Use of EEG and Neurofeedback in Treating Trauma Related Symptoms in Refugees

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Background

People living in the aftermath of trauma suffer profound deficits in both physical and emotional regulation. As trauma therapists, we are constantly searching for ways to help our clients deactivate fear, rage and shame.

From a neurobiological perspective, the ability to self-regulate is tightly linked to the communication patterns in the brain. In particular, patterns reflecting increased arousal and poor emotion regulation are observed in trauma[1,2]. These patterns can be measured and altered in real time using Electroencephalogram (EEG).

Neurofeedback holds promise as an effective therapy for trauma because it addresses the psychophysiological nature of trauma through re-training of the abnormal neuronal patterns.

Here we describe individual cases and a pilot study evaluating the effectiveness of neurofeedback for decreasing PTSD symptoms and normalising cognitive functioning.

Neurofeedback Therapy

- Delivered by trained psychologists using the EEGer system.
- Integrated with counselling in 1 hour sessions, scheduled 1-2 times per week.
- Used to address issues including affect regulation, attention, anxiety/hyperarousal, and sleep difficulties.

During neurofeedback training, electrical activity produced by the brain is measured from the scalp and fed back to the client through a computer screen in real time. This feedback provides positive reinforcement when brain activity meets the criteria set by the trainer according to training protocols. Training protocols are chosen or designed based on the analysis of qEEG data (Mitzar/ WinEEG system) and client's clinical presentation, and can be adjusted depending on the client's responses.

Efficacy of Neurofeedback – Case Studies

Case 1

Demographics: 50 year-old male
Diagnosis: Chronic PTSD, Dysthymia and Panic Disorder
Symptoms: insomnia, low mood, anger outbursts, depression, panic attacks
Trauma History: refugee trauma, childhood physical and psychological abuse
Neurofeedback: 26 sessions focusing on lowering arousal; included temporal –parietal alpha enhancement

<u>EEG profile</u> see a): Pre: fast posterior alpha rhythm and excessive widespread beta activity indicated overarousal. Post: increased slow posterior alpha

<u>Neurocognition - VCPT</u>
Behavioural : Omission errors reduced from 13 to 0 and response time became more consistent (14.3 to 5.4msec).
ERPs: normalisation of the CNV consistent with improvement in working memory processing (b)).

<u>Symptoms Scales</u>: PTSD (HTQ): 3.0 to 1.3; Depression (HSCL-D): 3.6 to 1.7; Anxiety (HSCL-D): 3.3 to 1.9

<u>Observations</u>: Increased engagement in therapy, more self-reflective and observant, processed key traumatic memories, improved mood regulation, sleep normalized, panic attacks stopped, did not need psychotropic medication.
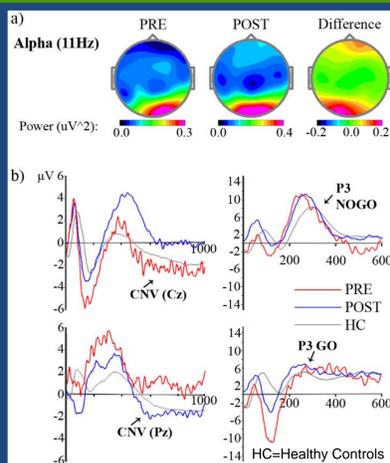
Case 2

Demographics: 54 year-old male
Diagnosis: PTSD, Major Depression
Symptoms: headaches, back pain, insomnia, ruminations
Trauma History: torture and war trauma
Neurofeedback: 36 sessions focusing on mood stabilization, tension reduction and sleep enhancement; included frontal downtraining and temporal enhancement of alpha

<u>EEG profile</u> see a): Pre: hypercoherent alpha frontally and poorly organised alpha posteriorly typically reflecting poor mood regulation and an inability to relax Post: decrease in frontal alpha coherence indicating improvement in affect regulation

<u>Neurocognition - VCPT</u>
Behavioural : Omission errors reduced from 36 to 2, commission errors from 12 to 0, and response time variability from 16.3 to 8.4msec.
ERPs: normalization in CNV, P3 NOGO and P3 GO (b)) suggesting improved attention and cognitive control

<u>Symptoms Scales</u>: PTSD (HTQ): 3.3 to 2.4; Depression (HSCL-D): 3.0 to 2.5; Anxiety (HSCL-D): 3.1 to 2.0

<u>Observations</u>: stable mood, improved sleep, a reduction in nightmares (from several per week to 1-2 per month) and only occasional headaches, reduction in pregabalin and tramadol,

[1]Jokić-Begić et al. Nord. J. Psychiatry. (2003) 57, 351–355; [2]Wahbeh et al. Appl. Psychophysiol. Biofeedback. (2013) 38, 57–69.

