CHAPTER 23

Conditioning Treatment of Nocturnal Enuresis: Present Status

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Introduction

The conditioning method, more popularly known as the 'bell and pad' or 'bed-buzzer', has become a standard form of treatment for nocturnal enuresis; it is used not only in hospitals and school health clinics, but also in the community, where the apparatus may be available on loan from the local authority (Taylor 1963). Furthermore, a large number of children are treated by their parents, using apparatus hired or purchased privately from the many commercial agencies.

There have been several excellent reviews concerned with conditioning treatment (Jones 1960, Lovibond 1964, Young 1965, Yates 1970). The purpose of this paper will be to consider the present state of the literature and to review our existing knowledge about the probable mechanisms underlying treatment.

First, however, it is necessary to comment briefly on the basic rationale of the 'bell and pad' technique. The conditioning method is one of several treatment procedures (known collectively as behaviour therapy) which have in common an attempt to apply the findings of the experimental psychologist to the understanding and treatment of behavioural disorders. According to this general approach, it is hypothesised that psychological disturbances are best understood as being the result of either a failure to learn or the acquisition of maladaptive patterns of behaviour. For example, in the case of nocturnal enuresis, the behaviour therapist argues that the child has failed to acquire a conditioned response of arousal at a point of bladder pressure and volume below the threshold of reflex discharge. The aim of treatment is, therefore, to provide the patient with the opportunity to learn what has not developed in the normal course of maturation. The hypothesis that the persistence of bedwetting is due to a learning deficit is in close accordance with recent classificatory models in child psychiatry, which define enuresis as a developmental problem, at least when it occurs in isolation (Rutter 1965, Rutter *et al.* 1969).

It would be inappropriate to consider here the many differences between behaviour therapy and the traditional psychiatric approach. An excellent review of the main points of contrast between the two positions has been provided by Lovibond (1964). There is, however, one critical point which requires rather more emphasis, namely the sharp contrast between the two positions as regards treatment. According to the psychodynamic view, bedwetting is interpreted as a signal of underlying psychological disturbance, and the referral problem (*i.e.* the bedwetting) is left untreated. The behaviour therapist, on the other hand, deals straight away with the enuresis; in this respect, his approach is very similar to that of the physician who seeks to alleviate a problem by appropriate drug treatment.

Definition of Nocturnal Enuresis

Nocturnal enuresis is defined as persistent involuntary micturition during sleep, in the absence of demonstrable organic pathology. As there is no general agreement about the age when enuresis should be considered 'abnormal' in the general population, it is hardly surprising that there is a considerable diversity of opinion about the age when it is appropriate to offer conditioning treatment. Some clinicians accept children for conditioning treatment so long as they are at least four or five years of age (Taylor 1963, Young and Turner 1965, De Leon and Mandell 1966, McConaghy 1969, Forsythe and Redmond 1970), while others require the patient to be over eight years old (Forrester *et al.* 1964). It is unclear why some clinicians withhold treatment until late childhood, but it may be, of course, that they are mindful of the very large number of children who would be eligible for treatment if cases were accepted at any earlier age.

Method of Treatment

Development of the Method

In the first decade of this century, French and German physicians reported that patients ceased to wet the bed if they were aroused immediately after each wetting incident (Pfaundler 1904, Genourville 1908, Rémy-Roux 1910). Pfaundler, a German paediatrician, had made the discovery accidentally; his original intention had been to devise an alarm system which would alert nursing staff when a child was wet and needed changing. The apparatus, developed as a nursing aid, was found to offer significant therapeutic advantages if used for a period of about one month. Despite these early reports of success, this type of treatment was not heard of again until the late thirties, when two groups of psychologists, apparently working independently, reported a high degree of success with the conditioning method (Mowrer and Mowrer 1938, Morgan and Witmer 1939). The Mowrers reported a successful outcome in thirty cases, using a modified version of the Pfaundler apparatus; more important, they also put forward a systematic rationale for treatment based on contemporary learning theory.

Apparatus

The aim of treatment is to awake the child as soon as urination occurs. Modern equipment follows the basic design of the apparatus described by the Mowrers, though incorporating advances in electronics. The child sleeps on some form of detector mechanism, which is triggered by the passage of urine into the bed. Some idea of how many variants of this design are available on the commercial market can be gained from considering the wide variety of arousal stimuli described in the published studies. Many authors have employed a bell to arouse the child (*e.g.* Mowrer and Mowrer 1938, Morgan and Witmer 1939, Geppert 1953, Gillison and Skinner 1958, Freyman 1963), while others have used buzzers (*e.g.* Young and Turner 1965, De Leon and Mandell 1966, Baker 1969), and in at least one study patients were woken by oscillator (Turner *et al.* 1970). Lovibond (1964) developed a Twin Signal alarm system employing a Klaxon horn to wake up the enuretic, and Crosby (1950)

