

WOUND HEALING

EXECUTIVE SUMMARY: Traditional medicine does not treat the physical wound to the brain. After a decade and a half of merely treating symptoms, DOD/VA lament the rise in suicides across the services. After billions spent on drugs, computer and device interventions, and questionable treatments, a suicide epidemic afflicts service members. Yet not one of the 80+ therapies/processes/procedures/devices, countless computer applications, and 114+ prescribed drugs has been approved by the FDA for TBI, nor do they "treat" wounds. All are used off-label for TBI. All are controversial at some level. Many of them are brand-new and haven't even been explored in the literature. No risk analysis has been performed, and no tracking is done. Yet neither the DOD nor the VA provide Hyperbaric Oxygen Therapy to treat and heal brain injury. HBOT is the one therapy proved by multiple clinical trials inside DOD/VA, across the US, and around the world to treat and help heal the wound to the brain, safely and effectively.

A wound will not heal without ENERGY and OXYGEN. A brain wound leads immediately to a "concussion cascade", a negative flow of adverse consequences that may lead to truly bad effects over time: diseases like Chronic Traumatic Encephalopathy (CTE), Alzheimer's, and other neurologic disorders. Symptoms may abate, but idling neurons may not recover without application of additional oxygen and energy delivered directly to the brain.

The use of Hyperbaric Oxygen addresses directly this negative cascade of damage and degeneration both in the acute phase of wound stabilization and in the acute and chronic phases of wound healing. Consider the known Mechanisms of Action or benefits of using HBOT for wound healing:

- Decreasing levels of inflammatory biochemicals
- Increased oxygenation to functioning mitochondria
- Increases in blood flow independent of new blood vessel formation
- Angiogenesis from the addition of oxygen: (growth of new blood vessels in the acute and chronic phases)
- Up-regulation of key antioxidant enzymes and decreasing oxidative stress
- Increased production of new mitochondria (the energy factories of the cells)
- Neurogenesis: (growth of new neuronal tissue and Remyelination during and after the treatments are completed)
- Bypassing functionally impaired hemoglobin molecules, the result of abnormal porphyrin production, thereby allowing increased delivery of oxygen directly to cells
- Improvement in immune and autoimmune system disorder
- Direct production of stem cells in the brain
- Increases in the production of stem cells in the bone marrow with transfer to the Central Nervous System

Current findings about substance abuse, and concussive brain and blast injury point to disruptions in cellular processes that may underlie long term impairment. **In a phrase,**

abuse of the body and brain can cause physical wounds which can't be seen, but which are accompanied by symptoms which can be observed. Physiological chaos in the head is linked to clinical characteristics of concussion: balance problems, migraine symptoms, cognitive impairment and numerous other observable and measurable dysfunctions. Treatments that can interrupt this damaging cascade of degeneration should be implemented immediately.

There is also increasing concern about the risk for chronic or even progressive neurobehavioral impairment after brain damage, as well as vulnerability to repeat injury. The current Concussion Protocol is born out of concern for such observables **but the protocol for concussions in place worldwide -- in DOD, the VA, military or civilian hospitals, the NFL, the NCAA or your local high school -- does nothing to address the physical wound. Similarly, treatments for substance abuse rarely if ever mention, must less address, the brain damage and the necessity to repair that damage while rehabilitation proceeds.**

Medicine has well-known explanations of the nature of wounds and the phases in wound healing. For example, the so-called "concussion cascade" that follows the wound to the head creates conditions that impede healing in the closed, unseen environment inside the skull. A concussion, just like substance abuse, begins a series of negative consequences. These can include tissue and nerve fiber ripping and tearing; inflammation; interrupted blood flow; oxygen starvation/hypoxia; cell death and cell stunning/inactivation. This insidious biological set of degenerative processes may or may not lead to permanent damage. This acute inflammation phase is the body's natural response to injury. After initial wounding, the blood vessels in the wound bed contract and a clot is formed. Blood vessels then dilate to allow essential cells, antibodies, white blood cells, growth factors, enzymes and nutrients to reach the wounded area. But it is this inflammation that impedes healing. Unlike with a wound that can be seen, there is solid evidence that this brain inflammation can continue and linger for a long time, impeding healing and increasing the likelihood that more physical damage is occurring and is likely to occur. HBOT counteracts this blood blockage, grows new blood vessels, and increase the amount of oxygen to the brain by 15-20 times.

It has been "common knowledge" that most concussions heal themselves. That is far too simplistic. The same is true for blast damage to the brain. What may be true is that symptoms may decrease. Yet damage that can lead to mental and emotional and social and physical and behavioral disability continues. Untreated brain wounds can lead to lifetime disability and chronic degeneration.



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