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Try Sleeping On It

by Eleanor Roberts, PhD

March has brought National Sleep Awareness Week (3rd-9th), and a concomitant conference entitled "The Role of Sleep on Memory and Learning". Studies dating back over 100 years have shown the positive effect of sleep on both memory and other cognitive processes. Recently, an investigation was carried out to compare the impact on learning after 12 hours of sleep vs. 12 hours awake. It was shown that presenting German words to English speakers in the evening and recalling them after sleep led to higher retention rates than presenting the words in the morning (p = .013). The authors concluded that the greater positive effect on word-retention after a full night's sleep was because of "interference" from the day's events for those whose words were presented in the morning.(2) Sleep on it indeed.

Thus if sleep is good for memory recall, an appropriate hypothesis may be that lack of sleep is detrimental. In a similar study, a group deprived of a night's sleep performed significantly worse on memory testing compared to a group who were not sleep deprived, even when given a further night's "recovery" sleep.(1) This has implications for those who miss sleep and then have to perform a job that involves cognitive functioning, not only the next day, but also two days later. One night's catch-up sleep may not be enough. Sleep deprivation/fragmentation may have an impact in the classroom as well. It is known that adolescents need 9-10 hours of sleep, but demands from early school times and after-school activities may intrude into sleep and shortened sleep times have been shown to impact school performance.(3) In a classroom study by Drake et al, a significant relationship was found between daytime sleepiness and both total sleep time (p < .01) and school grades (p = .02), implying that if an adolescent's grades are poor or slipping, their sleep habits may warrant investigation.(4)

Another large area of study is how cognitive faculties are affected by sleep-fragmentation that can occur with sleep-disordered breathing (SDB) and obstructive sleep apnea (OSA). Many people with SDB/OSA experience sleep-arousals that may not necessarily result in waking. Thus a person may complain of a decline in cognitive function without realizing OSA may be the cause. A meta-analysis of people with SDB found detriments in not only memory tasks but also a number of other cognitive functions including attention and executive function.(5)

Using neuroimaging to elucidate the detrimental effects of OSA on brain functioning, Thomas et al(6) revealed significantly decreased performance on a test of working memory in OSA subjects (p < .001). While in a control group there was activation in areas known to be involved in working memory - the dorsolateral prefrontal cortex (dlPFC) and posterior parietal cortex (pPC) - for the OSA group there was no activation in the former and lower activation in the latter (p < .05). After the OSA group received continuous positive airway pressure (CPAP) treatment working memory test scores became equal to controls but while activation in the pPC returned to near normal, there was still little dlPFC activation. These data indicate possible long-term detrimental effects of hypoxia in untreated OSA.

Cognitive decline in elderly people is another area of attention for further study. Cognitive decline in this patient population may be related to excessive sleepiness (ES). As part of the

Honolulu-Asia Aging Study, cognitive measures were examined over a 3-yr period in men of approximately 78 years of age. At the beginning of the study, 7.7% of 2346 men without dementia reported ES. At follow-up, 188 men had developed dementia. For those with ES the relative risk for developing dementia was 2.19 compared to those without ES.(7) This study did not address whether or not the patients with ES and cognitive decline had OSA. However, one study that did include subjects with OSA (n = 448, 82.8 ± 3.4 yrs) found a direct relationship between apnea-hypopnea indices values and impairment on the Mini-Mental State Examination (MMSE).(8) These data and the Honolulu-Asia Aging Study demonstrate a link between sleep disturbances and cognitive decline that demonstrates the need for clinicians to talk with their elderly patients about their sleep habits and to utilize tools such as CPAP when indicated.

In summary, memory and other cognitive abilities are intimately linked with the quality and quantity of sleep. Any instance of, even minor, cognitive problems should prompt examination of a patient's sleep habits and corrective measures should be taken if a relationship is revealed. Additional information regarding the role of sleep in cognitive functioning can be found in several archived neuroscienceCME activities such as Waking Up to the Problems of OSA: Consequences and Improved Recognition; neuroscienceCME Journal Club featuring a discussion with Najib Ayas on his group's paper The impact of obstructive sleep apnea and daytime sleepiness on work limitation;(9) and podcasts, including Part 1 and Part 2 of Expert Discussions on Sleep-Wake Medicine. Look for a more detailed summary of one of the articles discussed above - Spira et al – in our December 2007 sleep literature summaries section.(8) For additional archived neuroscienceCME activities and upcoming live activities, visit www.neuroscienceCME.com

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