

**The Peniston & Kulkosky Treatment for Chemical Dependence:  
A Replication, and Assessment of the Importance  
of the Electroencephalograph (EEG)  
Biofeedback Component of the Protocol.**

by

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## Abstract

This thesis is primarily a replication of Peniston and Kulkoskys' (1989; 1990) treatment (PKT) study which reported successful outcomes for alcoholics using an alpha/theta electroencephalograph (EEG) biofeedback protocol. The PKT protocol consists of 6 temperature biofeedback sessions of training increased hand temperature, followed by 30 sessions of training, via EEG biofeedback, increases in alpha/theta band amplitude. The latter sessions included visualisations of personality and physiology changes, and visualisations of scenes where alcohol is refused. Another aim of this study was to determine whether the EEG biofeedback element of the protocol was superior in outcomes to the subject simply listening to monotonous sounds.

In addition to three months of therapeutic community treatment, one experimental group of 15 subjects received the PKT protocol, the other received a modified version excluding EEG biofeedback, and a control group of 14 subjects had no additional treatment.

Post-treatment follow up revealed significant improvements for all three groups in key psychometric instruments. These were the Multiaxial Personality Inventory (MCMI-II), Situational Confidence Questionnaire (SCQ), Life Purpose Questionnaire (LPQ), and, at follow up, Addiction Severity Index (ASI). The control group changed in fewer MCMI-II scales, and had a higher treatment drop out rate. At follow up the groups' abstinence rates, using Peniston and Kulkoskys' measure, were also similar.

However, when more sensitive relapse measures were applied, the PKT groups' relapse results were about twice those of the control group. This was significant for male subjects' mean number of days using substances, whereas female subjects' abstinence rates were high in all three groups.

This therapeutic modality enhances therapeutic community treatment outcomes in a small sample of subjects, a result not common in the literature. It merits further investigation and implementation in a New Zealand setting.

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# Introduction

## *Overview*

The consequences of dependence on alcohol and drugs are extremely costly to society in terms of accidents, employment difficulties, crime, relationship breakdown, health problems, socio-economic status, and violence (Fisher & Miller, 1991). The expensive search for programmes that increase treatment success rates for chemical dependence has produced disappointing results (Project MATCH Research Group, 1997). One technique is rarely found to be significantly superior to another. More frequently, differing treatment approaches are not compared, and it is unusual for studies to include a control group.

Conventional treatment methods for addictions result in around 34% of those who complete treatment being successful in moderation or termination of drinking (Riley, Sobell, Leo, Sobell, & Klajner, 1987). Research indicates that 33% of residential treatment graduates are abstinent at one year follow-up for treatment terms of three months or more, and 67% for treatment terms of a year or more (Falco, 1992). Only one in four therapeutic community residents remain in treatment for more than three months (Falco, 1992). In contrast, a recent study (Saxby & Peniston, 1995) reports that 100% of 14 subjects treated with the Peniston and Kulkosky treatment (PKT) protocol, were abstinent from alcohol after 21 months and 92% did not experience any relapse. Although this study may be flawed as described below, such results warrant further investigation. PKT is the subject of this thesis. The PKT protocol utilises temperature and EEG biofeedback techniques. It is described in full later in the introduction.

This introduction first provides a brief definition of relevant EEG characteristics. The early history of EEG biofeedback, and its use in treating substance dependence is then summarised, followed by a description and critique of Peniston and Kulkosky's results, and subsequent independent research using their

protocol. The PKT protocol has three major components: biofeedback induced relaxation, constructed visualisations, and spontaneously occurring mental visual imagery otherwise known as hypnagogic imagery (Mavromatis, 1987). These aspects are reviewed separately as follows: first, a summary of research into the effectiveness of various relaxation techniques is included, to assess whether relaxation alone might account for recent successful results. Second, the component of constructed visualisations is evaluated for its possible therapeutic contribution to the protocol. Finally, a short discussion of the possible therapeutic effects of spontaneously occurring hypnagogic imagery during drowsy states is included. As all the subjects of this study are also receiving therapeutic community treatment, relevant therapeutic community outcome studies are reviewed. This review attempts to estimate the expected baseline success rate for all of this study's groups, given the population dynamics and treatment parameters pertaining to this study. The control group's results were expected to match this estimated baseline, whereas the experimental groups' results were expected to exceed it. The review will also include a discussion of relapse measurement methods. Finally, the aims of this study are described.

## ***Biofeedback***

### *EEG Characteristics*

This description of basic EEG terminology is intended to assist the reader's understanding of the EEG biofeedback technology used in this study. EEG is a measure of the electrical activity of the brain from standard scalp sites (Jasper, 1958). The frequency of the signal is measured in cycles per second or Hertz (Hz). The amount of energy in these signals is the mean height or amplitude of the waveform, measured in microvolts ( $\mu\text{V}$ ). The rhythmic electrical signals of the brain are sourced in the thalamus and the cortex in complex interaction. The

activity of the ascending reticular activating system desynchronises rhythmic activity (Fisch, 1991).

There are four broad frequency bands commonly filtered and monitored which correspond roughly with the following mental states in the resting individual: Delta (0-4 Hz) is associated with sleep; theta (4-8 Hz) is associated with drowsiness when hypnagogic mental images can spontaneously appear (Mavromatis, 1987); alpha (8-12 Hz) is associated with eye closure, relaxed attention and a rhythmic, sinusoidal wave form; beta (12-20 Hz) is associated with sight, movement, arousal, concentration, and alert cognitive states (Fisch, 1991). The following section introduces some biofeedback concepts.

#### *Brief History of Biofeedback and Basic Techniques*

For the last 30 years, health professionals in the United States and elsewhere have used biofeedback in physical rehabilitation and the treatment of psychosomatic disorders. Biofeedback involves teaching the client voluntary control of biological measures such as skin temperature, skin conductance, muscle tension (electromyography or EMG) and brain waves (electroencephalograph or EEG) with the goal of reregulating the client's physiological or psychological symptomatology, or both.

Biofeedback arose out of the combination of early research into operant conditioning in behavioural science and the development of sensitive electrical meters capable of measuring biological activity. In the 1960s, self-regulation theories were being applied to disorders such as obesity, smoking, sexual dysfunction. Approaches used both negative and positive reinforcement techniques to encourage the desired behaviour (for a review see Fischer-Williams, Nigl & Sovine, 1986, p. 29). Jacobson may have been the first person to use biofeedback as part of his research into progressive relaxation that began in 1908. He used an oscilloscope to feed back to the subjects their level of forearm muscle tension

(Jacobson and McGuigan, 1978). Skinner (1938), one of the instigators of behavioural science, failed to demonstrate operant conditioning of the smooth muscles of the vascular system. This stimulated interest in the topic, and reports of success in this area first appeared in the 1960s. For instance, DiCara & Miller, (1968) observed that rats could learn to lower their heart rate to avoid electric shock. In addition, in 1963, Basmajian began publishing his work on the control of single motor unit firing in the muscles of human subjects (Basmajian, 1979). In 1958, Kamiya (1969) began training human subjects to discriminate between the presence and absence of their alpha band brain wave production, and to suppress alpha band brain waves.

Therapeutic uses for biofeedback began in earnest during the 1970s. Increasingly, EMG techniques enhanced physical rehabilitation therapies for conditions such as paralytic foot drop. Green and Green (1977) of the Menninger Institute were pioneers in hand and forehead temperature training for migraine relief. Budzinski, Stoyva, Adler and Mullaney (1973) used EMG relaxation of the frontalis muscle in the forehead to eliminate tension headache. Green and Green also developed alpha/theta brain wave training. This involved the combined use of temperature and EEG alpha and theta EEG band biofeedback. This technique was first used in the enhancement of human potential, but also began to be used for its therapeutic effect on disorders such as chemical dependence. During the late 1980s and 1990s, advances in electronics made possible the development of more sensitive and relatively inexpensive EEG equipment. This facilitated a renewal of interest in alpha and theta EEG band biofeedback, when Peniston and Kulkosky's paper indicated excellent outcomes for alpha theta brain wave training. Its use in the treatment of chemical dependence is the focus of this study.

### *Temperature Biofeedback*

The earliest uses of temperature training were in the areas of migraine prevention and Reynaud's disease (Green & Green, 1977, pp. 35-41). Reynaud's disease and migraine are both disorders of disregulation of bloodflow, one in the hands, the other in the cranium. The fight-or-flight response to stress, which engages the sympathetic part of the autonomic nervous system, causes the release of vasopressin by the hypothalamus via the pituitary. This in turn can cause vasoconstriction of the arteries, decreased blood flow and lowered peripheral temperatures (Rice, 1987). The parasympathetic nervous system promotes normal levels of vasoconstriction. Thus, learning to increase hand temperature may encourage parasympathetic nervous system responses.

Green and Green report that successful hand warming is a form of "passive volition" or a way of allowing the calming of the sympathetic nervous system to occur, rather than a matter of effort or willpower. The client either listens to a continuous tone, which changes in pitch with the finger temperature, or watches changes in a meter or a computer generated graph, or both. The use of a relaxation script will aid the process of tension reduction. The relaxation script used with alpha/theta brain wave training, and used in this study, is an adaptation of Autogenic training (Appendix A). Schultz and Luthe (1959), psychiatrists who believed that therapists were being too directive in their approach to relaxation, developed Autogenic training. The script involves suggestions, rather than directives, of muscle relaxation, warmth and heaviness in the extremities, and mental calmness. Although the protocols used vary, regular practice sessions of the hand warming technique during six to ten weekly sessions, plus daily home practice, is usually necessary before establishment of the goal of voluntary internal control. At this point biofeedback can be discontinued.

Increased use of alcohol has been associated with increased negative response to stress (Rice, 1987). The initial psychological effect of alcohol is to

reduce inhibitions, and so reduce the perceived levels of stress. Research shows that alcohol has an anxiolytic effect comparable to benzodiazepines (The Secretary of Health and Human Services, 1993, p. 71). In individuals with an extensive family history of alcoholism, alcohol raises body temperature in the extremities by increasing heart rate and resultant blood flow (The Secretary of Health and Human Services, p. 119). This indicates that temperature training may be beneficial for alcoholics, simulating that physiologic effect of alcohol which may have become physiologically conditioned. If the hand temperature is warmer overall, perceived stress levels may be lower, and reductions in craving for alcohol may result. In addition, the positive effects of alcohol may not be as noticeable to the client, reducing the attractiveness of alcohol.

### *EEG Biofeedback*

From the 1950s, EEG biofeedback training research expanded, especially in the area of alpha/theta training that increased alpha or theta brain waves, or both, and encouraged the pre-sleep state. High amplitude EEG activity in alpha and theta frequency bands occur during meditation (Hirai, 1989). To encourage a similar relaxed mental state, the EEG biofeedback component consists of feeding back to the client, sounds which represent the amplitude (microvolts) of either alpha, or theta EEG frequency bands, or both. The therapist usually chooses a threshold that restricts aural feedback to the client to occurrences of the EEG amplitude ( $\mu\text{v}$ ) in that band exceeding the threshold. The task for the client is to increase the amount of time the amplitude exceeds threshold. The use of two bands for training requires the use of a different tone for each band.

Historically the EEG signal has been recorded and trained at the left occipital scalp location (O1, Jasper, 1958). The rationale for this was that relaxing the left or alleged rational portion of the occiput, by training increases in alpha and

theta band amplitude, would facilitate hypnagogic imagery (Green, & Green, 1977). More recently other practitioners (Fuller von Bozzay, 1995) used P3 and CZ scalp sites.

Initially, interest in this therapeutic technique focused on the hypnagogic imagery. Reports by volunteer student subjects, indicated that these were integrative experiences leading to feelings of psychological well being (Green & Green, 1977, chap. 7). Alyce Green reported the experience of three drug using subjects as follows:

“Three of our subjects spontaneously told me, during interviews following a lab session, that they would not use marijuana or LSD again. They found more enjoyment in hypnagogic experiences and liked not only the feeling of being in control, but also the knowledge that what they were experiencing was not stimulated by something they had taken.” (Green & Green, 1977. p. 143)

EEG biofeedback was first used with chemical dependence during the 1970s. Kurtz (1973) initiated the earliest study into the use of EEG biofeedback with substance abusers. When reporting the results, he echoed the Alcoholics Anonymous (AA) tenet that alcoholics are searching for the spirit(uality) in the bottle, in the following statement:

“Some persons have come to look at chemical dependence, not as a moral or ethical problem, not even as a handicap, but have dared to look at it as another kind of attempt to discover the buried, inhibited side of ourselves.”

He suggested that meditation, biofeedback, or AA could assist in the uncovering of that aspect of the self. Other researchers held similar opinions concerning the therapy “It may be viewed as a form of reintegrative psychodynamic psychotherapy” (Twemlow, Bowen, and Williams, 1976).

Some research indicates that alcoholics have higher frequency brain waves and fewer alpha brain waves than non-alcoholics do (a summary of this research

can be found in, The Secretary of Health and Human Services, 1993, p.71). Researchers (Jones & Holmes, 1976; Passini, Watson, Dehnel, Herder & Watkins, 1977; Twemlow, Sizemore, & Bowen, 1977) postulated that alcoholics could benefit if they learnt to increase alpha brain waves.

In terms of stress reduction and exploration of unconscious processes, the combination of temperature training and EEG biofeedback were thought to replace the effects of alcohol. The next section reviews the early research into this technique.

### *Early Alpha/Theta Brain Wave Training Research*

During the 1970s, biofeedback was used relatively extensively in treating chemical dependency in the United States. Treatment agencies using alpha/theta brain wave training, as developed by the Menninger Institute (Green, Green, & Walters, 1970), began reporting research into their application of this technique (Goslinga, 1975; Jones, & Holmes, 1976; Kurtz, 1973; Passini, Watson, Dehnel, Herder, & Watkins, 1977; Twemlow, Sizemore, & Bowen, 1977; Watson Jacobs, & Herder, 1979). Other research occurred in the university setting (Bearden, 1985; Kondas, 1973, Wong, 1975). The results for the early use of EEG biofeedback in addictions, shown in Table 1 below, were equivocal. Some contributing factors to the poor results may be the low number of sessions, variations in protocol such as the threshold settings above which feedback occurs, the number of sessions, and other methodological difficulties. In addition, early equipment had high latency between the detection of the signal and its display on the screen. Modern filters and amplifiers are more sensitive and better shielded from external electrical sources.



Table 1: Summary of alpha-theta brain wave training research prior to the Peniston and Kulkosky method

STUDY	EXP. N	CONTROLS	NUMBER OF SESSIONS	THRESHOLD	THERAPIST	ALPHA/ THETA RESULTS	DRINKING RESULTS	PERSONALITY INVENTORY CHANGES
Kondas (1973)	? outpatient alc & drug	? & ?	?	?	Probably not	Subjects learnt control of alpha - not enduring	?	Decrease of arousal on Act./Deact. checklist with increased alpha.
Wong (1975)	12 inpatient males	12? Inpatient males	15 BWT of 60 mins	?	Probably not	?	?	Sign. impr. for exp. Group on Repr./Sensit. scale, also congruence with ideal self-concept.
Goslinga (75)	67 inpatient males	None	5 temp train 25 of 45 mins + meditation	Adjustable 10% feedback	Volunteer plus group debriefing	?	?	POI reactivity sign. spontaneity sign. total score sign.
Twemlow, Bowen & Williams (76)								
Twemlow & Bowen (76)								
Twemlow & Bowen (77)								
Jones & Holmes (1976)	10 inpatient males	10 alcs: 10 & 10 matched non-alc	1 temp train 3 BWT of 20 mins	Fixed 15 $\mu$ vs	None	True & false feedback gave same increases for both groups	?	
Twemlow, Sizemore & Bowen (1977)	21 inpatient males	None	5 temp train 20 BWT of 45 mins + daily meditation	Adjustable 10% feedback	Volunteer plus group debriefing	No pre/post diff Sign. in-session alpha & theta changes	?	
Passini Watson, Dehnel, Herder & Watkins (1977)	25 inpatient males	25 inpatient alcoholics	2 temp train 10 BWT of 60 mins	Fixed for each client	None	Good alpha pre/post incr. Controls no change	Only 1 of 13 drinking measures impr. 1.5 yrs. later	Sign. state/trait anxiety impr. Not MMPI, BPRS, MAACL, anhedonia or sens/seek.
Watson, Jacobs & Herder (1979)	25 psych. inpatient males	25 & 25 inpatient alcoholics	2 temp train 10 BWT of 60 mins?	Fixed for each client	None	?	?	Only one criteria sign. of 53 scales used in above experiment (repl.). Chance effect.
Bearden (1985)	11 & 12 outpatient males and females	9 outpatient alcoholics	3 temp train 5 BWT of 20 min including visualisations	n/a	None	both exp. groups produced equivalent amount of theta	NIAA scores halved at 3 months post-test (ns). Controls no change	At 3 month post-test, both Exp. groups mean standard scores for all 7 scales of OQLQ were higher than controls; sign. via sign test.

The protocol varied but usually began with fewer than ten temperature training sessions followed by ten or more sessions of the subject learning to increase amplitude or energy in slower brain waves. Twemlow et al. (1977) and Goslinga (1975) showed some promising results with a protocol of 25 sessions, however they used inexperienced volunteer therapists. No EEG biofeedback follow-up relapse studies were published during the 1970s or 1980s. Consequently, adequate evaluation of the effectiveness of the technique, in terms of amelioration of the disorder, was not possible.

Alpha/theta brain wave training had an unremarkable early history, marked by inadequate experimental design, which does not compare well with the more positive PKT results described below. However, there are methodological differences between PKT and early studies, the main ones being the early studies' lower frequency and number of sessions, and lack of visualisations of changes in personality, neurochemistry and abstinence. The summarised results from PKT research performed by Peniston and associates, and by other clinicians, is the subject of the next section.

### ***PKT and Supporting Research***

#### *Peniston and Kulkosky's Original Research*

Peniston and Kulkosky (1989, 1990) adapted the alpha/theta brain wave training protocol, by increasing the frequency of sessions to five days per week and the number of sessions to 36 in total. They also added to each EEG session, the visualisations, or mental images (generated by the client), of his or her desired outcomes in terms of personality and abstinence. In this way, the subject was rehearsing enhanced self-concept, interpersonal skills and substance refusal skills in every EEG biofeedback session. The goal was to change actual behaviours in daily life. The concept is similar to that underpinning imaginal systematic desensitisation where the client imagines coping with various levels of a fear stimulus (Wolpe,

1969), commonly used in the treatment of phobias. The client also visualised a decrease in levels of their neurotransmitter beta-endorphin<sup>1</sup> and increases in alpha EEG band amplitude<sup>2</sup>. The desired result was an improved physiological stress response. The PKT protocol also included discussion of spontaneous imagery that may have occurred during a session.

In brief, the Peniston and Kulkosky (1989) treatment (PKT) protocol, consists of approximately six initial sessions, on consecutive workdays, of skin temperature biofeedback training. While hearing the feedback sound lower in pitch as finger temperature rises, the client learns to increase his or her finger temperature to a criterion of over 95° F (36°C) for ten minutes. One session is then spent assisting the client to devise visualisations of alpha amplitude and beta-endorphin increase, alcohol rejection and abstinence scenes, as well as scenes of relaxed, “mellow” behaviour. Finally, the client undergoes 30 consecutive daily EEG alpha-theta EEG biofeedback sessions of 30 minutes. These sessions involve providing auditory feedback to the client of their alpha and theta brain wave signals and the client learning to produce more of these. Thresholds are set so that feedback occurs 50-60% of the time for alpha band and 20-30% of the time for theta band. EEG sessions begin with the rehearsing of visualisations previously developed, and ended with discussion of spontaneous hypnagogic imagery.

The original Peniston and Kulkosky (1989, 1990) study involved 20 male, alcohol dependent, inpatient subjects, referred to as alcoholics. Two were taking antidepressant medication. These individuals were residents of a one-month treatment programme at a Veteran’s Hospital, and had undergone an average of

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<sup>1</sup> Beta endorphins, endogenous 31-amino acid opioid peptides that regulate bodily stress by controlling responsiveness to pain, are released during periods of stress (Naber, Bullinger & Kahn, 1981). A decrease was thought to promote a decrease in perceived stress levels.

<sup>2</sup> Visualising increases in alpha brain wave amplitude, and decreases in beta endorphins, is thought to generate equivalent changes in the subject’s actual physiology.

five prior treatments at a similar facility. Using an undisclosed random sampling procedure, 10 subjects were assigned to a group receiving PKT in addition to their standard therapy, another group of 10 subjects were assigned to the one month residential programme. A further group of 10 non-alcoholic controls matched for age and social class were pre- and post-tested only.

Peniston and Kulkosky (1989) also looked at decreases in the production of beta-endorphins under stressful conditions that may occur after PKT treatment. To test this hypothesis they measured these levels at pre- and post- test, an hour after inducing anxious thoughts<sup>3</sup>. They found a significant pre- to post- test increase in beta-endorphin production after stress in untreated alcoholic subjects whereas the PKT treated group response to stress remained the same. Peniston and Kulkolsky hypothesised that conventional treatment, and the lack of alcohol, increase stress levels in alcoholics. Also, the additional PKT treatment may prevent this increased response to stress and so reduces the propensity to relapse. However, due to loss of data the sample was small (8 - 9 in each group) and, compared to pre-treatment levels, only three of the PKT group actually reduced beta-endorphin production after stress, post-treatment.

Psychometric tests occurred at pre- and post- treatment. These were the Beck Depression Inventory (BDI; Beck, Waugh, Mendelson, Mock & Erbaugh, 1961), Cattell's Sixteen Personality Factor (16PF; Cattell, Ebner, & Tatsuoka, 1970) test and the Millon Clinical Multiaxial Inventory (MCMI; Millon, 1983).

The BDI mean dropped significantly from pre- to post- treatment for the PKT group only (from approximately 55 to 25, the level of non-alcoholic controls). The alcoholic controls BDI score increased from about 42 to 43.

The PKT group showed seven 16 PF continuum score significant increases indicative of improvement (cool - warm; concrete-thinking - abstract-thinking; affected by feelings - emotionally stable; expedient - conscientious; shy - bold;

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<sup>3</sup> The client was asked to visualise an anxiety provoking scene.

practical - imaginative; undisciplined self-conflict - controlled), whereas the alcoholic controls decreased significantly in one score (concrete-thinking - abstract-thinking).

The MCMI-I pre- to post- treatment results showed that the PKT subjects' means significantly decreased on 13 scales (schizoid, avoidant, passive aggression, schizotypal, borderline, paranoid, anxiety, somatoform, dysthymia, alcohol abuse, psychotic thinking, psychotic depression, and psychotic delusion), opposed to only two significant decreases for alcoholic controls (avoidant, and psychotic thinking). The authors argued that this indicated superior gains for the PKT group in both clinical and personality aspects of psychological health. However, it is interesting to note that, at post-test, the alcoholic controls were only significantly different from the PKT alcoholic group in two MCMI-I scales, schizoid and avoidant personality. This indicates that the two alcoholic groups were different from each other at pre-test.

The paper contains no statistical information concerning differences between the two alcoholic groups at pre-test. However, the alcoholic groups were reported to be different from the non-alcoholic group at pre-test, as follows. Eight alcoholic control group MCMI-I scales were significantly different from the non-alcoholic group, whereas 12 PKT alcoholic group scales were significantly different from the non-alcoholic controls. On visual inspection of graphical data, all but four (histrionic, narcissistic, antisocial, and compulsive, all of which often increase with therapeutic gains) of the 20 scales are higher (more severe) for the PKT alcoholic group compared to alcoholic controls. This indicates that the random allocation of subjects may not have resulted in homogeneous alcoholic groups at pre-treatment.

Examination of the MCMI-I scale scores that exceed a clinically significant T score of 75 at pre-test, shows that the alcoholic control group exceeded that score in the alcohol abuse scale only. On the other hand, the PKT alcoholic group exceeded the threshold for four scales (alcohol abuse, dependent personality,

dysthymia, and anxiety). This also indicates some imbalance in the sampling process.

