Clinical

NEUROELECTRIC THERAPY (NET) IN ADDICTION DETOXIFICATION

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ABSTRACT

NeuroElectric Therapy (NET) is a benign and rapid, non-pharmacological detoxification treatment for the chemical dependent, either in-patient or out-patient, using very small amounts of electric current transcranially, with electrodes applied above the mastoid process. The pocket-size stimulator is used continuously for 7 to 10 days (3-4 days for nicotine), without supplementary drugs. Within this treatment period it eliminates the acute symptoms and also ameliorates the Chronic Withdrawal Syndrome, which otherwise could last 18 months or longer, to a very substantial degree. By the end of treatment, 95% of 102 consecutive patients claimed they were free of craving, 75% that they were free of anxiety. NET has a reported drop-out rate of 1.6% over a period of seven years. The basis of this therapeutic success has been the marriage of precision clinical techniques to highly specific combinations of electrical current parameters, both developed over 20 years of reported clinical and research work. It is suggested that the mechanism of action may be the rapid restoration to normal of abnormal neurotransmitter levels by specific electrical signals. Clinical treatments and double-blind studies are briefly described and reviewed, with new data on sleep effects.

KEYWORDS: NeuroElectric Therapy, addictions, withdrawal symptomatology, current parameters, chronic withdrawal syndrome, double-blind studies, sleep

INTRODUCTION

NeuroElectric Therapy (NET) has its roots in the serendipitous discovery 20 years ago by Dr. H. L. Wen (a surgical colleague of one of the authors), in the Hong Kong hospital where she was head of surgery. It was observed that the electroacupuncture analgesia under investigation as a replacement for general anesthesia also brought a short one-hour cessation of withdrawal symptomatology in some opioid addicted patients. After receiving the electroacupuncture, they volunteered the information that not only had their withdrawals stopped (since they could not obtain their regular supply of drugs whilst in hospital), but that the treatment had made them feel as if they had had a compensatory dose of their opium or heroin.[1]

Several highly trained Chinese acupuncturists in Hong Kong then attempted to reproduce this rapid detoxification from opioids, using traditional acupuncture techniques, without success. They could achieve rapid improvement in acute or chronic pain conditions, but in chemical dependency only a slow amelioration of some symptoms over a period of several weeks or months was possible.

The Chinese pulse generator used for the electroacupuncture coincidentally could deliver an electrical signal of only 111 Hz (pulses per second), a frequency later found to be within the range appropriate for opioid detoxification.[2] Experiments with a re-designed stimulator which could produce 250 Hz, elicited from addicts that they experienced a distinct euphoria which the previous treatments had not induced. This discovery suggested that different parameters could lead to different clinical effects and Dr Patterson became convinced it was the electrical component of the treatment which had significant influence in withdrawal cessation, and not the acupuncture system which had never proved successful in treating the widespread opium use of earlier regimes in China.

Several months later, in London, UK, we began using adhesive electrodes instead of needles for transmitting current, to avoid both pain and risk of infection.[3] Also, the Chinese pulse generator was found to have an inadequate range of parameters for other addictive substances. For example, a patient addicted to methadone and Ritalin (the stimulant, methylphenidate) claimed that his craving for methadone disappeared by the third day of treatment, but

that his Ritalin craving was totally unaffected. It was only after developing a new stimulator, with a wider range of specifications, that it was possible to relieve the Ritalin craving with 2,000 Hz, a frequency deduced from literature emanating from Russia and Eastern Europe where bioelectricity had been practiced for many years. However, it was observed that such high frequencies must be used with knowledge of their responses, to avoid undesirable side effects such as agitation, disorientation or hallucinations.

With the discovery of the brain's endogenous opioids, the endorphins, in 1975,[4] and the subsequent worldwide burgeoning research into the relationship between different neurotransmitters and various addictive chemicals,[5] it became evident that the *modus operandi* of electrical stimulation in chemical dependency lay mainly in its effects on the reproduction or utilization of the relevant neurotransmitters or neuromodulators[6] when these are in diminished production or availability due to the receptors on brain cells being constantly occupied by exogenous substances. The function of the endorphins is related to pain control, emotion and motivation, and stimulation of the endorphins therefore affects either or all of these to a greater or lesser degree.

