Oculomotor Behavior of Acutely Concussed Patients undergoing Hyperbaric Oxygen Treatment

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Introduction

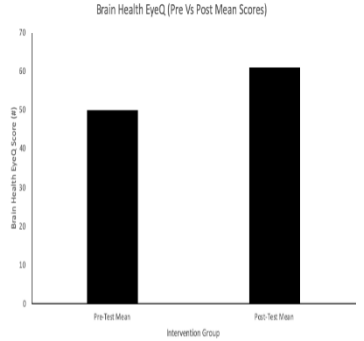
- Hyperbaric oxygen therapy (HBOT) – a promising new technique for treatment of TBI
  - Administration of oxygen at high pressure rates may reduce inflammation and speed up the brain's recovery time and healing process.
- New eye tracking technology, such as RightEye, offers an objective, reliable and quantifiable way of differentiating between individuals with different severities of TBI, and those without a TBI.

Methods

- 60 patients (47 males; 51 with a sports-related concussion), ages 8-19, treated with HBOT at Healing with Hyperbarics Clinic in Fargo, ND within 12 days after diagnosed concussion.
- Prior to treatment, the patients were assessed using the Acute Concussion Evaluation (ACE) checklist and the RightEye Brain Heath EyeQ.
- HBOT performed in a Sechrist mono-place chamber, pressurized with 100% oxygen using a protocol for acute concussions that factors length of time from injury, number of previous concussions and extent of symptoms and others.
- Treatments were given as frequently as four hours apart and ideally on consecutive days until the patient achieved a sustained symptom free (SSF) status, defined as a patient being back to pre-concussed daily activities.
- After the HBOT treatment, the Brain Health EyeQ measurements were repeated and the data were analyzed.

Results

- Significant mean differences on RightEye Brain Health EyeQ metrics pre and post HBOT treatment.
- The mean pre-treatment ACE score was 9 (range of 2-18) with headaches being the primary symptom in 85% of the subjects.
- 51 (85%) patients achieved SSF after an average of 4.4 treatments (range 2-17). 9 patients discontinued treatments prior to achieving SSF for various reasons.



Conclusion

- RightEye Brain Health EyeQ metrics showed a significant improvement in most eye movement behaviors for acutely concussed patients undergoing HBOT.
- Improved oculomotor behavior correlated with improved symptoms in most cases.
- This technology may help to provide objective evidence of the efficacy of early concussion interventions, such as HBOT.

RightEye Brain Health EyeQ Sample Metrics

Test	Metric	Pre-Test Mean	Post-Test Mean * - sig. at α =0.05	Effect Size
Brain Health EyeQ	Brain Health EyeQ Score	50	61*	0.284
Circular Smooth Pursuit	On Target Smooth Pursuit (%) - Both Eyes	49	59*	0.230
Horizontal Smooth Pursuit	Smooth Pursuit Efficiency - Left Eye (mm)	23	18*	
Vertical Smooth Pursuit	Eye Target Velocity Error - Left Eye (dps)	21	20*	0.019
Horizontal Saccades	Saccadic Velocity - Right Eye (dps)	59	51*	
Vertical Saccades	Saccadic Amplitude - Left Eye (mm)	187	183*	0.075
Fixation Stability	Depth (+/- mm)	-24	-2*	0.001
Choice Reaction Time	Reaction Time (ms)	1075	936*	0.190
Discriminate Reaction Time	Processing Speed (ms)	478	379*	

Future Directions

- Comparison of the rate of change in symptoms and oculomotor performance of concussed patients undergoing early HBOT intervention to a matched cohort control group that does not undergo HBOT treatment.
- Comparison of symptom and oculomotor outcomes of HBOT with a combined vision rehabilitation plus HBOT intervention for concussion.
- Addition of objective measure of vergences, electro-retinography, open-field autorefraction, optical coherence tomography, visual-evoked potential, and pupillometry.