

Event-Related Potential dynamics changes in SCD and MCI patients across low and high level performances in a visual attention task

Alberto Arturo Vergani, A. Vergani, G. Salvestrini, R. Burali, V. Moschini, S. Padiglioni, S. Mazzeo, C. Fabbiani, M. Lassi, B. Nacmias, S. Sorbi, V. Bessi, A. Grippo, A. Mazzoni

The BioRobotics Institute - S. Anna School of Advanced Studies - Pisa

The BioRobotics Institute and Department of Excellence in Robotics and AI - S. Anna School of Advanced Studies - Pisa

IRCCS Fondazione Don Carlo Gnocchi, - University of Florence - Florence

IRCCS Fondazione Don Carlo Gnocchi, - University of Florence - Florence

Department of Neuroscience, Psychology, Drug Research and Child Health - Careggi University Hospital - Florence

Research and Innovation Centre for Dementia-CRIDEM - Careggi University Hospital - Florence

Department of Neuroscience, Psychology, Drug Research and Child Health - Careggi University Hospital - Florence

IRCCS Fondazione Don Carlo Gnocchi, - University of Florence - Florence

The BioRobotics Institute and Department of Excellence in Robotics and AI - S. Anna School of Advanced Studies - Pisa

Department of Neuroscience, Psychology, Drug Research and Child Health - Careggi University Hospital - Florence

IRCCS Fondazione Don Carlo Gnocchi, - University of Florence - Florence

Department of Neuroscience, Psychology, Drug Research and Child Health - Careggi University Hospital - Florence

IRCCS Fondazione Don Carlo Gnocchi, - University of Florence - Florence

The BioRobotics Institute and Department of Excellence in Robotics and AI - S. Anna School of Advanced Studies - Pisa

Objectives. SCD and MCI patients have different underlying clinical conditions and brain resilience against neurodegeneration. This heterogeneity could be investigated through specific executive tests relating behavioral performances with brain activity measures. Herein, we adopted Event-Related Potentials (ERPs) recorded during a visual attention task with the aim to ground cognitive differences with electrophysiological dynamics changes [1].

Data. We collected a cohort of 111 subjects, which are 54 patients diagnosed with Subjective Cognitive Decline (SCD), 41 patients with Mild Cognitive Impairment (MCI) and 16 aged-matched healthy people.

Methods. We adopted a knowledge based parcellation by collecting closest channels in relation to their anatomical meaning: partitions were defined to isolate the specific contribution of frontal, central, parietal, temporal and occipital scalp topography. For each parcellation, we then explored the ERP wave process along two latent neurocognitive processes, namely encoding (0-200 ms, lasting as the stimulus presentation) and decision (200-500 ms, covering choice ideation and execution). Performances are computed with F-Measure, which takes in account both reaction time and accuracy. Observed differences are intended significant with p -value <0.05 and Bonferroni correction.

Results. High performances values have been achieved from a subclass of SCD (18/54) and MCI

Event-Related Potential dynamics changes in SCD and MCI patients across low and high level performances in a visual attention task

(11/41), beside a subset of controls (9/16). We then explored ERP differences and found that controls, SCD and MCI mostly differ during the encoding process for the occipital parcellation, while for the decision process in the central parcellation. Given that, we questioned about differences across pathological subjects by comparing low and high performances. We found differences for the parieto-occipital zones during the encoding and central zones during the decision process. In particular, for high performer subjects, we observed shorter and more negative N100 components during encoding and longer and more positive P300 components during decision.

Discussion. These observations can be explained by the emergence of subject-specific neuroplasticity processes against pathology. One effect of these compensations are neural mechanisms related to brain reserve [2], which may sustain the high performances achieved from the patients. Another source of explanation is the specificity of the cognitive task required by the visual attention test, which highlights the preservation of domain-specific executive functions.

Conclusions. A clinical application of this evidence could be regular follow-up EEG monitoring of the visual N100 and central P300 components in patients with SCD and MCI, in order to detect electrophysiological changes that could be indicators of a worsening of the patient's condition and consequently indicate more personalized therapeutic paths.

References: Waninger, S., Berka, C., Meghdadi, A., Karic, M. S., Stevens, K., Aguero, C., ... & Verma, A. Event-related potentials during sustained attention and memory tasks: utility as biomarkers for mild cognitive impairment. *Alzheimer's & Dementia: Diagnosis, Assessment & Disease Monitoring*, 2018, 10, 452-460.
Stern, Y., Barnes, C. A., Grady, C., Jones, R. N., & Raz, N. Brain reserve, cognitive reserve, compensation, and maintenance: operationalization, validity, and mechanisms of cognitive resilience. *Neurobiology of aging*, 2019, 83, 124-129

Tipo presentazione: ORALE