To my family, Richard, Sharon, & Raymond
ACKNOWLEDGMENTS

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Problem behavior that occurs only under covert conditions can be difficult to assess and treat because it may be seen rarely. The purpose of this study was to evaluate the effects of two procedures that may decrease covert self-injurious behavior (SIB) maintained by automatic reinforcement: stimulus control training and contingencies on response products (i.e., tissue damage). These interventions were examined both during sessions and across the day. Stimulus control was first established during sessions by pairing a distinctive visual cue with the appearance of a therapist who delivered a verbal reprimand contingent on self-injury. If this produced reductions in SIB, the signal was placed throughout the subject’s environment. If SIB reemerged, contingencies were placed on the appearance of tissue damage. Stimulus control initially was effective for 5 of 6 subjects. However, when blocking was no longer paired with the signal, stimulus control was lost for all subjects. Contingencies on response products were effective both within session and across the day for all subjects with whom it was implemented.
CHAPTER 1
INTRODUCTION

A developmental disability is a severe, chronic mental or physical impairment, or a combination of mental and physical impairments, that is manifested before the age of 22, is likely to continue indefinitely, and results in substantial functional limitations in 3 or more of the following areas of major life activity: (a) self care; (b) receptive and expressive language; (c) learning; (d) mobility; (e) self-direction; (f) capacity for independent living, and (g) economic self-sufficiency (Developmental Disabilities Act, 2000). The estimated number of individuals diagnosed with a developmental disability (DD) living in the United States in 1995 was 3.9 million (Larson et al., 2001).

In addition to the functional limitations mentioned above, individuals with DD have been reported to engage in a variety of problem behaviors such as self-injurious behavior (SIB), aggression, and property destruction (Emerson et al., 2001). In particular, a great deal of research has been conducted on SIB, defined as any behavior that produces physical injury to one’s own body (Tate & Baroff, 1966). SIB is exhibited by approximately 10% to 17% of individuals with developmental disabilities (Griffin, Williams, Stark, Altmeyer, & Mason, 1986; Jacobson, 1982; Maurice & Trudel, 1982), and the most commonly reported topographies are headbanging, self-biting, and head hitting (Griffin et al.; Schroeder, Mulick, & Rojahn, 1980). SIB often results in tissue damage such as bleeding, swelling, and/or bruising (Carr, 1977); in addition, SIB interferes with the individual’s ability to participate in a variety of social and educational or vocational activities (Favell et al., 1982).

The most effective means of eliminating self-injurious behavior are based on the principles of operant conditioning (Iwata, Dorsey, Slifer, Bauman, & Richman, 1982/1994). The standard treatment for SIB begins with a functional analysis, an assessment that is designed to identify the
environmental determinants of an individual’s SIB. During a functional analysis, the individual is exposed to different test conditions in which reinforcement contingencies known to influence SIB are manipulated. Iwata et al. developed a general functional analysis (FA) methodology, which included 3 test conditions and a control condition. The first test condition was the alone condition, during which the subject was left alone in a room with no toys or other items, and there were no consequences delivered for SIB. This condition tested for SIB maintained by automatic (sensory) reinforcement. The next test condition was the social disapproval (or attention) condition, which tested for behavior maintained by social positive reinforcement in the form of attention. During this condition, the therapist ignored the subject unless SIB occurred; contingent on SIB, the therapist delivered a brief statement of social disapproval. During the demand condition, the therapist presented tasks and, contingent on SIB, provided a break from work. The demand condition tested for behavior maintained by social negative reinforcement in the form of escape from demands. If SIB is maintained by a particular reinforcer (e.g., attention, escape from demands), responding should occur at differentially higher rates in the test condition involving the delivery of that reinforcer. Once the reinforcer that maintains SIB has been identified, this information is used to develop a treatment. Functional analyses have been used to examine a wide range of problem behaviors and in hundreds of published studies (Hanley, Iwata, & McCord, 2003). These studies have shown that SIB can be maintained by a variety of reinforcers; however, an epidemiological analysis of SIB conducted by Iwata et al. (1994) indicated that approximately 74% of cases of SIB were maintained by social reinforcement.

Much less is known about SIB in specific diagnostic groups. In particular, the behavior seems to have different characteristics in individuals diagnosed with Prader-Willi Syndrome (PWS). PWS is a genetic disorder that affects 1 in 15,000 to 1 in 30,000 births (Cassidy &
Driscoll, 2009) and early in life is associated with hypotonia (poor muscle tone) and poor feeding (failure to thrive). Around 1 year of age, individuals with PWS begin engaging in hyperphagia (excessive consumption of food), which results in morbid obesity and related health problems (Holm et al., 1993). Most individuals with PWS also are diagnosed with mental retardation, typically in the mild to moderate range (Greenswag, 1987). Behavior problems are commonly reported in this population; in addition to hyperphagia and tantrums, self-injurious skin picking seems to occur at higher rates in the PWS population relative to the general DD population (Akefeldt & Gillberg, 1999). Neidert (2007) surveyed caregivers of 203 individuals with PWS and found that SIB was reported for 117 of these individuals, or nearly 58% of the sample, which is roughly 4 times more often than in the general DD population. Further, she found that the most common topographies of SIB were different for individuals diagnosed with PWS. The most commonly reported topographies in the PWS population were skin picking, orifice digging, and rumination, whereas the most commonly reported topographies in the general developmental disabilities population were head hitting, biting, and head banging. She then conducted functional analyses of SIB for 52 individuals diagnosed with PWS and found that 83% of cases were maintained by automatic, or nonsocial, reinforcement. Interestingly, the first subject in the study initially engaged in SIB in the traditional alone condition as described by Iwata et al. (1982/1994). However, SIB ceased when the subject apparently detected the presence of the observer located on the other side of the one-way observation window. Responding was recovered when sessions were resumed in a room with a hidden camera, indicating that SIB would occur only under covert conditions.

