

Effect of Electrical Stimulation during Functional Proprioceptive Neuromuscular Facilitation Training on Hand Function and Spasticity among Individuals with Sub-acute Stroke

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ABSTRACT

Introduction: Stroke is a leading cause of chronic disability, frequently resulting in upper limb spasticity and impaired hand function that compromise daily independence. While Electrical Muscle Stimulation (EMS) and Proprioceptive Neuromuscular Facilitation (PNF) are both established rehabilitation modalities, evidence on their combined use and the optimal timing of integration remains limited.

Aim: To evaluate the effect of electrical stimulation during functional PNF training to help improve hand function and reduce spasticity in individuals with sub-acute stroke.

Materials and Methods: Thirty-six sub-acute stroke patients (one to six months post-onset) were randomly allocated into three equal groups. Group A received EMS before PNF, Group B received EMS simultaneously with PNF, and Group C received PNF alone. All groups completed 20 sessions over four weeks (five sessions/week). Outcomes of hand function and spasticity were assessed using the Michigan Hand Outcomes Questionnaire (MHQ), Chedoke

Arm and Hand Activity Inventory (CAHAI-13), and Modified Modified Ashworth Scale (MMAS) before and after intervention.

Results: All groups improved significantly, but Group B (concurrent EMS+PNF) demonstrated the greatest gains across all measures. Group B achieved the highest hand function scores (MHQ: 86.67 ± 4.09 ; CAHAI-13: 82.67 ± 4.54) and lowest spasticity (MMAS: 8.29 ± 0.66), outperforming Group A (MHQ: 55.08 ± 3.77 ; CAHAI-13: 46.75 ± 3.96 ; MMAS: 11.04 ± 0.72) and Group C (MHQ: 64.12 ± 3.00 ; CAHAI-13: 55.67 ± 3.11 ; MMAS: 9.79 ± 0.54). All comparisons involving Group B were statistically significant ($p < 0.001$).

Conclusion: Concurrent application of EMS during PNF training yielded superior improvements in hand function and spasticity over PNF alone or pre-applied EMS, supporting its use as a more effective rehabilitation strategy for sub-acute stroke patients.

Keywords: Chedoke Arm and Hand Activity Inventory, Electrical Muscle Stimulation, Michigan Hand Outcomes Questionnaire.

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