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BEHAVIORAL RELAXATION TRAINING WITH HYPERACTIVE CHILDREN

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Summary—Three boys meeting multiple criteria of hyperactivity were trained to emit ten specific relaxed behaviors by means of Behavioral Relaxation Training (BRT). Dependent measures included the Behavioral Relaxation Scale (BRS), frontalis electromyogram (EMG), the Conners Parent Symptom Questionnaire, and self-report. A multiple-probe design across subjects was employed, plus a reversal between recliner and beanbag chair for each subject. BRT was effective in producing high levels of relaxed behaviors and low EMG levels in the office setting, particularly in conjunction with the beanbag chair, with some reduction of hyperactivity scores on the Conners. Subsequent training in each child's home by his mother was accompanied by further reductions in parent-reported symptoms and low EMG levels, which were maintained at a 1-month follow-up.

Hyperactivity is said to be the problem most frequently referred to child guidance clinics (Safer and Allen, 1976; Stewart, Pitts, Craig and Dieruf, 1966) and is estimated to affect between 3 and 5% of American school children (Barkley, 1981). Clinically, hyperactive children are described as overactive, impulsive, incapable of sustained attention, and having difficulties at school (Porrino, Rapoport, Behar, Sceery, Ismond and Bunney, 1983). Stimulant medication is by far the most common treatment (Lambert, Sandoval and Sassone, 1978), but the efficacy of long-term psychostimulant use has been seriously questioned (O'Leary, 1980). Noxious somatic side effects (Conners, 1972; Werry and Sprague, 1974), ethical objections (Whalen and Henker, 1976), and the large percentage of hyperactive children unaffected by medication (Safer and Allen, 1976) have made alternative treatments imperative (Hollander, 1983).

An alternative behavioral treatment has been to employ relaxation training as a setting event (Wahler and Fox, 1981) to reduce the child's general level of activity and arousal. The two chief methods of relaxation training have been some variation of Jacobsonian progressive muscle relaxation exercises, or frontalis EMG biofeedback.

Several single-subject studies have reported that frontalis EMG biofeedback reduced muscle tension levels with concomitant improvements in behavior at home or school (Braud, Lupin and Braud, 1975; Hampstead, 1979; Hughes, Henry and Hughes, 1980). In a group comparison, Braud (1978) found that both progressive muscle relaxation and frontalis EMG biofeedback reduced muscle tension, produced significant improvements on parent rating scales, and some improvement on psychological tests. Dunn and Howell also (1982) found that relaxation tapes, frontalis biofeedback, and relaxation plus biofeedback all resulted in significant improvements on motor and cognitive tasks and parent ratings. Lupin, Braud, Braud and Duer (1976) asked parents and their children to listen daily to relaxation tapes, following which significant behavioral and academic improvements were noted for the children.

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Other research indicates that relaxation is no more effective than control procedures. Putre, Loffio, Chorost, Marx and Gilbert (1977) presented tapes containing either relaxation instructions or adventure stories to groups of hyperactive boys. Both groups showed significant reductions in frontalis EMG tension. Klein and Deffenbacher (1977) compared the effects of relaxation training with large muscle exercises. Both groups performed significantly better on a matching but not a motor task during post-training assessment. Luiselli, Steinman, Marholin and Steinman (1981) compared relaxation training with card playing in "learning disabled" children and found no effect on academic or conduct measures.

While suggestive, these studies allow no definitive conclusions. Many suffered methodological problems, such as inadequate subject selection criteria, poor specifications of procedures, no reliability of measurement, confounded experimental design, no training criteria, and no follow-up. With the exception of Luiselli *et al.* (1981) no measures of relaxation were assessed, other than EMG in biofeedback studies. Luiselli, Marholin, Steinman and Steinman (1979) have pointed out that researchers in relaxation have rarely assessed whether or not the subjects were relaxed. Many authors have suggested that relaxation research should employ physiological and behavioral as well as self-report measures (Hillenberg and Collins, 1982; Luiselli, 1980; Schilling and Poppen, 1983).

