TREATMENT OF DISEASE WITHOUT THE USE OF DRUGS I. RESEARCH ON BIOFEEDBACK TRAINING

By M. K. Sim

INTRODUCTION

As early as 1910 autogenic training has been used by Schultz and Luthe (1959, 1969) in their treatment of psychosomatic diseases. In this kind of treatment the patient treats himself and the physician acts as a guide. Through a process of mental control, exercise or concentration the patient learns to produce relaxation of voluntary muscle, increase of hand temperature, or alter other physiological processes that will ameliorate his psychosomatic ailments. Unfortunately autogenic training has never been popular nor in common use mainly because the outcome of the training depends on the patient's effort and beneficial gain or complete recovery is not easily brought about though not unattainable. The method used for the mental exercise in not unlike the chanting of mantras used by yogis during certain forms of meditation. The patient autosuggests to himself to relax by repeating, preferably verbally at first, various phrases e.g. "I will relax, I feel relaxed, I am relaxing".

Precipitating factors of most psychosomatic diseases (e.g. tension, stress and strain, frustration and worries) are associated with hightened activity of the patient's sympathetic system. Ability to voluntarily restore the sympathetic output would produce the desired effect in preventing the onset of psychosomatic ailments. Learning to self-regulate one's physiological processes in voluntary, autonomic and central nervous systems is not new, it has been part of a series of exercises practised by hatha yogis since ancient times (Majumdar, 1971). Present day knowledge equates hatha yoga to a system of exercises which leads to the control of physical and mental functions. The first and primary aim of hatha yogis is therefore to strive for mastery over their autonomic system (Wenger and Bagchi, 1961), a task which was formerly considered beyond one's ability (Kimble, 1961). Because the autonomic nervous system controls and regulates the vital systems of which our good health and well-being depend it is not without basis that yogis, who have gained considerable control over their autonomic system, claim that they have a kind of awareness in which they developed both physiological and psychological self-knowledge. If one can accept autogenic training as a form of treatment without drugs, then yoga is prophylaxis without the use of drugs. However, it is difficult to envisage a time when the ordinary individual will be prepared to practise hatha yoga to avoid disease and drug though it is considered commonsense that everyone should exercise regularly to be healthy.

It is also not easy for a patient with psychosomatic disease to autosuggest to his autonomic nervous system and so obtain relief or recovery. The alternative to treatment of psychosomatic diseases and disease with a psychosomatic component is the chronic use of drugs to control the symptoms of the disease. Drug actions are many and, concurrent with exerting their desired effects, they exert harmful effects. Prolonged drug usage predisposes the patient to a multitude of adverse effects. Research on biofeedback training carried out at the Menninger Foundation in Kansas and other medical centers in America may provide an alternative to the use of drugs in the treatment of certain diseases. Biofeedback training is training to control and regulate the bodily functions with the aid of electronic equipment. Immediate ongoing information about the trainee's biological processes or conditions e.g. muscle tension, heart behaviour, brain activity, are recorded by electronic equipment and displayed to the trainee as visual or auditory feedback. Using this information to change or control voluntarily the specific process or response is biofeedback training. With such aids patients have learnt to re-regulate their abnormal physiological functions, and once the technique is mastered the continued use of biofeedback equipment is no longer necessary. The rationale of biofeedback training as postulated by Green and Green is illustrated in Fig. 1. The potential usefulness and practicality of biofeedback training in treatment of disease without the use of drugs is reflected by the widespread interest shown and the many successful pilot schemes carried out at various established medical centers in North America.

Control of Migraine Headache

Joseph Sargent (Sargent, Green and Walters, 1973; Sargent, Walters and Green, 1973), Director of Internal Medicine at the Menninger Foundation began biofeedback treatment for migraine sufferers based on the careful observation of Elmer and Alyce Green (Green, Green, Walters, Sargent and Mayer, 1973) that ability to suddenly increase the blood flow and temperature of the hands was accompanied by the sudden relief of the subject migraine headache. Migraine, a complex dysfunction of cranial vasculature is a chronic disease. Ergotamine tartarate is

