

## Hyperbaric Oxygen Treatment In a Portable Chamber Improves Attention Span and Reaction Time in Patients with Acquired ADD

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### Introduction

Toxic chemical exposure (solvents, pesticides, mold toxins and others) can significantly affect brain function in children and adults. These effects may last for years after toxic exposure has ceased.<sup>1</sup>

In many of our patients, attention and reaction time become impaired. We have therefore suggested that Attention Deficit Disorder (ADD) can be acquired and thus develop *de novo* in a patient who had perfectly normal attention and reaction time before exposure. To test this assumption, we started evaluating our patients with a Test Of Variables of Attention (T.O.V.A).<sup>2</sup> We found that most of our patients indeed showed definite impairment.

In the past, we have shown that mild Hyperbaric Oxygen Therapy (mHBOT) significantly improves brain function as measured by SPECT brain scanning.<sup>3</sup> In this publication we describe T.O.V.A. as an indicator of attention and reaction time and evaluate the effect of mHBOT on those functions.

### Materials and Methods

All Patients selected for this study had a documented history of exposure to toxic chemicals (incl. mycotoxins) (Table 1) and underwent a T.O.V.A. test prior to mHBOT. This was given in the morning while the patient was comfortably seated in a quiet room and attended by a professional (O. Aguilera, M. D.) who instructed and observed the patient throughout the procedure. After ten consecutive sessions of mHBOT, the T.O.V.A. was repeated, again during the morning hours.

During T.O.V.A. testing, the patient sits in front of a computer screen which randomly brings up a square shape in two locations. Only when the square shape shows up in the upper center of the screen does the

patient push a button. If it shows up in the other location the patient should not push the button. This simple design measures the various categories displayed in Figures 1 through 10.

It is important to note that no learning takes place during T.O.V.A. testing which can therefore be repeated multiple times and remain valid. This is why we chose T.O.V.A. for this study. Finally, T.O.V.A. can be administered all the way from age four to advanced age.

T.O.V.A. constitutes a Continuous Performance Test (CPT).

Errors of omission are considered to be a measure of inattention and occur when the subject does not respond to the designated target. We have displayed this in our figures as a measure of attention.

Errors of commission are considered to be a measure of impulsivity and/or disinhibition and occur when the subject incorrectly responds to the non-target. We have displayed this in our figures as a measure of self-control.

Correct response time is the processing time (in msec) that it takes to respond correctly to a target. We have displayed this as reaction (quickness of response).

Response time standard deviation is considered to be a measure of variability or inconsistency and is the standard deviation of correct response times. We have displayed this in our figure as consistency.

Every individual T.O.V.A. test result is compared with a normal control population and expressed in a numerical fashion (see figures).

mHBOT was administered once or twice daily to a total of ten consecutive sessions, using a previously published protocol (1.3 ATA, 24% O<sub>2</sub>), in our portable chamber.<sup>3</sup>

Each treatment lasted one hour while the patient was reassured and observed by a trained technician.

Our portable chamber was previously discussed and shown on the cover of the published Proceedings of The 2nd International Symposium on Hyperbaric Oxygenation in Cerebral Palsy and The Brain Injured child.<sup>3</sup>

### Results

All Patients showed improvement after only ten sessions of mHBOT. Improvement was optimal when the patient had no more toxic exposure at all and was now living/working in a toxic-free environment.

As with SPECT brain scans<sup>3</sup>, T.O.V.A. showed further improvement when mHBOT was extended to a total of twenty or more sessions.

All patients reported subjective improvement which matched that of the T.O.V.A. results.

It should be noted that improvement was noted in several categories of performance.

### Discussion

Exposure to toxins, including mycotoxins, can lead to significant long-lasting impairment of brain function, often leading to temporary, even permanent disability. Typical complaints include impairment of short-term memory, intermittent disorientation, disturbed balance and coordination, inability to multi-task, and impairment of attention span and reaction time. This is seen in adults and also in the young.

While ADD is usually thought of as a disorder in the young, it certainly can occur in adults.<sup>4</sup> In our case it should be considered as acquired, i.e. secondary to toxic exposure.

In recent years, we have seen an increasing number of patients who were exposed to mold and mold tox-