A recently developed procedure, Behavioral Relaxation Training (BRT), consists of 10 overt postures and behaviors, taught by modeling, prompting and feedback (Schilling and Poppen, 1983). The objective nature of BRT may allow it to be more easily learned than the subjective discriminations required in EMG biofeedback or progressive muscle relaxation. A concomitant Behavioral Relaxation Scale (BRS) permits an objective, reliable and quantitative measure of relaxation. The relaxed behaviors defined by the BRS have been shown to reduce tension in the relevant muscles (Poppen and Maurer, 1982).

The purpose of the present study was to teach hyperactive children to relax with BRT in a methodologically rigorous fashion. The first phase demonstrated acquisition of relaxed behavior in a clinic. A second phase demonstrated that these skills could be maintained at home by parents.

METHOD

Subjects

Three boys were selected who were diagnosed as hyperactive by at least one physician and who met the following additional criteria adapted from Barkley (1981): parental and teacher complaints of inattentiveness, impulsivity and restlessness; age of onset of problems by 6 years; duration of symptoms for at least 1 year prior to the date of referral; problem behaviors occurring in 50% or more of the situations described in the Home Situations Questionnaire and the School Situations Questionnaire (Barkley, 1981); a score of two standard deviations or higher above the norm for age on the hyperactivity index of the Conners Parent Symptom Questionnaire (Goyette, Conners and Ulrich, 1978); and no evidence of gross sensory, motor or neurological dysfunction or psychosis.

All subjects were referred to a community mental health center at which the first author was conducting child behavior therapy. Subject 1, 11 years, was referred by his family; he was taking 10 mg of Ritalin per day. Subject 2, 9 years, was referred by his family physician and was currently taking no medication. Subject 3, 9 years, was referred by the school when he was not currently taking medication.

Setting

Initial training was conducted in a fluorescent-lighted office containing a large recliner (and later, a beanbag chair) and a chair for the experimenter. Electronic equipment was concealed to reduce distraction. The subject's chair faced a one-way mirror. Colored cue lights were situated behind the subject, out of his view. Later training took place in each subject's home.

Apparatus

EMG activity in the office was monitored by an Autogenic Systems, Inc. (ASI) Model 1700 with a bandpass at 100–200 Hz and a time-averaging value of 1 sec. After the forehead was thoroughly cleansed with alcohol, gold-plated silver/silver-chloride electrodes were attached with adhesive discs and a nonsaline conductive gel in a standard frontalis placement (ASI, 1975). Output, in microvolts, was determined by the integral averaging method. EMG data were collected by an ASI Model 5400, a special purpose computer which took readings at the rate of 2 per sec and printed averages in digital form at preset intervals. Observational intervals were signaled by colored cue lights timed by solid-state equipment in an adjoining room. EMG measures in the home were obtained with a portable unit

(ASI Model HT-1) connected to a digitial integrator (HT-10) which provided numerical averages at 10-sec intervals. Observational intervals in the home were timed by an electronic stopwatch.

Dependent measures

BRS. The scale consisted of 10 items coded as either relaxed or unrelaxed during five 1-min intervals at the end of each session. Each minute was divided into a 30-sec period to count breathing rate, a 15-sec period to observe the other nine items, and a 15-sec period to record on a data sheet. The 10 items, briefly, consisted of the following: (1) breathing—scored as relaxed if occurring at a frequency less than baseline; (2) quiet—no vocalizations; (3) body—no movement of the trunk; (4) head—in midline with the body; (5) eyes—closed with smooth eyelids; (6) mouth—lips parted in center; (7) throat—no movement; (8) shoulders—sloped and even, no movement; (9) hands—curled in "clawlike" fashion, and (10) feet—pointed away from each other at a 90° angle. Only the final 3 min of the 5-min observation period were scored for BRS and EMG due to the fact that at the conclusion of each training period the children often stirred and took about 2 min to adjust themselves. It was decided that scoring during this readjustment would result in artificially inflated levels of unrelaxed behaviors.

