IMPROVED ADHESION AND GROWTH OF OSTEOBLAST-LIKE MG-63 CELLS IN CULTURES ON TITANIUM MODIFIED BY GOLD PARTICLES

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Abstract

Metallic materials are important for load-bearing bone implants. The osteointegration of these implants can be improved by appropriate surface modifications. Therefore, we present here a study of the cell growth on titanium surfaces modified with films created from gold microparticles. These particles in the form of microplates or polyhedral microcrystals were deposited on titanium plates from ethanol solutions, dried and annealed with a hydrogen flame. Some samples were additionally modified by polyethylene imine. The materials engendered from these modifications were used to investigate the adhesion and growth of human osteoblast-like MG-63 cells on these surfaces in the DMEM medium with 10% of fetal bovine serum.

One day after seeding, the highest number of initially adhered cells was found on the surfaces modified by both types of gold microparticles. This trend was the same three and seven days after seeding. The numbers of cells on pure Ti and Ti modified only with gold particles were significantly higher than on samples which were modified with polyethylene imine. The cell spreading areas projected on the materials were significantly larger in cells on the samples with polyethylene imine modification. However, the shape of these cells was mostly rounded or star-like with thin and long protrusions, while on the materials without polyethylene imine, it was mostly polygonal.

The cell proliferation activity was estimated from XTT test, based on the activity of mitochondrial enzymes. This test showed that the proliferation activities of osteoblast-like MG-63 cells of the 3rd and 7th days of the experiment were more pronounced on the samples modified only by gold microparticles.

Immunofluorescence showed that the focal adhesion plaques containing vinculin and the fibers containing β-actin were most apparent, more numerous and more brightly stained in cells on Ti modified by gold microplates and gold polyhedral microcrystals, especially in comparison with the corresponding samples modified with polyethylene imine (Fig. 1).

Thus, it can be concluded that the modification of titanium samples by both types of gold microparticles enhanced the adhesion and growth of MG 63 cells.

Keywords: *metallic material, titanium, surgical implants, gold microparticles, cell adhesion, cell growth*

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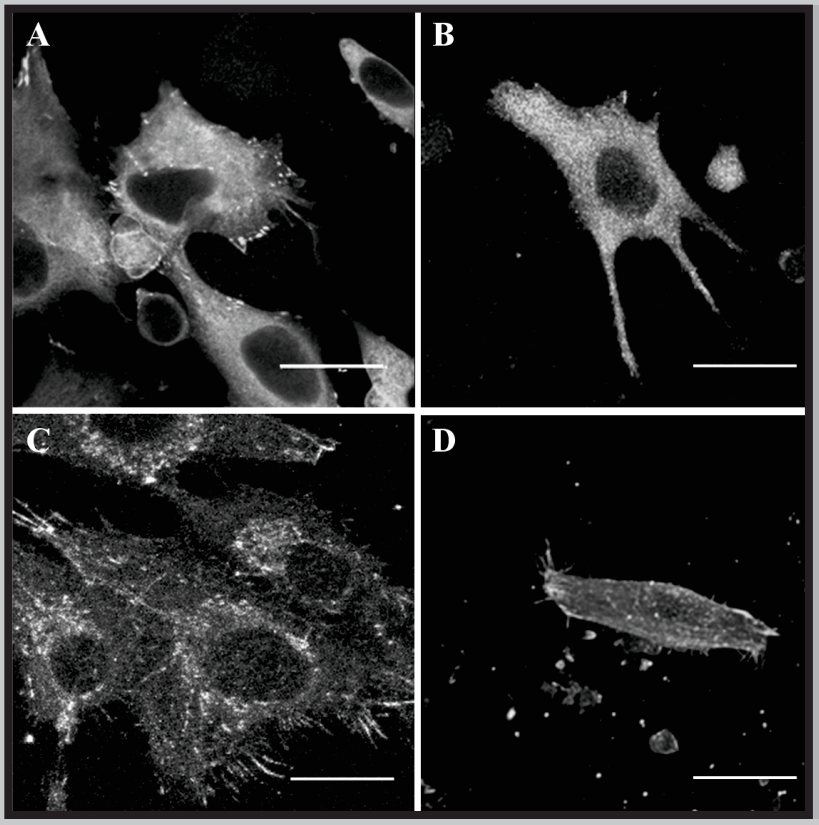

FIG. 1. Immunofluorescence staining of vinculin, an integrin-associated protein of focal adhesion plaques (A, B), and β-actin cytoskeleton (C, D) in osteoblast-like MG-63 cells on day 5 after seeding on Ti samples modified by gold microplates (A, C) or by gold microplates and polyethylene imine (B, D). Leica confocal laser scanning microscope (TCS SP2, Germany), obj. 60x, zoom 2x, bar = 25 μm.