**EEG paradigms as a supplemental tool to behavioral assessments of DOC**

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**Introduction**

Diagnosis and prediction of recovery in the acute phase of disorders of consciousness (DOC) are critical for subsequent medical decisions. However, reliable assessment remains elusive due to the inability of current validated clinical scales to take into account motor and drive deficits. Recently, the Motor Behaviour Tool (MBT), a novel clinical scale, has been developed to address this caveat (1). In this context, neuroimaging and brain-computer interface (BCI) have also been proposed to improve the diagnosis and prognosis of these patients.(2).

**Objectives**

This pilot study aims to investigate the diagnostic and prognostic value of two electroencephalography (EEG)-based paradigms in patients with DOC, i.e., coma, Unresponsive Awareness Syndrome (UWS) or Minimally Conscious State (MCS). As a second step, we will employ them as evidence to further establish the added value of the MBT (i.e., assessment of minimal responses suggesting remaining conscious processing) combined with the Coma Recovery Scale-Revised (CRS-R), a standardized validated scale commonly used to assess consciousness in this population (3).

**Patients & Methods**

Acute DOC patients undergo CRS-R and MBT assessment prior to two EEG paradigms. Firstly, a motor attempt EEG-BCI coupled with Functional Electrical Stimulation (FES) is used (4). We hypothesize that replacing the need for overt movements with motor attempt can alleviate the tendency of CRS-R to underestimate the level of awareness in case of cognitive-motor dissociation (CMD) (5). In addition, a second EEG protocol presents patients with FES-tactile (T), auditory (A), and audio-tactile (AT) stimuli both in actionable and non-actionable space. EEG evoked potentials observed in the actionable space are expected to show a non-linear addition of sensory stimuli (i.e., A+T ≠ AT) indicating multisensory integration and the capacity of conscious processing (6).

**Results**

Pending elaborate analysis, preliminary findings show (Fig. 1) that BCI accuracy is significantly above chance only for a patient who was diagnosed as UWS by the CRS-R evaluation, but exhibited a motor behavior classified as CMD confirmed by the MBT tool, and not for one in real UWS (same diagnosis based on CRS-R and MBT), implying the presence of the hypothesized relation between motor EEG correlates and awareness (7). Average EEG evoked potentials of 8 patients during the second EEG paradigm highlight a difference between within (solid line) vs. outside (dashed line) the actionable space (Fig. 2), suggesting awareness-dependent modulation. Future analyses will explore correlations of such EEG descriptors with the clinical outcomes.

**Conclusion**

EEG correlates extracted from these EEG paradigms are promising tools for diagnosis of DOC and may supplement current clinical scales to help the validation of new tools like the MBT.

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