EMG. Frontalis EMG levels were automatically recorded during the first 45 sec of each min of the observation period, corresponding to the BRS observation phase. An average EMG for each min was printed at the conclusion of the observation period.

Conners. This 48-item global rating scale is grouped into five general categories: conduct problems, learning disability, psychosomatic problems, impulsivity—hyperactivity, and anxiety. Each item was rated on a three-point scale according to the frequency of occurrence. The scale was completed by the parents on each day in which there was a baseline or training session. They were not informed when baseline or training conditions changed.

Self-report. Following each treatment session, subjects verbally responded to one question from the experimenter: "Do you feel relaxed or unrelaxed?" The order of presentation of the two descriptors was randomized.

Experimental design

A multiple-probe across subjects design was used (Cuvo, 1979; Horner and Baer, 1978). A reversal was incorporated into the design when it was serendipitously found that a beanbag chair enhanced relaxation.

Procedure

At the initial visit, the program was explained to parents and children and informed consent was obtained. The rationale was provided that certain postures required the least muscular effort to maintain and that by learning these postures the child could learn to relax. Baseline measures were obtained during this and the next three visits. Baseline consisted of asking the subject to sit quietly and relax in the recliner for 15 min, following which the observation period was implemented. Four baseline sessions were given to all subjects, and then training began for Subject 1 who displayed the least relaxed behavior. Baseline probes were given to the other subjects when change in the BRS was evident in the trained subject(s). Training occurred approximately twice per week with some variation due to scheduling conflicts.

Training sessions consisted of adaptation, training and measurement periods. Adaptation periods were 5 min, training periods were 15 min, and measurement periods were 5 min (the last three of which were scored). During training, a shaping procedure utilizing token reinforcement was used. Tokens were contingent upon performance of the relaxed behaviors for increasing periods of time and were subtracted for pulling on the electrodes. They were exchanged after each session for agreed-upon edibles and activities. The order in which the behaviors were taught varied with each child according to his baseline operant level. Behaviors which occurred correctly most often during the baseline sessions were taught first to help insure immediate success.

Each of the 10 behaviors was trained individually in modeling and training trials, and then trained together in rehearsal and proficiency trials. Modeling trials consisted of the experimenter demonstrating an unrelaxed and a relaxed behavior, and asking the subject to imitate the latter. Tokens and praise were delivered for successful imitation. The subject was instructed to maintain the relaxed behavior for progressive periods of 10, 20, 30 and 60 sec with tokens and praise contingent upon successful completion. Manual guidance and corrective feedback were provided when a subject encountered difficulty in imitation.

After the behavior could be maintained for two 60-sec intervals, rehearsal trials were conducted by having the subjects practice all the trained behaviors simultaneously for one or more 60-sec intervals to a criterion of at least 70% correct. Training then began on the next behavior. After the final behavior was trained, proficiency trials were used to train the entire set of ten relaxed behaviors to at least 80% relaxed, as measured during the end-of-session measurement period, for two consecutive sessions.

Beanbag chair

During an outing with Subject 1, after his 10th training session, the experimenter noticed that the child sat quietly in a beanbag chair. This subject had reached a plateau in training and we decided to see if the greater body support offered by the beanbag would improve performance. Accordingly, a beanbag chair was substituted on subsequent training sessions. After reaching criterion, a reversal to the recliner was implemented followed by a return to the beanbag. This same procedure was employed with Subjects 2 and 3 after they had completed a similar number of sessions in the recliner. Follow-up sessions occurred 10–12 weeks after the final training session. They were similar to the baseline sessions except that the beanbag was employed.

Phase 2, Home training

After the follow-up session, the results of the office training were discussed with the parents and they were offered the opportunity to learn the procedure in their home. All parents accepted. The mother was the person trained in all cases. Training took place in the living rooms of

Subjects 1 and 2, and in the bedroom of Subject 3. Subjects relaxed in beanbag chairs which their parents purchased.

