Morphological alterations in human neutrophils caused by exposition to Titanium (TiO$_2$) nanoparticles.

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Introduction: Neutrophils treated with nanoparticles of titanium tend to change their morphology, exhibiting tubulovesicular extensions, villi and membrane pores. During the exposure, a considerable increase in the area of membrane of neutrophils treated is noticed, with appearance of microvilli and membrane folding in the outer surface of these cells, and it is known that these features promote the phagocytosis of the nanoparticles. This process, triggered by the first line of defense of the human immune system, is associated with cytotoxicity and dependent on the size of the TiO$_2$ particles.

Materials and methods: Neutrophils were separated by percoll method, incubated for 5, 30 and 60 minutes at 37 °C with TiO$_2$ particles. After the incubation period the cells were fixed in Karnovsky solution, processed with poly-L-lysine and fixed to be observed by SEM. Aliquots of the incubated cells were also analyzed by light microscopy for viability and phagocytic function.

Results: The data obtained by SEM showed in the times of 5, 30 and 60 minutes images compatible with vesicles (blisters) on the surface of the cell membrane, which were not observed in the control group at the respective time analyzed. In tests for phagocytosis, time was the determining factor for the significant difference between control and treated cells.

Conclusion: The morphology of these vesicles have been found associated with injury and cell death. The results obtained, considering the intense distribution of vesicles at the cell surface at different times (5, 30 and 60 minutes) and the presence of phagocytosis in cells treated, show that the TiO$_2$ nanoparticles promote neutrophil activation despite its use as a biocompatible material.

Keywords: Neutrophils, TiO$_2$, SEM, Phagocytosis, nanoparticle, Microscopy.

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