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► To cite this version:

Marie Pelou, Poeiti Abi-Saab, T. Monseigne, Camille Jeunet, Fabien Lotte, et al.. Neurofeedback training to improve wakefulness maintenance ability: a pilot study to develop cognitive strategies to overcome Excessive Daytime Sleepiness. 17th World Sleep Congress, Oct 2023, Rio de Janeiro, Brazil. pp.S77, 10.1016/j.sleep.2023.11.244 . hal-04721841

HAL Id: hal-04721841

<https://hal.science/hal-04721841v1>

Submitted on 4 Oct 2024

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NEUROFEEDBACK TRAINING TO IMPROVE WAKEFULNESS MAINTENANCE ABILITY: A PILOT STUDY TO DEVELOP COGNITIVE STRATEGIES TO OVERCOME EXCESSIVE DAYTIME SLEEPINESS

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Introduction:

Excessive Daytime Sleepiness (EDS) is a common symptom of sleep disorders, and is the consequence of reduced wakefulness maintenance ability. This reduced ability has an impact on quality of life and results in functional disturbances. The persistence of EDS in certain pathologies, such as Obstructive Sleep Apnea Hypopnea Syndrome (OSAHS), led to the development of new treatments, including non-pharmacological ones, such as neurofeedback (NFB) to improve wakefulness maintenance abilities. The effectiveness of NFB training seems to rely on the subject's ability to implement cognitive strategies to successfully complete the neuromodulation task. Yet the study of these cognitive strategies has often been neglected when it could be a good predictor of success.

Materials and Methods:

The Wakefulness Maintenance Test (MWT), which assesses objective wakefulness maintenance abilities, and the Karolinska Sleepiness Scale (KSS), which assesses subjective wakefulness maintenance abilities, were administered to a group of healthy sleep-deprived subjects ($n = 8$) before (V1) and after (V2) the 8 neurofeedback sessions on b/(q-a) target. During both visits (V1 and V2), subjects are deprived of a full night's sleep in a controlled manner according to an acute sleep deprivation model, inducing behavioral EDS (intense sleep debt). We use as an EEG target the combination of a marker of homeostatic sleep pressure (power of the spectral band q-a (6.25-9Hz) in Cz) and a marker of vigilance (power of the spectral band b, which decrease with sleepiness). Cognitive strategies learned during NFB were evaluated with an open-ended question. Objective and subjective sleepiness measures obtained during the two visits (before, V1 and after, V2) are compared using a Student's t test and a repeated-measures ANOVA. Cognitive strategies were analyzed using a Chi-squared test in relation to MWT results.

Results:

Mean sleep latency on the MWT and mean KSS scores increased significantly between V2 and V1. Average latencies increase from 15.1 min (V1) to 23.8 min (V2) on the MWT with a p-value of 0,018. Also, the mean KSS score increase from 6,7 (V1) to 5,5 (V2) with a p-value of 0.006. Certain types of cognitive strategies, such as focused attention, self-encouragement and visual mental imagery, appeared to be more effective than others in improving wakefulness maintenance abilities, even though the results are not significant.

Conclusions:

A neurofeedback training targeting EEG b/(q-a) activities seems to be of interest to improve objective and subjective wakefulness maintenance abilities and decrease EDS. Further research is needed to confirm the efficacy and benefits of this type of non-pharmacological therapy for subjects suffering from EDS in the context of sleep disorders. In addition, exploring the role of cognitive strategies in the NFB learning process would increase the number of subjects responding to this type of intervention.

Acknowledgements:

We thank the LabEX BRAIN, associated with the University of Bordeaux for fundings.