JOURNAL OF APPLIED BEHAVIOR ANALYSIS 1994, 27, 447–457 NUMBER 3 (FALL 1994)

A PRELIMINARY EVALUATION OF EMPIRICALLY DERIVED CONSEQUENCES FOR THE TREATMENT OF PICA

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Individualized treatment packages were developed for 3 children with high-rate severe pica using a discrimination training paradigm and a behavioral assessment-based procedure known as empirically derived consequences. Children received empirically derived reinforcers for eating under appropriate stimulus conditions (i.e., eating food only from a plate and placemat that served as a discriminative stimulus) and empirically derived punishers for attempts to engage in pica. This treatment package resulted in marked reductions in pica and an increase in appropriate eating for all 3 children in a "baited" analogue condition. In addition, low rates of pica were maintained for 9 months for all 3 children. These results suggest that treatment effectiveness may be enhanced when behavioral assessment data are used to identify potent consequences.

DESCRIPTORS: pica, severely mentally retarded, behavioral assessment, discrimination training

Pica, the ingestion of nonnutritive objects, is a specific form of self-injurious behavior that poses a significant health risk for a substantial number of persons with mental retardation. Pica has been reported to result in lead poisoning, intestinal blockage, parasites, surgery to remove objects from the stomach, and death (Foxx & Martin, 1975; Leventhal & Gimmon, 1978; Moncrieff et al., 1964). In fact, the risk of death from pica appears to be higher than from any other form of self-injury (McLoughlin, 1988). Unfortunately, the most frequently investigated treatments for pica, involving some combination of differential reinforcement, extinction, and punishment, have not been shown to be consistently successful (e.g., Bucher, Reykdal, & Albin, 1976).

As shown by Mace and Knight (1986), one approach to enhancing treatment efficacy of differential reinforcement is to prescribe specific interventions on the basis of functional assessment data (Carr & Durand, 1985; Iwata, Dorsey, Slifer, Bauman, & Richman, 1982). If pica is identified as serving a specific operant function, then treatment can be based on that identified function. However, for behaviors such as pica, the results of the functional analysis are often equivocal or may identify the behavior as being maintained by automatic or internal stimuli (Iwata, 1991). In addition, given the health risks associated with pica, conducting a functional analysis may be problematic. For these reasons, the use of a punishment procedure that rapidly suppresses pica warrants consideration.

In cases in which punishment is considered for inclusion in a behavioral treatment package, a systematic method for identifying effective punishers for specific individuals is needed. Although reinforcer assessment procedures are available (Fisher et al., 1992; Pace, Ivancic, Edwards, Iwata, & Page, 1985; Wacker, Berg, Wiggins, Muldoon, & Cavanaugh, 1985), a similar empirical approach to assessing punishers has not been reported in the literature. An empirical method for identifying effective punishers would have several advantages. First, an efficient method of identifying punishers increases the probability of quickly suppressing behavior and decreases the likelihood that the individual will be exposed to a series of potentially unpleasant, but not punishing, stimuli over ex-

This investigation was supported in part by Grant MCJ249149-02 from the Maternal and Child Health Service of the U.S. Department of Health and Human Services.

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tended time periods. Although the immediate result of conducting a punisher assessment is repeated exposure to potentially unpleasant stimuli, the long-term gain is an overall reduction in exposure to ineffective but unpleasant procedures. A second potential advantage is that the assessment data may permit reductions in the intensity of the punishing stimulus, because only the intensity necessary to suppress behavior is used during treatment. This is important, given that prior exposure to a low-intensity, less effective punisher may lessen the effectiveness of a moderate-intensity stimulus and, thus, increase the probability that a higher intensity stimulus will be required to achieve response suppression (Azrin & Holz, 1966).

The primary purpose of this investigation was to develop a preliminary technology for identifying effective punishers and reinforcers using a behavioral assessment-based procedure known as empirically derived consequences (EDC). To study the use of EDC, we selected pica as the initial target behavior because of its severity and because it is often maintained via automatic reinforcement. For both reasons, punishment is frequently considered for inclusion in treatment packages. The EDC procedure for pica consisted of (a) standardized protocols for identifying potent reinforcers and punishers, and (b) a discrimination training paradigm wherein children received the empirically derived reinforcers for eating under appropriate stimulus conditions (i.e., eating food only from a plate and placemat that served as a discriminative stimulus) and empirically derived punishers for attempts to engage in pica. When the treatment packages were demonstrated to be effective in an analogue condition, we assessed the extent to which the treatments reduced pica across the day in different settings and over time.