A further explanation is the possibility that a higher rate of dropouts from the control group could cause lower overall pathology levels, given that dropouts are likely to have more personality problems. The paper does not include dropout rates for the groups. In the absence of replacements, it is possible that some of the alcoholic control group received minimal conventional intervention, whereas the PKT alcoholic group all completed PKT. The mean actual length of time in treatment for each group is also not reported.

Additionally, the undisclosed conventional treatment that alcoholic controls were receiving instead of PKT appears to be particularly ineffective. Their MCMI-I results do not match those of McMahon, Davidson and Flynn (1986), whose six-week therapeutic community programme treatment resulted in significant improvement in 14 out of 20 MCMI-I scales. The conclusions to be drawn from the results of Peniston and Kulkoskys' study may have been quite different if PKT had been compared with an alcoholic group undergoing an effective conventional treatment, or with more clinically significant MCMI-I scale scores.

It is also possible that Peniston and Kulkosky (1989, 1990) studied a particular subgroup of alcoholics. Bartsch and Hoffman (1985) identified five distinct MCMI-I profiles of elevated scales determined via cluster analysis of 125 alcohol dependent individuals. They describe a subtype cluster with elevated clinical scales for anxiety, depression, and dependent, avoidant, schizoid, bipolar personality scales that encompass the clinically significant scales noted above for Peniston, and Kulkoskys' (1990) PKT alcoholic group. Other profile clusters described by Bartsch and Hoffman (1985) were an antisocial, and compulsive profile cluster, two antisocial, narcissistic, and histrionic profile clusters and a bipolar, paranoid, dependent, avoidant profile cluster. Peniston and Kulkoskys' PKT alcoholic group MCMI-I scales means are not clinically significant for most of the scales comprising these profiles, nor the antisocial, aggressive-sadistic, and

passive aggressive personality scales of the profile observed by Millon (1987). Whether Peniston and Kulkoskys' results generalise to other alcoholic MCMI-I subtypes described by Bartsch, and Hoffman (1985), and Millon (1987) is uncertain.

The PKT group significantly increased alpha amplitude (from approximately 25 to 50  $\mu$ v RMS) at bipolar posterior P3/O1 and P4/O2 sites<sup>4</sup>. Peniston and Kulkosky hypothesised that PKT corrects alpha EEG band amplitude deficits sometimes reported in alcoholics (Gabrielli, Mednick, Volavka, Pollock, Schulsinger and Itil, 1982; Funkhauser, Nagler & Walke, 1953; Little & McAvoy, 1952). However, this indicates that the alcoholics of Peniston and Kulkoskys' study should have exhibited lower pre-treatment alpha band amplitude ( $\mu$ v) than the matched non-alcoholics in the control group. On the contrary, the mean alpha amplitude ( $\mu$ v) for the PKT alcoholic group was greater at both measurement sites, than that of the matched non-alcoholics before treatment. Hence, it is difficult to explain Peniston & Kulkosky's very large reported increases in alpha and theta amplitude after treatment in terms of deficits in initial EEGs. This effect may be the result of a habituation response. Alpha naturally occurs on eye closure, but may not occur in unfamiliar surroundings because of an orienting or blocking response, related to cognitive vigilance. Once the procedure becomes familiar, alpha may become more prevalent. Work by Graap, Janzen, Norman & Fitzsimmons (1994) indicates that pre-test measures can be artificially devoid of

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<sup>4</sup> Peniston and Kulkosky used a bipolar electrode placement for their pre and post EEG baselines. A P3/O1 placement involves one electrode being placed at 10-20 site P3 (left hemisphere parietal location) and one electrode being placed at O1 (left hemisphere occipital location). They used referencing to linked ears (which is usually used when the electrode placement spans both hemispheres). The signal produced is the result of subtracting signals common to both sites to eliminate electrical interference. Other placements mentioned in this paper are monopolar, where the EEG is recorded from one site only, and is referenced to one ear.

alpha because of the novelty of the situation. The subject is alert and orienting him or herself to the new circumstances. Graap et al. Found that subsequent retests at eight days and five months contained more alpha band activity probably due to more familiarity and less apprehension. In Peniston and Kulkoskys' study, by the time of the retest six weeks later, the PKT alcoholic group subjects were very familiar with the procedure whereas the controls were not.

Peniston and Kulkosky report only on the alcohol use of their subjects. In New Zealand, youthful treatment centre clients are most commonly users of both alcohol and cannabis. This may confound the results of this thesis because of the increased mean alpha power ( $\mu v^2$ ) that appears in the EEG of regular cannabis users relative to non-users (Struve, Straumanis, Patrick & Price, 1989). Administration of Delta-9-Tetrahydrocannabinol (D-9-THC), the key psychoactive ingredient of cannabis, increases alpha band power in association with feelings of euphoria (Lukas, Mendelson & Benedikt, 1995). D-9-THC accumulates in fatty tissue with the prolonged use of marijuana, and has a half-life of approximately eight days. Thus, the increased alpha power of habitual users reported by Struve et al. (1989) might drop during recovery as D-9-THC levels gradually drop.

Peniston and Kulkoskys' (1989) 13 month follow up showed that 20% of the treated group and 80% of the control group relapsed during this period in terms of the criterion of seven contiguous days drinking. This is a rather unusual measure of relapse that does not take into account the quantity of alcohol consumed. It also does not acknowledge the fact that some weekly binge drinking patterns can be very harmful but would not count as relapse on these terms. This researcher was unable to find any other instances of the use of such a measure in recent literature. The follow-up procedure included monthly contact with subjects. This may distort the results. Research has shown that regular follow-up contact increases the likelihood of abstinence from smoking (Grunberg, & Bowen, 1987).

Peniston's unpublished eighteen and thirty-six month follow-up data indicate that all 10 alcoholic controls were rehospitalised by 15 months post-



treatment. Four essentially did not leave hospital. Peniston reports that 80% of the PKT alcoholic group had not relapsed (seven days drinking) during further 36 month follow up.

A more recent outpatient study without a control group, used 14 subjects described as alcoholics (Saxby, & Peniston, 1995). The authors reported that depression, as measured by the BDI, improved while similar MCMI-I scales to those observed by Peniston and Kulkosky (1990) decreased (improved) significantly. The initial MCMI-I profile of the group was also similar, with elevated depression, anxiety and somatoform scales. Of 14 subjects, only one had relapsed during 21 months' follow-up. This study does not describe the random sampling procedure, or the sample population, or the definition of relapse. Clients at the Biofeedback Centre where the clients received their treatment, are very likely to be private clients with health insurance. If so, this study's subjects will be from a higher socio-economic group, with fewer initial problems and perhaps more motivated to change. Their mean age was 48 and their alcohol abuse history spanned a mean of 17 years. Although the EEG data was recorded, the paper reported no EEG results.

The following criticisms apply to all of the studies described above. The only definition of relapse offered is extremely liberal. The authors do not report their drop out policy, sampling procedure, or the subjects' use of any other substances of abuse. They may have studied a particular subtype of alcoholic, an older subject with tendencies toward depression and anxiety. In addition, monthly follow-up contact of subjects may inadvertently contribute to their continued abstinence.

#### *Recent EEG Biofeedback Studies by Other Authors*

Fahrion, Walters Allen, and Coyne, (1992) published a case study of outcomes after using PKT with a 39 year old male experiencing craving. After

PKT, the client generated more alpha brain waves and lower diastolic blood pressure during a cold-pressor test than during the same test prior to PKT. This result indicates an improved response to stress. Two months after treatment the client was able to discontinue medication for hypertension. The researchers also detected decreases in nine out of ten scales of the Minnesota Multiphasic Personality Inventory-II (MMPI-II; Hathaway, & McKinley, 1943), indicating personality improvements. They also noted large, clinically significant changes for the MMPI-II hypochondriasis (features include defeatism, hostility, physical complaints) and hysteria (features include repression, dependence, naiveté, somatisation) scales.

Another case study (Byers, 1992) described the outcomes of PKT treatment of a 27 year old alcohol and xanax (a benzodiazepine anxiolytic prescription medication) dependent individual. These outcomes included large increases in eyes closed alpha and theta peak to peak amplitude at all international 10-20 sites (Jasper, 1958) and large drops in MMPI-II, BDI, and MCMI-I scores. The MCMI-I scores decreased for the same subscales as in Peniston and Kulkoskys' (1990) results.

Other unpublished controlled clinical studies involved treating criminal offenders exhibiting addiction or behavioural problems with PKT (Bermea, 1995; Bodenheimer-Davis, & De Buis, 1995; Sealy, Bernstein, & Magid, 1991) and the results included significant improvements in psychometric and behavioural measures. There have also been unpublished and uncontrolled conference presentations (Blackman-Miroff, 1993; Fuller-Von Bozzay, 1995; Smith, & McAlevey, 1994; White, 1991) reporting clinical success with addictions measured in terms of psychometric scales and life adjustments. The studies mentioned above suffer variously from the lack of matched control groups, follow-up of substance use, or critical peer review.

Two unpublished studies have not been as successful. One uncontrolled New Zealand pilot study (Sellman, 1994) studied the use of the PKT protocol with

long term alcoholics, considered untreatable and domiciled in a custodial institution. The research nurse reported the most reduction in self-harming behaviour for that population in his experience. Ten of 11 subjects were moderately, to extremely pleased with the treatment. Relapse assessment at seven months, revealed that five had relapsed (drank for a week or more), four had drunk alcohol pathologically for periods of one or two days but not continuously, and three were abstinent, two of the latter remaining in the institution. Unfortunately, the results of this study are anecdotal. One uncontrolled Alberta University master's thesis study using PKT with an indigenous alcohol dependent population resulted in a 50% relapse rate upon six-month follow-up (Fitzsimmons, George, personal communication).

### *Summary*

Initial results with PKT in the treatment of substance users have been reported to be superior to other techniques. However, there are anomalies in the reports. Peniston and Kulkoskys' (1989,1990) initial study did not adequately describe the control treatment used, which the results show to be rather ineffective. Their results include alcohol use only. The energy deficits ( $\mu v$ ) expected in slow EEG bands for alcohol dependent subjects were not observed in their study. Actually the alcoholic groups had higher mean energy ( $\mu v$ ) than the non-alcoholic controls before treatment. High levels of familiarity with the procedure (Graap et al., 1994) may account for the large pre- to post- eyes closed base line increases in these bands observed by Peniston and Kulkosky for PKT treated subjects. The subjects in their studies are older depressed and anxious individuals, not particularly representative of the general population of substance users. In addition, the relapse criterion is either not stated or rather generous. The alcoholic groups do not exhibit equivalent pathology in terms of MCMI-I scores at pre-test raising questions around randomisation or drop out rates, or both. Finally, as yet,

long term alcoholics, considered untreatable and domiciled in a custodial institution. The research nurse reported the most reduction in self-harming behaviour for that population in his experience. Ten of 11 subjects were moderately, to extremely pleased with the treatment. Relapse assessment at seven months, revealed that five had relapsed (drank for a week or more), four had drunk alcohol pathologically for periods of one or two days but not continuously, and three were abstinent, two of the latter remaining in the institution. Unfortunately, the results of this study are anecdotal. One uncontrolled Alberta University master's thesis study using PKT with an indigenous alcohol dependent population resulted in a 50% relapse rate upon six-month follow-up (Fitzsimmons, George, personal communication).

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Peniston has co-authored all scientific studies. Some subsequent case studies appear to support the original findings, but other studies do not. These studies lack a control group, do not measure substance use outcomes, or have other methodological flaws.

An independent researcher is yet to do a controlled follow-up relapse outcome study. EEG alpha/theta biofeedback may simply be a sophisticated form of relaxation. The next section examines whether other relaxation techniques have contributed notably to chemical dependence outcomes.

### *The Relaxation Response*

#### *General Relaxation Techniques*

There exists a large body of research into the physiology of relaxation training. Techniques such as Autogenic Training (AT), Progressive Relaxation (PR), biofeedback assisted relaxation (BR), and Transcendental Meditation (TM) have all been associated with increases in theta, alpha EEG band amplitude, or both, characteristic of increased drowsiness (Lichtstein, 1988). Other studies report decreases in beta and alpha band amplitude as theta band amplitude increases (Lichtstein). In addition, significant decreases in oxygen consumption, carbon dioxide production, respiration rate, muscle tension, heart rate and blood pressure, as well as increased skin conduction have been observed (Lichtstein). The four approaches are not appreciably different in reported psychological or physiological effects. The only characteristics of relaxation that have been found to significantly improve effectiveness are, live rather than taped presentation of the relaxation script, and increased rehearsal of the technique (Lichtstein).

Research into the effectiveness of relaxation covers a wide variety of psychological and physical disorders. Lichtstein (1988) concludes that complaints such as headache, essential hypertension, anxiety/phobias and insomnia respond well, but the results with drug dependence are equivocal. When used in

populations of substance abusers, sometimes psychological variables such as state anxiety are improved, but alcohol and drug consumption may not be influenced by relaxation (Ormrod, & Budd, 1991). Some researchers found that bibliotherapy (reading literature about how to give up addictive substances) is just as effective as the relaxation techniques of PR or TM, or a combination of the two (Marlatt, & Marques, 1977, as cited in Klajner et al., 1984; Miller & Taylor, 1980, as cited in Lichtstein, 1988). The former study demonstrated no significant change in drinking behaviour for any group, but the subjects were student heavy drinkers and may not be representative of substance users presenting for treatment. The latter study demonstrated significant reductions in alcohol use at 12 months' follow up for all treated groups of problem drinkers. No treatment approach was deemed superior to the others.

In contrast, relaxation was the only treatment modality positively correlated with treatment outcome in a survey of 74 residential treatment programmes for drug dependent adolescents (Friedman, & Glickman, 1987). In a review of the literature with respect to alcohol and drug treatment, Klajner, Hartman, & Sobell (1984) recommend matching client to treatment. They suggested using relaxation-based therapies with anxious clients. An area highlighted by these authors was the need to optimise the treatment length and delivery as many studies use rather truncated versions of the procedure under investigation. They also express the need for follow-up periods of at least 18 months.

### *EMG Biofeedback*

EMG biofeedback assisted relaxation (BR) involves relaxing a target muscle group by lowering the amount of electrical discharge from those muscles. Although this technique targets specific muscle groups, it usually also entails the relaxation of the entire body. A number of researchers (Antrim, 1980; Calvert, 1980; Denney, & Baugh, 1992; Klajner et al.; Rosenberg, 1980; Wayne, 1981)

treated alcoholics with EMG BR usually of the frontalis muscles found in the forehead. Rosenberg associated 6 sessions of EMG BR with significantly greater reduction in alcohol consumption (as measured by the Alcohol Use Inventory (AUI; Horn, Warberg & Foster, 1983)) than 6 sessions of alcoholism education. This result applied only to alcohol dependent subjects scoring high on state anxiety, not trait anxiety (as measured by the State-Trait Anxiety Inventory (STAI; Spielberg, Gorsach, & Lushene, 1970)). Rosenberg also found that continued use by the client of the relaxation technique used in the study, resulted in significantly less alcohol use on two of the three (AUI) measures used. Denney, and Baugh also found that, for 82 subjects who received more than five biofeedback sessions, anxiety reduction (measured by a subjective Likert scale) significantly positively correlated with sobriety (measure used is not explicit). Antrim studied two groups of 12 alcohol dependent inpatient graduates with high levels of psychophysiological arousal as measured by the Physical Symptom Check List, the Stress Response Check List, and the STAI. He found 10 sessions of EMG or temperature BR with home practice significantly improved arousal measures, and the BR treated subjects reported experiencing a more positive sobriety compared to similar untreated controls at one to three month follow up. By way of contrast, Calvert found that BR did not enhance inpatient treatment personality and life adjustment outcomes in a large sample of alcohol dependent males. The number of BR sessions did not influence results either. However, the abstract includes no treatment details, and no evidence of client to treatment matching. Calvert advocates the use of BR with anxious and tense clients.

Eno (1976) reports that the use of BR in conjunction with PR has superior results over BR or PR alone, with respect to reductions in state anxiety levels (not trait anxiety) and muscle tension. This characteristic of the combination of BR and AT, or BR and PR producing superior results to each procedure alone, is repeated throughout the literature. A summary of such studies appears in Lichtstein (1988,

pp. 186-187). The PKT protocol uses a combination of BR and AT which may serve to enhance its effectiveness.

Beauséjour and Lamontagne (1977-1978) treated four groups of 15 regular users of cannabis and hallucinogens with 12 sessions over four weeks followed by home practice. The four treated groups received alpha feedback, EMG BR, pseudo or false feedback, no feedback. There was also a similar untreated control group. They reported that EMG BR resulted in the most reduction in usage for minimal and moderate users, after treatment and at six month follow up. After treatment and at six months follow up, the alpha feedback, EMG BR, and false feedback treatments reportedly reduced the drug use of heavy users, whereas heavy users in the other two groups increased their use. These results are anecdotal. The picture is also quite confused for other measures. The EMG BR group achieved higher scores in sleep factors, physical condition, scholastic performance, but not psychological condition, compared to other groups. However, the researchers do not describe the measures used and do not report their pre-treatment scores. The follow-up rate was 89%. The authors judged the alpha EEG BR group as less able to transfer laboratory learning to daily life. However, the reporting and design of the study is poor. In addition, due to logistical problems in such studies, the person who delivers treatment is usually not blind to the treatment modality, thus experimenter bias effects on outcome are likely.

Denney, Baugh, and Hardt (1991) studied a protocol involving at least five thermal and EMG biofeedback training sessions along with PR, AT, breathing exercises, meditation and systematic desensitisation. The study followed 233 male graduates (mean 45 years of age) of a three week inpatient substance abuse treatment programme. The groups receiving additional biofeedback treatment contained greater ( $\chi^2, p \leq .10$ ) percentages of subjects completely abstinent at 3, 6, and 12 month follow up, than the group that received no training sessions. Similarly, the group that received less than six sessions contained significantly ( $\chi^2$ ,



$p \leq .05$ ) fewer abstinent subjects, at all follow-up points, compared to the groups that received more sessions. At 12 months the abstinence rates were 39% (more than seven sessions), 29% (more than five sessions), 10% (less than six sessions), 15% (no biofeedback). The frequency of sessions was two to three per week. The authors do not report the follow-up rate nor relapse to substances other than alcohol.

### *Meditation*

The term meditation usually represents some form of introspection. Meditation's effectiveness in the reduction of substance use, is not proven, as studies are generally not methodologically sound (Lichtstein, 1988). Summaries of two of the more scientific studies follow. Brautigan (1977, as cited in Lichtstein, 1988) performed a controlled study demonstrating the effectiveness of meditation. His treated group reportedly reduced their use of drugs whereas waiting controls that received counselling (poorly attended) did not. However, 80% of the 20 treated subjects had periodically relapsed during the two-year follow up.

A more rigorous experimental study, is one by Taub, Steiner, Weingarten, and Walton (1994). They studied a population of male, predominantly African American skid row alcoholics, undergoing a three-month inpatient treatment programme. They compared four groups. Each received a course daily 20-minute sessions of a specific technique. The techniques were: Transcendental Meditation (TM; 20 sessions of sitting with eyes closed, silently repeating a specific sound, plus home practice), EMG BR (20 sessions plus home practice), "neurotherapy" (NT; 15 sessions involving applying electrical stimulation via electrodes on the scalp), and routine inpatient therapy sessions (RT). Trained therapists, enthusiastic about the modality, delivered each treatment. Each group contained 24 to 35 subjects. Alcohol was the only substance use outcome reported. Seven to twelve month follow up of 91% of subjects resulted in abstinence rates of approximately

25% (TM), 35% (EMG BR), 10% (NT), and 15% (RT). Days drinking were 35% (TM), 33% (EMG BR), 45% (NT) and 47% (RT). TM and EMG BR pre- to post-differences were each reportedly significantly greater than RT. Both EMG biofeedback and meditation significantly increased this chronic group's chances of recovery. The NT group is interesting as a placebo control. This highly technical approach with electrodes applied to the head failed to produce discernibly different results from routine therapy. Unfortunately, a some nonstandard ways of reporting the data and a twenty-year delay to publication, reduce its credibility.

### *Summary*

Overall, research into relaxation techniques does not provide strong evidence of its effectiveness with substance abuse. However more frequent sessions of EMG BR, and to a lesser extent meditation (Taub et al., 1994; Denney, & Baugh, 1991) demonstrate a therapeutic advantage over standard treatments. Research appears to indicate that the combination of a relaxation protocol and EMG BR seems desirable (Eno, 1976). Other research recommends using relaxation therapies with clients whose substance use is related to anxiety (Rosenberg, 1980; Denney, Baugh, & Hardt, 1992). Increasing the number of sessions may also enhance outcomes (Denney, & Baugh, 1991). The PKT research includes all of these effectiveness-enhancing features: an intensive protocol of 30 daily sessions, the use of an Autogenic relaxation script as well as temperature biofeedback, and subjects with depressed and anxious tendencies. None of the above studies into relaxation techniques contains results that are comparable to the published PKT follow-up outcomes (Saxby, & Peniston, 1995; Peniston, & Kulkosky, 1989).

Another element of PKT, the visualisations of refusing alcohol in tempting situations and of "mellow" personality, is similar to cognitive behavioural techniques (CBT) such as imaginal systematic (covert) desensitisation. A review

of the research into CBT techniques found some techniques, which appear to approximate the visualisation element of PKT. Miscellaneous positive imaginal techniques are reviewed next to determine their effectiveness in the treatment of chemical dependence. All of the techniques involve promoting changed emotional and physical responses to substance use situations.

### *Imaginal Cognitive Behavioural Therapies and Substance Abuse*

#### *Background*

Researchers have found that, for 57% of spontaneously recovered alcoholics, their primary motivation for resolving their dependency problems was a cognitive appraisal of the costs and benefits of drinking (Sobell, Sobell, Toneatto, & Lea, 1993). Motivational Enhancement Therapy (MET) as applied by the Project MATCH Research Group (1997) is designed to assist this process for those who are undecided, as is the first step of the AA 12 step programme. It seems likely then, that the PKT visualisations of the idealised self, refusing to use substances, would enhance that process. If these voluntary visualisations are congruent with the subject's desired outcomes, then new behaviour patterns may result.

The following discussion reviews the CBT literature concerning imaginal techniques only. Other in vivo techniques such as aversion therapy and cue exposure are not discussed.

#### *Desensitisation*

Desensitisation in addictions typically involves gradually reducing the craving response to a graded hierarchy of trigger situations. Another approach is to desensitise subjects to anxiety provoking situations that may trigger relapse. This occurs either in the imagination or in vivo. Desensitisation is the cognitive

behavioural technique that most closely resembles the PKT technique of imagining refusing alcohol in trigger situations. Childress, McLellan, and O'Brien (1985) reviewed the literature, which consisted of several case studies but only one controlled study. The latter study resulted in a slight non-significant enhancement of self-reported alcohol abstinence in the systematic desensitisation group. No recent research in this area was located. This therapy requires individualised protocols and may be quite time consuming compared to other approaches.

### *Covert Aversive Stimuli*

This is also an imaginal technique. However, the client learns to associate substance use with an aversive physical state, rather than reducing the potency of stimuli associated with substance use as in systematic desensitisation. Childress, et al. (1985) reviewed the literature concerning imaginal aversion therapy (usually the client visualises vomiting with the use of substances). They report that they found no controlled studies that supported the effectiveness of this method. However, they do describe a controlled study (Ashem, & Donner, 1968) which resulted in 40% abstinence in long term alcohol abusers at six months for the treated group and no abstinence in untreated controls. They also describe an uncontrolled study (Elkins, 1980) showing that the 69% of subjects who developed conditioned nausea, maintained significant periods of abstinence after treatment. The abstract does not describe what constitutes a significant period, nor is the follow-up duration given. However most conditioned subjects came under an abstinent or normal-drinking classification and most non-conditioned subjects were excessive drinkers, after treatment.

