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Role of mechanical stretching in the modulation of myocytes phenotype: implications for tissue engineering

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The phenotype of myocytes is regulated by various stimuli, including mechanical environment (Davis-Dusembery et al., 2011; Lu et al., 2011). Several studies examined the role of mechanical strain on myogenesis in skeletal muscle cells, but the mechanisms that dictate the effects of cyclic strain on myocytes phenotype are still not understood (Simmons et al., 2004). Cellular responses to mechanical stress depend on to the substrate deformation, frequency and duration of the applied mechanical stress (Kook et al., 2008). Physiologic mechanical stimuli may affect the properties of the tissues, leading also to the development of several pathologies.

In this work, we studied the effects of different cyclic strains on C2C12 myoblasts phenotype. Cellular mechanisms involved in the mechanical stress-mediated modulation of myogenesis or osteogenesis were considered. In particular, low (2%) and high (15%) substrate deformations were applied and cell proliferation and differentiation markers (Myf5, Myogenin, Osteopontine, ALP) were observed by RT-PCR and western blot analyses. Results showed that cell phenotype switches from myogenic to osteogenic, depending on the dynamic conditions applied. In particular, the myogenic differentiation was inhibited through the down-regulation of muscle specific markers, and the up-regulation of the osteogenetic phenotype markers.

References

Davis-Dusembery et al. (2011) Micromanaging vascular smooth muscle cell differentiation and phenotypic modulation. Arterioscler Thromb Vasc Biol 31: 2370-2377.

Lu et al. (2011) Role of shear stress and stretch in vascular mechanobiology. J.R.Soc.Interface 8: 1379-1385.

Simmons et al. (2004) Mechanical stimulation and mitogen-activated protein kinase signalling independently regulate osteogenic differentiation and mineralization by calcifying vascular cells. Journal of Biomechanics 37: 1531-1541.

Kook et al (2008) Cyclic mechanical stress suppresses myogenic differentiation of adult bovine satellite cells through activation of extracellular signal-regulated kinase. Mol Cell Biochem 309:133-141.

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