ASSESSMENT AND TREATMENT OF MULTIPLE TOPOGRAPHIES OF SELF-INJURY MAINTAINED BY SEPARATE REINFORCEMENT CONTINGENCIES

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Functional analysis procedures were used to assess and treat multiple topographies of self-injurious behavior exhibited by an individual. An experimental functional analysis indicated that one topography, hand biting, appeared to be maintained by social positive reinforcement in the form of delivery of tangible items. The analysis also provided evidence that a second form of self-injury, skin picking, was automatically reinforced. To treat positively reinforced hand biting, access to a preferred tangible was arranged contingent on the omission of biting for a prespecified time interval. Hand biting was nearly eliminated, and low rates were maintained as the schedule of reinforcement was thinned to 10 min. Competing stimulus assessments identified that magazines effectively suppressed all occurrences of skin picking; therefore, noncontingent access to magazines was implemented. Using a combination of multielement and multiple baseline designs, we were able to demonstrate that the two topographies of self-injury were maintained by independent reinforcement contingencies and that interventions corresponding to each topography and function effectively treated both behaviors.

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TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

CHAPTER 1

INTRODUCTION

Self-injurious behavior (SIB) consists of a wide array of behaviors (e.g., head banging, biting, eye poking, skin picking or scratching) that can result in immediate or long term tissue damage to the individual. This behavioral disorder is seen primarily in individuals with developmental disabilities and has been studied in a variety of settings such as classrooms, hospitals, outpatient clinics, institutions, and homes (Hanley, Iwata, & McCord, 2003). In addition to the physical dangers of SIB, it can be a barrier to participation in activities and habilitative programming, as well as integration into community settings (Iwata et al., 1994). Based on these concerns, a large body of literature has investigated assessments and interventions for individuals who engage in SIB. Within that literature, experimental functional analysis (EFA) and function-based interventions have emerged as recurrent themes (Carr, 1977; Carr, 1994; Hanley et al., 2003; Kuhn, Hardesty, & Luczynski, 2009; Mace, 1994; Pelios, Morren, Tesch, & Axelrod, 1999; Smith, Iwata, Vollmer, & Zarcone, 1993; Smith, Lerman, & Iwata, 1996; Vollmer, Iwata, Zarcone, Smith, & Mazaleski, 1993a; Vollmer, Marcus, Neef & Iwata, 1994; Vollmer, Marcus, & Ringdahl, 1995).

Experimental Functional Analysis (EFA)

As interest in the development of effective interventions to reduce SIB has grown, methods anchored in basic operant conditioning have produced the most successful treatment options. These methods rely on an understanding of the effects of environmental antecedent and consequential conditions on the occurrence of problem behaviors such as SIB. Knowledge of these factors has been shown to be critical in the development of interventions that address the

underlying “cause” of the behavior. Previously, practitioners simply applied reinforcement or punishment contingencies to behaviors without regard to reinforcement history or hypotheses about potential relationships between the environment and the behaviors of interest (Mace, 1994). Identification of the functional properties of behavior and the environment provides a foundation for treatments that can directly address the operant function of SIB (Carr, 1977; Mace, 1994).

Achieving control over SIB as a function of specific environmental antecedent and consequential arrangements, Iwata and colleagues (Iwata, Dorsey, Slifer, Bauman, & Richman, 1982/ 1994) introduced function-based assessment and provided a foundation for a functional analytic approach to intervention. Iwata and colleagues found that consequences such as attention from caregivers and escape from aversive demands could increase levels of SIB in their participants. This started an era of innovation among researchers and practitioners working with individuals who engaged in SIB. Many researchers worked to refine experimental functional analysis methodologies (e.g., Carr, 1994; Iwata, Duncan, Zarcone, Lerman, & Shore, 1994; Vollmer, Iwata, Zarcone, Smith, & Mazaleski, 1993b; Vollmer, Marcus, Ringdahl, & Roane, 1995).

EFA procedures involve systematically exposing an individual to a set of analog conditions designed to simulate antecedent and consequential events that may be functionally related to the behavior of interest. Differentiation of problem behavior across these conditions provides evidence of a specific operant function for the behavior. Subsequently, the antecedent and consequential events that are shown to increase problem behavior can be manipulated in an effort to reduce or eliminate the behavior. Thus, EFA allows for the identification of functional reinforcers for problem behavior which, in turn, can lead to more effective intervention (Hanley

et al., 2003). Brief summaries of the primary categories of operant relations that have been found to maintain problem behavior, typical analog conditions designed to assess those operant functions, and some generic function-based interventions are described below.

