P530

Functional and directed coherence on simultaneous recorded EEG and MEG data during resting state

M. Siniatchkin[1], M. Muthuraman[2], A.R. Anwar[2], K.G. Medeksa[2], V. Moliadze[1]

[1]Goethe-University of Frankfurt, Department of Child and Adolescents Psychiatry, Frankfurt, Germany; [2]Christian-Albrechts-University of Kiel, Department of Neurology, Kiel, Germany

Question: In the last years, more and more attempts have been done to increase validity and sensitivity of different methods of neuroimaging using a combination/fusion of methods. This study focuses on the combination of EEG and MEG and tries to describe advantages of each particular method and their fusion.

Methods: Ten healthy adults were investigated using simultaneous recordings of EEG (60 channels, VSM MedTech system) and MEG (256 channel, VSM MedTech) in two resting state condition: with 5 min eyes closed (EC) and 5 min eyes open (EO). Each recording was segmented into a number of 1s-long epochs. The data were analyzed across the following frequency bands: delta (1-3 Hz), theta (4-7 Hz), alpha (8-13 Hz), and beta (14-30 Hz) for each condition. Analysis of power spectrum, Dynamic Imaging of Coherent Sources (DICS) for source analysis, Renormalized Partial Directed Coherence (RPDC) for information flow between sources, and the signal-to-noise ratio (SNR) analysis were performed using FIELDTRIP. All analyses were carried out for EEG and MEG separately and for combined EEG-MEG data sets.

Results: 1) Spectral mean power was significantly higher in EEG than in MEG data for all frequency bands; 2) For the source absolute mean power the combined approach had significantly higher power compared to EEG and MEG alone; 3) For comparison between EEG and MEG for both the cortical and sub-cortical sources, there was no significant difference for the number of voxels in sources ($p=0.45$). However, the combined approach (EEG+MEG) had significantly lower number of voxels activated for both cortical and sub-cortical sources (EEG vs. MEG+EEG: $p=0.006$; MEG vs. MEG+EEG: $p=0.009$); 4) During both conditions with EO and EC the direction of information flow for EEG and MEG was not different between the sources. However, the combined approach detected some additional interactions in each of the frequency bands. The RPDC values in all the four frequency bands showed a similar pattern ($p=0.004$; MEG+EEG$>$EEG$>$MEG); 5) On the scalp and source levels, the relative SNR showed significant difference between the three modalities. In all frequency bands the pattern remained similar ($p=0.006$; MEG+EEG $>$ EEG $>$ MEG).

Conclusion: The combined approach of EEG and MEG fusion may increase validity of results leading to the more focused source reconstruction, better modeling of information flow and higher SNR.