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Combining taVNS with early CIMT to improve health outcomes of infants: a case report

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Abstract

Introduction: Infants born premature or who suffer brain injury at birth are at increased risk for early motor delays, a frequent antecedent of cerebral palsy (CP). Early targeted rehabilitation for these high-risk infants takes advantage of critical windows for neuroplasticity to improve functional outcomes. Constraint Induced Movement Therapy (CIMT) is the gold-standard in pediatric rehabilitation. Transcutaneous auricular Vagus Nerve Stimulation (taVNS) is a form of non-invasive brain stimulation and may boost rehabilitation outcomes when paired with motor activities. Few studies have used neuromodulation combined with intensive motor therapies, such as CIMT, to enhance neuroplasticity and improve functional outcomes in infants.

Methods: In a prospective, open label, IRB-approved pilot trial we combined 40 hours of CIMT with taVNS in infants 6-18mo of age with hemiplegia, after parental consent (NCT05101707). We measured improvements in hand grasp (QUEST), and attainment of therapeutic goals with the Goal attainment scales (GAS).

Results: We present a case study from the first infant to undergo the combined treatment, a male born at 23-weeks gestation who suffered severe intraventricular hemorrhage resulting in global

developmental delay with pronounced left-sided hemiplegia at 11-months corrected gestational age. Pediatric CIMT trained therapists manually triggered taVNS stimulation with active movement, using subthreshold taVNS without adverse events. At baseline the infant showed little spontaneous use of his left arm. Significant improvements were seen on the QUEST in dissociated movement (Δ=40.63 CIMT+taVNS vs expected Δ=5.2 with CIMT alone) and grasping ability (Δ=18.5 vs expected Δ =11.1 with CIMT alone). Goal Attainment Scaling was better-than-expected (+28.3±9.8, p<0.001). Mother reported he was consistently engaged in bimanual play at home after 4 weeks of combined taVNS-CIMT therapy.

Conclusions: taVNS-paired with CIMT appears safe and may boost attaining motor goals in less time than CIMT alone in young infants with hemiplegia.

Research Category and Technology and Methods

Clinical Research: 12. Vagus Nerve Stimulation (VNS)

Keywords: Cerebral Palsy, taVNS, CIMT, rehabilitation

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