Laboratory and Field Studies of Naps and Caffeine as Practical Countermeasures For Sleep-Wake Problems Associated With Night Work

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Study Objectives: To evaluate the effects of napping, caffeine, and napping plus caffeine on performance and alertness in both laboratory and field settings.

Design: (1) Laboratory Study: parallel-groups design with random assignment to 1 of 4 experimental conditions. (2) Field Study: crossover design.

Setting: Sleep laboratory and field settings.

Participants: (1) Laboratory Study: 68 healthy individuals; (2) Field Study: 53 shiftworkers who worked nights or rotating shifts.

Interventions: (1) Laboratory Study: an evening nap opportunity before the first 2 of 4 consecutive simulated night shifts plus placebo taken all 4 nights, caffeine taken nightly, the combination of the nap and caffeine conditions, or placebo. (2) Field Study: an evening nap on the first 2 of 4 consecutive night shifts plus caffeine taken nightly versus placebo taken nightly without naps.

Measurements and Results: (1) Laboratory Study: Napping, caffeine, and their combination all improved alertness and performance as measured by Maintenance of Wakefulness Test and Psychomotor Vigilance Task, but the combination of napping and caffeine was best in improving alertness. (2) Field Study: Napping plus caffeine improved performance as measured by Psychomotor Vigilance Test and decreased subjective sleepiness in individuals working the night shift.

Conclusions: Napping plus caffeine helps improve performance and alertness of night-shift workers.

Keywords: Naps, caffeine, shift work, sleepiness, performance

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Hypersynchronous Delta Waves and Somnambulism: Brain Topography and Effect of Sleep Deprivation


Study Objectives: Hypersynchronous delta activity (HSD) is usually described as several continuous high-voltage delta waves (≥ 150 μV) in the sleep electroencephalogram of somnambulistic patients. However, studies have yielded varied and contradictory results. The goal of the present study was to evaluate HSD over different electroencephalographic derivations during the non-rapid eye movement (NREM) sleep of somnambulistic patients and controls during normal sleep and following 38 hours of sleep deprivation, as well as prior to sleepwalking episodes.

Design: N/A.

Setting: Sleep disorders clinic.

Patients: Ten adult sleepwalkers and 10 sex- and age-matched control subjects were investigated polysomnographically during a baseline night and following 38 hours of sleep deprivation.

Interventions: N/A.

Measurements and Results: During normal sleep, sleepwalkers had a significantly higher ratio of HSD over the time spent in stage 2, 3 and 4 on frontal and central derivations when compared with controls. Sleep deprivation resulted in a significant increase in the ratio of the time in HSD over the time in stage 4 on the frontal lead in both groups and on the central lead in controls. There was no evidence for a temporal accumulation of HSD prior to the episodes.

Conclusions: HSD shows a clear frontocentral gradient across all subjects during both baseline and recovery sleep and has relatively low specificity for the diagnosis of NREM parasomnias. Increases in HSD after sleep deprivation may reflect an enhancement of the homeostatic process underlying sleep regulation.

Keywords: Sleepwalking, parasomnias, delta activity, hypersynchronous delta, electroencephalogram, sleep deprivation

Citation: Pilon M; Zadra A; Joncas S et al. Hypersynchronous delta waves and somnambulism: brain topography and effect of sleep deprivation. SLEEP 2006;29(1): 77-84.
Short-Wavelength Sensitivity for the Direct Effects of Light on Alertness, Vigilance, and the Waking Electroencephalogram in Humans

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Study Objectives: To assess the wavelength-dependent sensitivity of the acute effects of ocular light exposure on alertness, performance, waking electroencephalogram (EEG), and cortisol.

Design: A between-subjects design was employed to compare the effects of exposure to 460-nm or 555-nm light for 6.5 hours during the biological night.

Setting: Intensive Physiological Monitoring Unit, Brigham and Women’s Hospital, Boston, MA.

Patients and Participants: Sixteen healthy adults (8 women; mean age ± SD = 23.3 ± 2.4 years).

Interventions: Subjects were exposed to equal photon densities (2.8 x 10¹³ photons·cm⁻²·s⁻¹) of either 460-nm (n = 8) or 555-nm (n = 8) monochromatic light for 6.5 hours, 15 minutes after mydriasis.

Measurements and Results: Subjects underwent continuous EEG/electrooculogram recordings and completed a performance battery every 30 to 60 minutes. As compared with those exposed to 555-nm light, subjects exposed to 460-nm light had significantly lower subjective sleepiness ratings, decreased auditory reaction time, fewer attentional failures, decreased EEG power density in the delta-theta range (0.5-5.5 Hz), and increased EEG power density in the high-alpha range (9.5-10.5 Hz). Light had no direct effect on cortisol.