Problem behavior that occurs covertly is difficult to assess and treat. Because the behavior occurs when detection is least likely, standard measurement procedures based on direct
observation do not reflect actual rates of problem behavior. Further, if caregivers are unable to observe the behavior, it may be impossible to establish contingencies for its occurrence or nonoccurrence.

Stimulus control techniques, in conjunction with unobtrusive observation, might be used to mitigate some of the difficulties encountered when treating covert behavior. Stimulus control procedures have been shown to be effective in treating several problematic behaviors including stereotypy (Doughty, Anderson, Doughty, Williams, & Saunders, 2007), pica (Piazza, Hanley, & Fisher, 1996), and covert food stealing (Maglieri, DeLeon, Rodriguez-Catter, & Sevin, 2000).

Doughty et al. (2007) used a two-component multiple schedule (a schedule that alternates within a session) to demonstrate the effects of pairing an antecedent stimulus with the absence of punishment. During the no-punishment component, a discriminative stimulus (a black bracelet for two subjects and a chair facing a red wall for the third) was paired with the absence of punishment, during which stereotypy produced no programmed consequences. This component alternated with one that was correlated with the absence of the black bracelet for two subjects and a chair facing a blue wall for the third subject, in which stereotypy was punished. All three subjects displayed significantly reduced rates of stereotypy in the punishment component but no reduction in stereotypy in the no-punishment component. However, because all sessions were conducted in a treatment room, it is unclear whether these effects would have maintained under more naturalistic conditions.

A similar procedure was used by Piazza et al. (1996). However, in this study, the authors used a purple card (as an S-delta) to signal the unavailability of reinforcement for cigarette pica maintained by automatic reinforcement. When the card was placed on the wall, the therapist entered the room contingent on pica, interrupted the response, and delivered a verbal reprimand.
In addition, the subject had noncontingent access to edibles and work or leisure materials. After 180 training sessions, assessment sessions were conducted in the session room as well as in other hospital and community settings to evaluate the effectiveness of the S-delta in the absence of consequences delivered by the therapist. Responding did not occur in the presence of the S-delta but did occur in the presence of a card that had not been associated with any programmed consequences.

Maglieri et al. (2000) utilized a stimulus control procedure to eliminate covert food stealing exhibited by an individual diagnosed with PWS. During training trials, the individual was placed in a room containing prohibited food items, denoted by a sticker on the food container. The therapist instructed the subject to not consume the food and then exited the room. Upon returning, the therapist weighed food items in front of the subject and delivered a verbal reprimand if any food had been consumed. Although treatment was effective, all sessions were conducted on a hospital unit, and the authors suggested that some features of that setting may have maintained stimulus control over responding rather than just the presence of the stickers. In addition, although checks were conducted intermittently during the generalization phase, verbal reprimands were delivered for missing food each time checks were conducted. This suggests that contingencies on response products, rather than stimulus control per se, may have produced the reduction in food stealing behavior.

As suggested by the Maglieri et al (2000) study, another approach to treatment that may be particularly well-suited to problem behavior that is difficult to observe is response-product contingencies. Grace, Thompson, and Fisher (1996) placed contingencies on the response products created by an individual who engaged in self-injury almost exclusively under covert conditions. Medical exams were conducted at three predetermined times each day, and the
individual earned access to attention, tangible items, and outings contingent on the absence of new tissue damage during the checks, as well as the absence of other targeted problem behaviors. These contingencies resulted in a decrease in the percentage of medical checks during which new tissue damage was detected.

Another strategy might involve the use of covert observation. Cowdery, Iwata, and Pace (1990) used covert observation and differential reinforcement of other behavior (DRO) to eliminate self-injurious scratching that occurred only when the individual was alone. During the DRO condition, the subject was left alone in a room with a one-way observation window and was examined for wounds at the end of the session. If no SIB occurred, the subject earned a penny that was exchanged for back-up reinforcers. The length of the DRO interval was initially brief but was gradually increased to 30 min while SIB remained suppressed.

