

THE "PHYSICS AND CHEMISTRY" BEHIND THE "BIOLOGY" OF PULPAL REGENERATION

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Abstract

Root canal therapy for the management of pulpo-periapical diseases involves three phases access to the pulp space, removal of the necrotic content from the canals and obturating the space with synthetic biomaterials. Majority of the failures in root therapy is attributed to the last phase of obturation. Persistence of infection or reinfection is mainly due to the re-establishment of the microbes in the canal space establishing through the interface between the natural root dentin and the artificial sealers and obturating materials. Thus the focus started on filling the space with the natural pulp and dentin structures in the root canal without resorting to synthetic materials. Thus emerged the concept of Pulpal Regeneration. Revascularization of the pulp, use of stem cell engineering are few concepts in this. This article focuses on the current trend and practice of pulpal regeneration and the biomaterials that are used for regeneration and tissue engineering.

Key words: *Revascularization of pulp, pulpal regeneration, Dental pulp stem cells (DPSC), Stem Cells from Human Exfoliated Deciduous teeth (SHED)*

Introduction

"Restitutio as integrum" is the ultimate goal for all medicinal therapy including pulpal regeneration. Regeneration of pulp can be accepted only when newly formed pulpal tissue has vascularized connective tissue, neural tissue and functional odontoblast lining the dentin wall of the pulp chamber.^[1,2] This goal is yet to be achieved in the science and the following review will highlight the path till travelled by the researchers of the past and present.

Techniques for Pulp regeneration

The concept of tissue engineering was coined and explored by Langer and Vacanti in 1993. Regeneration and Repair of pulp are two different biologic processes for replacement of lost pulpal tissue with different outcomes. *Repair* of pulp with biomaterials will lead to formation of new tissue that is devoid of function and structure similar to

the original pulp tissue (Scar tissue). *Regeneration* means to restore the lost tissue by new tissue which will not be different from the original tissue in structure and function. *Revascularization* is another terminology that is used in pulpal regeneration, which is ill defined and many times synonymously used with regeneration. Scientific documentation of revascularization dates back to 1960, when Nygaard-Ostby et al reported pulpal healing of infected root canals by mechanical creation of blood clot.^[3]

The following are the pulpal regenerative techniques that are being explored for the clinical applications:^[4]

1. Root canal revascularization via blood clotting
2. Stem cell based therapies
3. Cell free therapies: scaffold implantation
4. Cell free therapies: injectable scaffold delivery
5. Pulp implantation
6. Three dimensional cell printing
7. Gene therapy

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