

Development of fast conformable scaffold applied in bone defects

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Abstract

Orthopaedic, craniomaxillofacial surgery and accidental injury frequently results in large bony defects require the bone grafts to enhance bone healing. Synthetic bone graft substitutes such as hydroxyapatite, tricalcium phosphate and calcium sulfate have shortcomings in the sense that they have prolonged working and setting time, as well as poor compressive strength. Therefore, the aim of this study was to develop a new, convenient and easily moldable bone filling material based on the poly-lactic acid (PLA)/polycaprolactone (PCL) matrix with a pore-former filler (calcium sulfate). The self-formation of interconnected pores within this thermo-moldable scaffold can be observed only after the implantation due to the fast absorption characteristic of calcium sulfate within the body. The optimum ratio of the composition is 18% PLA: 42% PCL: 40% CaSO₄. The compressive strength, three point bending strength and elastic modulus were 38.2±1.2MPa, 67.5±7.2MPa, 7.0±0.7GPa, respectively while the shaping temperature was 50±2°C, the setting and hardening time did not exceed 6 minutes. Cytotoxicity revealed bullet-shaped and intact cells with no mutation or apoptosis present. In addition, good cell attachment was observed. MTT test indicated that cell viability observed in the experimental group is higher than 100%. After immersion in phosphate-buffered solution (PBS) for 8~12 weeks, 50-200µm sized pores were observed under scanning electron microscope (SEM). It will be the good choice for bone grafting.