P116 | Quantitative modelling of the direct alerting effects of light

T. Tekieh[1]; S. McCloskey[1,2]; S.W. Lockley[2,3]; P.A. Robinson[1,2,4]; S. Postnova[1,2,4]

[1]School of Physics, University of Sydney, Sydney, NSW, [2]Cooperative Research Centre for Alertness, Safety and Productivity, [3]School of Psychological Sciences and Monash Institute of Cognitive and Clinical Neurosciences, Monash University, Melbourne, VIC, [4]Centre of Excellence for Integrative Brain Function, University of Sydney, Sydney, NSW, Australia

Objectives/Introduction: Light affects alertness in two distinct ways: (i) via its effects on the circadian phase thus adjusting the daily rhythm in alertness, and (ii) as a stimulant, by directly increasing alertness during light exposure. Prediction of alertness would prove highly useful, especially under shiftwork and jetlag conditions where reduced alertness increases the risk of accidents. A number of models have succeeded in predicting the circadian rhythm of alertness. To date, however, none have accounted for the direct alerting effects of light. We have extended our model of arousal dynamics to incorporate the direct alerting effect of light and tested those predictions against experimental data.

Methods: Our model of arousal dynamics simulates the flip-flop switch between the sleep- and wake-active neuronal populations under the effects of the homeostatic and circadian drives. The phase of the circadian drive is adjusted by light according to the human phase- and dose-response curves. The model has been successful in prediction of subjective sleepiness and objective performance under acute sleep deprivation and forced desynchrony in dim light conditions. It has been proposed that the direct effects of light on alertness are regulated by the homeostatic rather than circadian mechanisms. Here this theory is tested computationally and an extended model is developed to incorporate the direct alerting effects of light.

Results: The model is tested against published experimental data from five laboratory studies investigating direct alerting effects of light (with 39 to 14 subjects). The model successfully reproduces the dose-response of subjective sleepiness to light exposure at night as well as the effects of bright vs. dim light exposure at different circadian phases on subjective sleepiness and objective performance. The model is further tested for compliance with previous results for sleep propensity and for alertness dynamics in dim light conditions. It is thus shown to perform well against data from twenty-two studies with protocols challenging prediction of alertness under different conditions.

Conclusions: A modified model of arousal dynamics is successful in reproducing the experimentally observed alerting effects of light and allows for testing of potential mechanisms.

Disclosure: Svetlana Postnova (SP) serves as a Theme Leader, Steven W Lockley (SWL) as a Program Leader, and Peter A Robinson (PAR) as a Chief Investigator in the Cooperative Research Center for Alertness, Safety, and Productivity. TT, SM, SWL, PAR and SP have no additional conflicts of interests related to the research or results reported in this paper.

P117 | Relationship between sleep structure of patients after ischemic stroke and daily measures

Z. Roštáková; R. Rosipal

Department of Theoretical Methods, Institute of Measurement Science, Slovak Academy of Sciences, Bratislava, Slovakia

Objectives/Introduction: We aim to identify specific sleep temporal profiles reflecting important physiological aspects of sleep of patients following an ischemic stroke.

Methods: We applied the developed probabilistic sleep model (PSM) to the polysomnographic data from 24 patients following an ischemic stroke. Subjects performed a battery of tests for assessment of attention, concentration, working memory and fine-motor activity and questionnaires scoring their subjective level of drowsiness, exhaustion and motivation before and after performing the tests.

The PSM represents the sleep process by posterior probability values of a finite set of sleep microstates. This representation can in turn be considered as a set of temporal curves and the methodology of functional data analysis can be applied. In the present work functional cluster analysis and time synchronization of curves is used for detecting groups of subjects with similar curve - profiles. Finally, the Kruskal-Wallis test is used for testing significant differences in daily measures between the formed clusters.

Results: Relationship between clustering structure and daily measures was found for several sleep microstates. Subjects with deeper sleep were observed to feel less drowsy or exhausted after performing the whole battery of tests and they were able to remember more digits in backward order (p-value 0.02) than their colleagues with low probability values for the deep sleep. On the other hand they showed higher reaction times (p-value 0.02).

In the case of the *Wake* stage and related sleep microstates the curves alignment led to inferior results in comparison to the clustering of original curves. Therefore, we hypothesize that the exact occurrence of the wake periods during the night are important factors establishing a stronger relationship between sleep and the investigated daily measures. Increased probability of sleep microstates similar to the *S1* stage was observed to improve performance in the Fine Motor Activity test (p-value 0.02). However, increased probability for sleep microstate laying on a border between stages *S1* and *S2* led to opposite results.

Conclusions: This preliminary study shows statistically significant relationships between the sleep structure of patients after stroke and daily measures. The PSM and functional data analysis are promising tools for the analysis of the sleep process.

