



IADR

International Association
for Dental Research

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NOVEL HYDROGEL SYSTEMS FOR DENTIN REGENERATION

Toronto, ON, Canada – Dental caries, or tooth decay, continues to be the most prevalent infectious disease in the world, presenting significant public health challenges and socio-economic consequences. It leads to the loss of the hard tissues of the tooth, followed by inflammation and necrosis of the subjacent dental pulp. In the U.S. alone, over 20 million dental restorations are placed each year, with failure rates of up to 60%. Hence, there exists a critical need for better biologic therapeutics to restore the damaged dentin-pulp complex to its original form and function. However, progress in this area has been slow compared with that in other fields of regenerative medicine.

Tissue-engineering strategies directed at mimicking the natural extracellular matrix have utilized synthetic and non-synthetic scaffolds to direct cell differentiation and matrix mineralization (in the case of bone). The most promising among the new generation of delivery systems are synthetic peptide hydrogels, which provide a nanostructured matrix highly similar to natural matrix. Short peptides can be designed to self-assemble into nanofibers, form macroscopic gels, and entrap living cells. With single amino acids as building blocks, the resulting materials are non-toxic, non-inflammatory, and biodegradable. The modular concept allows for high control over the system and, at the same time, makes it extremely versatile.

Speaking today during the 86th General Session of the International Association for Dental Research, a team of investigators from Baylor College of Dentistry (Dallas), the University of Regensburg (Germany), and Rice University (Houston) presents its preliminary data describing the results of studies on hydrogels made of peptide amphiphiles, where a short peptide sequence is attached to a fatty acid, which provides the driving force for self-assembly. However, they recently applied a different design concept, where the self-assembly of peptide chains is achieved without attaching a hydrophobic tail. Based on their design, the chains can include bioactive peptide sequences for cell adhesion, binding of growth factors, or other biological molecules with therapeutic potential. Hence, multidomain peptide hydrogels represent a novel and highly versatile material offering a higher degree of control over nanofiber architecture and better chemical functionality.

The overarching goal of this research is to utilize these multidomain peptides as a biomimetic scaffold, along with dental stem cell therapy, to provide a natural 3D environment that can control and direct the differentiation and function of dental stem cells for the targeted regeneration of the dentin-pulp complex.

This work is highly translational and innovative, since it capitalizes on a new and previously untested material with novel properties for the regeneration of the dentin-pulp complex. Importantly, the results will provide the foundation for developing multidomain peptide scaffolds as novel therapeutics for the regeneration of the dentin-pulp complex.

About the International Association for Dental Research

The International Association for Dental Research (IADR) is a non-profit organization with more than 10,800 individual members worldwide, dedicated to: (1) advancing research and increasing knowledge to improve oral health, (2) supporting the oral health research community, and (3) facilitating the communication and application of research findings for the improvement of oral health worldwide.

To learn more about the IADR, visit www.iadr.org.

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This is a summary of an abstract entitled "Novel Hydrogel Systems for Dentin Regeneration", by R.N. D'Souza *et al.*, of the Baylor College of Dentistry (Dallas), to be presented at 3:30 p.m. on Friday, July 4, 2008, in Hall D-E of the Metro Toronto Convention Centre, Toronto, ON, Canada, during the 86th General Session of the International Association for Dental Research.

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