Innovative biofabrication strategies for engineering large, artificial skeletal muscles

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The importance of skeletal muscle tissue is undoubted being the controller of several vital functions including respiration and all voluntary locomotion activities. However, its regenerative capability is limited, and significant tissue loss often leads to a chronic pathologic condition which significantly impairs patients' lives. To tackle this challenge, we have developed recently innovative biofabrication approaches by combining co-axial extrusion, microfluidics, and wet spinning. Our methods enable the rapid production of myo-substitutes capable of properly supporting myogenesis in vitro and, upon implantation, rapidly restoring skeletal muscle mass, 3D histoarchitecture and functionality in vivo. Such results are made possible by recapitulating muscle anisotropic organization and micro-environment at the microscale level, thus resulting in an efficient cell differentiation and myobundle formation. At the moment, the proposed strategies are under investigation in a large size animal model (mini pig) for the repair of a volumetric muscle damage using autologous progenitors. If successful, a possible translation into clinical scenarios of our systems will be significantly closer.