



## **COMPARATIVE EFFECTS OF 1 HZ AND 30 HZ ELECTRICAL STIMULATION ON SPASTICITY IN HEMIPLEGIC PATIENTS: AN ELECTROMYOGRAPHIC BIOFEEDBACK STUDY**

**Giovanni Pegoraro**<sup>1,4</sup>

<sup>1</sup>Brain Clinic Fondazione Borghi, Brebbia, Varese; <sup>2</sup>GVDR Cadoneghe; <sup>3</sup>Private Physiotherapy Clinic Padova and <sup>4</sup>Pianiga, Venezia, Italy.

This study examined the impact of low-frequency (1 Hz) versus high-frequency (30 Hz) electrical stimulation on spasticity in hemiplegic patients using surface electromyographic (EMG) biofeedback to quantify neuromuscular responses. The objective was to determine whether stimulation frequency influences electrophysiological activity associated with spastic muscle co-contraction. Fourteen hemiplegic patients were enrolled and allocated into two groups: a study group (n = 7) receiving 1 Hz stimulation and a control group (n = 7) receiving 30 Hz stimulation. Electrical stimulation was applied to the finger extensor muscles for 20 minutes per session over a one-month period. During stimulation, a biofeedback device recorded action potentials, expressed in microvolts ( $\mu\text{V}$ ), from the antagonist finger flexor muscles. This

methodology allowed objective assessment of reflex activation and spastic co-activation patterns. The results demonstrated a frequency-dependent difference in EMG activity. Stimulation at 1 Hz elicited lower action potential amplitudes in the finger flexor muscles compared to 30 Hz stimulation. In contrast, 30 Hz stimulation produced higher microvolt values, indicating greater neuromuscular excitation and increased antagonist activation. In conclusion, low-frequency electrical stimulation at 1 Hz does not evoke action potentials of the same magnitude as 30 Hz stimulation in hemiplegic patients. These findings suggest that stimulation frequency plays a significant role in modulating neuromuscular excitability and may influence therapeutic strategies for spasticity management in neurorehabilitation.

**Keywords:** *Electrostimulation parameters, spastic muscle, electromyographic biofeedback.*