Abstract

Evaluation of the Cytotoxic Effects of Polyethylenimine Nanodendrimer on Human Dental Pulp Stem Cells

Introduction: Oral and dental health is one of the factors that usually affect people's quality of life. To prevent dental diseases, including tooth decay, it is necessary to observe oral and dental hygiene. The material investigated in this study was the 4th generation Polyethyleneimine nanodendrimer (PEI ND G4). PEI ND G4 with amine terminal groups has a high antibacterial effect. The purpose of this study was to investigate the cytotoxicity of PEI ND G4 on human dental pulp stem cells (hDPSC).

Methods and materials: DPSC cells were purchased from the National Centers of Genetic and Biological Reserves of Iran. The cells were treated for 48 and 72 hours with different concentrations (0.5, 1, 2, 4, 8, 16, 32, 64, 128 and 256 μg/ml) of PEI ND G4. MTT test was used to evaluate cellular toxicity. The doubling time of the cells was also checked. FTIR, FE-SEM and TEM analyses were used to determine the structure and size of the PEI ND G4.

Results: The viability of DPSCs was relatively decreased with the augmentation of PEI ND G4 concentration. By increasing the concentration from 0.5 to 256 μg/ml, DPSC cell survival decreased from 99.76 to 61.22 and from 95.33 to 56.06% after exposure time of 48 and 72 hours, respectively. The results of the MTT assay showed that there is no significant difference between the increase in the concentration of PEI ND G4 from 0.5 to 4 μg/ml as compared with the negative control group ($p>0.05$). However, there was a statistical significance ($p<0.05$) between the concentration of PEI ND G4 from 8 to 256 μg/ml compared to the negative control group during the exposure time. Examining the growth curve and doubling time of cells demonstrated a no significant difference between the proliferation of cells in the second to ninth days (exposure to different concentrations of nanoparticles) and the negative control samples ($p>0.05$).

Conclusion: The results showed that the cytotoxicity of PEI ND G4 on the DPSC cell line is relatively low and it can be used as an antibacterial agent.

Keywords: Polyethylenimine, 4th generation nanodendrimer, DPSC, Cytotoxicity, proliferation rate.