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Neurofeedback Training: Integration with Diet and Detoxification Programs

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ABSTRACT. *Introduction.* This is a single case-study of the evaluation and training with neurofeedback of a 51-year-old male presenting multiple insults: (a) stress-related disorders: high blood pressure (180/105 mmHg, medicated), arrhythmia, anxiety disorder (Beck-anxiety scale) and overlapping ADD symptomatology (based on DSM-IV questionnaire for ADD); (b) chronic toxic exposure to mercury; and (c) Verapamil, the calcium channel blocker, used for over two years significantly imbalanced the tissue content of calcium and magnesium.

Methods. Treatment design consisted of a diet and detoxification program in parallel with the neurofeedback training.

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Results and Discussion. Preliminary data suggest that: (a) biofeedback/neurofeedback is a positive factor in decreasing reliance on medications, (b) detoxification is a cofactor in helping rebuild neural networks that have been affected by chemical and/or trauma insults, and (c) the recovery has a long-term positive outcome and the peak performance achieved was an added benefit.

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KEYWORDS. Neurofeedback protocols, high blood pressure, arrhythmia, anxiety disorder, attention deficit disorder, peak performance, diet/detoxification program, trace mineral analysis, mercury toxicity

INTRODUCTION

In our practice we have met some complex patient cases with a multitude of physical, cognitive, and emotional dysfunctions. A limited therapeutic scheme often aggravated the outcome and did not resolve the patient's complaints. We found that (a) some psychiatric diagnoses have organic explanations, and (b) neurofeedback training progress seemed to be hampered by the underlining neural toxicities. Generally, immune suppression (Gasque, Jones, Singhrao, & Morgan, 1998; Gasque, Dean, McGreal, VanBeek, & Morgan, 2000) is a direct result of toxic exposures. Neuronal damage has also been demonstrated (Pfeiffer, 1987). Patients with toxic illnesses present neuro-physiological as well as other signs of brain stem involvement. Neurofeedback training coupled with a detoxification program has proven to be a powerful approach (Ibric, McCourt, & Baumzweiger, 2000). It is possible to combine treatment modalities in order to optimize the therapeutic effect. Detoxification is desirable in these cases (Englund et al., 1994). However, it is a multi-step process that requires not only removal of toxic material and/or residues, but also the reduction of neuronal damage and immune system dysfunction. Evaluation of the presence of toxins and the immune and hormonal dysfunctions has been done using blood, urine, cerebral-spinal fluid (CSF), and hair specimens, (hair trace mineral analysis, HTMA; Watts, 1995). Tuthill (1996) showed the correlation between hair minerals and ADD symptoms. Studying over 50,000 patients Davies et al. (1997) emphasized hair chromium levels in cardiovascular disease and Type II Diabetes Mellitus and the change in its

concentration with aging. Chronic toxic exposure to mercury from silver dental fillings may be an etiological factor in depression, anxiety and anger (Siblerud, Motl, & Kieholz, 1994). Our study is presenting the importance of a combined approach of neurofeedback coupled with diet and detoxification in the treatment of high blood pressure and arrhythmia, when chronic toxic exposure to mercury has been detected.

MATERIALS AND METHODS

Neurofeedback evaluation and training. Neurofeedback evaluation of three points electroencephalography (EEG) over the central sensory-motor area at C3, C4 and Cz positions, according to the 10/20 international electrodes positioning was done using Neurocybernetics instrument and the inter-hemispheric frontal beta and synchronization was done using Roshi/Brain Link[®]. A qualitative electroencephalogram (QEEG) evaluation was done eyes-open, eyes-closed, during serial 7 (counting backwards from 100 by 7's) and imagining drawing a picture. (More details about the training protocols are included in the results session.)

Cognitive testing. Cognitive testing was done using the Test of Variables of Attention (TOVA). TOVA was administered at the intake and after each group of 20 consecutive neurofeedback sessions. The standard scores were calculated against the standard norms and standard deviation from norms according to age and male population cohort, provided by Universal Attention Disorders, Inc.