Social Positive Reinforcement

In some cases, parents, teachers, caregivers, or others might inadvertently reinforce undesired behaviors by providing attention, physical contact, tangible items, or access to activities when undesired behaviors occur. Often, those consequences are delivered in an effort to calm the individual and stop the episode of problem behavior.

At least two procedures have been used to asses if problem behavior is maintained by social positive reinforcement. In the "social disapproval" condition (Iwata et al., 1982/1994), attention in the form of statements of concern and physical contact are delivered contingent upon the occurrence of SIB. All other behaviors are ignored by the therapist. This condition is designed to assess if SIB is maintained by access to socially mediated positive reinforcement in the form of attention.

Day, Rea, Schussler, Larsen, and Johnson (1988) demonstrated that problem behavior could be maintained by access to tangible items. An analog condition has been developed to assess behavioral maintenance by socially mediated positive reinforcement in the form of access to tangible items (Fisher, Piazza, & Chiang, 1996; Vollmer, Marcus, Ringdahl, & Roane, 1995). During the "tangible" condition a preferred item is delivered for a brief period of time contingent on the occurrence of problem behavior. This condition is designed to simulate a situation in which a caregiver may inadvertently reinforce problem behavior by providing access to preferred items in an effort to calm the individual during or following episodes of problem behavior.

Hanley et al. (2003) reported that 38.3% of functional assessments included an assessment of the effects of contingent presentation of toys, food, or some type of tangible item on the occurrence of problem behavior.

A range of interventions have been used to treat problem behavior maintained by social positive reinforcement. Extinction is perhaps the most direct function-based approach to the treatment of problem behavior. Extinction of problem behavior maintained by social positive reinforcement involves simply withholding the reinforcing event (e.g., attention or tangible items) following occurrences of the behavior. For example, Mace, Page, Ivancic, and O'Brien (1986) utilized attention extinction to treat the aggressive and disruptive behaviors of subjects whose behavior was at least in part maintained by social positive reinforcement in the form of statements of disapproval. Withholding attention following instances of problem behavior was effective in decreasing future occurrences.

Differential reinforcement interventions decrease inappropriate behavior with extinction while providing reinforcement contingent on its absence for prespecified time intervals (differential reinforcement of the omission of behavior, or DRO) or increasing appropriate or alternative behaviors with positive reinforcement (differential reinforcement of alternative behavior, or DRA; functional communication training, or FCT). DRO interventions have been implemented with success in the treatment of attention and tangibly-maintained SIB (e.g., Mazaleski et al., 1993; Vollmer et al., 1993b). Heard and Watson (1999) used DRO to treat the positively reinforced wandering of two participants. Following a functional assessment indicating that wandering was maintained by access to tangible items and access to attention those events were delivered contingent on the absence of wandering for various periods of time.

All participants' behaviors were significantly reduced, supporting the conclusion that wandering had been positively reinforced.

Although DRO has been shown to be effective to decrease problem behavior, it does not result in the acquisition or reinforcement of alternative, more adaptive behaviors. Thus, interventions that provide access to the source or reinforcement contingent on other specific responses (DRA, FCT) may prove more effective, efficient, and durable. DRA involves placing problem behavior on extinction and delivering reinforcement contingent upon some other more appropriate behavior and has been used widely in the treatment of aberrant behavior (Vollmer & Iwata, 1992). Research outcomes suggest that extinction is a critical component of treatments using differential reinforcement (McCord et al., 2001).

Finally, other studies describe the manipulation of antecedent events to reduce SIB maintained by social positive reinforcement. For example, Vollmer and colleagues (1993b) provided response-independent attention at regular intervals, thereby reducing the attention-maintained SIB of three participants. As with effective applications of differential reinforcement, it appears that extinction may play an important role in the reductive effects of NCR. Results showing maintenance of decreases in SIB as NCR intervals are thinned (e.g., Vollmer et al., 1993b) suggest that extinction is at least partially responsible for treatment effects.

Social Negative Reinforcement

Behavior maintained by social negative reinforcement can become a part of an individuals' repertoire if caregivers provide "breaks" from difficult situations when problem behavior occurs. This relationship may be observed in academic settings such as classrooms, in

the context of medical or dental routines, in sheltered workshops, and during individualized therapy sessions. In these settings SIB may be reinforced if the person obtains escape from the non-preferred activity as a consequence of the behavior.

The "academic" condition was designed to simulate situations in which demands are placed on the individual frequently (Iwata et al., 1982/1994). In this condition experimenters deliver a demand at regular intervals and provide temporary escape from tasks contingent upon the occurrence of SIB. The experimenter may indicate a break from demands by physically turning away from the client and removing the task materials for a period of time. This condition was designed to assess whether problem behavior is maintained by social negative reinforcement in the form of escape from or avoidance of demands.

