TITLE

The effect of posture on resting-state EEG connectivity in healthy individuals and stroke patients

ABSTRACT

Recent literature provided evidence of highly organized brain networking in healthy participants during resting state.[1,2] Most of Resting State Network (RSN) studies have been carried out using functional neuroimaging techniques, and horizontal body position is the posture typically adopted for brain imaging recording. However, recent literature showed how this position is associated, among other dysfunctional patterns of cognitive activation, to a general decrease of resting state EEG rhythms typically associated with cognitive arousal.[3-5] The present research project aimed at further understanding the decrease of cortical activity associated with horizontal body position by measuring the cortical EEG activity from healthy individuals with a high-density EEG system in a resting state experimental condition. To this end, 40 young adults will undergo to a repeated measure design, in which resting state EEGs from 256 active scalp recording sites will be acquired in sitting control (SC) and horizontal Bed Rest (hBR). After data collection, the RSN analyses will be carried out on both SC and hBR conditions, and compared to highlight the effects of the body posture on neural network organization. Once we will clarify the relationship between body position and RSNs, the second step of the research project will be focused on the study of the impact of structural brain damage on EEG-based RSNs. To this aim, high-density EEG resting state data will be collected (in SC and hBR positions) in 30 neurological patients suffering from first ischemic cerebrovascular accident (15 left-hemisphere damage, LHD, and 15 right-hemisphere damage, RHD, patients), and their RSNs will be analyzed. In particular, we will investigate the possible interaction between posture and the position of the structural damage on resting state EEG connectivity. We will also examine the possible associations of patients' RSNs and their performance to a battery of neuropsychological tests.

REFERENCES

1. Mantini D., Perrucci M.G., Del Gratta C., Romani G.L., Corbetta M. (2007). Electrophysiological signatures of resting state networks in the human brain. PNAS 104, 13170-13175.
2. Liu Q., Farahibozorg S., Porcaro C., Wenderoth N., Mantini D. (2017). Detecting large-scale networks in the human brain using high-density elecroencephalography. Hum Brain Mapp 38, 4631-4643.
3. Thibault R.T., Lifshitz M., Jones J.M., Raz, A. (2014). Posture alters human resting-state. Cortex 58, 199–205.
4. Spironelli C., Busenello J., Angrilli A. (2016). Supine posture inhibits cortical activity: Evidence from Delta and Alpha EEG bands. Neuropsychologia, 89, 125-131.
5. Spironelli, C. and Angrilli, A. (2017). Posture used in fMRI-PET elicits reduced cortical activity and altered hemispheric asymmetry with respect to sitting position: an EEG resting state study. *Biological Psychology*, 127, 180-190. *Frontiers in Human Neuroscience*, 11, 621. doi: 10.3389/fnhum.2017.00621.

PARTICIPANTS (PI and co-PIs): Chiara Spironelli e Dante Mantini

EXPERIMENTAL DATA:

To be acquired	X
Already acquired (ready to be used)	

Brief description of the Experimental setup, methods, instruments and scheduling

Forty young healthy participants will be enrolled. All participants will be right-handed according to the Edinburgh Handedness Inventory, and have normal or corrected-to-normal vision. They will provide their written informed consent to the study, according to the Declaration of Helsinki. The experimental procedures will be approved by the Ethics Committee of the School of Psychology, University of Padova.
Participants will undergo two experimental sessions involving EEG measurements. A structural MR image of the subjects' head will also be collected in a separate experimental session. In each EEG session, the volunteers will be first prepared for electrophysiological recording and sensors position coordinates were obtained. Each EEG session will include two 10-min, open-eyes resting runs. Specifically, participants will be requested to relax and refrain from moving, and to watch a fixation cross in the center of a PC monitor. High-density EEG recordings will be acquired by using a 256-channel system from Electrical Geodesics, installed at the Center for Neuroscience of the University of Padua. Half of the participants will first sit on a soft chair (SC condition) for 10 minutes and will then lay on a mattress parallel to the floor in the supine position (hBR condition) for other 10 minutes. This order will be reversed in the other half of the participants. This experimental design will allow us to compare the EEG connectivity of the same group of participants in different bodily posture conditions.
Thirty neurological patients suffering from first ischemic cerebrovascular accident, at > 3 months after onset (i.e., 15 LHD and 15 RHD patients) will undergo to a complete neuropsychological assessment at the San Camillo Hospital (Lido-Venice). The stroke patients will carry out the same experiment conducted in young healthy volunteers in Padova. HdEEG data will be recorded using a 128-channel system (BrainAmp, BrainProducts, Germany) with active electrodes with impedance conversion (ActiCAP, BrainProducts).
HdEEG analyses will be based on in-house software for artifact removal, head modeling, source localization and connectivity analysis.

ETHICS COMMITTEE:

Obtained		
Conditioned submission*	X	Expected time response (in months): 2-3 months
Not required		

* request will be submitted only if a PhD student will be associated to the project