### *Positive Imaginal Techniques*

The use of success oriented visualisations is now common in areas such as boosting elite athletes' performance, and boosting the immune system (Norris,

1989). In conjunction with psychotherapy, Silver (1993) found that, by teaching her clients the ability to imaginally recreate at will, the feelings of intoxication, 79% achieved abstinence of more than three years. Her clients were mostly well educated, and professionally successful subjects who had previously failed to respond to treatment. Controlled studies of the use of such techniques with substance dependent populations are lacking in the literature.

Neurolinguistic programming (NLP) also involves using the imagination to reimprint undesirable habitual behaviours with desirable ones (Bandler, 1985). PKT's visualisations, which involve endorsing positive behaviours, most closely mimic NLP techniques. However, there appear to be no NLP outcome studies in the scientific literature, precluding discussion of this technique.

### *Summary*

Most of the cognitive behavioural studies reviewed here show that techniques that involve conditioning of changed responses to the drug of choice, may enhance recovery. However, the results described do not clarify whether that enhancement would exceed the estimate of Riley et al. (1987), that 34% of treated individuals improve. The review uncovered surprisingly little research into the use of these cognitive behavioural techniques with substance dependent populations. Some studies indicate that combinations of techniques may enhance effectiveness (Childress, Ehrman, McLellan, & O'Brien, 1988).

PKT also involves the processing of spontaneous imagery, or hypnagogia that arises in a drowsy state. The following discussion reviews some of the limited amount of literature available on this topic. No therapeutic outcome studies were found in the literature concerning imagery techniques used in the treatment of addictions.

## *Spontaneous Imagery*

### *Discussion*

Hypnagogic images can arise unbidden in a drowsy state. If such imagery occurs during PKT, the therapist and client usually discuss it. The client determines whether the images have an underlying meaning of a personally relevant nature. The following discussion is an attempt to examine what therapeutic benefits this technique may confer, in the absence of literature directly related to addictions.

Many Psychodynamic counselling approaches involved some form of free association of feelings and ideas to tap unconscious processes (Ivey, Ivey & Simek-Downing, 1987). PKT uses a word association technique. For example, the client may associate an image of a string bag designed to contain meat, with the phrase "pulling at the heart strings". This phrase might then stimulate a discussion about the client's unfaithful partner. A similar principle underpins specific psychodynamic techniques such as Leuner's Guided Affective Imagery. Lusebrink (1990) reported that there is some evidence for its effectiveness, but the original paper in German is not available. Assagioli's (1974) reflective meditation involves becoming receptive to visual and auditory imagery, to enhance personal development.

Green, and Green (1977) investigated the images produced during alpha/theta brain wave training and wrote anecdotally about the archetypal nature of some of the imagery (pp. 143-149). Oliver, (1976), analysed 503 images experienced by two subjects during occipital theta band EEG biofeedback. He reported that these images were repetitive, symbolic in nature, and over time, dominant themes and solutions emerged.

Kubie (1943) found that a person listening to his or her own breathing, experiences hypnagogic imagery. Kubie believed that this was therapeutically

beneficial. Fahrion, and Norris (1990) reported that hypnagogic imagery also arises during temperature training.

As it seems likely that introspection alone may result in hypnagogic imagery, this study attempts to determine whether the EEG alpha/theta training sessions subsequent to initial temperature training are equivalent to subsequent sessions just listening to monotonous natural sounds.

### *Summary*

The literature contains some reports of the use of imagery as a therapy, but not empirical reports of its therapeutic effectiveness. Its spontaneous nature and the difficulty in quantifying the therapeutic element of such events probably preclude such research. There appear to be no reports of its use with substance dependent individuals. This aspect of PKT is a factor in the design of this experiment that has been difficult to measure or control for.

### *Summary of Related Treatment Approaches*

Previous sections have examined the effectiveness of individual therapies somewhat similar to the three main approaches of PKT, in the treatment of substance abuse. Common themes are that combining techniques and intensifying the frequency of delivery appears to enhance results. Relaxation techniques seem most appropriate for anxious subjects. EMG BR and meditation can measurably enhance treatment outcomes. There are insufficient controlled studies into CBT and spontaneous imagery techniques to assess their effectiveness in improving outcomes for substance dependent individuals. As PKT involves a type of relaxation, plus an imaginal form of systematic desensitisation and spontaneously occurring imagery, it may have superior results to those reported for each individual approach.

Measurement of treatment outcome results should be, in terms of not only personality improvements and lifestyle, but also in terms of substance use behaviours at follow up. The question of what constitutes a successful outcome in terms of substance use is vexatious. A discussion of the pitfalls of relapse assessment and interpreting outcome studies follows. The subsequent review of relevant outcome literature, specifically therapeutic community follow-up studies will indicate what baseline substance use outcomes might result for all groups of this study. Finally, there follows a brief summary of possible male and female outcome differentials.

### *Outcome Criteria and Therapeutic Relapse Results*

#### *Assessment of Relapse*

Miller (1996) describes important issues in the assessment of relapse. Does the definition of relapse include tolerance of drinking and if so, what are the limits? What assessment period is ideal; from the end of treatment to a set point, or for a consistent "snapshot" period? What period of sobriety should elapse before a new relapse can occur? Does relapse to a different drug constitute relapse? A study by Miller, Westerberg, Harris, and Tonigan as cited in Miller (1996) found that 47% of 125 previously alcohol dependent people who reported abstinence from alcohol at six month follow-up were using illicit drugs. The majority of studies assess relapse on one substance alone, or at best assess each substance separately, i.e., relapse for a substance is only counted if the subject was a prior user of that substance. Should nicotine be included? Should the researcher rely on self-report or also get confirmation from associates? Should outcome measures include other life issues, such as involvement with the law, employment, etc.

The word relapse implies that abstinence is the preferred goal. Is harm reduction a more realistic outcome? Miller (1996, p. 23) states "The more typical



course of recovery is a change in the flow of drinking, with generally decreased quantity and frequency, some waves and an eventual stabilisation. It resembles the approximations of a developmental or learning curve.”

Peniston, and Kulkosky (1989) used a relapse statistic of seven contiguous days drinking. This researcher could not find any reference to such a statistic in recent literature. Saxby, and Peniston (1995) do not report their relapse criterion. The methodology chosen for this study incorporated some more common relapse statistics, taking into consideration the drug and alcohol use assessment issues described below.

#### *Assessment of Control over Substance Use*

As Miller (1996) suggests, it may be more pertinent to measure the frequency and quantity of substances used rather than abstinence rates. Abstinence may not be a realistic goal for many people, although that is the expressed aim of most inpatient programmes.

There are a number of variables to consider when assessing the degree of substance use over the follow-up period. Should the subject keep a diary, be questioned frequently, or attempt to remember past use at follow up? Compliance with the first option is unlikely for the majority of subjects, the second option may have an unintended positive effect on sobriety (McCaughrin, & Price, 1992), and the third relies on the accuracy of subjects' memory over a long period. O'Malley, Bachman, and Johnston (1983) found that reliability and stability of self-reports of licit and illicit drugs was high for surveyed high school students. However, underestimation of self report over the last 12 month period may occur, on the basis of much higher reported use over the last month compared to the last year. However, they asked a blanket question concerning occasions using a substance during the last 12 months, rather than a detailed review of use throughout the year.

With respect to quantities, standard drinks are the usual measure but these can be complex to assess post hoc, and how do these compare with puffs on a cannabis cigarette or the use of pills? Would the monetary value of the substances used be a universal measure? A literature search uncovered no published research standards for the comparison of quantities between substances.

### *Difficulties of comparison between Studies*

Outcome research has many difficulties associated with it. One important issue is the number of not contactable subjects at follow-up. Desmond, Maddux, Johnson, and Confer (1995) cite four studies, which provide evidence that uncontacted subjects, are more likely to have relapsed. A study of an adolescent population (Stinchfield, Niforopulos, & Feder, 1994) supports this hypothesis. Studies that make claims to the contrary, base this assertion on the fact that the uncontacted population is not significantly different from the contacted population demographically. Thus, both groups should behave in a similar way with respect to resumption of substance use. However the studies report no relapse data to confirm this (Desmond et al., 1995; Taub et al., 1994). Without evidence, this is conjecture. Desmond et al. recommend follow-up subject contact rates of more than 85%. Different population pools, patterns of addiction, relapse criteria, sources of information, and variations in follow up period also make the task of comparison of results between studies extremely difficult.

### *Outcome Research for Programmes Other than Therapeutic Community*

As an example of unremarkable results, Griffiths (1977) reports that 10% of male clients receiving treatment (including some inpatient stays of up to six weeks) or advice, were virtually abstinent after one year with a 95% follow up rate. Estimations of yearly spontaneous recovery rates vary from 1-33% of alcohol

dependent individuals. The same author also notes that problem drinking incidence declines with age (Smart, 1975, as cited in Prugh, 1986).

The Project MATCH (Project MATCH Research Group, 1997) results for inpatient aftercare groups (aftercare arm) over one year follow up, are more encouraging. Results showed that subjects used alcohol on about 10% of follow-up days, and 35% were abstinent from alcohol (93% follow-up rate). This is a recent seminal, large scale and highly resourced study into the characteristics of clients for whom selected treatment modalities are successful. There were five three monthly follow-up contacts. The researchers do not report equivalent scores for other substances. Prior alcohol involvement, psychiatric severity, being male, support for drinking, and severity of alcohol typology predicted the post-treatment number of drinks per drinking day in the after care arm. Subjects self-selected and those with the resources and motivation to attend outpatient sessions may be over represented in this study.

In New Zealand, Sellman and Joyce (1996) contacted 94% of 99 alcohol dependent men who had completed two week inpatient treatment followed by a one week day programme. Follow up entailed monthly contact with subjects. Thirty-three per cent of the sample reported alcohol abstinence at six months, which increases to 42% by including non-problem drinkers. About 42% of subjects were also cannabis dependent. However, the results include no relapse to cannabis use statistics, or follow-up data beyond six months. Regular subject follow up may also have positively influenced results.

### *Therapeutic Community Outcomes*

Reports of therapeutic community treatment outcomes reveal widely varying success rates for drug users (Kooyman, 1992). For instance, 18% of clients recovered after a one-month programme (Bleiberg, Devlin, Croan, & Briscoe, 1994). A maximum of 63% (46% if the 28% not followed-up are

assumed to have relapsed) of homeless males were abstinent by self report for 30 days prior to six month to one year follow up (Burling, Seidner, Salvio, & Marshall, 1994). Their median stay in the CBT and therapeutic community hybrid programme was 84 days. Follow-up contact was monthly. Success rates for therapeutic communities are not significantly different from other treatments (McLellan, Luborsky, Woody, O'Brien, & Druley, 1983); length of time in treatment being the main predictor of success (Condelli, & Hubbard, 1994) for clients with low to medium psychiatric distress ratings (McLellan et al., 1983). Symptom improvements probably occur equally for alcohol users and drug users (McLellan, Luborsky, O'Brien, Woody, & Druley, 1982). The CATOR (Comprehensive Assessment and Treatment Outcome Research) was a 6-12 month follow-up survey of 8,087 inpatient abstinence based programme graduates, with a 57% follow-up rate (Hoffmann, & Miller, 1992). Follow-up abstinence rates from mood altering drugs were 60% with rates dropping to 34% if uncontacted graduates are assumed to have relapsed. Many of these programmes are a year or more in duration.

#### *Male Versus Female Outcome Results*

It is necessary to examine possible differential results for males and females, because the present study involves both male and female clients and Peniston, and Kulkoskys' (1989; 1990) study subjects were male only. Glover, and McCue (1977) compared aversion therapy with conventional psychiatric inpatient therapy. In the former group, 78% of females and 58% of males improved (abstinence or controlled drinking). In the latter group 43% of females and 28% of males improved at six-month to four-year follow up with 88% follow up rate. Davies et al. (1956, as cited in Annis, & Liban, 1980) followed up 98% of 50 clients at two years after inpatient treatment, which lasted two to three months and included aftercare. They found that 54% of females and 31% of males were virtually

abstinent. Although these studies indicate sex-linked outcome differences, reviews of the literature covering all treatment modalities find no overall outcome difference between the sexes (Duckert, 1987; Annis, & Liban, 1980).

One predictor of success for females is to have children in their care (Baily, Saunders, Phillips, & Allsop, 1990). Hatsukani, and Owen (1982), report 68% abstinence rates from drugs, alcohol, or both, for women with children compared to 45% without children (49% follow-up rate). The Project MATCH Research Group (1997) found that being male predicted a significantly greater number of days drinking and drinks per drinking day (the latter effect increasing with time) at follow up in the aftercare arm. It was thought likely that women would recover more readily than men in the present study, especially if they had children.

### *Summary*

Untangling the mass of outcome research is a difficult task. Studies reviewed above either have a follow-up rate greater than 85% as recommended by Desmond et al. (1995), or are large in scale, or demonstrate a result pertinent to this study. There are many complicating factors, not the least being that therapeutic communities in the United States primarily treat dependence on drugs such as opiates and cocaine and are usually at least one year in duration. Other confounding issues are that only graduates are included in the follow ups, and the fact that a follow-up process of frequent contact with subjects can contaminate the results. Although the studies quoted here may provide a guideline, perhaps the only meaningful comparison can be between groups within this study.

The literature contains reports of a wide range of outcome results. Longer-term programmes seem to produce superior results, and some studies indicate that women in the therapeutic community could to recover more reliably than males, especially if they care for children.

## *Aim of This Study*

### *Background*

A successful replication of Peniston and Kulkosky (1989; 1990) has not yet been completed. This study aims to replicate their study and evaluate whether EEG equipment is essential by comparing the standard protocol with a modified version of PKT treatment.

Early criticism of PKT research concerned the confounding of treatment variables given that it incorporates three distinct treatment approaches (open discussion at the Association of Applied Psychophysiology and Biofeedback conference, 1992). There is not yet any understanding of how each component contributes to the outcomes.

Attendees at the same conference suggested that temperature training alone might result in similar outcomes to PKT. Sealey et al. (1991) also suggested using an additional experimental group of 30 temperature training sessions, including visualisations and processing of imagery but excluding EEG biofeedback. Such an experiment would indicate whether the costly EEG equipment is essential for a significant improvement in treatment effectiveness.

### *Experimental Design*

Apart from replicating Peniston and Kulkosky's results, the main aim of this study was to discover whether the EEG component of the PKT protocol was essential, without substantially changing the procedure for the group not getting EEG biofeedback. Thus, the two experimental groups were to be essentially blind to the differences in treatment, to prevent possible differing expectancy effects of subjects in each group. Although the methodology used meant that the therapist could not be blind to the treatment differences, the therapist, who was also the

researcher, believed that both treatments were potentially similarly effective. The groups were as follows:

1. One experimental group (PKT-repl) comprised a group treated with the Peniston and Kulkosky treatment method, in addition to therapeutic community treatment, in an attempt to replicate Peniston and Kulkoskys' (1989; 1990) results. The PKT protocol was as close as possible to Peniston and Kulkoskys'. It comprised six sessions of finger temperature biofeedback using the Autogenic script, followed by 24 sessions of alpha/theta biofeedback. Debriefing of subjects occurred after each session. A tape recorder supplied EEG feedback sounds. The control of the tape recorder was via a relay switch, playing an audiotape of natural sounds that the subject chose from a small range of tapes. The subject would hear bursts of the sounds, which became more continuous if the subject produced the desired amplitude of the target brain wave more frequently. 1.
2. The modified experimental group (PKT-mod) was a group, treated identically, but instead of EEG biofeedback sessions, this group listened to pleasant monotonous sounds for the same period. To ensure that the subjects were blind to the differences between the groups, monitoring of their EEG occurred during sessions and the researcher briefly discussed the EEG recording with them after the session. However, instead of listening to intermittent natural sounds depending on their brain wave patterns, they listened to the tape of natural sounds of their choice, continuously. The subjects' sessions included the visualisation to increase the amplitude of their target brain waves but they had no meaningful feedback during sessions to determine whether they were successful. 1.
3. The control group (CTRL) received therapeutic community treatment only.

### *Outcome Measures Used*

At the end of treatment, between group outcome comparisons were in terms of EEG changes, personality and psychopathology changes. Drinking behaviours and life adjustment changes were measured at one-year follow up.

The choice of personality and psychopathology measures for the end of treatment was largely dependent on Peniston and Kulkosky's original research. They measured EEG pre- to post- treatment and they used the MCMI-I, a complex personality inventory involving multiple subscales. For this study, the MCMI-II<sup>5</sup> was used in order to replicate Peniston and Kulkosky's work. Another reason for its use was because its author claims that it measures a number of relatively common psychiatric clinical disorders such as bipolar disorder, depression, and anxiety and personality disorders such as antisocial, narcissistic, and passive aggressive as described in the American Psychiatric Association's diagnostic manual (DSM-III-R). A summary of the features of personality disorders appears in Appendix B. As Peniston and Kulkosky detected significant improvements for the majority of MCMI-I scales in PKT treated groups and not for conventionally treated groups, this study seeks to duplicate this effect but not to explain the significance of changes in the MCMI-II scales.

The study employed two other questionnaires at the end of treatment. PKT subjects were spending 24 sessions actively imagining resisting the urge to drink in tempting situations. To measure this, a questionnaire assessing subjects' ability to resist the temptation to drink (Situational Confidence Questionnaire) was used to attempt to assess how the visualisations may have differentially improved their chances of resisting alcohol compared to the conventionally treated controls. A questionnaire assessing a subject's feeling of having a purpose in life (Life Purpose

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<sup>5</sup> The MCMI-II is a more recent version of the MCMI-I. The differences are described in the Methods section below.



Questionnaire) was added to similarly attempt to differentially assess how spontaneous and possibly inspirational, imagery may have enhanced their feelings of having a valuable contribution to make in their future life. These questionnaires were included to assess the possible contribution of the non-physiological aspects of the therapy, involving interaction between therapist and subject. Of course, there is no way to differentiate between the effects of the different aspects of PKT, so any differences detected would need further investigation as part of components analysis research.

Peniston and Kulkosky (1989; 1990) used a rather crude measure of relapse at follow up. The substance use measures chosen for use in this study at one year follow up were not only expected to measure abstinence, but also to measure quantities and frequency of use, if substance use had resumed. To account for multiple periods of abstinence, subjects estimated the weekly number of days using substances and the dollar value, for each of the substances used, at various stages over the follow-up period (see Appendix C). The interviewer verified the subject's account of his or her substance use with a third party known to the subject, with the subject's permission. Because recovery is not just measured in terms of substance use, the follow up included another questionnaire, the Addiction Severity Index. This measures life changes in terms of economic status, legal involvement, relationships, and mental and physical health.

### *Reasons for the High Number of Outcome Measures*

This study involved more data points than subjects because of the number of questionnaires used, some consisting of multiple subscales. This may compromise the validity of the statistics. For the following reasons, the researcher decided that it would be advisable to obtain as much information as possible:

1. Peniston and Kulkosky also used a large number of data points and this was a replication of their work.

2. The objective of using the Life Purpose Questionnaire and the Situational Confidence questionnaire was to attempt to detect the differential effects of two of the PKT components; visualisations and spontaneous imagery. There is no record of a previous attempt to measure their therapeutic impact.
3. Peniston and Kulkoskys' relapse measure was rather imprecise. It was desirable to use more conventional relapse measures, including life adjustment, to be able to compare results with other outcome research.
4. Peniston and Kulkosky recorded only alpha and theta EEG bands. As beta and delta bands are co-related to alpha and theta bands, it was of interest to report how these other bands may vary with PKT.
5. The subjects were receiving standard therapeutic community treatment and not hospital treatment with no discernible therapeutic effect as in the original study. It was uncertain which measures would demonstrate a differential therapeutic effect for the additional PKT treatments, without undertaking a major pilot project.
6. This study represented a major undertaking in time and resources and as such, presented an opportunity to accumulate as much information as possible, to increase the body of scientific knowledge of this topic.

### *Hypotheses*

It was expected that the PKT-repl group would surpass the performance of the CTRL group in EEG results (greater alpha and theta band amplitude), MCMI-II results, and relapse results, comparable to the results of Peniston and Kulkoskys' (1989; 1990) work.

Because the PKT-mod group was learning temperature biofeedback and was spending all sessions in a relaxed state, this group was expected to exceed the outcomes of the CTRL group, but not by as much as the PKT-repl group. If the

two PKT groups achieved similar outcomes, then EEG biofeedback could be judged to be an inessential part of the protocol.

As previous PKT research suggests that EEG band amplitude increases elicit improved behavioural and psychometric scores, correlation between these variables was expected. Peniston, and Kulkosky (1989; 1990) did not look at these relationships.

The substance use outcome results were expected to exceed the outcome results reported in the introduction for therapeutic community treatment, and for the modalities that are similar to the individual components of PKT. This would indicate that PKT might be a superior treatment to other comparable programmes for substance abuse.

The dropout rates for each group were monitored because there is some indication from the Peniston and Kulkosky (1989; 1990) data that the control group dropout rate may be greater than that of the PKT groups.

If the results for the LPQ and SCQ questionnaires demonstrated differential outcomes for the experimental groups with respect to the CTRL group, this may contribute to the understanding of the therapeutic components of PKT. Spontaneous imagery is thought to have a therapeutic effect. It usually occurs during PKT when theta amplitudes are high. Consequently, correlation was expected between the number of images occurring during PKT and substances use outcomes.

## Method

### *Subjects*

#### *Subject Population*

The Victoria University Ethics Committee granted ethical approval for the study. Subjects were residents of Aspell House treatment centre at Plimmerton, New Zealand, a therapeutic community run by a charitable trust, the National Society for Alcoholism and Drug Dependence (NSAD). They were invited to join the study over the 14-month duration of the study. The therapeutic community aims to re-establish routines and self care patterns in the lives of the residents. It incorporates the philosophies of Alcoholics Anonymous (AA), and group therapy including psychodrama, transactional analysis, behavioural therapy, and Gestalt techniques. The usual day consists of routine household duties, conflict clearing meeting, group therapy, daily diary communication with personal therapist, education, sport, AA meeting. Residents could request one-on-one counselling. The programme is a minimum of 12 weeks' duration, and residents originate from many parts of the North Island of New Zealand. The programme is drug free and clients do not usually receive medication for co-morbid psychopathology such as affective disorders, nor is antidipsotropic medication (drugs which result in an aversive reaction on drinking alcohol) prescribed.

NSAD approved the study with the following conditions. The additional treatment was not to disrupt the conventional treatment being given, particularly group therapy. To ensure client privacy the experimenter did not have access to NSAD client files. The first requirement meant that all subjects would receive the therapeutic community treatment whereas Peniston and Kulkosky (personal communication, 1994) did not give their experimental group any additional treatments.

### *Subject Selection*

Clients, who had been abstinent for at least two weeks and less than 8 weeks, underwent the assessment process described below. If they consented and met the study criteria, they joined the PKT-repl, PKT-mod or CTRL group. As much as possible, allocation to groups occurred in the order of the subject's arrival at the centre, to ensure randomisation of selection. The first person joined the PKT-repl group, the second joined the PKT-mod group, the third became a CTRL subject and so on, with a maximum of five subjects being treated at one time, until each group comprised 15 subjects. Exclusion criteria were: presence of psychosis, diabetes, epilepsy, heart condition, serious head injury, heroin addiction, and abstinence of more than 2 months. The researcher allocated to each client, a unique number that appeared on all documentation in place of his or her name to protect anonymity.