ANIMAL RESEARCH

With a stimulator that could provide a large range of clinically useful electrical signals—the first of eight increasingly advanced designs to date (1993) to meet chemically complex requirements—it became possible to investigate clinically, and later scientifically, the significance of each of the current components, and their relationship to each other in the context of addiction treatments. The development of neurotransmitter research by other investigators, in particular, the effects of specific electrical signals on neurotransmitter production and other functions, *in vitro* as well as *in vivo*[7-19] (see Table I), provided an increasingly clearer picture of the probable neurochemical mechanisms of NET.[20,21] For example, it has been shown in humans that cerebrospinal fluid (CSF) β-endorphin levels can be raised by percutaneous,[22] transcutaneous,[23] or direct brain stimulation,[24] and that they will spontaneously return to their normal base level within 90 minutes in non-pain subjects,[23] that is, they cannot exceed the body's natural metabolic ceiling.

Table I

System and Parameter Influence of the electrical signals. A list of some recent relevant research.

System	Parameter	Reference
Salivary gland gene transcription	Frequency, wave-shape	Goodman, *et. al.* 1987[7]
Salivary gland and fibroblast protein synthesis	Frequency, wave-shape, intensity	Goodman & Henderson 1988[8] Bourguignon & Bourguignon 1987[9]
Salivary gland protein secretion	Frequency	Jones & Wilson 1985[10]
Bone cell cAMP levels	Intensity	Korenstein, *et. al.* 1984[11]
Chick brain calcium efflux and chick chondrocyte calcium influx	Frequency	Blackman, *et. al.* 1989[12] Bassett, *et. al.* 1979[13]
Rabbit spinal cord enkephalin and dynorphin release	Frequency	Han & Sun 1990[14]
Chick sensory ganglion neurite outgrowth	Frequency, wave-shape	Sisken, *et. al.* 1981[15]
Adult newt limb regeneration	Wave-shape	Smith & Pilla 1981[16]
Chick embryogenesis	Intensity, wave-shape	Ubeda, *et. al.* 1983[17]
Acetylcholine & dopamine release in rabbit striatum	Frequency	Cubeddu & Hoffman 1983[18]
H-noradrenaline release in clonal nerve cell line	Frequency	Dixey & Rein 1982[19]

Cheng and Pomeranz studied electro-analgesia in mice, using different pulse frequencies (0.2, 4 or 200 Hz). The least level of analgesia resulted from 0.2 Hz and the greatest from 200 Hz—a frequency that is often used in NET for pain, but again such high frequency must be used with care. Cheng and Pomeranz found they could completely reverse the 4 Hz analgesia with naloxone, indicating endorphinergic mechanisms, but there was no inhibition at 200 Hz. (A later study by Han, *et. al.* did show some reversibility at 100 Hz with higher doses of naloxone.)[25] Conversely, parachlorophenylalanine (a serotonin formation inhibitor) partially blocked 200 Hz analgesia but showed no effect at 4 Hz, suggesting that the action of the higher frequency may be serotonergic in origin.[26] Our own animal work showed significant effects on the serotonergic system at both 10 Hz and 500 Hz.[21]

In 1990, Han and Sun reported that different CNS neuropeptides (metenkephalin and dynorphin A) were released in rats by different frequencies of electrical stimulation (ES),[14] 2 and 100 Hz respectively. In 1991, this effect was confirmed by Han and Terenius, in the CSF of humans who were given transcutaneous electric stimulation (TENS) through peripheral skin electrodes placed over certain acupuncture points, at either 2 Hz or 100 Hz.[27]

In the early days of NET, physiologists often argued that nerves could not respond to frequencies higher than 200 Hz at most, yet there was no doubt at all about the clinical response to 2000 Hz, which is the highest unmodulated frequency used in NET for patients, to avoid the risk of diathermy effects which begin about 6000 Hz. Several *in vitro* experiments confirmed that neurons could respond to such high frequencies;[19] and recently Han reported an investigation into the effects of 2000 Hz (2kHz) and 5000 Hz (5kHz) on the tail flick latency (TFL) of rats.[28] A significant increase in TFL was obtained after 10 minutes of electrostimulation and lasted for the whole stimulation period of 30 minutes, although somewhat less at 5kHz than 2kHz. It is interesting that 20 mg/kg of the opioid antagonist naloxone produced a 50% blockade of the antinociception induced by 2kHz but not from the 5kHz stimulation, indicating different physiological mechanisms.

