Motor Activated Auricular Vagus Nerve Stimulation (MAAVNS) Improves Motor Kinematics in Stroke Patients With Upper Extremity Deficits

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BACKGROUND

- Many stroke survivors experience motor function impairments resulting in poorer quality of life and reduced well-being.[1]
- Improving motor function post-stroke is achieved through repetitive motor rehabilitation; however, these effects take time to develop.
- We have developed motor-activated auricular vagus nerve stimulation (MAAVNS) therapy, an intelligent closed-loop motor rehabilitation program to improve upper limb function for adults post-stroke.[2]

MAAVNS REHAB THERAPY

Figure 1. Overview of MAAVNS Therapy

- MAAVNS was invented at MUSC and is a novel motor rehabilitation therapy.
- We are completing a phase 1 clinical trial exploring using 4-weeks of MAAVNS Therapy for motor rehab.

SPECIFIC AIM

- As part of the ongoing MAAVNS clinical trial (NCT04129242), we conducted a subanalysis aimed to compare the motor kinematics of stroke patients before and after completing MAAVNS therapy to better understand how MAAVNS therapy improves a) hand velocity, b) hand jerk, and c) trunk displacement.

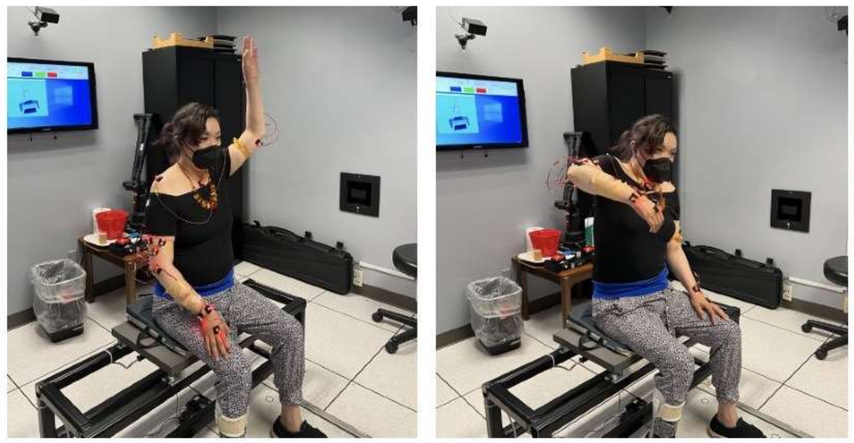
HYPOTHESIS

We believe MAAVNS therapy will increase hand velocity, reduce hand jerk, and reduce trunk displacement during upper extremity motions.

METHODS

- We assessed patients' upper extremity motor kinematics before- and after- one month of MAAVNS rehabilitation therapy (12 sessions, see Figure 1).
- Using motion capture technology, we investigated the changes in stroke participants' affected- and unaffected arms (n=10, 2 women).

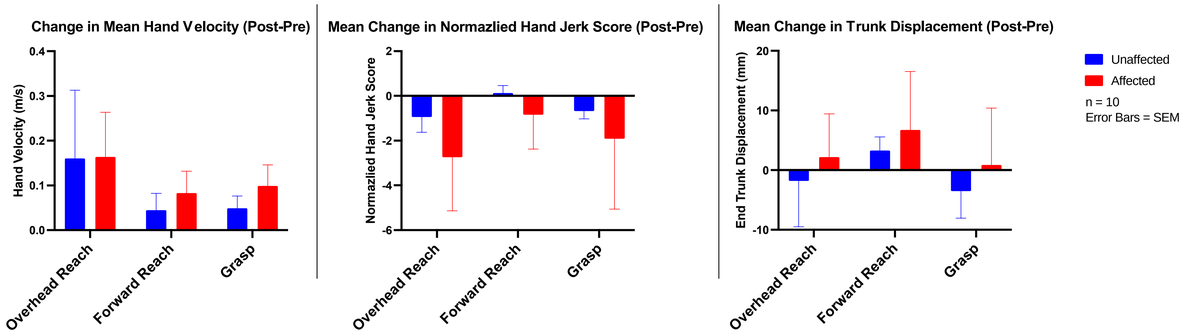
Recording Kinematics During Upper Extremity Movements



- Using 36 active markers and 10 cameras we recorded the kinematics of the participants.
- Three movements captured: a) forward reach, b) grasp, and c) overhead reach.

RESULTS

Figure 2. Change in Motor Kinematics for three discrete arm movements in both affected and unaffected arms



Mean maximum hand velocity improved in all affected arm movements.
(overhead: 0.16 m/s, forward: 0.08 m/s, grasp: 0.09 m/s)

Mean Normalized hand jerk was also reduced in all affected arm movements.
(overhead: -2.7, forward: -0.85, grasp: -1.92)

There were no conclusive changes in trunk displacement.

DISCUSSION

- Motor kinematic measurements provide a more quantitative assessment of body movement and support the standard motor outcomes to give a better narrative of how the body is recovering.
- Motion capture and the technology employed ensure objective and repeatable data collection.
- After MAAVNS therapy, motor kinematics improved in both affected and unaffected arms. More specifically, we observed increased hand velocity and decreased hand jerk.
- Trunk displacement data provided no conclusive evidence of improvement.
- This data suggest that MAAVNS rehabilitation therapy improves the motor kinematics of stroke participants, and future research should 1) increase the sample size of patients evaluated, 2) evaluate whether increased rehabilitation time results in increased improvements.

CONCLUSION

- MAAVNS rehabilitation therapy is a safe technique to improve motor function.
- Our findings suggest that four weeks of MAAVNS rehabilitation therapy increases hand velocity and reduces jerk in the upper extremities of stroke participants with unilateral motor deficits.

REFERENCES

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FUNDING

This work was supported in part by NIH grant R25 DA020537 and P20GM109040 (Kautz, Project 4 PI Badran).