ALPHA-THETA BRAINWAVE NEUROFEEDBACK TRAINING: AN EFFECTIVE TREATMENT FOR MALE AND FEMALE ALCOHOLICS WITH DEPRESSIVE SYMPTOMS

ELLEN SAXBY
The Biofeedback Center
Pacific Grove, California

EUGENE G. PENISTON
Sam Rayburn Memorial Veterans Center
Bonham, Texas

This was an experimental study of 14 alcoholic outpatients using the Peniston and Kulkosky (1989, 1991) brainwave treatment protocol for alcohol abuse. After temperature biofeedback pretraining, experimental subjects completed 20 40-minute sessions of alpha-theta brainwave neurofeedback training (BWNT). Experimentally treated alcoholics with depressive syndrome showed sharp reductions in self-assessed depression (Beck's Depression Inventory). On the Millon Clinical Multiaxial Inventory-I, the experimental subjects showed significant decreases on the BR scores: schizoid, avoidant, dependent, histrionic, passive-aggression, schizotypal, borderline, anxiety, somatoform, hypomanic, dysthmic, alcohol abuse, drug abuse, psychotic thinking, and psychotic depression. Twenty-one-month follow-up data indicated sustained prevention of relapse in alcoholics who completed BWNT.

Peniston and Kulkosky (1989, 1990, 1991) have demonstrated efficacy of alpha-theta brainwave neuro-feedback therapy (BWNT) in the treatment of alcoholics. In randomized controlled studies on alcohol abuse, given electroencephalogram (EEG) brainwave alpha-theta training, a biofeedback technique used to learn control of particular brainwaves, chronic alcoholics showed significant increased percentage of alpha and theta brainwaves in the EEG record, and increased alpha rhythm amplitudes posttraining (Peniston & Kulkosky, 1989, 1990, 1991) in comparison with alcoholic and nonalcoholic controls.

These changes were associated with reductions in depression, serum beta-endorphin levels, anxiety, and other personality changes (Peniston & Kulkosky, 1989, 1990, 1991).

In brief, alpha brainwaves of frequency 8-12 Hz were said to be connected with feelings of well being, and theta brainwaves of frequency 4-7 Hz were associated with the pre-sleep or day-dreaming state in which spontaneous hypnagogic imagery (Green, Green, & Walters, 1970) and/or abreaction (i.e., traumatic anxiety-provoking events) arose (Peniston & Kulkosky, 1991; Peniston, Marrinan, Deming, & Kulkosky, 1993). Beta brainwaves of 13-20 + Hz have been associated with concentration or anxiety and confusion; Delta brainwaves indicate sleep.

Peniston and Kulkosky (1989) developed their novel treatment protocol based on the work of others who had provided some evidence that the eyes-closed relaxed EEG of alcoholics shows deficient alpha activity and decreased amplitudes and increased latencies in some subwaves of event-related potentials (Elmasian, Neville, Woods, Schuckit, & Bloom, 1982; Gabrelli et al., 1982; Porjesz & Begleiter, 1983; Propping, Kruger, & Mark, 1981).

These findings suggest that some persons with a predisposition to develop alcoholism are characterized by deficient alpha activity compared to controls (Funderburk, 1949; Funkhauser, Nagler, & Walke, 1953; Gabrielli et al., 1982; Vogel, Schalt, Kruger, Propping, & Lihnert, 1979).

Special thanks to Paul J. Kulkosky, Ph.D., Statistical Consultant, Psychology Department, University of Southern Colorado, for his assistance.

Reprint requests should be addressed to Ellen Saxby, R.N., The Biofeedback Center, Pacific Grove, CA 93950.

Several recent studies indicate that the Peniston and Kulkosky alpha-theta brainwave neuro-feedback therapy proved to be very effective, particularly in achieving abstinence for those individuals who complete this protocol and can no longer physically tolerate alcohol abuse (Blackman-Miroff, 1993; Boeving, 1993; Byers, 1992; Fahrion, Walters, Coyne, & Allen, 1992; A. Kelly, 1993; M. Kelley, 1991; Ochs, 1992; Peniston & Kulkosky, 1991; Sealy, Bernstein, & Magid, 1991; Sullivan, 1993; White, 1993; Wuttke, 1992).