Blood pressure and heart rate. An aneroid sphygmomanometer with stethoscope was used to measure the patient's blood pressure, before and after each neurofeedback session. Due to the patient's arrhythmia two minutes of heart rate was counted using a watch with second hand and averaged per minute.

Hair trace mineral analysis. HTMA was done by plasma mass spectrometry. Hair samples, first from the scalp, then from the pubic area were sent to Trace Elements, Inc. The analysis was performed as follows: each sample was prepared for analysis, weighed and placed in individual test tubes for digestion. The digestion process includes the addition of acids to the specimens that are then heated to speed up the digestion or dissolving process. After complete digestion of the protein matrix, only the mineral salts remain, which are then re-diluted and suspended for testing. Analysis was performed by inductively coupled

plasma-mass spectrometry (ICP-MS; Perkin Elmer Sciex, Élan 6100 Model). Laboratory equipment was calibrated before testing began and after every 12 specimens. Test results were then transferred to a database for graphic presentation. (Data are presented in calibration units.)

Detoxification program and dietary changes. Supplements were added and dietary adjustments were made according to the HTMA results (Watts, 1995). The mineral profile of this patient's metabolism was determined to be Fast 4. A Fast 4 metabolizer is characterized by increased sympathetic activity due to an overactive thyroid and adrenal glands, which in turn accelerate the cellular metabolism. To correct this exaggerated metabolism the diet and supplements were modified accordingly.

The diet was modified for Fast 4 metabolizer as follows: (a) increased intake of high purine protein food such as liver, kidney, tuna, sardine; (b) increased intake of milk, milk products and nuts; and (c) reduced intake of refined and unrefined carbohydrates. Specific supplements were prescribed for Fast 4 metabolizer that included calcium (Ca), magnesium (Mg), iron (Fe), copper (Cu), vitamins E and B6 as well as a combination of hormones and enzymes meant to act as catalytic adjusters. In addition to the dietary changes and supplemental regimen, six amalgam dental fillings were removed by a holistic dentist followed by oral chelation.

The oral chelation (meso 2,3-dimercaptosuccinic acid [DMSA]) consisting of 200 mg three times per week and progressing to 500 mg three times a week was completed over a year. Frequent 30-minute sauna sessions (dry heat at 120-140° F) three times a week on alternate days were also performed. After neurofeedback training and adjunct therapies the patient was able to double the time of exercise per day. His exercise consisted of a regimen program of Qi Gong, Chinese internal martial arts (i.e., Imperial Palace Ba Gua Chuan [circular power] and Hsing Yi Chuan [linear power]), as well as aerobic workouts on a Nordic Track ski machine. Diet was adjusted according to the HTMA results. (See details in the results section.)

RESULTS

The patient, a highly educated (conversant and literate in eleven languages) 51-year-old Caucasian male, was evaluated for stress related disorders, high blood pressure, arrhythmia and anxiety with overlap-

ping ADD symptomatology. Blood pressure (BP) at the intake was 150/90 (but he often had values as high as 180/105, even on 240 mg/24h Verapamil) and presented an irregular heartbeat (HRT = 56-63BPM).

Neurofeedback training was started three years ago. Over a year and a half this patient completed a total of 49 sessions (Table 1).

Twenty-six sessions, 30-minutes each, were first completed on Neurocybernetics, mainly done over the sensory motor area, at Cz or C4 positions, enhancing SMR (12 to 15 Hz) and concomitantly reducing theta (4 to 7 Hz) and high beta (22 to 30 Hz) frequencies. BP and HRT were checked before and after each session, and daily at home. BP post-training sessions showed constantly lower values for both systolic and diastolic pressure (see below).