### *Apparatus*

The EEG equipment used was the Thought Technology Ltd's Flexcomp computerised biofeedback system comprising a unit capable of recording eight channels from a variety of biological sensors. This study employed one temperature sensor and one EEG sensor. The specifications of this equipment follows. The temperature sensor is a .125" bead thermistor with a 50°-120° F (10° - 49°C) range. The EEG specifications are: common mode rejection over 30-500Hz is >130dB (at 50 Hz is 180 dB); preamplifier size is 1.5" diameter x .25"; sensitivity is < .08  $\mu$ v RMS; bandwidth is 5-100 Hz (adjustable); range is .08-2000  $\mu$ v. Fibre optic cable electrically isolates the subject, to exclude the possibility of electric shock. Electrodes were of the silver chloride reusable dome type and were replaced approximately every six weeks. The computer used was a 33 Hz 486 IBM compatible personal computer. The Flexcomp gives simultaneous visual feedback of up to eight representations of physiological data via computer screen,

and up to three digital or analogue sound representations of that data. The feedback can also be directed to two relay switches to which any device can be attached.

For the EEG training of the PKT-repl group, a technician wired two Walkman tape recorders so that they turned on via the computer relays, when the selected channel exceeded threshold. The subject listened to the intermittent output of both tape units, through a single set of earphones. The clients could choose between tapes of a heartbeat, sea sounds, bird sounds, or stream sounds, the latter three recorded in New Zealand. Another tape recorder with earphones, not connected to the computer relay system, was used to continuously play the subject's choice of tape to the PKT-mod treated control group.

Micropore tape secured the thermistor to the subject's finger. The researcher prepared EEG electrode sites with Nuprep abrasive skin prep gel, Curity alcohol preps and Signa Creme electrode cream.

Subjects underwent training sessions in a small room reserved for this purpose. A thermostatically controlled heater, a blanket, curtains and fan were used to keep heat levels constant around 65°F (19°C). A reclining chair, stool, cushion and inflatable neck pillow added to the subjects' comfort. Closed curtains reduced the amount of light in the room. However, noise levels were dependent on the activities going on in the centre and the traffic outside. Over the first six months superficial renovations to the treatment centre were ongoing and proved disruptive at times.

### *Physiological Baseline Measures*

For each subject, as close as possible to the same time of the day pre- and post- treatment, the researcher recorded four minute eyes open and four minute eyes closed baselines of temperature and EEG parameters. The procedure was as follows:

The subjects' had the thermistor attached to the middle finger of their left hand. Thermal data was produced at 500 samples per second (sps) and averaged to two sps for recording at every baseline and session.

The O1 (left occipital) site (international 10-20 montage, Jasper, 1958), and both earlobes, were rubbed with abrasive cream then cleaned with an alcohol prep then a little electrode cream was applied to the site. A small amount of electrode cream was applied to the electrodes. The active electrode was attached to the O1 site via a Velcro headband for stability. The reference electrode ear clip was attached to the subject's left earlobe and the ground electrode ear clip was attached to the right earlobe. Impedance was measured between the reference electrode lead and the active electrode lead. Excessive levels indicated to the experimenter that better contact was needed and the EEG leads were reapplied to obtain acceptable levels.

Data was collected at baselines and during sessions for EEG raw data at 1980 sps, and beta (13-20 Hz band), alpha (7-13 Hz band), theta (3-7 Hz band), delta (2 Hz band using high pass filter) EEG data all at 124 sps. EEG bands were averaged at 500 sps and all six were displayed simultaneously with a two-second sweep and appropriate scaling. An on-line waterfall spectral analysis was also on screen. It was refreshed at two-second intervals, displaying EEG activity up to 30 Hz.

### ***Intake Instruments:***

#### *Intake Questionnaire*

The Intake Questionnaire was used to gather information to assist in follow up, and to discover any pre-existing pathology that would preclude candidates from the programme as described in the selection section above (Appendix D).

### *The Mini Mental Status Examination (MMSE)*

This test (Folstein, Folstein & McHugh, 1973) measures dementia at a score of 22 or less out of a possible 30. It has high reliability with normal and cognitively impaired subjects, high validity for moderate to severe levels of dementia and correlates highly with other cognitive and neuropsychological tests (Tombaugh & McIntyre, 1992). This test provided a rough guide to possible attention deficits in subjects. McCrady and Abrams (1985) used a score of 22-25 on the MMSE to indicate possible cognitive impairment of addicts on intake. The cut-off of 25 or less was used in this experiment in an attempt to exclude those who may be adversely affected by the treatment because of attention deficit problems. PKT slows brain activity and there have been reports that this can accentuate pre-existing disorders of attention. This study used the less stringent MMSE scoring system of using the higher score of the serial sevens task and the spelling backward item (Tombaugh and McIntyre, 1992).

### **Psychometric Post-test Measures:**

#### *Millon Multiaxial Personality Inventory (MCMI-II)*

The MCMI-II (Millon 1987) was chosen to assess personality and clinical syndrome change and to enable comparison of results with those of Peniston and Kulkosky (1990). Although the MCMI is less sensitive to change than the MMPI, it is considerably shorter and so more practicable for use with this population. Its test/re-test reliability coefficients range mostly from .6 to .8. These are higher for personality disorders than for clinical syndromes, and higher for non-clinical populations than clinical (Craig and Weinberg, 1994). It has relatively poor convergent validity with clinically derived DSM-III-R Axis I and Axis II syndrome diagnoses.

The MCMI-II has two more scales than the MCMI-I. Millon formed an aggressive sadistic scale from the antisocial scale, and a self defeating scale from



the passive aggressive scale. Millon also changed 45 of the 175 questions and instituted a weighting system which improved sensitivity considerably for scales such as alcohol dependence and bipolar disorder (Gilbertini, 1993). The MCMI-II was designed to be isomorphic with the MCMI-I, and few differences have been found so far (Craig and Weinberg, 1993). There is some debate over the need for local base rate scores of prevalence in the psychiatric population. Millon provides base rate tables for males and females for both MCMI versions. He provided tables for Hispanic and African-American races for the MCMI-I only. There appears to be no literature concerning the use of the MCMI with New Zealand populations. Millon's (1987) personality disorder scale descriptions can be found in Appendix B.

McMahon, Davidson and Flynn (1986) used the MCMI-I to assess the effectiveness of the therapeutic community treatment for addictions. They observed significant changes after 4-6 weeks of treatment in 18 out of 20 scales for 98 alcoholics. Only paranoid and delusional scales were not significantly decreased (improved) and histrionic, narcissistic, antisocial, and compulsive scores increased significantly. As all groups in this study were receiving therapeutic community treatment, they were all expected to improve similarly on MCMI scales, the controls to a lesser extent. A 5 week inpatient programme, where trauma was relived in the imagination, involving 50 combat-related PTSD sufferers (Hyer, Woods, Bruno & Boudewyns, 1989) resulted in a non significant increase in 17 out of 20 scales in the MCMI-I. This indicates that some treatment programmes can have a negative effect on MCMI results.

#### *Situational Confidence Questionnaire (SCQ)*

The SCQ short form (Annis & Davis, 1988a) was designed to determine what triggers people to use substances. For this reason, it was used to construct appropriate imaginal scenes of resisting the temptation to use. Because subjects

practised these scenes during 24 sessions, it was thought that greater pre- to post-changes in the SCQ for the PKT groups may be an indication that the visualisations had enhanced the subjects' perceived level of control of their addiction in various situations. Greerly, Swift, and Heather (1992) found a negative correlation between the desire to drink on cue exposure, and levels of self efficacy. Pre-treatment (Rychtarik, Prue, Rapp & King, 1992; Solomon & Annis, 1990; Annis & Davis, 1988b) and follow-up SCQ means (Solomon, et al, 1991) have been positively correlated to consumption levels at follow up. Others have not found this relationship with post-treatment SCQ means (Rychtarik, Prue, Rapp & King, 1992; Mayer & Koeningsmark, 1991). However, Sitharthan & Kavanagh (1990) found that the number of situations where the subject had maximal confidence at post-treatment predicted consumption. Miller, Ross, Emmerson, and Todt (1989), reported an overall mean of 66% confidence for alcoholics on admission to treatment, and 91% after one year of abstinence. This study also demonstrated good discriminant validity. DiClemente, and Hughes (1990) hypothesised that self efficacy is indicative of the level of commitment to change. Barber, Cooper, and Heather (1991) adapted the long form to apply to heroin users. These researchers also found a moderate negative correlation between self efficacy and depression. The current study used the SCQ for both alcohol and marijuana users, by asking the client to answer the questions with respect to their drug of choice.

#### *Life Purpose Questionnaire (LPQ)*

This questionnaire is a short form of the purpose in life (PIL) questionnaire (Crumbaugh 1968; Crumbaugh & Maholick, 1964) which is based on Frankl's logotherapy (1955). The PIL differentiates between non psychiatric and psychiatric populations, correlates moderately with clinical assessment ( $r = .38$ ), and is reliable ( $r = .92$ ). Carroll (1991) reported positive correlation between higher PIL scores in recovered AA alcoholics, and the practice of

prayer/meditation, AA meeting attendance and length of sobriety. Other studies have shown it to correlate with depression, locus of control, the concept of an existential vacuum (Dyck, 1987) and the Short Index of Self-actualisation (Ebersole & Humphries, 1991). The LPQ (Hutzell & Peterson, 1986) is a shortened version of the PIL, with good validity ( $r = .75$  with PIL) and test/re-test reliability ( $r = .9$  after one week). It was chosen for this study to detect improvement in existential/spiritual parameters, as a possible measure of the effectiveness of the spontaneous imagery aspect of the PKT protocol. Higher scores on this questionnaire will indicate a less impulsive and more goal directed style found to be necessary for recovery in a review by Miller (1991). A score of 0-9 suggests no life meaning, 10-16 indicates uncertain definition and 17-20 suggests a definite sense of life meaning (Hutzell, et al, 1986). A score of around 17 (PIL 115) is expected in the New Zealand normal population (Black & Gregson, 1975). Alcoholics improved from mean scores of 10 - 11 (PIL 91 - 96) at intake to 14 - 15 (PIL 105 - 108) after 20 days of inpatient treatment (Jacobson, Ritter & Mueller, 1977).

### *Interviews for Follow Up:*

#### *Follow-up Questionnaire*

A purpose designed form (Appendix C) solicited the subject's opinion of the additional treatment, further treatment received, and reactions to alcohol on relapse. This form also elicited the start and finish date periods of each instance of relapse for each substance used by the subject. It also required the subject's use in terms of weekly frequency and quantity, in dollar value, during each period. This approach allows for flexibility in analysing the data. It will be possible to look at follow-up data for a finite period, specifically one year post-treatment. It will also be possible to obtain statistics for use of all substances, or an individual substance.

Another advantage of this approach is that Peniston and Kulkoskys' relapse statistic of drinking seven days or more can also be extracted for comparison.

The single follow up was to occur after one year had elapsed from termination of treatment. Although some accuracy may be lost by not keeping monthly records of usage, the researcher believed that a single follow up was preferable to prevent artificially positive relapse statistics through frequent contact. However, a single follow up increases the difficulty of locating subjects, as people can move frequently during one year.

#### *Addiction Severity Index (ASI)*

This is a widely used measure of recovery in terms of drug taking behaviour, social adjustment and medical, psychiatric, employment, and legal status. McLellan, Luborsky, Cacciola, Griffith, Evans, Barr, and O'Brien (1985) carefully constructed the inventory with good reliability and validity. McLellan, Luborsky, Woody, O'Brien and Druly (1983) found the psychiatric portion of the ASI to be the best predictor of treatment outcome. The developers found that the use of the ASI may be inappropriate for older alcoholics with cognitive impairment, younger drug abusers with histories of criminal activity, and adolescents under age 16 (McLellan, Luborsky, Cacciola, et al.). In this study, the role of the ASI was to judge comparative readjustment into the community and reductions in drinking behaviour. It was chosen from nine other possible instruments because it addresses both drug and alcohol use and recovery on a number of socio-economic axes as well. It takes about 10 to 20 minutes to complete, and can be administered by telephone.

## *Procedures*

### *Assessment Procedure*

All subjects who had been at the treatment centre for more than two weeks and less than eight weeks voluntarily attended a morning assessment session with an assessor independent of the researcher. This person's role was to minimise the effects of demand characteristics on the assessment data. The subjects completed the subject intake form and the MMSE, and read an explanation of the treatment (Appendix E). If they met the mental and physical health criteria of the study and agreed to participate, they could then ask questions about the study. They then had the consent form (Appendix F) explained to them which they signed, witnessed by the independent assessor.

Subjects then completed the MCMII-II, SCQ, and LPQ tests. The researcher checked that the tests had been completed correctly. The independent assessor then conducted the ASI interview, to be repeated at follow up. The researcher used two independent assessors. A social work student assessed about 75% of the subjects, a registered psychologist assessed the balance.

Subjects were dropped from the study if the MCMII results were invalid. Millon (1987) considers that disclosure scores over 590 indicate that respondents are over reporting symptoms and exaggerating their problems. Seventeen people were dropped for this reason alone. In all 88 people were assessed and 45 people were accepted into the study. Only two people did not want to participate. If the person met all of the forgoing criteria, the physiological baseline measures as described above, were then recorded.

The MCMII-II, SCQ, and LPQ tests and the physiological baseline were repeated after the six week treatment period for all subjects.

### *Treatment Sessions*

Each treated subject received 30 sessions comprising 6 temperature training and visualisation development sessions followed by 24 alpha/theta brain wave training sessions. Each subject came at a different time each day in rotation so that he or she missed a different hour of their conventional treatment (not group therapy) each day. This controlled for the possible confounding effects of time of day. Each session comprised around 30 minutes of biofeedback, and 30 minutes of applying and removing equipment. The latter included discussion of the aims and modality of the treatment, and discussion of any imagery (the procedure for this is described in full below) or any issues that arise as a result of training.

At the end of each session, subjects completed a form describing their experiences during the temperature and EEG biofeedback sessions (Appendix G). The researcher then discussed with the subjects the physical sensations, emotions and the thoughts, fantasies and images that occurred. Each element of an image was subject to a word association procedure, where the subject associated word or words with that element, then associated other words with that word. If possible, the subject located an underlying meaning for the overall image, which made sense to him or her. It was quite acceptable to find no particular meaning, but an attempt was usually made. The subjects sometimes appeared to gain insight, understanding and support from these connotations. For example, an image of a field of daffodils was a positive experience for a subject who associated daffodils with concepts such as Spring, growth, and joy.

### *Temperature Training Procedures*

Temperature was recorded as described in the Physiology Recording Procedures section above. The feedback was aural reverse analogue, i.e., it was a continuous tone which went down in pitch as the temperature went up and vice

versa. The pitch going down as temperature rises is thought to enhance relaxation (Fahrion, & Norris, 1990). No threshold settings were used. The goal of temperature training was to reach 95°F (36°C) finger temperature and maintain that temperature or higher for ten minutes.

During the first session, the researcher explained abdominal breathing and encouraged the use of it. For the six temperature training sessions, the researcher read the Autogenic script used by Peniston and Kulkosky. The researcher then asked the person to visualise a favourite warm place and, depending on the progress of the subject, verbal encouragement was given to let go the muscles of the shoulders, to feel pulsing in the fingers. It was also suggested that the subject reverse any downward trend in finger temperature by going down into the sound of the feedback.

Subjects developed visualisations, for later use with the EEG training, during a portion of the last three sessions of temperature training, as described below.

#### *Procedures for Developing Visualisations*

The researcher used the SCQ results to determine subjects' potential trigger situations for relapse. Each subject developed, in the form described below, three or more visualisations of rejecting addictive substances in these situations. Subjects also discussed what aspects of their behaviour either they, or other significant people in their lives, would like to see changed. The subject developed at least three more visualisations to promote these changes. The latter visualisations were sometimes based on MCMI-II results. For instance, if the MCMI-II clearly indicated a clinically significant personality deficit of passive aggressive behaviour, the subject would construct a visualisation of the subject expressing their feelings rather allowing them to build up. All visualisations could

be changed or omitted and new ones added as the subject desired. Some subjects chose to add affirmations they had developed with their counsellor at the centre.

Each visualisation consisted of mentally putting the self in the situation in general terms, perhaps, "I meet some friends and they offer me a drink". This was followed by standard phrases intended to make the visualisation more real, such as, "feel the feelings, be in the situation". After a short pause the subject rehearsed a new way of responding to the situation by seeing him or herself performing the new behaviour, e.g. "I see myself say, 'I don't drink any more, but I'd love a fruit juice'. If the pressure continues I see myself leave and ring my AA sponsor". Finally the subject imagined how he or she would feel having successfully overcoming temptation, for instance, "I feel relieved that I didn't pick up. I feel really good about myself." Another pause between visualisations allowed the subject to mentally complete the visualisation. The same general format was used to encourage the desired behavioural and personality changes.

### *EEG Training Procedures*

The researcher recorded the EEG physiology as described in the Physiology Recording Procedures Section above. Feedback was supplied by way of two tape recorders connected to the Flexcomp relays. One turned on when the EEG alpha band exceeded threshold and played a tape. The other turned on when the EEG theta band exceeded threshold and played a different tape. Subjects could choose between commercial tapes of stream sounds, bird sounds, sea sounds, and sounds of a heart beat. The tapes were chosen to not be too interesting, yet to be pleasant enough to want to hear them. The tapes remained on for a minimum of 1.5 seconds (a convenient limitation of the equipment that prevented very short bursts of sound) or until the EEG band signal dropped below threshold. They played simultaneously if both bands exceeded threshold. The experimental controls that were not receiving feedback, spent each session listening to their choice of the



aforementioned tapes. If a subject tended to go to sleep, the sea sound tape was often used because it contained occasional loud noises.

For the experimental group, the threshold was set so that the subject heard alpha feedback most (around 50-60% of the time) and theta feedback least (about 20-30%). Because there was no accurate way to judge the percentage feedback on-line, this was set in a rather arbitrary way. The researcher observed the amount of feedback and occasionally adjusted it within each session. The researcher instructed the subject to increase the amount of time alpha and theta feedback was audible.

When the subject was comfortable as described under treatment sessions above, he or she listened to the researcher reading in a slow and measured way, the individualised visualisations developed during temperature training. Although Peniston did not read visualisations to subjects, it was done in this study to ensure that the visualisations were at least brought to mind by the subject. The researcher then observed the subject while the subject focused on the feedback. If the researcher thought the subject had gone to sleep, she would make a noise to rouse the person slightly or quietly ask the person to lift a finger if he or she could hear her. If the person made a sudden movement, the researcher would ask what prompted that reaction. The researcher monitored the equipment and changed tapes and batteries as required.

End of session procedures, as described under treatment sessions above, were then followed.

### *Drop-Out Policy*

A decision was made to replace drop outs from the programme of all three groups, if they dropped out during the six week period that they were involved in the study. Peniston and Kulkosky did not report their drop-out rates, nor how they handled them, however these rates are important when it comes to follow up for

two reasons. First, it may show that PKT treatment is more enjoyable and results in higher retention of clients. Second, it may also result in lower pre-test MCMI-II scores for the CTRL group. This is because subjects with more conflictual behaviour patterns and, therefore higher MCMI-II scores, might be expected to drop out. Drop outs are usually asked to leave the treatment centre by centre staff. This may make it more difficult to attain post-test MCMI-II differences between groups, as PKT groups will have to change more to attain equal scores.

### *Follow-up Procedures*

As soon as one year had elapsed since leaving treatment, attempts began to locate subjects. Some subjects took over a year to find and others were located quite quickly.

Subjects had supplied up to three contact addresses and phone numbers on the intake form (Appendix D), and agreed to being contacted at follow up by signing the consent form (Appendix F), as recommended by Desmond et al., (1995). Desmond et al., (1995) recommended other measures which were taken as follows. A follow-up client finding form (Appendix H) assisted in tracking attempts to contact the subject. The follow-up interview was by telephone, reducing delays. The follow-up interview was short, about 20 minutes in duration. Interviewers were empathic and enthusiastic and were the same individuals who had previously conducted the intake interviews. The researcher located and interviewed some subjects who proved difficult to find.

The interview consisted of the ASI interview and the follow-up questionnaire described above (Appendix C). A relative or friend was asked to confirm the subject's substance use and life circumstances on the Close Associate's Follow-up Form (Appendix I). Early attempts to get subjects to complete MCMI-II, SCQ and LPQ forms via surface mail were unsuccessful and soon abandoned.

### *Data Analysis*

The SYSTAT statistical package for IBM compatible personal computers was used to perform statistical analyses. The Microsoft Excel spreadsheet package for IBM personal computers was used to prepare results in chart form.

Because of the small sample sizes, non-parametric analysis of variance techniques were planned. Wilcoxon's Signed Pairs test was used for repeat measures. The Kruskal-Wallis test and the Mann-Whitney U test were used for comparisons between three and two groups respectively.

To further relate EEG band changes to treatment outcome measures, Pearson correlation coefficients and forward stepwise multiple linear general model regressions were used to compare EEG band changes with changes in all MCMI-II subscale scores, changes in all ASI subscale scores, and days relapsed results. The Fisher's Exact test was applied to abstinence results, being a variation of the Chi-square test ( $\chi^2$ ) accurate for small samples. The version used allows analysis of tables larger than 2x2. An alpha level of .05 was used for all statistical tests.

## Results

### *Sample Characteristics*

After follow up, a control group subject was excluded from all results because she did not meet the criteria of less than two months abstinence prior to treatment. She was abstinent for a year prior to treatment. Table 2 shows the number of subjects in each group.

Table 2 illustrates the main characteristics of the sample population. The “% with children” heading indicates that the person is residing, in a parental role, with children, not necessarily their own. Those of non-European race described themselves as Maori, except for one Pacific Islander in each of the PKT-mod and the CTRL groups. The illegal income category indicates those whose main income is from illegal activity, often drug dealing. The percentage in brackets after the percentage who had undergone prior treatments, indicates what proportion of the sample had attended more than one prior treatment. The non Drug related convictions percentage includes those who have convictions for offences other than offences related to assault, drugs, weapons, drunkenness, vagrancy and driving. The listed offences were omitted because they may be a consequence of the addiction. Justice interest indicates those on parole, awaiting trial or under justice supervision for any offence. The majority was unskilled with minimum education levels of 10 years schooling. All categories are not significantly different between groups by way of Kruskal-Wallis test for age and Pearson’s chi-square test ( $\chi^2$ ) for the other categories. Justice interest approaches significance ( $\chi^2, p < .1$ ). These results indicate that the sample is random in nature.

Table 2: Percentage exhibiting demographic characteristics in each group.

Characteristic	PKT-repl n=15	PKT-mod n=15	CTRL n=14
Mean Age (range)	29 (16-42)	25 (17-36)	28 (19-43)
% with partner	47%	33%	36%
% with children	47%	33%	36%
% women	27%	27%	29%
% non-Caucasian	40%	33%	36%
% alcohol use only	27%	47%	21%
Usually employed	27%	47%	36%
Illegal income	13%	20%	21%
Non drug convictions	67%	47%	50%
Prior treatments	33% (13%>1)	33% (13%>1)	36% (7%>1)
Justice interest	33%	33%	71%

All subjects' scores for MCMI-II alcohol and drug dependence scales were over 57. The MCMI median for a clinical population's is 60.

### *Treatment Period Results*

#### *Pre-treatment Differences*

Prior to treatment the means of the three groups did not differ significantly in any psychometric or EEG measures by way of the Kruskal-Wallis (K-W) test.

In this study, replacements were required for seven control group subjects who were asked to leave the treatment centre by centre staff before the end of the six week treatment period. In contrast, only two in the PKT-repl group and three in the PKT-mod group were similarly replaced. However this difference was not significant ( $\chi^2$ ).

One indication that the higher drop-out rate resulted in less pathology in the resulting CTRL group, is that the group of seven drop outs from the CTRL group had a significantly higher ( $U, p < .05$ ) MCMI-II antisocial personality scale mean

( $M = 106$ ) than the actual CTRL group ( $M = 87$ ). This mean ( $M = 106$ ) was not significantly different from the PKT groups' antisocial scale mean ( $M = 99, 97$ ).

### *Post-Treatment Differences*

Post-treatment there were no significant differences between the three groups for the LPQ, the SCQ, the MCMI scales or the EEG physiology measures, except for one physiological measure. Beta eyes open amplitude was significantly greater ( $U, p < .05$ ) for the PKT-repl group than the CTRL group, post-treatment. This may be a chance result given that 46 variables were compared, and that the PKT-repl group beta was similarly higher at pre-test (see Table 5).

