A NOVEL METHOD FOR THE DIAGNOSIS OF PHOTOSENSITIVE EPILEPSY BASED ON THE PHASE-LOCKING OF EVOKED GAMMA-BAND MAGNETOENCEPHALOGRAPHIC OSCILLATORY BRAIN RESPONSES

N. Tsarouchas[1,3], G. Perry[3], K. Singh[3], K. Hamandi[2,3]
[1]*Department of Clinical Neurophysiology, Cardiff University Hospital of Wales, UK*
[2]*Department of Neurology, Cardiff University Hospital of Wales, UK*
[3]*MEG Laboratory, Cardiff University Brain Research Imaging Centre (CUBRIC), UK*
nick_tsarouchas@yahoo.com

Larger size and higher spatial frequency of grating stimuli have been shown not only to maximally modulate early gamma-band visual cortical responses but also to provoke seizures in photosensitive epilepsy.

Occipital brain magnetic field (MEG) oscillatory responses were evoked upon static square-wave grating pattern (3 cpd spatial frequency at 100% contrast) stimuli presented in 12 patients with photosensitive epilepsy and 2 matched control groups, one with epilepsy but no photosensitivity and the other healthy controls.

The continuous wavelet transform was employed to characterize the time-frequency dynamics of the inter-trial phase coherence (phase-locking factor: PLF) of the early gamma-band evoked oscillatory responses. General linear models (2-way ANOVA) were used for the statistical analysis of the mean phase-locking factor magnitude in a 100ms time-window centered at the N70m MEG component when activation of the primary visual cortex takes place.

The photosensitive epilepsy group showed a statistically significant increased phase-locking of the evoked gamma-band responses at 40Hz (p0.05), whereas the healthy controls showed increased phase-locking at 25Hz (p0.01). The non-photosensitive epilepsy group showed significant decrement in phase-locking at 10Hz and 30Hz compared to healthy controls (p0.01).

Photosensitve epilepsy seems to be characterised by altered phase synchronization dynamics at a higher frequency (40Hz) compared to healthy controls (25Hz). Our results indicate that photosensitive epilepsy is driven by the large-scale phase-locking of the underlying primary visual cortical unit oscillators at specific “photosensitive” frequency components (phase-attractors). Our method could provide a novel diagnostic tool in safely detecting, investigating and assessing response to treatment in photosensitive epilepsy.