Vagus Nerve Stimulation Paired with Rehabilitation Improves Upper Limb Recovery after Chronic Ischemic Stroke

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Background

A vagus nerve stimulation (VNS) based rehabilitation therapy has been developed by MicroTransponder for patients with upper limb weakness after stroke. VNS paired with movement induced specific plasticity in rat motor cortex and improved upper limb function after induced ischemic stroke. VNS may exert these effects on neuroplasticity via activation of nucleus basalis and locus ceruleus neurons, which release acetylcholine and norepinephrine to cortical neurons. Our hypothesis is that short bursts of VNS paired with movements will drive plasticity and facilitate motor recovery after stroke. A proof-of-concept, 20 subject, parallel, randomized, controlled pilot study assessed a chronic ischemic stroke population (9 VNS device plus rehabilitation subjects and 11 rehabilitation only subjects). The primary endpoints were safety, tolerability, and feasibility; secondary endpoints included measures of upper limb function (e.g., Upper Extremity Fugl Meyer (UEFM) score). Subjects had 18 in-clinic rehabilitation sessions. At each session, the subjects performed ~300-400 repetitions across several tasks that were goal-oriented, and intensive. For the VNS group, each movement was paired with a brief burst of VNS. The control group performed approximately the same number of movements; however no VNS was paired. Subjects tolerated both the surgery and stimulation similarly to the commercially approved indications of VNS for epilepsy and depression. The therapy was well-tolerated, there were no significant compliance issues and no serious adverse events related to therapy. For UEFM, a ≥6 point increase from baseline was considered clinically meaningful. We observed a clinically meaningful improvement in UEFM from baseline to the post-therapy session in 67% of subjects in the VNS + rehabilitation group compared to 36% of subjects in the rehabilitation only group. The average improvement in UEFM for the VNS group was 8.7±5.7 (mean±std) points while the average change in the rehabilitation group was 3.0 ±6.1 points at the end of therapy. VNS appears feasible and safe in adults with chronic stroke. The final results from the study will be available in November and will be available for first presentation at the ISC. A confirmatory pilot study is underway in the US.

Disclosure

J.D. Dawson: None. N. Engineer: Employment; Significant; Employee at MicroTransponder, Inc. D. Pierce: Employment; Significant; Employee at MicroTransponder, Inc. T. Kimberley: Consultant/Advisory Board; Modest; Consultant to MicroTransponder. B. Tarver: Employment; Significant; Employee at MicroTransponder. A. Dixit: None. M. Walters: None. S. Cramer: Consultant/Advisory Board; Modest; Consultant to MicroTransponder, Inc.