METHOD

Subjects and Setting

Three children with severe pica were admitted to an inpatient unit specializing in the treatment of destructive behavior disorders. Ava, age 3 years, was diagnosed with severe mental retardation, seizure disorder, and postherpes encephalitis. Ava's pica included ingestion of broken light bulbs, feces, pet hair, insects, and cigarette butts. Previous interventions implemented at home had been supervised by trained applied behavior analysts and included differential reinforcement of other behavior (DRO), training in alternative behavior (i.e., to throw pica items in the garbage can), blocking pica, redirecting her to an appropriate activity (e.g., toy play), and time-out. Jeff, age 5 years, was diagnosed with profound mental retardation and pervasive developmental disorder. Prior to admission, Jeff's pica was considered to be sufficiently dangerous that he had been prescribed arm restraints and a helmet with a faceguard that proved to be unsuccessful for preventing his pica (which included ingestion of grass, bugs, string, glass, tile adhesive, plaster, and rocks). Previous interventions, also under the direction of a behavior analyst, included constant supervision, frequent hand washing, praise for appropriate toy play, and verbal reprimands for pica. Tom, age 3 years, was diagnosed with severe mental retardation and pervasive developmental disorder. Tom's history of pica included ingestion of rocks, wood chips, feces, and dirt. Tom was seen by a series of trained behavior analysts who had unsuccessfully attempted to treat his pica on an outpatient basis using functional communication training, reinforcement of compliance, DRO, and ignoring.

Sessions were conducted in a treatment room (3 m by 3 m). The room contained a table, chair, and a few toys. Small pieces of food were scattered on the floor, table, and window sill. In addition, edible items resembling nonfood items, such as paint chips (made from flour and water), metal pieces (cake decorations), and cleaning fluid (water with food coloring), were available. All surfaces were cleaned prior to the distribution of the edible items.

Human Rights Procedures

Prior to initiation of the stimulus avoidance assessment and the punisher assessment (described below), the procedures were reviewed and approved by the Institute's Human Rights Committee. In

addition, each of the procedures was discussed in detail with and approved by the child's caregivers. The caregivers were also provided with information on the availability of alternative treatment procedures. If any child exhibited excessive or unexpected emotional responses during any of the procedures (i.e., emotional responses more intense than those observed during the client's normal daily routine), a supervising psychologist would have been notified; however, this did not occur with any children in the current investigation.

Procedure

Identification of reinforcers. Reinforcers were identified through a two-step assessment procedure that was described in detail by Fisher et al. (1992). (The stimulus preference and reinforcer assessment data for Ava are representative of the data in the current investigation and are published in Fisher et al. The list of specific stimuli selected by each client during the forced-choice assessment is available from the authors upon request.) During the first step, forced-choice assessment, a standard set of 16 stimuli were presented two at a time. Each stimulus was presented once with every other stimulus. On each trial, two stimuli were placed in front of the child, and brief access was given to the first stimulus the child approached. If neither stimulus was approached within 5 s, the therapist prompted the child to sample each stimulus and then the trial was repeated. Trained observers recorded approach responses during each trial in order to identify highly preferred items. Jeff and Tom appeared to exhibit preferences for items not included on the standard forced-choice assessment. Therefore, to insure that the most potent reinforcers were used for each child, parents were interviewed to identify other high-preference items or activities not included in the standard forced-choice assessment. The information generated from the parental interview was then added to the information generated from the standard forced-choice procedure for use in the reinforcer assessment.

During the second step, reinforcer assessment, a concurrent operants paradigm was used to evaluate whether stimuli identified as high preference during the forced-choice assessment and by parental report functioned as reinforcers. During the baseline phase, free-operant levels of simple, equivalent target responses (e.g., sitting in Chair A vs. Chair B) were obtained. For children who resisted sitting in a chair, squares (2 ft by 2 ft) were outlined on the floor of the room, and "in-square" behavior was used as the target response in place of "in-seat" behavior. Each chair or square was associated with a particular stimulus by placing the stimulus in or next to the corresponding chair or square (e.g., cracker next to Chair A vs. cheese next to Chair B), and the child gained access to the stimulus by emitting one of the operants (e.g., the cracker was presented for sitting in Chair A). The stimulus associated with a particular square or chair was presented by the therapist immediately after the child stood in the square or sat in the chair and was withdrawn immediately if the child left the square or chair. Social stimuli (e.g., praise, hugs) or stimuli that could be consumed rapidly (e.g., juice, cracker) were presented once every 10 s while the child stood in the square or was seated in the chair.

