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Professor Simon Tran received his dental degree from the University of Montreal. His residency in periodontics was done at the University of Minnesota, where he also received a PhD in Oral Biology. His postdoctoral studies in Tissue Engineering was done at the National Institutes of Health (NIH), Maryland. He is a board-certified periodontist (Diplomate of the American Board of Periodontology, and Fellow of the Royal College of Dentistry Canada). He is currently a Professor and the Director of Graduate Studies in the Faculty of Dentistry at McGill University. His research group, the McGill Craniofacial Tissue Engineering and Stem Cells Laboratory, has for mission to develop experimental therapies for the repair and regeneration of salivary glands, dental, and craniofacial tissues. His research bridges the lab bench to the clinic. He has published close to 100 papers/chapters and trained over 50 graduate students. He serves as an associate editor for the journal Oral Diseases.

Prof. Simon Tran

Periodontal Tissue Engineering and Regenerative Medicine

McGill University, Faculty of Dentistry, Craniofacial Tissue Engineering
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Simon Tran

Periodontitis and peri-implantitis are chronic multifactorial inflammatory diseases and are characterized by a progressive destruction of the tooth/implant-supporting apparatus. (alveolar bone, cementum, gingiva, and periodontal ligament). Earlier periodontal treatment strategies, such as mechanical control of the dysbiotic plaque biofilms and resective periodontal surgeries, mainly achieved partial tissue healing via repair processes. By realizing through experimental animal models and clinical studies that ingrowth of gingival epithelium cells during periodontal wound healing limited new periodontal attachment formation, various strategies were then tested to regenerate the periodontium, such as root surface conditioning, bone and soft tissue grafting, barrier membranes, gene therapy, growth factors, and platelet-rich fibrin. The 1st generation of guided tissue regeneration (GTR) membranes used non-resorbable materials (e.g. expanded polytetrafluoroethylene). Next was the development of a 2nd generation of GTR membranes that were resorbable (e.g. collagen) to avoid re-entry surgery. The 3rd generation was based on GTR membranes in combination with bioactive molecules (e.g. bioguiding). However, the functional integration of the different periodontal tissue components via scaffold- and matrix-based guided tissue regeneration still represented a great challenge. In the early 2000s, the concepts of Tissue Engineering and Regenerative Medicine which combine cells with scaffolds and bioactive factors, were used in periodontology with the goal to fully regenerate periodontal tissues, both functionally and esthetically. Tissue engineering and additive biomanufacturing (such as 3D-printing) provided new experimental treatment approaches to periodontal researchers, such as cell sheet engineering and multiphasic scaffolds. Additive biomanufacturing is a manufacturing method where objects (e.g. alveolar bone) are designed and fabricated in a layer-by-layer manner; and this has allowed biomedical engineers and periodontists a technology to achieve tissue regeneration instead of repair. This talk will review past and current regenerative procedures for periodontal healing and regeneration, as well as discussing their progress and difficulties in clinical practice and future perspectives. Tissue engineering using engineered stem cell-scaffold constructs will provide more opportunities for predictable and optimal tissue regeneration for periodontal bone defects.