### *Pre- to Post- Treatment Comparisons - Psychometric Scores*

#### *LPQ and SCQ*

The LPQ and the SCQ increased significantly indicating improvement, for all three groups (see Table 3). The mean SCQ in a North American alcohol dependent population one year sober has been reported to be 91% (Miller, Ross, Emmerson, & Todt, 1989). In a similar population, Jacobson, Ritter, and Mueller (1977) also observed that LPQ scores improved from 10-11 to 14-15 after 20 days inpatient treatment. Outcome scores observed in this study fell in the range of 80-90% for the SCQ and 13.5-15 for the LPQ close to those predicted by these studies.

*Table 3: Wilcoxon signed pairs tests, one tailed, of LPQ and SCQ from > 2 Weeks Abstinent (Pre) and 6 weeks later (Post).*

Test	PKT-repl			PKT-mod			CTRL		
	Pre- M(SD)	Post- M(SD)	<i>p</i> ( <i>n</i> =15)	Pre- M(SD)	Post- M(SD)	<i>p</i> ( <i>n</i> =15)	Pre- M(SD)	Post- M(SD)	<i>p</i> ( <i>n</i> =14)
LPQ	8.9(4)	14.8(4)	.000***	7.2(3)	13.5(2)	.000***	10.0(5)	14.5(3)	.003**
SCQ	60(23)	86(12)	.000***	55(22)	81(21)	.002***	64(23)	86(13)	.000***

\*\*  $p < .005$ , \*\*\*  $p < .001$ .

## MCMI-II

The MCMI is more complex. Some scales might be expected to increase with recovery and some decrease. As reported by other studies described above (McMahon et al., 1986), this study also demonstrated small increases or virtually no change in the following scale means: histrionic, narcissistic, antisocial, aggressive sadistic, and compulsive (see Table 4). The bipolar disorder mean also changed little in this study.

Table 4: Wilcoxon signed pairs tests, one-tailed, of MCMI-II Scales from > 2 Weeks Abstinent (Pre) to 6 weeks later (Post).

MCMI-II Scale	PKT-repl			PKT-mod			CTRL		
	Pre- M(SD)	Post- M(SD)	p (n=15)	Pre- M(SD)	Post- M(SD)	p (n=15)	Pre- M(SD)	Post- M(SD)	p (n=14)
PERSONALITY DISORDERS									
Schizoid	74(15)	59(16)	.001****	75(23)	54(28)	.005****	68(27)	59(28)	.051#
Avoidant	84(19)	68(25)	.008**	93(14)	70(22)	.003****	81(27)	73(23)	.079#
Dependent	60(28)	41(27)	.018*	55(36)	35(28)	.070#	59(28)	53(26)	.164
Histrionic	68(17)	75(13)		71(11)	73(10)		68(20)	72(25)	
Narcissistic	78(20)	86(9)		75(18)	75(25)		77(19)	86(23)	
Antisocial	99(15)	95(17)		97(15)	101(17)		88(21)	88(17)	
Aggr. Sadistic	92(19)	92(24)		84(19)	80(24)		81(26)	79(20)	
Compulsive	45(28)	53(25)		36(20)	53(18)		52(24)	52(24)	
Passive aggr.	99(18)	82(26)	.015*	100(15)	69(32)	.002****	90(32)	72(30)	.012*
Self Defeating	81(19)	62(25)	.005****	92(16)	65(18)	.000****	83(21)	67(24)	.011*
SEVERE PERSONALITY DISORDERS									
Schizotypal	76(19)	63(21)	.005****	85(24)	62(14)	.002****	68(11)	65(18)	.079#
Borderline	88(17)	73(20)	.003****	92(18)	74(11)	.004****	85(27)	75(28)	.013*
Paranoid	73(13)	67(12)		70(16)	64(15)		68(24)	74(26)	
CLINICAL SYNDROMES									
Anxiety	60(31)	39(25)	.001****	73(13)	36(29)	.001****	65(20)	37(22)	.002****
Somatoform	56(7)	43(17)	.013*	57(10)	44(17)	.028*	60(11)	46(24)	.037*
Bipolar	62(9)	62(14)		60(12)	64(10)		67(24)	63(20)	
Dysthymia	64(26)	51(27)	.050*	79(18)	61(20)	.008**	67(21)	55(22)	.032*
Alcohol depend	90(14)	84(13)	.025*	91(10)	83(11)	.009**	88(16)	81(12)	.028*
Drug depend.	91(13)	89(15)		90(9)	84(14)		89(18)	84(20)	.089#
SEVERE CLINICAL SYNDROMES									
Thought dis.	68(8)	61(13)	.010**	78(19)	55(23)	.001****	65(24)	60(22)	.098#
Major depr.	64(16)	51(16)	.002****	69(14)	57(7)	.006**	59(19)	53(17)	.027*
Delusional dis.	63(11)	59(21)	.084#	59(12)	54(18)		64(21)	62(23)	

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .005$ , \*\*\*\*  $p < .001$ , #  $p < .1$

Of the 16 scales that decreased, 13 of the PKT-repl group scales decreased significantly, 12 of the PKT-mod control group scales decreased significantly and eight of the CTRL group scales decreased significantly (see Table 4).

The scales in which either PKT group, or both decreased significantly and the CTRL group did not (although nearing significance), were: schizoid, avoidant, schizotypal, and thought disorder (see Table 4). The dependent scale improved significantly for the PKT-repl group only (see Table 4). All three groups significantly decreased in passive aggressive, self defeating, borderline, anxiety, somatoform, dysthymia, alcohol dependence and major depression scales (see Table 4).

#### *Pre- to Post- Test Difference Comparisons - Psychometric Measures*

Comparisons between pre- to post- test MCMI-II subscale differences between groups, revealed two significant differences. First, the PKT-mod group thought disorder scale decreased (improved) significantly more than the CTRL group ( $U, p < .05$ ). Second, the PKT-mod group compulsive scale increased<sup>6</sup> significantly more than the CTRL group ( $U, p < .005$ ). Similar comparisons for the SCQ and LPQ results revealed no significant differences. This may be a chance result given that 24 variables were compared between groups.

#### *Pre- to Post- Treatment Comparisons - Physiology Measures*

EEG RMS amplitude means and area under the curve, over a two minute artifact free epoch, were extracted for beta, alpha, theta and delta EEG bands. These were repeated with the subjects' eyes closed and eyes open, resulting in a

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<sup>6</sup> The pattern for all studies of MCMI changes with treatment is for the compulsive scale to increase. From the literature, other scales which might be expected to increase are histrionic, narcissistic, antisocial, and hypomania (bipolar disorder) (Byers, 1992; McMahon, Flynn & Davidson, 1995; Peniston & Kulkosky, 1990; 1992). These scales showed little change or some increase in this study also, including the aggressive sadistic scale which was derived from the antisocial scale of the MCMI-I.



total of 16 variables pre- and post- treatment. In the CTRL group, 15 out of 16 EEG measures reduced (see Table 5). Although the sign test for the preceding results is not valid owing to natural covariance<sup>7</sup>, it is highly significant ( $p < .005$ ). Nine of these reductions were significant (eyes open beta area under the curve, eyes open theta and theta area under the curve, eyes closed beta and beta area under the curve, eyes closed alpha and alpha area under the curve, eyes closed delta and delta area under the curve (WC,  $p < .05$ )). Only two of 16 PKT-mod measures decreased significantly (eyes open theta area under the curve, eyes open delta area under the curve (WC,  $p < .05$ )). No PKT-repl group measure changed significantly (see Table 5).

Table 5: Wilcoxon signed pairs tests, two tailed, of EEG band measures from > 2 Weeks Abstinent (Pre) to 6 weeks later (Post).

EEG Measure	PKT-repl			PKT-mod			CTRL		
	Pre- M(SD)	Post- M(SD)	$p$ (n=15)	Pre- M(SD)	Post- M(SD)	$p$ (n=15)	Pre- M(SD)	Post- M(SD)	$p$ (n=14)
<b>EYES OPEN</b>									
Beta	2.0(.5)	2.1(.6)		1.9(.5)	1.8(.5)		1.8(.5)	1.7(.8)	.074#
Beta AUC	211(78)	184(55)		212(168)	168(92)	.056#	204(64)	171(103)	.041*
Alpha	3.2(1.1)	3.6(1.6)		2.9(.9)	3.0(1.2)		2.9(1.2)	3.0(1.9)	
Alpha AUC	346(170)	332(217)		326(96)	293(189)	.056#	333(154)	315(239)	
Theta	2.7(.6)	2.7(.7)		2.8(1.1)	2.5(.5)		2.6(.7)	2.3(.7)	.026*
Theta AUC	276(105)	237(398)	.064#	299(85)	226(102)	.035*	301(93)	239(105)	.019*
Delta	6.4(1.3)	6.6(1.8)		6.2(1.2)	5.8(1.3)		6.0(1.4)	5.8(2.6)	.084#
Delta AUC	666(234)	590(246)		695(187)	547(266)	.022*	688(188)	605(351)	.074#
<b>EYES CLOSED</b>									
Beta	2.5(.9)	2.4(.8)		2.2(.7)	2.1(.7)		2.7(1.0)	2.2(.9)	.016*
Beta AUC	267(129)	270(84)		247(104)	210(99)		313(128)	227(111)	.019*
Alpha	6.7(3.9)	6.7(4.0)		6.8(2.9)	7.4(3.4)		8.0(3.9)	6.4(3.3)	.009**
Alpha AUC	759(511)	752(459)		751(307)	755(443)		936(487)	689(424)	.019*
Theta	2.8(1.0)	3.2(1.2)		2.7(.6)	2.8(.6)		3.0(.8)	2.8(.9)	
Theta AUC	304(150)	358(144)	.042#	302(99)	268(115)		350(109)	290(127)	.084#
Delta	9.1(4.0)	9.2(4.0)		8.9(2.9)	9.4(3.3)		10.2(3.9)	8.8(3.7)	.016*
Delta AUC	1007(570)	1037(463)		979(354)	938(486)		1119(495)	941(495)	.030*

\*  $p < .05$ , \*\*  $p < .01$ , #  $p < .1$   
 Note: AUC = Area Under the Curve

<sup>7</sup> EEG band amplitudes tend to vary in unison as they are essentially derived from the same basic signal.

Separation of groups for main drug of choice, being either alcohol or cannabis, revealed no significant differences between groups pre- or post-treatment and within groups pre- to post- treatment. When all subjects who took alcohol only ( $n = 14$ ) were separated from subjects who took cannabis with or without alcohol involvement ( $n = 31$ ), the alcohol only group was lower on all 16 EEG measures. Although the sign test is again not valid owing to natural covariance between EEG measures<sup>7</sup>, it is also highly significant,  $p < .005$ . Two were significantly lower (eyes closed theta area under the curve and eyes closed alpha area under the curve ( $U, p < .05$ )). However, analyses revealed no statistically significant comparisons between groups depending on substance used, at pre- or post- test, possibly due to the small sample size.

#### *Pre- to Post- Test Difference Comparisons - Physiology Measures*

Figure 1<sup>8</sup> shows the differences in the four EEG bands from pre- to post-treatment. The drop in amplitude ( $\mu\text{v}$ ) is clearly greater for the CTRL group. This difference is significant for the PKT groups as indicated on the graph. The PKT-repl group changes are not significantly different from those of the PKT-mod group, in any of the four EEG bands. However the PKT-repl group changes are significantly greater than the CTRL changes for the beta EEG band ( $U, p < .05$ ) and the PKT-mod group changes are significantly greater than the CTRL changes for the alpha and delta EEG bands ( $U, p < .05, p < .01$ ). Other bands approach significance.

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<sup>8</sup> The four measures of eyes closed amplitude means for beta, alpha, theta and delta EEG bands are the most relevant as alpha and theta amplitudes were trained for increase with the eyes closed, not eyes open; also the area under the curve is a measure which is equivalent to amplitude and is somewhat redundant. For the remainder of the EEG results, only the four eyes closed amplitude measures will be considered for each band.

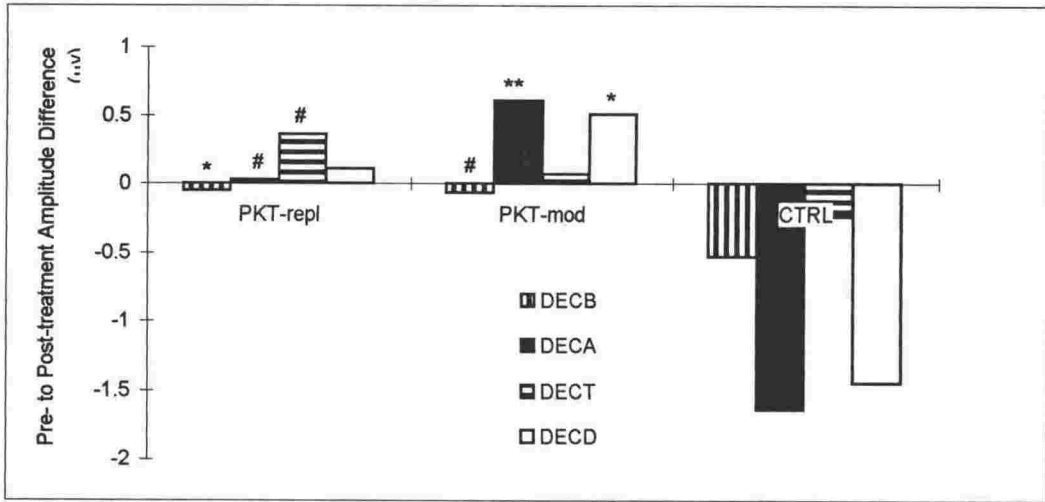


Figure 1: Pre- to post-treatment amplitude differences for each treatment group for 4 EEG bands; eyes closed beta (DECB), eyes closed alpha (DECA), eyes closed theta (DECT), eyes closed delta (DECD), all subjects.

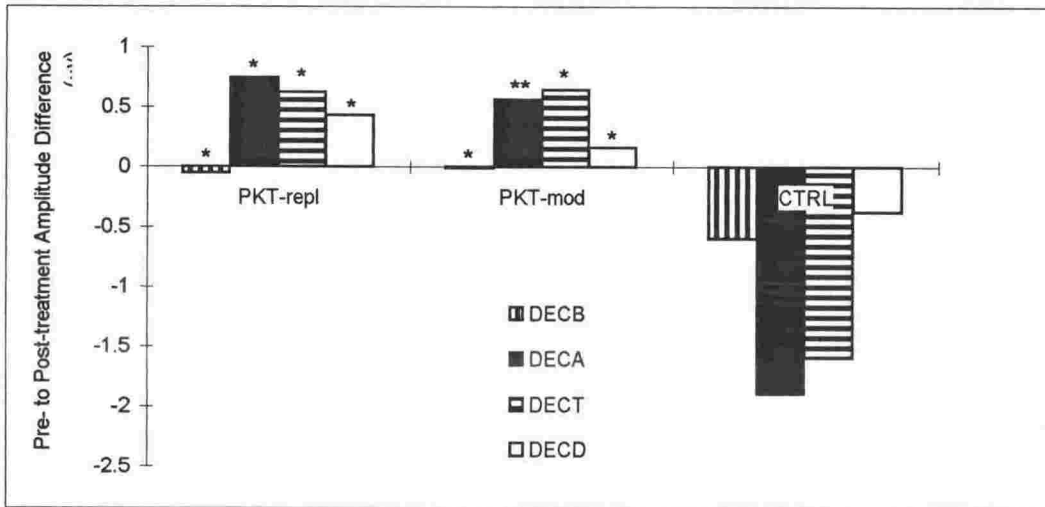


Figure 2: Pre- to post-treatment amplitude differences for each treatment group for four EEG bands, users of cannabis and alcohol.

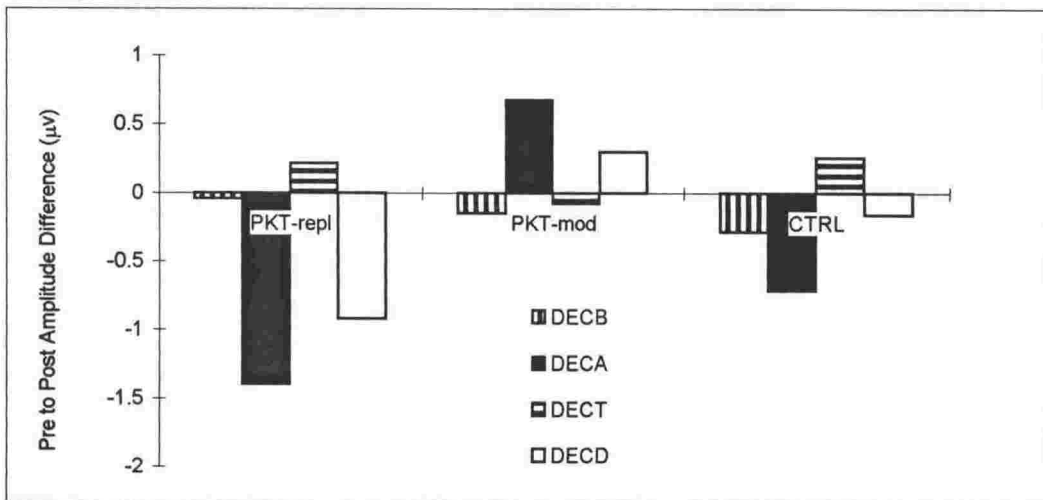


Figure 3: Pre- to post-treatment amplitude differences for each treatment group for four EEG bands, users of alcohol only. (No significant differences between groups.)

Note. Statistical significance notes are for Mann-Whitney U Test comparison of PKT groups with CTRL group

\*  $p < .05$ , \*\*  $p < .01$ , #  $p < .1$

When only cannabis users are considered (Figure 2), the between group variations shown in Figure 1 are accentuated. Figure 2 shows that cannabis users of both PKT groups achieved significantly higher amplitude change than the CTRL group for all EEG bands. Figure 3 on the other hand shows that alcohol users did not demonstrate an identifiable pattern of EEG change. In addition, none of the groups were significantly different from each other for any EEG band.

### *Relationships Between EEG Changes and MCMI-II changes*

Several Pearson correlation coefficients between the eyes closed EEG band changes and MCMI-II scale changes were significant for each group as described in Table 6. However, because 264 correlation calculations were performed, Bonferroni probabilities were subsequently applied and none were significant. Consequently, the Pearson correlation results reported here may be suspect. Nonetheless, in every case the significant relationships are as predicted, i.e., as the EEG change increases (improves), the MCMI-II difference decreases further (improves). For that reason, they have been included.

*Table 6: Significant Pearson coefficients of correlation between eyes closed EEG band differences and MCMI-II scale differences for each group.*

Group	MCMI-II Scale	EEG band	<i>r</i>	<i>p</i>
PKT-repl	Beta	Antisocial	-.611	.016 *
	Alpha	Aggressive Sadistic	-.605	.017 *
	Alpha	Antisocial	-.628	.012 *
	Alpha	Paranoid	-.565	.028 *
	Theta	Dysthymia	-.537	.039 *
	Theta	Self Defeating	-.568	.027 *
	Delta	Antisocial	-.610	.016 *
	Delta	Paranoid	-.533	.041 *
PKT-mod	Alpha	Major Depression	-.642	.010 *
	Delta	Major Depression	-.668	.006 **
CTRL	Beta	Dysthymia	-.616	.019 *
	Beta	Major Depression	-.711	.004 ***
	Beta	Somatoform	-.547	.043 *
	Alpha	Alcohol dependence	-.556	.039 *
	Alpha	Bipolar disorder	-.641	.014 *
	Alpha	Drug dependence	-.550	.042 *
	Delta	Alcohol Dependence	-.543	.045 *
	Delta	Bipolar Disorder	-.657	.011 *

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .005$

Additionally, eight comparisons approached significance ( $p < .1$ ) for the PKT-repl group, six for the PKT-mod group and five for the CTRL group. In total, 198 of the 264 correlation results were in the desired direction and 37 of these reached or approached significance. However in all cases, these correlation results only account for about 30% to 50% of the variance. The following regression analyses further support the relationship.

Separate stepwise forward regression analyses of all EEG bands with all MCMI-II scales were performed across groups, with groups entered into the model as levels, using the following model:

$$\begin{aligned} \text{MCMI-II subscale difference} = & \text{constant} + \text{PKT-repl grouping} + \text{PKT-mod grouping} \\ & + \text{CTRL grouping} + \text{EEG band difference} \end{aligned}$$

These results are summarised in Table 7 below. They show a significant linear relationship in the appropriate direction, between all of the above MCMI-II scale differences (except somatoform, and dysthymia) and EEG band amplitude differences. Table 7 also contains additional significant MCMI-II scale negative regression relationships with EEG band differences (borderline, delusional, and passive aggressive). One positive and highly significant regression result was for compulsive personality. This indicates that as the theta EEG band amplitude increases, compulsive behaviour increases similarly in all three groups. As previously stated, effective programmes result in an increase in the MCMI compulsive scale. However, these regression relationships account for 25% of the variance at most, indicating a relatively poor fit. This variability can be seen in the examples of plotted data in Figures 4 to 6 below.

An attempt was made to improve the fit within groups by adding likely variables to the equation. No combination attempted, increased the variance accounted for, to significant levels. The group level variables did not significantly contribute to the models, except for bipolar disorder regressions with alpha and delta EEG bands. This indicates that the slope of the CTRL group's linear

equation was significantly lower than the PKT-repl group, indicating greater levels of decrease (improvement) in bipolar symptoms given the same amount of change in EEG. This is a scale which is often seen to increase (worsen) with effective treatment as previously described. Consequently, the CTRL group's enhanced

Table 7: Summary of hierarchical regression analysis for eyes closed EEG band changes predicting MCMI-II scale changes (n=44).

EEG	Band	Group (Step 1)	MCMI-II Scale Difference (Step 2)	<u>B</u>	SE <u>B</u>	$\beta$
<b>Difference</b>						
Beta			Major Depression	-16.855	4.263	-.545 ****
			Paranoid	-12.757	5.614	-.331 *
Alpha	CTRL		Aggressive Sadistic	-.3513	1.498	-.337 *
			Alcohol Dependence	-1.631	.667	-.353 *
			Antisocial	-2.548	1.128	-.329 *
			(Bipolar)	-12.546	4.804	-.414 *
			Bipolar	-2.818	.997	-.447 **
			Borderline	-2.150	1.066	-.294 *
			Delusional disorder	-1.806	.844	-.310 *
			Drug Dependence	-2.159	.936	-.335 *
			Major Depression	-3.128	.983	-.441 ***
			Paranoid	-3.856	1.229	-.436 ***
Theta			Borderline	-2.226	1.081	-.300 *
			Compulsive	11.439	3.975	.402 ***
			Major Depression	-8.420	3.551	-.344 *
Delta	CTRL		Aggressive Sadistic	-3.261	1.561	-.307 *
			Alcohol Dependence	-1.784	.670	-.380 *
			Antisocial	-2.417	1.155	-.307 *
			(Bipolar)	-11.987	4.730	-.395 *
			Bipolar	-2.819	1.004	-.438 **
			Borderline	-2.226	1.081	-.300 *
			Delusional disorder	-1.924	.853	-.325 *
			Major Depression	-3.382	.982	-.469 ***
			Paranoid	-3.946	1.246	-.439 ***
	Passive aggressive	-4.136	1.994	-.032 *		

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .005$ , \*\*\*\*  $p < .001$

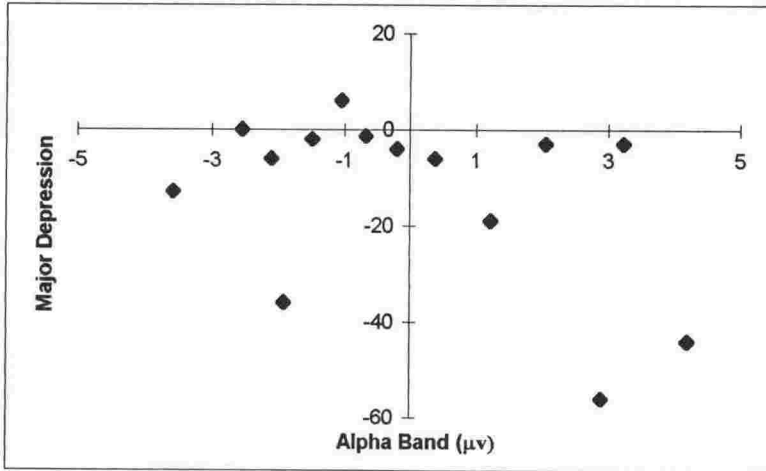


Figure 4: PKT-repl group scatter plot of MCMI-II scale differences and eyes closed alpha EEG band differences.

