*MODIFICATION OF SEIZURE DISORDERS:
THE INTERRUPTION OF BEHAVIORAL CHAINS¹*

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This study investigated the effects of interruption and differential reinforcement on seizures in children. Seizures were conceptualized as the terminal link in a behavioral chain, resulting in a strategy aimed at identifying and modifying behaviors that reliably preceded the seizure climax. Seizure frequency was reduced in four of five subjects, whereas the frequency of pre-seizure behavior was reduced in only three subjects. Parents and school personnel were successfully used as change agents.

DESCRIPTORS: chaining, seizures, epilepsy, children, DRO, interruption of seizure chains, parent(s) as therapist

Recent laboratory advances in the operant control of autonomic functioning (Kimmel, 1967; Miller, 1969), lend credence to anecdotal clinical reports on the success of environmental manipulations in modifying behaviors previously thought to be beyond voluntary control. One example of this strategy has been the control of seizure disorders by conditioning techniques. Forster (1969), for example, treated reflex epilepsies by repeatedly presenting the eliciting stimulus until extinction occurred, or gradually shifting the stimulus from noneliciting to eliciting values. In a similar conditioning paradigm, Parrino (1971) eliminated grand mal seizures in a 36-yr-old male using systematic desensitization.

Gardner (1967) reported one of the first

explicit applications of operant-conditioning techniques to the control of seizures. He eliminated psychogenic seizures of a 10-yr-old girl by using differential reinforcement, *i.e.*, extinction contingent upon seizure occurrence, and reinforcement for incompatible behaviors, such as appropriate play with siblings.

The fact that seizures can be interrupted before the seizure "climax" has been frequently noted anecdotally in neurological practice. Such a phenomenon has been observed most commonly in Jacksonian seizures, with methods as diverse as mustard applications and stimulation being employed (Lennox, 1960).

The cases described below represent a further attempt at controlling seizures of both organic and nonorganic etiology with operant-conditioning techniques by applying consequences to behaviors that reliably *precede* the seizure itself. Reliably occurring pre-seizure behaviors (prodromal behavior, or premonitory symptoms) such as headaches, tinnitus, polydipsia, and localized spasms have been described by Henner (1962). In some cases, these behaviors precede the seizure by as long as 10 days.

Basic research has shown that chained behavior can be disrupted, particularly if earlier components are involved (Findley, 1962; 1964). If seizures are viewed as the terminal link Kelleher and Fry, 1962; Skinner, 1934; Thomas,

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in a chain of behaviors, these data suggest that seizures can be prevented by interfering with pre-seizure behaviors.

Clinical-experimental applications of this chain-disruption strategy are rare. Efron (1957*a*, 1957*b*) was able to abort grand mal seizures in a 46-yr-old woman by presentation of what might be described as an aversive stimulus (odor of hydrogen sulfide) contingent upon behaviors that she reported occurring before the grand mal climax. Similarly, Kohlenberg (1970) successfully eliminated vomiting in a 21-yr-old retarded girl by applying electric shock contingent upon stomach contractions that reliably preceded vomiting episodes.

The present study sought to eliminate or decrease the rate of seizures in children by identifying and modifying reliable pre-seizure behaviors. Effects of two operant procedures were examined: contingent interruption and reinforcement of behavior incompatible with seizures. Concomitantly, an effort was made to investigate predictability of seizures and to confirm feasibility of employing nonprofessionals in the environment of seizure-prone children as primary change agents. That parents can be employed successfully as therapists for their children has been amply demonstrated (Johnson and Katz, 1973).

GENERAL METHOD

The pool of 18 subjects, from which five were selected for this study, was obtained from a variety of sources, including referrals from local neurologists, public schools, physicians, and psychologists. The criteria for selection were that subjects show: (1) a behaviorally observable seizure, such that at least a 90% agreement could be established between two independent observers; (2) a minimum seizure frequency of at least one per day, to facilitate data collection and more easily assess the effects of experimental manipulations; and, when possible, (3) a formal diagnosis of epilepsy based upon EEG and/or clinical observation by a certified neurologist. With the exception of Subject 1, all subjects in

this investigation met these criteria. Subjects were eliminated before treatment when either reliable data could not be acquired (eight children) or the seizure could not be operationalized for accurate measurement (five children).

