Bright Light Therapy Improves Sleep, Cognition in Mild TBI

By Megan Brooks, Medscape Medical News, June 10, 2013

BALTIMORE, Maryland — Bright light therapy may improve sleep and aid recovery after mild traumatic brain injury (TBI), new research hints.
In a small study of patients with mild TBI, researchers saw improvements in sleep, cognition, emotion, and brain function after 6 weeks of morning bright light therapy.

Mareen Weber, PhD, instructor in psychiatry at McLean Hospital/Harvard Medical School in Belmont, Massachusetts, pointed out that sleep disturbance is one of the most frequently reported subjective symptoms after mild TBI. It's estimated that "at least 50% of individuals with this injury will present with some kind of sleep disturbance at some point following TBI," Dr. Weber told *Medscape Medical News*.

"Improving sleep would, of course, reduce personal suffering," she added." However, recent animal research suggests that sleep is essential for brain plasticity; thus, improving sleep following mild TBI might facilitate recovery from the injury." She reported the findings June 3 at SLEEP 2013: Associated Professional Sleep Societies 27th Annual Meeting.

An Aid to Recovery?

The study involved 18 adults with a history of at least 1 mild TBI and sleep disturbance that emerged or was aggravated with the most recent injury. The researchers gathered data by using Multiple Sleep Latency Tests (MSLT), actigraphy and sleep diaries, functional MRI (fMRI), and comprehensive psychiatric and neuropsychological assessments before and after 6 weeks of 30 minutes of blue wavelength or amber wavelength (placebo) light therapy daily.

"Blue wavelength light might be particularly effective in TBI-related sleep disturbance, as it affects melatonin production and thus may help re-entrain the circadian rhythm, resulting in improved sleep, cognition, emotion, and brain function," the investigators explain in meeting materials.

Compared with placebo light, 6 weeks of blue light therapy significantly reduced daytime sleepiness. "Indeed, everyone randomized to the treatment condition showed a reduction in self-reported daytime sleepiness compared to only 16.7% in the placebo condition," Dr. Weber told *Medscape Medical News*.

"More importantly, more than half of the individuals in the treatment condition showed a reduction in daytime sleepiness below the clinical cut-off on this self-report measure, compared to 0% in the placebo group."

She said a greater reduction in subjective daytime sleepiness was associated with less objectively measured daytime sleep propensity in sleep conducive conditions and greater nighttime sleep quality. Blue light therapy was also associated with improvements in

mood and performance on measures of attention, speed of information processing, memory, and executive functioning.

Using fMRI, the researchers were able to show greater activation in clusters involving the left thalamus and left dorsolateral prefrontal cortex.

"These regions are involved in sleep and higher-order cognitive functioning and have been previously demonstrated to show increased activation in response to bright light. Interestingly, the thalamus is also involved in the generation of sleep spindles," Dr. Weber said.

Potential Downsides?

"It's nice to see the possibility of cognitive, sleep and mood improvement in mild TBI," said Michael Terman, PhD, head the Center for Light Treatment and Biological Rhythms at Columbia University Medical Center in New York, who wasn't involved in the study. The small sample size "justifies a more extensive clinical trial," he said.

Dr. Terman also noted that while amber light, which excludes blue light, is "in principle a reasonable placebo control, differences in perceived brightness and patients' expectations present a likely confound. More importantly, there is a sufficient blue component in standard bright white light therapy, which unlike narrow-band blue has been extensively tested for efficacy and ocular safety."

He also cautioned that glare production, and possible long-term adverse effects of photoreceptor and pigment epithelial function, are "potential downsides to the choice of blue light for anything more than brief treatment. Melanopsin production in the retina, a gateway to circadian rhythm adjustment, is undoubtedly excited by narrow-band blue and white light alike. The green component of white light is an additional active factor."

Dr. Terman said, "A more convincing story would be revealed if standard white light of 10,000 lux at 4500 Kelvin color temperature were added as an arm of the study. It is far more difficult to demonstrate differences in effect size between 2 effective treatments — and, if none were found in this comparison, white light therapy would be the preferred choice for clinical application."

Dr. Weber noted that these are preliminary findings from an ongoing study, and they need to be confirmed in the final sample. She said it would be interesting to test whether bright light would yield similar clinical improvements in conditions other than mild TBI that also present with high rates of sleep disturbance, such as post-traumatic stress disorder.

"Furthermore, our current sample comprises adults, but given the injury's high prevalence and incidence in children and adolescents, it would be interesting to extend this line of research to this population," she said.

Dr. Weber and colleagues have disclosed no relevant financial relationships. Dr. Terman is the author of Chronotherapy *(Avery/Penguin, 2012).*

SLEEP 2013: Associated Professional Sleep Societies 27th Annual Meeting. Abstract 0751. Presented June 3, 2013.