EEG connectivity in sleep spindles of ADHD children

Federica De Dea[1,2], Caterina Zanus[3], Marco Carrozzi[3], Antonino Accardo[2]

[1]Department of Life Sciences, University of Trieste, Italy; [2]Department of Engineering and Architecture, University of Trieste, Italy, [3]Child Neuropsychiatry, Children's Hospital "Burlo Garofolo", Trieste, Italy

The attention deficit and hyperactivity disorder (ADHD) concerns attention and concentration difficulties and the ability to control the impulses. The sleep disturbance in ADHD children include difficulties in falling asleep, in awakening and in maintaining adequate alertness for daily activities. Sleep spindles that arose during NREM Stage 2, are oscillatory EEG activities of fusiform morphology in the range of 11-16 Hz and their duration is between 0.5-3 seconds. The sleep spindles have been associated with cognitive faculties and intelligence, with various disease states (e.g., schizophrenia, mental retardation, abnormal maturation) and post stroke recovery processes, but now they are also considered to be significantly involved in sleep-dependent memory consolidation [1]. The aim of this paper was to study the EEG connectivity pattern during sleep in ADHD children compared with a control group. In particular, we examined possible changes in brain connectivity before, during and after sleep spindles. The study group encompassed 8 ADHD and 11 control children (matched for age: mean age=8.9 years, SD = ± 1.34) deprived of sleep on the day of the acquisition to enhance the deep sleep during the recording. The EEG data were acquired using 19 electrodes at a sampling rate of 512 Hz. For each subject we analyzed three different epochs lasting 1 second centered on the spindle and on epochs before and after the spindle, named Pre-spindle and Post-spindle, respectively. The Generalized Partial Directed Coherence (gPDC), calculated by means of the SIFT MATLAB toolbox [2, 3], was used to extract the connectivity matrices of each epoch. Moreover, based on graph theory, the cortical network properties were investigated by assessing the degree and the clustering coefficient of nodes and the characteristic path length of the entire network. The preliminary results of this study showed slight differences between case and control groups in all the three considered epochs. However, deeper statistical analysis had to be performed to better understand their significance.

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