The purpose of this initial study was (1) to evaluate further the protocol of Peniston and Kulkosky (1989, 1990, 1991); (2) to evaluate personality changes in chronic alcohol patients after BWNT; and (3) to determine whether this protocol could be implemented in a private group practice with an already established outpatient treatment program for alcohol abuse.

METHOD

Subjects

Subjects were 14 individuals (8 males and 6 females) with a 17.30 year history of chronic alcohol abuse and depression who had been treated using brainwave neuro-feedback therapy. The present study will focus primarily on personality changes, self-assessed depression, and abstinence for those individuals who completed BWNT. The data from both (male and female) subjects were combined for the purposes of statistical analysis. All subjects gave their informed consent to participate in this study. The rationale for the subjects' participation in the study included statements on the informed consent form that the purpose of the study was to determine whether BWNT was a major factor that contributes significantly to personality changes and abstinence of individuals with alcohol abuse and depression (Peniston & Kulkosky, 1989, 1990, 1991).

The subjects were selected randomly from a population of alcohol abuse outpatients evaluated for treatment of the aforementioned psychiatric disorder treated at the Biofeedback Center. The subjects were selected on the basis of the following criteria: (a) diagnosis of alcohol dependence as defined by DSM-III-R (American Psychiatric Association, 1987); (b) no evidence of psychotic symptomology (i.e., hallucinations or delusions); and (c) no known organic dysfunction. All subjects were given the Peniston and Kulkosky (1989, 1990, 1991) BWNT protocol for alcohol abuse.

These alpha-theta brainwave therapy subjects had a mean chronological age of 48.38 years (SD = 8.19) and a mean alcoholic history of 17.30 (SD = 6.30).

Dependent Measures

Beck Depression Inventory (BDI). Each participating subject was asked to respond to a self-report measure designed to assess depression prior to and after completion of neuro-feedback therapy. The BDI (Beck et al., 1961) is designed to assess the severity of a variety of symptoms of depression. Each of the 21 items consists of four sentences, and the subject is instructed to choose the one that best describes him- or herself at the present time. Each set of sentences describes symptoms of depression, which ranged from normalcy to severe clinically significant symptoms. Each item is scored from 1 to 4, which results in a range of scores from 21 to 84. Limits of severity are based on mean scores (i.e., normal range below 50, mild to minimal depression 50-59, moderate to marked depression 60-69, severe to extreme depression 70 and over). BDI has been used widely in research studies that have investigated individual differences in severity of levels of depression (Dorus, Kennedy, Gibbons, & Ravi, 1987; Hengeveld, Ancion, & Rooifmans, 1987; Steer, Beck, & Shaw, 1985; Steer, McElroy, & Beck, 1993).

Millon Clinical Multiaxial Inventory (MCMI-1). Each subject was requested to complete the MCMI, an objective personality inventory. The test consists of 175 true-false items, takes 15-25 minutes to administer, and requires an eighth-grade reading skill

(Millon, 1983). Base rate (BR) scores are provided for eight basic personality patterns (i.e., schizoid, avoidant, dependent, histrionic, narcissistic, antisocial, compulsive, and passive-aggressive), three pathological personality disorders (i.e., schizotypal, borderline, and paranoid), and nine clinical syndromes (i.e., anxiety, somatoform, hypomania, dysthymia, alcohol abuse, drug abuse, psychotic thinking, psychotic depression, psychotic delusion). In addition, there are two correction scales that provide identification and adjustment of possible test-taking distortion. Interpretations are based on the presence (BR scores over 74) or prominence (over 84) of specific scale elevations.

Apparatus

A T808A Feedback Thermometer (Bio-logic Device Inc.) was used to measure subjects' temperatures and to provide audio feedback. Audio feedback was in the form of a beep tone that rose in pitch as subjects' temperatures increased and that lowered in pitch to corresponding decreases in temperature. The thermometer data collected were in the form of degrees Fahrenheit using a T808A Feedback Thermometer. The thermometer supplied a digital record of summated temperature activity during each 30-minute session.

