



Electrical Stimulation Duration is Not Associated with Upper Extremity Motor Outcomes in Subacute Stroke

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BACKGROUND

- Upper extremity (UE) hemiparesis is common among stroke survivors and often leads to decreased function and difficulties with valued activities.^{1,2,3}
- Rehabilitative efforts frequently focus on increasing paretic UE use and movement.^{1,2,4}
- Neuromuscular electrical stimulation (NMES) has been used in clinical and research environments to increase post-stroke UE active range of function.^{1,5,6,7}
- Electromyography-triggered neuromuscular stimulation (ETMS), a form of NMES, encourages paretic UE muscle activation using visual biofeedback.
- The optimal duration of any NMES regimen in subacute stroke (< 3 months post ictus) remains unknown.
- Some evidence suggests that longer NMES durations convey greater paretic UE motor changes in chronic stroke⁸
- To our knowledge, this was the first study examining the impact of NMES duration in subacute stroke.

Objective: To determine the association between electromyography-triggered neuromuscular stimulation (ETMS) duration with: (a) UE impairment; and (b) UE functional limitation.

Hypothesis: FM and AMAT scores would be positively, significantly, associated with duration of use.

Study significance: The optimal duration of neuromuscular electrical stimulation (NMES) at which the impact of upper extremity (UE) paresis is significantly reduced remains unknown in the rapidly growing stroke survivor population.

METHOD

Design: Secondary analyses of data obtained from a multicenter randomized control trial.

Participants: 41 subjects in the subacute stage of stroke (24 males; mean age = 65 + 12 years; mean time post stroke onset = 92 + 52. 3 days) exhibiting mild, stable UE hemiparesis.

INSTRUMENTS

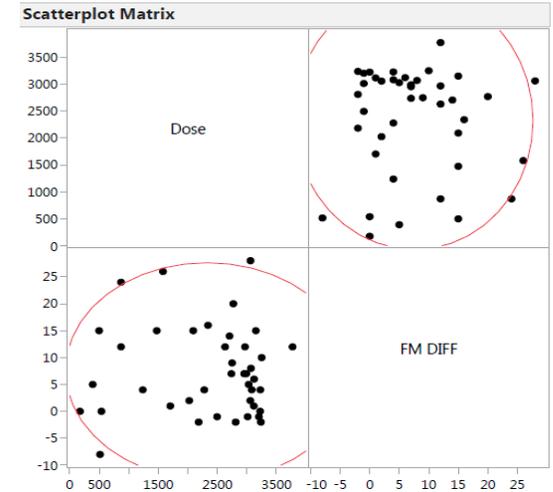
- The *UE Fugl-Meyer (FM)*: used to assess upper extremity impairment. Items are scored on a 3- point ordinal scale (max = 66).
- The *functional ability (FA) scale of the Arm Motor Ability Test (AMAT)*: used to assess ability of the hemiparetic UE to execute common household activities. Items are scored on a 5- point ordinal scale.

INTERVENTION

- The FM and AMAT were administered at baseline (about 7 days before start of the ETMS intervention), at end of the intervention period (within 7 days of concluding the 8-week ETMS intervention), and at 1, 3, and 6 months after conclusion of the intervention.
- ETMS intervention was administered in two, 40 minute sessions/weekday over an 8-week period
- Electrodes were first placed over the motor points of the paretic extensor carli radialis (ECR) and the extensor digitorum communis (EDC) to produce wrist and finger extension. Activation of either muscle would stimulate the ETMS.

RESULTS

- subjects used ETMS for a mean duration of 2346.7 + 987.9 minutes (range = 173 - 3773 minutes)
- Following intervention, **both FM and AMAT scores increased significantly from baseline to end of intervention** (28.4 + 13.3 points at baseline to 35.8 + 16.1 at final testing on the FM {Z = -4.58, p<0.001}; 1.85 + 1.21 points at baseline to 2.45 + 1.47 points at final visit on the AMAT {Z = -4.41, p<0.001}).
- **no association was found between total ETMS use and changes in scores** at end of intervention (FM {p = -0.072; p = 0.65}; AMAT {p = 0.079; p = 0.62}).
- Time post stroke was significantly correlated with changes scores on both the FM (F = 9.65; p<0.01) and the AMAT (F = 10.74; p<0.05).



Scatterplots of Fugl-Meyer and AMAT Score Correlations with Duration (Measured in Minutes)

DISCUSSION

- Possible explanations for outcomes
 - **Spontaneous neurological recovery**
 - ETMS exposure in subacute phase has impact regardless of duration
- Data in this study strongly indicated that **people with more recent strokes (measured in days) exhibit larger score changes** on the FM and AMAT.
- May be an optimal window during which ETMS should be administered.
- Those with greater level of impairment may benefit more from ETMS.

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