Sleep Apnea and the Concussion Connection

Banning headers is not expected to reduce concussions in soccer. Credit: Diane Scavuzzo|Lenny Ignelzi|AP

For each of the 2,000 Players in the NFL, about 2,000 kids play – or about 4 million. Credit: John Sohm|Dreamstime

According to published studies, scientists have found brains of sleep apnea, chronic traumatic encephalopathy (CTE), and Alzheimer's Disease patients have something in common: elevated levels of β-amyloid plaque and toxic clusters of tau protein with measurable amounts in their cerebrospinal fluid.

That's important because cerebrospinal fluid (CSF) *circulation* is critical to the proper functioning of the brain and toxic clusters of tau protein and β-amyloid plaque can have significant negative consequences. So, what's the connection with sleep apnea? Each time a person inhales and their lungs fully inflate, pressure is exerted within their body that helps pump and circulate cerebrospinal fluid, which among other functions, carries away metabolic waste products that can accumulate in the deep interstitial areas of the brain. This flushing effect happens predominantly during periods of deep sleep, when the brain actually reduces in size to widen these areas and allows for a more thorough 'cleaning' and restoration – provided the CSF pump is working correctly with regular *natural* breathing.

So, what are some of the adverse effects that can happen when the lungs don't fully inflate with each breath? Here are just a few:

- When CSF flow is interrupted, it impedes the body's ability to cleanse toxic wastes from the brain and help restore or replace damaged cells.
- When a person stops breathing, it causes a sensation of suffocation and anxiety. That results in the release of epinephrine (aka Adrenaline® in commercial form), which causes the body to produce extra glucose and spike the heart rate in a fight-or-flee response that often causes a brief awakening and disrupts restorative sleep.
- Harmfully low blood oxygen levels (hypoxemia) occur, which can cause inflammation and damage every organ in the human body over time.

A person with moderate sleep apnea will have up to 232 episodes of reduced airflow and potential hypoxemia with awakenings in an 8-hour sleep session and not remember any of it in the morning. According to studies, a person with a brain injury from a concussion is also likely to have central as well as obstructive apneas during recovery, even if they were previously healthy or athletes in top physical condition. If untreated, even a few central apneas per hour, or 24 in an 8-hour sleep session, can prevent cerebral healing following even a mild traumatic brain injury and have been associated with permanent cerebral damage and the development of CTE over time according to published studies.

In another nod to “not all things are equal,” women are reported to fare far worse from concussions than men. The reasons are just beginning to be understood but include several possible contributing factors. One observation is that when women strike their heads on the ground, there’s more of a whiplash and downward acceleration motion thought to be associated with neck strength. Another is a difference in brain neuronal structure, wherein the axons that transmit signals are more slender in women—and thus more easily subject to breakage during a brain trauma. Finally, the levels of progesterone at the time of injury are reported to make a difference, with women on birth control (i.e., more even levels) reported to recover better than those injured during the luteal phase of the menstrual cycle following ovulation when progesterone levels are at their highest.

Beyond the immediate impact on an individual’s body and health, research has suggested that people with a history of concussions are *at a higher risk* of developing sleep apnea, and vice versa. Also, some studies have suggested that individuals with sleep apnea may be *more vulnerable* to the effects of concussions and may be more likely to develop CTE.

While there are compelling studies available today, it's clear that more research is needed to fully understand the relationship between sleep apnea, concussions, and CTE—particularly for women. However, given the initial research and implications, it's important that we share this knowledge: allowing a concussion patient to experience apneas during recovery is not a best practice, nor is it for anyone who may have sleep apnea and could experience the serious negative health consequences that can occur.

#CTE #concussions #sleepapnea

About the Author – Michael Nathans is the CEO and one of four Co-Founders of WhisperSom Corporation, a medical device and informatics company. He holds a degree in biology and Pre-healing Arts from Franklin & Marshall College and has a 35-year business background that includes 5 years at PwC, two U.S. patents, and two grants from the Ford Foundation. Visit WhisperSom on LinkedIn and Facebook to follow more discussions about sleep apnea and raising the 5% treatment rate through education.