wall defects, should be included in future study designs to establish treatment protocols to allow for optimal regenerative outcomes.

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