

Effect of Electric Aversion on Cigarette Smoking

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Summary: Electric aversion was administered to 14 cigarette smokers. Six of the nine who completed the treatment were still abstinent at one-year follow-up. Three cases relapsed (at one, three, and four months) and five dropped out of treatment. Depression was a troublesome side-effect and was responsible for two of the drop-outs. The overall average of 21.5 cigarettes on the day before treatment dropped to an average of 1.4 cigarettes per day after the third aversion session, and though individual response varied widely most patients stopped smoking within five sessions. It is concluded that electric aversion is a powerful suppressor of cigarette smoking, but more experience is needed to ensure its best use as a measure to achieve permanent abstinence. Its use is limited to a small group of well-motivated smokers.

Introduction

Although cigarette smoking is now well recognized as a notable health hazard the habit still afflicts well over half the adult population of this country (69% of men and 43% of women in 1965) (Tobacco Research Council, 1966).

Anti-smoking measures of all types (supportive counselling, group therapy, hypnotism, the use of lobeline, amphetamine, and tranquillizing drugs) have been uniformly disappointing. Of those attending an anti-smoking clinic some 30 to 40% are able to stop smoking by the end of the course, but by follow-up at one year the success rate dwindles to a range of 12 to 28% (Ejrup, 1963; Edwards, 1964; Ball *et al.*, 1965; Cruickshank, 1965; Hammett and Graff, 1966; Plakun *et al.*, 1966; Pyke *et al.*, 1966; Thompson and Wilson, 1966; Lawton, 1967; Frederickson, 1968; Schwartz and Dubitzky, 1968; Lichtenstein and Keutzer, 1969). If it is borne in mind that the spontaneous discontinuance rate is 20 to 30% within the untreated smoking population, conventional anti-smoking measures would seem to achieve at best only a transient effect. Simple advice to stop smoking given by the doctor to patients attending a chest clinic gets better results (Burns, 1969; Williams, 1969).

Previous attempts at control of smoking have rested mainly with public health officials, chest physicians, and Church organizations rather than with behavioural scientists. Conventional anti-smoking measures probably fail because they are directed at conscious cognitive processes; yet it is realized that many people are quite unable to give up though they may consciously wish to do so. Persistent smoking is probably governed mainly by unconscious psychophysiological mechanisms rather than conscious cognitive processes (Russell, 1968). Electric aversion therapy provides a means whereby conscious levels may be by-passed and an unpleasant autonomic response to smoking induced.

Aversion therapy has proved capable of suppressing unwanted behaviour—for example, sexual disorders, alcoholism, gambling, etc.—but its application to smoking has hardly been explored. Of the few previous studies in this field (Greene, 1964; McGuire and Vallance, 1964; Raymond, 1964; Wilde, 1964; Koenig and Masters, 1965; Franks *et al.*, 1966; Carlin and Armstrong, 1968) only three used electric shocks as the

aversive stimulus, and their results are inconclusive. One does not state the length of follow-up (McGuire and Vallance, 1964), and the others (Koenig and Masters, 1965; Carlin and Armstrong, 1968) do not use abstinence from smoking as the criterion of success.

Assessment and Selection of Subjects

All the subjects were chest clinic patients referred by their chest physicians for cigarette withdrawal. The first phase of the assessment consisted of a one-hour interview at which a detailed history was taken of smoking habits and reasons for wishing to stop. A full social, family, medical, and psychiatric history was obtained and an impression gained of the personality of the subject. The subject then spent 20 to 30 minutes completing the Eysenck Personality Inventory (E.P.I.) and the specially designed attitude scale (described below). Finally the principle of the treatment was explained. They were told that this was a trial so far as its application to smoking was concerned, but that electric aversion was an established, widely used, and completely safe technique.

It is obviously no use applying a treatment regimen that cannot be completed. It was therefore essential that subjects be well motivated. As electric aversion is a relatively drastic measure, it seemed most appropriate to reserve it for smokers who were unable to give up by their own will-power or other conventional means. It was not proposed to persuade smokers that they should stop. The purpose was rather to assist those who of their own free will wished to stop but seemed unable to succeed in spite of persistent effort. Many smokers fail to stop only because they are ambivalent. Such cases were thought to be unlikely to complete a course of aversion therapy.