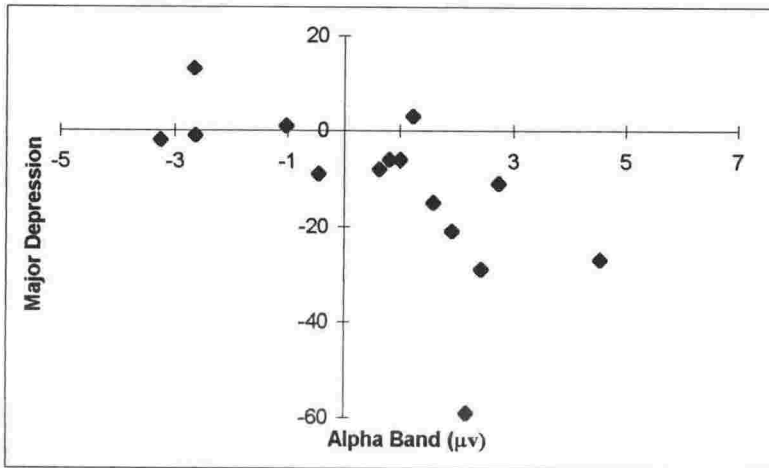


Figure 5: PKT-mod group scatter plot of MCMI-II scale differences and eyes closed alpha EEG band differences.

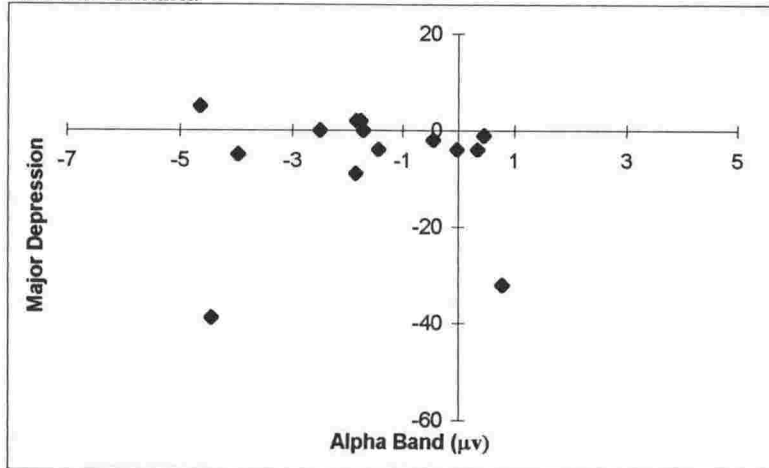


Figure 6: CTRL group scatter plot of MCMI-II scale differences and eyes closed alpha EEG band differences.

improvement in this scale could be an indication of less effective treatment. Otherwise, the fact that the grouping variables do not contribute to the variance in most cases indicates that all three groups have the same linear relationship between EEG band differences and MCMI-II differences. The plots of the major depression raw data for alpha EEG band only, in Figures 4 to 6, show that the CTRL group trends appear to have the same general linear relationship as the PKT groups.<sup>9</sup> However, the two PKT groups' data extend further into the lower right quadrant. This indicates that subjects in the PKT groups experienced higher levels of improvement in those related variables.

### *Follow-up Results*

#### *Sample Characteristics*

Forty-three of 45 subjects were contacted (96% follow-up interview rate). Desmond et al (1995) conclude from the literature that a follow-up interview rate greater than 85% is desirable for valid results. In this study, the PKT-mod and the CTRL groups had 100% follow-up interview rate. Two of the PKT-repl group subjects were unable to be found, but reliable reports indicate that they have both relapsed. The two research assistants, who conducted the intake, contacted and interviewed about 70% of follow-up subjects. The researcher found and interviewed the balance of subjects who were more difficult to trace.

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<sup>9</sup> It must be remembered that the four EEG bands are naturally correlated with each other. Thus if major depression changes correlate with alpha band changes, it is likely to have a similar association with the other three bands. Similarly for MCMI-II scales, the same items can contribute to a number of different scales, causing a natural correlation between some MCMI-II scales.



At the time of follow up, all experimental subjects reported that they were blind to the fact that there were two experimental groups. This outcome occurred in spite of the subjects having been told on intake that they would be randomly assigned to two experimental groups that were slightly different.

Following participation in the treatment phase, none of the control group but two of the PKT-repl group and three of the PKT-mod group reported feeling sick on using alcohol the first time or on smelling alcohol. Ethically it was necessary to inform subjects that this might happen on entry to the study, so suggestion may play a part in this result. Twelve of 13 PKT-repl group subjects and 13 of 15 of PKT-mod control group subjects felt that PKT helped them. Subjects described the benefits, in order of frequency, as via relaxation, visualisations, access to inner thoughts, help with fears, increased confidence, and fewer symptoms of depression.

### *Relapse Results*

Tables 8 and 9 below show relapse rates. Table 8 represents a snapshot of subjects' drinking patterns for first year post-treatment. Table 9 contains a summary of data throughout the follow-up period which varied depending on the time spent locating the subject. The mean follow-up time was between 17 and 18 months for all three groups. Figures 7 to 12 below show tables 7 and 8 in graphical form. Considering abstinence statistics only, no significant differences were found between groups, by way of the Fisher's Exact test ( $\chi^2$ ). Tables 8 and 9 demonstrate that, excluding female results, the two PKT groups' relapse results are superior to the CTRL group in all measures. The male results are consistently more than twice those of the CTRL group. Despite low numbers in each group, the male number of days using substances at one year follow up, is significantly different between groups (see Figures 9 and 11). Both PKT groups are superior to controls (K-W  $p < .05$ ). The PKT-repl group is using substances significantly less

than the CTRL group ( $U, p < .05$ ), as is the PKT-mod group ( $U, p < .05$ ). The male percentage of days using substances over the entire follow-up approaches significance between groups (K-W,  $p < .1$ ) and the PKT-repl group (males) uses substances on significantly fewer days than the CTRL group ( $U, p < .05$ ).

On the other hand, of the 12 females in the study, only two relapsed seriously, one in the PKT-repl group and one in the CTRL group. Any chemical use by the other females was not more than one occasion of moderate use per fortnight or less frequently. Females recovered at a high rate in all three groups as shown in Figures 8 to 11. The literature indicates that the fact that all but two of the women who participated in the study, have young children in their care, may contribute to their recovery rate.

Table 8: Relapse rates at end of first year after treatment.

Statistic	PKT-repl	PKT-mod	CTRL	<i>p</i>
No. abstinent for 1 yr. Follow up	7 (47%) <i>n</i> =15	7 (47%) <i>n</i> =15	4 (29%) <i>n</i> =14	
-males	5 (56%) <i>n</i> =9	4 <sup>a</sup> (36%) <i>n</i> =11	1 <sup>a</sup> (10%) <i>n</i> =10	
-females	2 <sup>a</sup> (50%) <i>n</i> =4	3 <sup>a</sup> (75%) <i>n</i> =4	3 <sup>a</sup> (75%) <i>n</i> =4	
No. abstinent 1 month at 1 yr follow up	8 (62%) <i>n</i> =13	8 (53%) <i>n</i> =15	5 (36%) <i>n</i> =14	
-males	5 (56%) <i>n</i> =9	5 (45%) <i>n</i> =11	2 (20%) <i>n</i> =10	
-females	3 (75%) <i>n</i> =4	3 (75%) <i>n</i> =4	3 (75%) <i>n</i> =4	
Mean days using chemicals in first year	52 (14%) <i>n</i> =13	38 (11%) <i>n</i> =15	107 (30%) <i>n</i> =14	.105 <sup>b</sup>
-males	45 (13%) <i>n</i> =9	51 (14%) <i>n</i> =11	125 (35%) <i>n</i> =10	.017 <sup>b*</sup>
-females	62 (17%) <i>n</i> =4	4 (1%) <i>n</i> =4	68 (19%) <i>n</i> =4	.601 <sup>b</sup>

<sup>a</sup> Each of these abstinent groups included one individual who had used substances minimally, using alcohol or cannabis for a few hours less than monthly.

<sup>b</sup> Kruskal-Wallis non-parametric test

\*  $p < .05$

Table 9: Relapse rates for entire follow-up period.

Statistic	PKT-repl	PKT-mod	CTRL	<i>p</i>
Mean percent days using prior to study (at worst)	74% <i>n</i> =13	69% <i>n</i> =15	79% <i>n</i> =14	
Mean number of months of follow-up period	17.2	17	17.7	
Mean percent days using chemicals for entire follow up	16% <i>n</i> =13	16% <i>n</i> =15	32% <i>n</i> =14	.232 <sup>a</sup>
-males	14% <i>n</i> =9	26% <i>n</i> =11	36% <i>n</i> =10	.085 <sup>a #</sup>
-females	18% <i>n</i> =4	1% <i>n</i> =4	21% <i>n</i> =4	.695 <sup>a</sup>
Subjects abstinent for entire follow up	6 <sup>b</sup> (40%) <i>n</i> =15	6 <sup>b</sup> (40%) <i>n</i> =15	3 <sup>b</sup> (21%) <i>n</i> =14	

<sup>a</sup> Kruskal-Wallis non parametric test

<sup>b</sup> Of the 15 subjects reported as abstinent in these three groups, a total of five reported using alcohol or cannabis for a few hours less than monthly

#  $p < .1$

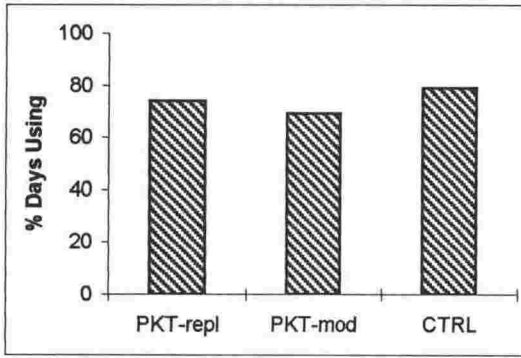


Figure 7. Mean percentage days using drugs/alcohol, at worst, pre treatment.

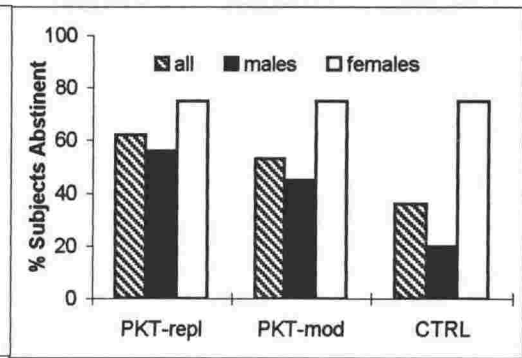


Figure 8. Mean percentage subjects abstinent for final month of one year post treatment period, all substances.

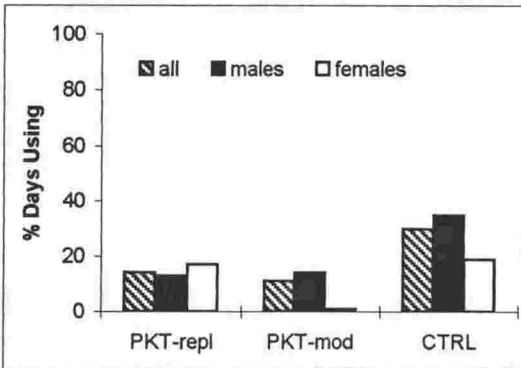


Figure 9. Mean percentage days relapsed in first year post treatment, all substances.

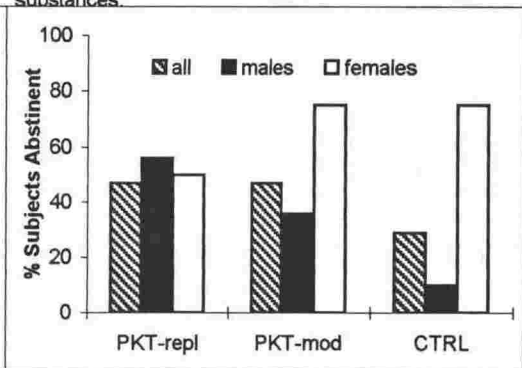


Figure 10. Mean percentage subjects abstinent for first year post treatment, all substances.

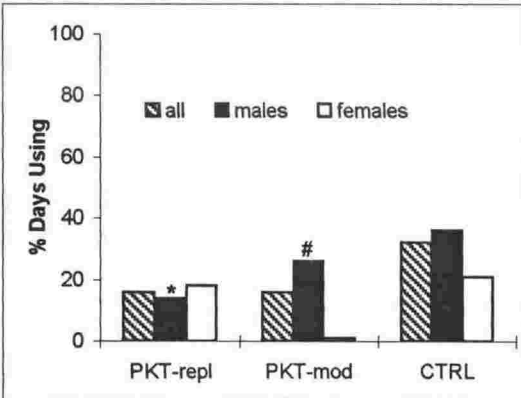


Figure 11. Mean percentage days relapsed in entire follow-up period, all substances.

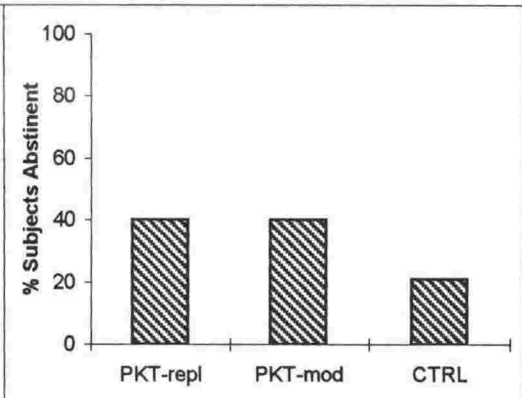


Figure 12. Mean percentage subjects abstinent for entire follow-up period, all substances.

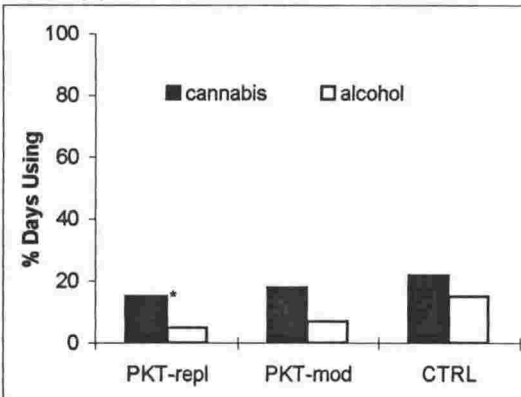


Figure 13. Mean percentage days relapsed on particular substances in first year, for users of those substances.

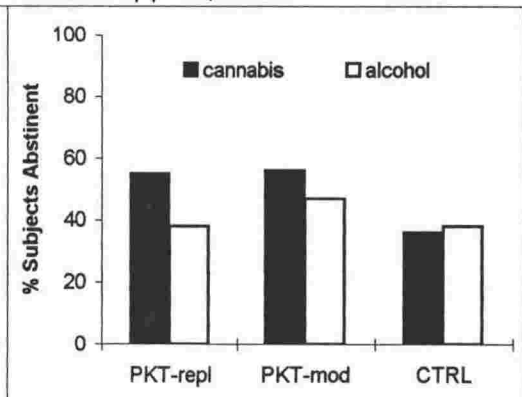


Figure 14. Mean percentage subjects abstinent for particular substances in first year, for users of those substances.

\*  $p < .05$ , #  $p < .1$  Mann Whitney U-Test

If Peniston and Kulkoskys' (1989) relapse criterion of seven contiguous days use of alcohol is applied to the data, then the results for the three groups are somewhat different. This researcher used a criteria of any occurrence of six contiguous days of alcohol use, and abstinence rates increased to 92% (PKT-repl), 80% (PKT-mod), and 86% (CTRL) at 17 month follow up. If subjects using cannabis for six contiguous days are also included, then abstinence rates drop to 62% (PKT-repl), 66% (PKT-mod), and 64% (CTRL).

Figure 13 and 14, show the one year follow up data broken down with respect to the drug used. The data is expressed as a proportion of those who used the substance not the total. Although the differences are not significant, abstinence from cannabis in PKT groups is more markedly different from the CTRL group than abstinence from alcohol. On the other hand, the PKT groups' number of days using is more clearly different from the CTRL group for alcohol rather than cannabis.

#### *Relationships Between EEG Changes and Days Using Substances*

The measures that Peniston and Kulkosky chose did not allow investigation of the relationship between EEG changes and follow up measures such as the number of days using substances and ASI results. If biofeedback is effective, then a relationship should exist. Analysis of the relationships between EEG band amplitude changes and the number of days using substances during the first year after treatment, revealed the following. Twelve correlation calculations were performed for each PKT group and none were significant using Bonferroni probabilities. When p-values for standard correlation were computed, only PKT-repl group beta changes correlated negatively with the number of days using substances ( $r = -.593$ ,  $p = .033$ ). However, the PKT groups had so many zero values (7/15) in the days using substances variable, that a linear relationship was

unlikely due to a floor effect. However, the CTRL group's correlation coefficient for theta band changes and days using, approached significance ( $r = -.499$ ,  $p = .070$ ). If females subjects (3/4 of these are zero) are extracted from the CTRL data, the correlation coefficient ( $r = -.580$ ,  $p = .079$ ) for theta band changes and days using, and the correlation coefficient ( $r = -.615$ ,  $p = .058$ ) for alpha band changes and days using, approach significance. Also the correlation coefficient ( $r = -.729$ ,  $p = .017$ ) for delta band changes and days using becomes significant. If the relationship exists for the control group then a treatment that increases EEG amplitude, may facilitate recovery. The same relationship is investigated below with respect to ASI changes

### ASI Results

The ASI scores improved significantly at follow up for six scales in the PKT-repl group, five scales in the PKT-mod group and five scales in the CTRL group (see Table 10). The levels of probability of significance indicate that the CTRL group ASI scales have not improved quite as reliably as the other groups. There were no significant ASI subscale differences between groups at either pre-test or follow up. None of the ASI subscale pre- to post- changes were significantly different between groups.

Table 10: Wilcoxon signed pairs test, one-tailed of ASI Scales from > 2 weeks abstinent (Pre) to follow up (Flwp) at end of 17 months (mean) after treatment - all subjects.

Subscale	PKT-rep			PKT-mod			CTRL		
	Pre-M	Flwp. M	p n=13	Pre-M	Flwp. M	p n=15	Pre-M	Flwp. M	p n=14
Medical	20.8	9.1	.297	7.1	4.3	.459	6.8	9.1	.233
Emplymnt	80.8	59.2	.007**	78.8	40.1	.001****	40.3	32.5	.014*
Alcohol	32.8	8.0	.008**	44.4	11.6	.000****	37.7	13.9	.015*
Drugs	23.8	3.8	.003***	12.9	1.0	.002***	14.2	4.2	.009**
Legal	15.7	1.9	.023*	13.7	2.3	.017*	32.5	4.0	.006**
Family	6.1	-9.9	.047*	9.0	-9.1	.011*	10.9	-9.3	.017*
Psych	25.1	13.7	.030*	17.7	15.1	.124	19.5	9.2	.085#

\*  $p < .05$  \*\*  $p < .01$  \*\*\*  $p < .005$  \*\*\*\*  $p < .001$  #  $p < .1$

### *Relationships Between EEG Changes and ASI changes*

Pearson correlation calculations and regression analyses revealed some weak associations between EEG changes and ASI changes as indicated by Table 11. The medical scale correlation is positive, which is contrary to expectation.

*Table 11: Significant Pearson coefficients of correlation between eyes closed EEG bands and ASI scale changes.*

Group	ASI scale	EEG band	<i>r</i>	<i>p</i>
PKT-repl	Alpha	Alcohol	-.481	.096#
	Theta	Employment	-.529	.063#
CTRL	Beta	Family	-.483	.080#
	Beta	Medical	-.600	.023*
	Alpha	Legal	-.466	.093#
	Alpha	Medical	.525	.054#
	Delta	Medical	.564	.036*

\*  $p < .05$ , #  $p < .1$

### *Relationships Between Spontaneous Imagery and Relapse Results*

For each subject, the researcher counted the number of sessions during which the subject reported at least one distinct, definable image. The number of days using substances did not correlate with the number of sessions producing images. However, as shown in Table 12, in the PKT-repl group, subjects abstinent from all substances for the first year after treatment had significantly more sessions containing images than non abstinent subjects ( $U, p < .05$ ). The PKT-mod difference was not significant but the abstinent subjects of the two PKT groups combined also had significantly more sessions containing images than non abstinent subjects ( $U, p = .05$ ). Although the two PKT groups' spontaneous imagery means were different (PKT-repl  $M = 10.9$ , PKT-mod  $M = 14.1$ ), the difference was not significant ( $U$  test).

Table 12: Comparison of the mean number of sessions producing images, within group and abstinence categories.

	PKT-repl			PKT-mod		
	Non Abstinent	Abstinent	<i>P</i>	Non Abstinent	Abstinent	<i>p</i>
<i>M</i>	7.6	15.7	.032*	13.3	15.1	.684
<i>n</i>	8	7		8	7	

\*  $p < .05$ .

The PKT groups' abstinence results were not associated with significantly different EEG band changes (*U* test). However the PKT-repl group's number of sessions producing images correlated positively with beta band EEG changes ( $r = .519, p < .05$ ) and approached significance for delta and alpha bands ( $p < .1$ ). This indicates that as the EEG changes increased the number of sessions producing images also tended to increase. Similar correlation relationships were not found for PKT-mod data.

## Discussion

### *Background*

The search for an effective treatment for substance dependence is ongoing. There is ample evidence that excessive intake of alcohol and drugs cause high levels of harm in the community. Given that the client is motivated to change and is seeking treatment, historically only about a third improve (Riley et al., 1987) and the majority drop out before treatment completion (Falco, 1992). There is evidence that just reading about recovery from substance dependence, results in significant improvement in consumption one year later (Miller, & Taylor, 1980 as cited in Lichtstein, 1988). Spontaneous recovery is relatively common (Smart, 1975, as cited in Pugh, 1986).

Standardised measurement of treatment success is difficult. Each programme is distinct, with differing duration, target population, philosophy, staffing level and intensity. The definition of relapse is equally troublesome. Both abstinence data and frequency, in addition to quantity of use, are of interest. Even the method of measuring outcomes can influence success rates, for instance frequent follow-up contact with a client can enhance substance use results (Grunberg, & Bowen, 1987). For this study, measurement tools, and approaches to follow up were carefully selected in an attempt to minimise such problems.

