TACSM Abstract

Muscular Torque Output During Neuromuscular Electrical Stimulation Following a 4-week Training Intervention in Older Adults

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ABSTRACT

Neuromuscular electrical stimulation (NMES) can be used to induce muscle torque by generating involuntary muscle contractions. If a greater muscular torque and torque maintenance could be induced by NMES training bouts, it may lead to improvements in electrically induced muscular endurance. However, little is known regarding torque output during NMES pre-post training. **PURPOSE:** The purpose of this study was to determine if a 4-week NMES training intervention would alter involuntary muscular torque output during the NMES protocol in older, healthy adults. **METHODS:** Eleven older adults (68.7 ± 2.1 years) completed 12 (Day 1 – Day 12), 40-min NMES training sessions of the quadriceps muscles three times a week, over 4-weeks, with the stimulation frequency set at 60 Hz. Maximal voluntary contractions (MVC) were measured pre-training and mid-training. NMES was delivered through stimulation electrodes placed on the quadriceps muscles and torque output was recorded during the training sessions. Stimulation intensity was set to generate muscular torque output to meet a target representing 15% MVC and was adjusted every 5 minutes to achieve target torque. During each training session, 96 total contractions were generated during the NMES protocol. For Day 1 and Day 12, mean torque, peak torque, and torque time integral (TTI) were measured for each contraction and were then normalized to the pre-training MVC for Day 1 and mid-training MVC for Day 12. The overall mean of the 96 contractions was then calculated for each torque parameter. Sum of TTI (STTI) was calculated by summing the normalized TTI for all contractions. The average stimulation intensity was recorded, and the mean was calculated for each day. Paired sample *t*-tests were used to test for differences between Days (Day 1 and Day 12) for torque parameters and stimulation intensity. Statistical significance was set at $p \leq 0.05$. **RESULTS:** TTI (Day 1: 90.5 ± 6.1% MVC vs Day 12: 75.9 ± 9.4% MVC; $p = 0.036$) and STTI (Day 1: 8,686.4 ± 582.0% MVC vs Day 12: 7,2801.0 ± 903.8% MVC; $p = 0.036$) were lower on Day 12 compared to Day 1. Additionally, there was a trend toward lower mean torque after training (Day 1: 8.7 ± 0.5% MVC vs Day 12: 7.3 ± 0.9% MVC; $p = 0.055$). Peak torque was not different between days (Day 1: 12.9 ± 0.6% MVC vs Day 12: 13.0 ± 0.7% MVC; $p = 0.859$). Stimulation intensity showed a trend toward higher stimulation intensity on Day 12 compared to Day 1 (Day 1: 13.3 ± 0.7 mA vs Day 12: 14.6 ± 1.0 mA, $p = 0.10$). **CONCLUSION:** Torque output during the NMES protocol was not improved with NMES training and demonstrated a decrease in some torque parameters. The inability of the muscle to produce similar torque output after training may be due to muscle accommodation to the NMES stimulation with repeated bouts. If the goal is to improve involuntary muscular endurance, allowing for more recovery between NMES sessions and use of a lower stimulation frequency may facilitate greater overall muscular torque output following NMES training.