After the first 26 sessions, the training was switched to Roshi/Brain-Link® AVS (Ibric & Davis, 1999, 2000, 2001) for another group of 25 sessions. Electrodes were placed over the F3/F4 positions of the

TABLE 1. Neurofeedback Training Sessions of a Male 51-53 Year Old and Its Effects on Neural Efficiency Index (NEI)

NF instrument/ Session no.	Electrode position	Brain wave enhanced and stabilized	Brain wave inhibited	Stimulation	Neural efficiency index (NEI)
Neurocyb./ Sessions 1-26	Cz or C4	SMR (12-15 Hz)	Theta (4-7 Hz) High beta (22-30 Hz)	No	NA
Roshi/ Sessions 27-34	F3/F4	B17/ Beta max (15-18 Hz)	Alpha (8-12 Hz), theta (4-7 Hz), High beta	Yes/CAM LCL-EEG	+3 to +16
Neurocyb./ Sessions 35-38	C4	SMR (12-15 Hz)	Theta (4-7 Hz) High beta (22-30 Hz)	NO	NA
Roshi/ Sessions 39-42	F3/F4	Beta (12-18 Hz)	AO [I] (8-12 Hz)	NO and Yes/CAM LCL-EEG	+9 to +3
Roshi/ Sessions 43-49	F3/F4	Sync (all frequency bands) Between F3 and F4	N/A	Yes/CAM LCL-EEG	+80 to +99

Abbreviations: NF, Neurofeedback; Neurocyb, Neurocybernetics Instrument; Roshi for Roshi/Brain Link®, CAM, Complex Adaptive Modality; AO [I], Alpha Only Inhibit; Sync, Synchronization protocol; NF LCL-EEG, or NF enhanced by light closed loop-EEG.

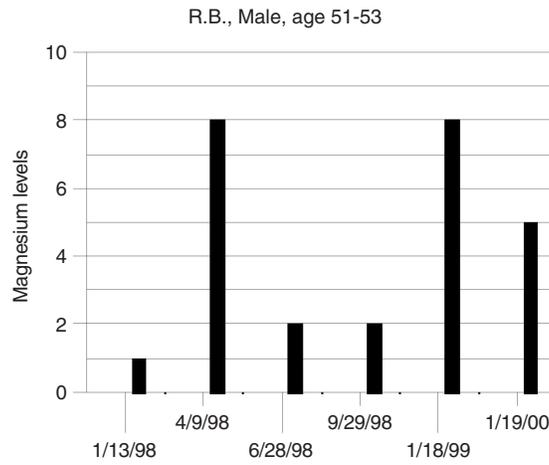
International 10/20 electrodes placement system and programs for inhibiting alpha (alpha only inhibit, AO [I]) or, enhancing B17 were set. Synchronization protocols were done as well over the frontal areas at F3 and F4 electrode positions. The neurofeedback training on Roshi/Brain-Link® has been enhanced by light closed loop-EEG presented in complex adaptive modality (CAM)®, originally designed by Charles Davis (Ibric & Davis, 1999, 2000, 2001; Roshi training manual). Roshi training resulted in an increase in beta as B17, measured by an increase in the neural efficiency index (NEI) from a low of plus 3 up to a maximum of plus 16. The alpha only inhibit, AO [I] protocol over the left and right frontal areas, at F3 and F4 positions, was followed by a lowering of the NEI from plus 9 to plus 3. Finally, using a synchronization protocol over the frontal area, the synchronization between the two electrodes as measured by NEI was increased from plus 80 to the maximum of plus 99, and stabilized.

The dietary/nutritional supplements/detoxification programs were monitored by repeated HTMA. Tests were initially run every three months followed by annual tests. Adjustments in supplementation were done where indicated. The baseline HTMA showed a high level of mercury (0.44 CU, normal under 0.1 CU) and lower Ca and Mg levels (1 CU and 13 CU, respectively, when normal values are 4 to 8 CU, and 28 to 56 CU, respectively). Other nutritional elements such as Fe, Co, Chromium (Cr), and Manganese (Mn) were significantly lower than normal.