In addition, Russian colleagues, in particular Professor Valeri Lebedev of the Pavlov Institute in St. Petersburg, have described their extensive research, still mostly in Russian literature, to find the optimum parameters which will induce

endorphinergic systems in a variety of animal species, and particularly in humans, using transcranial stimulation. They have concluded that 77.5 Hz is the optimum in humans.[29]

CLINICAL RESEARCH

In the early days of our research, in the seventies, (see UN Bulletin)[30] we experimented clinically with many different parameters of electrical current within each course of treatment, then estimated which frequencies and which size and shape of pulse seemed to bring the greatest symptomatic relief from withdrawals to that individual. Finally, we analyzed the treatment response to each different group of drugs abused, and found there was a distinct correlation between the optimum type of electrical signal and the drug of addiction. Within the opioid group, there were even differences between the different opioids; for example, the optimum basic frequency for heroin was found to be 90 Hz, for Palfium (dextromoramide) 150 Hz and for methadone 70 Hz. This has been confirmed repeatedly by experienced members of our trained staff, and such empirical clinical research still continues.

The advantages of NET were found to lie not only in rapid, drug-free detoxification, but also the patients' emergence from the 7 to 10 days' treatment with a clear, alert mind, and showing signs of the beginning of motivation towards living a more constructive life. I. S. Cooper of New York has also emphasized the beneficial behavioral effects of electrostimulation (ES) when used to treat intractable epilepsy or spastic conditions, with electrodes implanted on the cerebellum, even if the epilepsy was not diminished,[31] and R. G. Heath in New Orleans has independently reported similar encouraging results from ES with implanted electrodes, in intractable behavioral disorders due to epilepsy or trauma, and in severe depression.[32] A few anecdotal cases of clinical improvement have now been reported by Childs of Austin, Texas, using surface (transcranial) ES in cases of post-traumatic amnesia and spasticity.[33,34]

Only one double-blind study of NET has been published to date, conducted by the Philadelphia Addiction Research Center, in cooperation with two of the authors.[35] It should be emphasized that all treatments given were below the level of sensation in order to make the study truly blind. Only the staff who

were trained in the use of the research model of the MEGANET stimulator and pre-set the codes were able to gain access to the displays showing the actual amount of current and voltage being given to each subject. It is interesting that 42 of the 43 addicted subjects in the study showed clinical improvement, and completion rate was 88%, yet by statistical analysis there was no significant difference between placebo and active treatment groups. However, the trained technicians who assessed the subjects twice daily and were blind to the groupings, correctly guessed the active treatment subjects 76% of the time, indicating that clinical differences were conspicuous.

The explanation for this could lie in the fact that the placebo treatment provided 0.2 milliAmps(mAmps) of current in order to produce a display on the stimulator which was exactly the same as for those receiving active treatment. Before the trial, it was thought that such a small amount of current would not effect a clinical response. All active treatments were given at a subliminal level of sensation, which previous research had shown to be effective in detoxification. Each person has a different subliminal level of current, presumably due to differences in skin and bone resistance. In this trial, the subliminal level ranged from 0.6 to 4.3 mAmps.

To elucidate the relationship between current level and treatment efficacy, one of us (L. Patterson) conducted an open investigation in an Addiction Treatment Center, with signed patient consent, into the effect of a standard microcurrent level of output (1.0 mAmps as suggested by FDA for CES) on withdrawal symptomatology, with alcohol as the primary substance of addiction, using the MEGANET VII stimulator. The results indicated that microcurrent levels of output could noticeably ameliorate withdrawal symptomatology; the further removed the patient's liminal level was above the 1.0 mAmps standard, the less efficacious the stimulation, the more overt the underlying anxiety/aggression, and the more profound the 'swings' that occur during the NET treatment.[36]

Two patients in the Philadelphia double-blind study were treated twice. The two methadone patients who relapsed and returned for a second treatment during the trial period, by sheer chance were given one active and one placebo treatment each. One of these two relapsers had very severe withdrawal symptoms with his first treatment which the later analysis showed to be placebo:

his second treatment several months later was active and virtually symptom free. The significance of this lies in the fact that this patient required the highest current of all 43 subjects to obtain a liminal level of sensation, and was therefore unlikely to receive any benefit from a 0.2 mAmps output. Dummy leads will be used in all future blinded studies to clarify the issue of the effectiveness of minimal current as compared to zero current.

