Background & aims

Numerous studies have shown that Alpha (8-13 Hz) oscillations were attenuated by attention and mental effort as well as affected transiently by other sensory stimuli and mental alerting activities (e.g., mental arithmetic) or by anxiety [1]. These oscillations during wakefulness and best were seen during physical relaxation and eyes closed over posterior regions of the head. Anxiety is thought to be associated with increased attentional demand on threat cues involving a modulation of the alpha activity. Spontaneous self-referential thoughts were associated with enhanced alpha activity in the posterior default mode network (DMN) hub during resting state and the social game [2]. Further, it has been shown that neural activations during visual-sequence learning lead to a decrease in post-training spontaneous EEG [3]. However, few studies in humans have shown the link between alpha oscillations and anxiety using imaging and stimulation technologies. We thus examined the changes on two-minute periods eyes-open EEG resting state in yong subjects to see the evolution of neural activations over time in alpha band before, during and following a forty-minute attentional-task (Stroop-task). We first established the topography and time course of oscillatory alpha activity changes in both low- and high-anxiety groups to investigate pre- and post-task effects on spontaneous EEG over right and left posterior brain sites in order to assess whether EEG alpha enhancement effectively reduces state anxiety (e.g., alpha oscillations as a correlate of trait anxiety).

Methods

Subjects

- 32 young adults (17 males, 15 females; mean age = 23 years, SD = 7, range 18 to 50 years)
- Participants completed the Spielberger State-Trait Anxiety Inventory (STAI-T) before the experimental session [4].
- Eighteen participants with scores ranged from 25 to 38 were attributed to a low anxiety group (LA) (mean score = 32.94, SD = 9.016) and fourteen participants with scores ranged from 40 to 57 were attributed to a high anxiety group (HA) (mean score = 47, SD = 5.897).

Experimental setup

- Stroop task: Continuous EEG was recorded from 64-channel ActiTwo system (BrainProducts) in addition to 2 x EEG. Data were sampling at 1024 Hz and Laplacian reference (CSD) was chosen for analysis.
- Preprocessing: Band pass filter between 0.5 and 60 Hz, notch 50 Hz. Bad channels replaced and interpolated.
- Independent component analysis (ICA) was used to identify vertical and horizontal artifacts.
- Resting state analysis: EEG data for each block of resting state were segmented into 2 seconds epochs for each block (total of 110 epochs) then bad epochs were rejected visually for further analysis. The power spectrum for each channel was computed via the multitaper frequency transformation (FFT - 'dpss' window) using Fieldtrip/Matlab toolbox.

EEG

Data Recording: Continuous EEG was recorded from 64-channel ActiTwo system (BrainProducts) in addition to 2 x EEG. Data were sampling at 1024 Hz and Laplacian reference (CSD) was chosen for analysis.

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Statistical analysis. We computed the correlation between the STAI score of anxiety and the EEG alpha power changes the average resting-state (RS) blocks over the LPO and RPO regions of the brain across subjects.

References