Effects of Sleep Fragmentation on Error Monitoring

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ABSTRACT BODY:

Introduction: Sleep fragmentation (SF) involving frequent arousals from sleep, no matter they are aware or not, may lead to partial sleep loss and/or bad sleep quality, and thereby relates to daytime sleepiness. Experimentally manipulated SF is commonly applied by giving intermittent arousing stimuli such as auditory noises. Our previous studies found that one night of total sleep deprivation impaired error monitoring functions, both in behavior performance and brain activity (Tsai et al., 2005; Hsieh et al., 2007, 2009, 2010). This study further examined the effect of one night of artificially fragmented sleep on error monitoring.

Methods: After an acclimatization night, all participants (five men and three women) underwent an undisturbed sleep night and a tone-induced SF study night in a counterbalanced, repeated-measures design. The event-related brain potentials were obtained during Flanker task performance tested in the morning following each sleep night. The error negativity or error-related negativity (Ne/ERN) and the error positivity (Pe) seen immediately after errors were analyzed.

Results: Compared to the undisturbed sleep condition, SF showed a tendency to lower response speed (p <.01), increased post-error slowing (p <.01), and impaired post-error improvement in accuracy (p <.01) but none of the effects reached statistical significance. The amplitude of the Ne/ERN was reduced in the SF condition (p =0.046).
Conclusion: These data suggest one night of SF impaired both the error detection and error remedial actions and led to making more successive errors. The negative effect of one night of SF on error monitoring is comparable to that of one night of total sleep deprivation.

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