EEG Biofeedback as an Adjunctive Therapy in the Treatment of Crack-Cocaine Dependence

V. Shannon Burkett*, M.A., John M. Cummins, Ph.D., Robert M. Dickson, L.P.C., and Malcolm H. Skolnick, Ph.D., J.D.

Abstract:

Objective: This study investigated treatment outcomes among men dependent on crack-cocaine participating in a treatment program utilizing electroencephalographic biofeedback training (EEG-BFB). Method: Subjects were participants in a long-term residential treatment program (LTR) within a faith-based homeless mission. Aside from educational, religious, and basic health services, EEG biofeedback was implemented as an augmentation. Men were assessed twelve months after completion of the biofeedback portion of the program. Follow-up procedures consisted of drug urinalyses, along with self-report depression, anxiety, and drug use measures. Results: After the introduction of the neurofeedback to the mission, length of stay tripled, initially averaging 30 days and increasing to 103 days after implementation. Individuals who completed 30 sessions of EEG biofeedback stayed 206 days on average. One-year follow-ups of 87 treatment completers indicated 49.4% of subjects reported no crack use 12 months after completion of biofeedback, and 40.1% used crack 1-9 times after their stay during a lapse, but were abstinent at follow-up. The remaining 10.4% reported using crack greater than 20 times over the previous year indicating a full relapse to crack-cocaine addiction. Urinalysis results corroborated self-reports of crack use (98% agreement). Self-reports of alcohol and marijuana use indicated that 90% of men did not use either over the previous twelve months. 45% of those who reported using any substances returned to treatment. Furthermore, 92.0 % of subjects were maintaining a regular at this point; 90.8 % were employed/in school or training; and 88.5 % had no subsequent arrests. Self-report depression scores (BDI) dropped by 70.5% and self-report anxiety scores (CAS) by 57.0%. Conclusions: The addition of EEG biofeedback to crack-cocaine treatment regimens offers promise as an effective intervention for treating crack-cocaine abuse. A controlled study is currently underway to assess the specific contributions of EEG

biofeedback with this population.

Introduction:

Substance abuse is one of the most significant problems facing the United States today (National Institute on Drug Abuse, 2002). The illegal drug market is fueled by criminal activity and represents a severe challenge to our courts, the law enforcement establishment, and our economy. The number of people in the criminal justice system because of drug related crimes continues to grow and society has been forced to outlay increasing expenditures to process criminals as well as build the prisons to house/"rehabilitate" them.

Of the many addictive drugs that are widely available, cocaine is one of the oldest known and most addictive. Cocaine is labeled a Schedule II drug (FDA, 1970), meaning that it has high potential for addiction and abuse. In fact, cocaine is the most common drug problem of patients entering treatment for illicit drug use (NIDA's Drug Abuse Treatment Outcome Study, 1999, http://www.datos.org/adults/adults-coctrt.html). "Crack-cocaine" is the name given to the freebase form of cocaine that has been processed from powdered cocaine hydrochloride to form a substance to be smoked. Two factors combine to make "crack" widely popular; (1) Smoking "crack" can give a user a high in less than ten seconds; and (2) this form of cocaine is also less expensive than other psychogenic drugs. The National Institute on Drug Abuse states "cocaine abuse and addiction is a complex problem involving biological changes in the brain as well as a myriad of social, familial, and environmental factors", (2002, http://165.112.78.661/ResearchReports/Cocaine/cocaine4/html). The widespread use of cocaine and its debilitating effects have stimulated extensive efforts to develop treatment

programs.

Various treatment methods for substance abuse have been inconclusive and generally depend upon the source and/or study. The first comprehensive national evaluation of community-based drug treatment programs was initiated by the Drug Abuse Reporting Program (DARP) from 1969 to 1974 (Hubbard et al., 1989). These initial findings found no significant differences in treatment approaches, but did find a recurring theme that length of treatment was the only factor associated with positive drug treatment outcomes. The second major addiction study was conducted from 1979 to 1981 by the Treatment Outcome Prospective Study (TOPS). One-year abstinence rates were greatest for cocaine users who stayed in treatment for a minimum of one month (Hubbard, et al., 1989). They found similar results regarding the previous findings that treatment modalities exhibited similar results when they were similar in duration.

Though studies vary in treatment efficacy reports, few studies have monitored the relapse to "gateway" drugs of abuse after crack-cocaine treatment, such as reduction to alcohol or marijuana dependency. Nunes-Dinis, et al. (1993) reported though cocaine use decreases during and after treatment, alcohol and marijuana use increases. While subjects may have recovered fully from cocaine addiction, they may replace the cocaine with alcohol or marijuana. Subsequently, alcohol use has been shown to predict inability to achieve cocaine abstinence after treatment (Mengis, 2002). The majority of studies have only addressed residual cocaine abuse at follow-up, wherein other abusive patterns may have emerged from beginning to end of treatment.

The Drug Services Research Study (1993) reported that patients admitted to substance abuse programs seek treatment on average 1.9 times per year, indicating the lack of

effectiveness of current treatment programs. Other sources state cocaine abuse relapse rates are nearing 80% post-treatment (Alterman et al., 1998; Higgins, et al., 1995; Kang, et al., 1991). Research investigating the clinical effectiveness of treatment for cocaine addiction is vital, alongside addressing the adoption and implementation of novel treatment interventions. Roman, et al. (2002) state that it is imperative to denote the extent to which these novel approaches can alter or enhance existing techniques and programs, such as group therapies or 12-step programs. They further add that one of the barriers to the development of innovative treatments is resistance from those who are "intensely socialized into the extant treatment techniques and feel both personally identified and strongly committed to those practices".

