

Optimizing Degradable Scaffolds for Cranium Tissue Repair

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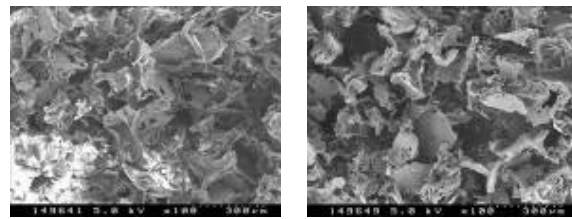
INTRODUCTION: The issue of repairing deformities in the craniofacial area continues to be a challenging one for reconstructive surgeons. To date many methods and materials have been used to obtain a waterproof seal of bone defects in the cranium [1]. Various methods have been used for the preparation of porous polymeric structures for biomedical applications [2]. The aim of this study is to develop a new scaffold formation method for cranium tissue repair, so that the scaffolds with high mechanical properties and high pore interconnection can be obtained.

METHODS: Medical grade poly(lactic acid) (PURASORB™) (PLA) was used to generate scaffolds by using two porogens. NaCl was used to control macro-pore size as to 100 to 250 µm; whilst naphthalene was utilized as a porogen to increase pore interconnections. After the salt was leached out by water, naphthalene was removed by tetrahydrofuran (THF) and this step followed by the removal of THF by ethanol. The morphology of the scaffolds manufactured with and without naphthalene was observed by SEM. MG63 osteoblastic cells were seeded in the scaffolds with the density of 1×10^6 cells per scaffold. Cell attachment and viability were investigated by live/dead fluorescent dye kit and observed in confocal microscopy.

RESULTS: Introducing naphthalene as the second porogen in solvent-casting and salt-leaching process resulted in improvement of the pore interconnectivity. By using 20% naphthalene, highly interconnected pore structures achieved. SEM images of the scaffolds prepared with and without naphthalene are given in Figure 1. Extra small pores presented in the pore wall were visualized in the scaffolds produced with naphthalene (Fig1 b). Both cell-scaffold constructs made with and without naphthalene exhibited strong green fluorescence (Figure 2), indicating that the cells were alive and healthy, and the naphthalene in the scaffold process did not affect cell viability.

DISCUSSION & CONCLUSIONS: Application of two porogens may produce mechanically strong porous scaffolds for cranium repair by using small

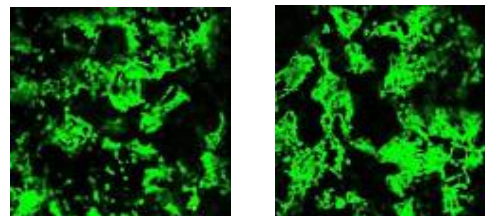
NaCl particulates. The nutrient diffusion efficiency can be compensated by the smaller pores generated by the second porogen, naphthalene, which enhance the pore interconnection.



(a)

(b)

Fig. 1: SEM images of scaffolds prepared by solvent-casting and salt-leaching technique. (a) without naphthalene; (b) with naphthalene



(a)

(b)

Fig. 2: Confocal microscopic images staining with live/dead fluorescent kit. (a) without naphthalene; (b) with naphthalene

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