All subjects were encouraged to attend a conventional anti-smoking clinic at Islington with a view to returning for aversion therapy if this failed. Most subjects, however, had little faith in conventional measures, and only three attended the Islington Clinic, where one successfully stopped smoking. The majority opted for aversion therapy in the first instance. They were asked to make a final serious attempt to stop by their own will-power, but none succeeded. The average delay of two and a half months between initial assessment and starting aversion therapy was felt to be a useful test of motivation.

Subjects were excluded for the following reasons: (1) ambivalence and indecision about whether they really wished to stop smoking, (2) cardiac condition predisposing to arrhythmia, (3) psychiatric disorder that could be adversely affected by electric aversion, (4) successful cigarette withdrawal in interim phase, (5) reluctance to receive aversion therapy, and (6) failure to reattend. Table I shows the reasons for exclusion from the trial of 9 of the 23 cases referred.

TABLE I.—23 Referrals from which 14 Trial Cases were Selected

No. of Cases	Selected for Trial	Reason for Exclusion
14	Yes	—
1	No	Cured at Islington Clinic
2	No	Failed to reattend
1	No	Ambivalent
1	No	Ischaemic heart disease
1	No	Phobic anxiety
1	No	Depression
1	No	Previous paranoid psychosis
1	No	Refused aversion therapy

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Methods

Aversive Stimulus.—The shock box was a portable battery-driven multivibrator type similar to that used by Marks and Gelder (1967). The strength of shocks could be finely controlled to a maximum of about 250 volts. The shocks were delivered via two metal discs 1 cm. in diameter strapped 3 cm. apart on to the forearm. The spacing and positioning of the disc electrodes was important in that the wider they were spaced the more unpleasant was the shock. Most subjects found the shock more intense when electrodes were placed on the anterior and medial as opposed to the posterior and lateral surfaces of the forearm. This may have been due to differences in skin thickness and hair distribution, but another variable was that different underlying muscle groups were caused to contract. Proximity to larger nerve trunks may have caused some pain due to direct stimulation. The strength of the shock was determined by the subject's own feelings and was kept at a level that was unpleasant but not intolerable.

Semantic Differential Attitude Scale.—The subjects' attitude to various concepts was measured on an attitude scale adapted from that used by Marks and Gelder (1967). The technique consists of the rating of concepts on a series of seven-point bipolar adjectival scales (see Fig. 1). The attitudes were measured at the initial assessment and again just

before treatment. Thus two pretreatment scores were available as a baseline and guide to reliability. Repeated measurements were made throughout the course of treatment and follow-up. Fig. 2 shows the change in mean evaluative score to two concepts (cigarettes and tea) in a single subject (Case 4) before, during, and up to one year after treatment.

Method of Treatment.—All subjects were treated as out-patients. Sessions lasted about one hour. The aim was to have the first few sessions daily to bring about a rapid cessation of smoking. This was thought desirable in order to avoid extinguishing the effect of treatment by non-reinforced smoking between sessions. As the ability to do without cigarettes grew, the sessions were increasingly spaced. Treatment was continued until the urge to smoke was eliminated or rendered minimal.

Aversion to Smoking Practice.—After placement of electrodes on the left forearm an unpleasant but not intolerable shock intensity was selected. The subject was seated with his back to the therapist. On the desk beside him were an ashtray, matches, and a packet of his favourite brand of cigarettes. Conveniently at hand was a dust-bin. He was instructed to start smoking in his usual way. At any stage during the smoking act, from reaching for the packet, to lighting, to almost finishing the cigarette, a signal (pencil tap on desk) was given. This signal was followed in three out of four trials by a shock. This partial reinforcement was on a variable ratio schedule. The time interval between the signal and the shock was about half to one second, but did not vary outside this range. The subject was instructed to stub out and discard the cigarette into the bin immediately on receiving the signal. He was warned that any tardiness would incur a second shock. In practice this was rarely necessary, except in the first few trials. The subjects soon learnt to stub out and discard rapidly and vigorously. Some did so in an effort to "beat the shock," believing erroneously that if they got rid of the cigarette rapidly enough they would avoid the shock. About 20 such smoking practice trials (involving 15 shocks) were performed each session (range 15 to 30 trials). The interval between trials was usually 30 to 60 seconds. Occasionally there was a longer period if some point in treatment needed discussion. Though about 20 cigarettes were used, the amount smoked during the half-hour or so of this part of the session could not have been more than the equivalent of two or three complete cigarettes.

