Application of Periodontal Tissue Engineering Using Enamel Matrix Derivative and a Human Fibroblast-Derived Dermal Substitute to Stimulate Periodontal Wound Healing in Class III Furcation Defects

Lawrence R. Hovey,* Archie A. Jones,† Michael McGuire,‡ James T. Mellonig,§ John Schoolfield,‖ and David L. Cochran†

Background: Enamel matrix derivative (EMD) has been shown to promote several aspects of periodontal regeneration in vitro and in vivo. Recently, a bioengineered tissue (DG) was developed to promote wound healing of chronic skin ulcers. This pilot study sought to assess the effects of EMD and DG, alone or in combination, on periodontal wound healing in surgically created Class III furcation defects.

Methods: Six female baboons received bilateral ostectomy of ~10 mm around the first and second mandibular molars to achieve Class III, subclass C furcation defects. Wire ligatures and cotton pellets were left in place for 2 months to maintain the depth of the defects and promote plaque accumulation. Each furcally involved molar was then assigned to one of four treatments: open flap debridement (OFD), OFD plus EMD, OFD plus DG, or OFD plus DG and EMD. This resulted in six total sites per treatment group. Seven months after defect creation and 5 months after treatment, and after no oral hygiene, tissue blocks of the mandible were taken for blinded histometric analysis to assess parameters of periodontal regeneration adjacent to furcal root surfaces and from the mid-furcal aspect (i.e., new bone, new connective tissue attachment, new epithelial attachment, and new cementum formation).

Results: Histometric analysis demonstrated differential regenerative responses with respect to treatment within each animal. However, statistically significant differences between treatments from all six animals were not observed ($P>0.20$, mixed-model analysis of variance). EMD-treated sites presented mildly positive regenerative results and no negative responses. Both DG only and combination therapy demonstrated similar or less than positive responses relative to OFD controls.

Conclusion: The descriptive analysis may suggest a positive effect of enamel matrix proteins and a negative effect of DG used alone or in combination with enamel matrix proteins on the regeneration of Class III furcation defects in baboons. *J Periodontol 2006;77:790-799.*

KEY WORDS

Furcation defects; histology; regeneration; tissue engineering.

* Private practice, Portland, OR.
† Department of Periodontics, University of Texas Health Science Center at San Antonio School of Dentistry, San Antonio, TX.
‡ Private practice, Houston, TX.
§ Head Specialist Division and Advanced Education Program, University of Texas Health Science Center at San Antonio School of Dentistry.
‖ Department of Academic Informatics Services, University of Texas Health Science Center at San Antonio School of Dentistry.

Much effort has been devoted to determine the specific cells, soluble mediators, and extracellular matrix components that contribute to the formation of periodontal tissues.[1-5] The information gained from this effort has given us the opportunity to begin applying the concepts of tissue engineering to develop new regenerative therapies. Tissue engineering is a field of the biomedical sciences involved in the development of techniques for the fabrication of new tissues to replace lost tissues and is based on the principles of cell biology, developmental biology, and biomaterials.[6] Engineered tissue is defined as tissue produced by cells seeded onto a bioabsorbable matrix and includes the implantation of devices that promote tissue regeneration.[7,8] An engineered tissue should provide three main components: regulatory signals

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