Data were collected on laptop computers by trained observers who recorded the total duration of in-seat or in-square behavior during the 10-min session. The stimuli selected as reinforcers for each child were the stimuli associated with the highest and most stable rates of in-seat or in-square behavior during the reinforcer assessment (i.e., juice and cracker for Ava, fan and busy box for Tom, and cheese and string toys for Jeff).

Identification of punishers. Punishers were also identified through a two-step process consisting of a stimulus avoidance assessment and a punisher assessment. The stimulus avoidance assessment was based on the stimulus preference assessment developed by Pace et al. (1985). The rationale for the stimulus avoidance assessment is that just as high-preference items or activities have been demonstrated to function as reinforcers, those items or activities that an individual avoids or does not prefer may function as punishers. In the current investigation, the nine potential punishers listed in Table 1 were assessed with each child. These nine pro-

Table 1
Operational Definitions of the Procedures Evaluated During the Stimulus Avoidance Assessment

Basketbold time-out: The therapist stood behind the child and held the child above the wrists with the child's arms folded across the chest.

Tidiness training: Toys and crumpled paper were strewn around the room, and the therapist instructed the child to put the paper in the garbage and the toys in a toy crate. If the child did not begin the task after 5 s, the therapist used the minimum amount of physical prompting necessary to guide the child to complete the task.

Chair time-out: The therapist instructed the child to go to time-out. If the child did not comply with the instruction within 5 s, the therapist used the minimum amount of physical prompting necessary to guide the child to sit in the designated time-out chair that was positioned in a corner.

Water mist: The therapist stood directly in front of the child and activated a plant mister approximately 6 in. away from the tip of the child's nose. The mister was slanted downward to avoid spraying directly into the child's eyes.

Facial screen: The therapist stood behind the child and placed one arm around the child's arms while placing the other hand over the child's eyes.

Contingent demands: The therapist stood behind the child and said, "[child's name], touch your head, touch your shoulders, touch your waist, touch your shoulders, touch your head," while using the minimum amount of physical prompting necessary to guide the child to complete demands.

Contingent exercise: The therapist stood behind the child and said, "[Child's name], touch your toes," while using the minimum amount of physical prompting necessary to guide the child to complete the exercise.

Hands down: The therapist stood behind the child and held the child's hands to his or her sides.

Quiet hands: The therapist used the minimum amount of physical prompting necessary to guide the child's hands onto the child's lap for 5 s at a time. The therapist repeated the procedure, allotting 5 s between each implementation.

cedures were selected because of their reported effectiveness in the literature and their previously demonstrated effectiveness on our unit with other children.

Before each session, one of the procedures was selected randomly for assessment. One session was conducted for each procedure. During the session, the participant and therapist were alone in the room. The selected procedure was implemented with the participant approximately 10 times (i.e., 10 trials) in a single session with a 30-s interval between each implementation. A buzzer was sounded immediately before each implementation of the procedure to help to prevent superstitious conditioning. The procedures were presented noncontingently and associated with a buzzer for two reasons: (a) Pilot data indicated that clients occasionally displayed positive vocalizations and approach responses (e.g., signing "more") following implementation of one or more of the procedures, and contingent application of the procedures could have placed the target response on a mixed schedule of reinforcement and punishment; and (b) if we had established a response–stimulus relationship between pica and a procedure that elicited a burst of maladaptive behavior, we either would have had to terminate the procedure in the middle of the burst (and potentially reinforce the burst) or continue to implement the procedure until the burst ended (resulting in many more applications than was otherwise necessary). The length of each trial was selected randomly, such that the procedure was implemented approximately twice for each of the following durations: 15 s, 30 s, 60 s, 120 s, and 180 s. One exception was water mist, which was implemented for approximately 1 s each time. The trial lengths were varied to help to determine the most effective duration for each procedure. (Because no clear differences were obtained, the 30-s duration was selected for practical reasons during subsequent treatment sessions.) The session was terminated after 20 min. Both adaptive and maladaptive behaviors were ignored. Following each session, the therapist and child participated in a preferred activity in the session room to help to prevent either the therapist or the room from becoming a negative stimulus.

