Investigating the Anti-Pain Effect of taVNS in Patients with Chronic Post-Stroke Upper Extremity Pain

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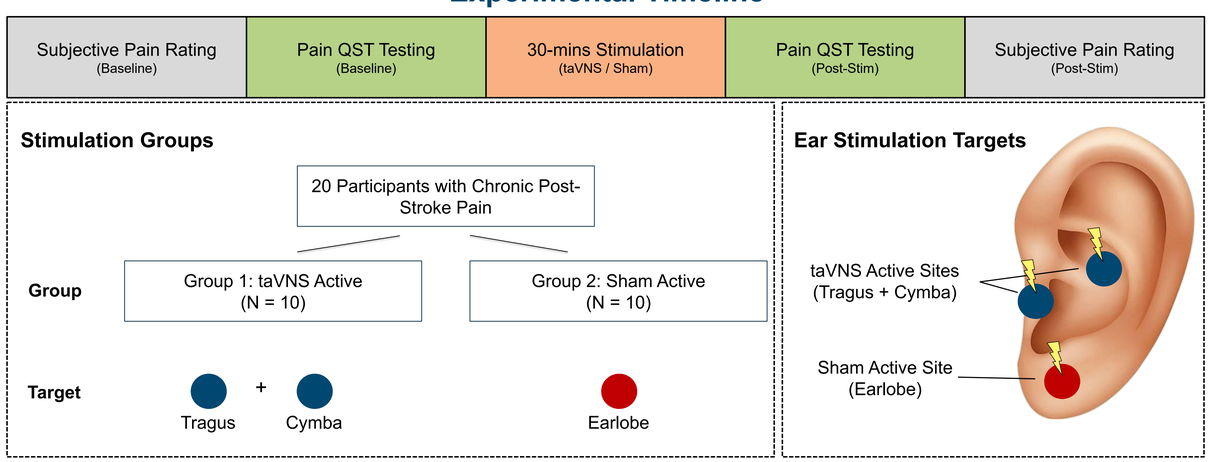
BACKGROUND

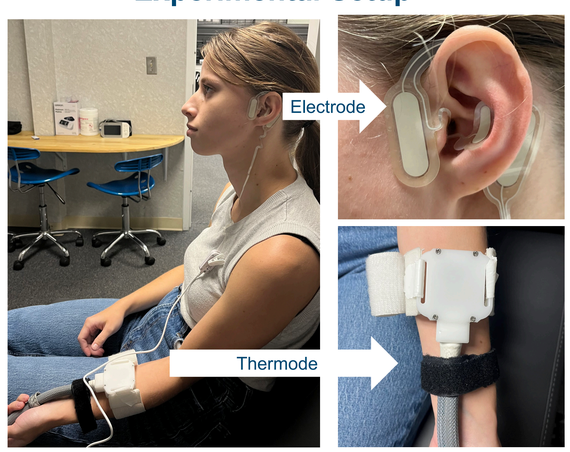
- Approximately 800,000 Americans suffer from stroke annually, with 8% experiencing chronic post-stroke pain (CPSP).[1]
- Neurostimulation therapies such as deep brain stimulation (DBS) and vagus nerve stimulation (VNS) show promising analgesic effects in CPSP but are costly and invasive.
- Recent advancements have enabled non-invasive stimulation the vagus nerve—a method known as transcutaneous auricular vagus nerve stimulation (taVNS) which stimulates the ear.[2]
- taVNS activates various subcortical afferent cranial nerve networks, which may lead to pain reduction, however, there is limited knowledge of its analgesic effects in CPSP.
- Thus, we describe an ongoing research study investigating the anti-pain effects of taVNS in stroke survivors with CPSP.

METHODS

Experimental Timeline



Experimental Setup



- We have now enrolled six chronic stroke survivors with CPSP (N=5 female, mean age±SD: 56.8±10.7 years) into this single-visit, randomized, sham-controlled, single-blinded trial.
- Each participant completed quantitative sensory testing (QST) to determine pain thresholds (pain, tolerance) respectively before and after ear stimulation. Five tests were conducted for each threshold; mean threshold was calculated from the final four runs of each threshold.
- Mean thermal threshold changes were compared between pre- and post-stimulation using the change in degrees Celsius.

RESULTS

Overall Change in Thresholds (After Stim)

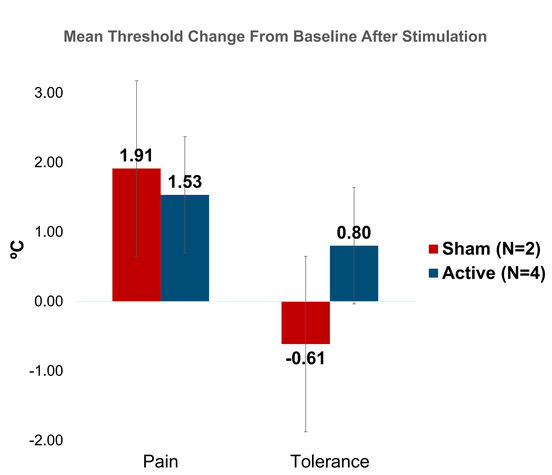


Figure 1. Change In Thermal Thresholds After Active Or Sham Stimulation. (Error Bars = S.E.M.)