The aim of this study was to examine the effectiveness of a particular approach to the treatment of substance dependence developed by Peniston and Kulkosky (1989, 1990). Although the treatment primarily involves EEG biofeedback, the complete protocol also involves rehearsing visualisations of change (at the beginning of the session), and processing any spontaneous imagery that occurred during the session (at the end of the session). The experimenter observed that training clients to produce slower brain waves, facilitated very deep levels of relaxation. This may then be the primary treatment effect, irrespective of



whether lasting changes in EEG amplitudes were achieved. There may also be an element of cognitive restructuring in the rehearsal of personalised visualisations (of improved personality and abstinence behaviours), during each session. A further feature of the procedure is the processing of spontaneously occurring imagery which may have a psychotherapeutic effect. Although multiple treatment elements makes the interpretation of results difficult, the experimenter felt that any reduction of the protocol, could diminish its effectiveness. Because each of the three aspects could account for any resultant improved outcomes, research into their equivalent therapies of relaxation, CBT, and therapeutic imagery approaches, was reviewed in the introduction. The literature review uncovered little evidence that any individual method significantly improves outcomes, except for two EMG biofeedback studies (Denney, et al., 1992; Taub et al, 1994), and some indication that combined techniques are more successful (Childress et al., 1988)

The researcher expected PKT therapy, which combines the three approaches, to enhance their effectiveness in terms of relapse and psychometric outcomes, similar to those reported by Peniston, and Kulkosky (1989;1990). The outcome measures were expected to improve commensurate with EEG amplitude increases. The modified therapy (PKT-mod) results were expected to exceed those of the CTRL group but not attain the levels of the PKT-repl group. It was also anticipated that the PKT groups would exceed outcomes reported for therapeutic community treatment and other modalities summarised in the introduction. The LPQ and SCQ questionnaires were used to possibly highlight any differential effect of the visualisation and spontaneous imagery components of the protocol. The drop-out rate was expected to be higher for the CTRL group.

A summary of the results, in terms of the aims of the study, follows. The limitations of the study are then discussed, followed by a summary of the findings of the study and their implications. The many recommendations for future research occur throughout the discussion.

## *Summary of Results*

### *Similarity of Results to Those of Peniston and Kulkosky*

The population available to this study varied considerably from Peniston, and Kulkoskys' (1989; 1990) study population in terms of more substances of abuse, younger age, and having a larger range of clinically significant MCMI-II categories. All groups in this study, also concurrently underwent therapeutic community treatment. Peniston, and Kulkoskys' groups were hospital inpatients but the authors do not describe the therapeutic interventions employed by the hospital. Their alcoholic control group did not improve in any measured variable so it is probable that the hospital's interventions were not effective. Apparently, their PKT groups received only PKT. The above factors complicate assessment of the similarity of the results between the two studies.

One major measurable similarity is that, using Peniston, and Kulkoskys' relapse measure of seven continuous days drinking, all three of the groups of this study exceeded their 80% "abstinent" result. Their control group result of 20% "abstinent" indicates a very poor outcome for their conventional treatment programme. Fortunately, this study used more sensitive measures of relapse, and differences between the groups of this study did emerge as discussed below.

The MCMI-I/MCMI-II<sup>10</sup> profiles were quite different at pre-test between studies. However, the pattern of change is the same. Eleven of the 13 MCMI-I scales that significantly improved in Peniston, and Kulkoskys' (1989; 1990) PKT group, also improved significantly for the PKT groups in this study. The other two scales (paranoid personality and delusional disorder) were not significant for this study although delusional disorder approached significance for the PKT-repl group. Two scales (dependent personality and self defeating personality)

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<sup>10</sup> As outlined in the methods section, research has not revealed detectable differences between the MCMI-I and MCMI-II except two additional scales derived from two existing scales.

significantly improved in this study and not Peniston and Kulkoskys' study. The latter scale is new to the MCMI-II and is derived from the passive aggressive scale. This study's CTRL group improved in the same scales as the PKT groups, although not as reliably (some scales only approached significance) whereas their control group did not improve.

Peniston, and Kulkosky (1989;1990) recorded large significant increases in alpha and theta EEG band amplitudes for the PKT group. In this study, the CTRL group reduced amplitude in all four bands recorded with eyes closed; three of which were significant (beta, alpha, and delta). There were no significant reductions in EEG band amplitude for the PKT groups, although PKT-repl reduced in fewer measures than PKT-mod. Figure 1 shows the pre- to post- differences clearly. When those who are users of alcohol only are removed from the totals (Figure 2), it is clear that the cannabis users in the PKT groups increased alpha, theta, and delta band amplitude. On the other hand, those in the CTRL group reduced amplitude in all bands. The PKT group's cannabis users' differences were significantly greater than the CTRL group for all bands. PKT seems to have had no systematic effect on the EEG of the small number of alcohol only users (Figure 3). However, there is ample evidence that PKT has prevented a drop in amplitude for those who use cannabis. This may be because cannabis use increases alpha EEG band power (amplitude<sup>2</sup>) as described in the introduction (Struve, et al., 1989). PKT seems to effectively maintain or increase brain wave amplitudes, which would otherwise diminish with cannabis abstinence. This is different from Peniston and Kulkoskys' result of significant increases in EEG bands, possibly because this study included a high proportion of young marijuana users, and fewer of the older, depressed/anxious type of alcoholic population of their study. The latter might have alpha or theta deficits through sustained hyper-vigilance. Further research would establish whether variations in EEG profiles can be attributed to the impact of distinct age, personality, and drug use profiles. John, Prichep,

Fridman, and Easton (1988) demonstrated that people suffering from depression, and alcoholics have significant deficits in the slower EEG bands.

The two studies were similar in relapse results and MCMI change results for experimental groups but not controls. The controls in this study also improved, whereas they did not in the original study. The EEG results were similar in that the experimental groups changed in the desired direction. However, the control group of this study dropped in amplitude. Consequently, instead of increasing EEG amplitude as in Peniston and Kulkoskys' study, PKT seems to have prevented a drop.

#### *Correlation results between EEG Changes and Treatment Outcomes*

The number of days using substances correlated negatively ( $p < .05$ ) with beta band amplitude changes for the PKT-repl group. That is, as the number of days using substances decreased, EEG beta band amplitude changes became higher. When female data points were removed from the CTRL group data, alpha, theta, and delta band correlation results with EEG changes were either significant or approached significance. One explanation may be that, if a relationship is expected between increased EEG changes and improved substance use, it follows that the control group will also demonstrate such a relationship. Most of the PKT groups' EEG bands did not demonstrate this relationship because of a floor effect caused by at least half of subjects' in those groups reporting zero or almost zero days using substances. Similar statistical analyses revealed only weak relationships between ASI scale changes and EEG band changes.

The relationship between MCMI-II scales and EEG amplitude changes provides a more encouraging picture. Eleven of 22 MCMI-II scales correlated in the predicted direction, albeit weakly, with at least one EEG band in at least one group. The fact that quite a few CTRL group MCMI-II scale changes correlated significantly with EEG bands in Table 6 is also probably due to the fact that, if

there is a relationship between EEG improvements and personality improvements, then that relationship may occur in the absence of EEG training. It follows that the data for all groups will lie on a line with a similar negative slope and similar constant. However, the PKT groups' data should lie predominantly in the lower right quadrant if PKT enhances outcomes. Figures 4 to 6 confirms this pattern, Thus the group level variables would not be expected to contribute significantly to the regression of each MCMI-II scale dependent variable and the results in Table 7 confirm that they don't. There is one exception; the CTRL group improved significantly more in bipolar symptoms of mood swings than the PKT groups given the same alpha or delta band changes. Research indicates that MCMI bipolar symptoms may worsen with treatment (McMahon, Flynn & Davidson, 1995). This may be a chance effect, or perhaps there is a way in which more effective treatments, such as PKT, increase the occurrence or reporting of variations in mood.

The regression results in Table 7 provide further evidence that EEG band increases are predictive of greater improvements in the MCMI-II scales of aggressive sadistic personality, alcohol dependence, antisocial personality, bipolar disorder (control group), borderline, delusional disorder, drug dependence, major depression, passive aggressive, and paranoid personality, across all groups.

The number of sessions producing images positively correlates with beta band EEG increases (and approaching significance for alpha and delta bands) for the PKT-repl group only. The results shown in Table 12 indicate that all PKT-mod group subjects had similarly high numbers of sessions that produced images. This causes a ceiling effect for the PKT-mod group, which may prevent correlation. Long term abstinence is associated with a higher number of sessions producing images also. This is a very interesting result which may simply indicate that effective PKT promotes the drowsy state in which these images occur, or that people who report images are somehow more likely to recover, or it may indicate

that spontaneous imagery has a therapeutic effect of some kind. This warrants further investigation.

There is evidence that some personality and clinical scale improvements, the number of days using substances, and the number of sessions producing spontaneous imagery, are related to EEG changes across all groups. They change in a direction that indicates increasing clinical improvements, as EEG amplitudes increase. Thus, there may be an association between recovery from addiction and increases in EEG band amplitude, whatever the therapeutic intervention is. Since EEG changes are significantly higher for PKT groups than the CTRL group, it follows that PKT may enhance personality and behaviour changes by increasing EEG amplitudes. It appears that manipulation of the independent variable of EEG amplitude does influence treatment outcomes.

#### *Comparison of Results Between Study Groups*

Tables 8 and 9, and Figures 7 to 14 show that the PKT-repl and PKT-mod groups improve more than the CTRL group in follow-up substance use measures. The two PKT groups are not significantly different from each other for any of these relapse measures. The number of days relapsed (using substances) during the first year after treatment for both PKT groups is significantly greater than the CTRL group, for males. Over the entire follow-up period, the male result is significantly greater for the PKT-repl group only. Interestingly, female relapse results were distinctly different from male results, in that more females recovered in all three groups. This is in line with research reported in the introduction which indicates that women are more likely to remain abstinent if they have children (Baily et al., 1990; Hatsukani et al., 1982). Ten out of twelve female subjects in this study had children in their care.

There was a tendency for more MCMI-II scales to improve significantly in the PKT-repl and PKT-mod groups than the CTRL group. There were no significant differences between the PKT-repl and PKT-mod groups for means at pre-test or post-test or for the pre- to post- test differences. Although many MCMI-II scales improved to within normal limits, the only significant results were two pre- to post- test differences for the PKT-mod group versus the CTRL group. These may be random effects given the high number of comparisons. The ASI, LPQ and SCQ test results were not different significantly different between groups, for any of the three groups of this study.

Figure 1 shows that the changes in the four EEG bands of the PKT-repl group were greater than the CTRL group but not the PKT-mod group. This difference was significant for the beta band only, although the alpha and theta band approached significance. All four band amplitude changes were significantly greater for cannabis users (Figure 2). However, again the PKT-repl group does not exceed the PKT-mod group. The EEG changes for users of alcohol only (Figure 3) are not different between all three groups, possibly because of the small number of subjects.

Table 10 show only a slight tendency for PKT-repl and PKT-mod groups to improve significantly in more ASI scales than the CTRL group. No scale is significantly different between groups at pre-test or follow up nor are the pre-test to follow up differences significantly different between groups. All three groups improved commensurably.

In summation, the PKT groups' results were superior to the CTRL groups in some MCMI-II measures, substance use measures and EEG differences. The PKT groups' outcome results were not different from each other, for any substance use measure, psychometric tests and EEG changes. This indicates that any gains created by the additional treatment are not reliant on the EEG biofeedback component of the protocol. As this component requires an expensive piece of

equipment, it is a desirable result in terms of the economic feasibility of future implementation of the protocol.

### *Comparison of Relapse Results with those of other Studies*

First, the substance use outcome results of the control group are compared with other studies described in the introduction. These include selected therapeutic community and cognitive behavioural programmes. Then this study's female results are also compared with studies from the literature. Finally, the improvement in outcomes observed for the PKT groups of this study are similarly compared.

Table 8 shows CTRL group abstinence rates for one substance of 36% (alcohol) and 38% (cannabis) at one year follow up. This exceeds the rate of 33% reported by Falco (1992) for three months or more therapeutic community treatment. The abstinence rate of 29% for all substances is also encouragingly close to expectation as subjects only needed to complete seven weeks of treatment qualify for inclusion in this study. The definition of abstinence for this study does allow an occasional slip of a few hours moderate substance use once in a two month period. This is in line with many other follow-up studies (Taub et al., 1994; several studies reviewed by Annis, & Liban, 1980).

Project MATCH inpatient arm result of 35% abstinent from alcohol at one year post-treatment is similar to this CTRL group's result of 36%. The Project MATCH study group utilised a shorter treatment time, and a more stringent definition of abstinence. Their days using alcohol result of about 11% is superior to this study's CTRL group result of 15%, although not equal to the PKT groups' results of 5% and 7%. However the project MATCH subjects self-selected for the additional outpatient treatment being studied and had a degree of motivation and resourcefulness not needed for participation in this study. This motivation, and



quarterly follow-up contact may have positively influenced the Project Match outcome results.

The Burling et al. (1994) result of 46% to 63% abstinence rates in the month prior to follow up appears to be superior to this study's CTRL group score of 36% (all substances) in the twelfth month after treatment. This programme was a combination of therapeutic community and CBT approaches. However Burling et al. used a shorter follow-up period (about nine months), their subjects spent longer in treatment, the outcomes included alcohol use only, and the researchers contacted subjects on a monthly basis which may positively influence results.

Sellman et al. (1996) achieved a 42% controlled drinking rate (allowing no more than five drinking occasions during the six months) using a two week inpatient and one week outpatient CBT programme. The subjects were contacted on a monthly basis. In this study the CTRL group achieved 36% controlled drinking (allowing no more than six drinking occasions during the year) over one year follow-up, after at least seven weeks' treatment. A shorter follow-up period, and a high number of follow-up contacts, positively influence the results of Sellman et al.s' study, although their treatment length was shorter.

Although all of the above studies report good follow-up rates, none reached 100%, which was achieved for this study's CTRL group. Most of the above studies canvassed only graduates of the programmes under study.

Research summarised in the introduction, indicates that the abstinence rate for women may be 15% to 23% higher than that of males. In this study, over all groups, abstinence rates in the first year were 34% for males and 67% for females, 33% higher. Some explanations are; the high proportion (83%) of women with dependent children; the low number of women in the study; and perhaps some unintended bias of the selection criteria toward more motivated women.

The results of this study at least match those reported for therapeutic communities, and may have been comparable to some other studies if confounding

factors had been controlled. It follows that the superior relapse results of the PKT groups, particularly the results for male subjects, are probably accounted for by the additional treatment. The difference in substance abuse results between PKT groups and the CTRL group of 16 - 19% is quite high. The results of Project Match established virtually no differences between the three treatment modalities studied, with hundreds of subjects in each group. These treatments were considered to be the best currently available. Taub, et al. (1994) increased outcomes at 9-12 month follow up, by 20% via the addition of EMG biofeedback to inpatient treatment, and 10% by the addition of meditation to inpatient treatment. Denney, et al. (1991) found that more than seven sessions of EMG biofeedback increased abstinence rates over one year by 21%. Five to six sessions also increased the rates by 14%. Unfortunately the number of subjects lost to follow up is not reported although non contacted subjects were counted as relapsed which could artificially lower relapse statistics. In addition, the study was retrospective. Of the above studies, neither delivered particularly effective control treatment (just 15% abstinent) nor did they report relapse to other substances or drop out rates. Neither of these studies achieved the 47% abstinence rate from all substances at one year follow up attained by the PKT groups of this study. However, they both featured a high frequency of sessions, being daily or almost daily. Glover, and McCue (1977) increased outcomes by 30 - 35% by adding aversion therapy to psychiatric inpatient treatment. However the definition of recovery was any improvement in drinking patterns and the follow-up period was very prolonged and variable.

The evidence indicates that the control group reached expected substance use outcomes, and that the PKT groups of this study achieved unusually high substance use outcomes, involving increases in outcomes not often recorded. However, direct comparisons with other studies are difficult.

### *The Therapeutic Effects of Visualisations and Spontaneous Imagery*

The researcher hypothesised that the LPQ results might highlight any additional therapeutic effect due to the spontaneous imagery and the SCQ results might act similarly for the visualisation aspect of the protocol. Neither the LPQ nor the SCQ was able to demonstrate any superior therapeutic effects attributable to PKT. This may be because these scales were not sufficiently sensitive, as all three groups improved to within normal limits.

Abstinent subjects had significantly more PKT sessions resulting in spontaneous imagery in the PKT-repl group only, which indicates that either spontaneous imagery or the relaxed state that promotes it, has a beneficial effect on substance use. All subjects in the PKT-mod group had high numbers of such sessions, which indicates that PKT-mod is more successful at encouraging the states that promote imagery than PKT-repl. This is additional evidence that the EEG biofeedback element of the protocol may not be necessary. It also indicates that relapse can still occur when the number of sessions containing images are high.

It would seem that the SCQ and the LPQ are not adequate tools to measure the differential effects of aspects of PKT, against therapeutic community treatment. Spontaneous imagery may have a beneficial effect on substance use, but this may equally be a result of associated EEG changes.

#### *Drop-out Rate*

This study's considerably lower drop-out rate for the PKT groups was not significant. However, there is evidence that PKT assists in retaining those subjects with a high score on the MCMI-II antisocial personality scale. This may be of special significance for programmes for individuals in the justice system.

## *Limitations of the Study*

### *Possible Confounding Variables*

Although every attempt was made to control for confounding variables, the following factors may have influenced results. An attention placebo effect may have enhanced results for the PKT groups; i.e. the PKT treatment sessions may have had a similar impact to a protocol of the same number of additional one-on-one counselling sessions. However Miller and Hester, (1986, as cited in Alterman, O'Brien, & McLellan, 1991) in reviewing the literature, found little evidence for the effectiveness of psychotherapy or counselling approaches in the treatment of chemical dependency. However, psychotherapy has been attributed to decreased discharges from treatment (Rogalski, 1984 as cited in Dodes, & Khantzian, 1991) and reduction of stress on treatment centre staff (Woody, McLellan, Luborsky, and O'Brien, 1986 as cited in Dodes, and Khantzian, 1991). These effects parallel the improved discharge rate observed in this study. Research is necessary to determine whether a similar number of psychotherapy or counselling sessions would result in similar outcomes to PKT. The unusually high frequency of sessions in this treatment regime also may have an influence on the effectiveness of psychotherapy. However, a literature review uncovered no research to substantiate that possibility.

A further placebo effect is possible with respect to the technology involved. This may enhance the subjects' positive perception of the treatment. Taub et al. (1994) used an experimental control called neurotherapy using technical equipment and electrodes attached to the scalp. The therapists were enthusiastic about the effectiveness of the therapy. This therapy did not result in improved follow-up outcomes compared to controls, indicating that the use of impressive technology alone does not facilitate recovery.

### *Experimental Design Weaknesses*

a) The accuracy of follow-up days relapsed statistics depended upon self reported recollection of periods, frequency and quantities of use. It is possible that these were inaccurate or underestimated. The follow-up research assistants noted that subjects readily pinpointed periods, quantities, and frequency of use, of each substance. It may be that a period of inpatient treatment had heightened subjects' awareness of their drinking and drug use patterns, and enhanced their recall of substance use behaviours. However, if there was a tendency to underestimate the occurrences, this effect should be global and should not prevent comparison between groups.

b) It is desirable to express substance use results in terms of quantities as well as frequency of use. Unfortunately, in an attempt to standardise quantities across substances, this study requested information on quantities of substance used, in dollar value instead of number of standard drinks or joints. This ultimately rendered the quantities unsuitable for analysis because the dollar value of a substance can vary widely depending on its source. Cannabis is often without monetary cost to the user. This parameter requires more accurate investigation in future research.

c) A further weakness of this research, was a lack of a pre-test analysis of drinking patterns for the year prior to treatment, to compare with the follow-up relapse data (see Appendix C for follow-up data collection forms). This may have determined whether the improved relapse outcomes observed with PKT could be attributed solely to the predictive power of pre-treatment drinking patterns previously reported by the Project MATCH Group (1997). There is some indication that these were a little unbalanced between groups, prior to treatment (Figure 7), although the CTRL group had less severe clinical scores as indicated by the results concerning drop-outs.

d) The sample selected for this study was not representative of the treatment centre population pool. About 18% of those tested did not qualify because their MCMI-II score was too high. Others did not qualify because they were either, users of heroin or psychedelic drugs, or relatives of dependent persons, or sufferers from epilepsy, attention problems, or bipolar disorder. Thus, the scope of this work applies only to alcohol and cannabis dependent persons without serious physical and psychological problems. More research is required to determine the suitability of PKT for other individuals.

e) For reasons of expediency, this study took place in a therapeutic community setting. One advantage of this arrangement was a readily available population of substance dependent individuals. Obtaining permission to access a substance dependent population had been a major hurdle in commencing this research. One difficulty was a requirement of the management that PKT be provided in addition to the therapy available at this treatment centre. Therefore, it was not possible to compare PKT as a stand-alone treatment against therapeutic community treatment. This effect of treatment similarity was compounded when the treatment centre instituted relaxation for one hour a week for all residents soon after the commencement of the study. Despite these difficulties, PKT did enhance therapeutic community outcomes.

#### *Methodological Differences Between This Study and Peniston's Studies*

a) There were two major departures from the original protocol as laid down by Peniston and Kulkosky. The equipment used was different, with different specifications. It also had an aversive feedback tone, which led to the use, in this study, of the different feedback modality of taped natural sounds. Peniston and Kulkosky's reports are not clear concerning the number of sessions they gave clients. E. G. Peniston (personal communication, November 27, 1995) states that

his protocol consists of six temperature training sessions and 30 EEG training sessions, six more than offered in this study.

b) Peniston and Kulkoskys' (1989, 1990) controls received treatment which did not markedly change their MCMI, MMPI and BDI scores. This resulted in 80% of control subjects using alcohol for seven contiguous days, whereas all subjects in this study did receive effective treatment.

c) Peniston and Kulkoskys' (1989,1990) sample population is quite different from the sample population of this study in age, sex, and clinical and personality characteristics. Their sample population comprised anxious, depressed, dependent personality, and alcohol dependent males around their late 40s. On the other hand, this study involved alcohol and cannabis dependent males and females, on average, 20 years younger with clinically significant mean MCMI scores for most scales.

d) Peniston and Kulkosky (1989, 1991) contacted their subjects every month and offered a series of six booster sessions to subjects who felt at risk of relapse. The subjects in this study did not have that service available. Regular follow-up contact increases the likelihood of long term abstinence from smoking (Grunberg et al., 1987).

e) Peniston and Kulkosky (1989; 1990) do not report how they handled drop outs. The design of this study required that members of each group completed at least seven weeks of conventional treatment, and drop outs during that time were replaced. In this study, the drop-out rate was lower for treated groups. If Peniston and Kulkosky did not replace drop outs, then the probable higher drop-out rate of the control group may partially account for the very poor relapse results of their control group.

f) Previous PKT research papers (Peniston & Kulkosky, 1989;1990; Saxby, & Peniston, 1995) report only drinking outcomes, not drug use. Although this was an older group whose culture may exclude cannabis use, cross addiction to another drug is always possible and should be reported. Saxby, and Peniston also do not

define what they mean by relapse. Peniston and Kulkosky (1989) define relapse as one week of daily drinking. The results of this study show that abstinence rates exceed 80% for alcohol in all three groups at 17 months, using the less stringent criterion of alcohol use six days per week. These results fall in-between the PKT treated group abstinence rates of 80%, at 13 months reported by Peniston, and Kulkosky, and 93% at 21 months, reported by Saxby and Peniston. In this study, the inclusion of subjects using cannabis six days per week, causes the abstinence rates to fall in the 60-70% range for all three groups. This confirms that the Peniston and Kulkoskys' relapse criterion of seven days drinking is rather a gross measure and does not have sufficient sensitivity to detect treatment differences, nor dependence on other drugs. No research was found to substantiate the use of this measure. Many people who enter treatment are not using alcohol, drugs, or both, as much as seven days in one week in the weeks or months prior to treatment, which renders this outcome measure somewhat unhelpful.

### *Summary*

How the above differences between the studies impact on the outcomes is uncertain. One important factor may be the different population pool as indicated by MCMI scores. This study sample contained elevated scores for all of the scales of the MCMI profiles associated with the abuse of alcohol described by Bartsch et al. (1985). However, Peniston and Kulkoskys' sample had clinically significant scores in only MCMI alcohol abuse, dependent personality, dysthymia and anxiety scales. Whereas the antisocial, aggressive-sadistic, and passive aggressive personality scales of the profile observed by Millon (1987) were not clinically significant. Rosenberg (1980) found that EMG biofeedback was more successful with subjects whose drinking was related to anxiety. This may indicate that Peniston and Kulkoskys' group was more likely to improve than the subjects of this study. Another considerable contribution to the disparity in results is the



unusual measure of relapse used by Peniston and Kulkosky, and the very poor outcome for the control group given the very broad definition of relapse.

