Abdominal electrical stimulation with respiratory muscle training to improve cough in acute spinal cord injury

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INTRODUCTION

• From 2010 to 2017, respiratory diseases were the leading cause of mortality in spinal cord injury (SCI).1
• The ability to produce an effective cough is severely impaired in cervical and high thoracic SCI and leads to increased pulmonary complications.2-4

OBJECTIVE: Examine if co-treatment with abdominal functional electrical stimulation (AFES) + respiratory muscle training (RMT) improves unaided cough in an individual with acute SCI.

METHODS

• Study design: Case-report.
• Subject: 68-year-old female presenting with T2 AIS A SCI after falling while hiking.
• Intervention: AFES and RMT co-treatment (Figure 1).
• Dose: 45-minute sessions of RMT 5 days/week with AFES 3 days/week for a total of 2 weeks.
• RMT: Inspiratory (IMST) and expiratory muscle strength training (EMST) with calibrated pressure threshold resistance (Figure 2), diaphragmatic and stack breath, huff cough, and loud voice projection.
• AFES: Electrodes applied to bilateral rectus abdominis and external obliques (Figure 3), timed to stimulate concurrently with expiratory phase of RMT.
• Positions: Supine, prone, supported and unsupported short sitting, and quadruped positions used to allow for increased or decreased load during training.
• Outcomes: Cough effectiveness, peak expiratory flow (PEF), and the function in sitting test-SCI (FIST-SCI).

RESULTS

• Cough effectiveness, measured using a 5-point Likert scale, baseline of 2/5 was maintained after week 1 and increased to 3/5 after week 2 (50% increase) (Figure 4).
• PEF increased from 260 L/min to 300 L/min after week 1 and was maintained in week 2 (15% increase) (Figure 4).
• FIST-SCI increased from 30 to 42 after week 1 and was maintained in week 2 (40% increase) (Figure 4).

SIGNIFICANCE: Because respiratory issues are a leading complication after SCI, consideration must be given to strengthening respiratory function during rehabilitation.

CONCLUSION

• Co-treatment with AFES + RMT showed improvements in subjective rating of cough, PEF and the FIST-SCI in an individual with acute SCI, potentially through the increase of intra-abdominal pressure.