SMR & Sleep

**Instrumental Conditioning of Human Sensorimotor Rhythm (12-15 Hz) and Its Impact on Sleep as Well as Declarative Learning**

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**Abstract**

**Study Objectives:**

To test whether instrumental conditioning of sensorimotor rhythm (SMR; 12-15 Hz) has an impact on sleep parameters as well as declarative memory performance in humans.

**Design:**

Randomized, parallel group design

**Setting:**

10 instrumental conditioning sessions, pre- and posttreatment investigation including sleep evaluations

**Participants:**

27 healthy subjects (13 male)

**Interventions:**

SMR-conditioning (experimental group) or randomized-frequency conditioning (control group); declarative memory task before and after a 90-min nap

**Measurement and Results:**

The experimental group was trained to enhance the amplitude of their SMR-frequency range, whereas the control group participated in a randomized-frequency conditioning program (i.e., every session a different 3-Hz frequency bin between 7 and 20 Hz). During pre- and posttreatment the subjects had to attend the sleep laboratory to take a 90-min nap (2:00–3:30 pm) and to perform a declarative memory task before and after sleep. The experimental design was successful in conditioning an increase in relative 12–15 Hz amplitude within 10 sessions (d = 0.7). Increased SMR activity was also expressed during subsequent sleep by eliciting positive changes in different sleep parameters (sleep spindle number [d = 0.6], sleep onset latency [d = 0.7]); additionally, this increased 12–15 Hz amplitude was associated with enhancement in retrieval score computed at immediate cued recall (d = 0.9).

**Conclusion:**

Relative SMR amplitude increased over 10 instrumental conditioning sessions (in the experimental group only) and this “shaping of one's own brain activity” improved subsequent declarative learning and facilitated the expression of 12–15 Hz spindle oscillations during sleep. Most interestingly, these electrophysiological changes were accompanied by a shortened sleep onset latency.

Instrumental conditioning, SMR, sleep spindle, sleep quality, declarative memory

**Topic:**

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