

Restorative Neurophysiology: Feasibility of “backup and restore” technologies for brains and bodies

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Introduction: The goal of mental health treatments is to return a patient to a pre-illness baseline state. However, because patients present when they are already ill, baseline function is typically unavailable to clinicians. Instead, most interventions attempt to bring people closer to what research has determined the average healthy individual looks like (e.g., neurologically, chemically, behaviorally). We have developed a suite of assessment and stimulation technologies for restoring neurophysiological activity to previous states. By fully assessing soldiers' neurophysiology before deployment and using high-density neural and physiological stimulation technologies to restore those measured states when they return, we can allow war fighters with trauma sequelae, including PTSD, to return to their own pre-deployment baseline healthy state.

Materials and Methods: Participants' neurophysiological activity was recorded during rest and emotional memory recall at baseline via 64-channel EGI EEG system. Following a traumatic event, they received stimulation via transcranial alternating current stimulation (tACS) to match the brain pattern from baseline. They then performed neurofeedback to maintain that brain state in the absence of stimulation. Additional physiological measures included at baseline and restoration include facial muscle activity, breathing, heart rate, skin response, and vocal parameters. We are currently conducting a pilot feasibility/acceptability study in healthy individuals (planned n=60).

Results: At the time of abstract submission, n=12 have undergone the backup procedure and n=8 have returned and undergone the restore procedure. These participants were able to successfully match their previously backed-up brain state with stimulation and neurofeedback. They reported improvements in mood, specifically reporting increased feelings of happiness and decreased feelings of sadness according to the visual-analogue rating scale.

Conclusions: Our results show that tACS combined with neurofeedback improves mood in healthy individuals when restored to the state backed up during the participants' optimal baseline. Our future plans are to seek military collaboration to test this procedure on warfighters prior to their first deployment.