Several researchers have utilized escape extinction to reduce the occurrence of SIB in the presence of task demands. Iwata and colleagues (1990) demonstrated the effectiveness of escape extinction on negatively reinforced SIB. During this experiment, multiple methods of preventing or interrupting SIB were utilized, (e.g., response blocking, physical guidance to comply with task, and continued task presentation) which effectively suppressed self-injurious behavior and increased compliance. These researchers highlighted the pattern of increased SIB rates upon initial implementation of the extinction component and the eventual decrease in rate of SIB. Similarly, Goh and Iwata (1994) conducted an analysis on behavioral variability during the treatment of escape maintained SIB during extinction based interventions. While demonstrating the effectiveness of extinction these researchers also point out the effects induced by the procedure, including increases in aggression (a non-targeted behavior) as well as increases in target responses prior to the ultimate reduction in SIB.

Differential reinforcement procedures have also been implemented by experimenters to reduce behaviors maintained by socially mediated negative reinforcement. For example, Kodak, Miltenberger, and Romaniuk, (2003) successfully reduced the occurrence of escape maintained problem behavior and simultaneously increased compliance by implementing a differential negative reinforcement of behaviors intervention (DNRO). This procedure involved providing brief escape from instructional activities contingent on the omission of problem behavior for a prespecified interval of time. By providing the hypothesized reinforcer for problem behavior contingent upon periods of time without problem behavior, experimenters demonstrated the effectiveness of interventions that match behavioral function.

Iwata and colleagues (1990) found that DRO using positive reinforcement was effective in reducing the negatively reinforced SIB. They delivered sips of soda contingent upon brief periods free from SIB, and successfully faded the DRO interval to 15 min. Although this manipulation did not utilize escape as the DRO functional reinforcer, interventions such as these may be better suited in some cases. For example, in cases such as medical or dental appointments, daily living routines, or therapy sessions, escape may not be the most feasible reinforcer to deliver. If providing escape is not an option, DRO using positive reinforcement may be the most appropriate intervention for the treatment of behavior maintained by escape.

Differential reinforcement of alternative behaviors (DRA) interventions have been used to treat problem behaviors maintained by negative reinforcement. For example, Steege and colleagues (1990) implemented DRA with two individuals with escape maintained SIB. One participant got brief breaks from grooming activities contingent upon compliance and the other participant got brief breaks from teeth brushing trials contingent upon pushing a button that

stated “stop.” Both DRA manipulations produced suppression of self injury and significant increases in the alternative or replacement behaviors.

Similarly, Roberts, Mace, and Daggett (1995) used DNRA to reduce self injury maintained by escape from bathing related demands. During DNRA sessions therapists provided a brief break from demands contingent upon compliance. By providing the hypothesized reinforcer of escape contingent upon the appropriate bathing related behavior, compliance increased and self injury was almost completely suppressed.

Antecedent manipulations such as noncontingent reinforcement have been used to reduce SIB maintained by social negative reinforcement. For example, Vollmer, Marcus, and Ringdahl, (1995) provided two participants with noncontingent escape and significantly reduced the occurrence of SIB maintained by negative reinforcement in the form of escape from instructional activities. These authors point out that NCE was effective for both subjects, producing fairly immediate suppression.

Other researchers have found that noncontingent delivery of positive reinforcers can reduce escape-maintained problem behavior. For example, Vollmer and colleagues (Vollmer, Marcus, & Ringdahl, 1995) provided clients with frequently scheduled noncontingent escape, which produced substantial decreases in negatively reinforced SIB. Similarly, Wilder, Normand, and Atwell (2005) extended the use of NCR to SIB maintained by escape from food presentations. In this arrangement, noncontingent access to a video decreased SIB responses significantly while food acceptance increased to near 100%. Another antecedent manipulation studied in the treatment of escape-maintained problem behavior is instructional fading. Instructional fading involves the elimination, and the subsequent slow and systematic reintroduction of aversive events into the context in which problem behavior occurs. Zarcone

and colleagues (1993) examined the effects of instructional fading when paired with extinction in the treatment of escape maintained SIB. Baseline conditions involved providing the participant with escape contingent upon SIB. Initially fading alone was implemented across participants. During these conditions, escape was provided when SIB occurred. For each participant, increases in SIB were observed as demands were faded into the schedule and, ultimately, extinction was required to suppress SIB for each. Thus, the effectiveness of the antecedent intervention in this case required a consequent manipulation (extinction).