Reliability checks were obtained for all dependent measures and consisted of two trained observers (or one observer and a parent) watching the subject for 1 hr or more from opposite sides of the room, noting the time and occurrence of each seizure. Reliability was computed as per cent agreement by dividing the number of intervals scored identically by the total number of intervals. Because perfect reliability could be obtained even though no seizure had occurred, reliability checks were not concluded until at least six seizures had been noted. The same procedure was employed for determining reliability figures on pre-seizure behaviors. Absolute frequencies were used due to the relatively low frequency of the behaviors in question. Once satisfactory reliability was established, subsequent reliability checks were made once in each experimental phase.²

Based on anecdotal reports mentioned earlier, an interruption procedure for pre-seizure behavior was implemented for Subjects 1 to 4. Essentially, it consisted of the following, implemented by the change agent: (1) shout, "No!" loudly and sharply, and (2) grasp the subject by the shoulders with both hands and shake him once, vigorously.

For Subject 5, a differential-reinforcement procedure was implemented contingent upon the pre-seizure behavior of arm raising. It consisted of: (1) placing the subject's hands down to her side (or lap if she were sitting), (2) waiting approximately 5 sec, and (3) delivering a combination of primary and social reinforcement contingent upon "arms down".

SUBJECT 1

This subject was a 7-yr-old male Caucasian enrolled in a behavior modification program for

²See General Discussion for an elaboration of the reliability issue.

emotionally disturbed children. He had been alternately diagnosed as autistic, brain damaged, and as having a learning disability. He had a history of seizures from the time that he was 2 yr old. No recent EEG testing results were available, and earlier testing had evidently revealed no abnormalities. Although these seizures were not at any time described as functional, a formal diagnosis of epilepsy was never specifically made.³ Medication notwithstanding (8 ¼ grain tablets of Dilantin per day), seizures averaged 12 per day.

The seizure itself consisted of three distinguishable component behaviors: (1) fixed gaze at a flat surface (either a table top or wall), followed by (2) the body becoming rigid, followed by (3) myoclonic spasms (violent shaking), and (4) terminating with a fall to the floor. Corresponding seizure symptoms such as confusion, incontinence, *etc.*, were not observed. No seizures were ever observed that were not preceded by the fixed stare. As a result, the staring behavior was chosen as the target for modification.

With the discrete nature of these behavioral components, interobserver reliabilities on the seizure and pre seizure responses were 100%.

Subject 1 was treated within a local public school behavior modification unit. With few exceptions, all procedures were carried out in the regular classroom, which consisted of a group of 10 to 12 children who were involved in a developmental curriculum.

Procedure

Baseline. The child was observed continuously from 9:00 A.M. until 3:00 P.M. for a period of three weeks by an assigned staff member who worked in his classroom and recorded the total number of seizures per day. Further data were also obtained to determine whether the seizures were discriminated as a function of time, activity, or person(s). Once a seizure occurred, the typical

reaction of the school staff was that of general inattention, which approximated the conditions in effect before baseline.

Interruption phase. When baseline data had stabilized, the staff were instructed to implement the interruption procedure described above contingent upon the occurrence of visual fixation. No consequences were applied once the seizure itself had commenced.

Reversal phase. During this condition, a multiple-schedule strategy was instituted to determine if the reduction in seizure rate was a function of the independent variables. From 9:00 A.M. to 12:00 P.M., the interruption contingency was removed, and fixated staring was no longer followed by any interruptions. From 12:00 P.M. until 3:00 P.M., however, the interruption contingency remained in effect. The reversal was implemented for one day only, due to the reluctance of the investigators to re-instate a behavior as severe as seizures.⁴ Parental permission was obtained before this phase was implemented.

Interruption phase. The interruption procedure was re-instated in all conditions.

RESULTS AND DISCUSSION

Figure 1 shows the number of seizures plotted per week. During baseline, seizures occurred with a frequency of just under 60 per five-day school week, or about 12 per day. Data from prebaseline conditions revealed no apparent discrimination of these seizures on person, place, time, or activity. With introduction of the interruption procedure, the frequency quickly fell to five to 10 per week, or about one or two per day. Seizures were eliminated by the seventh week of treatment. During reversal, when the interruption procedure was removed in the morning, six seizures occurred during the 3-hr period when it was not in effect. Before this time, seizures

³This subject was treated before formalization of an experimental design and was essentially considered to be a pilot study. The more stringent criteria for subject selection began with Subjects 2 through 5.