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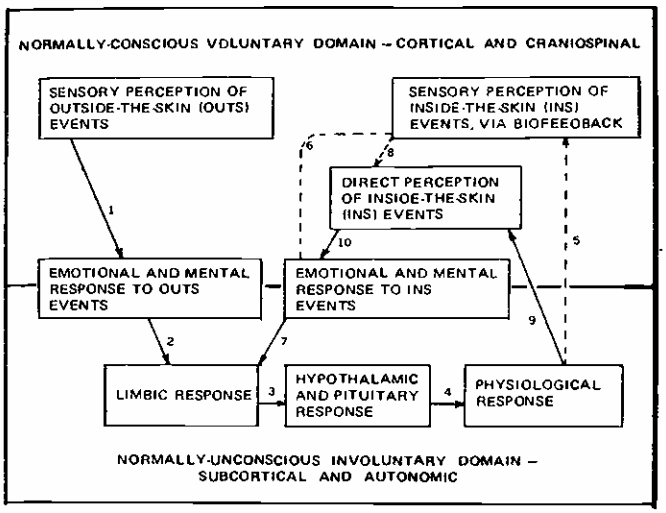

SIMPLIFIED OPERATIONAL DIAGRAM OF "SELF REGULATION" OF PSYCHOPHYSIOLOGICAL EVENTS AND PROCESSES

Fig. 1. Sensory perception of OUTS events, stressful or otherwise (upper left box), leads to a physiological response along Arrows 1 to 4. If the physiological response is 'picked up' and fed Back (Arrow 5) to a person who attempts to control the 'behaviour' of the Feedback devise, then Arrows 6 and 7 come into being, resulting in a 'new' limbic response. This response in turn makes a change in 'signals' transmitted along Arrows 3 and 4, modifying the original physiological response. A cybernetic loop is thus completed and the dynamic equilibrium (homeostatis) of the system can be brought under voluntary control. Biofeedback practice, acting in the opposite way to drugs, increase a person's sensitivity to INS events and Arrow 8 develops, followed by the development of Arrows 9 and 10. External feedback is eventually unnecessary because direct perception of INS events becomes adequate for maintaining self regulation skills. Physiological self control through classical yoga develops along the route of Arrows 7-3-4-9-10-7, but for control of specific physiological and psychosomatic problems biofeedback training seems more efficient. (Reproduced, by permission, from Green and Green, in "Being Well is a Responsibility" Nils O. Jacobson (ed), Turnstone Books, London, 1975).

used during attack and methylsergide malate is used prophylactically. However these drugs have significant adverse effects which limit their use. Voluntarily warming of hand is believed to lead to a rebalance of the vascular dysfunction in the head, a possible reflection of a general sympathetic relaxation associated with self-induced vasodilation in the hand. Through temperature biofeedback training sufferers learn to increase their hand temperature. Since 1968, 150 patients have participated with more than 80% responding to the treatment with relief ranging from "little" to "almost complete" cure and a few reporting a migraine free life. Treatment of migraine with temperature biofeedback training has also been carried out at other laboratories and clinics (Gladman Estrada, 1974a; Adler, 1974; and Diamond, 1974). Similar temperature biofeedback training has also been used to treat Raynaud's disease (Gladman and Estrada, 1974b; Taub, Emurian and Howell, 1974; and Schwartz, Shapiro and Tursky, 1973a). The basic rationale for its occurrence and for its amelioration seems to be the same as for migraine headache.

Control of Tension Headache

Biofeedback has been used to treat tension headache (Budzynski, Stoyva and Adler, 1971). Their patients received biofeedback training to reduce frontalis EMG. The patients usually received two to three 30-minute feedback training sessions per week for up to 2 months. Practice of relaxation was encouraged at home. Their results indicate that with training both frontalis EMG and headache declined. The patients also reported changes in their approach to the tension. They tended not to over-react to stress and developed an ability to reduce such tension. In a recent paper, Budzynski and associates (1973) reported the outcome of their controlled study. Their experiment showed significant reduction in headache of participants of biofeedback training over non-participants and those who participated in pseudo-feedback training. Three months follow-up of participants revealed greatly reduced need for medication. Among others who have used EMG biofeedback training for treatment of tension headache are Wickramsekara (1972) and Gladman and Estrada (1974a).