Given the lack of support for the effectiveness of current treatments for "crack" addiction, efforts to find alternative treatment modalities are receiving more attention than ever. EEG biofeedback has been demonstrated as effective in the treatment of alcoholism, as evidenced by Peniston and Kulkosky's research efforts (1989, 1990). EEG biofeedback (neurotherapy or neurofeedback) is based on operant learning principles, wherein identified EEG activity is reinforced or inhibited to evince changes in brainwave patterns (ref requested but none in particular found: any ideas?).

To date, most research with alpha-theta EEG biofeedback has addressed alcohol addiction. With cocaine being the most common drug problem of patients entering treatment for drug abuse (NIDA's Drug Abuse Treatment Outcome Study, 1999), research in the treatment of this population is warranted.

The current study is a 5-year research project developed and funded by the Southwest Health Technology Foundation (SHTF). The study operates under the supervision of the

Institutional Review Board (Committee for the Protection of Human Subjects) of the University of Texas Health Science Center-Houston. It is currently underway at the Open Door Mission in Houston, Texas.

The Open Door Mission invited SHTF to use its clientele as a test bed beginning in 1999. In return, SHTF foundation provides free EEG biofeedback services to all students within the addiction recovery program. The goal of this study was to analyze the effectiveness of the "Open Door" mission program augmented with EEG biofeedback in the treatment of crack-cocaine addiction. Given the previous literature results, SHTF identified five major areas to monitor for treatment progress: increases in treatment retention, along with reductions in substance abuse (cocaine, alcohol, and marijuana), homelessness, unemployment, and criminal activity. To be considered a "success" at one year follow-up, subjects must have had: 1) current living arrangements [not currently homeless]; 2) no substance abuse [including alcohol, marijuana, and "crack"]; 3) no subsequent involvement with the criminal justice system; and 4) current employment or student status.

Method:

Subjects:

Participants were recruited from the Open Door Mission drug rehabilitation program, entitled "Door Way". The Open Door Mission is a faith-based, 120-bed homeless and drug treatment facility located in Houston that provides daily meals and beds to area and transient homeless persons. The "Door Way" program is a 9-month drug rehabilitation center, providing religious studies, as well as educational, vocational, basic health, and

biofeedback services. The mission also contracts Harris County nurses to provide basic health care, including first aid and communicable disease testing. On average, "Door Way" can accommodate 80 "students" at one time as permanent residents.

Students are required to attend 15 religious study classes per week, as well as maintain designated responsibilities on property, from kitchen duties to landscaping. After the first two months or completion of biofeedback offered by SHTF, students are eligible to attend GED or computer training classes. Vocational training is offered towards the end of the nine-month program.

To be eligible for the study, subjects had to meet criteria for substance abuse disorder for cocaine/crack-cocaine, as diagnosed by the DSM-III-R (APA, 1987). Additionally, participants had to have cognitive resources available to provide educated informed consent, as well as the absence of severe medical or psychological disorders. Informed Consent, in a form approved by the University of Texas Health Science Center – Houston, was obtained from all subjects prior to participation with copies provided when requested.

From April 1999 to April 2000, 34 subjects were paid $300.00 for follow-up completions. Funds were provided by the Open Door Mission, but after spring 2000, no other follow-up compensation was offered.

Variables:

Abstinence:

Primary outcome measures for this study were urine toxicology screens obtained at twelve-month follow-ups. ProXam urine assays were used, which detect active metabolites associated with crack-cocaine ingestion as well as marijuana use.

Participants were monitored by researchers to ensure authenticity of urine specimens. Secondary outcome measures included self-report drug and alcohol use. Questionnaires were completed on site at the time of urinalysis.

Length of Stay:

Length of stay was measured in number of days of residence within the mission setting. Initial entry was documented at point in time of acceptance into the "Door Way" drug treatment program, which was measured at an average of one-week post mission arrival. Last day of stay was documented by "Door Way" staff as when the subject moved out of the residential program.

Psychological and Demographic Inventories:

Baseline and post-treatment measures included the Beck Depression Inventory (BDI), Clinical Anxiety Scale (CAS), and an intensive social history questionnaire, including drug use behavioral measures (see Appendix A). Post-treatment abstinence was assessed with a self-report questionnaire (see Appendix B). The BDI is a 22-question, self-report inventory with an internal consistency of .89 when employed with crack-cocaine users (Falck, 2002). The authors report that the BDI may be a suitable tool since it has an acceptable level of internal consistency when employed with crack users. The CAS is a 25-question, self-report inventory measuring symptoms of anxiety and stress.

Procedures:

Biofeedback equipment:

The CapScan EEG/EMG C-80 Biofeedback System (American BioTec Corporation, Ossining, NY) was utilized with all subjects involved in this investigation. The CapScan is a computerized biofeedback data acquisition system. Its primary use is to permit

voluntary control and monitoring of brain wave physiological states to allow implementation of neurotherapy protocols. The CapScan is a single amplifier, real time feedback system. Raw EEG is sampled at 128 bits per second, utilizing a fast Fourier transform (FFT) filter device. The digital filtering of white noise as well as low level AC biopotentials allows the EEG signal to be appropriately processed before analog to digital conversion. The filters are designed to measure and feedback a range of 1-40 Hz EEG and 1-200 Hz EMG. Data integration allows for monopolar and bipolar hook-ups, with ground and reference electrodes designed for ear lobe attachment. Scalp electrode placement was based on the International 10-20 Electrode System.

