PHOTOSENSITIZING TIO2- POLYMERIC MICROPARTICLES FOR PHOTODYNAMIC THERAPY: EVALUATION OF ANTITUMOR EFFECT IN VITRO

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Introduction: TiO2is a photocatalytic agent excited by ultraviolet (UV) light and upon the radiation it produces oxidizing radicals. TiO2is used in photodynamic therapy (PDT) for focal cancer treatment as well as post radiotherapy. We report synthesis and characterization of new 3D-crosslinked polymer microparticles which expose TiO2nanoparticles at their surface. Preliminary observations regarding the cytotoxicity of such particles on cancer cells (with and without illumination with UV-light) are described.

Methods: Microspheres were prepared using suspension polymerization technique, where monomer cocktail (methyl methacrylate (MMA), 2-hydroxyethyl methacrylate (HEMA), initiator (trigonox), cross-linker (1,4-butanediol methacrylate) and TiO2nanoparticles (3%) were mixed and added dropwise to detergent solution at ~90ºC and stirred for 15 min. Cooled particles were washed and sieved. For viability and irradiation, 20,000 cells were seeded per well to 96 well-plate and incubated for 24 h at 37°C in 5% CO2. Then TiO2/polymer particles were added to the cells and incubated at 37°C for 3 h. Plates were irradiated with a UV lamp (360 nm) for 15-60 min at 37°C. We tested viability using the MTT test. Positive controls of cells without particles and irradiation were used to normalize all samples and negative controls contained particles and media.

Results: The synthesized TiO2/MMA microparticles had a diameter of 100-200 micrometers. Surface characterization of microspheres shows the layer of TiO2particles on the surface of the polymer core and structural analysis confirms the presence of titanium. In vitro cell viability confirm the biocompatibility of these particles. The UV irradiation showed no significant effect on cancer cells, while in adding TiO2/MMA and increasing UV irradiation time the cytotoxic effect increased. Cell number drastically decreased by 30% after 60 min of the irradiation.

Conclusion: TiO2is promising for the PDT application, however, its clinical use is restricted by the poor dispersibility in aqueous solution and the photocatalytic effect can be suppressed when TiO2particles are not well dissipated. Here, to avoid the aggregation we synthesized composite polymer that can be easily dispersed in aqueous media thus TiO2particles are then optimally exposed to surrounding cells. Synthesized microparticles demonstrated preliminary antitumor properties.