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Alterations in EEG connectivity in healthy young adults provide an indicator of sleep depth

Carolina Migliorelli, Alejandro Bachiller, Andreia G Andrade, Joan F Alonso, Miguel A Mañanas, Cristina Borja, Sandra Giménez, Rosa M Antonijoan, Andrew W Varga, Ricardo S Osorio ... Show more

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Abstract

Current sleep analyses have used electroencephalography (EEG) to establish sleep intensity through linear and nonlinear measures. Slow wave activity (SWA) and entropy are the most commonly used markers of sleep depth. The purpose of this study is to evaluate changes in brain EEG connectivity during sleep in healthy subjects and compare them with SWA and entropy. Four different connectivity metrics: coherence (MSC), synchronization likelihood (SL), cross mutual information function (CMIF), and phase locking value (PLV), were computed focusing on their correlation with sleep depth. These measures provide different information and perspectives about functional connectivity. All connectivity measures revealed to have functional changes between the different sleep stages. The averaged CMIF seemed to be a more robust connectivity metric to measure sleep depth (correlations of 0.78 and 0.84 with SWA and entropy, respectively), translating greater linear and nonlinear interdependences between brain regions especially during slow wave sleep. Potential changes of brain connectivity were also assessed throughout the night. Connectivity measures indicated a reduction of functional connectivity in N2 as sleep progresses. The validation of connectivity indexes is necessary because they can reveal the interaction between different brain regions in physiological and pathological conditions and help understand the different functions of deep sleep in humans.

electroencephalography, slow wave activity, entropy, functional connectivity

Topic:

electroencephalography

entropy

sleep stages

brain

sleep

Issue Section: Basic Science of Sleep and Circadian Rhythms

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