**Abstract**

Here we describe the formulation of a morphogenetically active bio-ink consisting of amorphous microparticles (MP) prepared from Ca$^{2+}$ and the physiological inorganic polymer, polyphosphate (polyP). Those MP had been fortified by mixing with poly-e-caprolactone (PCL) to allow 3D-bioprinting. The resulting granular PCL/Ca-polyP-MP hybrid material, liquefied by short-time heating to 100 °C, was used for the 3D-printing of tissue-like scaffolds formed by strands with a thickness of 400 µm and a stacked architecture leaving *almost equal to* 0.5 mm$^2$-sized open holes enabling cell migration. The printed composite scaffold turned out to combine suitable biomechanical properties (Young's modulus of 1.60±0.1 GPa; Martens hardness of 153±28 MPa), matching those of cortical and trabecular bone, with morphogenetic activity. This scaffold was capable of attracting and promoting the growth of human bone-related SaOS-2 cells as demonstrated by staining for cell viability (Calcein AM), cell density (DRAQ5) and SEM studies. Furthermore, the hybrid material was demonstrated to upregulate the steady-state-expression of the cell migration-inducing chemokine SDF-1a. EDX analysis and FTIR measurements revealed the presence of hydroxyapatite in the mineral deposits formed on the scaffold surface. Based on the results we conclude that granular PCL/Ca-polyP-MP hybrid material is suitable for the fabrication of bioprintable scaffold which comprises not only biomechanical stability but also morphogenetic potential. Statement of Significance: In present-day regenerative engineering efforts, biomaterial- and cell-based strategies are proposed that meet the required functional and spatial characteristics and variations, especially in the transition regions between soft (cartilage, tendon or ligament) and hard (bone) tissues. In a biomimetic approach we succeeded to fabricate amorphous Ca-polyP nanoparticles/microparticles which are highly biocompatible. Together with polycaprolactone (PCL), polyP can be bio-printed. This hybrid material attracts the cells, as documented optically as well as by a gene-expression studies. Since PCL is already a FDA-approved organic and inert polymer and polyP a physiological biologically active component this new bio-hybrid material has the potential to restore physiological functions, including bone remodelling and regeneration if used as implant. © Elsevier B.V. Reproduced with permission.