Conclusions: Short-wavelength sensitivity to the acute alerting effects of light indicates that the visual photopic system is not the primary photoreceptor system mediating these responses to light. The frequency-specific changes in the waking EEG indicate that short-wavelength light is a powerful agent that immediately attenuates the negative effects of both homeostatic sleep pressure and the circadian drive for sleep on alertness, performance, and the ability to sustain attention.

Keywords: Alertness, alpha waves, auditory performance, circadian photoreception, cortisol, fatigue, light, vigilance, waking EEG, light wavelength

Citation: Lockley SW; Evans EE; Scheer FAJL et al. Short-wavelength sensitivity to the direct effects of light on alertness, vigilance, and the waking electroencephalogram in humans. SLEEP 2006;29(2): 161-168.

Focusing on Vigilance Instead of Sleepiness in the Assessment of Narcolepsy: High Sensitivity of the Sustained Attention to Response Task (SART)

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Study Objective: The severity of narcolepsy is commonly measured with the Multiple Sleep Latency Test (MSLT), focusing on the tendency to fall asleep. A neglected but perhaps equally important complaint is impaired performance in the waking state. We evaluated the Sustained Attention to Response Task (SART) for the quantification of vigilance in narcolepsy.

Design: The SART involves withholding key presses to 1 in 9 target stimuli. In the present study, it was administered prior to each of 5 MSLT sessions in a 1-day study. The Epworth Sleepiness Scale was administered to measure subjective sleepiness. SART and MSLT results (number of errors and sleep latency) were compared using Receiver Operating Curves, sensitivity, and specificity.

Setting: Tertiary narcolepsy referral center in a university hospital.

Patients: Fifteen untreated narcoleptics and 15 matched controls.

Interventions: None.

Measurements and Results: The area under the receiver operating curve was 0.97 for the MSLT and 0.95 for the SART. Sensitivity and specificity for the MLST were 80% and 100% using a cutoff point of 5 minutes. For the SART, these values were 87% and 100%, using a 5-error cutoff. The SART and MSLT showed no correlation with each other or with the Epworth Sleepiness Scale.

Conclusions: The SART, measuring attention, was abnormal as often as the MSLT, measuring sleepiness. The inability to remain vigilant during the day may be the most serious complaint in narcolepsy, since it impairs performance. The SART is valid in this respect, is easy to administer, and takes little time.

Keywords: Narcolepsy, vigilance, performance, Multiple Sleep Latency Test, excessive daytime sleepiness

Citation: Fronczek R; Middelkoop HAM; Van Dijk JG et al. Focusing on vigilance instead of sleepiness in the assessment of narcolepsy: High sensitivity of the sustained attention to response task (SART). SLEEP 2006;29(2): 187-191.
The Effect of 2 Sympatholytic Medications—Propranolol and Clonidine—On Sleep Bruxism: Experimental Randomized Controlled Studies

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Sex and Age Differences in Sleep Macroarchitecture in Childhood and Adolescent Depression

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Subject Objective: To evaluate age and sex differences in sleep macroarchitecture in children and adolescents with major depressive disorder. Design: Ninety-seven (50 F; 47 M) symptomatic unmedicated depressed outpatients were compared with 76 healthy controls (42 F; 34 M) matched for age and sex. Setting: Participants spent 2 consecutive nights in the sleep laboratory. Participants: One hundred seventy-three children and adolescents, aged 8 to 18 years. Measurements and Results: Significant group-by-age-by-sex interactions were evident for total sleep period, percentage of Stage 1 sleep, percentage of Stage 2, percentage of slow-wave sleep, and rapid eye movement (REM) sleep latency. The depressed adolescent boys had the greatest sleep disturbance with the highest amount of percentage of Stage 1 sleep, the shortest REM latency, and the least percentage of slow-wave sleep and number of minutes of slow-wave sleep in the first non-REM period. There were minimal age differences in sleep parameters between depressed children and adolescent girls. Within age groups, the sex differences were minimal in the healthy controls. The sex differences within the depressed group were substantially larger than controls. Conclusions: These findings suggest a differential developmental influence on sleep in early-onset depression that is heavily dependent on sex. Sex differences are substantially smaller in healthy individuals compared with those with depression, in agreement with previous studies in depressed adults. Keywords: Sleep, depression, sex, children, age, adolescence Citation: Robert JJT; Hoffmann RF; Emslie GJ et al. Sex and age differences in sleep macroarchitecture in childhood and adolescent depression. SLEEP 2006;29(3):351-358.