

Investigating the effects of closed-loop auditory stimulation on sleep and behavior in children with sleep-dependent epilepsy

Institution/s

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Objective

When recording brain activity with electroencephalography (EEG) during deep sleep, slow waves arise from highly synchronized brain network activity. Slow waves also contribute to the development of epileptic discharges. We have clear indications that epileptic discharges disrupt the normal recovery function of sleep. As sleep is important for the long-term development and maintenance of cognitive functions, affected children in the acute phase of epilepsy can have a distinct impairment in cognition or a regression of development. Using a method called «closed-loop auditory stimulation», slow waves are detected in real time and short, soft, non-arousing sounds are presented at a specific phase of slow waves. With this method we can manipulate slow waves and by that presumably the synchronization of network activity during sleep. In this study, we want to investigate whether closed-loop auditory stimulation can be used to influence not only physiological slow waves but also the pathological epileptic discharges. The successful application of closed-loop auditory stimulation in children with sleep-dependent epilepsy would open a new, non-pharmacological, non-invasive therapy window (sleep). The technological development of the stimulation approach is also of interest for basic research, since it allows the investigation of causal relationships.

Methods

We will measure brain activity with high-density electroencephalography (hdEEG) and standard polysomnographic measures, such as electrooculography (EOG), electromyography (EMG), and electrocardiography (ECG) during sleep. Short, soft, non-arousing sounds will be presented at specific points in time during sleep, i.e. at a specific phase of slow waves (closed-loop auditory stimulation). We also assess the performance in cognitive, motor and vigilance tasks, as well as the resting state of the brain during wakefulness with hdEEG, EOG, and EMG. A structural MRI will be acquired for source-localization analyses. Furthermore, we assess the IQ and various other variables with questionnaires.

In search of (partners, patients etc.)

Children with epilepsy of any gender (at least 4 years old), right-handed, attending a regular school, whose wake or sleep EEG within the last 12 months shows epileptic discharges.

State of IRB approval (needed/pending/approved)

Approved

Time frame/current status

Recruitment of participants from April 2020 onwards.

Contact

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