Impact of Pathogenic Elements of Cytoskeleton and Chemical Components on Muscle Mechanical Properties

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Context Myofibrillar Myopathies (MFM) are rare degenerative pathologies due to mutations within several genes. The disruption of tissues follows a slow degradation of muscular cell functions. The events leading to muscle disruption are largely unknown at biological, chemical and mechanical levels. Alteration of the mechanical characteristics of cells could be at the origin of this tissue disruption. Individual muscle cell characterization in microfluidic device offers stimulating perspectives for the study of myopathies and other cellular disorders. These differentiated cells can be studied with silicon nano-tweezers for local mechanical characteristics acquisition.

Objectives & Methods This study aims to investigate two aspects of the pathology: cell differentiation and mechanical impairment. C2C12 cells are transfected in order to express different pathogenic variants of human desmin. Then, differentiation is induced in standard conditions. Differentiated cells are isolated from the tissue and studied individually in a microfluidic device with nano-tweezers for mechanical characterization. The design of the device allows chemical stimuli. This will yield to investigate the effect of potential therapeutic compounds [1]. Both devices used in this study have demonstrated their ability to produce results of very high quality in comparable cellular context [2]. The combination of these technologies is an innovative way to study muscular disorders and to link genetic mutations to their consequences.

Results Previous works have described nano-tweezers and microfluidic device specific designs allowing nano-newton data acquisition. This permits experiments on isolated cell. Cells expressing different pathogenic variants of desmin (in comparable quantities) are studied under bright-field microscopy and human desmin presence is confirmed afterwards by immunofluorescence.

References