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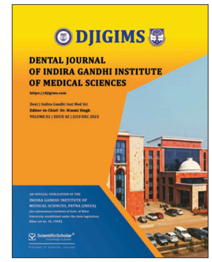

Review Article

Revitalizing Periodontal Therapy: Unveiling the Power of Growth Factor Enhanced Matrix 21s in Clinical Practice – A Literature Review

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ABSTRACT

Periodontal regeneration therapy attempts to revive the lost structures of the periodontium, which includes the gingiva, periodontal ligament (PDL), cementum, and alveolar bone, which get affected due to periodontal disease. One innovative approach for periodontal regeneration therapy is to use growth factors, particularly recombinant human platelet-derived growth factor (rhPDGF). GEM 21S, a product that combines rhPDGF-BB with a collagen matrix, has shown significant potential in enhancing periodontal regeneration. GEM 21S enhances the proliferation of periodontal ligament (PDL) cells, stimulates the differentiation of osteoblast cells, and supports the regeneration of key periodontal tissues. Clinical studies suggest that GEM 21S contributes to increased bone formation, improved attachment levels, and better overall clinical outcomes in periodontal defect treatment. While the results are promising, long-term research is needed to establish the prolonged effectiveness and cost-benefit profile of GEM 21S as a regenerative treatment option for periodontal disease.

Keywords: GEM21S, Periodontal Regeneration, Growth factor enhanced matrix

INTRODUCTION

Periodontal regeneration therapy attempts to revive the lost structures of the periodontium due to periodontal disease, which include the gingiva, periodontal ligament (PDL), cementum, and alveolar bone. Growth factors, such as transforming growth factors and platelet-derived growth factors, contained in the blood platelets that are released at the site of injury, have importance in normal healing.[1]

Growth factors Enhanced Matrix (GEM 21S) has recently become an available agent, offering enhanced capabilities for wound healing and bone regeneration. Its advanced properties make it an attractive option for promoting optimal healing outcomes.[1] GEM 21S is a bone graft that consists of recombinant human platelet-derived growth factor (rhPDGF-BB) and an osteoconductive matrix (bone scaffold), which is β-tricalcium phosphate.[1]

FUNCTIONAL MECHANISM

When rhPDGF is unveiled from the β-TCP matrix, it binds to receptors on bone and soft tissue healing cells, resulting in activation of GEM 21S® to initiate bone and soft tissue regeneration.[1,2] GEM 21S® attracts and stimulates cells necessary for tissue repair, enhancing their growth and accelerating healing. This leads to increased osteoblast, fibroblast, and cementoblast activity, as well as new blood vessel formation, promoting the revitalization of alveolar bone, PDL, and cementum. Over about six months, GEM 21S® is gradually replaced by the patient's own tissue, resulting in improved bone and PDL regeneration.[3]

CLINICAL IMPLICATIONS OF GEM21S:

Root coverage procedure

McGuire *et al.* conducted a split-mouth study where gingival recession defects were surgically created in teeth set for orthodontic extraction.[2] After a 9-month follow-up, the rhPDGF-BB + β-TCP-treated sites showed true periodontal regeneration, with new bone, cementum, and PDL with perpendicularly oriented fibers. In contrast, sites treated with CTG only exhibited a limited healing response characterized by the formation of a long junctional epithelium (LJE) but lacking true periodontal regeneration.[4] Thus, the GEM 21S has a promising effect in the management of gingival recession.

Furcation defect

Nevins and colleagues assessed rhPDGF-BB for treating Class II furcation defects in molars.[5] The results showed successful revitalization of the periodontal attachment, including new cementum, bone, and PDL, with continuous cementum and well-organized PDL fibers attached to it.[4]

Intrabony defect

Lynch *et al.*'s study on beagle dogs with periodontal disease found that open-flap debridement led to healing via a LJE. PDGF treatment promotes regeneration through enhanced cementogenic and osteogenic activity.[6]

In another study, open flap debridement (OFD)-treated sites showed epithelial migration below the defect base and no new cementum formation after five weeks. In contrast, rhPDGF-BB-treated sites exhibited significant new bone formation with osteocytes. The meld of rhPDGF-BB and IGF-I notably enhanced bone height, density, and new cementum length compared to OFD.[5]

Peri-implant regenerative therapy

Simon and colleagues assessed the use of rhPDGF for ridge augmentation around dental implants in a canine model. After 4 months, histological analysis revealed that demineralized bovine bone combined with a guided tissue regeneration (GTR) membrane resulted in limited bone regeneration. In contrast, demineralized bovine bone infused with rhPDGF-BB and a membrane showed considerable bone growth.[7]

Guided bone regeneration

Nevins *et al.* conducted two studies on using rhPDGF-BB to enhance bone regeneration. The results of the animal study showed that the use of rhPDGF-BB combined with equine equine hydroxyapatite collagen (eHAC) showed increased vertical ridge augmentation.[8] In the human Study,[9] he investigated the therapeutic potential of rhPDGF-BB in combination with a bovine or equine matrix for treating bone defects. Eight patients were treated with either bovine or equine matrix mixed with rhPDGF-BB (0.3 mg/mL). Histological analysis after 5 months showed new bone growth integrated with graft particles.

Alveolar ridge preservation

Mendoza-Azpur *et al.* assessed the use of rhPDGF-BB combined with an organic bovine bone and collagen for ridge preservation in 20 patients. At 4 months, both groups showed similar bone cell counts and new tissue regeneration. However, the rhPDGF-BB group had notably more blood vessels and stem cells.[10]

Sinus augmentation

Nevins and colleagues performed a histological study to evaluate the regenerative potential of rhPDGF in sinus augmentation, utilizing an organic bovine bone mineral combined with rhPDGF-BB in maxillary sinus augmentations. After 6 to 8 months, core biopsy analysis revealed the presence of vascularized lamellar bone and woven bone, with some graft particles resorbed and others remaining intact.[11]

Soft tissue augmentation

Simion *et al.* demonstrated the effectiveness of rhPDGF with a guided tissue regeneration matrix in enhancing soft tissue around dental implants. After 4 months, results showed tissue regeneration similar to healthy gingiva with resorption of the guided tissue regeneration matrix. This treatment approach offers promising implications for improving aesthetics and soft tissue outcomes around dental implants.[12]

CONCLUSION

GEM 21S, a synthetic bone graft containing rhPDGF-BB and beta-tricalcium phosphate, has demonstrated remarkable efficacy in various clinical applications. The cumulative evidence from multiple studies underscores the potential of GEM 21S to enhance periodontal regeneration, bone growth, and soft tissue augmentation.

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