The purpose of this study is to examine the extent to which stimulus control procedures might produce generalized reductions in covert SIB maintained by automatic reinforcement. Stimulus control first will be established during treatment sessions by pairing a visual stimulus with the appearance of a therapist who delivered a verbal reprimand contingent on self-injury. If effective under controlled conditions, generalization of stimulus control was assessed under naturalistic conditions when implemented across the day. If results of the stimulus control intervention were unsuccessful or limited, the effects of a reinforcement contingency based on response products were examined both within sessions and across the day.
CHAPTER 2
STUDY 1: FUNCTIONAL ANALYSIS OF SIB

Method

Subjects and Setting

Six individuals diagnosed with PWS participated in Study 1; all subjects also had some degree of mental retardation. Subjects were between 22-51 years old, could complete their activities of daily living independently, were able to follow multiple-step instructions, and could easily carry on conversations. Subjects were recruited based on referral by a behavior analyst who served as the subject’s clinical case manager. Subjects who had wounds requiring more than minor wound care (standard first aid procedures) were not included as participants, because it is possible that emergency medical interventions might influence the data. Informed consent was obtained for all subjects. All sessions were conducted in one of two observation rooms at an adult day placement for individuals with DD.

Response Measurement and Interobserver Agreement

The dependent variable was SIB. All subjects engaged in skin picking, which was defined as movement of a fingernail half an inch or more on the skin, touching an existing wound, tampering with a bandage, or touching the skin with the teeth or other object. The occurrence of SIB was observed directly using a 10-s partial interval procedure and was summarized as percentage of intervals with SIB within each session.

Interobserver agreement was assessed by having an independent observer collect data during at least 55% of all sessions. Sessions were divided into 10-s intervals, and data were compared on an interval-by-interval basis. The number of intervals in which both observers agreed on the occurrence or non-occurrence of the target behavior was divided by the total number of intervals, and multiplied by 100. Mean reliability scores were as follows: Lillian,
96.8% (range, 81% to 100%); Tessa, 95.5% (range, 85% to 100%); Justin, 96.3% (range, 80% to 100%); Daniel, 93.2% (range, 71.7% to 100%); Brian, 98.5% (83.3% to 100%); and Paige, 97.9% (range, 90% to 100%).

Procedures

Prior to the functional analysis, a paired stimulus preference assessment was conducted similar to the procedure described by Fisher, Piazza, Bowman, Hagopian, Owens, and Slevin (1992) to determine moderate- and high-preferred items for use in the functional analysis conditions. The functional analysis was conducted using procedures similar to those described by Iwata et al. (1982/1994) and included attention, demand, play, and no-interaction conditions, plus a covert alone condition. The rationale for including both the no-interaction and covert alone condition was that if responding did not occur in the no-interaction condition (or any other FA condition) but did occur in the covert alone condition, SIB could be described as covert.

During the attention condition, the subject was seated next to the therapist and provided with a moderately preferred activity. At the start of the session, the therapist informed the subject, “I have some work to do so I will talk with you later. You can play with your toy if you’d like.” The therapist ignored the subject unless SIB occurred; contingent on SIB, the therapist briefly touched the subject on the arm or hand and delivered a brief statement of social disapproval and concern.

During the demand condition, the therapist and the subject were seated at a table. The therapist continuously presented work tasks using a graduated three-step prompting procedure. Compliance with a task resulted in a brief statement of praise. Contingent on SIB, the therapist removed the work materials and turned away from the subject for 30 s.
During the play condition, the therapist and the subject sat together at a table, and several highly preferred toys were available. No demands were presented, and attention was delivered at least once every 30 s. There were no programmed consequences for SIB.

During the no-interaction condition, a therapist was present in the room but was seated facing away from the subject. The therapist ignored the subject for the duration of the session, and there were no programmed consequences for SIB.

During the covert alone condition, the therapist escorted the subject to a room equipped with a hidden camera. The subject was told, “I need to go take care of something for a few minutes. Please wait here in this room until I return.” The subject was then left alone in the room, and there were no programmed consequences for the occurrence of SIB.

Results and Discussion

Figures 2-1 (David and Lillian), 2-2 (Paige and Justin), and 2-3 (Brian and Tessa) show results of the functional analysis, expressed as the percentage of intervals of SIB during each condition. For each of the subjects, with the exception of Tessa, SIB occurred almost exclusively in the covert alone condition, indicating that their SIB was maintained by automatic reinforcement and was unlikely to occur in the presence of other people. Tessa initially engaged in higher levels of SIB during both the no interaction and covert alone conditions. However, as the assessment continued, SIB decreased in the no interaction condition but maintained in the covert alone condition, indicating that her SIB also was maintained by automatic reinforcement and more likely to occur in the absence of other people.
Figure 2-1. Functional analysis results for David and Lillian.
Figure 2-2. Functional analysis results for Paige and Justin.
Figure 2-3. Functional analysis results for Brian and Tessa.
CHAPTER 3
STUDY 2: ASSESSMENT OF STIMULUS CONTROL

Method

Subjects and Setting

All 6 individuals from Study 1 participated in Study 2. All sessions were conducted in one of two observation rooms at an adult day placement for individuals with DD.

