Caveolae formation in osteoblasts membranes on structured titanium surfaces – an attempted phagocytosis of micro-pillars

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Abstract

Cells are sensitive to their underlying topography and especially micro-topography offers cues that evoke large ranges of cell responses, but the complex interplay is not completely understood. For the investigation of topography-induced cell changes, geometric titanium-coated micro-pillared structures (diameters: width 5 µm; length 5 µm; height 5 µm; spacing 5 µm) were used as artificial surfaces. Human MG-63 osteoblastic cells growing on top of micro-pillar structures showed that the actin cytoskeleton was concentrated as local spots around the pillar edges instead of stress fiber formation seen on planar references. The altered cell architecture resulted in a decreased osteoblast function. [1, 2]

Our recent experiments showed an attempted caveolae-mediated phagocytosis of the fixed micro-pillars by osteoblasts, starting with the formation of a multi-caveolar structure on top of the micro-pillars. Cell membrane cholesterol formation as well as amount was also influenced by the micro-topography. As result we observed a strong relation between topography-induced cell membrane organization and osteoblast function with changes in the cellular energy metabolism, such as higher mitochondrial activity and ATP turnover accompanied with increased reactive oxygen species generation.

[1] Matschegewski C, Staehlke S, Loeffler R, Lange R, Chai F, Kern DP, Beck U, Nebe BJ. Biomaterials 31, 5729-5740, 2010

[2] Stählke S, Körtge A, Nebe B. Biomaterials 46, 48-57, 2015