A trained observer recorded on a laptop computer each occurrence of the following target responses: (a) *negative vocalizations,* defined as crying, screaming, cursing, yelling, and grunting, or negative verbalizations such as "go away," "stop," and so forth; (b) *avoidance movements,* defined as physically resisting implementation of the procedure (e.g., turning head or body away, stepping away, dropping to the floor, using hands or legs to block implementation of the procedure, etc.); (c) *escape from procedure,* defined as the child successfully stopping the implementation of the procedure when it had begun (e.g., the child breaks

out of a basket-hold); and (d) *positive vocalizations,* defined as laughing, smiling, signing "more," or positive verbalizations such as "fun," "more," "please," and so forth. Negative vocalizations and avoidance movements were used as a measure of nonpreference for the procedure, escape from procedure was used to measure treatment integrity, and positive vocalizations were used as a measure of preference for the procedure.

Next, three stimuli, defined as "low," "medium," and "high," were selected for each child based on the results of the stimulus avoidance assessment and were compared to determine which stimuli actually functioned as punishers during the punisher assessment. We hypothesized that for Ava, avoidance movements occasioned by a specific procedure reflected nonpreference for a procedure. Thus, for Ava, the procedures with the lowest, the median, and the highest number of avoidance movements (i.e., contingent demands, hands down, and facial screen, respectively) were selected for comparison during the punisher assessment. For Jeff and Tom, we eliminated procedures for which escapes occurred; for Jeff we then selected the low, medium, and high stimuli based on the combined rate of avoidance movements plus negative vocalizations. With this selection method, the low, medium, and high stimuli were tidiness training, contingent demands, and facial screen, respectively. Tom exhibited both positive and negative vocalizations in response to the same procedures. Thus, for Tom, we eliminated procedures for which escapes occurred, and then selected from the remaining procedures based on the combined rate of avoidance movements plus negative vocalizations minus positive vocalizations. With this selection method, the low, medium, and high stimuli were water mist, contingent exercise, and facial screen, respectively.

During baseline of the punisher assessment, the child and therapist were in a treatment room, and the child was given the opportunity to play with toys. The therapist presented social attention in the form of a verbal reprimand contingent upon targeted maladaptive response(s). The target maladaptive responses for each child were: (a) for Ava, pica, defined as placing inedible objects into her mouth; placing food from the floor, furniture, or window sill into her mouth; or licking objects, clothing, walls, or furniture; (b) for Tom, inappropriate touching, defined as placing his hand or fingers inside the clothing of another person (e.g., sleeves, pant legs, skirts) or touching another person's foot or ankle; and (c) for Jeff, disruptions, defined as banging his hand or an object on the floor, wall, or surface; throwing objects; stepping on toys; or stomping his foot or feet. All behaviors were recorded as responses per minute by trained observers on laptop computers during the 10-min session.

During the multielement punisher assessment, one of the three procedures was selected randomly for use. The contingencies for the session were explained and demonstrated to the child. The conditions were identical to baseline, except that each time the child displayed a target maladaptive behavior, the therapist provided a verbal reprimand (as in baseline) and then immediately implemented the potential punishment procedure selected for that session for 30 s. The stimulus that produced the greatest reduction in target response(s) during the multielement punisher assessment was then selected as the punishment component for treatment; this stimulus was facial screen for each child.

Evaluation of the treatment package. When reinforcers and punishers were identified, the efficacy of the treatment package for decreasing pica and increasing appropriate eating was evaluated in a baited environment using a multielement design. Pica was defined as placing inedible objects into mouth; placing food from the floor, furniture, or window sill into mouth; or licking objects, clothing, walls, or furniture. Appropriate eating was defined as placing food from the plate and placement into the mouth. All baseline and treatment sessions lasted 10 min. During baseline, the therapist verbally attended to occurrences of pica for Ava and Tom (e.g., "don't eat that; it's yucky"); for Jeff, the therapist ignored pica. In the food-access condition, sessions were identical to baseline sessions with the addition of a placemat and plate with appropriate food items on the plate. For Ava and Tom, the

therapist verbally attended to appropriate eating and to pica (as in baseline); for Jeff, the therapist ignored appropriate eating and pica (as in baseline). If the child ate all of the appropriate food items, the therapist replenished the supply. The purpose of this phase was to determine if the availability of appropriate food items and other potential discriminative stimuli (i.e., the plate and placemat) had differential effects on the rate of pica.

During EDC treatment sessions, appropriate eating from the plate on the placemat was differentially reinforced for 30 s using the empirically derived reinforcer, and occurrences of pica resulted in a verbal reprimand and the 30-s empirically derived punishment procedure. Before each session, the therapist used the minimum amount of physical prompting necessary to have the child bring an appropriate food item from the plate to his or her mouth; the therapist then immediately presented a reinforcer. Next, the therapist prompted the child in the same manner to bring an inappropriate item to his or her mouth; the therapist then immediately implemented the punisher. This was done in anticipation of generalizing the treatment to other therapists and settings and to the parents with the hope that preexposure to the contingencies would function as discriminative stimuli for low and high rates of pica and appropriate eating, respectively, and decrease the likelihood that the client would emit a burst of pica to test the contingencies with each new therapist and setting.

