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Cytotoxicity of titanium and magnesium particles to human osteoblast cells

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Abstract

Metal particles or debris can be generated by wear and tear from bone implants. Reports mentioned that debris can circulate in blood and trigger inflammation, aseptic loosening, and other complications. The mechanism of these phenomena remains unclear. This research is to investigate the toxicity of titanium and magnesium in bone implants due to these two are the most commonly used biomaterials based on excellent biocompatibility, low elastic modulus, and good mechanical strength.

During the cytotoxicity test, the metal particles were added to the petri dish. Ti particles showed toxic to osteoblast at different dosages and time, while Mg particles can reduce the Ti induced metal toxicity to the cells and boost cell proliferation. Mg particles can be toxic to osteoblast at a higher dosage as well. To better understand this phenomenon, human osteoblast cell line SAOS2 were exposed to different concentration of Ti/Mg/Ti-Mg particles. Cell proliferation was measured at 48/72/120 hours. The flow cytometry analysis results showed that Ti induced cell toxicity was through an increase in Reactive Oxygen Species production and induced cell apoptosis and necrosis. Fluorescence microscopy was implemented to observe the cell damage in mitochondria. Quantitative real-time PCR analysis for relative mRNA expression of SAOS2 cells was studied to understand the process better.

Through this study, a proper protocol was established to measure the cytotoxicity of metal particles. However, how to quantify the debris from wear and tear inside the human body, and the comprehensive mechanism of cellular interaction among particles, cells, and tissues require further investigation.

Biography:

Niyou is currently a Ph.D. candidate and research engineer at the National University of Singapore. He is working on a collaboration project between Mechanical Engineering and Anatomy. He has a rich mechanical background, strong biological knowledge, and hands-on experience. He has published one paper in Materials Science and Engineering C, and two papers are currently under review.

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