The Cap Scan Prism Five (American Biotec Corp., Ossining, NY) is a four-channel electroencephalograph (EEG) system that is fully computerized to provide a brain mapping visual display system as well as a conventional EEG recording system. The system is a low noise, four-channel, balanced differential system with two active commons, including a one-channel, electrically isolated AC amplifier and differential input. The Cap Scan Prism Five was used to measure the subjects': (1) brainwave activity; (2) to provide audio and visual feedback; (3) frequency and amplitude per 1-second epoch; and (4) percentage of time above threshold by band width. The Cap Scan Prism Five detects information in raw EEG by using three active band-pass filters. Alpha (8-to-13 Hz), beta (13-to-26 Hz), and theta (4-to-8 Hz) rhythms are detected by filters with 71db per octave attenuation rates. The audiovisual feedback unit of the instrument contained an individually controlled tone generator. The microvolt levels for each of these band-pass filters were controlled independently, and different individual tones provided audio feedback for the alpha, beta, or theta frequencies. An adjustable artifact inhibit detection circuity stops all feedback tones when the artifact (i.e., EMG from eye movement or other muscle signals) exceeds the selected artifact inhibit amplitude threshold. The audio feedback threshold for each frequency band (alpha, beta, and theta) was displayed as a color coded horizontal line and was adjusted before each training session. Only alpha and theta band widths were fed back simultaneously to the subject using distinctly different notes that make up a musical chord.

Brainwave Training Procedures

The training protocol described by Peniston and Kulkosky (1989, 1990, 1991) was followed in detail, beginning with thermal biofeedback-assisted autogenic training (Green & Green, 1977), followed by one session for constructing images for visualization and 20 40-minute BWNT sessions.

Subjects were instructed to sit in a comfortable reclining chair and to relax with eyes closed. During the pretraining session, the Medical Psychotherapist (MP) collected an index of autonomic activity by attaching a temperature sensor to the tip of the finger of the subject's dominant hand with micropore tape. The MP then introduced autogenic training exercises and rhythmic breathing techniques in order to induce relaxation of the body and to quiet the mind. Audio feedback was in the form of a beep tone that rose in pitch as subjects' temperatures increased and that lowered in pitch to corresponding decreases in temperature. The thermometer data were collected in the form of degrees Fahrenheit (°F) using a T808A Feedback Thermometer (Bio-Logic Device Incorp.). During the following four consecutive days, the subjects practiced temperature biofeedback-assisted autogenic training and rhythmic breathing techniques until the hand could be warmed to more than 94°F and held at that point during a session. Practice of temperature self-regulation was continued over four sessions until the subject could warm the hand to 94°F or above. Hand temperature data also were monitored/collected during each of the 20th BWNT sessions.

After thermal training, but prior to beginning BWNT, one session was devoted to construction of images of turning away from alcohol intake in situations relevant to the clients' previous drinking behavior, and images of increasing brainwave amplitudes (Kutner & Zahourek, 1989). Images were constructed in the words of the client for alcohol rejection, abstinence, and positive handling of personality and social issues in their lives. During both pretraining and BWNT training sessions, earlobes and the area around the inion were cleaned with alcohol prior to attaching the EEG electrodes. Hewlett-Packard Redux Paste was rubbed into the scalp at electrode sites to decrease skin resistance and used as a conduction medium to fill the cups of the silver-chloride electrodes. The 01 location was used for brainwave training from the first through the twentieth neuro-feedback session. An occipital electrode (01) was attached and held in place approximately 1 cm above and 1 cm left of the inion using a velcro headband. Two earclip electrodes were attached with the active electrode (01) referenced to the left earlobe (A1) and the ground electrode on the right earlobe (A2). A monopolar placement was used to prevent the differential amplifier from eliminating signals of interest that would be in common at two (bipolar) active sites in order to allow accurate, valid determination of waveform amplitude. The electrode assembly was connected to the appropriate input on the back of the Cap Scan Unit. Before recording commenced, electrode impedance was checked, and electrodes were reapplied if necessary. BWNT then was conducted as previously described by Peniston and Kulkosky (1989, 1990, 1991).

At the end of each BWNT session, the Medical Psychotherapist conducted a clinical interview to review the subject's verbal report on any visual/auditory images that were experienced during the BWNT session. The above-mentioned procedures were employed throughout each of the 20 40-minute BWNT sessions.

Data collection for this initial study was terminated at the end of the twentieth 40-minute session. The subjects were readministered the BDI and MCMI personality measures. These data (pre- and post measures), in conjunction with the 40-minute BWNT sessions, were analyzed with repeated measures analyses of variance at an alpha significance level of $p < .05$.

Follow-up Study

All 14 subjects and their informers (i.e., wives, husbands, family members, etc.) were contacted by telephone at monthly intervals for 21 months after completion of BWNT. To determine the long-term effects of EEG alpha-theta brainwave training, subjects and informers were asked to report instances of relapse of alcohol.