Mg and Ca levels presented (Figures 1A and 1B, respectively) were very low at first, compared with the reference ranges. The initial low values of Ca of 13 CU and Mg 1 CU had metabolic implications. These out-of-range values had consequences reflected in the cardiovascular deregulations. Low Ca levels produce hyperactive thyroid and adrenal glands (Schauss, 1999). Also, low Mg concentrations are followed by an increase in the diastolic BP. Absolute Mg deficiency can increase the systolic BP by an increase of adrenal stress hormone (Watts, 1995). Mg is also very important in keeping healthy higher levels of HDL and lower LDL, and maintaining arterial resilience. Absolute Mn deficiency reflects in disturbance of protein, fat and energy metabolism (Schauss, 1999). The patient's arrhythmia and hypertension were therefore at least partially consequences of these low levels of Ca, Mg, and Mn. The dietary changes and supplements adjustments plus the detoxification program led to the correction of these important elements and the reduction of mercury (Table 2).

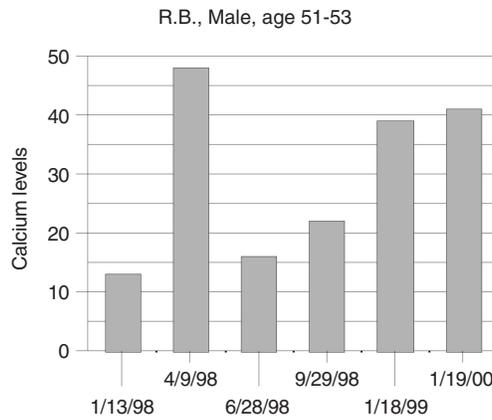
FIGURE 1. A and B. Changes in intracellular levels of magnesium and calcium, respectively, with time, diet changes and detoxification. Observe the lower levels of magnesium and calcium at the intake and the oscillations during the detoxification program, and their stabilization during the last year of neuro-feedback training and detoxification.

A.



Normal values, at reference range of 4-8 calibration units

B.



Normal values, at reference range 28-56 calibration units

After 15 sessions of neurofeedback and three months into the detoxification program, the patient gradually lowered Verapamil intake. He stopped it all together after six months. With the removal of Verapamil and correction of the diet, Ca and Mg levels improved and stabilized to normal. Heart rate and blood pressure stabilized and normalized, too. The changes in BP values (systolic and diastolic), pre-neurofeedback training, are presented in Figures 2A and 2B.

The BP means, pre- and post-neurofeedback training are presented in Figure 3. Changes, based on the “z” test, are statistically significant at $p < .001$, $n = 31$.

Three years since the neurofeedback and detoxification programs were started, the patient has sustained a normal BP and HRT without any medication. The patient’s cognitive test performance also improved, for response time (from 83 to 120) and variability (from 95 to 121) parameters (see Figure 4, TOVA). The improvements of the TOVA results were correlated to a lower anxiety level and a reduction in ADD symptoms (per ADD adult questionnaire).

Following the combined therapeutic scheme of neurofeedback training and detoxification, the patient experienced a lowering of his level of arousal, with a resulting reduction in anxiety. He also obtained a correction of his cardiovascular dysfunction, which allowed him to slowly reduce the blood pressure medication to zero (eliminating the adverse side effects). Overall the subject experienced increased mental, physical and psychological well-being. The patient noted a significant increase in his peak performance on Nordic Track, as stated below:

Prior to this neurofeedback experience, I completed an entire cycle of movement within the span of one second. (e.g., 60 complete cycles within one minute). After the Roshi training, I have been able to complete two entire NordicTrack cycles within the same time, all without any perceptible, additional effort, physical or emotional.

TABLE 2. Mercury (Hg) Level Changes with Detoxification Program

Time	Intake	3 mos	6 mos	9 mos	12 mos	24 mos
Hg *	0.44	0.34	0.28	0.06	0.04	0.04

*Hg levels are expressed in calibration units. Normal reference range is below 0.1 calibration units.