Response Measurement and Interobserver Agreement

The dependent variable was SIB, which was defined and summarized as described in Study 1. In addition, SIT scale measurements across blocks of sessions were conducted to assess tissue damage resulting from SIB. The SIT scale is an observational tool that documents the location, number, severity, and type of wounds produced by SIB. The SIT scale lists areas of the body (e.g., head, torso), and each area is then further divided into its component parts (e.g., scalp, ear, eye, face, nose, lips). The number of injuries on each component part is documented, and the injuries are classified as contusions or abrasions/lacerations. Finally, the worst injury in a component area is assigned a severity score. A severity score of 1 means that the area is red or irritated with only spotted breaks in the skin. A severity score of 2 means that there is a break in the skin, which is distinct but superficial, and no avulsion is present. A severity score of 3 means that the break in the skin is deep or extensive, or an avulsion is present. Iwata et al. (1990) evaluated the reliability of the SIT scale by comparing results from 50 pairs of independently scored SIT scales, and agreement across all categories (location of injury, type of injury, number of injuries, and severity of injuries) was high (range, 89% to 99%).

Interobserver agreement was assessed and calculated as described in Study 1. Mean reliability scores were as follows: Lillian, 93% (range, 80% to 100%); Tessa, 94.2% (range,
81.7% to 100%); Justin, 97.6% (range, 80% to 100%); Daniel, 93.6% (range, 71.7% to 100%); Brian, 90.1% (61.7% to 100%); and Paige, 98.7% (range, 91.7% to 100%).

Stimulus control was assessed across the day for Justin only. The dependent variable during this assessment was based on SIT scale measurements taken during daily exams. Interobserver agreement was assessed by having a second observer perform an independent rating during 30% of all medical exams. An agreement for a wound was scored if both observers agreed on both the location and the severity of the wound. Agreement percentages were calculated by dividing the number of agreements by the number of agreements plus disagreements. The mean reliability score was 77.8% (range, 0% to 100%). As indicated by the range, the reliability for one wound check was 0%. In this case, both observers agreed on the location of Justin’s one wound, but they disagreed on the severity score for that wound, which produced an agreement score of 0%.

Procedures

Stimulus control training was evaluated by conducting the following conditions in a multielement and multiple baseline across subjects design. Two rooms, room A and room B, each contained a hidden camera. Levels of SIB and tissue damage were assessed during the following conditions: Baseline, Baseline Plus Exam, Baseline Plus Signal, Stimulus Control, and Signal in the Natural Environment. The evaluation of these conditions was conducted in two rooms (designated A and B) and occurred over 6 phases as necessary. One session was conducted per day, unless there was enough time to separate sessions by at least one hour. All sessions were 10 min in length except as noted below.

**Phase I: Baseline.** Baseline was conducted in both rooms. This condition was identical to the covert alone condition of the FA.
**Phase II: Baseline Plus Exam.** Sessions were conducted in both rooms. This condition was similar to the previous baseline condition. However, the subject was required to attend a wound examination before and after each session, during which a SIT scale was conducted. This condition served as a control to insure that wound examinations per se did not have a suppressive effect on SIB.

**Phase III: Baseline Plus Signal.** Sessions were conducted in both rooms. This condition was similar to the baseline plus exam condition; however, a laminated piece of blue construction paper (the signal) was attached to the wall in both therapy rooms. This condition also served as a control to insure that the presence of signals had no suppressive effect on SIB prior to treatment.

**Phase IV: Baseline Plus Exam and Stimulus Control.** Baseline plus exam sessions (with no signal) continued to be conducted in Room A, whereas stimulus control training was conducted in Room B. The stimulus control condition was similar to the baseline plus signal condition; however, if the subject engaged in SIB at any time during the session, the therapist immediately entered the room and blocked SIB (as necessary) until SIB did not occur for 5 s, at which point the therapist left the room again. When the therapist entered the room, he or she stated, “Stop picking.” The times when the therapist was in the room were subtracted from session time, and that duration of time was added to the end of the session to equate session length across conditions.

**Phase V: Baseline Plus Signal.** This condition provided a test for generalization of stimulus control from Room B (associated with the signal, reprimand, and blocking in the previous condition) to Room A (in which the signal, reprimands, and blocking were absent in the previous condition). Once the subject had a history of the colored card being paired with reprimands and blocking in Room B, the card was placed in Room A. If stimulus control training
was effective and generalization occurred, SIB would be suppressed in the presence of the card in Room A, even though reprimands and blocking never occurred in this room. Therefore, in addition to serving as a generalization test to Room A, another purpose of this condition was to determine if the colored card would continue to suppress SIB in the absence of programmed consequences in Room B. If SIB remained low in this phase, an additional phase was conducted in which treatment was evaluated in the natural environment. If responding reemerged, the next study (Study 3) began.

**Phase VI: Signal in the Natural Environment.** The signal was placed in all environments where the subject was alone, and a wound examination was conducted twice per day. If responding remained suppressed, treatment was considered successful. If responding reemerged, the next study (Study 3) began.

**Results and Discussion**

Results from the assessment of stimulus control are shown in Figures 3-1, 3-2, and 3-3. For Figures 3-1 and 3-2, sessions conducted in Room A are depicted by the data path with the open circles; sessions conducted in Room B are depicted by the data path with the filled squares. For Figure 3-3, the percentage of wound free checks (no new or aggravated wounds) is depicted by the filled circles, and the number of checks conducted is depicted by the open circles.

