

Cytotoxicity of Nano β -Tricalcium Phosphate (β -TCP) on Human Osteoblast (hFOB1.19)

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Abstract : The objective of this study was to synthesize nano-sized β -tricalcium phosphate (β -TCP) powder and assess its cytotoxic effects on human osteoblast (hFOB1.19) by using four cytotoxicity assays, namely, lactose dehydrogenase (LDHe), tetrazolium hydroxide (XTT), neutral red (NR), and sulforhodamine B (SRB) assays. β -tricalcium phosphate (β -TCP) is a calcium phosphate compound commonly used as an implant material. To date, bulk-sized β -TCP is reported to be readily tolerated by the osteogenic cells and body based on in vitro, in vivo experiments and clinical studies. However, to what extent of nano-sized β -TCP will react in models as compared to bulk β -TCP is yet to be investigated. Thus, in this project, the cells were treated with nano β -TCP powder within a range of concentrations from 0 to 1000 $\mu\text{g}/\text{mL}$ for 24, 48, and 72 h. The cytotoxicity tests showed that loss of cell viability ($> 50\%$) was high for hFOB1.19 cells in all assays. Cell cycle and apoptosis analysis of hFOB1.19 cells revealed that 50 $\mu\text{g}/\text{mL}$ of the compound led to 30.5% of cells being apoptotic after 72 h of incubation, and the percentage was increased to 58.6% when the concentration was increased to 200 $\mu\text{g}/\text{mL}$. When the incubation time was increased from 24 to 72 h, the percentage of apoptotic cells increased from 17.3% to 58.6% when the hFOB1.19 were exposed with 200 $\mu\text{g}/\text{mL}$ of nano β -TCP powder. Thus, both concentration and exposure duration affected the cytotoxicity effects of the nano β -TCP powder on hFOB1.19. We hypothesize that these cytotoxic effects on hFOB1.19 are related to the nano-scale size of the β -TCP.

Keywords : β -tricalcium phosphate, hFOB1.19, adipose-derived mesenchymal stem cells, cytotoxicity

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