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THE USE OF BEHAVIORAL ASSESSMENT TO PRESCRIBE AND EVALUATE TREATMENTS FOR SEVERELY HANDICAPPED CHILDREN

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Behavioral assessment procedures were used to prescribe and evaluate treatments of maladaptive behavior for 2 children with severe multiple handicaps. In Experiment 1, the results of an assessment of reinforcer preference were used in conjunction with a functional analysis of the conditions maintaining self-injurious behavior to prescribe a treatment for a child with severe disabilities. The treatment procedure involved the use of a pressure-sensitive microswitch to activate reinforcing stimuli during two solitary conditions, during which self-injurious behavior had occurred at high rates. The results were evaluated with a multiple baseline across settings design and indicated that self-injury decreased with concomitant increases in microswitch activation. Results were maintained at 6 weeks, 8 weeks, and 6 months. In Experiment 2, the results of behavioral assessments of reinforcer preference and self-injurious behavior were combined to develop a treatment for a second severely handicapped child, who exhibited high rates of self-injury in demand situations. This treatment was evaluated with a multiple baseline across tasks design and resulted in the elimination of self-injury for up to 15 months.

DESCRIPTORS: behavioral assessment, self-injurious behavior, assessment of reinforcer preference, severely handicapped

Results of several recent investigations suggest that students with severe multiple handicaps are responsive to their environments and that their behavior can be used to identify potential reinforcers within the environment. Two types of studies have particular relevance to professionals working with clients who have severe behavioral deficits and excesses: (a) research on the identificaton of reinforcer preference (increase in motor behavior as a function of defined consequences), and (b) functional analysis of the controlling variables of maladaptive behaviors.

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The first area of research, assessment of reinforcer preference, generally involves the identification of sensory reinforcers (Datillo, 1986; Fehr, Wacker, Trezise, Lennon, & Meyerson, 1979; Wacker, Berg, Wiggins, Muldoon, & Cavanaugh, 1985). For example, Wacker et al. (1985) increased the arm- or head-lifting behaviors of profoundly and multiply handicapped students through contingent presentation of battery-operated devices that were activated via microswitches. Reinforcers were identified for every student, with several students demonstrating reinforcer preferences. Similarly, Datillo (1986) used a computer program to evaluate microswitch activation of various stimuli (auditory, visual, and tactile) by 3 severely handicapped individuals. The data from both studies revealed idiosyncratic patterns of stimulus preference, suggesting that students with severe handicaps can demonstrate preferences for specific stimuli. Finally, Pace, Ivancic, Edwards, Iwata, and Page (1985) used a two-step procedure to assess the stimulus preferences of 6 profoundly mentally retarded students.

Initially, the authors evaluated the students' approach to each of the 16 stimuli. They then examined the reinforcing properties of preferred and nonpreferred stimuli by delivering them contingently on the occurrence of selected behaviors and found that preferred stimuli resulted in higher rates of responding compared to both baseline and nonpreferred stimuli.

The results of these studies suggest that the stimulus preferences of individuals with severe multiple handicaps can be empirically identified and analyzed through a functional analysis of behavior. However, the application of these assessments to the ongoing treatment of children has not yet been demonstrated.

The second area of research examined the functional relationship of antecedent and consequence variables associated with self-injurious behaviors, indicating that in at least some instances, self-injury may be a function of different sources of control (Carr, 1977; Carr & Durand, 1985; Durand & Carr, 1985; Iwata, Dorsey, Slifer, Bauman, & Richman, 1982; Weeks & Gaylord-Ross, 1981). For example, Weeks and Gaylord-Ross (1981) examined the influence of task difficulty on self-injurious behavior with 2 severely handicapped children. Markedly higher rates of self-injury occurred in demand versus no-demand conditions. Moreover, higher rates of self-injury were observed when students were exposed to difficult tasks as compared to easy tasks. The authors concluded that the subjects' self-injury was maintained by negative reinforcement contingencies.

Iwata et al. (1982) assessed the functional relationships between self-injurious behaviors and antecedent and consequent conditions with mentally retarded subjects. Self-injury was measured within four conditions: (a) social disapproval, (b) academic demand, (c) unstructured play, and (d) alone. The results indicated that occurrences of self-injury varied considerably, both between and within subjects. In 6 of the 9 subjects, higher levels of self-injury were associated with a specific stimulus condition, suggesting that self-injury may be a function of different sources of reinforcement. Iwata et al. (1982) suggested that data from these functional assessments can be used as the basis for selecting child-specific treatment strategies.