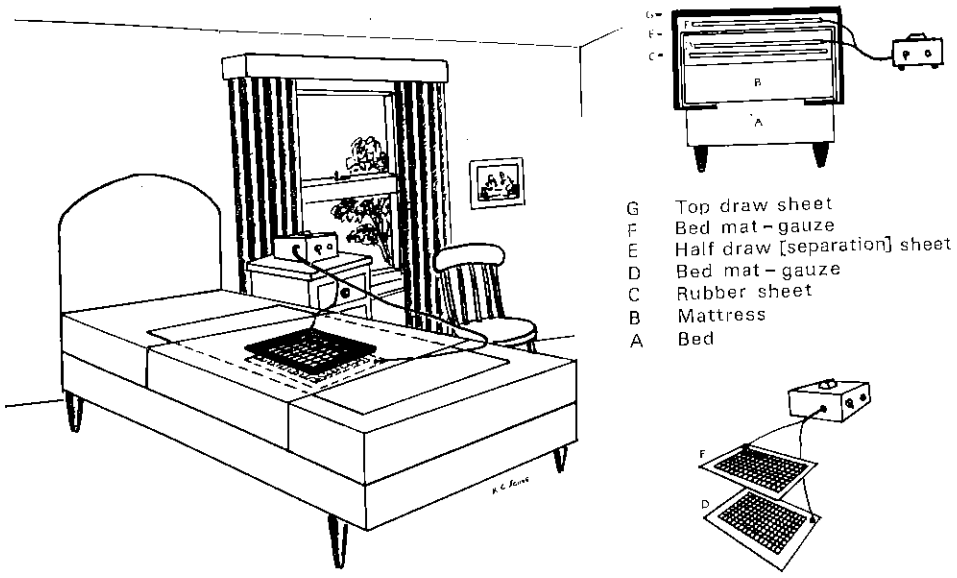

Fig. 1. The 'bell and pad' enuresis alarm device. The diagrams illustrate in exaggerated form the correct method of assembly on the bed, and show the simplified method of laying out the mats and wiring them up to the alarm.

designed a treatment system using faradic stimulation to the loins, with an accompanying audible signal to alert the attendant. There is similar diversity with regard to the design of the detector electrodes; the most common type consists of two detector mats (made of wire mesh or perforated aluminium foil), but Crosby (1950) employed genital electrodes, and Coote (1965) has devised a detector pad with flattened metal braid electrodes sewn into the grooves of a moulded rubber pad.

Figure 1 shows schematically the essential features of an alarm system, in which onset of urination is detected by electrodes of the wire mat type.

Procedure

After careful screening for possible organic disorder, the equipment is demonstrated, and the therapist explains the rationale of treatment. Once the apparatus leaves the clinic, treatment is entirely in the hands of the mother and, where appropriate, the patient. Parent and child are seen at weekly intervals until the therapist is satisfied that they know how to use the equipment. Thereafter, interviews are less frequent, being spaced at intervals of two or perhaps four weeks, depending on the custom of the clinic.

On the occasion of the demonstration of the apparatus, the mother is instructed to wake up her child, if not already aroused by the bell; then she has to take the child to the toilet to complete bladder discharge. The bed is remade, the equipment is reset, and the child goes back to sleep, perhaps to experience later in the night yet another conditioning trial (*i.e.* a wetting incident followed by the alarm).

The therapist stresses certain requirements of treatment: (1) the child must be aroused as soon as the machine is triggered, and then taken to the toilet; (2) the child should not wear pyjama trousers, as these may increase the time interval between wetting and the alarm being triggered; (3) the apparatus must be used every night; and (4) an accurate record *must* always be kept of wet and dry nights during treatment.

The need for close supervision of therapy has been stressed by several writers (*e.g.* Lovibond 1964, Yates 1970, Dische this volume Chapter 24), and it is indeed a fact that the treatment is not as simple as it may seem. For example, the equipment may be triggered accidentally by sweat, and false alarms occur with some older types of apparatus. Also, the treatment technique can cause major upheavals in the home, particularly if the bell wakes the whole household but fails to arouse the patient.

Criteria for Defining Outcome

Initial arrest of enuresis. Most authors have defined success in terms of some particular period of continence (*e.g.* fourteen consecutive dry nights). There is, however, quite considerable variation as regards how long this period should be (see Table I, column 2). Further confusion arises since some clinicians have adopted the practice of increasing fluid intake after, say, seven dry nights (Mowrer and Mowrer 1938, Freyman 1963, Lovibond 1964). This makes it difficult to compare studies, because the increase of fluid intake introduces into therapy a further and possibly significant factor, namely overlearning (Turner *et al.* 1970). In a few studies, results have been presented in terms of categories of response, such as 'improved' and 'slightly improved' (Forrester *et al.* 1964, Werry and Cohrssen 1965).

