

# 2022 Joint meeting of Neuroergonomics & NYC Neuromodulation

**Abstract Title:** CLINICAL EEG AND CORTICAL EVENT-RELATED POTENTIAL (ERP) TRACKING TECHNIQUES FOR TBI NEUROMODULATION INTERVENTIONS. BENEFITS OF ADVANCED COMPUTER ALGORITHMS.

**Abstract Number:** A53

Dear Presenting Author,

Congratulations! In addition to displaying your abstract "**CLINICAL EEG AND CORTICAL EVENT-RELATED POTENTIAL (ERP) TRACKING TECHNIQUES FOR TBI NEUROMODULATION INTERVENTIONS. BENEFITS OF ADVANCED COMPUTER ALGORITHMS.**" as a poster, you have been selected to give an Oral highlight presentation to promote your poster.

## Introduction

Successful medical, therapeutic and stimulation to improve brain function following ABI require objective baselines. EEG based cortical evoked potentials are consistent physiological markers. EEG frequencies and amplitudes are known to shift following medication or neuromodulation interventions. Advanced computer algorithms are now able to evaluate EEG activity and categorize individual patients into groups through cluster analysis. Clusters show uninjured control brain activity grouping contrasted with an injured patient who displays EEG activity quantified into a grouping consistent with prior brain injury. As patients respond to neurorehabilitation interventions, the individual EEG markers progress in the anticipated direction toward the uninjured clustering. Clinically, we have seen brain physiologic activity shift in the desired direction prior to noting functional improvement.

## Methods and Materials

EEG with audio P300 was collected as part of a health screening exam for studies through Colorado University, Boone Heart Institute Denver and WAVi Medical, 2,025 subjects aged 13-90 were evaluated for baseline both for pre-season sports in the younger groups and prior to engaging in rehabilitation interventions for the 54 patients who had sustained a closed head injury from blunt trauma or blast exposure.

19 active channel EEG were evaluated with eyes closed EEG followed by a 4 min. cortical P300 test using the standard "odd ball" paradigm.

Computer analysis of the EEG produced peak alpha frequency, background and target response cortical coherence at 3 frequency clusters, brain processing delay, physical response and P300 amplitudes for each electrode.

Individual subjects EEG were analyzed using Eigen clustering positioning individual vector scores within 3D group clustering of a cohort of 150 known TBI patients in comparative relation to uninjured subjects.

## Results

Validity of the tests were substantiated because of the test-retest consistency. P300 amplitudes and cortical delays. Standard deviation (SD) of 12%. pre-post concussion amplitudes and delays changed over 40% (-28% to - 64%) at 24 hrs following mTBI. As the subjects improved clinically, the EEG signals improved in 70% at 2 weeks and 90% returned to within 2 SD at 2 months. Upon repeat testing, individual alpha frequency peak activity remained stable over the course of 0-2 years in a test-retest dataset.

Eigen cluster analysis of raw EEG waves showed clear separation between statistically plotted characteristics of uninjured controls and those with a history of TBI. These statistical plots are presented in 3D mapping. Individual subject plots align within their respective groups.

With successful intervention, individuals trend toward the uninjured control statistical plots. Physiological improvement appears to precede clinical or functional improvement.

## Conclusions

New and adapted computer techniques applied to standard EEG and ERP analysis of TBI patients both recent or chronic TBI help track brain physiological progress. Rapid and simplified procedures also add to the clinical and research protocols.

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[Physiological Basis of tDCS - YouTube](#)

[Marom Bikson plenary talk on tDCS at Society of Biological Psychiatry 2018 meeting \(May 12, 2018\) - YouTube](#)

Brain Stim What Is TDCS? See in FX Elect folder