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Fabrication of Carbonate Apatite Forming Cement

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論文題目　Fabrication of Carbonate Apatite Forming Cement

(炭酸アパタイトセメントの創製)

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論　文　内　容　の　要　旨

In the present study, a relationship between carbonation and resorption of apatite cement consisted of TTCP and DCPA was investigated. Finally, fabrication of CO_3Ap forming cement was conducted to achieve ideal cement as bone replacement.

First, AC cements were prepared under the atmosphere with different CO_2 concentration in order to confirm whether or not the carbonation of AC occurred under the atmosphere similar to a body environment. AC's paste consisted of mixture of an equimolar tetracalcium phosphate and dicalcium phosphate anhydrous (DCPA) with distilled water was prepared then put into mold at 37°C and 100% relative humidity under 100% CO_2, 5% CO_2 and 100% N_2 atmosphere, respectively. As a result, carbonation on the surface of AC was successfully occurred when CO_2 was contained in atmosphere during setting and hardening of AC. Next, *in vivo* test using rats was performed in order to understand the different resorbability of set AC specimens prepared under 100% CO_2, 5% CO_2 and 100% N_2 atmosphere. As a result, carbonate content in AC specimen increased with increasing resorbability of AC. It is concluded, therefore, that the carbonation of AC would be an important process for resorption of AC after implantation.

Based on this finding, finally, new bone cement that fully transforms to CO_3Ap at physiological condition was fabricated. Mixtures of calcium carbonate ($CaCO_3$) and dicalcium phosphate anhydrous were chosen as powder phase and using three kinds of sodium phosphate solutions, which are NaH_2PO_4, Na_2HPO_4, and Na_3PO_4, respectively. The cement that fully transforms to CO_3Ap could be fabricated using vaterite instead of calcite as a $CaCO_3$ source, since their stability in aqueous solution is different, regardless of the type of sodium phosphate solution. It is concluded, therefore, use of vaterite has a good advantage to fabricate CO_3Ap forming cement, which is promising to be applied for an ideal bone replacement.