Failure. The usual practice has been to stop treatment when a child has failed to reach the criterion of success within an arbitrarily imposed time limit. In some studies, the maximum duration has been four months (Young and Turner 1965, Forsythe and Redmond 1970), while in another study the period was ninety days (De Leon and Mandell 1966). Elsewhere, failure has been defined in terms of an upper limit of conditioning trials, rather than duration of treatment; thus, therapy was terminated in three studies after children had experienced more than fifty conditioning trials (Lovibond 1964, Baker 1969, Turner *et al.* 1970).

Several authors have reported that poor parental co-operation is a significant factor in treatment (Geppert 1953, Freyman 1963, Taylor 1963, McConaghy 1969, Forsythe and Redmond 1970), and in some studies a quite separate category of failure due to 'drop-out' has been presented in the analysis of results (Young and Turner 1965, McConaghy 1969, Turner *et al.* 1970).

Relapse. Conditioning treatment, like any other therapy for nocturnal enuresis, must be judged in terms of its long-term effectiveness. The practising clinician is bound to ask for evidence about the number of children who cease to wet the bed after using the apparatus, and are still dry one or two years later. It is unfortunate, therefore, that so little attention has been paid to the definition and assessment of relapse. In the majority of studies, authors have reported relapse rates, but in the absence of any definition of what this means.

In fairness to research workers, it must be acknowledged that the task of defining relapse is a lot more difficult than may appear at first sight. The problem is that we have insufficient information about the number of children who experience an occasional wet bed without being considered enuretic. In short, it is difficult to find a reasonable target for treatment. The problem can be best illustrated by considering the case of a six-year-old child who is discharged 'cured', but who then wets the bed three times in two months; further enquiry reveals that each wetting incident occurred when the child was ill or in some way upset. Although the easiest course would be to classify the case as a relapse, this is arguable since we have practically no information about the number of 'normal' children of the same age who experience the occasional wet bed when ill or upset.

Duration and method of follow-up are also very important. Lovibond (1964) found that there was a significant correlation ($r = 0{\cdot}7$) between the relapse rates that have been reported in the literature and the minimum period of follow-up; this suggests that, the longer the contact with parents, the higher the reported relapse rate. Authors have also varied in respect of the method of follow-up. Some have contacted discharged patients by post or telephone (*e.g.* Lovibond 1964), while in other studies it has been left to parents to return, of their own accord, as soon as the enuresis recurs (*e.g.* Gillison and Skinner 1958). In summary, the position with regard to relapse is that much of the available evidence is unsatisfactory, due to (1) the failure of authors to define what they mean by relapse, and (2) inadequate follow-up procedure.

Results

The reviewer faces a formidable task in evaluating the current status of conditioning treatment, because of a variety of methodological weaknesses in many of the published studies (see above). Although evaluation of the long-term effectiveness of treatment is certainly a lot easier now that studies have begun to appear with follow-up over a reasonable period, the literature leaves a lot to be desired in other respects. For example, it is still impossible to find any generally agreed procedure. In particular, there is considerable variation between studies as regards the degree of supervision maintained by therapists: whereas some research workers have maintained the very closest supervision of each case (*e.g.* Lovibond 1964), others have kept therapist-patient contact to a minimum (*e.g.* Werry and Cohrssen 1965).

Another major criticism is that very few research workers have obtained a measure of bedwetting frequency prior to the onset of conditioning therapy; as a result, it is difficult to judge the reliability of the initial reports of severity, when these are based solely on what mothers describe as the average in the first admission interview. Certainly, it is arguable whether a definite treatment effect can be demonstrated in the absence of an objective pre-treatment measure.

One problem, which would be of particular concern to someone interested in using the 'bell and pad' treatment in, for example, a busy health centre, lies in assessing how generally one can apply reported results. Before using the treatment, the prospective therapist will want to know whether similar results could be obtained with *any* sample of enuretic children. Apart from wondering how far the results have been

affected by the enthusiasm and experience of research clinicians, he is also likely to ask whether the children who have been treated in the published series are typical. At present, the answer to these questions must be that there is not enough information about sampling biases. Two main problems preclude a more precise answer. First, authors have provided insufficient information about the composition of samples in respect of some very important factors (*e.g.* age, sex, types of enuresis, presence of diurnal symptoms). Secondly, children in the published treatment studies may be atypical due to (i) referral biases specific to particular treatment clinics, and (ii) ill-defined criteria of patient selection.

It is difficult to see any easy solution to the problem of assessing the significance of referral bias, without a lot more research. There is certainly evidence which suggests that children who are referred for treatment of enuresis differ from those who remain untreated (Blomfield and Douglas 1956, Hallgren 1957). However, it is also necessary to identify the referral biases that lead some children to be referred to, say, paediatricians or child psychiatrists while others are treated by a G.P. without referral to hospital or special clinic.