Treatment Sessions:

Treatment sessions followed the "Peniston protocol" format (Peniston & Kulkosky, 1989). The major difference between the protocol described here and Peniston was that temperature biofeedback training was not used for initial sessions. Instead, a 4-8 Hz inhibit/13-15 Hz enhancement was substituted utilizing an FP1/T4 split. Rationale for the first change is based on the premise that temperature feedback has been demonstrated to reduce 4-8 Hz (theta) and enhance 13-15 Hz (SMR beta), as well as incite relaxation training (Kaiser, et al., 1999). The theta-down, beta-up protocol was used until a drop in theta amplitudes was detected (ranging from session 5 to session 8), at which point the second phase of training consisting of alpha-theta sessions began. Alpha-theta sessions were accompanied by a relaxation/ drug rejection scenario script (see Appendix C). All subjects received identical script content and administration. Sessions were conducted in functionally identical treatment rooms.

EEG Biofeedback Training:

Subjects received a brief demonstration of the biofeedback equipment prior to beginning training. After introduction to the technique, all subjects received 30 sessions of EEG biofeedback. Session progress was interpreted and related to subjects by SHTF biofeedback providers. Sessions 1-7 (on average) were "eyes open" sessions consisting of inhibiting theta (4-8) and enhancing beta (13-15 Hz). Visual feedback was presented in the form of dynamic circles, driven by increases and decreases in brain wave amplitudes. Auditory feedback was delivered through headphones only when the subject's theta had dropped below a predefined threshold and their beta had exceeded a predefined threshold. Thresholds were set by the therapist according to previous session measurements, maintaining approximately 80% beta and 20% theta feedback. Thresholds varied among subjects due to variables such as skull thickness or brain function. Theta and beta tones were discriminated by pitch, the theta tone being lower than the beta. After the threshold had been reached, the tones gradually increased in volume. Subjects diagnosed with bipolar disorder or reporting a history of seizures continued with theta down, beta up protocols for all 30 sessions. This is to avoid alpha-theta training in which theta is enhanced, which has been shown to exacerbate or initiate bipolar symptomology and seizures.

At approximately session 8, the training protocol switched to enhancing theta (4-8 Hz) and enhancing alpha (8-12 Hz) amplitudes. No visual feedback was provided, given the sessions were "eyes closed". Auditory feedback was delivered through headphones only when the subject's theta or alpha amplitude had exceeded a predefined threshold. Again, thresholds were set by the therapist according to previous session measurements, maintaining approximately 75% alpha to 25% theta feedback. Alpha and theta tones

were discriminated by pitch, the alpha tone being higher than the theta. After the threshold had been reached, the tones gradually increased in volume. Total sessions involvement lasted between 35-45 minutes on average. Sessions one lasted for 10 minutes, sessions 2-7 for 20 minutes, and remaining sessions (alpha/theta sessions) were 30 minutes in length.

Results:

Subjects:

430 crack-addicted subjects were assessed as eligible for participation in this study over the last 4 years. 224 (48%) dropped out before the completion of all 30 biofeedback sessions (*mean*=10.2 sessions), 20 dropped out before treatment began (4.6%), and 8 opted against participation (1.7%). These subjects were not followed after leaving the program. Subsequently, data was analyzed for the remaining 178 DSM-IV cocaine-dependent males residing in the Door Way drug treatment program who had completed all 30 biofeedback sessions. 87 of the original 178 treatment completers were located for year follow-ups (49 %). Table 1 presents the demographic characteristics for the sample.

Table 1.
Subject Characteristics (*n*=178)

Variable	%	*Mean*	*SD*	Range
Age	---	40.49	7.57	[21-65]
Ethnicity				
Black	80.7	---	---	---
White	15.3	---	---	---
Education	---	11.5	2.18	[5-18]
Military history	29.2	---	---	---
Employed	15.7	---	---	---
Homeless	60.0	---	---	---
Daily crack use	66.9	---	---	---

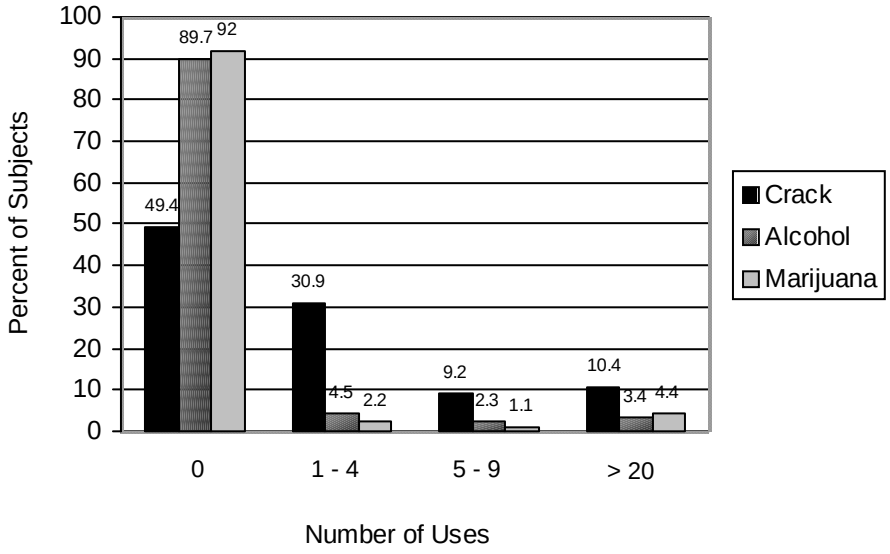
Weekly crack use	25.7	---	---	---
Previous treatment episodes	---	3.59	3.81	[0-16]
Years of crack abuse	---	12.66	6.42	[1-40]
Incarcerations	64.5	2.8	3.85	[1-25]
Drug related incarcerations	84.7	---	---	---

