授与機関名　順天堂大学

学位記番号　甲第 27 号

Effects of electrostimulation with blood flow restriction on muscle size and strength

(電気刺激と血流制限の組み合わせが筋サイズと筋力に与える影響)

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Abstract

Low-load voluntary exercise can induce muscle hypertrophy and strength gain when combined with blood flow restriction (BFR) in working muscles. However, it is unknown whether such hypertrophy and strength gain can be induced by involuntary muscle contractions triggered via low-intensity neuromuscular electrical stimulation (NMES), combined with BFR. The purpose of this article was to investigate whether low-intensity NMES combined with BFR could elicit muscle hypertrophy and strength gain in the quadriceps.

Eight untrained young males (means ± SEs; age 26.2±0.7 years, height 1.74±0.02 m, body weight 71.4±4.8 kg) received 23 min of unilateral low-intensity (5-10% of maximal voluntary contraction) NMES, twice per day, 5 days per week, for 2 weeks, with treatment of one leg being combined with BFR (NMES-BFR) and the other leg receiving NMES alone (NMES-CON). Quadriceps muscle thickness (MT) and isometric and isokinetic strength were measured before and every week throughout the training and detraining periods.

In NMES-BFR legs, MT increased after 2 weeks of training (+3.9%) and decreased after 2 weeks of detraining (-3.0%). NMES-BFR training also increased maximal knee extension strength in isometric (+14.2%) and isokinetic (+7.0% at 90°/s, +8.3% at 180°/s) voluntary contractions. In addition, maximal isometric strength decreased (-6.8%), whereas no large fall (-1.9% at 90°/s, -0.6% at 180°/s) in isokinetic maximal strength was evident after 2 weeks of detraining. In NMES-CON legs, no prominent change was observed; there was a negligible effect on isometric strength.

Low-intensity NMES combined with BFR induces muscle hypertrophy and strength gain in untrained young males.