Only one of the hospitals involved in this double-blind trial recorded the sleep ratings (for active subjects n = 8 and placebo n = 10), which have not been previously reported. Duration of sleep over 6 hours was rated 0 and less than 2 hours as 3; quality of sleep was rated 0 for peaceful and 3 for very restless. On average, the active subjects slept longer than the placebo group, but using the one tailed t-test the difference was not significant ($p > 0.1$). However, the quality of sleep was significantly better in the active group compared to the placebo ($p < 0.02$). Methadone, widely used as a heroin substitute, is notorious amongst addicts for its prolonged withdrawal insomnia.

Under NET, patients have been safely and rapidly detoxified—within 10 days—from daily drug dosages as large as 300 milligrams prescribed heroin to 10 grams of street heroin; 0.5 to 10 grams cocaine; 40 to 800 mg methadone; and various narcotic and psychotropic prescription medications up to 70 tablets daily. Up to 8 years after treatment, 80% of 93 traced patients claimed that they were still drug-free, 78% that they were alcohol-free.[37] The reported drop-out rate (DOR) of 1.6% in NET treated addicts over a period of seven years, compared to the 35 to 90% DOR reported for any other treatment process, emphasizes not only the success of the treatment but also its acceptability to patients.

NET includes not only multiple applications of differing electrical parameters, but also their carefully timed applications to provide the optimum advantageous clinical response. Twenty years of clinical investigation have demonstrated that even minute alterations of electrical parameters can have a large impact on the clinical outcome.

The Acute Withdrawal Syndrome (AWS) or Abstinence Syndrome (AS) varies with each group of psychoactive drugs, as described earlier[1] (pp. 245-248), but the most common and basic symptoms are those listed by Kolb and

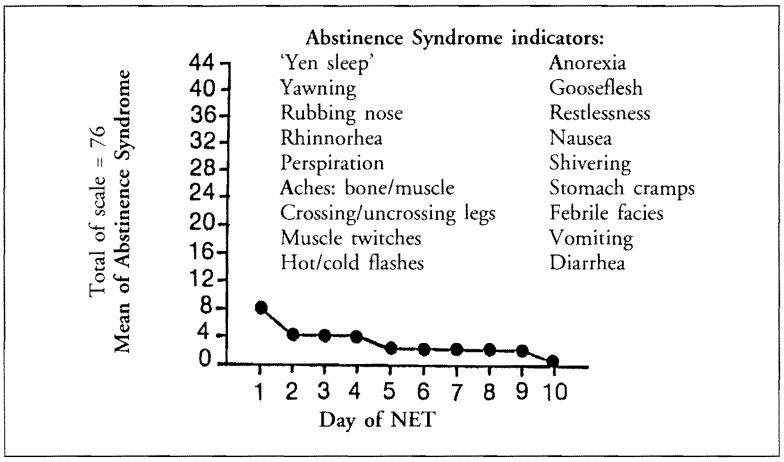

Figure 1. *Abstinence Syndrome (AS) indicators: Mean of daily means of the AS for all addictions combined (n = 102) for one year (1980), based on Himmelsbach's categorization.*[38] *Each of the 19 signs and symptoms (as in figure) were recorded on a 0-4 point scale, totalling a possible 76 points. The dominant AS indicators varied between patients; it was rare for anyone to experience all the symptoms. The highest mean recorded was 9 points out of 76 because all drugs were totally stopped on admission and NET started immediately; thus withdrawal symptomatology was kept at a minimum from the beginning. Recordings were made objectively by trained observers and corresponded closely with subjective ratings.*

Himmelsbach for opiates[38] (see Figure 1). Eventually the body will restore itself to physiological normality without any treatment at all, but this stage, known as the Chronic (or Protracted) Withdrawal Syndrome (CWS) may drag on for 18 months to 2 years after stopping drugs such as methadone, alcohol or tranquilizers. Some describe it as resembling a low-grade depressive syndrome, with a variety of specific symptoms associated with particular drugs. The CWS is a major cause of relapse to drug or alcohol use, the other common reason being the lack of an appropriate psychosocial or psychospiritual support system. All patients regard the rapid relief NET provides from the CWS as being of much greater consequence than the speedy elimination of the acute symptoms.

Another important factor to emerge from the research is that the most crucial aspect to any successful detoxification by ES is the delivery of the correct *combination* of specific and precise electrical signals at the relevant times in the treatment program. In addition to the basic pulse frequency for detoxification for each different group of psychoactive drugs, several other frequencies are utilized for relief of symptoms such as dysphoria or craving. The output is subliminal at 0.9 to 3.5 mAmps for the majority of subjects, but some patients prefer supraliminal current for psychological comfort. The significance of the correlation between the liminal level of output and effectiveness of treatment has not yet been finally determined.

