Abstract

Cell motility and cell shaping can be controlled by the extracellular mechanical properties, such as the surface topography. Here, we analyze the morphological changes of T24 (malignant) cells of urothelial origin on flat and nanotubular TiO2 nanostructures. Electron-microscope images reveal numerous membrane exvaginations and intercellular membrane nanotubes upon growth on a TiO2 nanotubular surface, whereas, the growth on a TiO2 flat surface leads to a considerably more smooth cell surface topography and cell flattening. The present model is aimed to demonstrate how the adhesion of cells to the TiO2 surface facilitates the growth of membrane protrusions. Since the adhesion of the cell membrane is only possible to the nanotube rims (edges), we assume that the adhesion surface area on the flat surface is greater than the one on the nanotubular surface. Results of numerical simulations reveal the homogeneous attachment of the cell membrane to the TiO2 flat surface, while the attachment to the nanotubular surface is through small attachment regions. The observed morphologic changes and attachment to the surface are discussed with respect to cell motility.