As regards patient selection, the problem is simply that in many cases the children whose treatment is described in the published literature have probably been selected according to criteria which have been left undefined. As Yates (1970) has observed, the criteria dictating the choice of sample are often not stated. The problem can be illustrated by considering the variable of severity. Lovibond (1964) accepted children for treatment only when they wet the bed more than three times a week, but elsewhere the acceptable limit has been as low as once a week (Forsythe and Redmond 1970, Werry and Cohrssen 1965). Furthermore, many authors have provided no details at all about the patients excluded from treatment because the enuresis was not severe enough. The clinician who uses 'bell and pad' treatment may well come across several cases where wetting occurs intermittently, perhaps with a frequency as low as once or twice in three weeks. At the present time, the literature can provide little guidance as to the usefulness of alarm treatment in such cases, since most therapists have excluded them; however, the reasons for exclusion seem to be based on clinical judgement rather than any hard evidence that contra-indicates the use of the 'bell and pad' technique.

Clinical Studies

Results of conditioning treatment in eighteen published studies are summarised in Table I, from which it can be seen that in most cases conditioning treatment does seem to be very effective in bringing about the arrest of enuresis (see Column 3). Considered in isolation, many of these studies are open to severe criticism, but the results over-all are encouraging, not the least because they are based on experience gained with a very large number of children. Furthermore, duration of treatment is brief, with reported averages ranging between six and eleven weeks (Freyman 1963, Young and Turner 1965, De Leon and Mandell 1966, Turner *et al.* 1970). It is also of relevance to note that the technique has produced broadly similar results when used by therapists from a wide variety of disciplines (*e.g.* child psychologists and psychiatrists, paediatricians, school health doctors and health visitors).

TABLE I

Results of conditioning treatment (Mowrer-type apparatus)

Author	*No. of patients*	*Criterion of arrest (days)*	*Initial arrest: percentages of patients*	*Relapse rates as percent of initial arrest*	*Period of follow-up (months)*
Mowrer and Mowrer (1938)	30	14*	100	?	?
Davidson and Douglass (1950)	20	14	75	13	5-9
Sieger (1952)	106	14	88·8	9	2-36
Geppert (1953)	42	7-10	90	13	1-?
Baller and Schalock (1956)	55	10	98	47	24-35
Behrle *et al.* (1956)	19	21	100	32	18-39
Wickes (1958)	100	?	65	14	4-12
Gillison and Skinner (1958)	100	14-21	90	14	4-12
Freyman (1959)	15	14-18	93	23	12
Taylor (1963)	100	21	68	17	6-12
Freyman (1963)	71	14*	64·8†	35	10
Lovibond (1964)	34	14*	91	35	3-12
De Leon and Mandell (1966)	56	17	86	79·6	1-7
Young and Turner (1965)	105	14	64·8†	29·5	12
Turner and Young (1966)	—	14	—	31·7	40-63
Baker (1969)	14	14	79	?	6
Forsythe and Redmond (1970)	200	?	66	18·2	12-36

*Fluid intake increased

†This figure allowed for a 30 per cent drop-out rate where treatment had to be discontinued due to poor co-operation.

It would, however, be misleading to confuse the terms 'initial arrest' and 'cure'. This much is also clear (see Table 1, Column 4). Although some of the reported relapse rates have been quite low, the results of studies with an adequate period of follow-up (*i.e.* at least one year) indicate that the relapse rate may be as high as 35 per cent of the cases discharged after the initial course of conditioning treatment (Freyman 1963, Lovibond 1964, Turner and Young 1966). The very high relapse rate of almost eighty per cent reported by De Leon and Mandell (1966) should be interpreted with caution, since relapse was defined with unusual stringency (*i.e.* a single wet bed).

In view of the relatively high relapse rates, it is relevant to consider the long-term effectiveness of conditioning treatment in studies where relapsed cases have been given the opportunity to have a second course of treatment. Lovibond (1964) reported a variable response to re-treatment in thirty relapsed cases; forty per cent of these cases responded more quickly on the second occasion of treatment, but thirty per cent showed a definitely slower response. However, all the children did reach the criterion of success, and in that respect there was a good outcome. Twenty per cent of these re-treated cases then relapsed a second time, and required three or four courses of treatment.

In their comparative study (see below), De Leon and Mandell (1966) reported that, of eleven children who relapsed and were re-treated, three failed to respond to

the second course of treatment, and eight responded successfully, reaching the criterion of 'cure' just as they had done in the first course of treatment; the median number of days on re-treatment was significantly lower.