The precision techniques underlying this successful detoxification include the placement of electrodes on a specific area above the mastoid process; and, most important of all, the clinical techniques, ensuring correct polarity. If the patient is right-handed, the positive electrode is placed behind the right ear; if left-handed, the positive electrode is placed behind the left ear. The apparent association with the dominant hemisphere of the brain has been established empirically although not yet fully understood, and if not adhered to, *the therapeutic effect will be completely negated.* Other independent researchers have since confirmed this finding in their own animal research, emphasizing that in rats the positive electrode must be applied to the right ear in order to reduce the withdrawal symptoms, but offering no explanation for this phenomenon.[39,40]

The ability of NET to rapidly restore a healthy sleep pattern—usually without any use of sleep medication—is one of its important features. Not originally used as a sleep aid, in 1974 a heavily addicted patient, whose daily 800 mg of methadone had been abruptly stopped on commencing NET, fell asleep while using the stimulator, and, continuing to wear it, slept the whole night through. Since then, considerable investigation has gone into developing the electrical signal optimally effective in inducing sleep during the associated insomnia of withdrawal.

NET has been noted by the authors for some time to be clinically most efficacious when the receptors are as clear as possible of exogenous substances. The technique of commencing stimulation only when the patient is in acute withdrawal is now standard procedure with all NET treatments. When Figure 1

Table II

Example of a first day withdrawal rating scale in 1991, a combination of subjective and objective observations. Male patient using heroin 1 $^{1}/_{2}$ grams daily.

OPIATE WITHDRAWAL RATING SCALE

TREATMENT DAY: One **MEGANET Unit No:**

Name: Deleted Date: Deleted

Drug (Check one): X Heroin Methadone Cocaine Other

Please enter time, and rate severity of withdrawal and craving on a scale of 0 to 10.

RATING SCALE:
NONE 0—-1—-2—-3—-4—-5—-6—-7—-8—-9—-10 SEVERE

Time:	10.20	11.35	15.35
Overall Withdrawal Severity	7	1	0
Feeling irritable/nervous	8	3	0
Low energy/fatigue	10	6	0
Body aches/pains	9	2	0
Feeling down/depressed	10	4	0
Chills	10	3	0
Yawning	6	0	0
Tearing	7	0	0
Running nose	6	0	0
Abdo cramps/diarrhea	8	0	0
Loss of appetite	6	0	0
Craving for heroin	10	0	0
Total:	97	19	0

Note: Rating on admission 97. Remained symptom-free after treatment.

was made on 102 consecutive patients treated in 1980, NET was commenced before the patients went into acute withdrawals (hence the low initial level of symptoms), but with the present regime, the zero level of symptomatology is reached considerably more rapidly, as demonstrated in Table II.

Unlike other forms of ES application in detoxification, NET is used continuously when possible, day and night, for the first half of the treatment period (approximately 5 days), in order to prevent re-emergence of symptoms.

PARAMETERS OF CURRENT

The use of a rectangular current wave form in NET emerged as a result of clinical comparison with a sinewave, which showed increased treatment benefit from the former. From personal communication with two fellow-researchers in the same field—Ellison of France and Lebedev of Russia—it was learned that they also arrived at their use of a rectangular wave by means of the same empirical approach. Both their and our independent and separate animal studies have reinforced the accuracy of this conclusion.[41]

NET incorporates only an AC signal, with zero net DC component. Direct current (DC) may produce more rapid effect, but it also carries the risk of ionization of tissues, and sometimes of skin burns under the electrodes. NET provides a rectangular wave with a pulse-width of 0.22 msec (asymmetric but balanced) and modulated by a rapid sinewave for sleep. Also, while the NET stimulator has a pulse frequency range of 5 to 2,000 Hz, frequencies above 200 Hz are used with caution for limited time periods only.

With the development of increasingly sophisticated stimulators, each better equipped to deliver the more subtle variations of electrical signals required in the complex addiction treatment process, it became possible to increase clinical efficacy with a consistently smaller amount of current. While the individual response, based on each individual's differing skin and bone resistance, still dictates the amount of current each person receives, clinical experience has established that subliminal levels of current are at least as efficacious as supraliminal in eliciting a therapeutic response. However, where the minimal level required to obtain a clinical response lies is still under investigation.