Participants averaged 40.4 years of age (*SD*=7.57) and 11.5 years of education (*SD*=2.18). 64.0% of subjects reported previous incarcerations (*mean*=2.8 times, *SD*=3.85), with 84.7% of those classified as drug offenses. Two-thirds reported daily crack-cocaine use (*n*=117) and one quarter reported weekly use (*n*=45), for a high abuse severity for 92.6% of subjects. 80.7% of participants were African-American. Self-reports indicated an average of 12.6 (*SD*=6.42) years of crack-cocaine addiction, with 60% of participants reporting polysubstance abuse. 84.3 % were unemployed at intake. 85.9% of subjects reported a history of previous treatment episodes (*mean*=3.6, *SD*=3.81).

Abstinence measures:

Figure 1 shows self-reported drug and alcohol use for 12-month follow-ups. One-year

Figure 1.
Self-Reported λ of Crack, Alcohol, and Marijuana Use at 12-Month Follow-up (*n*=87)



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follow-ups of 87 treatment completers indicated 49.4% of subjects reported no crack use 12 months after completion of biofeedback. 40.1% used crack 1-9 times after their stay during a lapse, but were clean at follow-up. The remaining 10.4% reported using crack greater than 20 times over the previous year indicating a full relapse to crack-cocaine addiction. Self-reports indicated that 90% of men did not use alcohol or marijuana during the previous twelve months. 45% of those who used anything returned to treatment. Table 2 identifies reported crack-cocaine use compared to urinalysis results.

Table 2.
Self-Reported Crack Use Compared To Urinalysis Results (*n*=87)

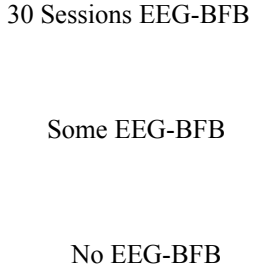
	Negative U/A	Positive U/A
Reported Non Use	49.4% (*n*=43)	0.0% (*n*=0)
Reported Use	39.1% (*n*=34)	11.5% (*n*=10)

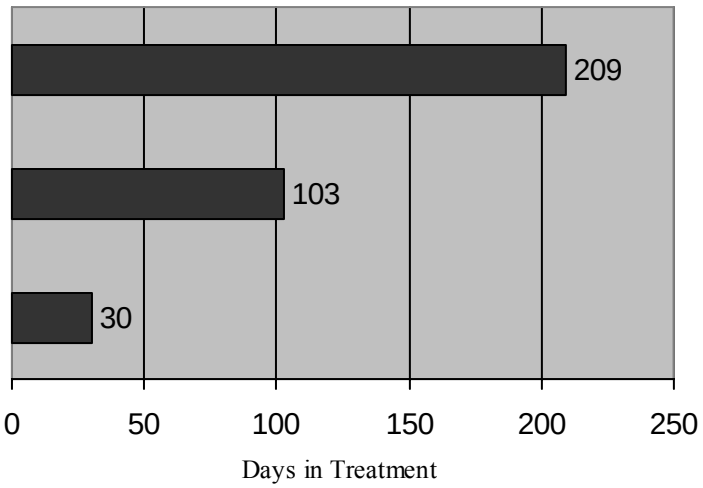
There was no evidence of denied verified use of cocaine confirmed by urine toxicology results (98% agreement). The 10.8% of positive U/A screens parallels the 10.4% of subjects who reported full relapse at twelve months. Of the 40.1% who reported a lapse of crack use (1-9 times) but reported being clean at follow-up, 39.2% exhibited negative crack-cocaine analyses, indicating that U/A results corroborated self-reports of crack use exceedingly well.

Treatment Retention:

Figure 2 shows a comparison of the mean number of days in treatment for clients who received EEG-BFB versus those who did not.

Figure 2.
Retention as a variable of EEG biofeedback in days (*n*=402)





On average, participants receiving biofeedback stayed in treatment 103 days longer. Of those who completed all 30 sessions of EEG biofeedback (N=178), treatment retention increased to 209 days. Similarly, before neurotherapy, the addiction program was "graduating" 12 men per year from their 9-month drug treatment program, which increased to an average of 12 graduates per month due to more men staying long term in the program. 57% of EEG-BFB completers continued in treatment up until the 9-month program graduation. This illustrates the effect of biofeedback on treatment retention.

Behavioral measures:

One-year follow-ups of 87 biofeedback completers indicated that 92.0 % of subjects were maintaining a regular residence, compared to 40.0% at intake. At intake, only 16.7% of subjects were employed or in school or training, a sharp distinction between the 90.8%

that were employed/or in training at one-year follow-ups. 88.3 % had no subsequent arrests twelve months post-treatment, with only 2 out of 87 subjects being re-arrested for drug violations. Psychological measures:

Table 3 shows the results of t tests analyzing improvements in depression and anxiety

Table 3.
T Tests for Overall Changes for Depression and Anxiety Scores (*n*=178)

Variable	Intake Score	Post EEG-BFB Score	Change	t value	p
Depression	19.49	6.80	12.69	15.84	.000
Anxiety	22.26	10.34	11.92	12.08	.000

Variable	Intake Score	12 Month Score	Change	t value	p
Depression	19.49	5.76	13.73	7.38	.000
Anxiety	22.26	9.64	12.62	5.68	.000

measures for subjects between intake and treatment completion, and intake and one-year follow-up. The table indicates that depression scores significantly decreased from pre-treatment to post-treatment ($t(156)=15.84$, $p<.0005$), and that decrease remained significant from intake to 12 months post-treatment ($t(156)=12.08$, $9<.0005$). Results were similar for the anxiety measure from pre to post-treatment ($t(41)=7.38$, $p<.0005$) and pre-treatment to 12-month follow-up ($t(44)=5.68$, $p<.0005$).