FIGURE 2A. Changes in blood pressure (BP) measurements pre-neurofeedback training and BP medication withdrawal during the detoxification program. BP is expressed in mmHg and Verapamil concentration in mg/24 hr.

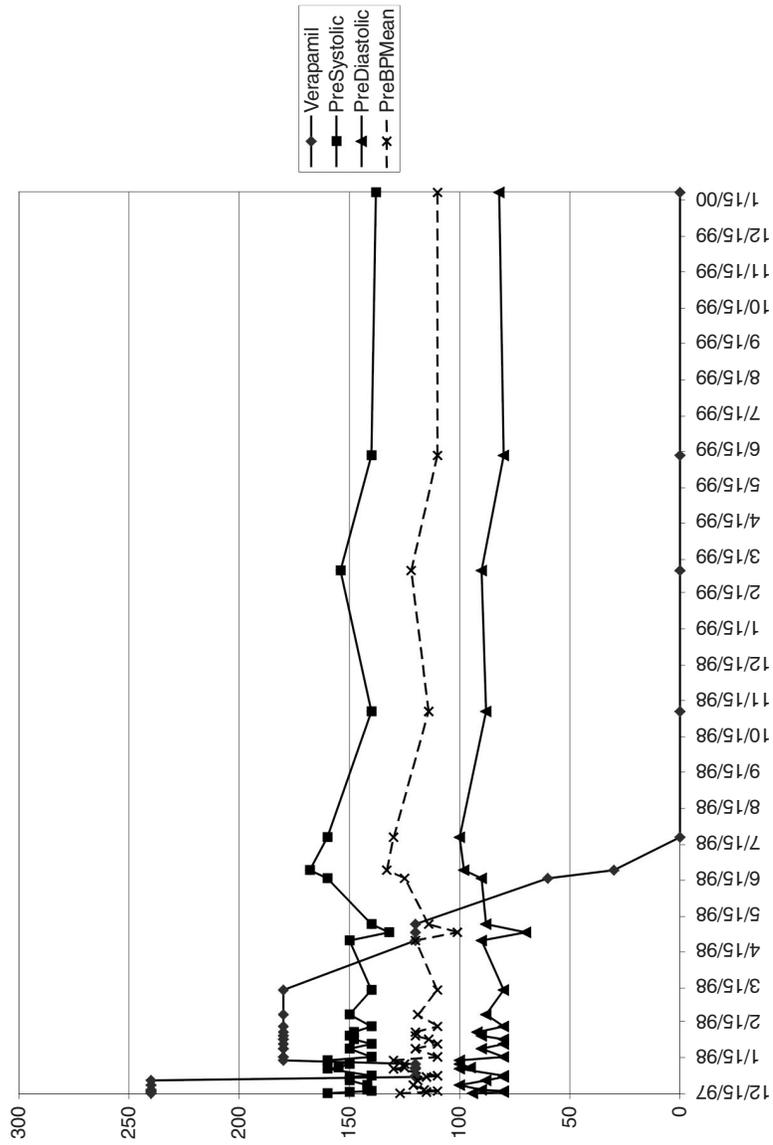


FIGURE 2B. Expansion of data from the first quarter of Figure 2A.