Carr and Durand (1985) evaluated the effectiveness of an assessment method for identifying conditions in which maladaptive behaviors (e.g., aggression, tantrums, self-injury) occur and used the assessment data to select relevant "communicative" behavior to replace maladaptive behavior. Following assessment, each of 4 subjects was taught verbal communication phrases that elicited either adult attention or assistance. Disruptive behavior was reduced to low levels when subjects emitted the trained communicative responses, but remained high when they emitted irrelevant communicative responses. These authors demonstrated that to be effective in reducing maladaptive behaviors, the incompatible communicative behavior must be functionally related to the controlling stimuli.

Assessment of reinforcer preference and evaluation of self-injurious behavior are interrelated to the extent that if the findings of these investigations prove to be generalizable (i.e., previously defined reinforcers are applied in a way that is functionally related to the variables controlling maladaptive behavior), a proactive treatment technology may then be available for severely handicapped persons who engage in maladaptive behaviors. Assessments of both reinforcer preferences and controlling variables of maladaptive behavior provide the behavior therapist with a functional analysis of current maladaptive behavior and with a specific stimulus that can serve to reinforce alternative behaviors.

The current investigation extends existing literature on the control of maladaptive behavior by systematically evaluating stimulus preferences and their generalizability to the control of maladaptive behavior. In both experiments, we combined the assessment of reinforcer preferences and the functional analysis of behavior to prescribe treatments of self-injurious behavior in 2 severely handicapped children. In the first experiment, we assessed and treated a child's self-injury that occurred primarily during conditions when the child was alone. In the second experiment, we assessed and treated a child's self-injury that occurred during instructional training activities.

EXPERIMENT 1: APPLICABILITY OF ASSESSMENT OF REINFORCER PREFERENCE IN THE TREATMENT OF CHRONIC SELF-INJURY

METHOD

Subject

Ron, a severely multiply handicapped 8-year-old student, participated in the experiment. He was nonverbal and nonambulatory. He was enrolled in a public school program serving severely handicapped students and was referred to the school psychologist for assessment and treatment of self-injurious behavior. Ron had been observed to engage in hand-mouthing behaviors for several years. His chronic hand mouthing had produced skin irritations and mild tissue damage.

Setting, Target Behavior, and Materials

Baseline, assessment, treatment, and maintenance sessions were conducted in one classroom. Three to 5 students and 2 to 4 educational staff were present during the sessions at any given time.

Two target behaviors were evaluated. Self-injurious behavior was defined as Ron biting his hand (teeth touching the skin of the hand). The second target behavior was activation of a pressure-sensitive microswitch.

A 15- by 15-cm pressure-sensitive (contact) microswitch was used during all phases of the investigation. When Ron pressed the microswitch, one of two stimuli were activated: a radio or a room fan. When Ron removed his hand from the microswitch, the radio or fan immediately stopped. These stimuli were selected by the classroom teacher as being potentially reinforcing to Ron. During the assessment of reinforcer preference, a restraint box was attached to Ron's lap tray on his wheelchair. The restraint box had solid sides and a Plexiglas top; it permitted Ron to have free movement across the entire lap tray but prevented him from raising his hands to his mouth. A clock was used to record the cumulative duration of microswitch activation. The clock was plugged into the same circuit as the radio or fan and was activated when the microswitch was pressed.

Data Collection and Reliability

The first author and one of two trained observers (graduate students in school psychology) simultaneously but independently observed and recorded occurrences of self-injurious behavior using a 6-s interval recording procedure. Reliability observations were conducted during both baseline sessions of assessment of reinforcer preference, 31% of the baseline sessions of self-injurious behavior, 25% of the treatment sessions of self-injurious behavior, and 67% of the maintenance sessions. Overall measures of agreement were calculated by dividing the number of agreements per 6-s interval by the total number of agreements plus disagreements and multiplying by 100. Interobserver agreement was 100% during assessment of reinforcer preference, 99% (range, 90% to 100%) during baseline of self-injurious behavior, 99% (range, 95% to 100%) during treatment of self-injurious behavior, and 97% (range, 89% to 100%) during maintenance sessions.

Design and Procedures

An alternating treatments design was used to evaluate the results of the assessment of reinforcer preference. A multiple baseline across settings design was used to evaluate the efficacy of the treatment of self-injurious behavior.

Assessment of reinforcer preference. Ron was positioned in his wheelchair by the classroom teacher with a microswitch placed on his lap tray during both baseline and assessment phases. During baseline, the two stimuli (radio and fan) were positioned on a table in front of Ron but were not connected to the microswitch. Ron was verbally prompted ("Ron, press the switch") to press the microswitch at the beginning of each session. If he did not respond to the verbal prompt, the classroom teacher provided a physical prompt (i.e., physical guidance) to activate the microswitch. This prompting was repeated every 5 min throughout each session. Each session lasted 15 min. Both the cumulative duration

of microswitch activation and the occurrence of self-injury were measured.