Aversion to Smoking Phantasy.—For most smokers there are special situations where smoking is most pleasurable—for example, first cigarette of the day, with morning coffee, in a pub, etc. Each subject selected situations in which he found it was most difficult to do without a cigarette. During the treatment session the subject was asked to imagine himself smoking in such a situation, and to say "now" when his phantasy reached the stage of lighting the cigarette. The moment he said "now" he received the signal (pencil tap), followed in three out of four trials by the shock. The rest period between trials varied from 30 to 60 seconds. The latency period (between beginning the phantasy and reaching the stage at which the subject said "now") was carefully timed with a stop-watch. Generally about 10 trials (involving seven shocks) of aversion to a phantasy were completed each session.

Drugs.—These were given when indicated but not as a routine. If a patient felt tense and irritable diazepam 2 to 5 mg. as required was given for use outside the sessions. Amitriptyline was given in the later stages of treatment and follow-up in the event of prominent depression developing after successful cigarette withdrawal. Dexamphetamine sulphate 10 mg. one hour before sessions was used if response to treatment was poor.

Therapist's Role.—The therapist attempted to assume the role of a friendly but directive doctor and to convey

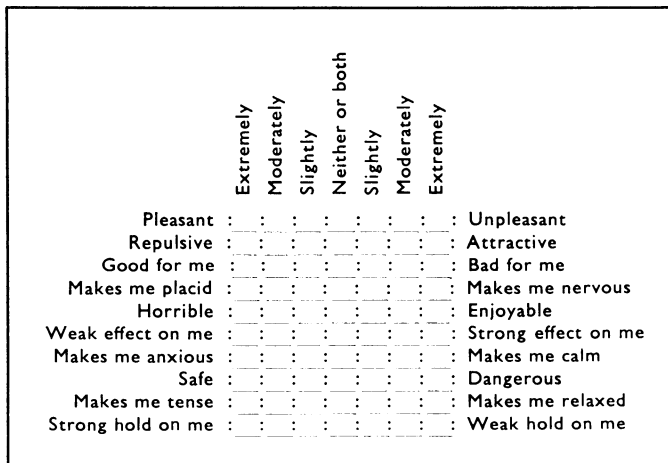


FIG. 1.—Semantic differential attitude scale. Three of the scales (pleasant—unpleasant, attractive—repulsive, enjoyable—horrible) represent an evaluative factor. Another three (placid—nervous, calm—anxious, relaxed—tense) represent an anxiety factor. There are two scales each for an addictive factor (strong effect—weak effect, strong hold—weak hold) and a nocive factor (good for me—bad for me, safe—dangerous). The results are measured by awarding points according to the position marked on the scale, with one point for extreme positive attitude and seven points for extreme negative attitude. A mark in the centre of the scale under "neither or both" scores four points. Thus on each scale a score of one to seven points is possible and the "mean evaluative score" is derived from the average score of the three evaluative scales.

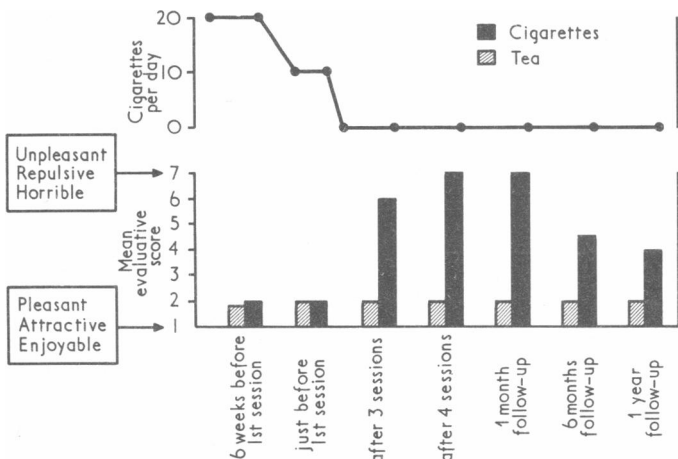


FIG. 2.—Changes in smoking attitude and behaviour with aversion therapy (Case 4).