⁴It should be remembered that this case was treated before neurological consultation and the senior author was less than enthusiastic about implementing a reversal. Problems associated with a 3-hr reversal are acknowledged.

Fig. 1. The number of minor motor seizures per week for Subject 1. The reversal is prorated for a five-day week. During reversal, ● = A.M. and ○ = P.M. Follow-up data represent the absolute number of seizures for the next six months.

had been distributed unsystematically throughout the day. With the re-introduction of interruptions, seizure frequency quickly dropped to zero, where it remained.

Two additional points merit discussion. First, the pre-seizure behavior of fixated staring decreased in direct proportion to the decline in rate of the seizures themselves (since this was the case for all subjects, only the seizure data are presented in the figures). Second, after introducing interruptions, seizures occurred only when staff members were unable to apply the contingency in time, *i.e.*, within 10 to 15 sec after the onset of staring.

Further, the subject's anticonvulsant medication was systematically reduced by one tablet every two weeks. At termination of treatment, seizure frequency was zero and no medication was being administered.

Although therapy plans originally called for parental involvement, almost complete and spontaneous generalization from school to home eliminated the need to do so. Although no data were formally collected in the home, the parents reported a gradual reduction in both staring

and seizures, which coincided with introduction of the interruption procedure at school.

At the end of the first six month follow-up, only one seizure had been observed, which occurred while the subject was on the playground. However, the child was reported only to have fallen; whether a seizure in fact occurred is unclear. No interruption procedures were applied after termination of treatment.

SUBJECT 2

Subject 2 was a 4-yr-old male Caucasian, diagnosed as moderately retarded with undetermined brain damage. Seizures began at the age of 18 months. A diagnosis of epilepsy, minor motor type, had been made by a neurologist on the basis of seizure pattern, history, and corroborative abnormal EEG findings. A wide spectrum of anticonvulsant medications had been tried with slight or no success.

Behaviorally, the most prominent seizure pattern consisted of (1) a lowered activity level, followed by (2) the minor motor seizure, which was characterized by a sudden flexion of the arms and head. A second, less serious form of seizure, referred to neurologically as an "absence", was characterized by 20 to 30 sec of vacant staring, which terminated with brief vomiting.

Reliabilities of 100% agreement between observers were obtained on both variants of seizures, and reliabilities of 92% were obtained between two observers and the subject's mother for the lowered activity level. The predictability of this response ranged between 50 and 80% (*i.e.*, the lowered activity level preceded an average of 60% of the seizures). No pre-seizure behaviors were observed for the absence seizure.

Since this study was initiated during the summer months before the subject's enrollment in a behavior modification school program, the minor motor seizures were treated in the home environment. The absence-seizure pattern commenced in the fall and was treated at school.

Procedure

Baseline—minor motor seizures. The child's parents were interviewed to determine the ap-

proximate number of seizures per day, relevant stimulus conditions, possible consequences, and the existence of pre-seizure behaviors (*i.e.*, predictability). Next, a running description of the child's behavior (Bijou, Peterson, and Ault, 1968) was collected in his home. Finally, the parents were instructed to record the total seizure frequency per day, and the per cent of seizures per day that were predictable.

Interruption—minor motor seizures. Once baseline data had stabilized, the same interruption procedure that was employed for Subject 1 was instituted, except in this case it was contingent upon the occurrence of the lowered activity level. The subject's mother was successfully utilized as the therapeutic agent and no difficulties were encountered.

Baseline—absence seizures. In the fall, the "absences" with vomiting began. In this instance, periods of "absences" as well as episodes of vomiting were recorded each day, along with relevant information regarding the stimulus conditions under which they occurred. Parents and staff were instructed not to exceed attention previously given to these behaviors in or-

der to get accurate baseline data and to reduce the chance of reinforcing seizures.

Interruption—absence seizures. During this phase, the standard procedure was instituted as close to the onset of the absence (and before vomiting) as possible. No consequences were delivered contingent upon the vomiting. Consequences were delivered according to a multiple-schedule design, *i.e.*, absence seizures were interrupted at school but not at home.

Reversal—absence seizures. At this point, the interruption procedure was removed for a four-week period to determine the effectiveness of the procedures. Thus, when the absence began, no consequences were scheduled at any time in either stimulus condition.

Interruption—absence seizures. The interruption was re-instated for the absence seizures during school hours (9:00 A.M. to 3:00 P.M. only).