Figure 3-1 shows results for Lillian, Tessa, and Justin. Lillian engaged in similar levels of SIB in both rooms during the initial baseline phase. The addition of wound exams did not appear to have any effect on her SIB, nor did the addition of the signal prior to any pairing with blocking. The addition of blocking and reprimands during stimulus control training in Room B resulted in a decrease in SIB in that room. Room A remained in baseline (without the signal), where SIB continued to occur. During the reversal to baseline plus signal, when the signal was
no longer correlated with blocking and reprimands, responding reemerged in Room B. Thus, stimulus control procedures had only a temporary effect in Room B and no effect in Room A.

Tessa’s responding remained high and variable throughout all three initial baseline phases. When blocking and reprimands were initiated in Room B (stimulus control training), SIB immediately decreased to near-zero levels in Room B. As blocking sessions in Room B continued, SIB in Room A also decreased, even though there were no contingencies for responding in Room A and no signal. During the reversal to baseline plus signal, responding reemerged in both rooms.

Justin’s SIB occurred at variable levels throughout all three baseline phases. During stimulus control training, responding decreased in Room B, where blocking was paired with the signal, and responding also decreased in Room A, which remained in baseline. Interestingly, upon a return to baseline plus signal, SIB remained suppressed. There are two possible explanations for this pattern of behavior. First, stimulus control training was effective, and responding remained suppressed in the presence of the signal. The second explanation is that some other feature of the environment exerted stimulus control over Justin’s behavior, such as the session rooms themselves.

Figure 3-2 shows results for Daniel, Brian, and Paige. Daniel engaged in increasing levels of SIB in both rooms across the three initial baseline phases. When blocking and reprimands were initiated in Room B (stimulus control training), SIB decreased in this room. SIB also decreased initially in Room A, which remained in baseline; however, as blocking sessions continued in Room B, responding reemerged in Room A. During the reversal to baseline plus signal, responding resumed in Room B, and responding in both rooms increased to near initial baseline levels.
Brian’s responding remained high and variable throughout all three baselines. Blocking plus reprimands in Room B (stimulus control training) were ineffective in producing any reduction in SIB. Because no evidence of stimulus control was observed even during training, no subsequent conditions were run.

Paige engaged in variable levels of SIB throughout all three baseline phases. Blocking and reprimands produced near-zero level of responding in Room B (stimulus control training), and an initial decrease in Room A. As blocking continued in Room B, responding in Room A increased. During the reversal to baseline plus signal, responding reemerged in Room B. Thus, Paige’s results were very similar to those observed for Daniel.

Figure 3-3 shows results for the assessment of stimulus control across the day for Justin, the only subject whose initial treatment data showed evidence of generalized stimulus control and maintenance when stimulus control training was removed. Wound checks during baseline often showed evidence of new and/or aggravated wounds that had appeared since the previous wound check. Justin continued to produce new wounds and aggravate existing wounds during stimulus control across the day.

In summary, stimulus control was initially effective for 5 of 6 subjects. However, stimulus control was lost during the reversal to baseline plus signal for 4 of 5 subjects and was lost when attempted across the day for the fifth subject (Justin). Different patterns of responding were obtained during the stimulus control phase, when a signal was placed on the wall in Room B, and responding in this room resulted in the appearance of a therapist who delivered a verbal reprimand and blocked SIB as necessary. In Room A, no signal was present, and there were no consequences delivered contingent on SIB. As blocking and reprimands continued in Room B, there was no change in the level of SIB in Room A for Lillian. SIB in Room A initially
decreased for both Daniel and Paige, but as blocking and reprimands continued in Room B (and no blocking or reprimands occurred contingent on responding in Room A), responding in Room A reemerged, although it occurred at lower levels than in baseline. Tessa and Justin’s behavior showed generalization of stimulus control; as blocking and reprimands were delivered in Room B, responding in Room A also decreased to near zero levels. As previously mentioned, it seems likely that this pattern of responding occurred because some other feature of the environment was exerting stimulus control over SIB, such as the session rooms themselves.

Two subjects showed generalization to the baseline room (Tessa and Justin), and three subjects did not (Lillian, Daniel, and Paige); however, there was a third possible pattern that could have emerged, a contrast effect. During the stimulus control phase, if responding decreased in Room B (where blocking and reprimands were being delivered) but increased in Room A (which remained in baseline), this pattern of responding could be described as a behavioral contrast effect (Koegel, Egel, & Williams, 1980). Contrast effects can occur when a behavior contacts a contingency in one setting but not in another setting. Under these circumstances, the rate of behavior in each setting may change in opposite directions. If the behavior contacts reinforcement in one setting, the behavior might increase in that setting but decrease in settings where it is not reinforced. Similarly, if a behavior is punished in one setting, it might decrease in that setting but increase in another setting in which punishment is not in effect. Further, these effects are more likely if there are salient discriminative stimuli that are present in the treatment setting but are not present in the nontreatment setting (Gross & Drabman, 1981). During the stimulus control condition, the signal was designed to be a salient stimulus that was paired with punishment in Room B, and this signal was absent in Room A (which remained in baseline).
Under these conditions, behavioral contrast might be expected to occur yet there was no increase in SIB in Room A for any of the subjects.
Figure 3-1. Assessment of stimulus control results for Lillian, Tessa, and Justin. The open circles show percent of intervals with SIB in room A. The black squares show percent of intervals with SIB in room B.
Figure 3-2. Stimulus control assessment results for Daniel, Brian, and Paige. The open circles show percent of intervals with SIB in room A. The black squares show percent of intervals with SIB in room B.
Figure 3-3. Stimulus control assessment across the day results for Justin. The filled circles show the percentage of wound free checks. The open circles show the number of checks conducted each day.
CHAPTER 4
STUDY 3: EFFECTS OF CONTINGENCIES ON RESPONSE PRODUCTS