confidence in the efficacy of the treatment and its ability to stop the subject smoking. In the initial assessment phase no attempt was made to encourage the subject to have aversion therapy or even to give up smoking. It was made quite clear that this decision was to be his own. Once aversion therapy was started the therapist strongly reinforced any spontaneous expressions made about the hazards of smoking and the subject was encouraged in his resolve to stop. At a certain stage it was suggested that the subject avoid the temptation of having cigarettes at hand, and it became the responsibility of the therapist to provide cigarettes for the sessions. The subject was repeatedly invited to discuss as freely as possible his own spontaneous feelings about smoking, the treatment, and the therapist. A strong positive bond and sense of obligation to the therapist invariably developed in those completing the treatment.

Assessment of Results.—Response to treatment was assessed by (1) effect on cigarette consumption and (2) shift of attitude to relevant concepts on the semantic differential attitude scale. The outcome of treatment was regarded as successful only if smoking stopped completely.

Results

Overall Results (see Table II and Fig. 3).—Nine of the 14 subjects completed the course of aversion therapy, four dropped out, and one (Case 8) became so depressed that treatment was discontinued. Following a relapse into smoking two subjects (Cases 5 and 7) returned for a second course of treatment, which was again unsuccessful. Six subjects (43%) were still off cigarettes at the follow-up period of one year. The success rate of those completing treatment was 67%. All cases achieving one year of abstinence were checked by obtaining confirmation from a friend or member of the family. Numbers were too small for worth-while statistical analysis, but none of the variables in Table II appeared to have any relation to outcome.

Effect on Smoking Behaviour.—All subjects except one (Case 11) who dropped out after one session responded to treatment by stopping their smoking. Nevertheless, there was great variation in the rate of this response. Most subjects

stopped within five sessions, but one required as many as 14 sessions. After smoking ceased treatment was continued until the urge to smoke was minimal or absent. The complete course averaged 11 sessions (range 4 to 24) over a period of 27 days (range 7 to 69). In most cases there was a noticeable

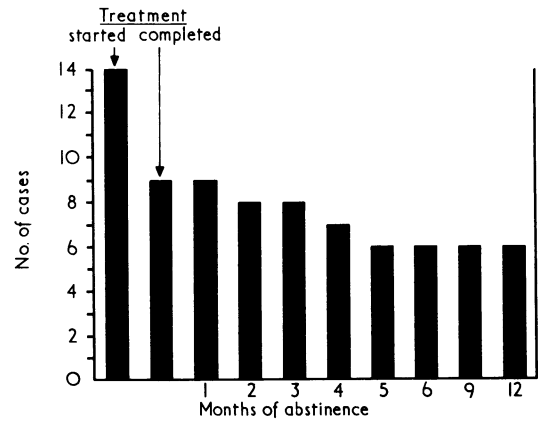


FIG. 3.—Follow-up results of treatment of 14 cigarette smokers with electric aversion.

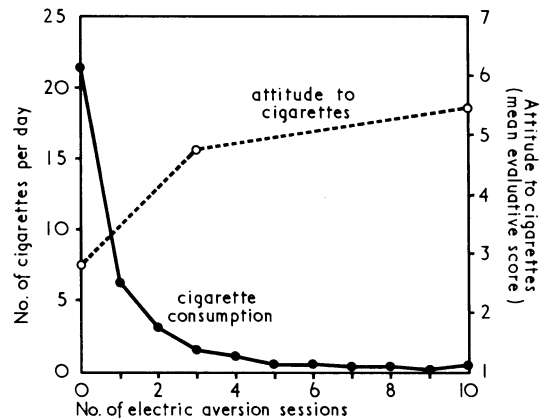


FIG. 4.—Changes in cigarette consumption and attitude to cigarettes (expressed as “mean evaluative score” derived from attitude scale) occurring during electric aversion therapy. Both curves derived from the mean of all cases.

