Motor Recovery using Plasticity-Inducing Cortical Stimulation

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INTRODUCTION

Stroke is a leading cause of long-term disability with 2/3rds of survivors experiencing decreased hand function

There are few treatments beyond rehabilitation, and decreased hand function impacts quality of life

After a stroke, patients identify the recovery of their hand function as a priority

Here we report the first human test of a fully-implantable brain system capable of recording brain activity and delivering cortical stimulation

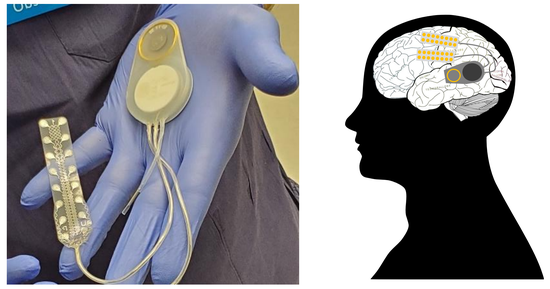

Figure 1. CorTec implant device with an array of electrodes and an example of the intended clinical use case of the implant.

The goal is to induce neuroplasticity and promote recovery by combining cortical stimulation and rehabilitation

Figure 2. Patient performing fine motor tasks as part of hand and upper extremity rehabilitation

PRELIMINARY RESULTS

Hand rehabilitation combined with brain stimulation is leading to recovery

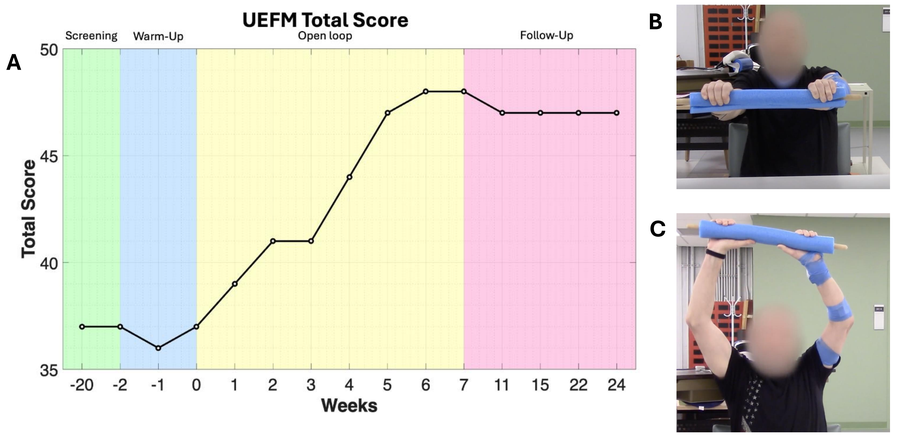

Figure 3. A- Upper Extremity Fugle-Meyer Assessment (UEFM) used to measure stroke impairment shows a trend of recovery over the rehabilitation and open loop stimulation phase. Improvements are sustained during the four months of follow-up. **B and C** example of participant improvement in shoulder range of motion over the open-loop phase of the study.

Changes in brain activity after rehabilitation and stimulation phase of the study

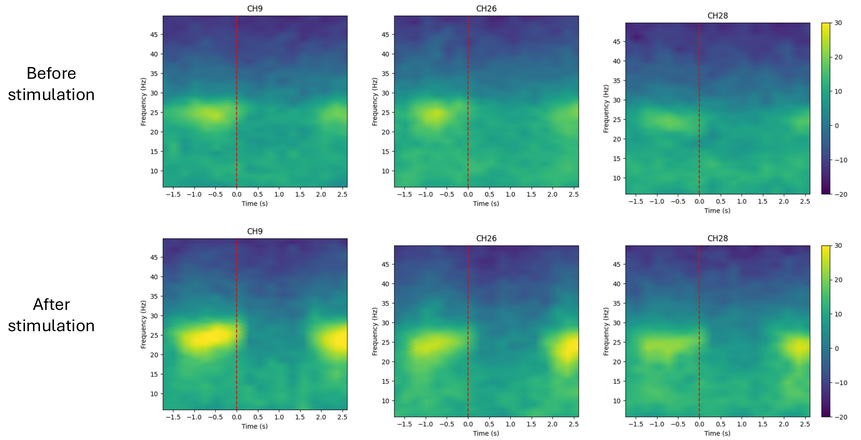

Figure 4. Examples of changes in beta desynchronization power on electrodes located over the motor cortex during a reach task. The red vertical line marks the cue initiating movement for task execution.

METHODS

Brain imaging is used to guide the placement of electrode grids

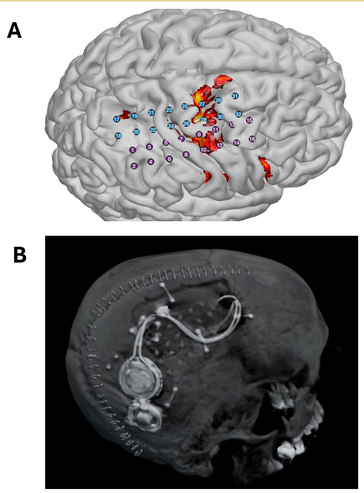

Figure 5. A- Functional Magnetic Resonance Image during activation of left upper extremity over motor cortex and electrode array over left hemisphere. **B-** Post surgery Computed Tomography showing the implanted CorTec device.

Wearable systems capture hand and finger kinematics, allowing quantification of improvement.

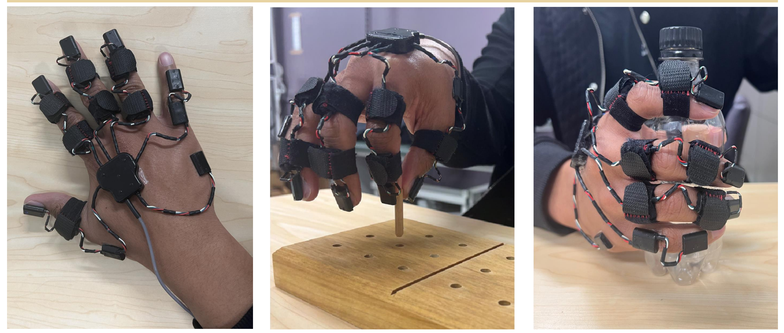

Figure 6. Modified Data glove attached to the dorsum of the hand with custom-made elastic rings and double-sided tape, offering minimal movement resistance.

Tip to tip pinch

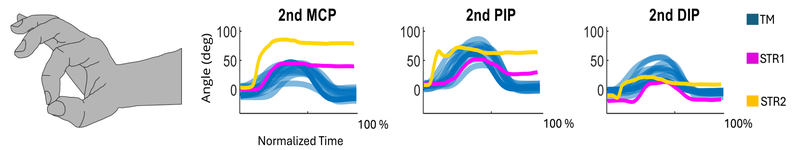

Figure 7. Example of joint angles for the Tip-to-tip Pinch task performed by a group of typically moving individuals (TM) and participants with stroke (STR).

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Neurosurgery

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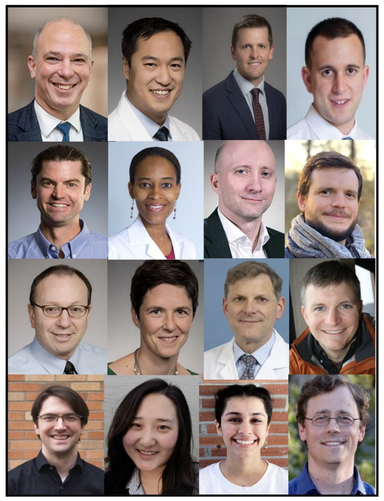

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