Longitudinal changes in the EEG spectrum during recovery after severe brain injury

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Introduction
Slow changes in brain structure and function can occur in the setting of severe brain injury. Finding out how and when these changes occur is essential to understanding recovery from severe brain injuries in general. This suggests longitudinal assessment of recovering patients.

EEG Methods
EEG methods allow us continuous sampling of brain states and network responses in order to characterize recovery over time. This method can be used to cross-validate imaging data as well as behavioral assessments i.e., CRS-R.

Results - Patients studied longitudinally

Patient 1 - 39 yr old man
1st visit - 20 yrs post-injury

Patient 2 - 18 yr old woman
1st visit - 6 mos post-injury
MVA in Aug 2008; bilateral craniectomies L cranioplasty prior to T1. S cranioplasty prior to T2. T1 - T2 = 4 months.

Patient 3 - 24 yr old woman
1st visit - 2 yrs post-injury
Stroke due to basilar artery occlusion with brainstem infarct to lateral thalamus and midbrain. Increased axonal regrowth in late recovery.

Patient 4 - 58 yr old woman
1st visit - 1 yr post-injury
Diffuse encephalopathy following fall accident in 2007. Status epilepticus: eyes open, consistent visual tracking.

Conclusions
Each patient is different, and yet, all patients demonstrated significant longitudinal changes in power spectra associated with behavioral recovery and metabolic change.

Increases in EEG power were seen in the beta and gamma frequency ranges (pts. 1, 2, 3, 4).

Decreases in power were seen in the delta and theta frequency ranges (pts. 1, 2, 4).

Using qEEG, specifically the power spectrum, we see common patterns of recovery for all of these patients despite varying structural abnormalities, different ages and etiologies, underlying medical conditions, medications and changing metabolic patterns.

References

Affected area is in all channels (2-12) but not obvious in any single lead.

Summary of Spectral Changes
Increase in power above 15 Hz (13-17 vs T1) primarily in the central channels.

Prominent peak shift (T2 vs T1) to higher frequency range (25-35 Hz).

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