Discussion:

These finding are significant in that conventional forms of substance abuse treatment report 65-70% relapses within the first year after treatment (McKay, et al., 1999). Furthermore, subjects with high-severity problems, as defined by weekly or daily use,

have significantly higher rates of relapse, though the current findings were based on over 90% high-severity subjects. Given the discrepancy between "lapse" and "relapse" in the addiction literature, it is important to recognize the large gap in number of uses reported. At follow-up, subjects regularly reported no uses, or 1 through 9 uses; in fact, 30.4% of the subjects who used crack-cocaine after treatment reported using one, two, three or four times. After self-reports of 9 uses, the number jumped to 20 times or greater, moving into the upwards range of 100+ uses. Marlatt (2001) calls the initial return to the addictive behavior a "lapse" and distinguishes it from the destructive loss of control of complete "relapse". Lapse can be considered a normal part of the recovery process, not a complete failure. It is a way to test newly learned coping skills and override old behavioral patterns.

Overall, these findings suggest that the synergy between neurotherapy and faith-based programs are effective in the treatment of crack-cocaine addiction. Similarly, the lack of post-treatment alcohol and marijuana use is significant, given that many prior cocaine addicts substitute other drugs for their addiction.

The observed BDI reductions are significant in light of research that suggests that the prevalence of depression among crack users is higher than has been reported in the past (Flack, et al., 2002). Anxiety reduction is important in that it has been shown to be a predictor of relapse in alcohol dependency, which can lead to subsequent cocaine use (Willinger, et al., 2002). Goeders (2002) reported similar data and suggests that stress reduction can possibly help reduce cravings and promote abstinence in individuals seeking relief from cocaine addiction. Richard, et al. (1995) similarly report that therapies that alleviate anxiety, depression and other effects associated with drug

addiction recovery are beneficial adjuncts to treatment. Richard, et al, also found that EEG biofeedback was among a group of adjunct therapies that improved attendance rates, and therefore indirectly contributed to successful treatment. EEG biofeedback appears to be a powerful adjunct, with research evidencing decreases in anxiety and depression, as well as increasing treatment retention.

As part of the discussion of these results, it is important to address the limitations of this project. First, no control was included in the initial experimental design, therefore no direct attribution of treatment modalities can be assessed. Implementing a control was initially difficult for a few reasons. One, subjects in such close living quarters readily converse about their treatment sessions. Students who received biofeedback would eventually speak with those who did not, and this subject insight would lead to self-fulfilling prophecies of treatment success. Another difficulty was related to ethical considerations. The Open Door Mission invited SHTF to provide feedback to *all* students, as designated by the IRB. ODM believed very strongly in the efficacy of the EEG-BFB and therefore, did not consent to allowing a subset of its students to be in a control group. Though there was no control group, the data does show the synergy of the available components within the Open Door mission program is effective in reducing crack-cocaine addiction. There is also evidence of reductions in criminal behavior, homelessness, and unemployment, as well as increases in treatment retention with the addition of EEG biofeedback.

Another limitation is the reliance upon self-report measures. Self-report validity studies have varied in conclusions; however, it is noted that when there are no contingencies for reported use, self-report data is fairly accurate (Amsel, et al. 1976; Bonito, et al. 1976;

Milby and Stainback, 1991, Schumacher, et al., 1995). In the current study at the Open Door Mission, there were no contingencies upon self-reported drug use. Also, data was collected in a non-threatening manner and confidentiality was assured, two other components that have been shown to improve self-report validity (Weatherby, et al., 1994).

Thirdly, nearly 50% of available year follow-ups were not located. Most follow-ups were completed when subjects returned to the mission setting, for social events or even return to treatment. Phone contacts were obtained, but given the transient nature of the population, only a handful of subjects were located. Therefore, it is a possibility that a large number of available follow-ups were not located due to 1) a complete relapse to drug use, or 2) because they are no longer abusing drugs, but are working full-time. As mentioned earlier, subjects were no longer offered compensation for completion of follow-ups after 2000. Without an incentive, few participants would be willing to sacrifice their work hours even if located.

Lastly, the design of the study itself is a limitation. First and foremost, EEG-BFB protocols were not significantly individualized per each subject's personal needs. For instance, outside of a research setting, a biofeedback practitioner may choose to work at different scalp sites with different brainwave bandwidths according to symptom reports. This study specifically tested a version of the Peniston protocol with crack-cocaine abuse. Furthermore, given the large number of subjects and the treatment setting itself, the EEG-BFB practitioners were not able to remain in the treatment rooms with the subjects during training. Therefore, no feedback was available during sessions, including changing of thresholds or even preventing a subject from sleeping during the learning

process.

Given the success of the "Open Door" drug abuse treatment program, interpreted carefully with the aforementioned limitations in mind, it is imperative to address which intervention components are attributing to the positive results, and by doing so allow scientific research to bridge the gap to clinical utility. As mentioned before, this project, as a treatment outcomes study, cannot assign outcome to any particular modality. However, one can assess individual components of the program from prior literature and ascertain what may be attributing to the overall success of the ODM. First, the Door Way program is a faith-based treatment facility. Faith-based programs have been shown to be successful in addiction recovery. The role of religion has a long-standing place in addiction recovery, though little scientific research has validated its contribution. Secondly, ODM is a long-term residential (LTR) treatment program. LTRs have been shown to have good treatment results in comparison to brief out/in-patient programs. Thirdly, the program offers EEG biofeedback, which has had positive outcomes in the treatment of addictions. Furthermore, the EEG biofeedback increased the length of retention in treatment three fold, culminating in 3 months on average, which has become the gold standard in addictions treatment.