Control of Heart Behaviour

Engel and his associates (Weis and Engel, 1971) in one of their studies described their work with patients suffering from premature ventricular contractions (PVCs) a symptom associated with sudden death and coronary artery disease. PVCs are often not suppressed satisfactorily with drug therapy. Their equipment had three lights to provide the visual feedback for training, a green one at the top to signal to the patient to increase his heart rate, a yellow in the center to indicate retention of the existing heart rate whenever the rate was correct, and a red light at the bottom to show slowing of heart rate. Ten sessions of about 30 minutes duration consisting of heart rate increasing, heart rate slowing, alternate speeding and slowing, and stabilising of heart rate were introduced to 8 patients. The sequence of the exercises provided the patients with information of the occurrence of each premature ventricular contraction. Four patients showed significant reduction of PVC occurrences and overcame them through resting. Three patients did not respond to the treatment, two had hearts which were diseased irreversibly, the other had cardiomyopathy which posed difficulties of heart rate and PVC detection making accurate feedback to the patient difficult. A five year follow-up of one patient showed that her PVCs continued to be rare and she did not require any antiarrhythmic medication (Engel and Bleecker, 1974). Application of biofeedback for the control of various other types of cardiac arrhythmias was also carried out by Bleecker and Engel (1973a, 1973b). Research on the control of heart behaviour has also been studied in other centers (Shearn, 1962; Bergman and Johnson, 1971; Shapiro and Schwartz, 1972).

Control of Blood Pressure

Evidence is accumulating that the CNS plays an important role in either the generation or the maintenance of high blood pressure. Some cortical areas have been shown by Chapman and workers (1954) to be possibly involved in arterial hypertension and to mediate blood pressure changes. In addition the current usage of drugs that interfere with autonomic control of the cardiovascular system also indicates some role for the central nervous system in maintaining abnormally elevated blood pressure. It has recently been shown that blood pressure can be brought under voluntary control in the laboratory using biofeedback (Shapiro, Tursky, Gershon and Stern, 1969; Brener and Kleiman, 1970; Shapiro, Tursky and Schwartz, 1970; and Shapiro, Schwartz and Tursky, 1972). Schwartz, Shapiro and Tursky (1973b) reported the use of biofeedback training in the control of seven patients with diagnosed essential hypertension. Using feedback devised in their laboratory, the seven patients trained to lower their systolic pressure until no further decrease in blood pressure were observed in five consecutive training sessions. Five patients responded with decrease in systolic pressure of 34, 24, 17, 16, 16 mm Hg. The other two showed no significant decrease in blood pressure. The authors suggest that their method coupled with other biofeedback techniques to lower sympathetic tone might be a fruitful approach in blood pressure control. Krist and Engel (1975) carried out a similar study on 5 patients with documented histories of essential hypertension of at least 10 years duration. Phase 1 of their study was a seven week period during which patients took their blood pressure at home and mailed the data to them. Phase 2 was a 3 week period during which patients were taught to control systolic blood pressure: patients were trained to raise, to lower and to alternately lower and raise systolic blood pressure. Phase 3 was a three month period during which patients again took their blood pressure at home and mailed their data daily for study. Their results show that all patients learned systolic blood pressure control and that baseline systolic blood pressure fell from 153 mm Hg during laboratory training to 135 mm Hg at the three month follow-up. Phase 3 home blood pressure fell 18/8 mm Hg from phase 1 level, and at home patients also were able to reduce systolic blood pressure from 141 mm Hg (average) to 125 mm Hg (average) by means of the lowering technique learned in the laboratory.

Control of Epilepsy

A fortuitous discovery by Sterman (1972) that cats previously trained to produce 12-14 cps brain rhythm from the sensorimotor cortex were distinctly resistant to the convulsive effects of convulsant drug led him to investigate the applicability of sensorimotor rhythm feedback training as a treatment of epilepsy (Sterman, 1974). Four of his patients after extensive feedback training of 12 to 24 months exhibited normal EEG pattern and significant reduction in seizure activity. His finding stimulated the interest of Poirier (1972, 1975) and epileptologist, who developed his own methodology for clinical application of EEG feedback. Dr. Poirier began his treatment with a 10 minute orientation consisting of slide show and explanation of alpha rhythm (8 to 12 cps EEG) in which he impressed the patients of their ability to wipe out the bad seizure with alpha wave. Dr. Poirier's approach may be an important factor in his reported successful training of 75 patients with reduced drug regimes. Research on biofeedback training for control of epilepsy though innovative is also in progress at other medical centers (Kaplan, 1974; Finley, Smith and Etherson, 1974; Rouse, Peterson and Shapiro, 1974; Finley, 1975; and Lubar and Seifert, 1975).

