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A Pilot Single Group Study Using EMG Biofeedback for Tremor Reduction in Subjects with Parkinson's Disease*

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Abstract

Study Design: A – B Design

INTRODUCTION

Surface electromyographic biofeedback (EMG BF) has been evidence-based since the 1970's for neuromuscular retraining. A new, wireless tablet based system (Jogo), is available to enhance ease of use by the therapist and patient, with improved patient outcomes.

Parkinson's disease (PD) is one of the most common chronic progressive neurodegenerative conditions with resting tremor as an early prevailing symptom. Being rated the second most "troublesome symptom" in early-stage PD, tremor often leads to feelings of "stigmatization and embarrassment" perpetuating worsening symptoms caused by stress. Currently, there is no evidence of any non-pharmacological and non-invasive treatments for Parkinsonian Tremor. After recent patient experience, we decided to investigate using Surface Electromyography Biofeedback (sEMG-BF) to reduce tremor in individuals with Parkinson's Disease.

METHOD

Subjects with a neurologist's confirmed diagnosis of PD in Stages 1 to 2.5 (on a modified H&Y scale), with tremor were included in the study after inclusion and exclusion criteria were met. A semi-structured protocol was followed by PTs trained in using JOGO/sEMG-BF to evaluate subjects, identify the target muscle group(s) for treatment of tremor and guide subjects in a customized home program. Baseline data was obtained using a modified version of the UPDRS along with subjective tremor severity via a self-reported Tremor Linear Numeric Scale (0-10). Subjects used EMG-BF a minimum of five days a week at home and were seen via weekly telemedicine sessions with a trained PT.

RESULTS

No adverse effects were reported. A total of 15 subjects completed the protocol and provided all baseline and outcomes measures. Paired sample T-tests for pre and post analysis on a single treatment group were computed via IBM SPSS v.28 using a 95% confidence level. One-sided p-value revealed a statistically significant difference for Tremor (p of .004) and a statistically significant difference for Perceived Motor Function (p of .001).

CONCLUSION

This pilot study on 15 subjects with early-stage PD revealed a reduction in tremor can be achieved with an average of ten weekly therapy sessions using sEMG-BF guided by a trained physical therapist.



Background

Measurement of skeletal muscle activity is over 100 years old. In 1930's, Jacobson, used surface EMG to measure muscle relaxation techniques. Basmajian (1960's) is considered the father of surface EMG Biofeedback. He initially measured single motor unit training with fine wire electrodes.

The 1970's was like the decade of EMG Biofeedback. Clinical research revealed its efficacy for rehabilitation of clients who sustained strokes and many neurological conditions affecting quality of movement. The technology was not ready for prime time, and it fell out of fashion. **Jogo creators saw the benefits and obstacles to clinical use, and developed this wireless, portable, easy to use system that now brings EMG BF into the 21st Century.**

Advantages of Wireless EMG & JOGO system:

Avoid movement artifact of wires/cabling between the subject and the equipment. Patients can learn motor control sitting, standing, walking, reaching without being tethered to cabling. Ease of setup, less than 5 minutes. Tablet based software is easy to upgrade and includes games.

JOGO provides real-time immediate feedback on muscle performance revealing the quality of goal directed movement. Displayed muscle activity (as a moving graph) serves as a reference for either positive reinforcement OR error detection and leads to effective motor control and recovery enabled by neural plasticity.

Displayed EMG is proportional to force production and motor unit recruitment. It is effective due to the neuroplasticity of the CNS by developing alternate neuronal pathways in helping to re-establish voluntary control of skeletal muscles throughout the body.

Take Home Message:

EMG BF is a non-invasive therapeutic intervention that has been shown to help reduce tremor in clients with early-stage PD. One of the many advantages is this can eliminate the need for early drug therapy that may not be effective in reducing tremor and will postpone the appearance of medication side effects and/or increased tolerance to drug dosage.

* Statistical Results

		Paired Samples Test									
		Paired Differences					t	df	Significance		
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				One-Sided p	Two-Sided p	
				Lower	Upper						
Pair 1	Tremor Pre-test Scores - Tremor Post-test Scores	1.667	2.059	0.532	0.527	2.807	3.136	14	0.004	0.007	
Pair 2	Motor Function Pre-test Scores - Motor Function Post-test Scores	9.400	8.903	2.299	4.470	14.330	4.089	14	0.001	0.001	