Future Directions:

For a program to be effective, drug treatment facilities need to incorporate a variety of services. Nunes-Dinis, et al. (1993) suggest that these services could include education, vocational training, medical services, social support, and counseling to name a few. The authors also state that conventional programs with one-month lengths of stay without the above services provided as follow-up components have not been shown to be effective.

The "Door Way" long-term residential drug treatment program has incorporated various aspects of these interventions in its treatment program.

Although outcome measures are proven successful, in the future it will be important to delineate which component parts of the Open Door treatment facility provide a significant impact on recovery. Currently, SHTF is implementing a controlled study within the ODM. The goal of this study is to assess differences in control and experimental groups with EEG biofeedback as the independent variable. The difficulty in setting up a controlled, single-blind study has deterred researchers in the past from executing well-designed, scientific studies with EEG biofeedback. SHTF has devised an "apparatus control" design in order to control for treatment novelty, therapeutic time, and Hawthorne effects. The development of this research design has been an intensive evaluation of possible placebo effects of EEG biofeedback, with the main goal in mind to research measurable effects of EEG-BFB as a valuable adjunct in the treatment of crack-cocaine addiction.

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Self-Reported λ of Crack, Alcohol, and Marijuana Use at 12-Month Follow-up (*n*=87)

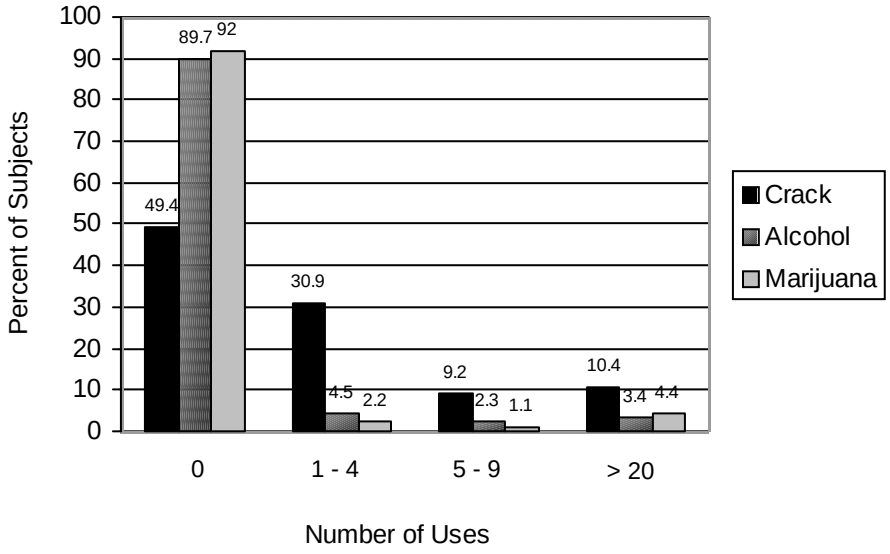
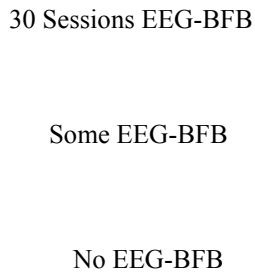
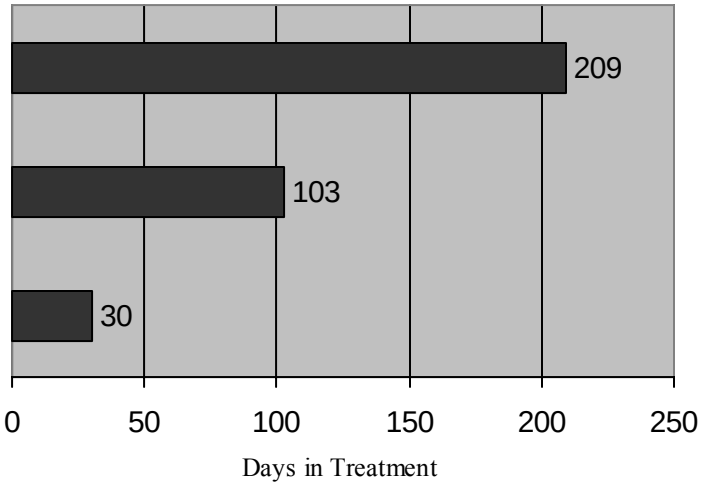

100
90
80
70
60
50
40
30
20
10
0
Percent of Subjects
89.7
92
49.4
30.9
4.5
2.2
9.2
2.3
1.1
10.4
3.4
4.4
0
1 - 4
5 - 9
> 20
Number of Uses
Crack
Alcohol
Marijuana

Figure 2.
Retention as a variable of EEG biofeedback in days (*n*=402)




209
103
30
0
50
100
150
200
250
Days in Treatment

Appendix A.

Social History Intake Form.

