

Study is first to find that CPAP therapy restores brain tissue in adults with sleep apnea

June 7 2010

Obstructive sleep apnea patients had reductions of grey-matter volume at baseline but showed significant grey-matter volume increase after three months of CPAP therapy, according to a research abstract that will be presented Monday, June 7, 2010, in San Antonio, Texas, at SLEEP 2010, the 24th annual meeting of the Associated Professional Sleep Societies LLC.

Results indicate that obstructive [sleep](#) apnea patients showed focal reductions of grey-matter volume at baseline in the left hippocampus, posterior parietal cortex and right superior frontal gyrus. Significant grey-matter volume increases were observed after three months of continuous positive airway pressure therapy in hippocampal and frontal structures. No further improvement in gray-matter volume was observed after one year of CPAP therapy.

"OSA patients showed cognitive impairment associated with neurostructural damage affecting specific cerebral regions," said principal investigator Vincenza Castronovo, PhD, clinical psychologist and psychotherapist and sleep laboratory coordinator at the University Vita-Salute San Raffaele and San Raffaele Scientific Institute in Milan, Italy. "In addition, we show that most of the neuropsychological deficits are reversed after three months of treatment with CPAP and, for the first time, that such cognitive improvements parallel an increase of grey-matter volume in specific hippocampal and frontal [brain regions](#). The

increase of grey-matter volume in these regions is significantly correlated with the improvement at neuropsychological tests of executive functioning and short-term memory."

The study involved 17 patients with an apnea-hypopnea index (AHI) greater than 30 (i.e., more than 30 breathing pauses per hour of sleep), indicating severe obstructive [sleep apnea](#). They were compared with 15 healthy controls. [Brain scans](#) were conducted by 3 Tesla [magnetic resonance imaging](#) (MRI), and a processing technique called "voxel-based morphometry" (VBM) was used to characterize regional cerebral volume and tissue concentration differences in gray matter by examining the entire brain. VBM increasingly is being used as a tool to examine patterns of brain change in healthy aging or neurodegenerative disease, as well as neuroanatomical correlates of behavioral or cognitive deficits and skills.

Castronovo added that measuring neuropsychological performance may help physicians assess OSA patients for treatment effectiveness.

"Our results also suggest that specific neuropsychological measures are valuable tools for the assessment of therapy success and can offer to patients and physicians the evidence that adherence to treatment can lead not only to clinical but also to brain-structural recovery," she said.

The National Institute of Neurological Disorders and Stroke reports that "gray matter" refers to the cerebral cortex, where the brain does most of its information processing. The cortex is a layer of tissue that has a gray-colored appearance because it lacks the myelin insulation that gives most other parts of the brain a white appearance.

According to the American Academy of Sleep Medicine, OSA is a sleep-related breathing disorder that involves a decrease or complete halt in airflow despite an ongoing effort to breathe. It occurs when the muscles

relax during sleep, causing soft tissue in the back of the throat to collapse and block the upper airway. This leads to partial reductions (hypopneas) and complete pauses (apneas) in breathing that can produce abrupt reductions in blood oxygen saturation and reduce blood flow to the brain. Most people with OSA snore loudly and frequently, and they often experience excessive daytime sleepiness.

The treatment of choice for OSA is CPAP therapy, which provides a steady stream of air through a mask that is worn during sleep. This airflow keeps the airway open to prevent pauses in breathing and restore normal oxygen levels. Help for OSA is available at more than 2,000 AASM-accredited sleep disorders centers across the U.S.

Last year Castronovo reported that there was a large overlap in the pattern of brain activity in men with OSA and healthy controls during a working-memory task. But some regions were less active in men with untreated OSA, while additional brain regions such as the hippocampus showed increased activation. Then after three months of CPAP therapy, men with OSA showed decreases in the activation of the left inferior frontal gyrus and anterior cingulate cortex, and bilaterally in the hippocampus. The study, published in the September issue of the journal *Sleep*, supports the "compensation hypothesis," suggesting that the brain "recruits help" to maintain performance and compensate for the neural dysfunction caused by OSA.

A South Korean study published in the February 2010 issue of the journal *Sleep* found gray matter concentration deficits in multiple brain regions of newly diagnosed men with severe OSA, including limbic structures, prefrontal cortices and the cerebellum. In the March 2009 issue of the *Journal of Sleep Research*, a French study reported finding gray matter loss in multiple regions, including the thalamus, hippocampus and cerebellum.

Provided by American Academy of Sleep Medicine

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