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NEWS

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Scientific Formal (Paper) Presentations

CODE: SSE17-06
SESSION: SSE17
Stroke Rehabilitation Using Brain-computer-Interface Technology with Multi-modal Neurological Feedback: Brain Activation Changes Associated with this Interventional Therapy

Date/Times

- **DATE: Monday**
- **TIME: 3:50 -4:00 PM**
- **LOCATION: N228**

PARTICIPANTS

- Brittany Young undefined - Nothing to disclose.
- Jie Song MS - Nothing to disclose.
- Leo Walton undefined - Nothing to disclose.
- Svyatoslav Vergun undefined - Nothing to disclose.
- Veena A Nair PhD - Nothing to disclose.
- Mitch Tyler undefined - Nothing to disclose.
- Justin Sattin undefined - Nothing to disclose.
- Dorothy Farrar-Edwards undefined - Nothing to disclose.
- Justin Williams undefined - Nothing to disclose.
- Vivek Prabhakaran MD, PhD - Nothing to disclose.

SUBSPECIALTY CONTENT

- Neuroradiology

PURPOSE
Brain-computer interface (BCI) is an emerging technology for stroke rehabilitation, but little is known about neuroplastic changes associated with its use. We examine changes in brain activity during imagined (MI) and executed (ME) hand motor tasks associated with BCI-based interventional therapy.

METHOD AND MATERIALS
Anatomical and functional images were collected on 16 subjects (8 stroke patients; 8 healthy controls) on a GE 3T MR scanner. Functional images were acquired during MI and ME finger tapping or squeezing of each hand. Not all subjects completed all tasks. Patients had right upper extremity impairment and were given therapy of the affected hand up to three times weekly for up to six weeks using BCI with tongue and functional electrical stimulations. Patients were scanned pre-, mid- and post-therapy. Group-level analyses compared mid- and post-therapy activation to pre-therapy using AFNI.

RESULTS
Normal and Stroke subjects showed supplementary motor area (SMA) and precentral gyrus activity in both MI and ME tasks. Stroke subjects showed mid-therapy activation increases that persisted post-therapy in the left SMA, premotor cortex, and cingulate during ME affected hand tapping, bilaterally in the cerebellar tonsils during MI affected hand tapping, in the left medial and superior frontal gyri and the cingulate during ME unaffected hand tapping, and in the right precuneus during MI unaffected hand tapping. Mid- therapy activation increased in the left sensorimotor cortex and SMA during MI tasks of the affected hand. Post-therapy activation increased in the left inferior frontal gyrus and insula during MI squeezing of the unaffected hand. All fMRI activity are reported at $p < 0.05$.

CONCLUSION
The results suggest that interventional therapy of the affected hand using BCI is associated with brain activity changes in specific areas involving both affected and unaffected hands. Persistent activation increases associated with ME and MI tasks of the affected hand may represent neuroplastic recovery. These data also suggest that some sensorimotor cortex changes may develop earlier while other changes take longer to emerge with BCI therapy.

CLINICAL RELEVANCE/APPLICATION
Characterizing changes in brain activation after stroke rehabilitation using brain-computer interface technology will provide insight into mechanisms of neuroplasticity associated with this therapy.