Freyman (1963) re-issued the 'bell and pad' apparatus to thirteen children who had relapsed following initially successful treatment; as many as five courses of re-treatment were found necessary for some of these children, and over-all success was achieved in four cases (*i.e.* 30 per cent). Re-treatment had to be abandoned in five cases mainly on account of lack of parental co-operation or because of changes in the home background.

Forsythe and Redmond (1970) reported that seventeen out of thirty relapsed cases were cured by a second course of treatment, but no further information is provided about their response. Baker (1969) reported that two out of four relapsed cases became dry after a second course of conditioning treatment.

In summary, we still have relatively little information about what happens to those children who achieve the criterion of initial arrest, only to suffer a relapse and require further help. In view of the relatively high relapse rate, this information is needed most urgently. On the basis of the evidence that *is* available, it would seem that some children need more than one course of conditioning treatment, and a few may require as many as five courses of treatment before they become dry.

There have been several reports which suggest that the general application of conditioning treatment in the community may well be limited by social factors. Research indicates that treatment has to be terminated prematurely in a substantial minority of cases, due to inadequate parental co-operation. Two studies with working class children have produced 'drop out' rates as high as thirty and fifty per cent respectively (Young and Turner 1965, Turner *et al.* 1970). In an Australian study, McConaghy (1969) stated that difficulty in obtaining adequate parent and child co-operation constitutes one of the main reasons for failure with the 'bell and pad'. Similar conclusions have emerged from other research studies (*e.g.* Geppert 1953, Freyman 1963, Taylor 1963).

What is needed now is research into the extent of the social limitations to the wider use of 'bell and pad' treatment. It is, for example, necessary to find out why some parents stop using the apparatus long before the treatment could be reasonably expected to have any effect on the bedwetting. The motivation of parent and child is important, and their expectations may be unrealistic. Then again, in the two studies with particularly high drop-out rates, the children came exclusively from working-class districts of London; it is difficult to ignore the very real difficulties that parents encounter in using the apparatus, especially when their housing is overcrowded, and mothers are stressed by large families and poverty.

The importance of obtaining adequate parental co-operation has been widely acknowledged, and there seem to be two main schools of thought as to how to tackle this problem. Yates (1970) and Dische (this volume Chapter 24) have stressed the need for the very closest supervision of each case, and have emphasised the point that the conditioning method is not a simple routine procedure. As with any other therapy, if it is to help the patient the administration of treatment has to be satisfactory. Yates observed that a truly accurate appraisal of conditioning treatment is possible only

when treatment is supervised closely on an individual basis. This approach would lead the research worker to discount the results of treatment administered under the sort of adverse home conditions that are to be found in urban slum areas.

To tackle the problem of inadequate parental co-operation by increasing supervision would certainly be desirable as an ideal for scientific research. However, an alternative strategy is to demand that treatment for nocturnal enuresis be tested under the most realistic of conditions; given the social gradient in the prevalence of enuresis, it does seem likely that the method will *have* to be used in many homes where living conditions are cramped. It is easy to forget that in conditioning treatment it is the mother who is the therapist, and the aim should be to reduce to a minimum the demands that treatment makes on her.

A few relevant suggestions emerge from a consideration of the literature. First, it is very difficult to arouse some children, and they fail to respond to treatment. It is clearly necessary for therapists to have available equipment with a large range of alarm signals, so that even the most deeply sleeping child can be woken up. Secondly, many parents give up treatment within the first week or two, and it is very important that accidental alarms which are very irritating to parent and child alike should be kept to a minimum. Thirdly, many parents seem to experience real difficulty in following the instructions, and again we need to know more about the problems that parents encounter in understanding the procedure of treatment.*

Finally, it would appear that one way to tackle the problem of poor parental co-operation is to prescribe adjuvant drug therapy. In a study where there was a very high drop-out rate, parents were found to co-operate more readily when a stimulant drug was combined with alarm treatment (Young and Turner 1965). Perhaps one reason was that the drug brought about a very rapid improvement, and this gave great encouragement to parents who were only moderately committed to treatment. Clearly, future research must be directed towards reducing the 'drop-out' rate, though first we have to assess the extent of the problem. Parental motivation would seem to be an obvious factor which requires investigation.

Comparison of Conditioning Treatment With Other Methods

Forrester *et al.* (1964) compared 'bell and pad' treatment with dexedrine drug therapy, in a sample of 37 children, all over eight years of age. Although conditioning therapy was found to be the superior form of treatment, this result is hardly surprising because the drug has not been found to be particularly effective when used alone (Hodge and Hutchings 1952, Zufall 1953, Holt 1956).