During assessment sessions, the conditions were identical to those in baseline with two exceptions: (a) the microswitch was connected to either the radio or the fan and (b) the restraint box was secured to Ron's lap tray, thus preventing occurrences of self-injury. Presentation of stimuli was counterbalanced, with each stimulus presented for a maximum of two consecutive sessions. Two sessions were conducted each day.

Baseline of self-injurious behavior. The percentage occurrence of self-injurious behavior was measured within three conditions: (a) solitary toileting, (b) solitary positioning, and (c) vocational task. The initiation of baseline conditions coincided with the onset of baseline of assessment of reinforcer preference. During the solitary toileting condition, Ron was positioned for 15 min on a toileting chair with a lap tray. The chair was located in a 6- by 12-ft area that was separated from the classroom by a partition. During the solitary positioning condition, Ron was positioned for 15 min in a stand-up box with a tray. The stand-up box was placed within view of teachers and students, but Ron did not have direct contact with them. During the vocational task condition, a classroom teacher or an aide provided Ron with direct instruction on a functional, age-appropriate vocational activity (e.g., sorting washcloths into students' grooming containers) for up to 15 min. During this activity, a least-to-most restrictive prompt sequence was used to train Ron to perform the tasks. The two solitary conditions were selected because the teacher reported high rates of hand mouthing whenever Ron was alone. The vocational task was selected as a control condition because the teacher reported no instances of hand mouthing during this activity. By including a vocational task that involved high demands and constant social attention, we were able to evaluate the effects of these variables on Ron's self-injurious behavior. The activities in each condition (toileting, positioning, vocational) were included as educational objectives in Ron's Individual Education Plan. During each of these conditions, the observers were present in the classroom but did not interact with Ron. The first three observations in each of these three conditions served as the behavioral assessment of self-injury.

Treatment of self-injurious behavior. Following baseline, treatment of self-injury was implemented during the 15-min toileting and positioning conditions while ongoing assessment occurred in the vocational task condition. Treatment of self-injury involved the use of the microswitch to activate reinforcing stimuli that were identified during the previous assessment of reinforcers. Presentation of stimuli was counterbalanced during each condition. The microswitch was placed on Ron's lap tray or stand-up box tray at a distance that prevented incidental activation (e.g., laying head on switch) but permitted access with both hands. The classroom teacher provided a verbal prompt ("Ron, press the switch") at the beginning of each 15-min session but provided no further assistance.

Results and Discussion

During the baseline phase of reinforcer assessment, Ron seldom pressed the microswitch ($\leq 10\%$ occurrence) but displayed high rates of self-injurious behavior ($\geq 90\%$ occurrence). However, when the switch activated the fan, the immediate effect was an increase in the occurrence of microswitch activation to over 75% by the second session, with 80%, 58%, and 80% activation on the final three sessions, respectively. For the radio, microswitch activation was increased to 82% by the third session, and to 75%, 80%, and 95% by the final three sessions, respectively. Thus, both stimuli were identified as reinforcing. The results of direct observation of Ron's behavior during the three conditions indicated that self-injury occurred at an average rate of 68% (range, 40% to 100%) during toileting, 57% (range, 40% to 70%) during positioning, and 0% during the vocational task. These results confirmed those obtained during interviews with the classroom teacher.

During baseline of the treatment condition (see Figure 1), the occurrence of self-injury during positioning ranged from 12% to 80%, averaging 50.4%. During toileting, the occurrence of self-