Control of Insomnia and Obesity

Relaxation of the frontalis muscle using EMG of the muscle as feedback was employed by Freedman and Papsdorf (1975) to treat insomnia in their controlled study of 18 chronic insomniacs. Their preliminary results indicate that participants showed significant reduction in sleep onset and time spent being awake, but an increase in percentage of REM (rapid eye movement) sleep. Use of electromyographic training to reduce sleep onset has also been studied by Montgomery (1975). A pilot study using yoga, autohypnotic suggestion and GSR-induced relaxation (relaxation associated with increase in glavanic skin resistance) to modify smoking and over-eating behaviours was carried out by Kothare (1975). Training included learning to increase GSR which was recorded and displayed as visuai feedback. Participants attended a twice weekly training session of 45 minutes for 4 weeks. Six of the smokers stopped smoking completely and two smokers reduced cigarette consumption considerably. All six obese persons altered their eating habits significantly toward desirable weight loss. Another pilot study using biofeedback to treat obese persons has been reported by Weinstock (1975). His preliminary results indicate that all 12 participants demonstrated weight loss.

Control of Physical Disabilities

In certain physical sickness and other disabilities where drugs cannot be of any use, biofeedback training provides the rational treatment.

Disorders of Voluntary Movement: Joseph Brundy and associates of New York University Medical Center innovated EMG biofeedback training in the treatment of spasmodic torticollis (Brundy, Grynbaum and Korein, 1974). After 10 weeks of training, 7 of his 9 patients overcame the spasm and feedback was no more necessary. All the subjects exhibited gain of self-assurance, overcoming depression and resumed their social contacts. At the ICD'S (Institute for the Crippled and Disabled) Medical Service, a private rehabilitation center which treats incapacitated

victims of stroke, cerebral palsy, spinal cord injuries, dystonia and other CNS and neuromuscular disorders Dr. Brundy established a sensory feedback therapy unit which employs estensive feedback training in his treatment (Brundy, 1974). In one of their reports 32 of the 36 patients with disorders of voluntary movement, including torticollis, dystonia and hemiparetic-spastic disorders of varied etiology responded with varying degree of improvement ranging from functional recovery to symptomatic relief within 8 to 12 weeks (Brundy, Korein, Levidow, Grynbaum, Lieberman and Friedman, 1974). In a later review of treatment and 3 months to 3 years follow-up of 114 patients, Brundy and associates (1976) reported that 50% of hemiparetic patients retained long-term significant functional gain, 40% of spasmodic torticollis patients maintained significant long-term improvement and 50% of the other patients of various muscle disorders responded to the treatment. Work paralleling that of Dr. Brundy has been carried out by Johnson and Garton (1973); Swaan, VanWieringen and Fokkemma (1974); and DeBacher and Basmajian (1975).

Subvocalisation: A rapid cure for subvocalisation using EMG feedback from laryngeal muscle was reported by Hardyck, Petrinovich and Elsworth (1966). In one training session of about 30 minutes duration, patients were able to remedy their subvocalisation. A follow-up of 3 months indicates ability to read normally without subvocalisation. It is amazing that a disability which had existed with the patients throughout their entire reading period could be remedied in 30 minutes of biofeedback training.

Fecal Incontinence: Engel, Nikoomanesh and Shuster (1974) taught six patients suffering from severe fecal incontinence to produce external sphincter contraction in synchrony with internal sphincter relaxation with the aid of their sphincter muscle EMG as feedback. During follow-up period of from 6 months to five years four patients remained completely continent and the other two observed definite improvement.

Control of Addiction

How are addicts to be treated using biofeedback training and what variables should be recorded and used as feedback? Unlike sufferers of diseases and disabilities alcohol and drug addicts show a different kind of defect. Dr. Kurtz (1973) approached the problem in a psychological way. He found that addicts are people who feel that they are victims of impulses and compulsions completely beyond their capacity to handle, that they are robots of some kind. By teaching them to use biofeedback to voluntarily alter three of their physiological processes (warming of hands, production of muscle relaxation and increasing the percentage of alpha wave in their EEG), Dr. Kurtz found that the addicts who developed the skill exhibited a high degree of freedom from drug and alcohol. They also became more manageable and cheerful while in hospital. Muscle relaxation and increase in alpha component of EEG are two of the known physiological changes that are associated with individuals who practise meditation (Wallace, Benson and Wilson, 1971; Wallace and Benson, 1972; Banquet, 1973, 1973). Perhaps by voluntarily producing the three physiological changes, addicts are able to produce in themselves a relaxed mental state with focus of attention on self-awareness as has been shown to occur in meditation (Hjelle, 1974; Ferguson and Gowan, 1974; Seeman, Nidich and Banta, 1972). Work on using biofeedback to treat drug and alcohol addiction has also been reported by Green, Green and Walters, 1973b; Fitzsimmons and Peiffer, 1974; and Jacobs, 1975.

