

Blink-related alpha and beta oscillations differentiate between minimally conscious state and unresponsive wakefulness syndrome/vegetative state

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Recently, we have shown the existence of EEG delta blink-related oscillations (delta BROs), which are peculiar to the resting state of the healthy subject. The hypothesis is that they can represent the activation of updating and short-term memorization of the context, which are at the basis of the global (gestaltic) awareness of the visuo-spatial environment. As expected, the source of these oscillations was located in the precuneus, whose function is believed to be the surveillance of the internal and external environments and some assessment of salience of stimuli for the individual. In patients with disorders of consciousness (DOC), delta BROs were poorly represented, so that it was not possible to identify unambiguous and homogeneous sources. However, parameters such as power and phase synchronization of delta BROs were directly proportional to the levels of consciousness expressed by the Levels of Cognitive Functioning Scale (LCFS) scores. Nevertheless, at the group level, it was not possible to statistically distinguish minimally conscious state (MCS) from unresponsive wakefulness syndrome/vegetative state (UWS/VS). In an effort to increase our capabilities of differential diagnosis, and taking into account that brain responses are to be considered as the superposition of multiple oscillations, we have extended our analysis to other frequency ranges than delta. EEG activity at rest was recorded in 12 healthy subjects and 9 patients with DOC (5 MCS, and 4 UWS/VS). Three-second-lasting EEG epochs centred on each blink instance were analysed in both time- (BROs) and frequency-domains (event-related spectral perturbation or ERSP). Cortical sources of blink-related band power maxima were estimated by SLORETA. It was thus possible to obtain a statistically significant differentiation between MCS and UWS/VS on the basis of both alpha and beta oscillations within a time window of about 1000ms after the blink. The brain region that turned out to be more active in MCS with respect to UWS/VS was the precuneus (which was however still deficient compared to healthy subjects). The brain regions that turned out to be more active in MCS with respect to both healthy and UWS/VS subjects were the left temporo-parietal junction and, to some extent, the left pre-frontal cortex. The activation of such a fronto-parieto-temporal network in MCS subjects could be interpreted as a compensatory mechanism to the current condition of functional insufficiency of the precuneus.