McConaghy (1969) compared conditioning with two types of drug therapy (imipramine and amphetamine), a random waking procedure (to control for the arousal component in conditioning treatment), and placebo preparation for each of the drugs, making five treatment groups in all. Amphetamine was of little value measured in terms of treatment response, and it had the added disadvantage of adverse side effects. When compared in terms of outcome, conditioning was found to be

*The author has developed a cartoon 'manual for mothers', which does seem to improve parental co-operation.

significantly superior to all other treatment procedures, with the exception of imipramine. At follow-up one year later, conditioning was still superior to other methods. McConaghy concluded, however, that although imipramine was less effective than conditioning, it might still offer a useful remedy in cases where parent and/or child objected to the 'bell and pad'.

There have been two studies where conditioning treatment has been compared with psychotherapy, and in each investigation the 'bell and pad' has been found to be superior. De Leon and Mandell (1966) found that psychotherapy counselling was no more effective than a control waiting-list procedure, and both procedures were less effective than conditioning treatment. Using a criterion of success of 13 consecutively recorded dry nights, they found that 86 per cent of the children treated by conditioning were treated successfully, as against 18 per cent of the children treated with psychotherapy counselling. In addition, the children who were treated successfully by conditioning stopped bedwetting in about half the time of those treated successfully by psychotherapy.

Werry and Cohrssen (1965) compared conditioning treatment with supportive psychotherapy; children allocated to psychotherapy (N = 21) received from six to eight sessions. The psychotherapy was 'essentially psychodynamically orientated', and was supplemented by suggestion and encouragement. A third group of children was allocated to a no-treatment control procedure. Whereas sixty per cent of children treated by conditioning were described as 'cured' or 'greatly improved', the equivalent percentages in the psychotherapy and control groups were 20 per cent and 10 per cent respectively.

In summary, conditioning treatment would appear to have definite advantages over drug therapies, although the latter may have a lot to offer in cases where the 'bell and pad' seems to be impractical, or where conditioning has failed. It is very difficult to see any evidence in support of psychotherapy, and when relative costs are taken into account, this prolonged form of treatment would appear quite impractical, in addition to being ineffective.

Comparison of Various Conditioning Methods

There are several types of conditioning apparatus currently in use; what is common to them all is that the patient is aroused by a noxious stimulus immediately after each wetting incident. Three main types of equipment can be identified, and it is of clinical relevance to consider the comparative effectiveness of these three types of instrument. (1) The now traditional Mowrer apparatus employs a bell, buzzer or some other suitable signal to arouse the child. (2) The Crosby apparatus uses electric shock (applied to the loins) to effect arousal (see Crosby 1950). (3) The Twin Signal apparatus (T.S.) developed by Lovibond emits a very loud signal from a Klaxon hooter of one second duration as soon as wetting occurs. There then follows a period of one minute's silence, after which a buzzer signal is triggered which continues until the machine is switched off.

Lovibond (1964) compared the effectiveness of these three types of device (*i.e.* Mowrer, Crosby, and Twin Signal) in a sample of 36 enuretic children. He found that

the Crosby apparatus had no particular advantage over the other instruments, and, if parental attitudes were taken into account, then it had distinct disadvantages. Parents expressed concern at the use of shock, and, what is more significant, three patients experienced burns at the site of the shock electrodes. The T.S. apparatus was found to be significantly more effective than the Mowrer type equipment, when compared in terms of the number of conditioning trials, but this initially favourable result did not receive confirmation when data were collected on a larger number of children (Lovibond 1964). Furthermore, a recent attempt to replicate the superiority of the T.S. equipment, this time with the intensity of the alarm held constant, has produced negative results (Turner *et al.* 1970).

It may be concluded then that, although the three main types of apparatus differ in their theoretical basis, there is little to choose between the T.S. and Mowrer in terms of effectiveness. The Crosby apparatus suffers from the practical disadvantages common to any forms of treatment that employ electric shock, in so far as it requires a much higher level of supervision. Also, many would consider that there are strong ethical objections to the use of electric shock, when other equally effective and less noxious methods of treatment are available. As regards the T.S., it is an expensive piece of apparatus, and in the absence of any clear evidence of its superiority it is difficult to see any justification for the greater cost that is incurred.

There have also been variations in the treatment procedures used, and two studies have investigated the use of intermittent reinforcement treatment. This particular modification was developed as part of an investigation into ways of reducing the relapse rate. Lovibond (1964) derived from experimental studies of learning the hypothesis that the relapse rate could be reduced by administering the initial course of treatment on an intermittent reinforcement schedule. In this form of treatment, the apparatus is used on 50 per cent of the nights of each week, so that on some nights the child goes to bed as usual but the machine is switched off, while on other nights normal conditioning occurs. This modification has the effect of prolonging treatment, and the child is unable to distinguish nights when no conditioning occurs from those when the machine is triggered as soon as wetting occurs. Lovibond found that whereas relapse rates were high for apparatus used on a 100 per cent programme, the proportion of children who relapsed following intermittent treatment was considerably (but not significantly) lower (*i.e.* 19 per cent as opposed to over 35 per cent). This encouraging result has been confirmed in a more recent study, although again the data failed to reach an acceptable level of statistical significance (Turner *et al.* 1970).