CONCLUSION

The close-to-total success of Kurtz's experiments provoke thoughts of the potential applicability of biofeedback in helping the individual to focus attention on self-awareness. Our current society offers many material comforts of life and the individual in striving for them may lose contact with his internal self. Concurrent with the development of modern progress is the ever suicidal increase in environmental pollution. A few enjoy the lion's share of comfort but pollution is forced on all. We should therefore not be sceptical of physicians who remind us that 80% of current human ailments are psychosomatic in origin or have some psychosomatic component. Table 1 depicts the disease and disability generating processes of our current society and the preventive measures biofeedback would have in revolutionising future medical and health care. If we accept provisionally that all diseases have a cause then it is not difficult to imagine how biofeedback can revolutionise our lives if it can be shown to be a means for us to remedy the cause. A patient with psychosomatic disease is not able to overcome his suffering by knowing that it is psychosomatic, but when provided with a means to re-adjust his physiological functions he is likely able to overcome and eliminate his suffering. If we do not abuse our bodily functions but learn to control and regulate them to prevent their malfunction we will then not be passive victims of our emotion, passion, and desire but a master of our own selves. Regular usage of biofeedback to voluntarily produce physiological changes that are known to be associated with meditation may provide a preliminary means for us to focus our attention internally to understand our reactions to external and internal stimuli, to understand the inter-dependence of living things and the dependence of living things on non-living things. If the individual puts into practice the noble view that prevention is better than cure then it should be his obligation to learn to overcome his defect, desire, emotion and control other environmental factors that will predispose him to sickness and suffering. That biofeedback would provide a means for the individual to work and live better in a stressful society may be illustrated by quoting Green, Green and Walters (1973):

TABLE I

THE WIDE APPLICABILITY OF BIOFEEDBACK TRAINING IN OVERCOMING HUMAN SUFFERING

Disease and Disability generating Processes and their control	Means for control	Future medical care	Future hospital
Hereditary and congenital defects currently beyond individual control	Requires further research	Necessary	Birth defect and pediatric hospital
Ignorance and poor personal hygiene within individual control	Education and biofeedback training	Limited necessity	
Accident and suicide not beyond individual control	Biofeedback training	Limited necessity	Hospital for the 'unresponsive-biofeedbackers'
Environmental pollution not beyond individual control	Mass-biofeedback training	Limited necessity	
Occupational stress and Hazard within individual control	Biofeedback training and safty measure	Limited necessity	
Abuse of bodily function within individual control	Biofeedback training	No necessity	
Greed and craving within individual control	Biofeedback training	No necessity	

Suffering due to defects which are within the individual control could be remedied by biofeedback training. However a hospital for patients unresponsive to the training is needed as human failing has been known to occur even at the best of times. Birth defect and pediatric hospital will take care of the few unfortunate defectively born children and the immature youngsters who have not yet learned to take care of themselves. Behavioural control centers which encourage mass-biofeedback training will provide the ordinary individual for the first time to take a fully active and direct role in literally learning not to be sick. This may be the alternative to the establishing of larger and expensive conventional type of hospital and personnel training institution. Larger conventional hospital and medical school only serve to cater for a larger number of patients. Promoting this centrifugal expansion of health care system is short sightedness and could lead to the maintenance of a near-cost-prohibitive and yet inefficient essential service. The ever increasing number of sick people at the hospital's door will inevitably force visionary planners to use preventive means to solve current and future health care problems. Biofeedback training will become indispensible in preventive medicine.

"Thus, through EMG and temperature feedback training, the peripheral nervous system is relaxed. Anxiety tension is reduced. When alpha-theta feedback is included in a training program, a state of calmness also issues in the central nervous system. Whatever the neurological and hormonal details, the total effect tends toward emotional tranquility coupled with increased self-awareness and a sense of self-mastery. To some it may sound too good to be true, and perhaps it is, but it does make sense, both neurologically and psychologically and corresponds with other integrative findings from biofeedback research."

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