Results

Beck Depression Inventory (BDI) Scores

Figure 1 depicts mean (Standard Error [SE]) scores on Beck's Depression Inventory (BDI) before and after treatment for the experimental subjects. A repeated measures analysis of variance (ANOVA) revealed a significant main effect of testing time (pre vs. post) on BDI scores, $F(1,13) = 121.03$, $p < .05$.

On the pretest, the experimental subjects had significantly higher BDI scores than on the posttest BDI scores ($p < .05$). The experimental subjects showed a significant decrease in their BDI scores after treatment.

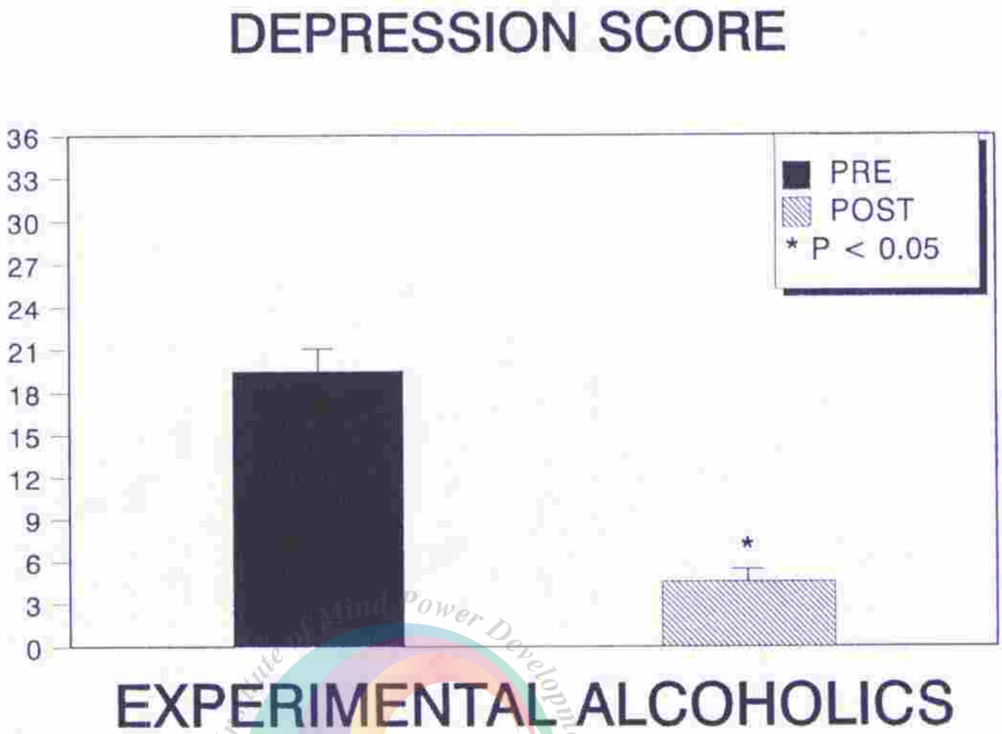

FIG. 1. BDI mean scores on Beck's Depressive Inventory for the experimental subjects, before and after alpha-theta brainwave treatment.

Millon Clinical Multiaxial Inventory (MCMI-I)

Mean (+ standard error, SE) MCMI BR scores on 20 personality and clinical syndrome scales of the experimental alcoholic subjects are displayed in Figure 2. On Scale 1 (DSM-III parallel: schizoid), analysis revealed a significant main effect of testing time (pre vs. post) on MCMI BR scores, $F(1,13) = 9.44$, $p < .05$. On the pretest, the experimental subjects had significantly higher pretest schizoid BR scores than on the posttest BR scores. On scale 2 (DSM-III parallel: avoidant), there was a significant main effect of testing time (pre vs. post) on MCMI BR scores, $F(1,13) = 29.94$, $p < .05$. The experimental alcoholic subjects showed a significant decrease across repeated testing. On scale 3 (DSM-III parallel: dependent), there was a significant main effect of testing time (pre vs. post) on MCMI BR scores, $F(1,13) = 10.10$, $p < .05$. The experimental subjects showed a reliable decrease in BR scores across repeated testing. On scale 4 (DSM-III parallel: histrionic), there was a significant main effect of testing time (pre vs. post) on MCMI BR scores, $F(1,13) = 13.88$, $p < .05$. The experimental subjects showed significantly higher pretest histrionic BR scores than on the posttest BR scores, $p < .05$. There were no significant main effects of testing time (pre vs. post) on MCMI BR scores found on scales 5 (DSM-III parallel: narcissistic), 6 (DSM-III parallel: antisocial), and 7 (DSM-III parallel: compulsive), $p > .05$. On scale 8 (DSM-III parallel: passive aggression), there was a significant main effect of testing time (pre vs. post) on MCMI BR scores, $F(1,13) = 17.20$, $p < .05$. The subjects showed a significant decline in BR scores across repeated testing. On scale 9 (DSM-III parallel: schizotypal), analysis revealed a significant main effect of testing time (pre vs. post) on MCMI BR scores, $F(1,13) = 8.69$,