On the first home session (baseline), the experimenter saw the child alone. After attaching the electrodes, the subject was asked to sit quietly and relax for 15 min, followed by a 5-min measurement period. During the second home session, the mother quietly observed the therapist conduct training and observation. During the third and fourth sessions, the mother conducted training while the therapist provided prompts by gestures and signals as to the required feedback. The mother then implemented training on her own for 10 consecutive days. Throughout training, tokens were awarded to the child for not exceeding five instances of unrelaxed behaviors during the session. Tokens were exchanged for activity or edible reinforcers supplied by the parents. BRS and EMG measures were obtained by the experimenter in one baseline session, after the fifth, tenth, and fourteenth mother-conducted sessions, and at a 1-month follow-up. At the conclusion of the study, each mother completed a 10-item Likert-scale questionnaire concerning her attitudes about the procedure, ease of implementation, convenience and perceived benefits.

Reliability

The experimenter was the primary observer in all sessions. Reliability on the BRS was assessed during each condition of the office phase on at least 25% of the sessions for each subject. Obervers had been trained to 90% criterion with videotaped and live models and were periodically calibrated to insure accuracy. Reliability observers were stationed behind a one-way mirror in an adjacent audio-equipped room. Reliability was calculated as

$$\frac{\text{agreements}}{\text{agreements + disagreements}}.$$

Reliability for Subject 1 ranged from 83 to 100% with a mean of 90.4%; reliability for Subject 2 ranged from 85.5 to 100% with a mean of 93%; reliability for Subject 3 ranged from 84.9 to 100% with a mean of 92.9%.

RESULTS

The per cent of relaxed behaviors as measured by the BRS is shown in Fig. 1. All subjects

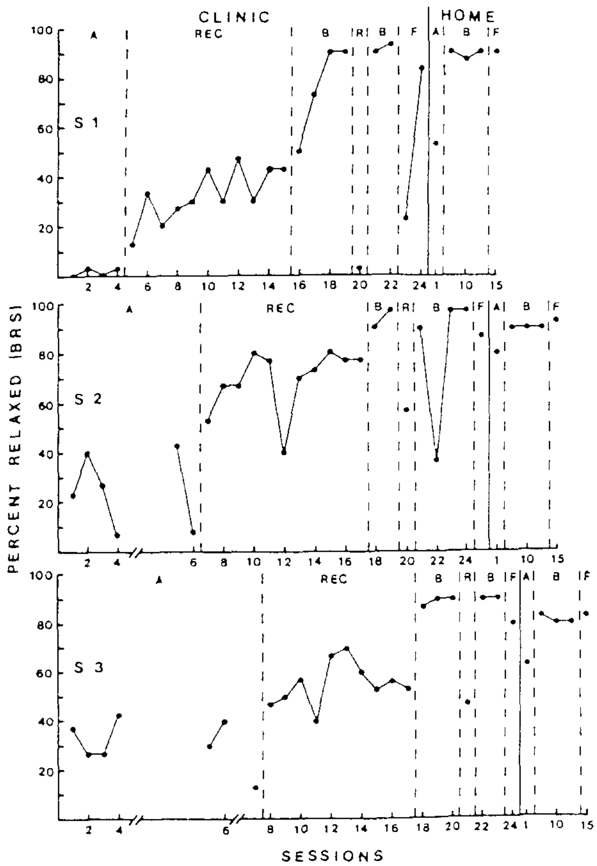

Fig. 1. Per cent relaxed behaviors on the Behavioral Relaxation Scale during the final 3 min of the observation periods. (A = baseline; REC = training in the recliner; B = training in the beanbag chair; R = reversal to recliner; F = follow-up)

showed an immediate improvement in relaxation when training was implemented. BRS scores continued to improve but appeared to reach a plateau after about seven training sessions.

For Subject 1, BRS scores improved markedly to over 90% relaxed after the beanbag chair was introduced. A reversal to the recliner resulted in a score similar to baseline, which recovered to over 90% when the beanbag was reintroduced. At follow-up, BRS scores fell below 30%, so a second follow-up was given 2 days later in which the subject was told to "Relax like you were taught", resulting in a BRS score over 80%. Subject 1 also showed a decline to almost 50% relaxed behaviors on the first home baseline session. His performance immediately recovered when home training was implemented by the experimenter. It remained at maximum levels when his mother conducted training, either under the experimenter's supervision or on her own. A final home follow-up, 1 month after systematic training, showed Subject 1 emitting 90% relaxed behavior when simply asked to do so.