Non-Social Behavioral Maintenance

Problem behavior can be maintained in the absence of socially mediated consequences. Automatically maintained problem behavior is difficult to treat because of the immediate and reliable reinforcers that it produces and because the source of stimulation is often unavailable for therapeutic manipulation. For example, eye-poking that is maintained by stimulation of the optic nerve is not amenable to extinction-based interventions, for obvious reasons. Often these behaviors will occur or persist in settings with few alternative sources of stimulation.

The “alone” condition used in standard EFA arrangements was designed to assess behavior in the absence of socially mediated consequences and simulates instances in which individuals are not engaged in task demands or leisure activities (Iwata et al., 1982/1994). During this condition the individual is alone in an observational room with no external sources of stimulation and all behaviors are ignored. Problem behavior that is mediated by automatic reinforcement may occur at high levels in the alone condition, due to a generalized deprivation from ambient stimulation and the absence of potentially negative contingencies (e.g., reprimands) for the behavior.

Sensory extinction programs have been shown to be effective to treat automatically reinforced behavior. For example, Iwata and colleagues (Iwata, Pace, Cowdery & Miltenberger, 1994) applied several extinction procedures to reduce an individual's head banging. Attention extinction and escape extinction were applied during attention and demand conditions but did not result in clinically significant reductions in SIB; however, sensory extinction eliminated SIB across conditions. This manipulation both confirmed the hypothesis that this participants' SIB was maintained by its automatically occurring consequences, and demonstrated that addressing functional reinforcers is crucial to the success of extinction based interventions.

Differential reinforcement of alternative behaviors (DRA) has also been shown to be effective in reducing automatically reinforced problem behaviors. Favell and colleagues (1982) taught individuals to access alternate sources of stimulation to reduce the automatically maintained self injury of individuals. By providing sources of stimulation that approximate or match the sensory feedback produced by SIB, appropriate alternative behaviors increased and self injury decreased.

Noncontingent access to an alternative source of sensory stimulation (NCR) has also been implemented successfully with individuals who engage in sensory maintained SIB. Roscoe, Iwata, and Goh (1998) eliminated the automatically maintained behavior (arm rubbing and skin picking) of individuals by providing free access to highly preferred stimuli. The authors also compared NCR and extinction in the treatment of automatically maintained SIB in this study. Both interventions were effective but the authors emphasize that NCR produced more immediate and complete suppression of self injury than did the extinction intervention. Piazza and colleagues have developed a procedure for empirically identifying stimuli that may be most useful in NCR arrangements to decrease automatically reinforced behavior (Piazza, Hanley, &

Fisher, 1996; Piazza et al., 1998). Their results suggest that a functional match between stimuli used in these arrangements and the form of stimulation hypothesized to maintain problem behavior can be an important consideration when selecting stimuli.

Undifferentiated Functional Analyses: The Problem of Multiple Control

Functional analyses sometimes yield unclear or undifferentiated results. One reason that problem behavior may be observed across several or all conditions of an EFA is that the problem behavior is non-social in nature. That is, problem behavior may occur across assessment conditions because the automatically produced consequence maintaining behavior is accessible throughout all conditions. For example, an individual who engages in eye poking to produce optical stimulation to the eyes may engage in the behavior across experimental conditions because the availability of optical stimulation is not affected by the experimental manipulations. Iwata and colleagues (1994) conducted an EFA that revealed high rates of SIB in attention, demand, and alone conditions. By applying extinction interventions to each relevant condition of the EFA they were able to show that SIB was reduced only when sensory consequences were interrupted or attenuated.

Results from functional analyses may also be unclear when behavior is controlled by more than one form of reinforcement. In these cases problem behavior may have been followed by multiple reinforcing consequences (such as escape, attention, and tangible items) thus some or all may maintain that behavior. For example, Smith and colleagues (Smith, Iwata, Vollmer, & Zarcone, 1993) showed that problem behavior may be sensitive to multiple sources of reinforcement. When target behaviors occurred across more than one of the EFA conditions, these researchers applied a relevant intervention to each of the corresponding EFA conditions

behavior was observed to occur in (e.g., applied NCR to alone baselines, and implemented a DRO during attention conditions). This approach successfully reduced the multiply controlled SIB in two of three subjects. It should be noted that both relevant interventions were required to obtain complete suppression of target behaviors.

Practitioners and researchers have met special problems in the area of intervening on multiply controlled problem behaviors. Most difficulties in treating multiply controlled behaviors stem from identifying interventions that do not contradict each other when implemented simultaneously. For these reasons, there is not much of research on multiply controlled SIB. When intervention is implemented for these types of behaviors it is best to introduce each treatment sequentially across the relevant baseline conditions.

