USE OF CALCITE IN TRICALCIUM PHOSPHATE BASED CHEMICALLY BONDED BIOMATERIALS

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Introduction

Biomaterials based on calcium phosphates are effective bone substitutes, mainly due to their chemical and mineralogical similarity to the inorganic component of bone. Recently, calcium phosphate bone cements (CPCs), especially on the basis of α-tricalcium phosphate (α-TCP), have been intensively studied [1]. CPCs are characterized by excellent biocompatibility and surgical handiness. Interesting modifier of CPCs is calcium carbonate ($CaCO_3$). Calcium carbonate has three anhydrous polymorphs vaterite, aragonite and calcite [2]. Calcite is a geologically abundant material, which can be used to produce scaffolds for clinical dental and orthopaedic applications It has been proven that $CaCO_3$ can be apply as one of the constituents of CPCs, in order to support formation of carbonated apatite as the end-product of setting reaction. Moreover, presence of calcium carbonate can improve the degradability of the apatitic calcium phosphate cements [3].

Materials and Methods

This study aimed to examine the effect of calcite incorporation into α-tricalcium phosphate based biomaterials. Materials containing 30wt% and 50wt% of calcite were examined. The influence of initial composition on setting times (Gilmore Needles), crystalline phase content (X-Ray Diffraction) and microstructure (SEM) of materials was investigated.

Results and Discussion

Setting times of cements ranged from 11 to 14 min (initial) and from 19 to 27 min (final). The setting depended on the composition of powder and liquid phase. Results of XRD analysis revealed that only two crystalline phases i.e. tricalcium phosphate and calcite were present after 7 days of hardening. SEM observations of fractured cement samples showed that calcite grains were embedded in calcium phosphate matrix (FIG. 1).

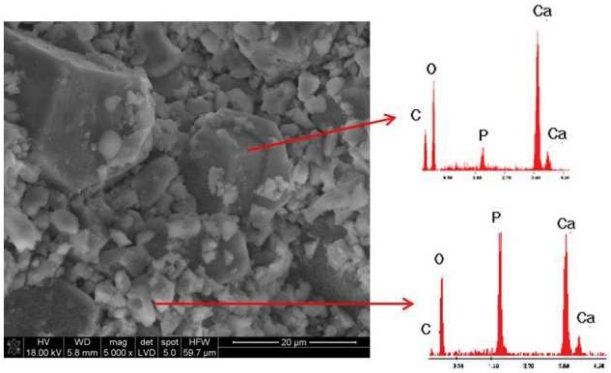

FIG. 1. SEM microphotograph and EDS analysis of fractured cement sample.

Compressive strengths of cements varied from 1.6 to 4.8 MPa. Increasing the amount of $CaCO_3$ decreases the mechanical strength of investigated biomaterials.

Conclusions

Presence of calcite in tricalcium phosphate based cements slightly increases their setting times and decreases the mechanical strength of final materials. Further *in vitro* and *in vivo* studies are required for the complete evaluation of the biomaterials.

Acknowledgments

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References

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