RESULTS AND DISCUSSION

Figure 2 shows the number of minor motor seizures plotted daily for Subject 2. During baseline, minor motor seizures averaged six per day. With introduction of the interruption compo-

Fig. 2. The number of minor motor seizures per day for Subject 2. The horizontal lines represent the mean rate for each condition.

nent, the number dropped to an average of three per day. The effect proved transitory, however, and eventually seizure frequency recovered to approximately five per day. Eight months later, frequency had reduced gradually to an average of two per day. This effect was independent of experimental operations. Although approximately 60% of the minor motor seizures were predictable, they were only immediately reducible by 50%, and terminally by 17%.

Figure 3 shows the frequency of absence and vomiting episodes for Subject 2 plotted daily. During baseline conditions (Part B), the frequency of absences and subsequent vomiting co-varied exactly and continued to increase. Because the vomiting caused the subject's family a great deal of discomfort, baseline conditions were terminated before stability was achieved. Part B of Figure 3 shows the total number of vomiting episodes (open circles). With introduction of the interruption procedure, the vomiting was reduced to a near-zero frequency. However, the number of absences increased over baseline.

The effects of the reversal are not immediately apparent until the data are scrutinized carefully. Although vomiting did not recur during this phase, on the third day of the reversal, Subject 2 began hyperventilating both at home and school (Part A of Figure 3). Further, when the absences are viewed separately by stimulus conditions (*i.e.*, home and school as in Part C of Figure 3), it can be seen that relative to the number during interruption, the frequency of absences during reversal increased temporarily at school (closed circles) where the interruptions were originally introduced, and declined further with re-introduction of the interruption procedure.

Absence seizures differ markedly from those of the minor motor variant, however, and these differences might account for the relative ineffectiveness of the procedure in this case. Although vomiting decreased while the frequency of absences remained unaffected, it should be remembered that the absence is a seizure in and of itself, rather than a pre-seizure behavior. This may support the notion that organic seizures must be

modified by the manipulation of antecedents rather than consequences.

Nevertheless, the fact remains that the interruption procedure had no discernible effect on this subject.

SUBJECT 3

Subject 3 was a 4-yr-old Caucasian male diagnosed as brain damaged with reduced dexterity on the left side (both arm and leg). Seizures began at 20 months and EEG testing and clinical history confirmed a diagnosis of epilepsy: minor motor type. Anticonvulsant medication had reduced seizure activity by about 10%, but the rate remained high, averaging about 12 per day.

Behaviorally, the seizure pattern consisted of (1) subtle behavioral change from which the subject's mother could predict 45 to 50% of his seizures, yet which proved impossible to define clearly and yielded an interobserver reliability of only 15%, and (2) the seizure, characterized by a sudden flexion of arms and head.

Reliabilities of 100% were obtained between two observers and the subject's mother for seizures. Subject 3 was treated at home during the summer months before his enrollment in a formal special education program.

Procedure

The procedure for Subject 3 was identical to that described for Subjects 1 and 2, with the interruption implemented contingent upon periods of "lowered activity". Data were collected by the subject's mother. As with the two previous subjects, one of the child's parents served as the therapeutic agent.

RESULTS AND DISCUSSION

Figure 4 shows the number of minor motor seizures for Subject 3 plotted weekly. During baseline, the rate averaged about 75 seizures per week, or 10 to 12 per day. Prebaseline and baseline observations revealed no predictable pattern of seizure occurrence. With introduction of the interruption procedure, the frequency quickly de-

Fig. 3. The number of absence seizures, hyperventilations, and vomiting episodes per day for Subject 2.

creased and stabilized at about 45 to 50 per week, or six to seven per day. During reversal conditions, the frequency increased to slightly under that observed during baseline. Reintroduction of interruptions resulted in a decrease of seizures nearly equal to that noted in the first interrup-

tion phase, although it took a longer period of time to achieve this effect. With only occasional exceptions, at no time did the child's mother predict a seizure that did not subsequently occur. Thus, the drop in number from baseline of 12 per day to the interrupted

Fig. 4. The number of minor motor seizures per week for Subject 3. The horizontal lines represent the mean rate for each condition.

frequency of about seven per day represents elimination of all predicted seizures (about five per day). In other words, the reduction of frequency occurred as a function of the abortion of predicted seizures. No change in the frequency of the pre seizure behavior occurred throughout the study. Follow-up data for Subject 3 are not available at this time.

