Online Proceedings

Poster Session 2

MGH 241, Easel 155

1:00 PM to 2:30 PM

Towards Biomimetic Treatment of Gum Disease: Repair of PDL via Peptide-guided Remineralization

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Mentor: Sami Dogan, Restorative Dentistry

Periodontal disease (PDL) results from a serious infection in the gingival tissue (gum) that can eventually lead to tooth loss and jawbone damage. The disease is common with more than 3 million cases in the US per annum. Bacteria build up in plaque lead to gingivitis and periodontitis under improper oral hygiene. If left untreated, the supporting tissues of the teeth e.g., cementum and periodontal ligaments will be lost, therefore making the teeth and supporting tissues vulnerable to bacterial attack, leading to serious infections and, even, to death. Current approaches in regenerating periodontal ligaments include the use of bioactive molecules and barrier membranes for guided tissue regeneration using human stem cells. Although the utilization of such materials enhances the cell proliferation and differentiation to a degree, the absence of cementum-like tissue prevents the complete regeneration of periodontal ligaments on the tooth surface. The aim of this project is to develop a biomimetic strategy to restore cementum tissue and regenerate the periodontal ligaments using human periodontal ligament (hPDL) cells in vitro. Using peptide-guided remineralization, we created a new cementum-like mineral layer on exposed dentin. The hPDL cells are then cultured and seeded on the novel cemento-mimetic layer and induced to differentiate. The proliferation and differentiation of the hPDL cells are monitored in detail using 3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) and alkaline phosphatase (ALP) assays, respectively. Our results show that the newly formed cemento-mimetic mineral layer facilitates the hPDL growth and differentiation. The method described herein offers a unique biomimetic solution to regenerate periodontal ligaments and thereby ultimately prevent tooth loss and eliminate periodontal disease. This work is supported by WA-State Life Sciences Discovery Funds, UW-School of Dentistry Spencer Funds, and Amazon-UW/CoMotion Catalyst Program.

Poster Session 4

MGH 206, Easel 172

4:00 PM to 6:00 PM

Engineering a Peptide-Guided Biomimetic Treatment for Dental Hypersensitivity

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Dental hypersensitivity (DH) is a common oral health condition in the U.S. affecting the majority of the adult population. It is caused by the exposure of dentin due to the demineralization of the protective cementum or enamel that covers the tooth surface. When the dentinal tubules are exposed, nerve fibers in the pulp or predentin are stimulated by the displacement of the fluid and report pain. The stimulus that triggers the onset of pain can be of thermal, chemical or mechanical origin. There is still no effective agent to completely resolve the patient's discomfort with DH. Over-the-counter products are commonly advised in the management of DH while toothpastes containing strontium, oxalate or potassium salts, or fluoride are recommended with limited efficacy to reduce the sensitivity from DH. Restorative materials using composite, glass ionomer or amalgam are adapted to treat the affected area with limited success. The goal of this project has been to develop a biomimetic treatment by restoring cementum tissue using a peptide-guided remineralization approach, thereby occluding the exposed tubules with a newly formed mechanically and thermally stable mineral layer. The College of Engineering working closely with School of Dentistry-UW involves mimicking the hypersensitivity condition by re-

moving enamel/cementum of extracted human teeth to expose underlying dentin. The samples are then treated with peptide-guided remineralization resulting in 10+ micrometer thick new layer over the damaged dentin. Our results exhibit a highly effective way to occlude the exposed dentinal tubules by a newly formed mineral layer which penetrates into the dentin tubules. The method described herein offers a unique biomimetic treatment protocol for dental hypersensitivity, which will be developed as a platform technology for effective in-clinic and over-the-counter hypersensitivity treatments. The work is supported by WA-State Life Sciences Discovery Funds, UW-School of Dentistry Spencer Funds, and Amazon-UW/CoMotion Catalyst Program.