Subject 2 displayed a more variable baseline than Subject 1, with greater amounts of relaxed behaviors. The beanbag was introduced at the same point in training as for Subject 1, with an immediate improvement in BRS scores. Reversal to the recliner produced a drop to below 60%, but relaxation recovered when the beanbag was again employed. The poor performance on Session 22 occurred because the subject was suffering from a cough. The office follow-up BRS score was 85%, which decreased slightly on the initial home baseline session. It improved to 90% with mother administering training, and remained at that level at the home follow-up.

Subject 3 showed a similar pattern to the other subjects, reaching about 50% relaxed in the recliner after 10 sessions, with an improvement to almost 90% in the beanbag. The reversal effect of the recliner and beanbag was replicated with Subject 3. His office follow-up BRS score was 80%. His home baseline BRS score dropped to about 60%, but improved to 80% when parent training was implemented, and at home follow-up.

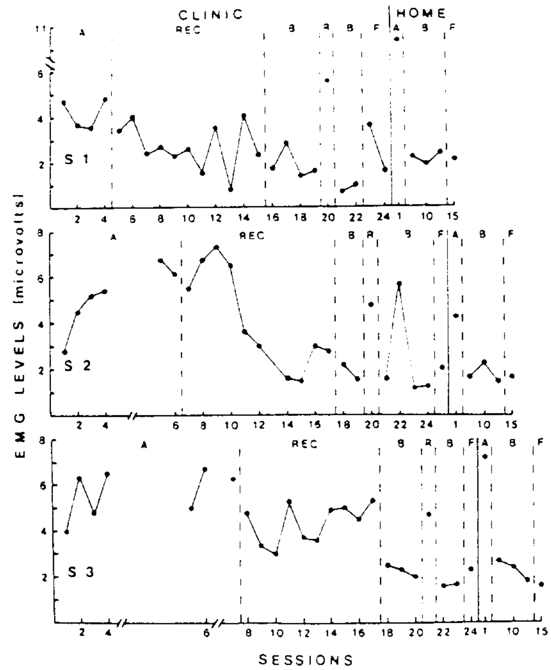

Fig. 2. Mean frontalis EMG levels during the final 3 min of the observation periods. (Phases as designated in Fig. 1.)

Frontalis EMG data for each subject are shown in Fig. 2. A marked correspondence to the BRS data in Fig. 1 is obvious. EMG levels decreased as subjects became more relaxed in training. The reversal effects of the recliner and beanbag were also obtained for each subject. Increases in EMG occurred in the initial home baseline session, but fell to low values with home training.

The Conners Parent Symptom Questionnaire data are shown in Fig. 3. Gradual reductions in the hyperactivity index occurred for each subject, with scores at the end of office training and follow-up at least one standard deviation lower than the scores at the end of baseline. These scores were still within the "hyperactive" range, being at least two standard deviations above the norm. Questionnaire scores for each child improved further when the mothers implemented training, falling below the "hyperactive" range at the last home follow-up.

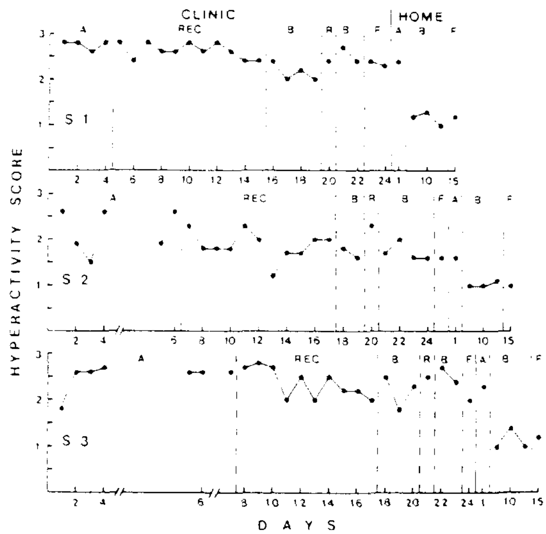

Fig. 3. Parental ratings on the hyperactivity scales of the Conners Parent Symptom Questionnaire for days on which observation or training was carried out. (Phases are as designated in Fig. 1.)