Long-term health effects have been carefully monitored. A follow-up study in 1981, covering the eight years after NET was serendipitously discovered (26% of the 93 patients traced had been treated more than 3 years previously), showed only beneficial side-effects, such as improved health, sleep and relationships

with family, and 79% were no longer addicted. All but one of the addiction-free and three of the relapsed reported their health to be the same, or improved; in fact, 87% of the drug-free and 44% of the relapsed claimed actual improvement. Full details of this follow-up are given in a 1984 issue of the Journal of Bioelectricity.[37]

Transcranial ES, including NET, used appropriately and without concurrent medication, is both a safe and highly effective treatment modality for the detoxification of the chemically dependent, as reported by two independent groups.[42,43] Long-term use of ES for chronic pain has been described as a "safe treatment" in an FDA investigation[44] with many patients using it daily for many years.

We know of no report suggesting any effect such as has been feared with long-term exposure to electromagnetic fields (EMF) created by, for example, overhead power lines[45] or even domestic appliances such as hair-driers. It has actually been claimed that "EMF-induced changes in immune cell biochemistry could affect the organism's immune response directly *in either a negative or positive manner.*"[46] Investigations are producing contradictory results[47] and mostly reflect whole-body fields; the localized application of NET is conceptually simpler and provides opportunities for finer control. Besides, NET is given for a maximum of 10 days, and in the case of drug and alcohol abuse, let alone the 3 days for cigarette smoking, any possible risk would be greatly outweighed by the potential benefits.

Nevertheless, careless or inappropriate use of such stimulation may endanger the individual if treated by an untrained person. It is for this reason that a fully pre-programmed, computerized stimulator has now been designed, with an accompanying Treatment Manual as a guide to the medical aspects of the treatment, so that mistakes are unlikely to be made by those who have an inadequate knowledge of bioelectricity or who do not have the time to study its many complexities in the field of addictions. The whole 24 hour-a-day, up to 10-day NET program is incorporated in the device, and the associated software, which includes programs adapted for out-patient treatment. Individual treatment regimes for different conditions, derived from close clinical observation of all forms of addiction over a period of 20 years, are included in the software. These are available as separate applications for

each of the major substances of addiction, or in combinations of substances abused, which can be simply administered by medical supervisors. The unit is easily carried in a pocket.

CLINICAL RESULTS

Amongst the authors' early patients there were many musicians. Some of the most notable advances in NET in its formative stages derived largely from these experts in electronic music, who were interested in constantly manipulating the electrical parameters of the stimulator (all hand-operated at that time) until they experienced what "felt right." A considerable amount of practical technical information in NET was derived from this musically inspired motivation.[1] Significantly, our later work with rats[48,49] demonstrated that those early subjective opinions as to what provided greatest withdrawal relief were confirmed experimentally as having the optimum measured effect using the Righting Reflex—a very accurate measurement in rats—of the speed of detoxification from various drugs (Table III).

The clinical regime involved in NET, and developed over succeeding years, is portrayed in a 36-year-old single European male heroin addict given 7 days of NET after abrupt cessation of all drugs. His first drug use had been when he was 15 years old—amphetamines, Mandrax (methaqualone) and cannabis, advancing to develop a severe cocaine habit, smoking and intravenous (I/V) use—and finally heroin, using between 1 and 1.5 G daily. He went through multiple 'cold turkeys' by himself but only one supervised attempt at detoxification, and he felt depressed and physically weak when off drugs.

The withdrawal relief experienced here under NET (Table II) was unusually profound, but illustrates the difference in effect between the 1980 regime (as in Figure 1) when NET was commenced on admission, and the present technique of commencing NET only when symptoms of acute withdrawal are evident. The majority of patients experience between 50 and 75% reduction in withdrawal symptomatology compared to their previous experiences by a variety of different methods of withdrawal (this taking the place of a controlled, comparative group in our 7-year follow-up) with a minority experiencing between 75 and 95% reduction. Most of these figures represent a combination

Table III

The Effect of Electrostimulation at Various Frequencies on the Hexobarbital (100mg/kg)-Induced Sleeping Times in Female Rats. Results represent mean ± S.D. for individual assays on six animals in each group. Two frequencies, either 10 Hz ($p < 0.001$) or 500 Hz ($p < 0.001$) were most effective in decreasing the hexobarbital-induced sleeping time. However, an unmodulated frequency of 500 Hz must be used with caution.