During the punisher-fading condition implemented with Jeff, a verbal warning was given following an occurrence of pica. If pica occurred again within 30 s of the warning, the facial screen was applied.

Design

Punisher assessment. During the punisher assessment, an ABA multielement design was used to evaluate the efficacy of the procedures for all children. During the first and last phases, baseline contingencies were in effect. During the middle phase, three punishers were compared using a multielement design.

Evaluation of the treatment package. During the evaluation, an ABACAD multielement design was used to evaluate the treatment and generalization effects of the EDC package on pica and appropriate eating for Ava. Following the initial baseline (A), the food-access condition (B) was implemented to evaluate the extent to which the availability of appropriate food items would result in a reduction in pica. This was done to control for the fact that the EDC package involved both a change in contingencies and the introduction of appropriate food items. In the multielement phase (C), baseline and treatment sessions were alternated in accordance with a multielement design to evaluate the treatment and generalization effects of the EDC package on pica. Following a return to baseline (A), the EDC package was reintroduced (D). For Jeff, the final phase consisted of the EDC package plus punisher fading. For Tom, the design was the same as for Ava except that additional food-access and baseline phases were conducted after the multielement phase to determine whether the plate and placemat functioned as a discriminative stimulus for low rates of pica following treatment with EDC.

Interobserver Agreement

Trained observers recorded responses for all behavioral assessment and treatment sessions. Paper-and-pencil methods were used to record approach responses during the forced-choice assessment, and laptop computers were used during all other assessment and treatment sessions. A second independent observer recorded responses during an average of 83% of trials for the forced-choice assessment (range, 51% to 100%), 52% of reinforcer assessment sessions (range, 47% to 55%), 67% of stimulus avoidance sessions (range, 33% to 100%), 77% of punisher assessment sessions (range, 54% to 95%), and 57% of sessions during the evaluation of the treatment package (range, 41% to 84%).

During the forced-choice assessment, the average agreement coefficients across subjects were 93% for occurrence (range, 91% to 95%) and 93% for nonoccurrence (range, 90% to 96%). During the re-

inforcer assessment, stimulus avoidance assessment, punishment assessment, and evaluation of the EDC treatment package, exact interval-by-interval agreement coefficients were calculated as a measure of reliability for target responses by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. An agreement was defined as a 10-s interval in which both observers recorded exactly the same number of occurrences of the target behavior or exactly the same duration of behavior. The average exact agreement coefficient across children for the reinforcer assessment was 98.4% (range, 98% to 99%). For stimulus avoidance, the average exact agreement coefficients across children were 92% for negative vocalizations (range, 84% to 100%), 93% for avoidance movements (range, 90% to 97%), 99.5% for escape from procedure (range, 99% to 100%), and 96% for positive vocalizations (range, 93% to 99%). For the punisher assessment, the average exact agreement coefficients were 94% for pica (Ava), 96% for inappropriate touching (Tom), and 90% for disruptions (Jeff). During the evaluation of the EDC treatment, the average exact agreement coefficients across children was 94% for pica (range, 92% to 96%) and 98% for appropriate eating (range, 97% to 99%).

Unit Data

On the inpatient unit, the frequency of pica during half-hour intervals was recorded for each child by trained observers during all of the children's waking hours. When the efficacy of treatment was demonstrated in analogue sessions, the treatment package was implemented throughout the day on the living unit for all children.

RESULTS

Figure 1 depicts the results of the stimulus avoidance assessment and punisher assessment for each child. The results from the stimulus avoidance assessment are ranked from high to low according to the formula indicated for each child. During the punisher assessment, the average frequency of the target responses per minute during the initial baseline was 7.45 for Ava, 7.85 for Jeff, and 1.29 for Tom. For Ava, all three punishers resulted in reductions in pica (facial screen, $M = 0.71$; hands down, $M = 1.06$; contingent demands, $M = 1.04$), with facial screen resulting in the lowest mean rates of behavior. For Jeff, facial screen resulted in the lowest mean rates of disruptive behavior (facial screen, $M = 0.28$; contingent demands, $M = 1.79$; tidiness training, $M = 0.82$). For Tom, water mist was ineffective ($M = 1.4$), contingent exercise was moderately effective ($M = 0.66$), and facial screen was most effective at reducing inappropriate touching ($M = 0.3$). The average rates of the target responses during the second baseline were 7.13 for Ava, 3.21 for Jeff, and 3.53 for Tom.

