Kenichi Shinomiya

１.Topic in Research Achievements in the Year 2006

Since 2002, we have developed porous hydroxyapatite / collagen composites (HAp/Col), which is an artificial bone with a nano-structure similar to natural bone, and its clinical trial started in 2006. Porous HAp/Col in next generation, of which porous structure is unidirectional, is also under development. Augmentation of tissue penetration rate into the implant has been already confirmed compared to the original porous HAp/Col.

To use bone marrow stromal cells (MSCs) for bone reconstruction, we have tried to improve the method through the procedures. As to cultural methods of MSCs, we confirmed a continuous dexamethasone treatment through the culture period was effective for in vitro osteogenic differentiation and in vivo bone formation capability. We also developed a novel cell induction method into a porous cell scaffold. Briefly, the scaffold was soaked in the cell suspension under a low-pressure condition in a chamber, and thereafter the valve connected to the chamber was opened to recover the normal pressure. The procedure and the device were very simple, and the cell-induction efficiency was significantly higher than those in previous reports which also used pressure control techniques. We tested effects of fibrin as a three-dimensional scaffold of MSCs. MSCs were suspended in plasma or culture medium and introduced into porous □-TCP bocks. Following the induction, fibrin network formation of the cell suspension using plasma was initiated, and then the blocks were implanted into extra-skeletal sites. The transplantation of the culture medium group was performed after 3-hour incubation for cell attachment to the porous □-TCP bocks. Each implant was harvested after 3-6 weeks later, and the quantifications of the bone formation showed more abundant bone formation in the plasma group. Now, we have started to develop methods for reconstruction of huge bone defects using these improved procedures.

２. Publications in the year 2006

○Tajima N, Sotome S, Marukawa E, Omura K, Shinomiya Kenichi S
A three-dimensional cell-loading system using autologous plasma loaded into a porous b-tricalcium-phosphate block promotes bone formation at extraskeletal sites in rats
Materials Science and engineering :C, in press

○Wang J, Asou Y, Sekiya I, Sotome S, Orii H, Shinomiya K
Enhancement of tissue engineered bone formation by a low pressure system improving cell seeding and medium perfusion into a porous scaffold
Biomaterials　27(13): 2738-2746,2006

Yunoki S, Ikoma T, Monkawa A, Ohta K, Kikuchi M, Sotome S, Shinomiya K, Tanaka J
Control of pore structure and mechanical property in hydroxyapatite/collagen composite using unidirectional ice growth
Materials Letters　60:999-1002, 2006

Yunoki S, Ikoma T, Monkawa A, Ohta K, Tanaka T, Sotome S, Shinomiya K
Influence of Gamma Irradiation on the Mechanical Strength and in vitro Biodegradation of Porous Hydroxyapatite/Collagen Composite
Journal of American Ceramic Society 89(9) 297-299 2006

Yunoki S, Ikoma T, Tsuchiya A, Monkawa A, Ohta K, Sotome, S, Shinomiya K, Tanaka J

Fabrication and mechanical and tissue ingrowth properties of unidirectionally porous hydroxyapatite/collagen composite

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