NOISY ELECTRICAL STIMULATION
TO COUNTERACT SKELETAL MUSCLE ATROPHY

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Several studies demonstrate the efficacy of direct electrical (ES) stimulation of muscles in counteracting atrophy following injury, surgery or in patients affected by chronic debilitating conditions (1,2). Similar to mechanical signals, ES increases muscle strength and endurance by inducing hypertrophy and structural changes in muscle. At cellular level, it activates signalling pathways related to cell survival, energy metabolism, and satellite cell differentiation, representing therefore a useful tool to sustain muscle performance and regeneration during rehabilitation programs (3). However, the applied protocols show still some disadvantages, since ES delivery can cause fatigue and pain (4). The definition of novel protocols to attain higher benefits and lower discomfort is therefore mandatory.

Recently, our group showed the efficacy of a newly designed “noisy” stochastic ES protocol, EMGstim, obtained from human electromyographic recordings. In vitro, EMGstim induces mouse myotube contractions and Ca2+ release more powerfully than “regular” conventional stereotyped ES protocols, thereby potentially limiting the common occurrence of pain and fatigue during ES (5). Recently, we explored the effect of EMGstim in adult skeletal muscle fibers. EMGstim was delivered to isolated adult Flexor Digitorum Brevis (FDB) mice myofibers and associated satellite cells. This model offers the possibility to follow the effect of ES in adult muscle fibers immediately after dissociation and on proliferation and differentiation of satellite cell in long-term culture. The results revealed that EMGstim maintained its efficacy also in adult skeletal muscle fibers with a favoring effect on muscle progenitor cell differentiation. Our data suggest that “noisy” ES protocols could be more efficient than regular stimulations to promote in vivo muscle regeneration after traumatic injury or in neuropathological diseases.

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