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# Studies Showing Effectiveness of HBOT with Traumatic Brain Injuries (TBIs) - Brain CT scan

5. Healing Traumatic Brain Injury with Hyperbaric Oxygen ...



## Studies Showing Effectiveness of HBOT with Traumatic Brain Injuries (TBIs)

Numerous studies, all the way to 1964, have looked at the benefits of hyperbaric oxygen, or HBOT, for patients with traumatic brain injuries (TBIs). The first study (Fasano et al.) in 1964 showed the therapeutic effect on TBI patients. Studies conducted in 1971, 1977, 1982 and 1994 showed that HBOT reduced intracranial pressure, reduced cerebral spinal fluid pressure, improved the metabolic activity of grey matter in the brain, and improved glucose metabolism.

A 2013 study reported that TBIs were the leading cause of death and disability in the United States. Their research looked at 56 patients that were 1 to 5 years post injury and suffering from post-concussion syndrome. Results of the study showed that HBOT induced neuroplasticity that helped to repair brain functions. As a result, patients saw a significant improvement in their quality of life.



## **How Hyperbaric Oxygen and HBOT Make a Difference in the Treatment of Traumatic Brain Injuries (TBIs)**

HBOT and hyperbaric oxygen treatment work in cases of traumatic brain injuries (TBIs) by assisting the body with neuroprotection in the brain. The earlier hyperbaric oxygen is administered, the more effective it is in preventing secondary brain damage due to traumatic brain injuries.

**There are five mechanisms that HBOT**

## provides:

- Increase in Tissue Oxygenation – The 100 percent oxygen in a high-pressure environment that HBOT provides floods the body with increased oxygen. This allows oxygen to pass to brain tissue that may be cut off due to damaged arteries and capillaries.
- Inflammation Suppression – In TBIs, the normal inflammatory response to injury can contribute to secondary brain damage. Reducing the inflammation response is essential. HBOT inhibits the neutrophils from adhering to their targets, increasing anti-inflammatory cytokine interleukin-10, reducing microgliosis, reducing the level of tumor necrosis factor- $\alpha$ , and decreasing the expression of matrix metalloproteinase-9. These changes slow down the body's normal inflammatory response.
- Decreases Apoptosis – The increased levels of oxygen delivered through HBOT reduces apoptosis, or cell death. This helps to preserve brain tissue and promote recovery.
- Reduces Intracranial Pressure (ICP) – HBOT plays a critical role in reducing intracranial pressure. It decreases endothelin. These peptides constrict blood vessels and increase blood pressure, which in turn increases pressure in the brain. HBOT and hyperbaric oxygen also improve blood flow in and around the brain as well as decrease cerebral vascular resistance in traumatic brain injuries (TBIs).
- Promotes Neurogenesis and Angiogenesis – Neurogenesis is the growth of new tissue while angiogenesis is the growth of new blood vessels. Increased levels of oxygen help to heal damaged tissue while stimulating new tissue growth. In the same way, it promotes the development of new blood vessels. While this mechanism of HBOT is beneficial at the time of injury, it also provides great benefit to those with post-concussion syndrome.

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## **HBOT, Veterans Affairs and the Department of Defense**

Despite numerous studies showing the benefits of HBOT on TBIs, the United States Department of Veterans Affairs refused to approve and pay for hyperbaric oxygen therapy, or HBOT, in soldiers with chronic blast-induced TBIs and PTSD.

After a study conducted by Dr. Paul G. Harch and his team in 2011, views of HBOT and hyperbaric oxygen treatment for TBIs began to change. Harch's study, published in the Journal of Neurotrauma, treated 16 active duty and retired veterans with HBOT. All 16 received their TBI at least three years before the study and suffered from post-concussion syndrome and PTSD. After 40 treatment sessions in one month, the veterans showed substantial improvement in post-concussion symptoms, such as headaches, cognitive function, increased brain flow, and improved quality of life. The cognitive gains were so incredible, the veterans achieved nearly a 15-point increase on IQ testing. In addition to treating the TBI, researchers saw improvement in PTSD symptoms as well.

Another study by Dr. Harch published in 2017, looked at 30 patients with post-concussion syndrome, with or without PTSD. After HBOT

treatments, veterans saw significant improvement in neurological exams, IQ, memory, attention, and quality of life. They also showed reduced levels of anxiety, PTSD, depression, and suicidal intent.

## **HBOT Receives Approval for TBI Treatment**

With other studies showing similar results, the Veterans Administration and Department of Defense have approved and will pay for hyperbaric oxygen and HBOT treatment for TBIs and PTSD in seven states (AL, FL, GA, MD, NJ, TX and OK) currently. There are 19 US Congressional Legislators that are currently encouraging the VA and DOD to use HBOT for TBIs and PTSD.