TABLE II.—Details of 14 Cases and Results of Treatment

Individual Variables					Smoking Variables							Treatment Variables				Results			
Case No.	Sex	Age	I.Q.	Social Class*	E.P.I. (Form A)			Onset Age		Total Years of Smoking	No. of Cigs. per day	Longest Previous Abstinence	Environment Favourable† or Unfavourable		Drugs	No. of Sessions		No. of days over which treatment was given	At 1-year follow-up
					N.	E.	L.	1st	Regular				Home	Work		To Stop Smoking	Total		
1	M	43	107	V	22	8	2	11	14	29	50	½ day	F	U	Diazepam	2	11	37	Abstinent
2	M	31	92	III	17	15	0	11	17	14	45	1 week	F	U	Diazepam	5	14	36	Abstinent
3	M	57	126	II	7	4	1	17	17	40	10	1 month	F	U	U	2	6	14	Abstinent
4	F	54	122	I	11	15	1	16	20	33	20	18 months	F	U	U	1	4	7	Abstinent
5	M	31	94	IV	18	12	4	14	15	16	40	½ day	F	U	Diazepam, Amphetamine	4	10	17	Relapsed at 3 months
6	M	35		V	4	20	0	11	13	22	20	6 months	U	U	U	8	20	69	Treatment stopped
7	M	47	120	II	12	11	2	14	16	31	40	3 weeks	U	U	Diazepam, Amphetamine	2	4	4	Dropped out of treatment
																14	24	36	Relapsed at 1 month
8	F	43	108	II	13	16	0	17	17	26	25	3 weeks	F	U	Amitriptyline	2	10	38	Relapsed at 1 month
9	F	44	98	II	16	16	0	12	18	26	20	9 months	U	U	Diazepam, Amitriptyline	6	10	23	Treatment stopped due to depression
10	M	55	109	II	4	12	1	14	18	37	35	1 day	F	U	U	5	9	17	Abstinent
11	M	49		V	20	9	5	14	15	34	20	2 weeks	F	U	U	5	1	1	Dropped out of treatment
12	F	39		III	6	15	3	21	22	17	40	6 weeks	U	U	U	2	3	4	Dropped out of treatment
13	M	49	100	III	16	5	2	15	17	32	25	3 months	U	U	U	4	13	66	Relapsed at 4 months
14	M	41	99	III	4	14	1	12	14	27	30	2 weeks	U	U	U	4	6	10	Abstinent
Mean		44.1	106.8		12.1	12.3	1.6	14.2	16.6	27.4	30.0					5.1‡	10.9‡	27.1‡	

*Social class categorized I-V according to Registrar General's classification. †A favourable environment is one with no other smokers. ‡Means of 9 cases completing a first course of treatment. Cases 5 and 7 had second course of treatment which was also unsuccessful. N. = Neuroticism. E. = Extraversion. L. = Lie scale.

effect after the first session. Cigarette consumption was sharply reduced (see Fig. 4), and frequently cigarettes were discarded after one or two puffs because they were not enjoyable or in some cases were unpleasant. Typical spontaneous remarks were: "I threw it away after two draws, to my surprise"; "I took only a few puffs—I just didn't fancy it. My mate laughed when I threw it out the window." One subject complained to the tobacconist that the cigarettes were stale.

Changes in Attitude.—All cases showed a striking shift of attitude to the concepts "smoking" and "cigarettes" (see Figs. 2 and 4), while attitude to non-smoking concepts such as "tea" and "mother" remained unaffected. In all cases the change in attitude and smoking behaviour occurred together. Where there was delay in attitude change the subject continued to smoke, and once an attitude change was induced smoking always ceased. Seventy-three per cent. of the total attitude change had occurred by the end of the third session (mean of all subjects).

Emotional Reactions During Therapy

Anxiety was felt by most subjects, but there was great variation. It was rated on a four-point scale during every session. This assessment was probably not valid, as three of the four drop-outs denied any anxiety. For most subjects the unpleasant nature of the treatment was offset by the comfort derived from their relationship with the therapist.

Aggression towards the therapist was never apparent or consciously experienced. Some cases, however, developed aggressive feelings towards the cigarettes, which were stubbed out and discarded with vigour and at times anger.

