The Potential of Light Therapy for Treating Brain Injuries like TBI & CTE

Head injuries and brain trauma are a growing epidemic in the United States, especially among football players and combat veterans. In recent years, the deaths of a number of high-profile athletes have opened the public's eyes to the potentially tragic long-term effects of things like Traumatic Brain Injury (TBI) & Chronic Traumatic Encephalopathy (CTE). Meanwhile, tens of thousands of former athletes, veterans, and their families are living with the negative consequences of head trauma every day.

Our brains are incredibly complex and more difficult to diagnose & understand than any other part of our body. Medications have a mixed record for treating the brain, but emerging research on light therapy and its effect on compromised brain cells give reasons for optimism.

Photobiomodulation, or light therapy, is the use of natural red & near infrared (NIR) light to stimulate and regenerate cells and tissue. With medical-grade, light emitting diodes (LEDs), red and NIR wavelengths are able to reach the brain through the head and skull. This has enormous potential to improve the cellular activity of compromised brain tissue, and many researchers believe noninvasive light therapy will play a major role in the future treatment of brain conditions. [1],[2]

This article provides an overview of TBI & CTE and summarizes the science behind light therapy and the treatment of brain injuries.

What is TBI?

TBI is more complex and difficult to treat than other kinds of physical injuries. One moment a person acts like their normal self, then life abruptly changes. With brain injuries, personality traits can change dramatically and may produce wildly different results in different people. Sometimes symptoms appear right away, others take days or weeks. One of the most common consequences of a brain injury is that the victim often doesn't realize a brain injury has occurred.

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TBI By the Numbers: [3]

- **153 people** in the United States die every day from injuries that include TBI. [3]
- 3 new occurrences of TBI happen in the United States **every minute**. [3]
- **5,000,000+ Americans** are living with TBI symptoms today. [3]
- **1.7 to 3.8 million people** suffer from TBI annually. Of those, 282,000 are hospitalized and 50,000 die. At least 10% of these cases are sports-related. [3]

Brain Injuries in Sports

The ongoing discussion about concussions in sports, especially football, and the efforts to prevent and treat sports-related brain injuries have brought more public attention to head injury issues than ever before.

CTE

If you suffer a concussion from a collision in a football game, that's an instance of TBI and can be mild or severe. The other term you often hear is **CTE**, or **Chronic Traumatic Encephalopathy**. This is the term for people who suffer from a history of *repetitive* brain trauma. It's most often found in athletes and military veterans. With CTE, a protein called TAU forms harmful clumps that slowly spread throughout the brain, killing brain cells. CTE has been seen in people as young as 17, but symptoms usually don't appear until years later. [4]

CTE doesn't just mean multiple concussions; most people diagnosed with this disease have suffered hundreds or thousands of head impacts over the course of many years. The best available evidence indicates that less-serious head collisions add up over time, which can lead to CTE.

CTE Symptoms

The most common symptoms of CTE include:

- **Mood**: Impulse control problems, aggression, depression, and paranoia.
- **Cognitive**: Cognitive symptoms usually appear later as CTE progresses. They include memory loss, impaired judgment, and progressive dementia.

Football & CTE

Recent research has made clear the severity and urgency of tackle football's "concussion epidemic". In 2017, the *Journal of the American Medical Association* released a study reporting that 110 of 111 brains from deceased former NFL players they studied had CTE. [5]

In recent years, the tragic side of CTE has been made more visible to the public through a series of CTE-related deaths of former football players. The tipping point for public perception may have been Junior Seau's suicide in 2012. His death, and revelations that he suffered from CTE, shocked the football world and opened more people's eyes to the extent of the problem. In 2017, an autopsy of former New England Patriots tight end Aaron Hernandez found he had stage 3 CTE at the time of his death at 27 years old. [6] Researchers had never seen such advanced CTE in a brain younger than 46 before. [7]

Beyond the headlines, there are far more pro players quietly retiring to prevent head damage and its consequences. There are no reliable statistics, but you can imagine how many kids and parents are deciding not to start up with football in the first place as more and more troubling information about CTE is revealed.

Light Therapy's Role in Treating TBI & CTE

"Near infrared light can penetrate quite deep into the body. So if you shine it on your head, it goes through your skull and quite a lot of it is absorbed by your brain. Once you understand this, it's amazing to think of the various diseases of the brain that need regeneration and healing, which could potentially be treated with light therapy." **- Dr. Michael Hamblin, PhD., Associate Professor, Harvard Medical School**

Natural red and NIR light therapy works by stimulating cells and tissues so they can repair themselves. With medical-grade LEDs, red & NIR light can reach the brain through the head and skull, providing a potential treatment method for TBI & CTE that's natural and noninvasive, without the wide range of potential side effects associated with psychiatric medications. [1] The beneficial effects of light therapy on the brain are realized by increasing cerebral blood flow, increasing oxygen availability & consumption, and boosting ATP energy production and mitochondrial activity. [2] Numerous reports have shown that the brain's brief exposure to light can have effects lasting days, weeks, or even months. [2]

The most promising element of light therapy for brain injury treatment may be the potential for increased *neurogenesis* (the growth of new nerve tissue) and *synaptogenesis* (formation of new synapses), which was reported in studies of animals treated with NIR in the acute post-TBI stage. NIR light has also been found in studies to have an anti-inflammatory effect on the brain, as well as strong antioxidant effects. [8]

One clinical study of men and women with TBI history were administered red and NIR light therapy treatment for their brains in 18 sessions over 6 weeks. The researchers noted improved sleep, better executive functions, improved social functioning, and an increased ability to perform tasks and activities. People also reported improvements in depression, anxiety, headaches, and overall cognition. [9]

Conclusion: Light Therapy is a Powerful Tool for Your Brain

Light therapy has enormous potential to treat challenging brain conditions like TBI & CTE in a natural, noninvasive way. TBI & CTE are a painful burden for athletes, military veterans, and their loved ones. The extent of the problem is now well-known, but treating brain conditions is still difficult, and usually relies on drugs and invasive procedures with risks and side effects. More encouraging research is emerging showing that light therapy could be a fundamental tool in the next generation of head trauma treatment.

For more info on the science behind light therapy and how it works, check out our library of photobiomodulation research articles.

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