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Scaffolds, stem cells, and growth factors in craniofacial bone regeneration

Tien-Min G. Chu
Indiana University School of Dentistry,USA

Abstract

Due to the limitations of autografts and alloplastic materials in craniofacial reconstruction, there is much interest in developing tissue engineering strategies for such applications. A craniofacial bone tissue engineering strategy should be based on a scaffold material that is biocompatible, osteoconductive, resorbable, and has mechanical properties approximating bone. Moreover, because the geometry of craniofacial defects is complex, it is essential that the scaffolds can be customized fit patients' anatomical profile. The long range goal of our research is to develop a biodegradable and customize-able scaffold that can be used to carry MSC and/or growth factors for craniofacial bone regeneration. Recently, we demonstrated that 3D scaffolds from polymer reinforced dicalcium phosphate dihydrate (DCPD) cement as well as from borate-based bioactive glass can be made using a rapid prototying technique. We further verified that these scaffolds are biocompatible and they promote for bone tissue ingrowth after implantation in rabbit critical-sized cranial defect for 6 weeks. We then tested the scaffolds with MSCs encapsulated in collagen gel or seeded on collagen sponges using the same animal model. The histological and micro CT evaluations from the in vivo testing of these MSC-seeded scaffolds will be presented. Additionally, we have tested the use of a thrombopoietic agent for facilitating cranial regeneration. The results from these experiments will also be discussed.

Biography

Dr. Tien-Min Chu received his Doctor of Dental Surgery degree from Kaohsiung Medical College in Kaohsiung Taiwan in 1989. He later received his PhD degree in Materials Science and Engineering from the University of Michigan in 1999. He is currently an Associate Professor of Dental Biomaterials at the Indiana University School of Dentistry where he also holds adjunct appointments at Department of Biomedical Engineering and Department of Orthopedic Surgery. He has published more than 40 papers in peer-reviewed journals and is a co-author on three US patents.