Method

Subjects and Setting

Four individuals from Study 2 (Brian, Tessa, Lillian, and Paige) participated in Study 3. Daniel and Justin were no longer available to participate in sessions. Subjects were selected if their SIB reemerged under stimulus control conditions. All sessions were conducted in one of two observation rooms at an adult day placement for individuals with DD.

Response Measurement and Interobserver Agreement

The dependent variable was SIB and was defined and scored as described in Study 1. In addition, SIT scale measurements were conducted as described in Study 2.

Interobserver agreement was assessed by having an independent observer collect data during at least 25% of all sessions. Agreement percentages were calculated for SIB as described previously in Study 1. Mean reliability scores were as follows: Lillian, 99.3% (range, 93.2% to 100%); Tessa, 99.1% (range, 96.7% to 100%); Brian, 97.9% (88.3% to 100%); and Paige, 99.5% (range, 98.3% to 100%).

Procedures

The following conditions were implemented in a multiple baseline across subjects design.

**Baseline Plus Medical Exam.** This condition was identical to the condition described previously in Study 1.

**Differential Reinforcement of Other Behavior (DRO).** This condition was similar to the baseline plus medical exam condition with the following exceptions. If no new tissue damage was recorded during the medical exam following a session, the individual selected an item from a predetermined list of potential reinforcers, which was compiled by asking both the subject and
their caregivers to suggest potential reinforcers. If new tissue damage was observed, the individual was informed that no item was earned for that session. The initial session length was determined by calculating the mean latency to the first response during the previous baseline phase. Following two consecutive sessions with no instances of skin picking, the session duration was increased by 50%. If skin picking occurred in two consecutive sessions, the session duration was decreased to the length of the previous step. If this condition was effective in suppressing problem behavior, subjects continued into the evaluation of contingencies on response product across the day (Study 4).

Results and Discussion

Results from the assessment of contingencies on response products are shown in Figure 4-1 as the percent of intervals with SIB (closed circles) and the duration of session in seconds (open circles). All four subjects (Brian, Lillian, Pam, and Tessa) engaged in SIB during baseline. During the DRO condition, SIB immediately decreased to zero or near-zero levels. Sessions were quickly (Brian, Pam, Tessa) or gradually (Lillian) increased to 10 min, and SIB remained low.

The effectiveness of the DRO treatment was likely due to several factors. First, the initial DRO interval was based on the latency to the first response during baseline, insuring that the subjects would contact reinforcement for the absence of skin picking at (or near) the beginning of the treatment phase. Second, subjects were told that there was a contingency at the end of the first session (i.e., following the medical exam, they were told that they did or did not earn an item for the session). All of the subjects had good verbal skills, and it seems likely that their behavior was sensitive to these statements about earning reinforcement. Third, because subjects were allowed to select their reinforcers from a menu of highly preferred items that were not
available to them through other means, and it appeared that these reinforcers competed with any reinforcement available for SIB, at least during the short session durations in this study.
Figure 4-1. Assessment of effects of contingencies on response products. The filled circles show percent of intervals with SIB. The open circles show the duration of session in seconds.
CHAPTER 5
STUDY 4: EFFECTS OF CONTINGENCIES ON RESPONSE PRODUCTS ACROSS THE ENTIRE DAY

Method

Subjects and Setting

Three individuals from Study 3 (Tessa, Lillian, and Brian) participated in Study 4. Due to Paige’s job assignment, she was no longer available to participate. While participating in Study 4, subjects carried out their normal daily routines. A therapist or staff member conducted the SIT scale in the nearest restroom or other secluded area.

Response Measurement and Interobserver Agreement

The dependent variable was SIT scale measurements, which were used to assess tissue damage resulting from SIB.

Interobserver agreement was assessed by having an independent observer collect data during at least 20% of all medical exams. Agreement for a wound was scored if both observers agreed on both the location and the severity of the wound. Agreement percentages were calculated by dividing the number of agreements by the number of agreements plus disagreements. Mean agreement scores were as follows: Tessa, 89.6% (range, 0% to 100%); Lillian, 88.7% (range, 0% to 100%); and Brian, 91.9% (66.7% to 100%). Both Lillian and Tessa had wound checks where the two observers had a 0% agreement. During these checks, the primary observer scored the presence of a single small wound, and the second observer indicated that the subject did not have any wounds.

