Biodegradable and bio-inspired scaffold for bone tissue engineering

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Introduction: Over last three decades, there have been significant advance in the development of biodegradable materials especially for use as bone repair materials or bone implants (1).

Natural bone is a 3D interconnected porous biomineralized composite with a hierarchical structure. It is assembled through the orderly deposition of apatite minerals within type I collagen fibers. Biomaterials based on these two components showed a high biocompatibility and bioactivity (2), but very weak mechanical properties (3).

The use of porous composite scaffolds in bone tissue engineering is a promising approach for bone regeneration and healing. Combining those composite materials with appropriate potentially osteogenic cell type is expected to further promote bone regeneration.

Methods: Using a biomimetic strategy combined with freeze-drying and salt leaching techniques, we developed a tri-component composite made from biodegradable elastic poly(L-lactide-co-ε-caprolactone) (PLCL) (70:30) copolymer, a natural biopolymer collagen (Coll), and bioactive ceramic hydroxyapatite (HA).

A scanning electron microscope (SEM) was used to investigate the morphology of the composite scaffold. The chemical analysis of scaffold was performed by ATR-FTIR spectroscopy. The toxicity/biocompatibility of the scaffold was investigated *in vitro* by culturing stromal osteoblasts Saos-2, and by studying their adhesion, proliferation and protein production.

Results: The newly synthesized scaffold was non-cytotoxic (data not shown) with an analogous morphology and composition to natural bone (Fig. 1). The composite presented an interconnected high porosity (80%) and a broad distribution of pore sizes (0.01-200 µm) suitable for bone tissue engineering, which was supported by osteoblast cell culture. The composite promoted Saos-2 cells adhesion, proliferation and maintains their osteoblastic profile.

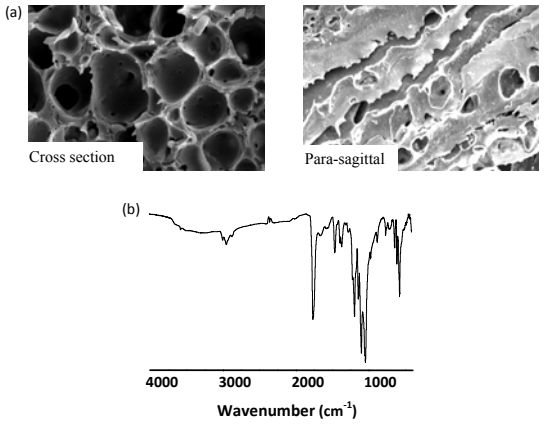

Figure 1: Three dimensions composite scaffold made by PLCL/Coll/HA SEM micrographs (a) and FT-IR spectra (b).

Conclusion: We have developed a biodegradable and bioactive tri-component scaffolding material for bone regeneration. The scaffold has surface properties and morphology similar to those of natural bone. This new scaffold might therefore maximize bone formation and promote cells/biomaterial interactions and thus improve the effectiveness of orthopaedic and dental implants.

References:

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