Abstract

In 2014, a 26-year-old male was involved in a motor vehicle accident resulting in a severe traumatic brain injury (TBI). The patient sustained a closed head left temporal injury with coup contrecoup impact to the frontal region. The patient underwent a left side craniotomy and was comatose for 26 days. After gaining consciousness, he was discharged to a brain injury treatment center that worked with physical, speech, and occupational issues. He was discharged after eight months with significant speech, ambulation, and objective measures of functioning improvements for self-report data were used for self-report data and objective measures of functioning to evaluate changes in symptomology.

Case Presentation

A 26-year-old male was involved in a motor vehicle accident and sustained a closed left temporal TBI with coup contrecoup impact to the frontal regions. He was comatose for 26 days following a left-sided craniotomy. He displayed motor deficits, short-term memory loss, executive dysfunction, affect issues as well as Broca’s aphasia and post traumatic epilepsy. He engaged in speech therapy, physical therapy, and occupational therapy, as well as taking Lamotrigine for seizure activity.

The final EEG showed the patient’s alpha range increased to 6.5-11 Hz with a peak at 8.3 Hz. Sharp and slow wave activity was still detected at T3 and P5 (sites of injury), but no spike activity was detected. The final SPECT scan showed increased perfusion, primarily in the left corticocerebral hemisphere. There were still areas of diminished perfusion in the midline temporal and parietal areas, but cortical perfusion increased overall.

Results

EEG presentation showed spike activity at T3 and T5 as well as sharp and slow activity with mild diffuse slowing. The background alpha range was 6-10 Hz with a peak at 7.8 Hz in the posterior areas. Mu rhythm was noted at 8-9 Hz in the left midline area. SPECT scans showed globally diminished perfusion, primarily in the left hemisphere.

Discussion

NFB training contributed to functional improvements, primarily at F8, T3, and P3 sites of injury. Changes in symptomology correlated with the normalization of electrical activity seen with the treatment of NFB and neurogenesis seen with the treatment of HBOT.

By training the SMR rhythm, the patient’s seizure activity decreased significantly and changed from complex partial to simple partial seizures, demonstrating a possible treatment for posttraumatic epilepsy.

The patient’s language abilities improved by training both Wernicke’s area and the articulate fasciculus, subsequently improving the connection to and firing of Broca’s area, demonstrating possible interventions for language issues and aphasia.

By training the frontal lobe and hippocampal areas, the patient’s short term memory improved significantly.

The SCAN index and CNC demonstrated improvements in executive functioning. Normalization of the gamma waves was seen and prior research indicates that elevated and asynchronous gamma waves contribute to executive dysfunction. More research into training gamma waves could reveal a promising intervention for executive dysfunction following a TBI.

Conclusion

NFB contributed to the functional rewiring of neurological systems and the normalization of neurological electrical activity. HBOT contributed to increased perfusion, neurogenesis, and mitochondrial function within the brain. Additional research is needed, but combining these two treatment modalities demonstrates an effective, direct neurological intervention in the treatment of TBIs.

References


Fig. 2. Pre and post-NFB CNC evaluation.

Fig. 3. Post SPECT presentation.

Fig. 4. Pre EEG Presentation.

Fig. 5. Pre SPECT Presentation.

Fig. 6. Pre and post-NFB CNC evaluation.

Fig. 7. (A) Pre NFB/HBOT SCAN evaluation performed on 09/11/2018. (B) Post NFB/HBOT SCAN evaluation performed on 10/28/2021. (C) Pre- and Post NFB/HBOT SCAN raw data.

Fig. 8. Major improvements signified by pre- and post-NFB p-values derived from EEG data.

Fig. 9. (A) Pre-NFB/HBOT/SCAN evaluation performed on 09/11/2018. (B) Post-NFB/HBOT/SCAN evaluation performed on 10/28/2021. (C) Pre- and Post-NFB/SCCAN raw data.