Subject #_____

Entry Date: _____

Social History Data Transfer Template (9/24/02)

IDENITIFYING INFORMATION 1=yes

1. _____Subject # 0=no
2. _____Age
3. _____Ethnicity (1-5)

   1 African-American 2 Hispanic 3 Caucasian 4 Asian Descent 5 Other

EDUCATION

4. _____Years completed (0-?) *including college
5. _____GED? (1,0)
6. _____Liked? (1,0)
7. _____Dropout B/C (1-6)

   1 Drugs 2 Didn't Like 3 Financial probs 4 Legal probs 5 social 6 N/A/other
8. _____Drugs/EtOH? (1,0)
9. _____Social patterns (1-3)

   1 Gregarious 2 Mod 3 Loner 4 D/A users only

EMPLOYMENT

History

10. _____Employed (1,0)
11. _____Professional (1,0)
12. _____Longest Job Held (0-? In months) (within one job or one type of work)*

Problems on the job

13. _____Resent authority (1,0)
14. _____Co-Workers (1,0)

15. _____Attendance (1,0)
16. _____Abandonment (1,0)
17. _____Illness/Accident (1,0)
18. _____Performance (1,0)
19. _____Boredom (1,0)
20. _____Drug Related problems at work? (1,0)
21. _____Other Financial Supp (1,0) Kind:_____

MILITARY HISTORY

22. _____Military History? (1,0)
23. _____Discharge Reason (0-5):

    0 N/A 1 Honorable 2 General 3 medical 4 dishonorable 5 undesirable

24. _____Rank (1-3)

    0 N/A 1 Officer 2 NCO 3 Enlisted

25. _____Drinking while in military? (0 N/A, 1 yes, 2 no)
26. _____Drug Use while in military? (0 N/A, 1 yes, 2 no)
27. _____Years in military (0-?)
28. _____Drug/EtOH Related Discipline in military? (0-3)

    0 N/A 1 no 2 yes, administrative 3 yes, court martial

MEDICAL HISTORY

29. _____Diabetes
30. _____Seizures
31. _____Bipolar
32. _____Std
33. _____Other (1,0) (_____)
34. _____Current Meds (0-4)
35. _____Past Meds (0-4)

    0 none 1 Psychoactive 2 Anti-Convulsant 3 Diabetic 4 Other _____

36. _____# of Head Injuries (0-?)
37. _____# of hospitalizations related to primary drug/alcohol (0-?) (alcohol poisoning)
38. _____# of hospitalizations related to secondary drug/alcohol injury (0-?) (accidents)
39. _____Prescription Abuse? (1,0)
40. _____Non-prescription abuse (over the counter stuff)? (1,0)

DRINKING/DRUG USE HISTORY

Drugs tried

41. _____ alcohol (1,0)
42. _____ marijuana (1,0)
43. _____ meth/ speed (1,0)
44. _____ opiates (1,0)

45. _____ LSD/ hallucinogens/ PCP (1,0)
46. _____ ecstasy (1,0)
47. _____ powder cocaine/crack cocaine (1,0)
48. _____ inhalants (1,0)
49. _____ embalming fluids (1,0)
50. _____ codeine (1,0)
51. _____Primary Drug of Abuse (1-5)

    1 EtOH 2 Crack Cocaine/ Powder 3 Crack+EtOH 4 Marijuana 5 Other (_____)

52. _____Frequency Of Use (1-5)

    1. 2-3 Yearly 2 Monthly 3 Weekly 4 Daily 5 Every/other weekend

53. _____Cocaine/Crack/Drug $$ Per Episode (0-?, UL) * put UL if used all $$ avail.
54. _____Beer Can Per Episode (0-?)
55. _____Mixed drinks per episode (0-?)
56. _____Age of first use anything (0-?) (what_____)
57. _____Years of crack Use (0-?)
58. _____Reason for using

    1 peer pressure 2 tried it and liked it 3 psychological effects 4 other _____

59. _____# Of Periods of Abstinence (0-?)
60. _____Longest Length (0-?) * in months
61. _____# of Treatment Episodes (0-?)

Abstinence was result of

62. _____Treatment program (1,0)
63. _____Incarceration (1,0)
64. _____Self-Imposed (1,0)
65. _____other (Support Group or Church, _____) (1,0)

Symptoms of abuse

66. _____Blackouts (1,0)
67. _____Seizures (1,0)
68. _____Hallucinations (1,0)
69. _____DTs (1,0)
70. _____Tremors (1,0)

PSYCH HISTORY

71. _____Current Suicidal Ideation (1,0)
72. _____Past Ideation (1,0)
73. _____# Of Attempts (0-?)
74. _____Professional outpatient counseling (1,0)
75. _____Inpatient hospitalizations (0-?)

LEGAL INVOLVEMENT

76. _____on parole (1,0)
77. _____on probation (1,0)
78. _____# of incarcerations (0-?)
79. _____Longest length of incarceration (0-? in months)
80. _____Possession (1,0)
81. _____Possession w/ intent to distribute (1,0)
82. _____Theft/robbery (1,0)
83. _____Assault (1,0)
84. _____Manslaughter/ Murder (1,0)
85. _____Parole violation (1,0)
86. _____DWI/PI (1,0) [other -_____]
87. _____Charges drug/EtOH related? (1,0, 3 N/A)

FAMILY HISTORY

88. _____Raised by? (1-6)

    1 Both parents 2 Mother 3 Father 4 Parent (m/f) with step parent

    5 Grandmother/father 6 Foster parent

89. _____EtOH use of biological father (1-5)
90. _____Drug use of biological father (1-5)
91. _____EtOH use of biological mother (1-5)
92. _____Drug use of biological mother (1-5)
93. _____EtOH use of other parental figure (0-4)
94. _____Drug use of other parental figure (0-4)

    0 N/A 1 Teetotaler 2 Moderate drinker 3 Problem drinker 4 Drug user

95. _____Introduced to a/d by family members? (1,0)