The experimental design weaknesses should not impact on the reported results apart from the lack of pre-test substance use data to compare with the follow-up relapse data. Similarly, it seems unlikely that the confounding variables mentioned, greatly influence the results reported here.

### *Summary of Study Findings and Research Recommendations*

The major finding of this study is first that the addition of PKT to therapeutic community treatment significantly enhances results. More psychometric test subscales improved for the PKT groups. Additionally the relapse measures and EEG measures were all superior, some significantly, for the PKT groups compared to the CTRL group. These results were achieved despite the effective treatment that the CTRL group received and the small sample size. The relapse improvement of around 18% for all substances is unusual in controlled treatment outcome comparison studies. Although there are methodological differences, this result is similar to those observed in studies involving EMG biofeedback and, possibly, aversion therapy, which indicates a need for further comparative research.

Secondly, the EEG biofeedback element of the protocol may not be essential for PKT to have superior results to conventional treatment. The PKT-mod subjects listened to pleasant, monotonous, and natural sounds, whereas the PKT-repl listened to intermittent EEG biofeedback of the same sounds. The PKT-mod group may have had better results in terms of the number of days using substances than PKT-repl if the entire PKT-repl group had been followed-up. This is a very positive outcome in terms of accessibility of treatment. PKT will be less expensive, less labour intensive and more portable without the EEG equipment. It will be necessary to perform comparison studies to ascertain whether, following the initial temperature training sessions, multiple daily sessions of EMG biofeedback,

relaxation, listening to music, transcendental meditation, temperature training, or psychotherapy will be more effective than PKT-mod which involves listening to pleasant monotonous natural sounds for 30 minutes.

A further finding is that the results for the population of this study, partially replicate those reported by Peniston and Kulkosky (1989). There are many differences between the two studies such as a different population pool, control group treatment approach, and outcome measures, which may account for any failure to duplicate outcomes. Further research into PKT as a stand alone treatment is necessary.

Another important result was that the PKT groups had half as many of subjects prematurely discharged from treatment compared to the CTRL group. When 75% of clients (Falco, 1992) routinely drop out of therapeutic community treatment in the first three months, and these dropouts are more likely to relapse (Desmond, Maddux, Johnson, & Confer, 1995; Stinchfield, Niforopulos, & Feder, 1994), then retention in treatment becomes a substantial issue.<sup>11</sup> A larger study would clarify this potential advantage.

This study provides evidence for a positive relationship between psychological and behavioural enhancement and EEG increases. Some psychometric and substance use improvements statistically positively correlate with EEG increases for all three groups. This confirms that the thesis behind early work in this field, that increasing EEG slow band amplitudes will enhance recovery from addiction. Other evidence indicates that PKT primarily prevents a drop in EEG

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<sup>11</sup> If relapse figures for drop outs were included in the results for each group, it is likely that the margin between the PKT groups and the CTRL groups would increase. In the same vein, the CTRL groups higher drop out rate resulted in the PKT groups being comprised of a higher number of more damaged individuals. Consequently, the CTRL group results could be expected to be superior to that of the PKT groups if the treatments received were equivalent.

amplitude. Figures 2 and 3 indicate that this effect may not apply to users of alcohol only, although only about a third of subjects fell in this category. The evidence is weak. Larger studies are needed to research; how falling EEG band energy contributes to relapse to cannabis use; whether the EEG results of this study can be replicated for cannabis users; and whether alcohol only users, who are not necessarily exhibiting slow EEG band deficits, can achieve significant increases in EEG bands with PKT treatment.

There are indications that spontaneous imagery, or the hypnagogic state in which they arise may have a discernible impact on recovery and may act as an indicator of treatment progress. As sleep will often prevent images reaching consciousness, this result also highlights the need to prevent clients from sleeping during PKT, by controlling comfort levels and the time of day sessions occur. From the literature reviewed in the introduction, there appears to be no previous scientific precedent for this result in the research. On a philosophical level, many claims have been made for the therapeutic effects of meditation and other contemplative techniques in terms of their reflective nature, which is purported to promote psychological health. The evidence provided by this study may be confirmatory, but there are other possible explanations that must be eliminated. Further research is indicated to substantiate these results. It will be useful to look at the results with respect to the impact of the imagery on the subject. It will also be necessary to determine whether imagery is simply a response to successfully reaching a pre sleep state, and no more.

Although female CTRL group subjects fared better than men in all relapse outcomes, it is possible that they battle on in the face of depleted EEG energy as, despite large drops in EEG amplitude with treatment, they remain abstinent. The CTRL group's correlation between EEG amplitude changes and the number of days using substances did not reach significance until the results for women were extracted from the data. The responsibility of caring for young children may encourage women to resist relapse in the face of physiological cues to use

substances. The number of women in this study is too small to draw any conclusions and further study is required in this area.

ASI scale changes were not able to detect any differential effects between groups. This scale may not be sensitive enough to discriminate between different treatment modality outcomes, as the scores at follow up were rather low overall. It may be that life improvements are achieved effectively and durably via therapeutic community treatment and cannot be significantly enhanced, or a larger sample is required to detect the differences. Perhaps PKT treatment does not have any effect on life circumstances. Conversely, it may be necessary to use or develop a more sensitive scale.

Although theta was one of the EEG bands being trained to increase, the delta EEG band increased more reliably instead. As delta is associated with sleep, enhancing it with treatment may be considered a less desirable outcome. This may be a chance effect, or an equipment difficulty, or an otherwise unmeasured effect as none of the published studies have reported delta EEG band results. Peniston, & Kulkosky (1989) reported significant increases in alpha and theta EEG bands with treatment. Byers (1992) reported an increase in alpha and decreases in theta and beta at the O1 and O2 sites with treatment. Fahrion, et al. (1991) reported both significant increases and decreases at different measurement periods at the O1 and O2 sites in the alpha EEG band only, from pre- to post- treatment. The common element appears to be alpha increases. Delta may increase due to harmonic effects from alpha increases, although one could expect theta to increase also depending on the peak frequency within the alpha band. Some practitioners report no significant EEG changes. In this study, the role of cannabis is important, as no discernible patterns are visible in the data for users of alcohol only. Larger studies are needed to clarify these issues.

Further research would assist in determining the optimum PKT treatment protocol in terms of economy and efficacy. For instance, the delivery of PKT to groups of clients, which is already commonplace in the USA, has not yet been

studied. The specific contribution of each element of the protocol to recovery, also needs to be isolated via components analysis.

### *Conclusion*

This treatment has three major aspects to it. Biofeedback promotes enhancement of physiological signs and over learning of the relaxation response. Biofeedback also promotes a degree of psychological composure. The visualisations may act as a type of systematic desensitisation or cognitive restructuring, also enhancing psychological health and harm reduction behaviour. The spontaneous imagery that occurs may simply be a function of increased levels of relaxation in a conscious state, but may also impart a sense of respect for previously unfamiliar aspects of human subconscious processes. It would seem that the protocol has physiological, psychological, behavioural, and perhaps spiritual aspects to it and as such, offers a holistic treatment approach. The contribution of each element should be assessed by components analysis research.

The study has sufficient limitations to cast doubt over the generalisability of the results. There are many research questions, as yet unanswered. Further replication is necessary and important issues such as the use of PKT as a stand-alone treatment and in groups are yet to be resolved by future research.

Further investigation of this technique may confirm that it is a cost effective way of retaining people in inpatient treatment and reducing subsequent alcohol and drug intake in most dependent individuals, especially males. This would ultimately reduce the social and economic cost of chronic substance abuse.

## Appendix A

### AUTOGENIC RELAXATION SCRIPT (from Green and Green, 1977)

Take five slow, full breaths, exhaling and inhaling from both nostrils...  
Then begin "equalised" breathing. Exhale and inhale through both nostrils slowly and smoothly, with no pause between the exhalations and inhalations...  
Concentrate attention of the flow of breath past the space between the nostrils...  
If your mind wanders, bring it back to the space between the nostrils...  
Continue doing this rhythmic breathing for a few minutes...

Now forget the breathing entirely and focus attention on the autogenic exercises for quieting the body (low muscle tension), and quieting the mind (inward-turned attention). Visualise, imagine, and feel the relaxation of each part of the body as you silently repeat the following autogenic relaxation phrases:

#### HEAVINESS PHRASES (TO PROMOTE MUSCULAR RELAXATION)

I feel quite quiet...  
I am beginning to feel quite relaxed...  
The muscles in my toes and feet feel heavy and relaxed...  
The muscles in my calves, thighs, hips and waist feel heavy and relaxed...  
My abdomen, solar plexus, ribs and chest feel heavy, relaxed, and comfortable...  
My fingers, hands, arms and shoulders feel heavy and relaxed...  
my neck, jaws, eyes and forehead feel relaxed, comfortable and smooth...  
The muscles in my whole body feel heavy, comfortable, relaxed and quiet....

#### WARMTH PHRASES

##### (TO PROMOTE INCREASED BLOOD FLOW IN THE HANDS AND FINGERS)

I am quite relaxed...  
My arms and hands feel heavy and warm...  
I feel quite quiet...  
My whole body is relaxed and my hands are warm, relaxed and warm...  
I can feel the warmth flowing down my arms into my hands...  
My hands and fingers are warm, pleasantly warm...  
Warmth is flowing into my hands, they are warm, very warm...  
My hands and fingers are warm, relaxed and warm...

#### WARMTH PHRASES

##### (TO PROMOTE INCREASED BLOOD FLOW IN THE FEET AND TOES)

I feel quite quiet...  
My legs, feet and toes feel heavy and warm...  
I am quite relaxed...  
My whole body is relaxed and my feet feel warm and relaxed...  
I can feel the warmth flowing down my legs into my feet and toes...  
My feet and toes are warm, relaxed and warm...  
Warmth is flowing into my feet, they are warm, very warm...

My feet and toes are warm, relaxed and warm...

QUIETNESS PHRASES ( TO PROMOTE THE CALMING OF THE MIND)

My whole body feels relaxed and my mind is quiet...

I release my attention from the outside world and I feel serene and still...

My attention is turned inward and I feel at ease...

Gently, I can visualise, imagine, and experience myself as relaxed and still...

I am aware in an easy, quiet, inward-turned way...

My mind is calm and quiet...

I feel an inward quietness...

I am at peace, I am at peace...

REACTIVATION PHRASES

(TO BRING THE INDIVIDUAL BACK TO THE WORLD OF ACTIVITY)

The relaxation is now concluded and the whole body is reactivated with a deep breath and the following phrases:

(a) I feel life and energy flowing through my toes, feet, calves, knees, thighs, hips, waist, abdomen, solar plexus, chest, shoulders, arms, hands, fingers, neck, jaws, lips, and head.

(b) This energy makes me feel light and alive.

(c) I open my eyes and make contact with the outside world.

(d) Maintain this inward quietness for about two minutes. Reactivate by taking five slow full breaths. Stretch and feel energy flowing through your body...

## Appendix B

- Schizoid personality: behaviourally lethargic, interpersonally aloof, cognitively impoverished, intellectualisation mechanism, flat mood, complacent self image, meagre internalisation, undifferentiated intrapsychic organisation.
- Avoidant personality: behaviourally guarded, interpersonally aversive, cognitively distracted, fantasy mechanism, anguished mood, alienated self image, vexatious internalisation, fragile intrapsychic organisation.
- behaviourally incompetent, interpersonally submissive, cognitively naive, introjection mechanism, pacific mood, inept self-image, immature internalisations, inchoate intrapsychic organisation.
- Histrionic personality: Behaviourally affected, interpersonally flirtatious, cognitively flighty, dissociation mechanism, fickle mood, sociable self image, shallow internalisations.
- Narcissistic personality: behaviourally arrogant, interpersonally exploitive, cognitively expansive, rationalisation mechanism, insouciant mood, admirable self image, contrived internalisations, spurious intrapsychic organisation.
- Antisocial personality: Behaviourally impulsive, interpersonally irresponsible, cognitively deviant, acting-out mechanism, callous mood, autonomous self-image, rebellious internalisations, unbounded intrapsychic organisation.
- Aggressive/sadistic personality: behaviourally fearless, interpersonally intimidating, cognitively dogmatic, isolation mechanism, hostile mood, competitive self image, pernicious internalisation, eruptive intrapsychic organisation.
- Compulsive personality: behaviourally disciplined, interpersonally respectful, reaction formation mechanism, solemn mood, conscientious self image, concealed internalisations, compartmentalised intrapsychic organisation.
- Passive-aggressive personality: behaviourally stubborn, interpersonally contrary, cognitively negativistic, displacement mechanism, irritable mood,



discontented self image, oppositional internalisations, divergent intrapsychic internalisations

- Self-defeating (masochistic) personality: behaviourally abstinent, interpersonally deferential, cognitively inconsistent, devaluation mechanism, doleful mood, undeserving self image, debased internalisations, inverted intrapsychic organisation.
- Schizotypal personality: behaviourally aberrant, interpersonally secretive, cognitively autistic, undoing mechanism, distraught or insentient mood, estranged self image, chaotic internalisation, fragmented intrapsychic organisation.
- Borderline personality: behaviourally precipitate, interpersonally paradoxical, cognitively capricious, regression mechanism, labile mood, uncertain self image, incompatible internalisations, diffused intrapsychic organisation.
- Paranoid personality: behaviourally defensive, interpersonally provocative, cognitively suspicious, projection mechanism, irascible mood, inviolable self image, unalterable internalisations, inelastic intrapsychic organisations

## Appendix C

Client Number \_\_\_\_\_ Date \_\_\_\_\_  
Please answer these questions as accurately as you can. It is very important for the research to know exactly what has happened to you in the last year.

If you received the study treatment please answer the next 3 questions:

1 Did you think you knew the difference between the two study treatments people were getting? YES/NO

If the answer is yes, what do you think the difference was?  
\_\_\_\_\_  
\_\_\_\_\_

2 Did you think that the treatment you got was BETTER/WORSE/EQUAL (circle one) to the other study treatment.

3 Do you think the extra treatment of the study made any difference to your chances of recovery? YES/NO

If the answer is yes, how do you think it has affected you?  
\_\_\_\_\_  
\_\_\_\_\_

4 Have you attended AA, NA, ACOA? YES/NO If yes, how many times have you been in the last year? \_\_\_\_\_ The last month? \_\_\_\_\_

5 Have you attended counselling or non AA group? YES/NO If yes, how many times in the last year? \_\_\_\_\_ The last month? \_\_\_\_\_

6 Have you had any further residential treatment during the year? YES/NO If yes, where and how long? \_\_\_\_\_

7 Have you taken any alcohol or drugs at all in the last year (don't count cigarettes or normal use of medication)? YES/NO  
If the answer is no, finish here. If the answer is yes, continue on the next page.

Only complete this page if you have taken any alcohol or drugs in the past year

8 Have you had any strange reaction to any drugs or alcohol since treatment? YES/NO

If the answer is yes, describe what it was and how it affected you and how that was different to your reaction to the drug before treatment:

DRUG	REACTION AFTER TREATMENT	REACTION BEFORE TREATMENT
_____	_____	_____
_____	_____	_____
_____	_____	_____

9 Please tell me about your using history for the last year. Please give the drug (including alcohol), the date about when you started it, and the date about when you stopped for more than two weeks (if you did not stop, leave that date out), about how much worth were you using a week, and how many days per week during that period you actually used. If you had 3 periods of drinking and two periods of smoking dope, then you would fill in 5 lines below:

DRUG	DATE STARTED	DATE STOPPED	WEEKLY USE IN \$s	NO. OF DAYS PER WEEK USING
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

# Appendix D

## INTAKE FORM

- 1 Fill this in only if you want to be part of the study.
- 2 If you agree to be part of the study there will be a 66% chance that you will be in a neurotherapy group.
- 3 Filling out this form does not guarantee a place in the study. A few people may not benefit and will not be included.

Name \_\_\_\_\_ Age \_\_\_\_\_ Sex \_\_\_\_\_ Male / Female  
(circle)

Date of arrival at Aspell \_\_\_\_\_ Today's date \_\_\_\_\_

Ethnic background \_\_\_\_\_ Religion \_\_\_\_\_

Home address \_\_\_\_\_ Close relative \_\_\_\_\_

\_\_\_\_\_ Address \_\_\_\_\_

\_\_\_\_\_

Phone \_\_\_\_\_ Phone \_\_\_\_\_

Close friend's name \_\_\_\_\_

Address \_\_\_\_\_

\_\_\_\_\_

Phone \_\_\_\_\_

Your main drug of choice \_\_\_\_\_ Other drugs taken often \_\_\_\_\_

Do you suffer from any of the following (circle disorder and indicate seriousness of disorder on a scale where 1 is slight and 5 is serious):

DISORDER	SERIOUSNESS
Heart disease	_____
Blood Pressure	_____
Epilepsy	_____
Diabetes	_____
Schizophrenia	_____
Manic depression (bipolar disorder)	_____
Head injury/concentration problems	_____

# Appendix E

## Alcohol Dependence Study

You are invited to become part of a PhD study. This opportunity is being offered to all people entering Aspell House Treatment Centre from now on until the study is complete.

Things you need to know:

- 1 The treatment being studied, sometimes called neurotherapy, involves a type of relaxation treatment for an hour every day, at a different time. In this time your brain waves are recorded and you can hear how your brain waves are changing depending on what you do. It is a new technique that is being used a lot in America, but it has not been researched fully. We do not know how it will work in New Zealand.
- 2 The treatment being studied is pleasant, interesting and nothing at all is put into your body. It is just training in the control of your own body. We all get into bad habits and it is helpful to learn new patterns.
- 3 At three points in the study you will be asked to complete forms; at the beginning of treatment, at the end of treatment and one year after treatment is finished. This will take from one to two hours. Any information gathered will be confidential to the researcher and will eventually be destroyed.
- 4 If you do take part, you will be randomly assigned to one of three groups: one which just gets the Aspell house programme or another two which get slightly different variations of the study treatment as well as the Aspell House Programme. You will be asked to sign a consent form.
- 5 Once a week you will miss your morning and lunch breaks. You will also need to keep your hair clean and not use conditioner, rinses or gels/creams in you hair.
- 6 Because you are going to be followed-up at one year after treatment, we need several addresses to help find you.
- 7 You will be informed about the results of the study at the time of the follow-up.

I want to thank you for your serious consideration of taking part in my research.

Fran Lowe  
Graduate Student  
25 May 1994

## Appendix F

### VICTORIA UNIVERSITY OF WELLINGTON CONSENT TO PARTICIPATE IN PHD PROJECT

**Project:** A Comparison Study of Neurotherapy in the Treatment of Alcohol Dependence.

**Access to files:**

The researcher will not have access to NSAD treatment and medical files. The data collected during the experiment is confidential to the researcher. The data will not be held on the premises of the treatment centre. The researcher will seek the permission of the participant if it is necessary to discuss treatment progress with other persons involved in the participant's treatment and welfare.

**Results of the research:**

Results will be amalgamated for publishing so that participants cannot be identified. If one individual's data is used as an example, permission will be sought to use that data and anonymity maintained. Participants whose whereabouts are known, will be informed of the results. The original data will be destroyed one year after publication of results.

**Outcome of treatment:**

Previous studies have reported that some people undergoing this treatment can no longer physically tolerate alcohol. This is a positive result which can prevent relapse. People undergoing the therapy will have no comeback or redress if they are unhappy about this outcome.

**Withdrawal from project:**

All participants are entitled to withdraw from the project at any time and to withdraw any data they have contributed, without explanation and without any penalty.

**STATEMENT OF CONSENT**

I have read an explanation of the research and have had opportunities to ask questions and had my queries answered to my satisfaction. I have read the points above, I understand them and I agree to participate in this project under these conditions.

**Signed:**

**Date:**

**Name of participant:**  
(please print clearly)

In my opinion consent was given freely and with understanding.

**Signed:**

**Date:**

**Name of independent observer:**

## Appendix G

Research Number \_\_\_\_\_ Neurotherapy Questionnaire

Date \_\_\_\_\_ Time \_\_\_\_\_

How did the training session seem?
Were you able to relax? YES/NO If not, what seemed to interfere?
Physical sensations that occurred:
Emotional feelings that occurred:
Thought, fantasies, and images:
Did your mind wander at all? YES/NO If so, A LOT/MODERATELY/SLIGHTLY Did you hear any sounds? OFTEN/SELDOM/NOT AT ALL Did you have any tendency to fall asleep (or get drowsy)? YES/NO  a If so, did these occur in a particular way? VISUAL/SMELL/AUDITORY/ TOUCH(PRESSURE).SPATIAL/TASTE  a If so, were you aware of these experiences all of a sudden or in a gradual way? GRADUAL/SUDDEN
Was there anything that you particularly liked or did not like about this training session?
Further experiences you would like to share, or remarks you would like to make (if necessary use the reverse side of this sheet):

# Appendix H

## CLIENT FINDING FORM

Client Number: \_\_\_\_\_

First Attempt:                      Date \_\_\_\_\_                      Time: \_\_\_\_\_

Phone Number	Person Contacted	Notes
--------------	------------------	-------

_____	_____	_____
-------	-------	-------

_____	_____	_____
-------	-------	-------

_____	_____	_____
-------	-------	-------

Second Attempt:                      Date \_\_\_\_\_                      Time: \_\_\_\_\_

Phone Number	Person Contacted	Notes
--------------	------------------	-------

_____	_____	_____
-------	-------	-------

_____	_____	_____
-------	-------	-------

_____	_____	_____
-------	-------	-------

Third Attempt:                      Date: \_\_\_\_\_                      Time: \_\_\_\_\_

Phone Number	Person Contacted	Notes
--------------	------------------	-------

_____	_____	_____
-------	-------	-------

_____	_____	_____
-------	-------	-------

_____	_____	_____
-------	-------	-------

Fourth Attempt:                      Date \_\_\_\_\_                      Time: \_\_\_\_\_

Phone Number	Person Contacted	Notes
--------------	------------------	-------

_____	_____	_____
-------	-------	-------

_____	_____	_____
-------	-------	-------

_____	_____	_____
-------	-------	-------

Address of Client: \_\_\_\_\_  
\_\_\_\_\_

Date left Aspell \_\_\_\_\_      Clean? YES/NO      Interview arranged? YES/NO

Name of person who knows about client's current using habits \_\_\_\_\_

Person's Phone number \_\_\_\_\_      Interviewed? YES/NO

Address \_\_\_\_\_



# Appendix I

CLOSE ASSOCIATE FOLLOW UP

Client Number \_\_\_\_\_

We are researching a new treatment and ..... participated in the research while s/he was in Aspell house. S/he has agreed to let us ask you some questions. If you don't know the answers, just say that you don't know.

1. What is your relationship to ..... ? \_\_\_\_\_
2. How often do you see ..... ? \_\_\_\_\_
3. When did you last see ..... ? \_\_\_\_\_
4. Does ..... have a job right now? YES/NO What is it?  
\_\_\_\_\_

How long has s/he had it \_\_\_\_\_

5. Has ..... taken a drink or used drugs in the year since treatment YES/NO

Has s/he used alcohol or drugs in the last month? YES/NO

What substances and how much do you think was spent a week on them?

SUBSTANCE	\$s SPENT PER WEEK
-----------	--------------------

_____	_____
_____	_____
_____	_____

How would you describe his/her using at present?

NO PROBLEM/SLIGHT/MODERATE/

SEVERE/ VERY SEVERE PROBLEM

(Record any comments here)

6. Does ..... go to AA? YES/NO Has ..... been to AA in the last month? YES/NO
7. Has ..... been to any other support group, counselling or treatment centre in the last year?

(Record details here)

8. How do you feel ..... is getting on now?

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