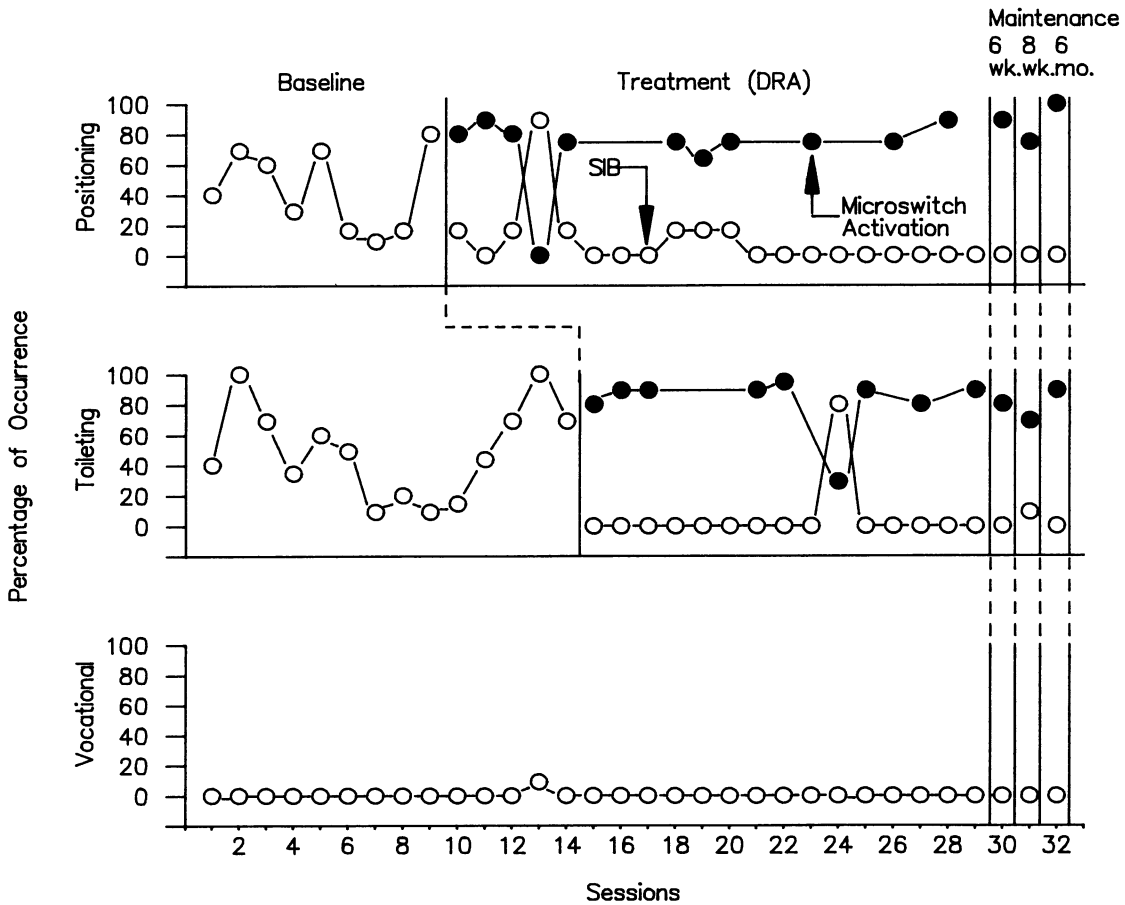

Figure 1. Percentage occurrences of Ron's self-injurious behavior and microswitch activation in positioning, toileting, and vocational activities during baseline, treatment, and maintenance phases.

injury ranged from 10% to 100%, averaging 49%. During the vocational task condition, self-injury was observed only in the 13th session (20% occurrence).

During treatment, self-injury was reduced substantially, whereas microswitch activation occurred at high levels. In the positioning condition, self-injurious behavior occurred very rarely (M = 7%; range, 0 to 100%) and microswitch activation occurred at high rates (M = 79%; range, 0 to 100%). During toileting, Ron exhibited self-injurious behavior only during the 10th treatment session (82% occurrence), in which microswitch activation occurred at the lowest level (32%). Ron engaged in high levels of microswitch activation during all other sessions (M = 87%; range, 80% to 95%). These levels were maintained at 6-week, 8-week, and 6-month follow-ups, with no occurrences of self-injury (except 7% during toileting at the 8-week probe) and high rates of microswitch activation.

In summary, a unique treatment approach was prescribed based on the results of two distinct assessments: reinforcer identification and functional analysis of self-injurious behavior. We hypothesized from baseline observations of the frequent occurrence of self-injury during the solitary conditions relative to the demand (vocational task) condition that Ron's hand mouthing served a self-stimulatory function. The use of a restraint box to inhibit Ron's hand-mouthing behaviors during assessment of reinforcer preference allowed us to identify reinforcing stimuli that could be used during solitary

conditions, after which we provided Ron with a method for appropriately receiving these stimuli (i.e., through activation of the microswitch). The results of treatment were then used to confirm the validity of assessment; increases in microswitch activation (confirming that reinforcers had been identified) and decreases in self-injurious behavior (confirming that hand mouthing was self-stimulatory) occurred immediately with treatment. Of even greater importance, maintenance of treatment effects occurred up to 6 months following treatment in the normal context of the classroom Ron attended.

Although these results are positive, further replication is needed to establish the generalizability of the findings. Experiment 2 was conducted to provide an extension of Experiment 1 (in which there was no apparent environmental contingency maintaining the behavior) by evaluating a direct function of self-injurious behavior that had an identified maintaining condition (i.e., escape or avoidance). In such situations, it is probably necessary to disrupt the maintaining contingency as well as to provide positive reinforcement for an alternative behavior. Thus, both types of assessment data (maintaining condition of self-injury and reinforcer identification) were needed to prescribe an effective treatment.