Frequency (Hz)	Sleeping Time (mins)	Percent Reduction in sleeping time
1	61±12	23
5	56±11	29
10	46±08	**42**
15	59±16	25
20	57±06	28
30	54±09	32
90	68±06	14
100	72±09	9
200	74±13	5
500	48±05	**39**
1000	58±06	27

of subjective and objective reporting. As can be seen from Table II, relief is almost immediate—between a half to two hours after commencement of NET, with all substances of addiction.

Yet the full 7 to 10 days of NET is always given, whether as in-patient or out-patient treatment, partly because symptoms may recur unexpectedly, and partly because the rapid clearing of the mind compels the patient to begin facing up to the real problems that caused the drug use in the first place. The therapist thus has a crucial supplementary role to play in the full recovery during the brief treatment period, and should also take responsibility for arranging a continuing support system. To achieve this mental and emotional clarity, no medication is given, even for substances with

Table IV

Assessments of some recent patients treated in Europe by NET. O/A = On Admission. O/D = On Discharge. SCL-90 = Symptom Check List-90: Highest (worst) possible figure is 450 and lowest (best) is 90.

Sex/Age	Substance of Addiction	Days NET	Beck Depression		Hamilton Anxiety		SCL-90	
			O/A	O/D	O/A	O/D	O/A	O/D
M 36	Heroin smoked	7	28	2	36	0	234	95
M 28	Cocaine nasal	7	41	6	25	6	287	134
M 27	Methadone oral +Heroin I/V +Cocaine I/V	9	16	4	16	6	145	110

a high risk of convulsion during withdrawal. This decision was made after observing, in the first convulsing addict treated, many years ago, that his convulsions stopped as soon as his epilepsy medication (Epanutin) and slow reduction of his phenobarbiturate dosage were discontinued.

It is no longer an accepted premise that pharmacology—and especially psychopharmacology—is required by clinical necessity for the successful detoxification of the chemical dependent, as has been demonstrated by recent independent clinical trials in the USA.[35]

Recently, we have begun to include a series of standard assessments as part of the admission routine, and repeat them prior to discharge. Table IV shows some typical results found in opiate and cocaine addicts treated by NET. This ability of transcranial electrical stimulation (ES) to substantially reduce psychic distress and aggression has been noted by other investigators (using different designs of stimulator, but again very specific current criteria), both in the field of affective disorders,[50] and affective disorders found as part of the alcohol withdrawal syndrome.[51] In the latter double-blind study, conducted in St. Petersburg, Russia, out of 2 matched groups of 10 volunteer alcoholics each, who had all been abstinent for 3-4 weeks, the decrease in both depression and anxiety, measured by 5 standard assessments, was statistically significant

($p < 0.01$), with a corresponding rise in the MAO-B in blood platelets ($p < 0.05$) and in GABA, in the active treatment group compared to the control.

REPRESENTATIVE CASE-HISTORIES

NET's rapidity of detoxification from prescribed drugs is equally effective, provided the current parameters are appropriate for that group of drugs. A young woman in her early thirties, on prescribed 6 mg Ativan (a benzodiazepine) daily for 10 years, wrote 3 months after NET, "I could never have undergone withdrawal without NET because of the short span of time that it has taken. The actual experience of withdrawal is one of self-discovery and rebirth. Rebirth is an excruciatingly painful business. One's sense of awareness is increased to what initially seems to be an unbearable degree. I needed constant companionship during the month following the treatment. The psychological experience is that of an extended acid trip which is pretty frightening if one feels stuck in it for quite a few weeks. Without NET it could have taken a couple of years and my life would have without a doubt been totally ruined. . . It's truly amazing after 10 years of 'blur' to have my memory back and all of my five senses in tip-top working order. People are constantly struck by my sense of optimism these days and my sense of purpose. . ."

A 51 year old alcoholic arrived for treatment in a state of extreme intoxication. Drinking four bottles of sherry wine daily for one and a half years, in addition, her physician had prescribed concurrently three different antidepressant drugs in an attempt to reduce her alcohol intake. All drugs and alcohol were stopped abruptly, yet she experienced neither delirium tremens nor 'the shakes'. The alcohol craving disappeared on the third day of NET and both her appearance and behavior improved dramatically.