Research to date has failed to show any substantial improvement on the cheap and widely used Mowrer-type apparatus. The reduction of relapse following use of intermittent treatment is a very encouraging result, and may be welcomed as a finding of considerable importance.

Conditioning Treatment With Special Samples

The studies mentioned so far have for the most part been based on the response to treatment of children. Despite a one or two per cent prevalence of enuresis among adults (Levine 1943, Thorne 1944, Wadsworth 1944, Plag 1964), there have been no

systematic studies of the effectiveness of the 'bell and pad' treatment with the adult patient.*

Conditioning apparatus has been used with institutionalised retarded patients, and although a good response has been reported in about 50 per cent of cases, the outcome generally has not been so favourable as with normal children (Kennedy and Sloop 1968, Sloop 1969).

The Mechanism of Treatment

One problem is to explain *how* the treatment works, when it works. Put another way, the question that needs to be asked is whether conditioning alone *is* in fact the basis of treatment, or whether the effectiveness of treatment should be ascribed to the more general effects of the intervention in the home, or to an interaction of both (Kanfer and Phillips 1970). The treatment method focuses the attention of the entire family on the child's nightly performance. It seems naive to ignore the effect of this social intervention just because it does not fit easily into a simple conditioning model. Nevertheless, theoretical explanations of how the treatment works have focused attention almost exclusively on the postulated conditioned associations that occur at the moment when the alarm is triggered and the child experiences a conditioning trial. Thus, Jones (1960) devoted a large portion of his theoretical account of the mechanisms of treatment to postulated changes in bladder pressure, in relation to reflex discharge and the threshold for cortical arousal. Crosby (1950) emphasised the importance of the arousal stimulus being similar to the 'somatic discomfort' of the wet urinous state. Lovibond (1964), who proposed an avoidance-learning basis of treatment, hypothesised that treatment would be facilitated by provision of escape training. What all these explanations have ignored is the possibility that response to treatment may be in part determined by many other factors. A strictly classical conditioning explanation must be supplemented by some acknowledgement that children may be rewarded for any signs of improvement, and accordingly it is necessary to take into account social learning.

Spontaneous Remission

On the basis of the age-incidence curve, Lovibond (1964) has estimated that about 25 per cent of children who are enuretic at any given age can be expected to stop wetting spontaneously over the following year (the percentage varies according to age). The accuracy of this estimate can best be evaluated by control studies where a waiting-list control group has been incorporated within the research design. Up to the present time, there have been three such studies, and these indicate that conditioning treatment is superior to control no-treatment procedures (*i.e.* waiting list), all of them covering a four-month period (Werry and Cohrssen 1965, De Leon and Mandell 1966, Baker 1969).

Gadget-effect. In their comparative study of conditioning, psychotherapy and control 'no-treatment' procedures, De Leon and Mandell (1966) made a careful

*Very encouraging results have been obtained in a series of ten adult enuretics, of whom nine have ceased to wet the bed after 'bell and pad' treatment (Turner and Taylor 1973).

evaluation of the initial effect of the alarm apparatus; they asked parents to leave the pad and the alarm disconnected so that, although the child slept on the pad, the apparatus was non-operative. They reported that the apparatus itself in combination with instructions tended to reduce the frequency of the enuresis.

Arousal effect. The procedure of conditioning treatment necessitates the arousal of the child immediately after each wetting incident. The threat of arousal itself could alter the level of sleep, in so far as the child goes to bed in the knowledge that the bell may sound at any time during the night. Baker (1969) compared conditioning treatment over a ten-week period with a 'wake up' procedure, in which the child was aroused at a fixed time each night and potted. Turner *et al.* (1970) included a similar control procedure, though it was only over a four-week period, and the children were aroused at random times rather than at a fixed time each night. The results of these two studies indicate that random arousal is as effective over the first month, but over a longer period of ten weeks the conditioning procedure is superior.

Summary and Conclusions

Conditioning treatment provides a safe, economic and effective remedy for nocturnal enuresis. Clearly, a lot more research is needed, but meanwhile results have been very encouraging. Bedwetting can be arrested in about 80 per cent of cases after a relatively brief course of alarm treatment (*i.e.* between eight and ten weeks); however, it must be accepted that re-treatment will be necessary in about one third of children. Furthermore, similar results have been obtained by a wide cross-section of therapists.