Figure 2 depicts the results of the treatment package. During the initial baseline, the mean responses per minute of pica were 3.2 for Ava, 8.9 for Jeff, and 5.1 for Tom. Providing access to appropriate food items in the food-access phase did not result in a substantial decrease in pica for any of the children. During the first return to baseline, the rates of pica were slightly higher for Ava but remained unchanged for Jeff and Tom.

In the next phase, treatment sessions and baseline sessions were alternated. For all 3 children, the rates of pica during treatment sessions were markedly reduced from baseline levels, and for Jeff, a carryover effect to baseline occurred. When EDC was reintroduced in subsequent phases, similar reductions in pica were observed, with the follow-up data suggesting durable effects for up to 9 months.

In addition to decreasing pica, appropriate eating was higher during the EDC phases than during the food-access phases. During the food-access phases, mean responses per minute of appropriate eating were 0.48 for Ava, 0.1 for Jeff, and 0.2 for Tom. During the EDC phases, the mean rate of appropriate eating was 1.3 for Ava, 0.52 for Jeff, and 1.96 for Tom.

Additional reversals were conducted for Tom between baseline and food-access phases to determine whether the plate and placemat functioned as a discriminative stimulus for increased appropriate eating and decreased pica. When the food-access condition was reintroduced with Tom, low