A 65 year old business man, smoking over 60 cigarettes daily, had such severe emphysema that he was breathless even after taking a shower. For the previous 20 years he had been trying every known treatment to stop the habit, without success. Six years ago, he received 4 days of NET treatment and hasn't smoked one cigarette since. In addition, his breathlessness has been markedly reduced.

CONCLUSION

After two decades of reported clinical and investigative work, NET has been demonstrated to be a safe and highly effective alternative to the restricted unsatisfactory pharmacological approach to detoxifying addicts. NET promotes and expedites the rapid return of the normal physiological functions and psychological stability which enhances the addicts' ability to benefit from relapse prevention programs. In fact, Figure 2, taken from a 7-year follow-up of NET patients,[1] shows that 42% of addicts who were drug or alcohol free at follow-up had had no structured rehabilitation at all—their freedom from relapse presumably due to the profound physiological effects of NET—although a friend or parent may well have acted as their post-detox "support system."

Even in the USA, where methadone maintenance is still strongly promoted, it was reported in 1991 that not more than 14% of the clients 'kick off' (heroin) in the course of a methadone program. Over a period of 8 months to 3 $^{1}/_{2}$ years at least 86% experience a relapse to illicit drugs at least once.[52]

In 1981, de Leon reported that "when effectiveness (of rehabilitation) is defined in terms of heroin or methadone abstinence, less than 10% are judged successful, 10 years after treatment."[53] And in 1990, Professor Kreek wrote that "in several follow-up studies it has been shown that more than 80 percent of former methadone-maintained patients, irrespective of the degree of the rehabilitation, relapse to heroin or other narcotic use within 2 years of leaving methadone treatment.[54]

With the recent rapid increase of babies born with defects due to the mother's addiction, NET will be made available to addicted pregnant women as soon as possible. Research is presently being conducted at the University of Texas into the effects on the fetuses of pregnant rats while being administered NET daily throughout pregnancy. The small amount of literature available on using electrical stimulation in human pregnancies suggest that it may be a safe procedure.[55,56]

Recent reports in the USA state that heroin is becoming both purer (having risen from 5-10% in the last few years to over 40%) and cheaper, indicating

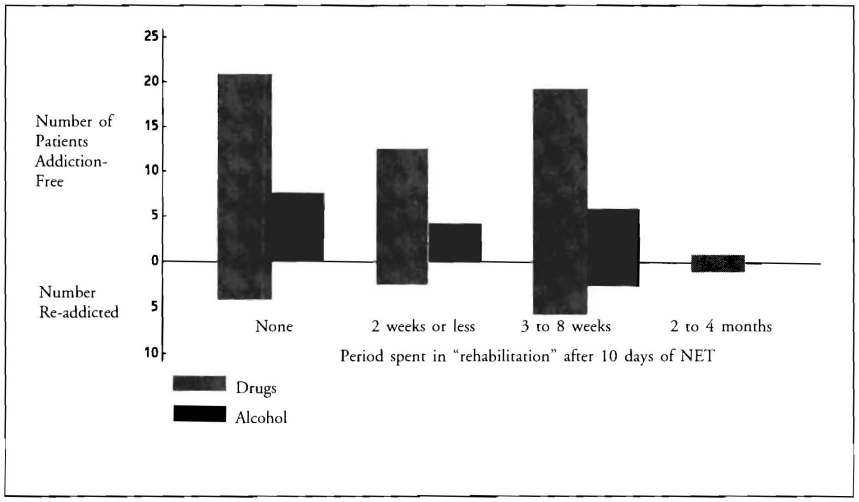

Figure 2. *Relationship between time spent in "rehabilitation" after completion of 10 days of NET, and long-term outcome (n=84). Statistically, the long-term outcome appears to be unaffected by the length of time spent in some kind of institution after completion of NET. A t-test was performed to determine if there was a mean difference in the days of rehabilitation between addiction-free and re-addicted. The mean number of days for addiction-free was 10.92, and for the re-addicted, 10.35. The t-test was not significant ($t = .16$, $df = 85$, $p > .05$) indicating that the duration of rehabilitation is unrelated to long-term outcome after NET. However, a short period of intensive "rehabilitation" may be of value to some, depending on individual character and needs. All received counselling during the 10 days of NET.*

the possibility of a new epidemic.[57] With addiction—and especially poly-substance addiction—on the increase world-wide, it is timely to consider a new bioelectronic approach to the medical treatment of the chemically dependent.

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