Pearson product-moment correlations between the BRS, frontalis EMG and the Conners for each subject are shown in Table 1. For all subjects there was a large and significant correlation between the BRS and EMG (the negative sign indicates that increasing BRS relaxation was associated with decreasing EMG) and a significant correlation between the BRS and the Conners. Subjects 2 and 3 also demonstrated a significant correlation between EMG levels and the Conners.

Table 1. Pearson product-moment correlations between the Behavioral Relaxation Scale, Frontalis EMG, and the Hyperactivity Scale of the Conners Parent Symptom Questionnaire

Subject	*r*	*p*
1		
BRS/EMG	−0.42	0.05
BRS/Conners	−0.70	0.001
EMG/Conners	+0.003	ns
2		
BRS/EMG	−0.56	0.01
BRS/Conners	−0.68	0.001
EMG/Conners	+0.52	0.01
3		
BRS/EMG	−0.81	0.001
BRS/Conners	−0.46	0.02
EMG/Conners	+0.45	0.02

Self-report measures did not correspond to other relaxation measures. With only one exception, all children reported themselves as "relaxed" on every session, including baseline.

DISCUSSION

BRT was found to be an effective method of teaching relaxation, as measured by BRS scores and frontalis EMG levels, to three children diagnosed as hyperactive according to multiple criteria. The objective nature of the relaxed behaviors made it relatively easy for the child to imitate and correct his performance when provided feedback, and for the experimenter to observe and consequate the subject's performance. An important contributing factor was the use of a beanbag chair, which allowed better body support than the adult-sized recliner. It is likely that progress would have been much more rapid if the beanbag had been used from the beginning. Maintenance of the relaxed behaviors was very good. Decrements at follow-up or in the home were quickly remedied by instructions or practice.

All mothers learned BRT very easily, though by the time they were introduced to the procedure their children were quite proficient and proudly showed off their relaxation skills. How well the mother could have implemented the procedure earlier in training is a matter for future study. Other programs have instructed parents to implement home relaxation practice (e.g., Braud *et al.,* 1975; Klein and Deffenbacher, 1977). The present study demonstrates that training parents and monitoring home practice can be easily implemented. Such training seems essential for long-term improvements.

The social validity measures were promising though certainly not conclusive. During office training no effort was made to transfer the relaxation skill to the home setting, but parental report on the Conners hyperactivity scale declined one standard deviation. Teaching the mothers to implement relaxation in the home was followed by sizeable decreases in the Conners scale. This may reflect changes in child behavior due to relaxation in the home, or the mothers may have altered their perception of their children after seeing them calm and quiet. At the conclusion of the study, the parents reported that the procedure was easily implemented with little or no inconvenience or change in daily routine, that it was very beneficial to their children, and that they would recommend the procedure to friends. These preliminary findings encourage further study of the effects of BRT on specific classes of hyperactive behavior.

Luiselli *et al.* (1981) caution that "the overzealous use of progressive muscle relaxation training as a setting event or as a nonspecific treatment procedure with school children may be unwarranted at this time". We suggest that, rather than rely on a "state" of relaxation, children be taught to engage in relaxed postures in situations in which they are likely to display hyperactive behavior. For example, in a classroom study period, or at home watching TV, children could be taught to slow their breathing, drop their jaw, remain quiet, and so forth. Observational measures of behaviors such as out-of-seat or talking to others would indicate the effectiveness of *in situ* BRT.

In summary, BRT appears to be an effective method of teaching relaxation to hyperactive children. Further research is needed to determine if a relaxed state has a calming effect on broad classes of hyperactive behavior, or if specific relaxed behaviors could be used by the child in difficult situations to compete with particular disruptive activities.

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