The **NSW Service for the Treatment and Rehabilitation of Torture and Trauma Survivors** (STARTTS) runs EEG assessment and neurofeedback treatment program as part of their clinical services available to refugees.
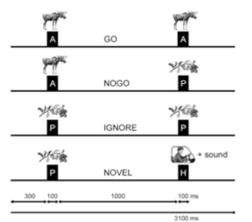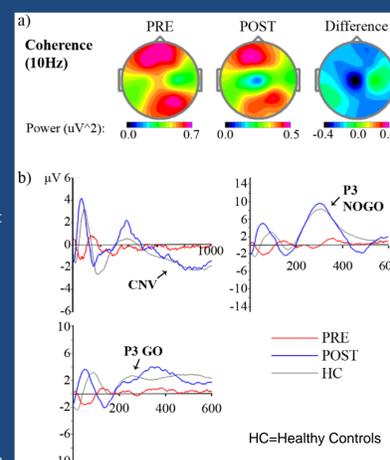
EEG & ERP Pre-Post Assessments

Electroencephalogram (EEG): Measures combined electrical impulses of neurons from the scalp. Used in clinical assessments to detect potential problems associated with this activity.

Event Related Potentials (ERPs): Assess brain electrical activity during a task. The *Visual Continuous Performance Task (VCPT)* assesses working memory and sustained attention. In clinical practice, this provides useful information about cognitive functioning, and to assess changes pre to post therapy.

The VCPT: Test consist of four possible pair sequences (trials) made from images of animals, plants and humans. When the first image in a pair is an animal, participants prepare either to respond if the second image is an animal (GO) or withhold responding if the second image is a plant (NOGO). A plant indicates that the second image is to be ignored, or may be unexpectedly followed by a human to elicit a novelty response. 400 trials. 3100ms stimulus onset asynchrony.

Markers of PTSD – Pilot Study

Forty clients with PTSD were assessed on the VCPT task (GREEN) and compared to a database of healthy controls (RED).

Grand Average ERP amplitude waveforms showing
Post Traumatic Stress Group, **Control Group** and **group differences**:
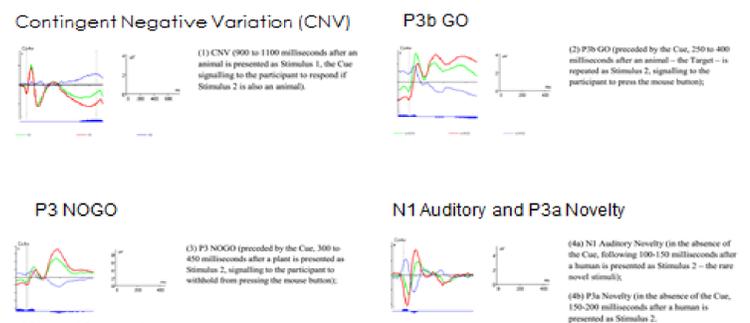
The differences in the ERPS of the PTSD suggest reduced ability to allocate attention, sustained attention and cognitive control.

Conclusions and Future Directions

- Our pilot study suggests that there might be some specific changes in brain's ability to process information related to PTSD. Analysis in a larger, controlled sample is warranted.

- Our case studies demonstrate how ERPs may be used to evaluate brain changes following neurofeedback therapy.

- Using ERPs to evaluate neurofeedback therapy can provide insight into the mechanisms by which neurofeedback works, one of which may involve improved control over emotional pathways

- Research is needed using a randomised controlled design, and to investigate other possible mechanisms for change, such as in emotional processing.