Disclosure: This research was supported by the Slovak Research and Development Agency (grant number APVV-16-0202) and by the VEGA 2/0011/16 grant.

BREATHING DISORDERS 1

P118 | Soft cervical support in obstructive sleep apnea: a pilot study

P. Bordier; A. Lataste; S. Orazio
Haut-Leveque Cardiology Hospital, Pessac, France

Objectives/Instruction: A soft cervical collar can limit antero-posterior flexion/extension of the head and backward motion of the mandible. Prior to a randomized controlled trial of a soft cervical collar to treat obstructive sleep apnea (OSA), our pilot study assessed 1) night tolerance of the soft cervical collar in patients with OSA; 2) alteration of pharyngeal patency with this support in OSA; 3) trial population size for conclusive results.

Methods: Among 78 consecutive subjects referred for suspicion of sleep apnea, 21 patients with severe OSA according to baseline nocturnal polygraphy were randomly assigned to second polygraphy either with no intervention (control group, n = 10) or wearing a soft cervical collar (intervention group, n = 11). Polygraphy data were compared and night collar tolerance was assessed with a questionnaire. Required trial population size was calculated using Cohen's d method.

Results: Fourteen men and seven women aged 53.9 ± 2.6, 33.8 ± 0.2 kg/m^2, were studied. Questionnaire showed that the collar was generally well tolerated by the patients. No polygraphy data were significantly different between the baseline and second recordings in each group, e.g., apnea-hypopnea index was 57.8 ± 5.5 vs. 52.4±7.2 (p = 0.40) in the control group and 54.2 ± 7.7 vs. 51.5 ± 7.6 (p = 0.47) in the intervention group. Data changes between the two recordings were the same in both groups. For conclusive effects according to the study design, trial population size was calculated at 246 patients equally distributed between both groups.

Conclusions: In our small-scale short-term randomized pilot study, a soft cervical collar was well tolerated and had no obvious effects on pharyngeal patency in patients with OSA. A larger-scale randomized controlled trial with conclusive results appeared feasible. On the other hand, beneficial effects of combination of a soft cervical collar with CPAP ventilation with a facial mask used to treat OSA in five patients have been recently published. It could reinforce the interest of further studies on cervical supports in patients with OSA.

Disclosure: Nothing to disclose.

P119 | Living obstructive, mixed and central apneas in the same epoch: an interesting OSAS case

S. Yilmaz; H. Selimoglu Sen; G. Kirbas; Sleep disorders
Department of Chest Diseases and Tuberculosis, Dicle University Faculty of Medicine, Diyarbakir, Turkey

Objectives/Instruction: Sleep related breathing disorders consists of several different disorders, like obstructive sleep apnea, central sleep apnea and Cheyne-Stokes respiration. An apnea is the near to interruption or interruption of airflow for at least 10 second. Central apnea, obstructive apnea and mixed apnea are respiratory events used to diagnose sleep related respiratory disorders. An obstructive apnea is associated with evidence of ongoing breathing efforts throughout the event. However, the central apnea is associated with the absence of breathing efforts and the mixed apneas are associated with the absence of respiratory effort at the beginning of the event, followed by respiratory effort during the second part of the event.

Methods: A 68-year-old male patient. He applied to our clinic with complaints of snoring, witnessed apnea, excessive daytime sleepiness, gasping and choking in the sleep. The patient was diagnosed as having obstructive sleep apnea syndrome (OSAS) with electroencephalography (EEG), electrooculography (EOG), electrocardiography (ECG), chin and pretibial electromyography (EMG), oximeter, pulse transit time (PTT), oro-nasal airflow, snoring voice, pulse and body position recordings were taken with all night polysomnography. During the recording, the sleep technician was ready for the whole shooting.

Results: The duration of total recording was 392.3 minutes and sleep efficiency was 80.4%. The REM stage was detected as 13.8%. The duration of non-REM stage-1 sleep was 7.3%, stage-2 was 65.2% and stage-3 was 13.8%. 251 obstructive apnea, 50 mixed apnea, 33 central apnea and 334 apnea in total were detected. However, 40 hypopneas were scored. Apnea index was calculated as 78.0 h and apnea hypopnea index (AHI) as 87.5 h. The lowest oxygen desaturation value was measured as 64% and the oxygen desaturation index (ODI) was measured as 93.6 h. According to the International classification of sleep disorders-3 criteria, the patient was diagnosed with severe obstructive sleep apnea syndrome.

Conclusions: The aim of this case is to determine in the same epoch both obstructive, central and mixed apneas during the polysomnographic respiration scoring (Figure 1). This situation has made our case interesting. We hope that this screen will contribute to literature as a education patient.

Disclosure: Nothing to disclose.