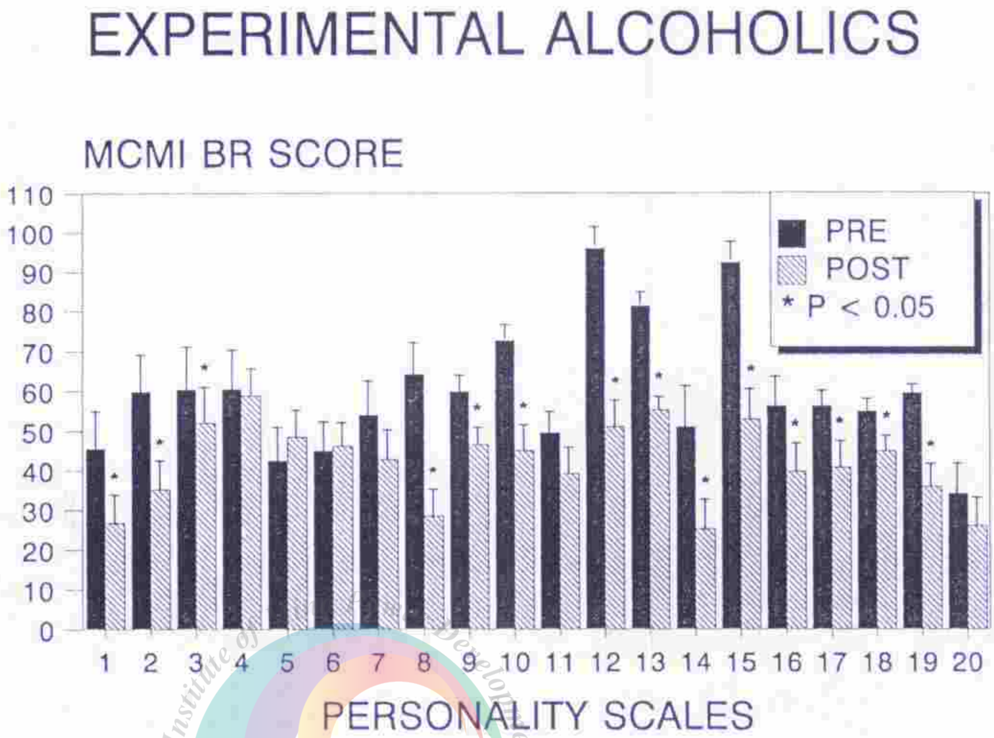

FIG. 2. MCMI BR scores of the experimental alcoholic subjects on 20 scales, before and after alpha-theta brainwave treatment.

