



Hyperbaric Oxygen Therapy Can Induce Angiogenesis and Regeneration of Nerve Fibers in Traumatic Brain Injury Patients

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Background: Recent clinical studies in stroke and traumatic brain injury (TBI) victims suffering chronic neurological injury present evidence that hyperbaric oxygen therapy (HBOT) can induce neuroplasticity.

Objective: To assess the neurotherapeutic effect of HBOT on prolonged post-concussion syndrome (PPCS) due to TBI, using brain microstructure imaging.

Methods: Fifteen patients afflicted with PPCS were treated with 60 daily HBOT sessions. Imaging evaluation was performed using Dynamic Susceptibility Contrast-Enhanced (DSC) and Diffusion Tensor Imaging (DTI) MR sequences. Cognitive evaluation was performed by an objective computerized battery (NeuroTrax).

Results: HBOT was initiated 6 months to 27 years (10.3 ± 3.2 years) from injury. After HBOT, DTI analysis showed significantly increased fractional anisotropy values and decreased mean diffusivity in both white and gray matter structures. In addition, the cerebral blood flow and volume were increased significantly. Clinically, HBOT induced significant improvement in the memory, executive functions, information processing speed and global cognitive scores.

Conclusions: The mechanisms by which HBOT induces brain neuroplasticity can be demonstrated by highly sensitive MRI techniques of DSC and DTI. HBOT can induce cerebral angiogenesis and improve both white and gray microstructures indicating regeneration of nerve fibers. The micro structural changes correlate with the neurocognitive improvements.

Keywords: hyperbaric oxygen, DTI, tractography, angiogenesis, MRI, perfusion, TBI, post-concussion

INTRODUCTION

Traumatic brain injury (TBI) is a significant public health concern in military and civilian populations (Chiu and LaPorte, 1993). The estimated number of TBI cases occurring each year is 10 million globally and 1.7–3.8 million in the United States alone. 75–90% of those are defined as mild TBI (mTBI) (Selassie et al., 2013; Marin et al., 2014).

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