#2461 - Posters

Enhanced Biocompatibility Of Co-Cr Alloy By Titanium Powder Coating Using 3D Metal Printing

Orthopaedics / Pelvis, Hip & Femur / Joint Replacement - Primary

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Introduction
3-D Printing with direct metal fabrication (DMR) technology was innovatively introduced in the field of surface treatment of prosthesis to improve, moreover to overcome the problems of plasma spray, hopefully resulting in opening the possibility of another page of coating technology. We presumed such modification on the surface of Co-Cr alloy by titanium powder coating using DMR would improve the ability of Co-Cr alloys to osseointegrate.
Objectives
We presumed such modification on the surface of Co-Cr alloy by titanium powder coating using DMR would improve the ability of Co-Cr alloys to osseointegrate.
Methods
We therefore compared the in vitro and in vivo ability of cells to adhere to DMR coated Co-Cr alloy to that of two different types of surface modifications: machined and titanium plasma sprayed (TPS). We performed scanned electron microscopy investigations to assess the structure and morphology of the surfaces. Biologic and morphologic responses to human osteoblast cell lines were then examined by measuring cell proliferation, cell differentiation (alkaline phosphatase activity), RUNX-2, fibronectin. In vivo study, we inserted the specimen in the medulla of the distal femur on rabbit (right – machined, left – DMR). After 3 months, the distal femurs were harvested, and then push out test and histomorphometry were performed.
Results
The cell proliferation rate, alkaline phosphatase activity, and cell adhesion in the DMT group increased in comparison to those in the machined and TPS groups. Human Osteoblast cells on DMT-coated surface were strongly adhered, and proliferated well compared to those on the other surfaces. In vivo test, the ultimate shear strength of DMR group was statistically higher than machined group. In histomorphometry, the bone ingrowth was well formed around the DMR specimen.
Conclusions
Titanium coating on the Co-Cr alloy with 3D metal printing provides optimal surface characteristics and good biologic surface in both vitro & vivo. This technique could apply to fabrication of cementless knee arthroplasty (TKR & Uni), and CoCr based acetabular cup in THR.