Relatives with drug/EtOH problems

96. _____# of siblings (0-?)
97. _____# of siblings with drug/EtOH problems (0-?)
98. _____Rank in family (1-?)
99. _____Grandparents (1,0)
100_____Aunts/Uncles (1,0)
101_____Cousins (1,0)

Family Attitude Re Using

102_____Family attitude towards EtOH (1-5)
103_____Family attitude towards drugs (1-5)

1 Intolerant 2 Tolerant 3 Permissive 4 Furnished to subj. 5 Shared experience

Relationship with Family Members

104_____Relationship with father (1-5)
105._____Relationship with mother (1-5)

1 Close 2 Cordial 3 Distant 4 estranged 5 deceased

106._____Relationship with siblings (1-6) *(put 6 if no siblings)

1 Close 2 Cordial 3 Distant 4 estranged 5 close to some 6 N/A

History of Abuse

107._____Psychological abuse (1,0)

108._____Physical abuse (1,0)

109._____Sexual abuse (1,0)

CURRENT RELATIONSHIP WITH SPOUSE, CHILDREN AND SIG OTHERS

110._____Marital status (1-5)

1Married 2 Separated 3 Divorced 4 Live-in / common law 5 Single

111._____# of marriages (0-?)

112._____# of live in relationships (0-?)

113._____# of children (0-?)

Quality of Relationships

114._____Quality of relationships (0-4)

0 N/A 1Good 2 Fair 3 Poor 4 Started good/ended bad

Habits of Partners

115._____EtOH habits of partners (0-3)

116._____Drug habits of partners (0-3)

0 N/A 1 = occasional/social use 2 abuse 3 no use

Relationship with Children

117._____Relationship with children (0-3)

0 N/A 1 Close 2 Occasional contact 3 No contact

Drug/EtOH habits of Children

118_____Drinking habits of children (0-3)

119._____Drug habits of children (0-3)

0 N/A 1 Yes 2 No 3 Don't know

120._____Do spouse/children have significant probs b/c of student's drug abuse?(1,0,3N/A)

Other Social Relationships

121._____Current social relationships (1-3)

1 Many friends 2 Some friends 3 Loner

REFERRAL INFO

122._____Reason for coming to open door mission (1-6)

1 Get off drugs 2 Change lifestyle 3 Achieve spiritual way of life

4 all of 1-3 5 homeless 6 homeless and b/c of drugs

Therapy type

139._____ (1,2) 1= 6-8 beta, 22-24 alpha/theta

2= all beta

Appendix B.

Follow-up drug behavior inventory.

DATE:_____
CASE#_____

SHTF
FOLLOW-UP FORM
ODM PROJECT – COHORT ____

FOLLOW UP : 1 MO 2 MO 6 MO 12 MO
(circle one)

1. How many months has it been since you finished biofeedback? _____
2. Are you clean/sober right now? 1= YES 0=NO
3. How many months have you been clean/sober? _____
4. Have you used any alcohol or drugs since biofeedback? 1= YES 0=NO
   (if you have not used, skip down to question 20)
   5. How many months after you stopped biofeedback did you use any substance (drugs or alcohol)? _____
   6. Have you sought treatment for drug or alcohol since finishing Biofeedback at the Open Door Mission? 1= YES 0=NO
      (if yes, where?_____)
   7. How many times have you used crack since biofeedback? _____
   8. Was it a good experience? 1= YES 0=NO
   9. How many times have you used alcohol since biofeedback? _____
   10. Was it a good experience? 1= YES 0=NO
   11. How many times have you used marijuana since biofeedback? _____
   12. Was it a good experience? 1= YES 0=NO
   13. How many times have you used a substance other than those above? _____
   14. Was it a good experience? 1= YES 0=NO
   15. Are you maintaining a regular residence or living arrangement? 1= YES 0=NO
   16. Are you employed or in school/training? 1= YES 0=NO
   17. Have you been arrested/charged with an offense since biofeedback? 1= YES 0=NO
   18. Was your arrest, if any, drug or alcohol related? 1= YES 0=NO
   (leave blank if not arrested or charged with anything)

19. Do you feel that biofeedback helped you to quit drugs or alcohol? 1= YES 0=NO

20. U/A 1=POSITIVE 0=NEGATIVE witness initials X_____

Appendix C.

Relaxation and drug rejection scenario.

Feel the circulation improving in your hands and feet ….; feel the circulation all the way to the tips of your fingers and toes….; feel your hands and feet becoming nice and toasty warm.

Now, feel yourself relaxing from the bottom of your feet to the top of your head…. ; feel this relaxation beginning in your feet and ankles….; now feel it in the calves of your legs and your knees…..; feel it in the thighs and hips….; feel it in the abdomen and chest muscles….;

Now feel the relaxation in your hands and wrists….; feel it in you forearms and upper arms….; now feel the relaxation in your back, shoulders and neck….; even your scalp is relaxed….; everything from the bottom of your feet to the top of your head, very, very relaxed.

When I leave the room, take a few moments an talk to your unconscious mind….; tell it that you are relaxed, you sleep, good and you feel good about yourself.

Then, picture yourself walking down the street and someone offers you some “crack”….; you say to him “No, I am drug free and I feel good about it!”….; say it just that positive: “No, I am drug free and I feel good about it!…; Then, see yourself walking away from the drugs and not using, and feeling good about not using!

Then, feel yourself become very mellow, feel the healing power of your alpha waves, feel yourself sink down into a very relaxed place, feel yourself becoming the person you want to be. Then tell your unconscious mind, “Just do it !”

(quietly leave the room and close the door)

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