Both EEG and fMRI studies showed neural signals linking to the performance of source memory (e.g. Ghetti & Bunge, 2012). Connections between findings from the two approaches remain unclear. The P2 and the late slow wave component (LSW) have been found to be associated with episodic memory, yet their sources and exact functionality is not fully understood. We applied source localization to bring the two modalities together.

Methods

General linear modeling was applied to identify EEG channels that showed significant differences between memory conditions. A cluster of EEG channels were identified in the left-frontal area.

These channels were used to identify peak P2 and time window of LSW. Data was re-epoch and baseline corrected to create 150ms sections of P2 (175 - 325 ms) and LSW (975ms - 1125 ms) components.

P2 and LSW were source localized using finite element modeling (FEM) and eLORETA methods. Head models were built and segmented from individual T1 images.

LSW and P2 source scores were compared area by area (using Brainnetome atlas) between memory conditions using paired t-tests. Multiple comparison correction was conducted using the Benjamini & Hochberg method. Right and left hemispheres were tested and corrected separately.

Results

P2 sources showed trends of differences, while insignificant, between source correct and source incorrect conditions after correction (ps >0.07; areas in left and right ORG, left ITG, left fusiform, and IPL).

LSW sources showed significant difference in left MTG (area 83, p= 0.035), and left ORG (area 41,45,49: p= 0.035), as well as a few marginally differences in left IPL and left ITL (ps=0.058-0.059).

Discussion

Sources of LSW showed significant differences between memory conditions in multiple areas that have been identified using fMRI, presenting remarkable overlaps in the neurophysiological signals between the two modalities. P2 sources showed similar trends of overlapping, but was not significant.

LSW source differences in MTG potentially links the functionality of LSW to semantic information processing during memory encoding.

Next step: apply subject-space fMRI ROI masks to individual EEG source results to better pinpoint the overlaps.

Take-Home Message

Memory-related components identified in EEG exhibit similar source differences compared to fMRI ROIs. Source differences in MTG directs attention to the functionality of LSW during memory.

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