

The Role of Slow-Wave Sleep and Oxygen Desaturation in Memory Consolidation Among Sleep-Disordered Individuals

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Abstract

Objective:

Obstructive sleep apnea (OSA) causes intermittent hypoxia and sleep fragmentation, which in turn disrupts sleep architecture and may impair memory consolidation, particularly during slow-wave sleep (SWS). This study aims to investigate the relationships between SWS, oxygen desaturation, and memory consolidation in individuals with sleep disorders.

Methods:

Participants underwent overnight polysomnography (PSG) to assess sleep architecture and oxygenation parameters. Memory consolidation was evaluated using the Word Sequence Learning Test-Memory Index Score (WSLT-MIS), with cognitive performance assessed both before and after sleep. The difference in WSLT-MIS (Δ) and retention rate were calculated. Linear regression models, adjusted for age, body mass index (BMI), and education, were employed to analyze the associations between SWS, oxygen desaturation index (ODI-3%), apnea-hypopnea index (AHI), and

memory consolidation.

Results:

In the cohort of 49 participants, SWS showed a significant positive association with both the Δ value in WSLT-MIS and retention rate ($p < 0.05$). Conversely, AHI and ODI-3% were negatively associated with the Δ value, particularly during non-REM sleep ($p < 0.05$). No significant associations were observed between REM sleep parameters and memory consolidation.

Conclusion:

This study highlights the crucial role of SWS in memory consolidation and suggests that oxygen desaturation and higher AHI impair memory consolidation in sleep-disordered individuals. These findings underscore the potential therapeutic importance of improving SWS and oxygenation in treatments aimed at enhancing cognitive function.

Keywords: obstructive sleep apnea, polysomnography, slow-wave sleep, Word Sequence Learning Test, memory consolidation

中文題目：慢波睡眠與氧氣飽和度下降在睡眠障礙者記憶鞏固中的腳色

作者：官怡君*、蔡承育、林昕緯、楊政璋 (英文如上表格所列)

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