## **What Causes a TBI?**

A traumatic brain injury occurs when something disrupts normal brain function. This can occur by a simple blow to the head after a fall or when, for example, football players collide, helmet first, into each other on the field. The violent impact of the head on another object shakes the brain within the skull, causing damage. A TBI can also occur with an injury that pierces the skull and brain tissue. Statistics estimate 50 to 70 percent of TBIs occur in motor vehicle collisions. In children, 21 percent of TBIs occur during sports and recreational activities. In the military, active-duty personnel suffers from TBIs due to explosive blasts. It is believed that the pressure wave that occurs during a blast passes through the brain, resulting in a disruption of brain function. In infants, violent shaking leads to shaken baby syndrome and infant TBIs.

## **How to Assess and Diagnose a TBI**

In order to quickly assess a possible TBI, doctors and medical professionals use what is called the Glasgow Coma Scale. This scale looks at three categories: Eye-opening response, verbal response, and motor response. Points are given to each possible answer in each

category. The higher the points, the less severe the injury. In severe cases, CT scans and MRIs will look for bleeding in the brain, clots, bruised tissue, and swelling. According to the National Institute of Neurological Disorders and Stroke, a blood test was approved in February 2018. The Brain Trauma Indicator measures two proteins: UCH-L1 and GFAP. These proteins are released when an injury occurs in the brain. Elevated levels in this test can reveal brain damage with intracranial lesions, typically only found with a CT scan.

## The Stages of TBIs

There are three stages of TBIs: acute, subacute and chronic phases. The acute phase occurs within 24 hours of the initial injury. The subacute stage is the few days following the injury. The chronic stage occurs in the weeks, months and even years after the initial injury. New symptoms can develop in all of the stages, secondary to swelling and decreased oxygen in the brain.

## Symptoms of a Minor TBI

A mild TBI can occur from a simple fall or accident and, in many cases, a person may not experience any symptoms aside from a minor headache. In most cases, you will not lose consciousness, or may only lose consciousness for a few brief seconds when the injury occurs. However, other symptoms may occur with a minor TBI that you may not be aware of. These symptoms include:

- Headache
- Nausea or vomiting
- Difficulty with speech
- Dizziness or loss of balance
- Sleep disturbances – this can include fatigue, difficulty sleeping or sleeping more than normal
- Sensory disruptions – this can include blurred vision, sensitivity to light and sound, ringing in the ears, changes in taste, and changes in smell
- Cognitive Issues – memory loss, problems concentrating, mood changes, depression or feeling anxious

## Symptoms of a Moderate to Severe

# Traumatic Brain Injuries

Moderate to severe TBIs occur with more significant or traumatic injuries. While mild TBIs temporarily affect the brain tissue, moderate to severe injuries cause bruising in the brain, torn tissue, bleeding, and other physical complications. Those with a moderate to severe traumatic brain injury will experience the same symptoms as a mild case, but to a greater extent. Other symptoms can include:

- A loss of consciousness for a few minutes to hours, the possibility of coma
- Headache that continues to worsen and become more intense
- Seizures or convulsions
- Vomiting or nausea that will not go away
- Vision changes – dilated pupils, double vision, loss of eye movement, light sensitivity, and possible blindness
- Fluid loss – You may notice a clear fluid (cerebrospinal fluid) leaking from the nose or ears
- Inability to awaken from sleep
- Numbness and weakness in the fingers and toes
- Confusion and loss of coordination
- Behavioral changes – moodiness, agitation
- Changes in speech – you may notice slurred speech, an inability to understand words, inability to find the words you want to say.
- Droopy eyelids or facial weakness
- Loss of bowel or bladder control
- Decreased breathing rate with increased blood pressure

## Types of Injuries Seen with TBIs

When it comes to TBIs, many different traumas can occur to the skull and brain. Contusions and hematomas, often referred to as mass lesions, are areas of localized trauma to the area around the brain or the brain tissue. Hematomas are blood clots within the brain or on the surface. Common hematomas associated with TBIs include epidural hematomas that occur between the protective layer of the brain and the

skull or subdural hematomas that sit directly on the brain. Contusions are bruising of the brain tissue, where blood has leaked. In addition, hemorrhaging, or bleeding in the brain tissue, is also common.

Diffuse injuries are a little more complicated and often cannot be seen through testing or imaging. A diffuse axonal injury affects the axons in the nerve cells that enable communication. When these are injured, communication is interrupted or lost completely, often resulting in severe disability. Ischemia is an insufficient blood supply to the brain, often limiting the oxygen supply to the brain.

Skull fractures are common with TBIs. Simple breaks or cracks typically heal on their own. However, the biggest concern with skull fractures is when they break into the brain or occur at the base of the brain, near major nerves and arteries. Fractures near the sinuses can result in cerebrospinal fluid leaking out of the nose or ears. Additionally, depressed skull fractures press into the brain and often require surgery to relieve the pressure.

## **Complications Associated with Traumatic Brain Injuries (TBIs)**

Moderate to severe TBIs can result in prolonged or permanent changes. Because of this, the more severe the TBI, the greater the risk of these complications and long-term disabilities. Some complications may last for short periods, remain for a few months, or cause permanent damage.

