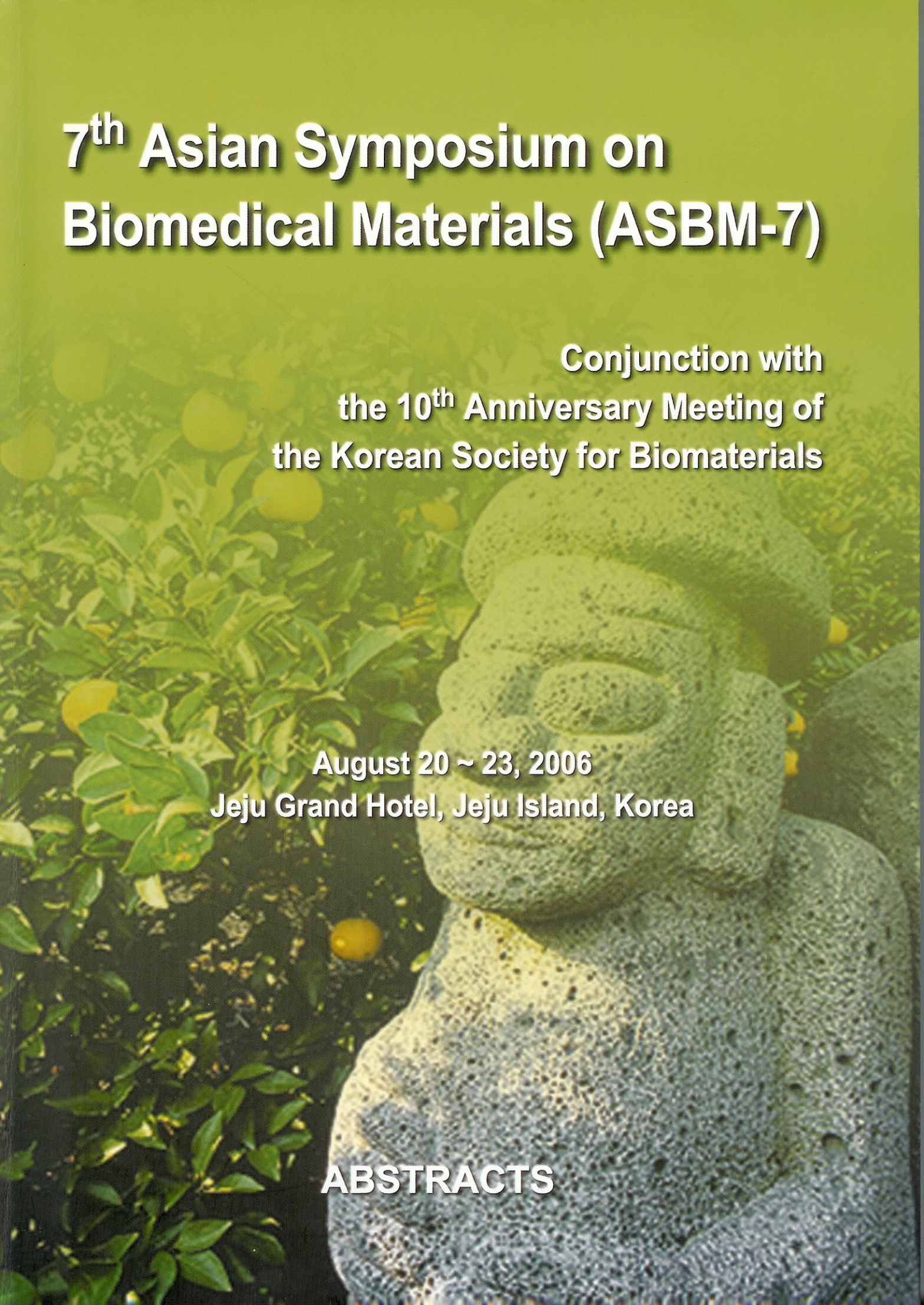
7th Asian Symposium on Biomedical Materials (ASBM-7)

Conjunction with
the 10th Anniversary Meeting of
the Korean Society for Biomaterials

August 20 ~ 23, 2006
Jeju Grand Hotel, Jeju Island, Korea



ABSTRACTS

A NOVEL DENTAL IMPLANT TECHNOLOGY FOR EARLY LOADING OF IMPLANT BY PERIODIC ELECTRICAL STIMULATION

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We developed a novel dental implant technology using early bone formation by electrical micro-current stimulator for early loading of implant. It integrated in healing abutment of dental implant. Electrical stimulation makes an early bone formation in areas surrounding implant surface, and this is made possible by changing microenvironments between cells and materials such as titanium and its alloy. The osteoblast forming a new bone is exposed to a periodic micro-current stimulation for a long time and proliferates more rapidly and induces growth factors such as VEGF during stimulation. These proteins accelerate angiogenesis around implants and result in nourishing its environments. In the end, bone mineral density is increased and surrounding tissues can more effectively support the implanted metals.

In this paper, in order to implement small sized stimulation system in healing abutment of dental implant, we needed a small sized stimulator chip that could be operated on a tiny battery. Thus, we designed a current stimulator chip using 0.35μm fabrication process of SAMSUNG semiconductor through the 41st IDEC MPW program. Stimulation parameters of the chip are fixed with 120μs of duration, 100Hz of pulse rate and 20μA/cm^2 of amplitude and power is delivered by a serial connected silver oxide battery(SR416SW, Sony) of which dimension is 1.65mm of thickness and 4.8mm of diameter. The chip consumed 142μW power and lasted 7 days in an implanted site. The fabricated chip is packaged in a healing abutment made with Poly-carbonate insulating materials.

We implanted the current stimulator system into the 10 dogs(Beagle). After pulling out premolar of maxillary and mandibular, wounded sites were stabilized for 45 days. Then, the system was implanted in mandibular first premolar with the control. Electrical stimulation was applied for 1 weeks and the test group was sacrificed at 2 weeks after stimulation. Histological specimens with H&E and Masson Trichrome staining were made and histomorphometrically analysed with image analyzer.

A new bone formation was observed around implants in the experimental group. The area of a new bone was increased from 13.77% to 43.93% compared to that of control. These results suggest that our newly developed system is effective in the early bone formation around the surface of implant. It can be a useful method in clinical application for the early loading of implant.