SUBJECT 4

Subject 4 was a 14-yr-old Caucasian female with a seizure history dating to the age of 18 months. EEG results and clinical history confirmed a diagnosis of epilepsy, minor motor and focal types. Even with anticonvulsant medication, seizure activity remained relatively high, averaging about two per day.

Behaviorally, this subject's seizure pattern was characterized by (1) the right arm slowly raised to a position parallel to the head, followed by (2) the seizure (about 60 sec in duration) consisting of myoclonic jerking and vacant staring. Predictability of the seizure from arm-raising was 100%, with interobserver reliabilities of 100% on the seizure itself.

Subject 4 was treated at home, since the severity and regularity of seizures prohibited her attending school. A teacher from the local school district visited the house twice weekly. The girl's mother was used as the therapist and other

siblings were frequently employed as ancillary data collectors.

Procedure

The procedure was identical to that described previously for Subjects 1, 2, and 3. Data were collected throughout the study by the subject's mother, who was instructed to note each seizure occurrence, when it occurred, who was present, and the activity in which the child was engaged. She was further instructed to respond to any seizure occurrence as she had in the past, that is to ignore it.

RESULTS AND DISCUSSION

Figure 5 shows the number of minor motor seizures plotted weekly for Subject 4. During baseline, seizures occurred on an average of 11 per week, or one to two per day. Prebaseline and baseline observations did not show that seizures were discriminated on people, location, time, or activity. With introduction of the interruption procedure, the frequency was quickly reduced and eventually stabilized, averaging two and one-half per week, or one every three days. With introduction of reversal procedures, the frequency gradually increased to a peak of eight per week, at which time interruptions were re-introduced. With this change in procedure, the number decreased to approximately three per week, or one seizure every two days. The occurrence of the pre seizure behavior (arm-raising) covaried exactly with seizure occurrence, and decreased in direct proportion to seizure activity.

The only deviation from the downward trend of the data during punishment was the one near-recovery of baseline frequency (arrow in Figure 5). During this week, the subject began her menstrual period and this may have contributed to the unusually high number of seizures. As reported by her mother, the subject's menstrual periods were irregular and occasionally accompanied by an abnormally high number of seizures.

The subject's mother reported that a further reduction in seizures might have been possible,

Fig. 5. The number of minor motor seizures per week for Subject 4.

but the other children were too young to employ the procedure, and the father was reluctant to become involved in the treatment.

At the end of six months, follow-up data indicated that in spite of continued use of the interruption procedure, the seizure frequency had increased by one or two per week, though remaining far below the initial baseline level. A 1-yr follow-up indicated that the interruption procedure had been used sporadically during the second six months after treatment terminated, with a reported (no reliability) gradual loss of effectiveness. Seizure frequency at this time is about equal to that observed during baseline.

SUBJECT 5

Subject 5 was a 17-yr-old Caucasian female diagnosed as mentally retarded with major motor epilepsy. She had a life-long seizure history, and at the time of this research was exhibiting multiple seizures daily, despite large doses of dilantin and phenobarbital.

Behaviorally, her seizures consisted of the following chain of behaviors: (1) her body became tense and rigid, (2) she clenched her fists and raised her arms at a 90-degree angle from her body, (3) her head snapped back and a grimace appeared on her face, and (4) the major motor seizure ensued. Reliabilities of 100% were obtained on the seizure and pre-seizure target behavior of arm-raising.

Subject 5 was treated at a training center for adolescent retarded children. This experiment was conducted by the second author concurrent to, but not in conjunction with the treatment of Subject 1.

Procedure

Data collection, observation, and reliability measures were identical to those described earlier. However, in place of the interruption procedure used with Subjects 1 to 4, a differential-reinforcement procedure (DRO) was implemented in an attempt to suppress seizure frequency. Essentially, this procedure consisted of the following steps: (1) as soon as the subject raised her arms into the air (component 2 described above) they were placed back down to her side, or in her lap if she were sitting, (2) a delay of 5 sec was interposed, (3) she was praised effusively for having her arms lowered, and (4) she was given a piece of M & M candy. The time delay was used to ensure that reinforcement was not contingent upon an undesired chain of behaviors, *e.g.*, hands up, followed by hands down.

This procedure was initially implemented by the second author and other teaching staff. Eventually, however, control was faded to other students at the training center.