A most important advantage of the alarm method is that it is relatively inexpensive. Initial outlay on the equipment is low (the apparatus can be purchased for under £10), and the administration of treatment is economic, when measured in terms of the time a skilled therapist has to spend with each patient, *i.e.* an average of about six interviews, of which four may be very brief. The cost of providing help for the vast number of enuretic children in the general population can be further reduced if treatment is organised on a community basis; then the task of supervising therapy can be spread among the many professional workers who are involved in the care of children. Of course, it is essential to ensure that all cases are carefully screened, to pick out those with an organic pathology or in whom there *is* evidence of generalised psychological disturbance.

Comparative studies are admittedly few in number, and more are needed, particularly where the alarm method is tested over, say, a one-year period. However, the available evidence indicates that the 'bell and pad' is superior to psychotherapy or drug treatment, in that it has a much higher reported success rate in bringing about the total arrest of enuresis. It should be added that there is no evidence that the alarm method has any adverse side effects, and in particular there has been no evidence of symptom substitution.

Having summarised the strong points of conditioning treatment, it is now necessary to consider two major problems that are apparent from the literature. First, there is the question of the premature termination of treatment due to inadequate parental co-operation. In these cases, the parents stop using the alarm before the

treatment has been given a fair trial. We still know very little about the extent of this problem, and it is impossible to say why some parents 'drop out' of treatment.* One might hazard a guess that in many of these cases environmental factors are important (*e.g.* inadequate and overcrowded housing), while in other families parental motivation is poor. Certainly the available evidence indicates that there *are* social limitations to the general application of the alarm method. Research must now be directed towards identifying the problems that are encountered by parents when using the 'bell and pad'. Also, the variable of parental motivation requires further examination.

In the meantime, treatment could be made more efficient by improving the design of the equipment so as to minimise false alarms (*i.e.* when the bell is triggered accidentally, even though the child has not wet the bed). However, any improvements in design should be carefully balanced against the possible disadvantages of raising the cost of the apparatus. The possibility of combining drug and conditioning treatment merits further investigation, and it may also be helpful to examine the instructions and procedure to see if they are readily understood by mothers of all levels of ability.

The second problem is that of relapse. The lesson to be drawn from the literature is clear; in many cases it is necessary to think in terms of more than one course of alarm treatment. Some children relapse and require re-treatment as many as four times. Anyone setting up a treatment service should ensure that there is always enough equipment for relapsed cases when they return to the clinic. Also, parents should always be warned that the enuresis may recur, particularly during the first six months following discharge.

It is now necessary to consider what can be done to improve the long-term effectiveness of alarm therapy. The most obvious conclusion is that re-treatment should be offered as a matter of routine, although it must be recognised that the research evidence on this point is hardly adequate. Another strategy is to use the 'bell and pad' method, but on an intermittent basis (see Lovibond 1964 for a description). The results are encouraging in that they indicate a lower relapse rate following this modification of standard treatment, and the finding should be incorporated immediately into current clinical practice.**

We are still a long way from knowing why the alarm method works. One reason for this state of affairs is that research workers have used an oversimplified model of treatment. Nearly all the investigations that have been published to date have been designed to test theoretical models which explain treatment mainly in terms of the processes that are hypothesised to operate at the very moment when the child wets the bed and the alarm is triggered.† The development of continence is explained in terms of classical or instrumental conditioning, on the basis of experimental studies in the learning laboratory. But there is a lot more to treatment than is encompassed

*This statement is now no longer true, and the interested reader is referred to a series of important studies into parental co-operation (Young and Morgan 1972*a* and *b*).

**Since this chapter was written, two important studies have appeared which show a dramatic reduction in relapse rate following conditioning with overlearning (Morgan and Young 1972, Young and Morgan 1972*c*).

†Atthowe (1971) has recently advanced an operant analysis of treatment along these lines.

within these particular models. For example, children may be rewarded (either socially or in more material terms) for any of the following indices of improvement: (a) occurrence of dry nights; (b) reduction in the amount of urine passed into the bed; (c) spontaneous arousal to urinate; (d) increased time between going to sleep and an enuretic incident; and (e) full arousal to the alarm. Parents, and indeed the whole family, focus their attention on the nightly performance of the child, and many forms of social (or monetary) reward are forthcoming when the child shows signs of improvement. This is not to mention the adverse consequences that children may experience if the whole family is inconvenienced, and there is no sign of improvement.

In addition to investigating the conditioning mechanism of treatment and monitoring sleep functions at the time of wetting, there is also a most urgent need for studies of changes in the pattern of family interaction when the 'bell and pad' apparatus is introduced into the home. This will involve the direct observation of families before, during and after treatment. Far more complex behavioural disorders than enuresis have been modified by altering the behaviour of parents, teachers and others in the child's environment. Very broadly, this approach is based on the assumption that deviant behaviours are maintained by their consequences for the child. Treatment should be directed towards assessing, and if necessary altering, the social environment.

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