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REM Sleep Selectively Optimizes Negative Emotional Face Processing

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Abstract

Previous studies highlight sleep's role in emotional processing, with rapid eye movement (REM) sleep showing a negative bias, though multi-level neural mechanisms require further exploration. This EEG study examined overnight sleep's modulation of emotional face recognition, integrating event-related potentials (ERPs), oscillatory activity, and connectivity measures. Thirty-six participants performed an emotional face classification task before and after polysomnographic monitoring. Results showed sleep-dependent enhancement of the N170 component specific to negative faces and dynamic modulation of the late positive potential (LPP). Higher REM proportion and stronger prefrontal theta-gamma phase-amplitude coupling correlated with greater behavioral efficiency gains. REM-specific directed theta connectivity from central to prefrontal regions selectively predicted improvements in negative face processing. These findings indicate that REM sleep adaptively optimizes negative emotional processing via hierarchical mechanisms from early structural encoding to late motivational evaluation, providing new insights into sleep's therapeutic potential for emotional regulation.