- Mean pain thresholds increased in both sham and active groups after stimulation.
- Mean tolerance thresholds decreased in participants receiving sham stimulation.
- Mean tolerance thresholds increased in participants receiving active stimulation.

Individual Thresholds (Active)

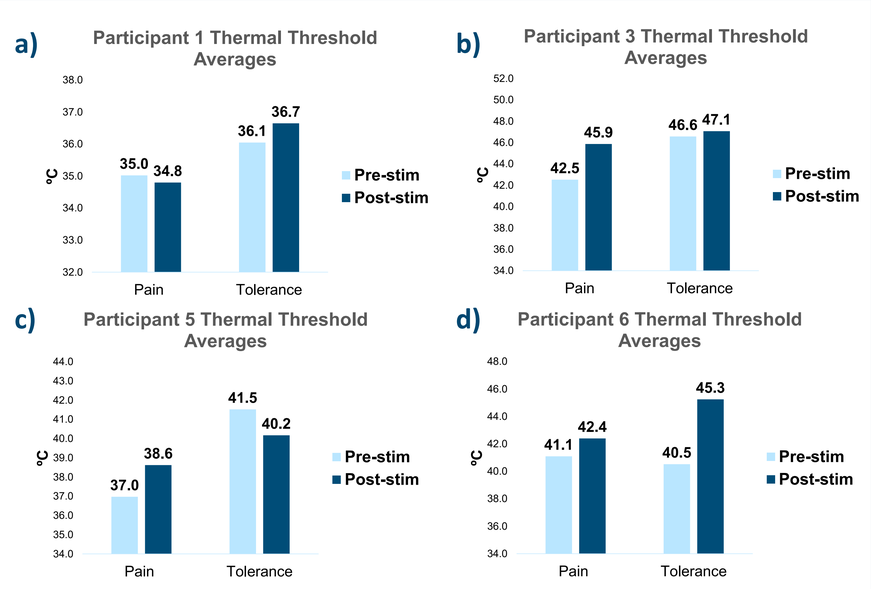


Figure 2. Thermal Thresholds Pre- and Post- Active Stim By Participant.

- Pain thresholds increased after stimulation in participants receiving active stimulation **(b-d)**.
- Tolerance thresholds increased after stimulation in participants receiving active stimulation **(a-b, d)**.

Individual Thresholds (Sham)

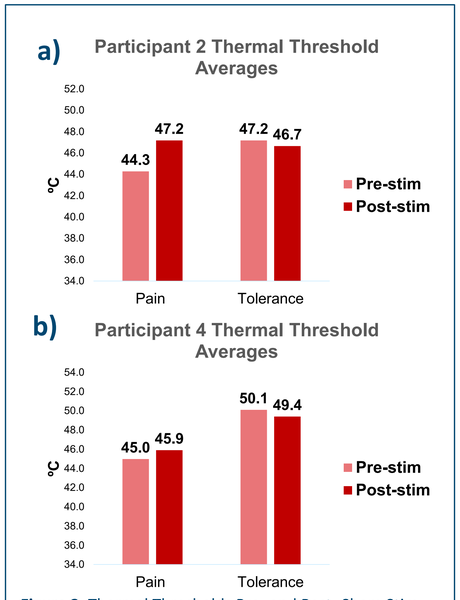


Figure 3. Thermal Thresholds Pre- and Post- Sham Stim By Participant.

- Pain thresholds increased in participants receiving sham stimulation **(a, b)**.
- Tolerance thresholds decreased in both participants receiving sham stimulation **(a, b)**.

CONCLUSIONS

- Our findings demonstrate that administrating taVNS in poststroke pain populations is safe and feasible.
- The preliminary findings suggest that auricular stimulation may modulate pain and tolerance thresholds in CPSP.
- Although limited by a small sample size and unbalanced treatment groups, these findings suggest taVNS may be a promising anti-pain administration for CPSP.

REFERENCES

[1]Centers for Disease Control and Prevention. Stroke: a public health problem. Atlanta, GA: Centers for Disease Control and Prevention; 2012.

[2]Badran BW, Dowdle LT, Mithoefer OJ, LaBate NT, Coatsworth J, Brown JC, DeVries WH, Austelle CW, McTeague LM, George MS. Neurophysiologic effects of transcutaneous auricular vagus nerve stimulation (taVNS) via electrical stimulation of the tragus: a concurrent taVNS/fMRI study and review. Brain stimulation. 2018 May 1;11(3):492-500.

ACKNOWLEDGEMENTS

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