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Introduction

Calcium-phosphate glasses (CPGs) are commonly used as scaffolds in tissue engineering. A novel formulation of optically transparent CPG has been recently developed to be used as an optical fibre for biomedical implantable devices [1-3]. Its purpose is to combine the bioresorbability of CPGs with optical features, thus extending the applications of bioresorbable sensors for in-body monitoring or diagnostics [3,4]. Modifications of the glass composition or post-treatments on the fibres can tailor the dissolution time and the interaction of the glass with different stimuli as well as with specific cells. The tested glasses both in bulk and fibre shapes showed good strength (from 200 to 350 MPa) with values that are lower than standard silica glass and much higher than common bioresorbable polymers [2]. CPG fibres were also implanted in living rats for several weeks and no clinical signs of any adverse effect have been found [3]. We will present our latest results on these subjects starting from the characterisation of the CPGs by means of dissolution tests, in-vitro, and ex-vivo experiments.

Experimental methods

Extrusion, stack-and-draw, or rod-in-tube technique have been employed to produce several metres of fibres. Tests of light guidance and delivery of liquids promoted by capillary force have also been conducted. The dissolution of different compositions has been evaluated in Phosphate Buffered Saline solution and the released ions have been analysed using ICP-Mass Spectroscopy. Tests with several kinds of cells/bacteria on bulk CPG substrates are ongoing and preliminary results of cell viability will be presented. The response of living tissues after implantation of a fibre bundle in adult mice has been studied, following ethical standards on animal care [3].

Results and discussion

The optical transparency of the proposed CPG covers a wide wavelengths range, from 200 to 2600 nm. This characteristic, together with good mechanical properties, makes these fibres suited for several biomedical applications: from drug delivery to Photo-Dynamic Therapy and deep-tissue imaging with infrared light. Preliminary results of cell viability will be presented, highlighting the safe interaction of the glass with different kinds of cells, also showing that doping the glass with ions such as copper can inhibit or enhance specific cell growth on the glass surface.

Conclusions

The obtained results show a promising pathway to a biocompatible, bioresorbable, and optically transparent CPG, drawable in form of a fibre or capillary and usable for several applications by combining simultaneous light guidance and drug delivery.

References

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