$p < .05$. The subjects showed a reliable decrease in schizotypal BR scores across repeated testing. On scale 10 (DSM-III parallel: borderline), there was a significant main effect of testing time (pre vs. post) on MCMI BR scores, $F(1,13) = 22.81$, $p < .05$. The experimental alcoholic subjects' pretest BR scores were higher than on the posttest borderline BR scores. There was no significant main effect of testing time (pre vs. post) on MCMI BR scores found on scale 11 (DSM-III parallel: paranoid), $p > .05$. On scale 12 (DSM-III parallel: anxiety), there was on a significant main effect of testing time (pre vs. post) on MCMI BR scores, $F(1,13) = 28.06$, $p < .05$. The experimental subjects showed a significant decrease in BR scores across repeated testing. On scale 13 (DSM-III parallel: somatoform), there was a significant main effect of testing time (pre vs. post) on MCMI BR scores, $F(1,13) = 27.04$, $p < .05$. The subjects showed a reliable decrease in BR scores across repeated testing. On scale 14 (DSM-III parallel: hypomanic), there was a significant main effect of testing time (pre vs. post) on MCMI BS scores, $F(1,13) = 18.59$, $p < .05$. On the hypomanic scale, the subjects showed a significant decline in BR scores across repeated testing. On scale 15 (DSM-III parallel: dysthymic), there was a significant main effect of testing time (pre vs. post) on MCMI BR scores, $F(1,13) = 27.74$, $p < .05$. Analysis revealed that the experimental subjects showed a significant decrease in BR scores across repeated testing. On scale 16 (DSM-III parallel: alcohol abuse), there was a significant main effect of testing time (pre vs. post) on MCMI BR scores, $F(1,13) = 6.97$, $p < .05$. The alcoholic subjects showed a reliable decrease in BR scores across repeated testing. On scale 17 (DSM-III parallel: drug abuse), there was a significant main effect of testing time (pre vs. post) on MCMI BR scores, $F(1,13) = 8.48$,

$p < .05$. The subjects showed a significant decrease in BR scores across repeated testing. On scale 18 (DSM-III parallel: psychotic thinking), analysis revealed a significant main effect of testing time (pre vs. post) on MCMI BR scores, $F(1,13) = 8.80$, $p < .05$. On scale 19 (DSM-III parallel: psychotic depression), there was a significant main effect of testing time (pre vs. post) on MCMI BR scores, $F(1,13) = 16.13$, $p < .05$. Analysis revealed that the experimental subjects showed a reliable decrease in BR scores across repeated testing. There was no significant main effect found of testing time (pre vs. post) on MCMI BR scores on scale 20 (DSM-III parallel: psychotic delusion), $p > .05$.

To summarize these data, the experimental subjects showed decreases in BR scores across repeated testing on scales 1, 2, 3, 4, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, and 20.

Follow-Up Reports

Table 1 displays counts of alcohol relapse of BWNT outpatients 21 months after training. Only 1 of the 14 experimental clients had relapsed by 21 months after training, which demonstrated a 92% efficiency rate.

Table 1
Twenty-one Month Follow-up Study

	Alcohol relapse	No relapse
N	1	13

Number of patients who showed relapse of alcohol 21 months after BWNT training.

Discussion

The observed results substantially confirm the reports of Peniston and Kulkosky (1989, 1990, 1991) studies that investigated the prevalence and nature of psychopathology, and other personality characteristics, and the outcome of EEG alpha-theta brainwave treatment among chronic alcoholics, using data from the self-rated depression inventory and the MCMI. Implications of the results are relatively straightforward. Depression as indexed by Beck's Depression Inventory (BDI) was reduced significantly after BWNT. Brainwave training is associated with a sharp reduction in self-assessed depression. Results of the BDI are validated by corresponding changes in MCMI and MMPI scales (Blackman-Miroff, 1993; Byers, 1992; Fahrion et al., 1992; Peniston & Kulkosky, 1989, 1990, 1991; White, 1993). The results of the current study documented that the highest mean MCMI BR scores (over 70) of alcoholics were on the pathological personality disorder scale for borderline and the clinical syndrome scales for anxiety, somatoform, and dysthymic. Some of these findings of elevated scores on the personality scales and clinical syndrome scales were similar to those reported by Craig, Verinis, and Wexler (1985), Flynn and McMahon (1984), Marsh, Stile, Stoughton, and Trout-Landen (1988), Millon (1983), and Peniston and Kulkosky (1990).

The analysis of these data clearly shows that administration of EEG alpha-theta brainwave training and associated relaxation therapies to the experimentally treated alcoholic subjects was accompanied by significantly decreased personality variable scores on scales 1 (schizoid), 2 (avoidant), 3 (dependent), 4 (histrionic), 8 (passive-aggressive), 9 (schizotypal), 10 (borderline), 12 (anxiety), 13 (somatoform), 14 (hypomanic), 15 (dysthymic), 16 (alcohol abuse), 17 (drug abuse), 18 (psychotic thinking), and 19 (psychotic depression). The experimental subjects who received the EEG alpha-theta brainwave training program showed significant decreases on their MCMI personality scales (1, 2, 3, 4, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19), which is a definite indication of the therapeutic effectiveness of the combination of temperature biofeedback-assisted autogenic training, respiratory training, guided imagery, and brainwave training in treatment of alcoholic personality dynamics. Further, the significant differences and changes on MCMI scales 15 (dysthymic) in the experimental alcoholic subjects are paralleled by very similar differences and changes on the BDI (Blackman-Miroff, 1993; Byers, 1992; Fahrion et al., 1992; Peniston & Kulkosky, 1989; White, 1993).

