Abstract

Cultivation of cells in bioreactors with mechanical load simulates the physiological conditions to which cells in the body are exposed. This technology has been used to induce the differentiation of stem cells from adipose tissue towards the phenotype of vascular smooth muscle cells, which can further serve to form vascular replacements. At present, there is no established strategy for cultivating stem cells while being exposed to mechanical stress. The main aim of this work was therefore to optimize the cultivation strategy and determine the ideal load parameters. Differentiation was analyzed by immunofluorescence of specific smooth muscle cell markers, α-actin and h1-calponin, which were quantified by Western blot. Extracellular matrix production was also detected by immunofluorescence staining. The outcome of this work is the establishment of ideal conditions of cell culture in a bioreactor with mechanical load, during which they differentiate into smooth muscle cells. Three types of scaffolds were used for cultivation; plasma treated glass, fibrin-coated glass and decelularized pericardium. Preliminary results show that smooth muscle differentiation was succesfully induced in human and porcine adipose tissue stem cells. Cells were analyzed after 3 and 7 days of culture. Developing a stem cell culture strategy in a bioreactor with mechanical stress can lead to a more efficient formation of vascular substitutes used in the treatment of cardiovascular diseases.

Key words: stem cells, mechanical loading, tissue engineering, cell differentiation, dynamic cultivation