EXPERIMENT 2: COMBINING ASSESSMENT PROCEDURES FOR CONTROL OF SELF-INJURIOUS BEHAVIOR

METHOD

Subject and Setting

Johnny, a 4-year-old, was referred to an inpatient treatment center for behavioral assessment of self-injurious behavior (hair pulling). Johnny was diagnosed as moderately mentally retarded (Vineland Adaptive Behavior Scales—Survey Form, Peabody Picture Vocabulary Test—Revised). He ambulated for short distances with a walker and crawled freely about the classroom. Johnny communicated by signing and pointing at pictures in his language book. All phases of the investigation occurred in a classroom for severely handicapped patients in a hospital inpatient unit serving developmentally disabled children on a short-term basis. One to four other patients and two to five staff were present in the classroom at any one time.

Target Behaviors and Materials

Interviews with Johnny's parents and his classroom teacher indicated that Johnny's self-injury was primarily hair pulling (defined as Johnny grasping his hair in either or both hands). Appropriate on-task behavior served as a dependent variable and was defined as visual attention to stimuli, appropriate interaction with stimuli (relevant task or activity), requests for stimuli, and/or responses to staff-initiated instructional prompts.

Classroom materials used during the assessment and treatment phases of the investigation included a 25-piece set of silverware, a 25-piece set of colored disks, a glass of water, Johnny's language book, a wooden slide (8 ft long, 3 ft high, 1.5 ft wide), and miscellaneous toys.

During assessment, Johnny was directed to complete a novel match-to-sample sorting task (sorting 25 pieces of silverware). During the treatment phase, Johnny was directed to sort silverware and to complete a second match-to-sample sorting task (sorting 25 colored disks). The latter task was chosen from Johnny's Individual Education Plan.

Data Collection and Reliability

The first author, two graduate students in psychology, and the classroom teacher served as observers. During reliability checks, two observers recorded the occurrence and nonoccurrence of self-injurious and appropriate on-task behavior using a 6-s interval recording procedure. Reliability checks were conducted on 56% of the functional behavioral assessment of self-injurious behavior sessions, 40% of the assessment of reinforcer preference sessions, 41% of baseline and treatment of self-injurious behavior sessions, and 100% of the maintenance sessions. Interrater agreement was calculated by dividing the number of agreements by the total number of agreements plus disagreements and multiplying by 100. Mean percentage of agreement for

occurrence of self-injurious behavior was 94% (range, 82% to 96%); 98% (range, 94% to 100%) for nonoccurrence of self-injurious behavior; 95% (range, 92% to 100%) for occurrence of appropriate on-task behavior; and 99% (range, 95% to 100%) for nonoccurrence of appropriate on-task behavior.

Design and Procedures

An alternating treatments design was used to evaluate the results of behavioral assessment of self-injury. A multiple baseline across tasks design was used to evaluate the efficacy of the treatment of self-injury.

Assessment of self-injurious behavior. Three of the four conditions of the self-injurious behavior assessment protocol were similar to those used by Iwata et al. (1982). These were (a) solitary (Johnny was left alone in the classroom without ready access to toys or play materials and did not interact with peers or staff), (b) demand (one trainer exposed Johnny to academic tasks using a prescriptive prompting procedure [Steege, Wacker, & McMahon, 1987] with a 20-s time-out from tasks procedure provided contingent upon the occurrence of self-injurious behavior), and (c) unstructured play (one trainer provided toys to Johnny, allowing him to engage in spontaneous isolated or cooperative play without making any demands for specific performance and providing social attention contingent upon no occurrence of self-injury). A fourth condition, response cost, was included to approximate conditions in the natural environment, involving the removal of objects or a sibling's toys with which Johnny was not permitted to play, that were reported by his parents to be associated with self-injury. During this condition, Johnny was instructed to play while an experimenter in the classroom sat at a nearby table and performed paperwork. When Johnny engaged a particular toy for 20 s or more, the experimenter approached Johnny, physically withdrew the toy, and said, "No, Johnny. You can't play with that toy. It's for the other kids." Johnny was exposed to the four conditions daily in a random order, for 10 min each, over a 4-day period.

Assessment of reinforcer preference. Assessment of reinforcer preference was based on the procedures used by Pace et al. (1985) and consisted of measuring Johnny's request for, approach toward, or engagement of a variety of stimuli in the classroom across five 10-min sessions. The responses used to measure preferences for stimuli were defined as Johnny attending visually to or interacting appropriately with a stimulus and/or requesting (via signing) a stimulus. Johnny was seated on a chair and positioned at a table with a variety of toys and objects available to him. When Johnny requested a toy or item (e.g., a drink of water) that was not present at the table, it was made available to him.

