2011 Annual ESE Research Grant Winner

Award 18000 Euros

Title: Release of growth factors from dentine and incorporation into a Hydrogel scaffold for regenerative endodontics

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Dr. Galler is an Assistant Professor in the Department of Restorative Dentistry and Periodontology at the University of Regensburg, Germany. After gaining her DDS degree from the Ludwig-Maximilians-University in Munich in 2000, she worked in private practice in Germany for two years. Subsequently, she started her first research project at the University of Regensburg, then transferred to the University of Texas Health Science Center in Houston to complete post-doctoral training; she was awarded a PhD in Bioengineering from Rice University in Houston in 2009. Recently, she finished her “Habilitation” with Prof. Gottfried Schmalz at the University of Regensburg. Dr. Galler’s time is divided between clinical work (primarily endodontics), teaching and research. Her current research interest is focused on the development of future treatment strategies incorporating scaffolds with biological dentine conditioning and dental stem cells for use in dental pulp tissue engineering and regenerative endodontics

Abstract

Recent advances in stem cell biology and dental pulp tissue engineering as well as clinical reports of regenerative procedures to sustain tooth vitality might be the prelude of a paradigm shift in endodontics and lead to the establishment of treatment strategies enabling the regeneration of dental pulp. Whereas implantation of autologous stem cells is a promising strategy, it is hampered by issues of cell harvesting and expansion as well as high cost. Alternatively, cell-free approaches could be considered, which involve the recruitment, migration, proliferation and differentiation of resident stem cells. The conditions for such a regenerative procedure might be optimized by the use of a bioactive scaffold material, which is placed into the root canal, and furthermore by taking advantage of growth factors entrapped in the dentine matrix. Modified protocols for root canal preparation, irrigation and filling will be required in order to provide an environment that is conducive for stem cell

recruitment and new tissue formation. In the proposed project, a protocol for root canal irrigation should be established, which will allow for the release of growth factors from the dentine matrix. Their short half-life could be prolonged by incorporation into a matrix capable of binding and cell-mediated release of these growth factors. A previously developed bioactive peptide-based hydrogel can bind and release growth factors via the glycosaminoglycan heparin. By optimizing conditions for growth factor release and enabling their immobilization, chemotactic migration and subsequent differentiation of stem cells might be triggered. This work could contribute to the development of a treatment strategy to engineer dental pulp which does not require the application of exogenous stem cells or growth factors and might thus be well applicable in regenerative endodontics.