December 29th, 2023

STROKE SPECIAL INTEREST GROUP

Academy of Neurologic Physical Therapy

In this newsletter...

- ***NEW Article Review
- Congratulations to our ANPT 2023 Poster Winner!
- Pre-Register for Pre-CSM Trivia Night February 8, 2024 7:30 pm EST

You can either read below, or listen to the audio version with this LINK

Completed by: Demiana Farag, SPT
Thank you, Demiana!

Overseen by: Daniel Dray, PT, DPT, NCS

Summary topic title: Motor Activated Auricular Vagus Nerve Stimulation as a Potential Neuromodulation Approach for Post-Stroke Motor Rehabilitation: A Pilot Study

Article reference: Badran BW, Peng X, Baker-Vogel B, et al. Motor Activated Auricular Vagus Nerve Stimulation as a Potential Neuromodulation Approach for Post-Stroke Motor Rehabilitation: A Pilot Study. *Neurorehabil Neural Repair*. 2023;37(6):374-383. doi:10.1177/15459683231173357

Definitions:
Vagas nerve stimulation (VNS): a form of neuromodulation that uses an implanted electrode to deliver electrical stimulation to the vagus nerve. This is thought to activate the neurocircuitry involved in neuroplastic mechanisms. Studies have shown that when VNS is paired with post-stroke upper extremity rehabilitation, it “nearly doubles the behavioral effects of conventional motor rehabilitation training” and

helps facilitate the recovery of greater upper extremity function. It is, however, a prohibitively costly surgical procedure (~ $30,000 - $50,000), limiting availability towards many potential beneficiaries.

Transcutaneous auricular vagus nerve stimulation (taVNS): a non-invasive method to stimulate the vagus nerve. taVNS works by utilizing surface electrodes that are applied in the ear to activate the auricular branch of the vagus nerve; it has been shown to have similar effects as VNS on motor rehabilitation effects.

Motor activated auricular vagus nerve stimulation (MAAVNS): a closed loop taVNS system paired and activated by upper extremity motor rehabilitation movements. This is a novel system created by the group who created this study.

Purpose: This article aimed to determine if taVNS could facilitate motor learning in post-stroke motor rehabilitation as well as VNS. More specifically, the authors wanted to determine if MAAVNS would improve upper extremity motor function in chronic stroke survivors with unilateral motor deficits. They wanted to discover the effect and implications linked to precise timing of stimulation (MAAVNS) during motor rehabilitation compared to active unpaired taVNS control.

Methods of interest: This was a randomized and double-blind study. Included individuals had an ischemic or hemorrhagic stroke occurring in the last 6 months with unilateral hemiparesis, and who completed at least one month of conventional rehab therapy prior to enrollment. Participants also must have a Fugl-Meyer Assessment-Upper Extremity (FMA-UE) scale score of < 58.
There were two groups: unpaired taVNS and taVNS paired with specific motor rehab movements (MAAVN). Both underwent the same motor rehab protocol (task-specific-training) facilitated by occupational therapists. The specific exercises were based on the activities and movements that the participants wanted to go back to doing, as determined through initial participant interviews. The two groups completed ~200 targeted motions in each session, which generally took ~1-1.5 hours to complete. Sessions occurred 3x/week for 4 weeks. The task difficulty was progressed once a > 80% success rate of a task or movement was acquired. The group with the unpaired taVNS received stimulation at a constant pace for the duration of the rehab session. In contrast, the paired MAAVNS group received stimulation once a paired movement was sensed by the implant, resulting in stimulation for however long the movement occurred. Outcomes utilized in this study were the FMA-UE and the Wolf Motor Function Test (WMFT). Both tests were administered by the occupational therapist at baseline and completion of sessions 3, 6, 9, and 12.

Results of interest: While both groups demonstrated significant improvements with their FMA-UE scores, the MAAVNS had a larger effect (Cohen's d = 0.63) compared to unpaired taVNS (Cohen's d = 0.30). The effect size of MAAVNS was similar to implanted VNS effect sizes in prior studies. Additionally, since the MAAVNS was paired with motor movements, the participants received fewer pulses than those in the taVNS group. The MAAVNS group received an average of 36,070 pulses per session, whereas the taVNS group received 45,000 pulses per session.

Discussion : This pilot study determined that taVNS significantly increased UE function in patients with chronic post-stroke hemiparesis. This study also indicated that timing of stimulation likely matters, and that pairing taVNS with movements may be superior to an unpaired approach. These findings lay the foundation to justify using a cheaper, less invasive, and potentially more accessible alternative to VNS in furthering the capability of UE motor rehabilitation. Another benefit of the MAAVNS system is its automaticity, limiting potential errors when used by patients and therapists. Limitations to this study include a relatively small sample size (16

participants) as well as a lack of a true control group to determine the difference between traditional UE rehabilitation and taVNS/MAAVNS assisted rehabilitation. Future questions and variables for consideration include determining the specific parameters (duration, frequency, intensity, repetition) that lead to the maximum level of neuromodulation/neuroplasticity that the intervention can provide, as well as specific patient characteristics' effects on outcomes.

Additional Resources

- Mechanism of VNS implementation and effect on upper limb rehabilitation post chronic stroke

Kimberley TJ, Pierce D, Prudente CN, et al. Vagus nerve stimulation paired with upper limb rehabilitation after chronic stroke. Stroke. 2018;49(11):2789–2792.

- Video included in the article on how to implement taVNS (included in the supplemental material of the article)

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10363288/bin/NIHMS1893293-supplement-suppl_material_video.mov

CONGRATULATIONS TO OUR 2023 ANPT Annual Conference Poster Winner

Catherine Boissoneault, PT, DPT

Board-Certified Clinical Specialist in Neurologic Physical Therapy

“Gait Recovery in an individual post-LVAD implantation complicated by post-surgical CVA”

View Dr. Boissoneault’s poster and presentation by clicking below!

Pre-Register for the Stroke SIG's Pre-CSM Trivia Night

February 8, 2024 7:30 pm EST

You are invited to a Zoom meeting.
When: Feb 8, 2024 07:30 PM Eastern Time (US and Canada)

Register in advance for this meeting:
https://us06web.zoom.us/meeting/register/tZUsfuuvrj8iG9QWDHTa3GZxTy4n4FQqMvIE

After registering, you will receive a confirmation email containing information about joining the meeting.

The first 10 people the pre-register and attend the event will win a pair of brain socks!

APTA
American Physical Therapy Association

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