The effect of neuromuscular electrical stimulation using the StimaWELL 120MTRS system on multifidus muscle morphology and function in patients with chronic low back pain: A pilot study

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Purpose: Individuals with chronic low back pain (CLBP) have greater difficulty activating the lumbar multifidus muscle than healthy controls. Neuromuscular electrical stimulation (NMES) was previously reported to elicit greater multifidus activation in LBP patients than sham NMES, as measured using B-mode ultrasound. Shear-wave elastography (SWE) is ultrasound application that can quantify muscle stiffness in real time. SWE may be sensitive to changes in resting multifidus muscle stiffness (indicative of change in muscle tone) following NMES application, but this has not been investigated. Therefore, the primary aim of this study was to examine the effect of a single treatment with the StimaWELL 120MTRS system (a medium-frequency electrotherapy device) on prone resting lumbar multifidus stiffness.

Hypothesis: We hypothesized that a single NMES treatment with the StimaWELL 120MTRS system would facilitate neural drive to the multifidus and lead to an acute/temporary increase in prone resting multifidus stiffness at L4 and L5.

Methods: 28 participants (16 women, 12 men, 42.9±12.6 yrs old) with CLBP were recruited from a broader RCT examining the effect of a 10-week intervention with the StimaWELL 120MTRS system on multifidus morphology and function at the PERFORM Centre (Concordia University). During their third visit, SWE measurements of the multifidus in prone at L4 and L5 spinal levels were taken prior to, and 15 minutes after, a 20-minute NMES treatment with StimaWELL 120MTRS system. Three images were acquired per-side, per-level, and the average stiffness (in kPA) was calculated. After running an exploratory data analysis, a mixture of paired t-tests and Wilcoxon Signed Rank tests were used to compare the change in resting stiffness from pre- to post-treatment.

Results: Wilcoxon Signed Rank tests revealed a significant increase in multifidus stiffness on the right (MD = 1.79 (7.47), p = 0.033) and left side (MD = 2.27 (6.25), p = 0.035) at the L5 level. Paired t-tests revealed no significant changes in stiffness at the L4 level on the right (MD = 1.89 (5.78), p = 0.094) and left side (MD = 0.83 (7.93), p = 0.588).

Conclusion: This study provides preliminary evidence that a single NMES treatment with the StimaWELL 120MTRS system acutely increases lumbar multifidus stiffness at L5 in CLBP patients. The results suggest that NMES treatment with the StimaWELL 120MTRS may have a priming effect on the lumbar multifidus at L5. We plan to continue our investigation to expand our findings.