Baseline of self-injurious behavior. The procedures used during baseline were identical to those used during the demand condition. During baseline sessions of sorting silverware and disks, Johnny was seated in a chair at a table with either set of materials placed 6 to 12 in. in front of him on the table. The classroom teacher sat in a chair next to Johnny and began each session with the verbal cue, "Johnny, it's time to work now," and proceeded to teach Johnny the task. When Johnny engaged in self-injurious behavior, the teacher said, "No!" and turned Johnny's chair around so that he was facing away from the table and tasks. After 20 s, Johnny's chair was turned around, and he was again introduced to the task, with instructional prompting reintroduced at the step of the task analysis at which the self-injury occurred. Observers recorded the occurrence and nonoccurrence of both self-injury and appropriate on-task behavior.

Treatment of self-injurious behavior. Treatment of self-injury was based on the results of assessments of self-injurious behavior and reinforcer preference. The criteria used to determine reinforcer preferences were: (a) Johnny attended to, interacted with, or requested a specific stimulus during at least three assessment sessions and (b) the cumulative duration across sessions of attending to, interacting with, or requesting a specific stimulus was at least 600 s (20% of the total exposure time). These data were used to prescribe a treatment package that included the habilitative training procedure (to teach the two tasks) and differential reinforcement of appropriate behavior (e.g., 1-oz drink of water and

20 s of signing with the language book following sorting of five pieces of silverware or five colored disks, and use of the slide for 1 min following completion of the entire sorting task). When Johnny exhibited hair-pulling behavior, he was redirected to the task.

To determine the acceptability and applicability of the treatment strategy, we contacted Johnny's classroom teacher and described the results of the assessment of self-injurious behavior, assessment of reinforcer preference, and treatment. The teacher indicated that providing positive reinforcement following the sorting of every fifth object would be difficult to implement in the classroom environment. In addition, a slide was not available in the classroom. During the second phase of the treatment, the schedule of reinforcement was therefore modified so that the drink of water and exposure to the language book were made contingent upon completion of the entire sorting task (25 items) and the slide was not offered as a reinforcer.

Maintenance. Three months and 15 months following his discharge, Johnny returned to the hospital inpatient unit for 1-day evaluations. He was provided with both the silverware- and the color-sorting tasks. A therapist implemented a treatment procedure that was identical to the one used during the second phase of the treatment.

Results and Discussion

The results of assessment of self-injurious behavior indicated that Johnny exhibited self-injurious behavior exclusively during the demand condition, suggesting that Johnny's self-injury was maintained by negative reinforcement (i.e., escape from demanding tasks). During the first assessment session, the occurrence of self-injury was 19%, reaching a high of 55% during the fourth and final assessment session.

The results of assessment of reinforcer preference indicated that Johnny demonstrated a preference for the following stimuli: drink of water (four sessions, 30%), slide (four sessions, 28%), and language book (three sessions, 22%).

The results of baseline and treatment of self-injurious behavior are shown in Figure 2. For both tasks, the treatment package resulted in an immediate decrease in the occurrence of self-injury and an increase in appropriate on-task behavior. During baseline observations of sorting silverware, the occurrence of self-injury averaged 45% (range, 25% to 58%) and appropriate on-task behavior averaged 24% (range, 0 to 60%). During treatment phases of sorting silverware, a decrease in self-injury (M = 4%; range, 0 to 30%) and an increase in appropriate on-task behavior (M = 78%; range, 35% to 100%) were observed. During baseline observations of sorting disks, the occurrence of self-injury averaged 68% (range, 30% to 85%), whereas occurrences of appropriate on-task behavior averaged 8% (range, 0 to 22%). During treatment phases of sorting disks, Johnny exhibited self-injurious behavior for the initial treatment session only (18%), and appropriate on-task behavior averaged 83% (range, 58% to 90%).

During a discharge conference, the results of both assessments and the treatment of self-injury were presented to Johnny's parents and local interdisciplinary team members. The specific treatment procedures were discussed and demonstrated. Parents and school staff indicated that they would implement the treatment procedures during demand conditions in the home and school environments. During the 3-month follow-up probe, Johnny engaged in high rates of cooperative behavior on each of the tasks, and no occurrences of self-injury were observed. Moreover, during 6 hr of observation in a variety of interdisciplinary evaluations, no self-injury occurred. During a 15-month follow-up probe, Johnny again engaged in high rates of appropriate on-task behavior, with no occurrences of self-injury on both training tasks.