The results of the follow-up study showed that most of the experimental subjects were maintaining abstinence and preventing alcoholic relapse during this period. Only 1 of the 14 subjects reported a relapse after a 21-month follow-up period. The above subject elected to undergo a booster BWNT session and has remained abstinent for better than 13 months. These results indicate a 92% efficiency rate and provide supportive evidence that the experimental subjects' response to BWNT resulted in moderately long-term prevention of relapse.

In summary, the above results are confirmatory evidence of the Peniston and Kulkosky (1989, 1990, 1991) research studies that produced fundamental changes in personality variables. These changes correspond to changes in MCMI personality scales and self-assessed depression on Beck's Depression Inventory (Peniston & Kulkosky, 1989, 1990). These changes correspond with a prolonged prevention of relapse in the experimentally treated alcoholics. Therefore, we have provided additional evidence that the BWNT treatment package for experimental alcohol subjects is an effective therapeutic approach to alcoholism and depression. These results should encourage large-scale investigations of its long-term efficacy and its mechanism of therapeutic effects. Thus, future studies should address the relative contributions of each therapeutic procedure to the outcome, as well as the possible roles of demand characteristics imposed by statements of purpose on the informed consent form, placebo, and Hawthorne effects.

References

American Psychiatric Association (1987). *Diagnostic and statistical manual of mental disorders* (3rd ed. rev.). Washington: Author.

Beck, A. T., Ward, C. H., Mendelson, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry, 4*, 561-571.

Blackman-Miroff, C. (1993). *Outpatient EEG: A clinical overview of a group outpatient treatment center.* Paper presented at the Association of Applied Physiology and Biofeedback Conference, Los Angeles.

Boeving, H. (1993). Watching addictions disappear. *Menninger Perspective, 1*, 9-11.

Byers, A. P. (1992). The normalization of a personality through neuro-feedback therapy. *Subtle Energies, 3*, 1-17.

Craig, R. J., Verinis, J.S., & Wexler, S. (1985). Personality characteristics of drug addicts and alcoholics on the Millon Clinical Multiaxial Inventory. *Journal of Personality Assessment, 49*, 156-160.

Dorus, W., Kennedy, J., Gibbons, R. D., & Ravi, S. D. (1987). Symptoms and diagnosis of depression in alcoholics. *Alcoholism: Clinical and Experimental Research, 2*, 150-154.

Elmasian, R., Neville, H., Woods, D., Schuckit, M. A., & Bloom, F. (1982). Event-related brain potentials are different in individuals at high and low risk for developing alcoholism. *Proceeding of National Academy of Sciences in USA, 79*, 7900-7903.

Fahrion, S. L., Walters, E. D., Coyne, L., & Allen, T. (1992). Alterations in EEG amplitude, personality factors and brain electrical mapping after alpha-theta brainwave training: A controlled case study of an alcoholic in recovery. *Alcoholism: Clinical and Experimental Research 16*, 547-552.

Flynn, P. M., & McMahon, R. C. (1984). An examination of the factor structure of the Millon Clinical Multiaxial Inventory. *Journal of Personality Assessment, 48*, 308-311.

Funderburk, W. H. (1949). Electroencephalographic studies in chronic alcoholism. *Electroencephalography and Clinical Neurophysiology, 1*, 369-370 (abstract only).

Funkhauser, J. B., Nagler, B., & Walke, N. D. (1953). The electroencephalograph of chronic alcoholism. *Southern Medical Journal, 46*, 423-428.

Gabrielli, W. F., Mednick, S. A., Volavka, J., Pollock V. E., Schulsinger, F., & Itil, T. M. (1982). Electroencephalograms in children of alcoholic fathers. *Psychophysiology, 19*, 404-407.

Green, E. E., & Green, A. (1977). *Beyond biofeedback*. San Francisco: Delacorte.

Green, E. E., Green, A. M., & Walters, E. D. (1970). Voluntary control of internal states: Psychological and physiological. *Journal of Transpersonal Psychology, 2*, 1-26.