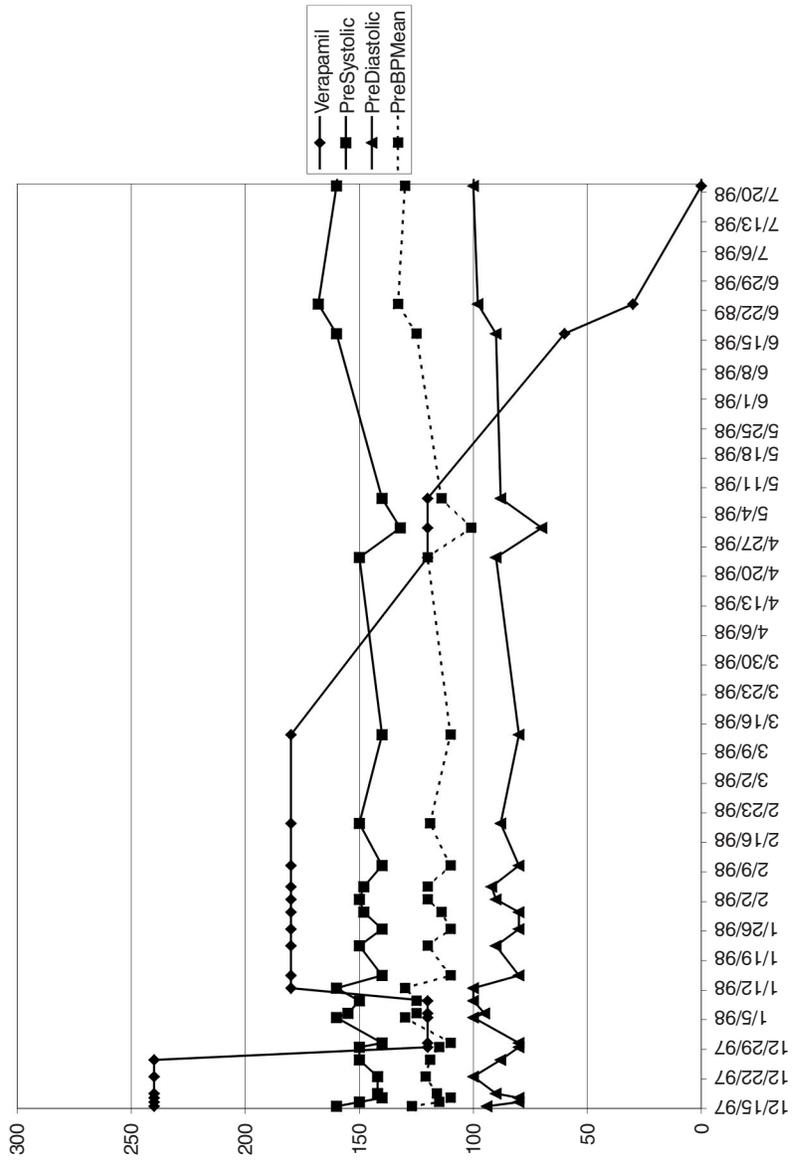


FIGURE 3. Significant changes in the blood pressure means pre and post neurofeedback training ($p < .001$, $n = 31$).

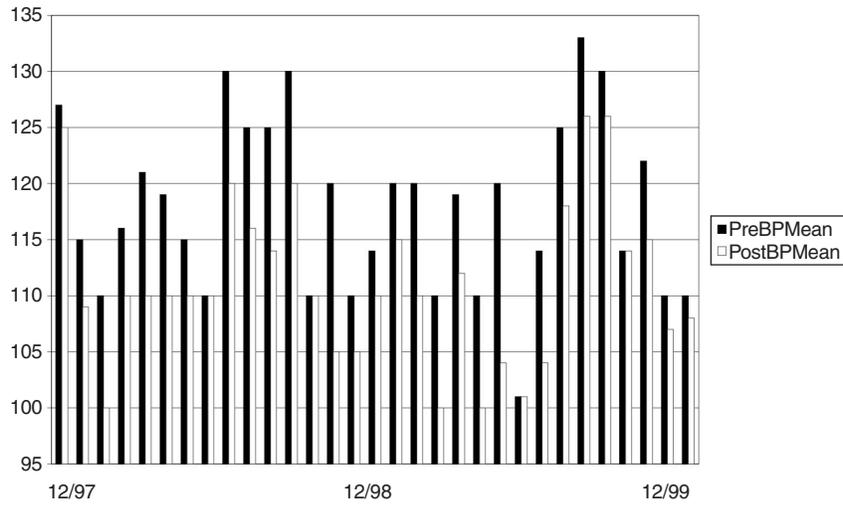
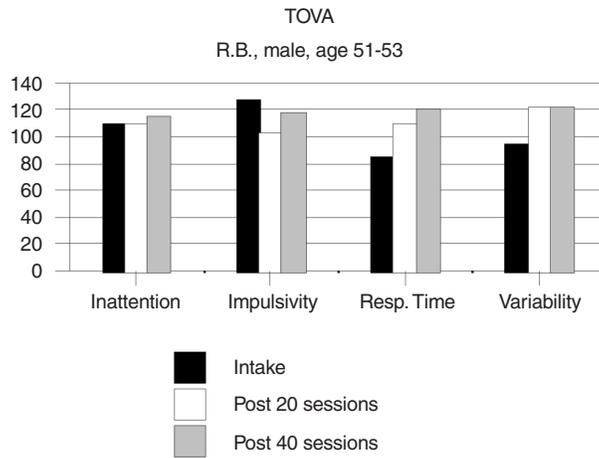


