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Fabrication of B-type carbonate apatite blocks by the phosphorization of free-molding gypsum-calcite composite

Chowdury Tanira ZAMAN[1)], Akari TAKEUCHI[1)], Shigeki MATSUYA[2)], Q.H.M. Shawket ZAMAN[1)] and Kunio ISHIKAWA[1)]

1) Department of Biomaterials, Faculty of Dental Science, Kyushu University
2) Section of Bioengineering, Department of Dental Engineering, Fukuoka Dental College

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Abstract:
B-type carbonate apatite (CO_3Ap) block may be an ideal artificial bone substitute because it is closer in chemical composition to bone mineral. In the present study, the feasibility to fabricate CO_3Ap blocks was investigated using compositional transformation, which was based on the dissolution-precipitation reaction of a gypsum-calcite composite with free-molding behavior. For the compositional change, or phosphorization, gypsum-calcite composites of varying $CaCO_3$ contents were immersed in 1 mol/L $(NH_4)_3PO_4$ aqueous solution at 100°C for 24 hours. No macroscopic changes were found after the treatment, whereas microscopic change was observed at SEM level. X-ray diffraction, Fourier transform infrared spectroscopy and CHN analysis indicated that the composites were B-type CO_3Ap containing approximately 6–7 wt% of CO_3, a value similar to that of biological bone apatite. Diametral tensile strength of the CO_3Ap block was approximately 1–3 MPa. Based on the results obtained, it was therefore concluded that gypsum-calcite was a good candidate for the fabrication of CO_3Ap blocks, coupled with the advantage that the composite can be molded to any shape by virtue of the setting property of gypsum.

Key words:
Carbonate apatite, Gypsum, Calcite, Phosphorization

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