### **These complications include:**

- **Changes in Consciousness** – A severe TBI can affect a person's level of consciousness. This includes a coma, vegetative state, and even brain death.
- **Seizures** – Seizures may develop and is referred to as post-traumatic epilepsy.
- **Infections** – When the skull fractures, tears damage the protective tissue around the brain, allowing bacteria to infect the tissue.
- **Hydrocephalus** – Cerebrospinal fluid builds up in the spaces around the brain, causing pressure and swelling.
- **Blood Vessel Damage** – Damage to the small and large vessels found in the brain can occur. This damage deprives the brain and surrounding tissues of oxygen.
- **Cranial Nerve Damage** – TBIs occurring at the base of the skull may

sustain cranial nerve damage. Damage to these nerves can result in a variety of complications, such as paralysis.

- Cognitive and Communication Problems
- Behavioral Changes – TBIs can often affect a person's emotional wellbeing and lead to behavioral changes. Conditions such as depression, anxiety, anger, difficulty with self-control, and an inability to handle social situations are common with severe TBIs.
- Degenerative Brain Diseases – Research shows that repeated TBIs increase the risk of degenerative brain diseases.

These symptoms can occur with moderate to severe TBIs and can last from a few weeks to a few months. Within this time-frame, it is considered persistent post-concussive symptoms. When symptoms last longer than a few weeks or become permanent, it is referred to as post-concussion syndrome.

## Traditional Treatments of Traumatic Brain Injury (TBI)

There is little that can be done to reverse the initial damage done to the brain from the injury. The focus of initial treatment for traumatic brain injuries (TBIs) is to stabilize the patient and focus on reducing any more trauma to the brain due to poor blood flow and oxygen deprivation. In mild cases of brain injury, rest and over-the-counter pain relievers are enough.

### In more severe cases, treatments vary and can include:

- Medications – Medications are administered to reduce the possibility of complications. Diuretics help to reduce the build-up of fluids in tissue and help reduce pressure on the brain. Because seizures are common with severe TBIs, anti-seizure medications are often given to reduce the risk of seizures. In severe cases where blood vessels are damaged and the oxygen supply is reduced, doctors may administer coma-inducing medications. The brain requires less oxygen when in a coma state.
- Surgery – Emergency surgery is often a necessary treatment in severe TBI cases to reduce damage to brain tissue. It may be necessary to remove blood clots that are putting pressure on the brain or repair skull fractures. Also to stop excessive bleeding in the brain or create a window in the skull to drain cerebrospinal fluid or allow more room for swelling.

- Rehabilitation – Rehabilitation occurs typically in severe cases where brain damage has affected normal function. Rehabilitation can include physiatrists, occupational therapy, physical therapy, speech and language therapy, neuropsychology, recreational therapists and much more.

## Take the Next Step in Your TBI Treatment Plan

If you or a family member experienced a traumatic brain injury (TBI) or suffer from post-concussion syndrome and want information about hyperbaric oxygen treatments and HBOT and how it may benefit you, give Dr. Spiegel and his team a call today. They will set up an initial consultation where Dr. Spiegel will go over your medical records and how HBOT can help to improve your quality of life. You may also visit [HERE](#) and fill out our online request form.

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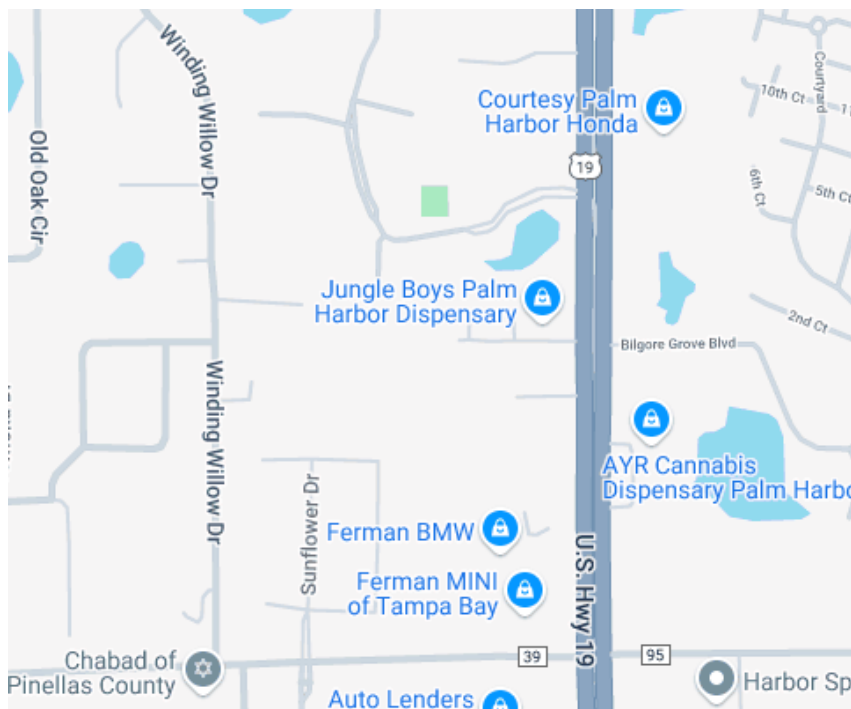
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