

IMPAIRED SLEEP-RELATED MEMORY CONSOLIDATION

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A group of German researchers recently assessed memory processing during sleep in individuals with primary insomnia with the aim of better understanding the mental processes involved in this sleep disorder. The results provide preliminary data indicating memory consolidation during sleep may be impaired in individuals with primary insomnia.

Research on the association between sleep and memory suggests that newly acquired memories are processed during sleep and that this process may contribute to changes in the brain that underlie long-term memory formation or the consolidation of new memories. Individuals with primary insomnia complain of various deficits in cognition, including attention and memory. Neuropsychological assessments conducted in the daytime have largely failed to confirm these deficits, and studies on sleep-related memory consolidation that may relate to these complaints have not been conducted.

In this study, researchers compared sleep-related consolidation of procedural memory in seven individuals with primary insomnia and seven healthy individuals. Procedural memory is the long-term memory of 'hands-on' physical skills or 'how to' knowledge; for example, the small [muscle](#) movements required for the precise hand-eye coordination of writing, drawing or doing up buttons.

Each subject spent one night in the sleep laboratory and was monitored with polysomnography, a test that measures biophysiological changes that occur during sleep, such as brain activity, eye movements, muscle activity or skeletal muscle activation, heart rhythm, and breathing. No significant difference in sleep between individuals with insomnia and healthy individuals was seen, although there was a trend toward disturbed sleep in individuals with insomnia compared with healthy individuals.

Participants also performed a mirror tracing task before and after sleep. This involved looking at an image in a mirror and tracing it using a pen with an electronic sensor that measured draw time, number of errors (when the pen left the paper), and total error time. This task is an established task for procedural or 'how to' learning and improvement in the task has been shown to be enhanced by sleep. Consolidation of this task was assessed in each subject by comparing their drawing ability before sleep with their drawing ability the following morning.

Both groups performed significantly better at the task when retested after sleep. Healthy individuals showed an improvement of about 43%, whereas individuals with insomnia showed an improvement of about 20%. The percentage of improvement after sleep was significantly lower in individuals with insomnia, compared with healthy individuals, suggesting that the sleep-related consolidation of procedural memory may be impaired in individuals with primary insomnia.

Interestingly, sleep-related improvement in the drawing task clearly differed between individuals with insomnia and healthy individuals whereas polysomnographic measurements did not. The researchers suggest that this lack of polysomnographic differences may represent a false negative, and they emphasize that study is preliminary because of the small number of subjects involved and because its design could be improved.

Because the results were based on a single night, without adaptation of participants to the sleep laboratory conditions, this may have contributed to the relatively poor sleep in the healthy individuals since other studies report particularly disturbed sleep for healthy individuals on the first night of sleep in a sleep laboratory. Additionally, the differences in polysomnographic measurements may have been further reduced between participants because individuals with insomnia have been found to sleep better on the first night in a sleep laboratory compared with a second night.

The researchers also point out that the design of the study was based on previous work indicating that sleep facilitates the consolidation of procedural memories. They state that waking conditions, including morning-to-evening and nightly sleep-deprivation, need to be conducted on study participants to provide direct evidence that the observed improvements in the drawing task after sleep are distinctly sleep-related.

The researchers conclude that sleep-related consolidation of procedural memories may be impaired in patients with primary insomnia. However, they note that the lack of severe deficits in patients with primary insomnia indicates that consolidation of memory is only partly dependent on sleep. They suggest that investigating whether patients with insomnia can compensate for potential sleep-related deficits during the day, how other forms of learning might be affected by lack of sleep, or the involvement of other types of memory could be the focus of future studies.

Susan Williamson