Procedures

The following conditions were implemented in a multiple baseline across subjects design.

Baseline. Wound checks were scheduled every 2 hours during waking hours (8 am – 8 pm). No consequences were provided for new tissue damage.
**Reinforcement.** This condition was identical to the previous condition; however, if no new tissue damage was observed during a medical exam, the subject earned a token. Tokens were exchanged once per day for a variety of back-up reinforcers. If new tissue damage was observed, the subject was told that no token was earned.

**Fading of the Contingencies on Response Products.** As the amount of new tissue damage remained low, the number of scheduled wound checks was reduced.

**Results and Discussion**

Results from the assessment of contingencies on response products across the day are shown in Figure 5-1 as the percent of checks during which no new or aggravated wounds were discovered (closed circles) and the number of wound checks per day (open circles).

Tessa created new wounds or aggravated existing ones during more than half (52.6%) of her baseline wound checks. Once reinforcement for wound free checks was introduced, the percentage of checks with no new or aggravated wounds increased, even as the number of checks conducted per day decreased. New or aggravated wounds were detected during only 11% of wound checks that occurred during treatment.

Lillian created new wounds or aggravated existing ones during more than 1/3 (40.8%) of her baseline wound checks. During reinforcement for wound free checks, the percentage of wound free checks immediately increased and remained high throughout the treatment. New or aggravated wounds were detected during only 6.7% of all wound exams that occurred during treatment.

Brian created new wounds or aggravated existing ones during more than half (53.1%) of his baseline wound checks. During reinforcement for wound free checks, the percentage of wound free checks immediately increased. However, as treatment continued, there were occasional days during which Brian often created new wounds or aggravated existing ones.
Although these periods are clearly problematic, there also were long stretches of consecutive days during which there was no evidence of any new wounds or aggravation of existing wounds, which never occurred during baseline. New or aggravated wounds were detected during only 13.5% of wound exams that occurred during treatment.

In summary, contingencies on response products were effective in increasing the percentage of checks during which no tissue damage was detected for all subjects. Even though improvements were made, new tissue damage was still detected during some checks conducted in the treatment phase, suggesting that SIB continued to occur.

There are some limitations inherent in using a permanent product measure, such as the wound checks used in this study. First, it is unknown what behavior produced the observed product (wounds). It possible that tissue damage could have been created through means other than SIB (e.g., bumping into an object, being scratched by the family pet, nicking oneself while shaving). Tissue damage created by some other means would produce a false positive outcome on the wound check. Second, false negative outcomes (failing to detect a wound following SIB) are also possible, although this is really no different than failing to detect an overt response. The interobserver agreement scores suggest that the wound check measure produced some false negative outcomes. Both Lillian and Tessa had wound checks with an agreement score of 0%. In these cases, one observer scored a very small wound that the other observer did not score. If the primary observer did not note the presence of a new wound during a check in the treatment condition, reinforcement would have been delivered even though it was likely that SIB had occurred.
Figure 5-1. Assessment of response product contingencies applied across the day for Tessa, Lillian, and Brian.
CHAPTER 6
DISCUSSION

This series of studies was designed to determine whether SIB that occurred primarily under covert conditions and was maintained by automatic reinforcement might respond favorably to an intervention based on stimulus-control procedures and, if not, whether reinforcement contingencies on response products would be effective. These interventions were examined both during brief sessions and across the day. Results from Study 1 showed that SIB was maintained by automatic reinforcement and occurred almost exclusively under covert conditions for 5 of 6 subjects. The 6th subject (Tessa) initially engaged in SIB in the presence of other people; however, this eventually was suppressed, and SIB occurred at higher rates when Tessa was alone. During Study 2, stimulus control was established during session for 5 of 6 subjects (the exception was Brian). Stimulus control was lost during the reversal to baseline plus signal for 4 of 5 subjects and was lost when it was implemented across the day for the 5th subject (Justin). Contingencies on response products (DRO) were effective for all 4 subjects (Study 3) and were effective across the day for all 3 subjects with whom it was implemented (Study 4).

Stimulus control was established quickly but was also lost quickly when it was no longer paired with blocking and reprimands. One obvious limitation of the stimulus control treatment is that behavior is unlikely to remain suppressed once the subject discriminates the absence of contingencies for problem behavior. Throughout the stimulus control condition, subjects would occasionally engage in SIB and would contact punishment. In most cases, SIB then would remain suppressed for the duration of that session. During the reversal to baseline plus signal, even though the signal was present, there were no contingencies for the occurrence of SIB. Subjects quickly contacted the absence of contingencies when the therapist did not enter the room following the first instance of SIB. At the beginning of the reversal phase, some subjects
engaged in lower intensity responses that still met the operational definition for SIB (and would have resulted in blocking and reprimands during stimulus control). After engaging in the response, the subject would look at the door. When no therapist entered, the subjects would engage in another lower intensity response and wait. After a few such instances, the subjects appeared to discriminate the absence of the contingency and resumed engaging in the same intensity and level of responding that was observed during baseline.