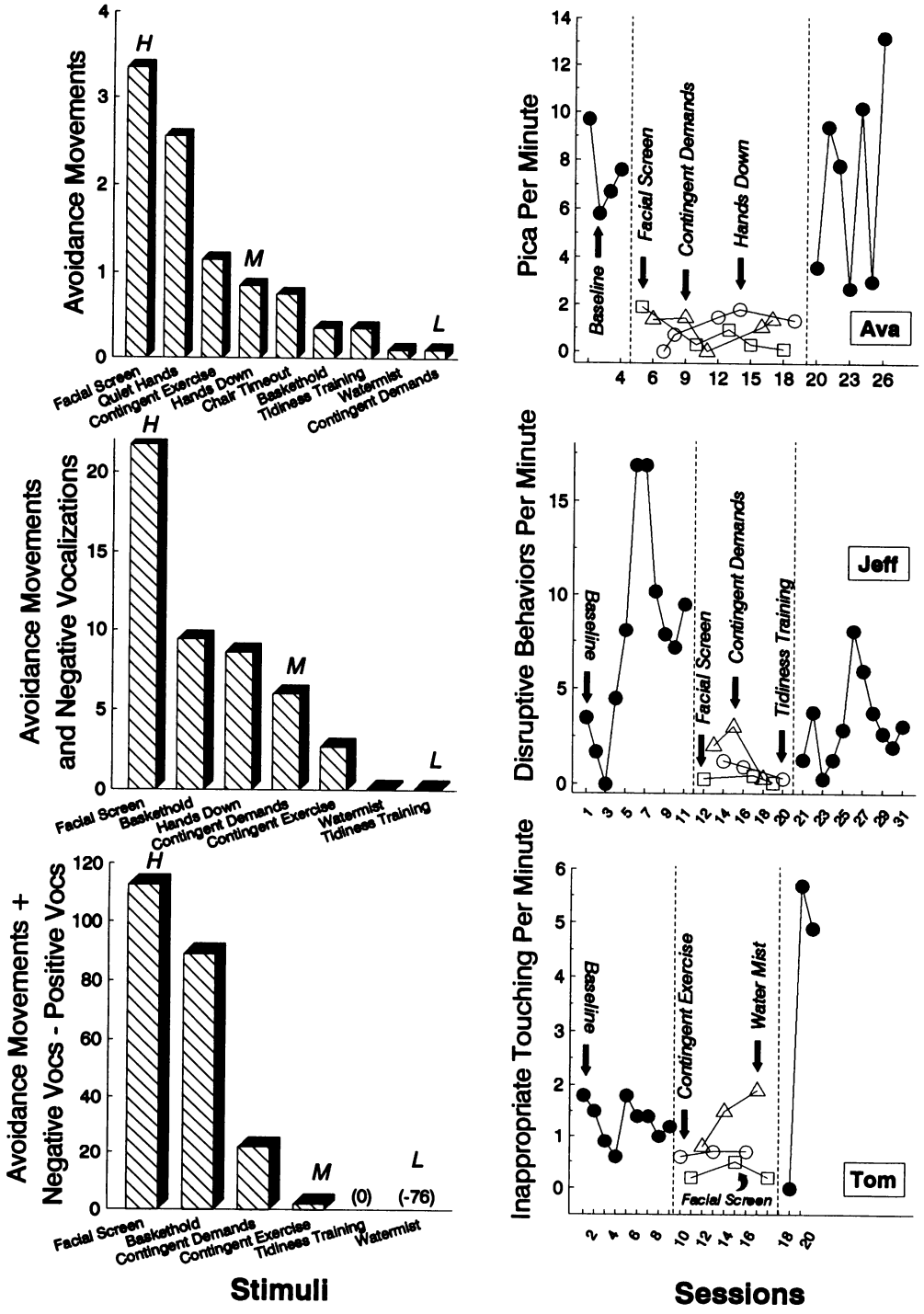

Figure 1. Results of stimulus avoidance assessments (left) and punisher assessments (right).

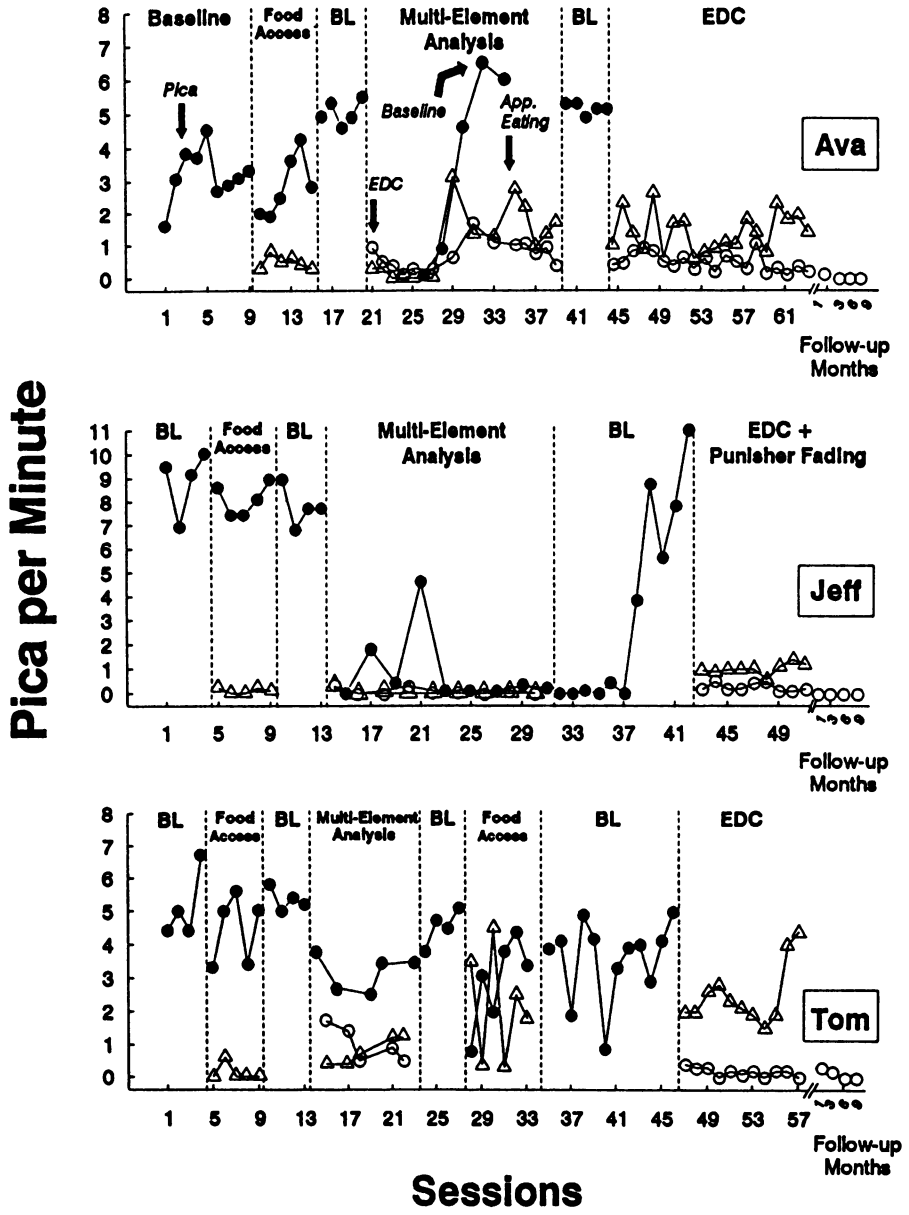

Figure 2. The rate of pica during sessions in a baited environment.

rates of pica were observed in the first session, but the rates of pica gradually increased in subsequent sessions of this phase. These results indicate that the introduction of the plate and placemat produced only temporary reductions in pica when this stimulus was not associated with the empirically derived consequences.