RESULTS AND DISCUSSION

Figure 6 shows the number of major motor seizures plotted daily for Subject 5. During baseline, seizures occurred on the average of 16 per day. With introduction of the differential-reinforcement procedure, the frequency of seizures diminished rapidly to a near-zero frequency. During the reversal phase, this contingency was removed and seizure frequency increased to about six per day. When the differential-reinforcement procedure was re-introduced, seizure frequency again dropped to a near-zero level.

The occurrence of arm-raising was observed consistently before the seizure climax. As with Subjects 1 and 4, the frequency of the pre-seizure target behavior decreased as a function of the experimental manipulation, in this case

while in others it remained unaffected (Subjects 2 and 3). Precise data on the number of times the interruption procedure was used and changes in pre seizure behavior are not available. In general, however, the number of interruptions remained constant in cases where the overall frequency of the pre seizure behavior was unaffected, and decreased proportionally in those where the pre seizure rate declined.

Two additional parameters of punishment are relevant to this discussion: (1) the intensity of the aversive stimulus, and (2) the schedule with which it is delivered. Numerous studies on the intensity of punishment have shown that the greater the intensity of the aversive stimulus, the greater the magnitude of suppression (Appel, 1963; Azrin, Holz, and Hake, 1963). These data suggest that a stimulus more intense than the one employed here might have produced greater suppression of pre seizure behaviors. Further, the degree of seizure predictability may also affect seizure suppression. With only 42% of Subject 3's seizures predicted, the schedule of punishment to pre seizure response would be an intermittent one, *i.e.*, about 2.5 to 1. Intermittent punishment schedules have been consistently less successful in suppressing behavior than continuous schedules of punishment (Azrin *et al.*, 1963; Estes, 1944).

The partial effectiveness of the startle-and-shake procedure, if due to punishment, is in some ways consistent with findings reported by other investigators (Azrin, 1968; Hollenberg and Sperry, 1951; Karsh and Williams, 1964) who have shown that loud noise and verbal punishment can suppress behavior. One limitation of this procedure is that it may vary in intensity and duration and cannot be applied as uniformly as other stimuli, such as electric shock. In this respect, other forms of aversive control such as timeout or shock, might prove to be more effective and should be investigated. Conversely, the effective use of differential reinforcement also suggests the feasibility of more innocuous approaches.

A brief note on reliability is appropriate. The

dangers inherent in data reported by parents are obvious. In most cases, trained observers can be easily implemented to solve this dilemma. Behaviors of such reduced frequency as seizures, however, produce two problems, whose solution remain elusive. On the one hand, it is extremely difficult to obtain accurate reliability because a frequency of two per day would require approximately 40 hr of total observer time. In addition, if punishment is the phenomenon producing seizure suppression, the question arises as to whether the child is simply avoiding the change agent; *i.e.*, the frequency is not reduced, seizures simply occur out of sight of the observer. The first problem was dealt with by requiring the observance of at least six seizures, and agreement on occurrence only; the latter problem is difficult to evaluate. While it is likely that a child could discriminate seizures on the absence of an observer, it seems implausible to assume that he could accomplish this on all or even a majority of occasions.

The focus of this study has been placed on pre seizure behavior and its relationship to seizure occurrence. Nevertheless, the importance of the consequences of seizures *per se* should not be overlooked. If reinforcing consequences could be identified, treatment strategies might be enhanced by straightforward extinction operations.

A decided advantage of the present procedure is that it can be carried out by appropriately trained parents and other nonprofessionals in the child's natural environment. In this respect, the investment of time for training parents and staff in the intervention techniques was minimal. Each parent was seen for a total of 4 to 6 hr, which included the initial history-taking and assessment, preliminary observations, and the explanation and initial implementation of the interruption procedure. Beyond this, the investigator made one to three phone calls per week to each parent to collect data and monitor progress.

In summary, the present procedures may hold promise in the treatment of some types of epilepsy. Precisely which phenomenon accounts

for the observed reduction after interruption remains unclear; hopefully, further replication will answer this question. Nevertheless, interruption and differential reinforcement do seem to be potentially useful and practical techniques.

A final point concerns the fact that environmental events may effect seizures of organic etiology. The present data suggest the possibility of promising behavioral interventions for this and other disorders, and highlights the importance of improved communication between the medical and behavioral sciences.

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