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Abstract

Periodontal wound healing and regeneration are highly complex processes, involving cells, matrices, molecules and genes that must be properly choreographed and orchestrated. As we attempt to understand and influence these clinical entities, we need experimental models to mimic the various aspects of human wound healing and regeneration. In vivo animal models that simulate clinical situations of humans can be costly and cumbersome. In vitro models have been devised to dissect wound healing/regeneration processes into discrete, analyzable steps. For soft tissue (e.g. gingival) healing, in vitro models range from simple culture of cells grown in monolayers and exposed to biological modulators or physical effectors and materials, to models in which cells are 'injured' by scraping and subsequently the 'wound' is filled with new or migrating cells, to three-dimensional models of epithelial-mesenchymal recombination or tissue explants. The cells employed are gingival keratinocytes, fibroblasts or endothelial cells, and their proliferation, migration, attachment, differentiation, survival, gene expression, matrix production or capillary formation are measured. Studies of periodontal regeneration also include periodontal ligament fibroblasts or progenitors, osteoblasts or osteoprogenitors, and cementoblasts. Regeneration models measure cellular proliferation, attachment and migration, as well as gene expression, transfer and differentiation into a mineralizing phenotype and biomineralization. Only by integrating data from models on all levels (i.e. a single cell to the whole organism) can various critical aspects of periodontal wound healing/regeneration be fully evaluated.