On the living unit during baseline, the mean number of occurrences of pica per hour was 4.5 for Ava, 3.8 for Jeff, and 4.9 for Tom. During treatment with the EDC package, the mean rate was 1.7 for Ava, 0.75 for Jeff, and 0.21 for Tom, and for the last 10 treatment days, the mean rate of pica was 0.87 for Ava, 0.58 for Jeff, and 0.23 for Tom.

DISCUSSION

In this preliminary investigation, we evaluated the procedure known as empirically derived con-

sequences for developing a treatment package for pica. With this approach, systematic stimulus assessments were conducted to identify potent reinforcers and punishers. The identified reinforcers and punishers were then used as part of a treatment package wherein children received reinforcers contingent upon appropriate eating and punishers contingent upon pica. Three potentially important findings were that treatment produced decreased pica during treatment and baseline sessions conducted in the multielement phase, appropriate eating increased during the EDC phase, and treatment effects were durable over time. Although these findings warrant further study, the paucity of follow-up data on the behavioral treatment of pica in the literature makes the maintenance data especially noteworthy. In one of the few investigations that included follow-up data, Foxx and Livesay (1984) reported that 3 of 4 children treated for pica with overcorrection had died within 10 years. In contrast, the 4 children treated for problems other than pica were still alive. Thus, pica is a chronic problem for persons with severe to profound mental retardation, and behavioral interventions may reduce risks of serious injury or even death, but only if treatment effects are maintained over time.

In cases in which pica or some other behavior is life threatening and reinforcement-based strategies have been ineffective, it may be reasonable to consider the addition of a punishment procedure. In the current investigation, we evaluated a preliminary technology for identifying punishment procedures for persons with severe disabilities that is comparable to procedures developed for identifying reinforcers (e.g., Charlop, Kurtz, & Casey, 1990; Fisher et al., 1992; Wacker et al., 1985). The advantage of this procedure was that treatment effects were achieved rapidly for all three cases of potentially life-threatening pica. In addition, brief exposures to potentially unpleasant stimuli during the stimulus avoidance and punisher assessments may have reduced the total number of exposures of unpleasant stimuli during unsuccessful treatment phases. For Ava, Jeff, and Tom, the most effective punisher (facial screen) was implemented 33%, 66%, and 55% (respectively) fewer times than the next most effective procedure during the punisher assessment.

Negative side effects are an important consideration when evaluating the relative advantages and disadvantages of any punishment procedure. Although all of the children demonstrated avoidance movements and/or negative vocalizations during the stimulus avoidance assessment, these responses stopped when the session was terminated. Although these findings are anecdotal, they are consistent with the basic literature in that sustained emotional distress is not a typical effect of punishment (Azrin & Holz, 1966).

To decrease the possibility that the punisher would produce the negative side effect of decrements in appropriate eating, the reinforcement component, differential reinforcement of appropriate eating, facilitated discrimination between appropriate eating and pica. Discrimination training could be accomplished by teaching the child which items are appropriate for eating (Finney, Russo, & Cataldo, 1982). However, persons with severe to profound mental retardation may not generalize this information and may require training each time new food items are encountered. The plate and placemat enabled the child to learn one simple discrimination.

It is important to note that pica was not eliminated completely with the introduction of treatment. For this reason, behavior analysts who choose to use this EDC package to treat pica should take additional measures to further lessen the health risks associated with pica. With the children in the present study, the treatment was first evaluated in a baited environment and was then generalized to a relatively safe environment (the living unit). The living unit was monitored closely so that objects that were sharp or small enough to be swallowed were not available. Follow-up sessions conducted in the home and other community settings were undertaken only after pica had been reduced by at least 90% from baseline in the baited sessions. In addition, these environments were monitored routinely to remove potentially dangerous objects.

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Received November 30, 1992
Initial editorial decision February 4, 1993
Revisions received April 7, 1993; June 16, 1993; July 2, 1993; February 18, 1994
Final acceptance February 18, 1994
Action Editor, David P. Wacker