Biological effects of PDGF-BB loaded biodegradable membrane: pharmacokinetics, biocompatibility, biodegradability and guided bone regeneration

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Interest to develop barrier membranes for guided bone regeneration has been turned to avoid inconvenience of second surgery and to accomplish effective replacement by healing periodontal ligament or alveolar bone after biodegradation of membrane. Several studies suggested the beneficial effects of biologically active materials released from biodegradable membranes for enhancing periodontal regeneration.

The purpose of this study was to evaluate the biological effects of PDGF-BB loaded biodegradable membrane including pharmacokinetics, biocompatibility, biodegradability and guided bone regeneration. The membranes were fabricated by coating meshes of polyglycolic acid (PGA) with poly-L-lactic acid (PLLA) containing PDGF-BB. Porous structure was generated at the surface and sublayer of the membranes by using a phase inversion method. The in vitro release of PDGF-BB from the membrane was investigated to optimize release kinetics for desirable wound healing effects. Biocompatibility tests including cellular activity and cell attachment were done to observe the biological effects of PDGF-BB in vitro. Biodegradation was observed until 16 weeks after implantation of the membranes in the dorsal skin of the rat. The effects on guided bone regeneration were studied by measuring new bone formation in the calvarial defects of rats and artificially created class II bifurcation periodontal defect in beagle dogs. Release of PDGF-BB from biodegradable membrane was controlled by the diffusion from surface laminated polyvinyl alcohol (PVA) film and therapeutic level was maintained for upto 4 weeks. The effect of cell attachment on the PDGF-BB loaded membranes was markedly higher than that of unloaded membranes. Cellular activity of PDL cell was significantly increased in PDGF-BB loaded membrane group compared with unloaded membrane group. Biodegradation at the surface of the membrane was first showed in 4 weeks specimens, perforation in 6 weeks specimens and fragmented in 8 weeks specimens. Significant formation of osteoid tissue in calvarial defects of rat was observed in 1 week specimen of PDGF-BB loaded membranes and remarkable early new bone formation in 2 weeks specimens. Bone and cementum regeneration were significantly enhanced by PDGF-BB loaded membranes without any ankylosis in beagle dog study.

These results indicated that PDGF-BB loaded biodegradable membrane should be useful tool for periodontal regeneration.