We developed an effective proactive treatment by combining the results of behavioral assessment of maladaptive behavior and assessment of reinforcer preference. An inverse relationship between self-injurious behavior and appropriate on-task behavior was demonstrated, indicating that the reinforcement of adaptive behavior can result in a decrease in maladaptive behavior. Finally, we determined the acceptability and applicability of the treatment procedure in the classroom setting and

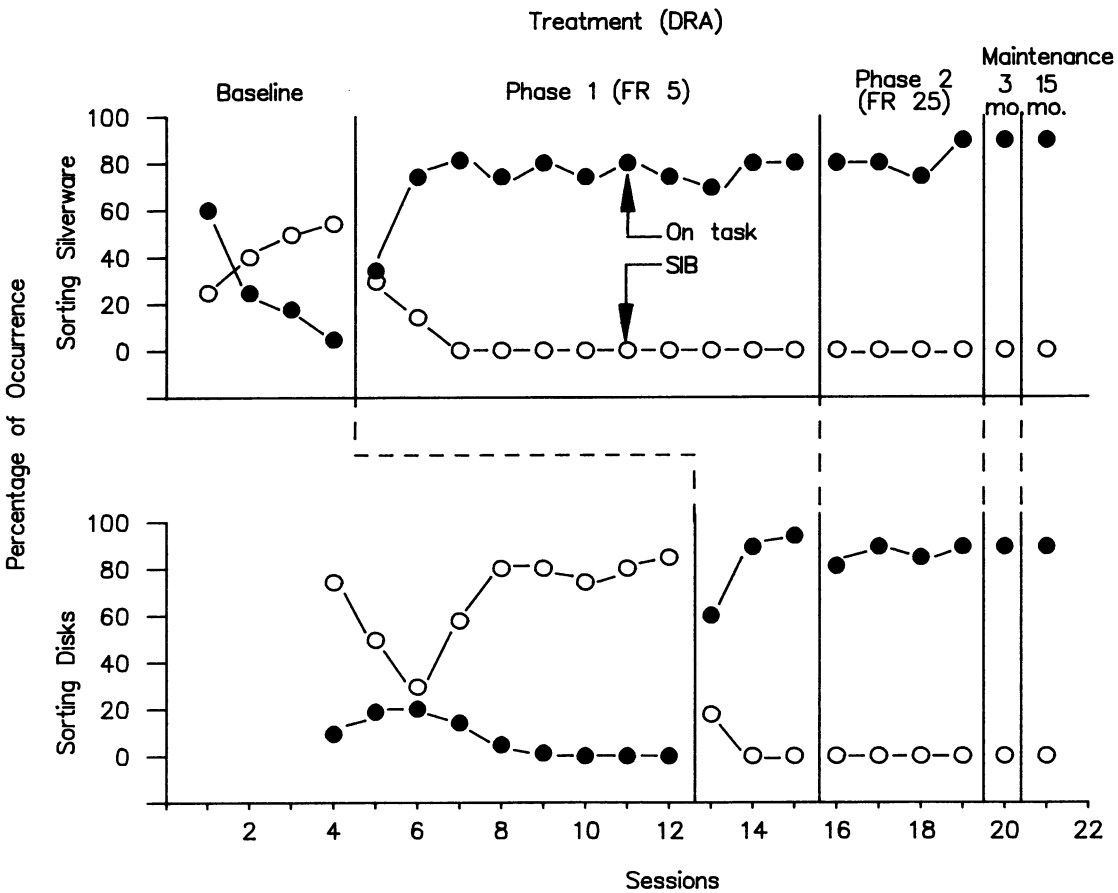

Figure 2. Percentage occurrence of Johnny's self-injurious and appropriate on-task behaviors in sorting activities during baseline, treatment, and maintenance phases.

subsequently developed a modified treatment program.

GENERAL DISCUSSION

Relatively quick results were obtained in both experiments, perhaps because empirically identified reinforcers were first determined. Although reinforcer assessments can be time-consuming and may appear to be unnecessary, the selection of an effective reinforcer identified through an empirical assessment may produce more rapid results during treatment. Moreover, the use of reinforcer assessments may prove to be more accurate than caregivers' subjective identification of reinforcers. For example, Green et al. (1988) demonstrated that stimulus preference rankings based on caregiver opinion did not consistently coincide with the results of a systematic observational approach to preference assessment.

In both experiments, the two-phase assessment procedure used to prescribe individual treatments is an extension of previous research, because assessment data identified both positive reinforcers for appropriate behavior and the maintaining conditions for self-injury. Both types of assessments may be needed for effective treatment. As far as we know, this is the first time that both sets of assessment techniques have been reported in the treatment of self-injurious behavior. Instead, previous researchers have identified either reinforcers (e.g., Wacker et al., 1985) or maintaining con-

ditions for self-injury (e.g., Iwata et al., 1982). Combining the assessment techniques results in more definitive information to treat self-injurious behavior.