This suggests one way in which stimulus control might be made to have more lasting effects, intermittently pairing the signal with the appearance of a therapist who blocks SIB and delivers reprimands. The intermittent delivery of punishment might make brief periods in which the contingency was not in effect less salient to the subject; however, it is unclear how often pairing would need to occur in order to maintain response suppression. Lerman, Iwata, Shore, and DeLeon (1997) examined the effects of intermittent punishment on SIB maintained by automatic reinforcement. Punishment was effective for all 5 subjects when delivered on a fixed-ratio (FR) 1 schedule. When punishment was delivered intermittently (on a fixed interval [FI] 120 sec or 300 sec schedule), SIB reemerged for 4 of 5 subjects. When the punishment schedule was gradually thinned from an FR1 schedule to an FI 120 sec or FI 300 sec, SIB remained low for 2 of 4 subjects. Schedule thinning was ineffective for the other 2 subjects; SIB reemerged during attempts to thin the punishment schedule. These results suggest that intermittent punishment alone may not be effective, but it is unknown whether stimulus control procedures in conjunction with intermittent punishment might be effective.

Another strategy for exerting stimulus control over SIB involves establishing a rule as a discriminative stimulus in addition to, or in place of, the visual signal. Establishing behavior under instructional control has been shown to make people less sensitive to future changes in
contingencies (Hackenberg & Joker, 1994); therefore, establishing a rule about not picking in the presence of the signal might make behavior less likely to reemerge when consequences are no longer delivered. There are potential two possible problems with this approach, however. First, given the verbal abilities of our subjects, it seems likely they were constructing their own rules based on contact with the punishment contingency. It is unclear whether providing a verbal statement of the contingency (a rule) would establish any greater stimulus control. Second, even if the rule was initially effective, one would expect the effect to only be temporary until the subjects contacted that the rule was inaccurate (i.e., there was no longer any contingency during the reversal to baseline plus signal). Research has shown that delivery of inaccurate rules can result in the elimination of instruction following behavior (Galizio, 1979).

Results from Studies 3 and 4 showed that DRO and DRO using contingencies on response products were effective in reducing SIB for all subjects. Study 3 used direct observation to determine whether the individual earned reinforcement; Study 4 used a permanent product, documenting the appearance or worsening of wounds, as evidence of SIB. Wilson, Iwata, & Bloom (in press) found that results of wound product measures for SIB corresponded with the occurrence (or nonoccurrence) of observed SIB. Low levels of SIB were associated with improvements in wounds, and higher levels of SIB were associated with worsening of wounds. Increases in SIB were detected immediately using the product measures; decreases in SIB resulted in improvements in the wound product measure, but these improvements were delayed. This suggests that the wound product measure is a conservative estimate of the occurrence of SIB.

However, as noted previously, there are some limitations inherent in using permanent products, which may result in either false positive or false negative outcomes. In addition, when
using permanent products, there is a delay between when the individual engages in the behavior and the delivery of consequences based on the product of the behavior. During Study 4, wound checks were often 2 or more hours apart. If a subject engaged in SIB immediately following a wound check, it would be hours before any consequences were delivered for that SIB. By contrast, when consequences are applied contingent on the observed occurrence of the behavior (as in Study 2), delays are typically much shorter. Delayed consequences have been shown to produce weaker effects than more immediate ones, and this weakening of effects is referred to as temporal discounting (Critchfield & Kollins, 2001). This may explain why subjects continued to engage in low levels of SIB during the treatment phase of Study 4. It is possible that shorter intervals between wound checks (resulting in shorter delays to reinforcement) might have eliminated some of the negative effects of temporal discounting; however, more frequent checks would be difficult to conduct without considerable disruption of the subjects’ daily activities.

In summary, the current series of studies demonstrated an effective method for assessing and treating covert self-injurious behavior maintained by automatic reinforcement. Other possible methods might include the use of protective equipment (if the wound area is small), noncontingent reinforcement in the form of access to competing activities when the individual is alone, response cost (e.g., loss of privileges contingent on tissue damage), or any combination of these procedures.
REFERENCES


BIOGRAPHICAL SKETCH

Meagan Gregory completed her Bachelor of Science degree at the University of Florida in 2001. Following graduation, Meagan worked as a clinical specialist on the Neurobehavioral Unit at the Kennedy Krieger Institute (KKI), where she developed assessment and treatment programs for children with severe behavior disorders. While working at KKI, Meagan earned a Master of Arts degree in psychology (behavior analysis concentration) from the University of Maryland Baltimore County. After completing her Master’s degree, Meagan accepted an opportunity to work as a research assistant at KKI, then she returned to the University of Florida to begin work on her Ph.D. in 2006. As a graduate student at UF under the supervision of Dr. Brian Iwata, Meagan’s clinical and research experiences centered on working with adults and adolescents with developmental disabilities and behavior disorders. Meagan served as the instructor for the introductory course in applied behavior analysis as well as the advanced laboratory course.

Meagan is now conducting research with individuals with autism at the Scott Center for Autism Treatment at Florida Institute of Technology and serving as a lead co-instructor for ABA Technologies.