Cytotoxic Effects of Graphene on Cell Proliferation of Skin Fibroblast Cells

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Graphene is a crystalline allotrope with sp2-bonded carbon atoms in a hexagonal lattice. Its versatile properties, such as high mechanical strength, biochemical functionalization, and high surface area due to its two-dimensional structure allow it to be an excellent drug carrier in target drug therapies. However, before drugs can be loaded, the effect of graphene on the behavior of normal cells must be tested. Therefore, the cytotoxicity of graphene on BJ skin fibroblast cells in vitro was determined along with the effect of graphene on molecular mechanisms within the fibroblast cells. The cytotoxicity was evaluated by measuring mitochondria dehydrogenase activity, mitochondrial membrane depolarization, and reactive oxygen species (ROS) levels. Graphene had cytotoxic effects at high concentrations, but at 20 µg ml-1, cell proliferation actually increased. Also, supporting the previous results, ROS levels were low at 20 µg ml-1, as seen in healthy cells. Correspondingly, at 20 µg ml-1, the mitochondrial membrane potential was high as the JC-1 aggregated in the mitochondria, like in normal cells. Therefore, these results support the conclusion that graphene at low concentrations, such as 20 µg ml-1 could be used to offer a novel therapeutic approach for the treatment of cancers, such as skin cancer. This research is the first step toward determining the use of graphene in target drug nanodelivery systems. Furthermore, given the promising results that showed an increase of cell proliferation at 20 µg ml-1, graphene could also be used as a scaffold for skin cell culture in the future.

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