

EVALUATION OF TWO EYELID CLOSURE MONITORS FOR DROWSINESS DETECTION

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Introduction: Excessive sleepiness due to sleep loss has deleterious effects on driving performance and increases crash risk. Manual evaluation of slow-eyelid closure from video recordings, as a measure of sleepiness, is related to performance failure in sleep deprived subjects. This study evaluated the ability of two eyelid closure monitors to detect sleepiness following sleep deprivation and the relationship between slow eyelid closure and driving performance.

Methods: Volunteer subjects underwent a 24 hour period of acute sleep deprivation, from 07:00am until 07:00am the following day. They had a baseline test battery and repeated the tests after being awake for 24 hours. The test battery included reaction time tasks and a 30 minute driving simulation (AusEd®). Slow eyelid closure was monitored using the Co-pilot® (Carnegie Mellon University) and Optalert® (Sleep diagnostics). The percent of time the eyelids were closed and the Johns Drowsiness Score (which incorporates relative velocity of eyelid closure) were calculated.

Results: 21 drivers participated in the study (mean age 20.8 ± 1.9). There was a 19% increase in variation in lens position ($p = 0.02$), twofold increase in crashes, slowing of reaction time ($p < 0.01$) and threefold increase in attention lapses ($p < 0.01$), after 24 hours awake. There was an increase in the percent of time the eyes were closed (Fig. 1) and the Johns Drowsiness Score after deep deprivation. The percent of time the eyes were closed and Johns Drowsiness Score were related to crashes and attention lapses (r values 0.42 to 0.61, $p < 0.01$).

Discussion: Slow eyelid closure, as measured by automated devices, increases after acute sleep deprivation and is related to deterioration in driving and psychomotor performance. Automated measures of eyelid closure may provide a useful measure of sleepiness whilst performing tasks such as driving.

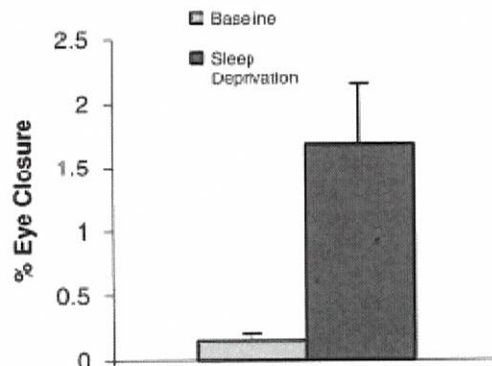


Fig. O-15-1 % Eye Closure