Depression was the most troublesome side-effect of therapy and was experienced by eight of the subjects. Case 2 broke down and wept as he confided his marital difficulties. Case 4, a widow, was tearful during one session as she talked of her loneliness. Case 5 became intermittently depressed and hypochondriacal. Cases 7 and 13 experienced some depression. Case 9 required amitriptyline. Case 8, a divorcee, became so depressed (including suicidal feelings) that treatment was stopped and supportive psychotherapy and amitriptyline instituted. Case 11 left treatment after one session and wrote back to say it made him too depressed. In most cases the depression was transient or mild. The two (Cases 8 and 9) in whom it was more serious and sustained had each had a previous depressive episode requiring tablets from their general practitioners. The occurrence of depression bore no relation to the outcome of treatment, but it was more frequent and severe in the women (occurring in three out of the four).

Withdrawal Symptoms.—Apart from depression some tenseness and irritability was experienced by six subjects. In only four (Cases 3, 6, 10, and 14) were all symptoms denied.

Discussion

The purpose of an anti-smoking measure is to enable the subject to give up cigarettes completely and permanently. One year of abstinence was achieved in less than half (43%) of the 14 subjects and only two-thirds (67%) of those who completed treatment. Though the relapse rate is small after one year, it is unlikely that all the six successful cases will remain permanently abstinent. Nevertheless, these results are an improvement on usual anti-smoking measures. Only three other published investigations have comparable success rates—namely, Hammett and Graff's (1966) hypnotherapy subgroup with 89% abstinent at three months; Resnick (1968), using a "stimulus satiation" technique, with 65% abstinent at four months; and Crasilneck and Hall (1968), who with hypnosis

achieved 59% abstinence at one to four years. The follow-up period of two of these studies is rather short.

In most cases the electric aversion sessions caused a prompt attitude shift and reduction of smoking (Fig. 4). In view of this powerful effect it is disappointing that the success rate (cases achieving abstinence for one year) was not higher. It is worth considering how they could have been improved. In retrospect, relapse may have been prevented in Cases 5 and 7 if a few "booster" aversion sessions had been given. Obviously it is no use applying a treatment regimen that cannot be completed. Though an attempt was made to exclude this possibility, there were still five subjects accepted for the trial who dropped out. Case 6 did express some ambivalence which should have pointed to his eventual abscondence. Cases 8 and 11 dropped out because of depression. At assessment both gave indications of previous depression, and possibly should have been excluded on these grounds. Case 12 expressed a fear of travel, which was perhaps an indication for exclusion. Only with Case 10 was there nothing to suggest he might drop out. Thus with more experience in selection of cases and judicious use of booster sessions, electric aversion should yield better results in the treatment of dependent smokers.

The reasons for the wide variation in response to treatment are not evident. There was no significant relationship to any of the individual and smoking variables in Table II. Though the effect of treatment was prompt and striking in most subjects, a few (notably Case 7) were less responsive. In general those who responded rapidly did better at follow-up, and it would seem that it is not worth while pursuing treatment in the slow responders. Case 7 required as many as 24 sessions, only to relapse after a month. This amount of treatment and therapist time could have been better used to treat three quick responders, who would also have been more likely to remain abstinent.

The results indicate that electric aversion suppressed cigarette smoking as effectively as reported with other unwanted behaviour (sexual disorders, alcoholism, gambling). This effect was probably due mainly to classical conditioning, but other influences (drugs, "suggestion," relationship with therapist) were applied in an uncontrolled way. The use of aversion therapy is becoming widespread, yet it is still not known how or why it works in humans; whether by classical conditioning as in animals or by cognitive processes such as those involved in religious conversion, faith-healing, and placebo response. Among these processes different aspects of subject-therapist interaction may be crucial. Crisp (1966) suggested that factors in the "transference" may influence the outcome of behaviour therapy. The magnitude of placebo response no less than the laying on of hands in faith-healing may be partly dependent on the confidence of the therapist in his therapeutic capacity. Indeed the lengths to which modern investigators go to ensure that therapeutic trials are not only "blind" but "double-blind" point to the importance of the subjective feelings of both therapist and patient in determining the outcome of any treatment situation. These factors are likely to be as important in aversion therapy as they are in drug therapy, and may account for the fact that in this study better results were achieved with the early cases, when the therapist himself was more confident in the efficacy of the treatment. Controlled trials are needed to identify and evaluate the effective elements in aversion therapy.

