

## **A New Method for Monitoring Drowsiness Based on the Velocity and Amplitude of Blinks**

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None of the existing methods for monitoring drowsiness in active people is entirely satisfactory. A new method based on eye and eyelid movements, measured by reflectance of infrared light pulses, has been incorporated into a psychomotor vigilance test (PVT).

A new variable, the ratio of the amplitude of blinks to their peak closing velocity (A/PCV), has been examined in relation to drowsy lapses in the PVT .

**Methods :** A series of experiments on 9 healthy subjects when alert and when drowsy because of sleep deprivation for 24-33 hr enabled the range of normal A/PCV ratios and their changes with drowsiness to be described for the first time.

**Results:** A/PCV ratios of alert subjects were normally distributed, mean = 4.1 +/- 0.8 (SD). The ratios increased after 20 hrs of wakefulness and with the time of night ( $p < 0.001$ ), particularly during the 30 sec before each lapse in the PVT ( $p = 0.003$ ). Partial blinks, with increased A/PCV ratios but without prolonged eyelid closure, were common in the drowsy state. Some PVT lapses occurred with eyes open, others during prolonged eyelid closure at the time of the visual stimulus.

**Conclusions:** The A/PCV ratios of blinks provide a continuous measure of drowsiness that is predictive of performance lapses. It may be suitable for monitoring drivers. A patent is pending for a new monitoring device based on these methods.