Hengeveld, M. W., Ancion, F. A., & Rooifmans, H. G. (1987). Prevalence and recognition of depressive disorders in general medical inpatients. *International Journal of Psychiatry Medicine, 17*, 341-349.

Kelly, A. (1993). *Applied psychophysiology in the treatment of chronic alcoholism symposium: "Somatic emotional processing in the treatment of addiction*." Paper presented at the annual meeting of the American Psychological Association, Toronto.

Kelley, M. (1991). Brainwave biofeedback for substance abuse: The development of a Navajo Alcohol Abstinence empowerment program. *Journal of Transpersonal Psychology* (Abstract only).

Kutner, G., & Zahourek, R. P. (1989). Relaxation and imagery groups for alcoholics. *Advances, Institute for the Advancement of Health, 6*, 57-64.

Marsh, D. T., Stile, S. A., Stoughton, N. L., & Trout-Laden, B. L. (1988). Psychopathology of opiate addiction: Comparative data from the MMPI and MCMI. *American Journal of Drug Alcohol Abuse, 14*, 17-27.

Millon, T. (1983). *Millon Clinical Multiaxial Inventory* (3rd ed.). Minneapolis, MN: National Computer Systems.

Ochs, L. (1992). EEG treatment of addictions. *Biofeedback: News magazine of the Association for Applied Psychophysiology and Biofeedback, 20*, 8-16.

Peniston, E. G., & Kulkosky, P. J. (1989). Alpha-theta brainwave training and beta-endorphin levels in alcoholics. *Alcoholism: Clinical and Experimental Research, 13*, 271-279.

Peniston, E. G., & Kulkosky, P. J. (1990). Alcoholic personality and alpha-theta brainwave training. *Medical Psychotherapy 3*, 37-55.

Peniston, E. G., & Kulkosky, P. J. (1991). Alpha-theta brainwave neuro-feedback for Vietnam veterans with combat-related post-traumatic stress disorder. *Medical Psychotherapy, 4*, 1-4.

Peniston, E. G., Marrinan, D. A., Deming, W. A., & Kulkosky, P. J. (1993). EEG alpha-theta brainwave synchonization in Vietnam theater veterans with combat-related post-traumatic stress disorder and alcohol abuse. *Advances in Medical Psychotherapy, 6*, 37-50.

Porjesz, B., & Begleiter, H. (1983). Brain dysfunction and alcohol. In H. Begleiter & B. Kissin (Eds.), *The pathogenesis of alcoholism* (pp. 415-483). New York: Plenum Press.

Propping, P., Kruger, J., & Mark, N. (1981). Genetic disposition to alcoholism. AN EEG study in alcoholics and their relatives. *Human Genetics, 59*, 51-59.

Sealy, R. C., Bernstein, B. E., & Magid, D. T. (1991). *New developments in brainwave training*. Workshop at the thirteenth annual meeting of the Biofeedback Society of New York (unpublished).

Steer, R. A., Beck, A. T., & Shaw, B. F. (1985). Depressive symptoms differentiating between heroin addicts and alcoholics. *Drug and Alcohol Dependence, 15*, 145-150.

Steer R. A., McElroy, M. G., & Beck, A. T. (1983). Correlates of self-reported and clinically assessed depression in outpatient alcoholics. *Journal of Clinical Psychology, 39*, 144-149.

Sullivan, A. (1993). *Applied psychophysiology in the treatment of chronic alcoholism symposium: Combining psychophysiological and psychotherapeutic methods treating addictive and MICA*. Paper presented at the annual meeting of the American Psychological Association, Toronto.

Vogel, F., Schalt, E., Kruger, J., Propping, P., & Lihnert, K. F. (1979). The electroencephalogram (EEG) as a research tool in human behavior genetics: Psychological examinations in healthy males with various inherited EEG variants. 1. Rationale of the study; material; methods; heritability of test parameters. *Human Genetics, 47*, 1-45.

White, N. (1993). *Clinical results with the Peniston neurotherapy for alcoholics and post-traumatic stress disorder*. Paper presented at the meeting of the Association of Applied Physiology and Biofeedback Conference, Los Angeles.

Wuttke, M. (1992). Addiction, awakening, and EEG biofeedback. *News magazine of the Association for Applied Psychophysiology and Biofeedback, 20*, 18-22.