The frequency of depression as a side-effect of the treatment is similar to that noted by Marks and Gelder (1967). This depression may represent "symptom substitution" arising from the loss of an important object—the cigarette (female clothes in Marks and Gelder's transvestites). Withdrawal of pharmacological effects of nicotine is another possible factor. On the other hand, this was a selected group. The mean Eysenck Personality Inventory neuroticism score (12.1, S.D. 6.3) is significantly higher ($t = 2.38$, D.F. = 13, $P < 0.05$) than the

normal population (mean 9.1, S.D. 4.8) (Eysenck and Eysenck, 1964). It is possible that underlying depression may have contributed to their initial seeking of treatment for their smoking. The fact that the depression was serious only in the two (Cases 8 and 9) who gave a history of a previous depressive episode suggests that an underlying depression or depressive tendency may be exacerbated by the treatment.

Conclusion

Electric aversion is a powerful suppressor of cigarette smoking. In most subjects it causes a rapid reduction in the number of cigarettes smoked and induces a negative attitude to smoking. More experience is needed to ensure its best use as a measure to achieve permanent abstinence from smoking. Though a few cases are less responsive, there is reason to believe that it may be effective in a fair proportion of those dependent smokers who have proved immune to other anti-smoking measures. Its use is limited to a small group of persistent smokers with strong internal motivation to break their habit.

I am grateful to Dr. Griffith Edwards for his help as consultant in charge of the cases. Dr. Isaac M. Marks gave advice on the semantic differential attitude scale, which was based on his design. I am also indebted to the chest physicians of numerous chest clinics for referring cases, especially Dr. B. J. Malley, of the Bermondsey Chest Clinic, Dr. W. E. D. Moore, of the Southwark Chest Clinic, and Dr. W. L. Ashton, of the Lewisham Chest Clinic, as well as to Dr. H. O. Williams and Mr. K. Robertson, of the Smoking Advisory Clinic, Islington, for their interest.

Suppression of Erythropoiesis by Alcohol

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Summary: Serial measurements in alcoholic subjects showed a profound fall of serum iron for three days after withdrawal of alcohol and a reversion of abnormal accumulation of erythroblastic haemosiderin to normal. These findings suggest an interference in normal haem synthesis, most probably by a direct effect.

Introduction

Anaemia and the prolonged ingestion of alcohol (ethanol) are frequently associated. The aetiology of this anaemia has been variously ascribed to gastrointestinal blood loss, dietary deficiency of iron and folic acid, increased haemolysis, and depressed haemopoiesis. The subject was reviewed by Kimber *et al.* (1965).

A direct effect of alcohol on haemopoiesis was suggested by Jandl (1955) and was supported by the finding of vacuoles in the primitive erythroid and myeloid cells in alcoholic patients (McCurdy *et al.*, 1962). Waters *et al.* (1966) supported the mechanism of a direct effect, while Sullivan and Herbert (1964) produced evidence of folate inhibition in alcoholic subjects. While this paper was in preparation additional support for an effect of alcohol on normoblast haemosiderin in

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folate-depleted subjects (Hines, 1969) and for a direct effect on serum iron levels in well-nourished non-anaemic volunteers (Lindenbaum and Lieber, 1969) has been presented.

The purpose of the present study was to investigate the changes in criteria of iron metabolism following cessation of prolonged alcohol intake in subjects who were well nourished and not anaemic, and had no clinical evidence of cirrhosis.

Methods and Materials

The subjects studied were alcoholic patients admitted to a private psychiatric hospital. Patients in this institution pay for their management and treatment and tend to be well nourished and non-anaemic.

Within two hours of their admission the subjects were selected on the basis of known prolonged alcohol intake (the admitted daily consumption of alcohol varied from one to three bottles of spirits and/or 10 to 30 pints (5.7 to 17 litres) of beer), adequate nutrition, and absence of anaemia. A total of 36 patients were investigated. Thirteen, however, declined to have any further investigations thereafter. The remaining 23 (22 men and 1 woman aged 28 to 72 years) had blood taken by venepuncture for a routine blood count (Dacie and Lewis, 1963), serum iron (Peters *et al.*, 1956), and serum folate (Temperley and Horner, 1966) both on admission (day 0) and on days 1, 2, 3, 7, 14, and, in a few instances, 21 days after admission. Except following admission venepuncture was per-

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