FIGURE 4. TOVA results at the intake and after 20 and 40 consecutive neurofeedback trainings. Observe constant improvements of all the parameters, particularly, response time and variability (normal standard scores: 90-110).



DISCUSSION

The most relevant component in the field of neurofeedback is the neuro-architectural reconstruction and repair of neural damage. Abnormal circuits can cause excess excitation or the destruction of circuits, cause low amplitudes of critical frequencies and low or hyper-coherence in the EEG. These abnormalities may be corrected or greatly reduced by the neuro-modulatory effect of neurofeedback training.

Exposure to toxic elements is usually followed by chronic inflammatory damage and damage to the neural control mechanism affecting major organs as well as damage to the circulatory and oxidative systems. These consequences must be reduced.

If there is evidence that toxic agents are still present in the body (blood, urine or hair), a detoxification program is warranted. Examples of detoxification are chelation therapy and saunas.

Neuronal excitation and inflammation are the direct result of toxic exposure. Neuro-protective and anti-inflammatory agents may be required (Ibric, McCourt, & Baumzweiger, 2000).

The cause of the immune imbalance may appear in certain laboratory tests related to the immune system. This immune imbalance that leads to central and peripheral inflammatory demyelination needs to be reduced.

CONCLUSIONS

Hypertension, as a disease due to stress and enhanced sympathetic arousal has been treated in the past with general biofeedback, relaxation techniques, and temperature training (Blanchard et al., 1996). Previously, we reported positive results using neurofeedback training with hypertensive patients (Ibric & Grierson, 1995; Ibric, 1996). However, hypertension can be caused by high level of mercury. Cloarec, Deschenes, Sagnier, Rolland, and Nivet (1995) reported that an infant developed hypertension after acute exposure to mercury vapors. The toxicity in this case was eliminated by chelation therapy.

Chronic exposure to mercury released from silver dental fillings may also produce depression, anxiety and excessive anger as mentioned by Sibley et al. (1994). In another clinical trial, 14 days exposure to dimercaptosuccinic acid (DMSA) produced an initial increase in urinary mercury excretion by 65 percent and one statistical significant effect was a decrease in fatigue-inertia in the DMSA group versus the

placebo group (Englund et al., 1994). However, the short time exposure to DMSA did not produce any major changes in depression or in the mood disorder.

Our preliminary data suggest that: (a) biofeedback and neurofeedback is instrumental in decreasing reliance on medications, (b) neurofeedback, probably through neuro-modulation, is useful in rebuilding neural networks that have been affected by chemical and/or traumatic insults, and (c) detoxification and dietary changes are required adjustments in patients who have been exposed to neurotoxic insults.

We emphasize that in order to establish the new operant conditioning a certain number of sessions are required for stability (which may vary from one patient to another).

In this report, we observed that specificity in planning the biofeedback training combined with detoxification and dietary programs are very important in obtaining successful outcomes in treating hypertension. Therefore, this paper points out the necessity for neurofeedback therapists to collaborate with other types of practitioners to resolve complicated medical, physiological and psychological cases to achieve more comprehensive and lasting results.

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