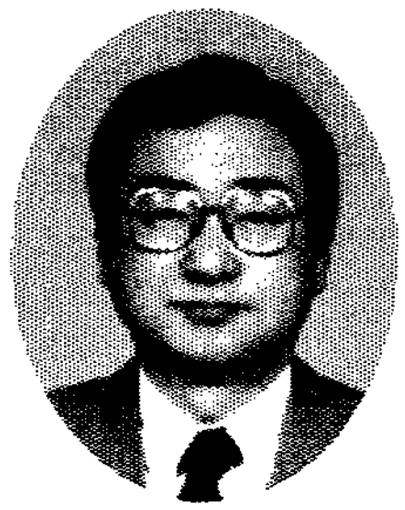
국내특강 I 표면활성 세라믹의 세포/조직 반응 (Interaction between Cell/Tissue and Surface Active Bioceramics)



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Great attention has recently been drawn to the surface active bioceramics by material scientists as well as by dentists, because of their bonding ability to bone tissue when implanted into body. It is known that the surface of the surface-active bioceramics go through a series of reactions at the interface after implantation. The surface releases ions from the surface which promote hydroxyapatite formation, provides bonding sites for collagen fibers, and generally promotes bonding to bone. The rate of reaction that allows surface bonding can be altered by local metabolic conditions and alterations in local pH and by some of additions to the basic formulations.

We evaluated the cytocompatibility and histocompatibility of different hydroxy apatites(HAPs), bioactive glasses, α-tricalcium phosphate and glass ceramics by means of the culture of L929 fibroblasts and osteoblasts, subcutaneous implantation and bone implantation. And we observed the bone-bioceramic interface by EDX, backscattered and transmission electron microscopy.

In the Millipore filter and agar overlay tests there were no leachable, toxic substances in all experimental bioactive ceramics. In the osteoblast culture on the bioactive glasses, bone nodules were formed on the surface of various bioactive glasses. After 12 weeks of subcutaneous implantation in guinea pig, most of HAPs, bioactive glass [46S, 52S] and glass ceramic implants were encapsulated with thin, non-inflammatory fibrous capsule, but group of macrophages around α-tricalcium phosphate and B_2O_3 containing bioactive glasses. The implantation of bioactive glasses, such as 46S, 52S, 55S, and 55SF, in a cortical defect drilled in rabbit tibia revealed bone-bonding character with the large amount of bone within one month. On the other hand, partial soft tissue interface was observed around B_2O_3 containing bioactive glasses up to 6 month of implantation. Contacts with soft tissue was increased around HAP on 18 months after implantation. At the interface of bone-HAP, bone-46S and bone-52S bioactive glasses after 18 month implantation, three sequential layers of apatites were observed.

We developed methods of rapidly coating charged solid surfaces, such as metals, polymers, tissues, and glasses, with thin film substrate composed of low crystalline apatite, which firmly attached to the

surface and bound together. The thin film substrate of apatites formed on the culture dishes was strong enough to culture and anaylzed cells in vitro and in situ, and represented the characteristics of biological crystals. We believe that it can be used as highly bio-reactive as well as biocompatible material.

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