# RESORBABLE COMPOSITE SCAFFOLDS FOR CRANIOFACIAL BONE TISSUE ENGINEERING

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**Aim:**
Bone loss associated with trauma, osteo-degenerative diseases and tumors has tremendous socioeconomic impact related to personal and occupation disability and health care costs. In the present climate of increasing life expectancy with an ensuing increase in bone-related injuries, orthopaedic surgery is undergoing a paradigm shift from bone-grafting to bone engineering, where a scaffold is implanted to provide adequate load bearing and enhance tissue regeneration. We aim to develop composite scaffolds for bone tissue engineering applications to replace the current gold standard of autografting.

**Methods:**
Medical grade polycaprolactone-tricalcium phosphate (mPCL/TCP) scaffolds (80/20 wt%) were custom made using fused deposition modelling to produce 1x1.5x2 cm sized implants for critical-sized pig cranial implantations, empty defects were used as a control. Autologous bone marrow stromal cells (BMSCs) were extracted and pre-cultured for 2 weeks, dispersed within fibrin glue and injected during scaffold implantation. After 2 years, microcomputed tomography and histology were used to assess bone regenerative capabilities of cell versus cell-free scaffolds.

**Results:**
Extensive bone regeneration was evident throughout the entire scaffold. Clear osteocytes embedded within mineralised matrix and active osteoblasts present around scaffold struts were observed. Cell groups performed better than cell-free scaffolds.

**Conclusions:**
Bone regeneration within defects which cannot heal unassisted can be achieved using mPCL/TCP scaffolds. This is improved by the inclusion of autogenous BMSCs. Further work will include the inclusion of growth factors including BMP-2, VEGF and PDGF to provide multifunctional scaffolds, where the three-dimensional (3D) template itself acts as a biomimetic, programmable and multi-drug delivery device.