An interesting finding from both experiments is that the appropriate behavior that increased for both participants was not motorically incompatible with self-injury. Ron could have bit his hand while pressing the switch, and Johnny could have pulled his hair while sorting objects. However, neither participant engaged in both appropriate and self-injurious behaviors simultaneously.

Perhaps the most direct explanation for these results is that in Experiment 1, Ron's self-injury was unrelated to attention or demands and, by default (as evaluated in the solitary conditions), was a self-stimulatory response. The treatment of self-injury consisted of providing a reinforcer contingent upon an arbitrarily selected alternative response (microswitch pressing). In other words, no contingency was directly implemented for self-injurious behavior. Such would not be the case if Ron's hand mouthing was either an attention-getting or an escape response, because in these conditions it might be necessary to disrupt the maintaining contingency in a more direct manner. In Experiment 2, Johnny's self-injurious behavior was maintained by escape from demanding tasks. The treatment involved reinforcement of appropriate on-task behavior and redirection to task contingent upon occurrence of hair pulling. Thus, two treatment contingencies were in effect: differential reinforcement of appropriate behavior and extinction of self-injury by redirecting Johnny to task, thus preventing escape. Therefore, extinction of self-injury and differential reinforcement of appropriate on-task behavior produced a decrease in the former and an increase in the latter. It is plausible that both treatment components produced a decrease in Johnny's self-injurious behavior and that it is not possible to determine which part of the intervention package was more responsible for the therapeutic change.

In addition, this investigation extends previous investigations because of our focus on relatively long-term maintenance in classroom settings. In Experiment 1, the assessment and treatment conditions were conducted in the classroom. More important, the treatment was included in the ongoing classroom routine, which may account for the maintenance achieved. In Experiment 2, the treatment procedures were discussed with the teacher prior to discharge, resulting in the elimination of one reinforcer (slide) and one change in procedures (reinforcement schedule). These relatively simple changes may have facilitated maintenance because they increased the applicability of the treatment to the classroom setting. Our results, and those of previous investigators, firmly establish that self-injurious behavior can be treated effectively under certain conditions. What is now needed are methods for transferring the use of this technology to natural school and residential settings to produce maintenance of treatment effects.

REFERENCES

Carr, E. (1977). The motivation of self-injurious behavior: A review of some hypotheses. *Psychological Bulletin,* **84,** 800–816.

Carr, E., & Durand, V. M. (1985). Reducing behavioral problems through functional communication training. *Journal of Applied Behavior Analysis,* **18,** 111–126.

Datillo, J. (1986). Computerized assessment of preferences for severely handicapped individuals. *Journal of Applied Behavior Analysis,* **19,** 445–448.

Durand, V. M., & Carr, E. (1985). Self-injurious behavior: Motivating conditions and guidelines for treatment. *School Psychology Review,* **14**(2), 171–176.

Fehr, M., Wacker, D., Trezise, J., Lennon, R., & Meyerson, L. (1979). Visual, auditory, and vibratory stimulation as reinforcers for profoundly retarded children. *Rehabilitation Psychology,* **26,** 201–209.

Green, C., Reid, D., White, L., Halford, R., Brittain, D., & Gardner, S. (1988). Identifying reinforcers for persons with profound handicaps: Staff opinion versus systematic assessment of preferences. *Journal of Applied Behavior Analysis,* **21,** 31–43.

Iwata, B., Dorsey, M., Slifer, K., Bauman, K., & Richman, G. (1982). Toward a functional analysis of self-injury. *Analysis and Intervention in Developmental Disabilities,* **2,** 3–20.

Pace, G., Ivancic, M., Edwards, G., Iwata, B., & Page, T. (1985). Assessment of stimulus preferences and reinforcer values with profoundly retarded individuals. *Journal of Applied Behavior Analysis,* **18,** 249–255.

Steege, M., Wacker, D., & McMahon, C. (1987). Eval-

uation of the effectiveness and efficiency of two stimulus prompt strategies with severely handicapped students. *Journal of Applied Behavior Analysis,* **20,** 293–299.

Wacker, D., Berg, W., Wiggins, B., Muldoon, M., & Cavanaugh, J. (1985). Evaluation of reinforcer preferences for profoundly handicapped students. *Journal of Applied Behavior Analysis,* **18,** 173–178.

Weeks, M., & Gaylord-Ross, R. (1981). Task difficulty and aberrant behavior in severely handicapped students. *Journal of Applied Behavior Analysis,* **14,** 449–463.

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