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+1-346-348-1205

TITLE: Dynamics of the 'cognitive' P3b brain wave at rest for AD prediction in MCI

Name: Camillo Porcaro
Affiliation: Professor at Università degli Studi di Padova
Country: Italy
Email ID: Camillo.porcaro@unipd.it

ABSTRACT (upto 300 words)

Alzheimer's disease (AD) is the most common cause of dementia that involves a progressive and irrevocable decline in cognitive abilities and social behaviour, thus annihilating the patient's autonomy. Among the neurophysiological markers of attention and cognition, one of the sub-components of the 'cognitive brain wave' P300 recordable in an odd-ball paradigm –namely, the P3b is extensively regarded as a sensitive indicator of cognitive performance. Several studies have reliably shown that changes in the amplitude and latency of the P3b are strongly related to cognitive decline and ageing, both healthy and pathological. Here, we used a P3b spatial filter to enhance the electroencephalographic (EEG) characteristics underlying 175 subjects divided into 135 mild cognitive impairment (MCI) subjects, 20 elderly controls (EC), and 20 young volunteers (Y). The Y group served to extract the P3b spatial filter from EEG data, which was later applied to the other groups during resting conditions with eyes open and without being asked to perform any task. The group of 135 MCI subjects could be divided into two subgroups at the end of a month follow-up: 75 with stable MCI (MCI-S, not converted to AD) and 60 converted to AD (MCI-C). The P3b spatial filter was built using a signal processing method called Functional Source Separation (FSS), which increases the signal-to-noise ratio by using a weighted sum of all EEG recording channels rather than relying on a single or a small subset of channels. A clear difference was observed for the P3b dynamics at rest between groups. Moreover, a machine learning approach showed that P3b at rest could correctly distinguish MCI from EC (80.6% accuracy) and MCI-S from MCI-C (74.1% accuracy), with an accuracy as high as 93.8% in discriminating between MCI-C and EC. Finally, a comparison of the Bayes factor revealed that the group differences among MCI-S and MCI-C were 138 times more likely to be detected using the P3b dynamics compared with the best-performing single electrode (Pz) approach. In conclusion, we propose that P3b, as measured through spatial filters, can be safely regarded as a simple and sensitive marker to predict the conversion from an MCI to AD status, eventually combined with other non-neurophysiological biomarkers for a more precise definition of dementia having neuropathological Alzheimer characteristics.

BIOGRAPHY (upto 200 words)

Camillo Porcaro completed his PhD at the University of Chieti-Pescara (Italy) in 2008. He is an Associate Professor at Padua University, Neuroscience department (DNS), Italy. He has over 100 publications that have been cited over 2700 times, and his publication h-index is 31. He has been serving as an editorial board member of several reputed journals.

Presenter Name: Camillo Porcaro.
Mode of Presentation: Webinar
Contact number: +39 0498212534