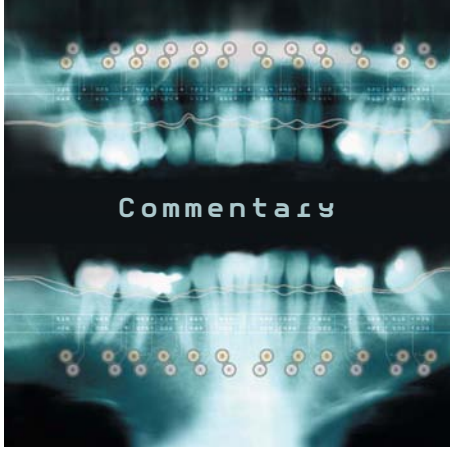

Periodontics – Tissue Engineering and the Future

Gordon L. Douglass, DDS

ABSTRACT

Periodontics has a long history of utilizing advances in science to expand and improve periodontal therapies. Recently the American Academy of Periodontology published the findings of the Contemporary Science Workshop, which conducted state-of-the-art evidence-based reviews of current and emerging areas in periodontics. The findings of this workshop provide the basis for an evidence-based approach to periodontal therapy. While the workshop evaluated all areas of periodontics, it is in the area of tissue engineering that the most exciting advances are becoming a reality.

Today, the emergence of biologics, agents that stimulate a true regeneration and reconstruction of the tissues to their original form, are becoming the new horizon in periodontics. In the past, we have had agents which facilitate healing but offer minimal osseoinductive effects such as demineralized freeze-dried bone allograft and platelet-rich plasma, which offer low levels of bone morphogenic proteins and low levels of platelet-derived growth factors, respectively. However, the levels offered by these substances, in most cases, are too low to truly induce regeneration, even though both may facilitate bone healing by being osseoconductive and mechanically improving the wound healing. Presently there are two biologics commercially available, enamel matrix derivative or Emdogain (Staumann Biologics, Boston) and recombinant human platelet-derived growth factors or GEN21F. (Osteohealth Co., Shirley, N.Y.).

Enamel matrix derivative stimulates the regeneration of new cementum and periodontal ligament fibers on the root resulting in the regeneration of a

Author / Gordon L. Douglass, DDS, is a periodontist who has practiced in Sacramento and Folsom for more than 30 years. He is past president of the Sacramento District Dental Society, a past president of the California Society of Periodontists, and a past president of the American Academy of Periodontology.

new attachment of the tooth with the adjacent bone and connective tissue. Strong evidence has shown it will improve current osseous grafting techniques, and emerging evidence has shown that it improves the regeneration of a new attachment with periodontal plastic surgery procedures, such as gingival grafting. The recombinant platelet-derived growth factors have been shown to induce osseous regeneration of periodontal defects when placed with tri-calcium phosphate as a carrier that is rapidly resorbed (see Dr. Richard Kao's paper "Tissue Engineering for Periodontal Regeneration" on Page 205).

The true regeneration induced by these biologics should not be confused with the repair that may result from more traditional mechanical procedures such as root planing, curettage, flap curettage or flap surgery. No matter what device is used — curet, scalpel, laser, etc. — the result is the same, a repair that may result in a significant improvement of the tissues, but not in a true regeneration of the tissues that is indistinguishable from the original.

Additionally, there are other biologics on the horizon (such as recombinant bone morphogenic proteins) which, as they become available for commercial use, will continue to expand our options. The development of improved delivery techniques will allow the biologic agent to remain in the healing wound which will increase the tissue response. Recently, Giannobile and coworkers reported the use of gene-transfer as a technique to deliver a time-released dose of platelet-derived growth factors to osseous periodontal defects. As tissue engineering continues to grow, not only will the list of biologics increase, but innovative delivery systems will be developed. If history continues, these tissue engineering techniques for regenerating periodontal defects will become the new basis for regeneration of the alveolus and the placement of dental implants.

These first steps into the frontier of tissue engineering provide an exciting and promising future for periodontics and dentistry. CDA

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2. Giannobile WV, Lee CS, Tomala M, Tejeda K, et al, Platelet-derived growth factor (PDGF) gene delivery for application in periodontal tissue engineering. *J Periodontol* 72(6):815-23, 2001.