HYALURONAN-BASED PERICELLULAR MATRIX: SUBSTRATE ELECTROSTATIC CHARGES AND EARLY CELL ADHESION EVENTS

Caterina Fotia, Grazia M.L. Messina, Giovanni Marletta, Nicola Baldini and Gabriela Ciapetti

Abstract

Cells are surrounded by a hyaluronan-rich coat called 'pericellular matrix' (PCM), mainly constituted by hyaluronan, a long-chain linear polysaccharide which is secreted and resorbed by the cell, depending on its activity. Cell attachment to a surface is mediated by PCM before integrins and focal adhesions are involved. As hyaluronan is known to bear a negative charge at physiological pH, the relevance of its electrical properties in driving the early cell adhesion steps has been studied, exploring how PCM mediates cell adhesion to charged surfaces, such as polyelectrolyte multilayer (PEM) films. Poly(ethylene imine) (PEI) and poly(sodium 4-styrene sulphonate) (PSS), assembled as PEI/PSS and PEI/PSS/PEI layers, were used. The nanoscale morphology of such layers was analysed by atomic force microscopy, and the detailed surface structure was analysed by X-ray photoemission spectroscopy. PCM-coated and PCM-depleted MG63 osteoblast-like cells were used, and cell density, morphology and adhesive structures were analysed during early steps of cell attachment to the PEM surfaces (1-6 h). The present study demonstrates that the pericellular matrix is involved in cell adhesion to material surfaces, and its arrangement depends on the cell interaction with the surface. Moreover, the PCM/surface interaction is not simply driven by electrostatic effects, as the cell response may be affected by specific chemical groups at the material surface. In the development of biomimetic surfaces promoting cell adhesion and function, the role of this unrecognised outer cell structure has to be taken into account.