Some researchers have focused on separate consequences that maintain one or more topographies of SIB (e.g., Derby et al., 1994; Gonzales et al., 1998; Thompson et al., 1998). Separate topographies are typically treated as a unit during functional analyses. However, although different topographies of behavior may be maintained by the same reinforcers, it may be that different topographies of problem behavior sometimes belong to different functional classes. Thompson and colleagues (1998) conducted functional analyses as well as indirect assessments with several topographies of aggression. Results of this study indicated that one response topography (grinding the chin on others) was maintained by automatic reinforcement while other topographies (hitting and kicking) were maintained by social positive reinforcement. Derby and colleagues (1994) showed that when response topographies are aggregated during experimental functional analyses, results may be undifferentiated or difficult to determine. In graphing the aggregate class of stereotypic behaviors and aggression there was no clear function identified. Conversely, when the same response topographies were graphed separately, there

was clear differentiation in the data indicating aggression was maintained by negative reinforcement and stereotypic behaviors were maintained by automatic reinforcement.

In an investigation that highlighted the importance of matching procedures to the functional properties of problem behavior in cases of multiple control, Iwata and colleagues (1994) used extinction to reduce the SIB of their participant with multiply maintained SIB (Iwata, Pace, Cowdery, & Miltenberger, 1994). Following a condition in which the researchers applied extinction of attention on a baseline of contingent attention, they applied relevant extinction procedures (sensory extinction and escape extinction) across respective EFA conditions (alone and demand settings). Results showed that each type of extinction was necessary to completely suppress SIB. The authors discuss effectiveness of extinction when reinforcers identified in an EFA were withheld in the treatment of problem behavior "reductions in SIB were observed only when implementation of extinction involved the discontinuation of reinforcement previously shown to be responsible for maintaining the behavior" (Iwata, Pace, Cowdery, & Miltenberger, 1994, p. 140).

The purpose of the current study was to replicate previous studies of multiple control by conducting functional assessment on multiple topographies of self injury to determine the functional properties of each. Using the information obtained regarding the operant function of these responses, treatment analyses were conducted to both confirm the hypothesized function of the behavior, and identify effective interventions for each.

CHAPTER 2

GENERAL METHOD

Participant, Setting, Materials

Kathy, a 57 year-old-woman diagnosed with profound mental retardation, participated. Kathy had resided at a state supported residential and training facility for individuals with developmental disabilities for 48 years at the time the study. Kathy's IQ score was 20 at the time of the time of this study. Due to right sided weakness and generally poor gait, Kathy used a wheelchair as a primary mode of transportation. During all experimental sessions Kathy was seated in a back-fastening wheelchair to prevent falling to the floor or tipping the chair over. Generally, Kathy used one word approximations and relied heavily upon gestures to access preferred items, activities, and staff attention. While at home Kathy was observed watching TV, looking at magazines, or laughing and commenting to staff. During times when Kathy left the home she was observed seeking social interaction with others (primarily direct care staff) by waving, yelling hello, giving high five, hand shakes, and hugs to others in her environment. Direct care staff often provided Kathy with attention. Kathy frequently recruited attention and compliments by pointing or signaling to her purse when others passed by. Kathy was referred to a behavior analytic clinic for assessment and treatment of self-injurious behavior in the form of skin picking/chewing and hand biting. A review of facility records for the year prior to the study revealed that hand biting occurred at moderate rates (i.e., 26 occurrences per month) while apparently occurring at a low intensity (no injuries produced by hand biting had resulted in medical attention over the previous year), but was a concern to her parents and was targeted for elimination in her habilitative programming. Records indicated that skin picking occurred at very low rates (8.33 occurrences per month); however, this behavior produced large open sores

resulting in calluses on her hands and wrists. It is possible that this topography was occurring at higher rates, but was perhaps less salient than hand biting. Kathy may have learned to engage in this topography when others were not present which could have produced the low rates reported by Kathy's direct care staff.

All experimental functional analysis (EFA) sessions were conducted in a behavior analytic clinic for the assessment and treatment of behavior disorders, which was located on the campus of the residential and training facility where Kathy resided. EFA sessions were 10 min in length and were conducted in a 3.7 m by 3.7 m observation room containing a table, one chair, and materials as appropriate for each experimental condition. A one-way mirror (1.3 m by 1.1 m) was affixed to the entry wall for unobtrusive observation. Data collectors were positioned outside the one-way mirror and scored Kathy's behavior with hand held computers.

Materials used in the EFA conditions included magazines, necklaces, a deck of playing cards, a spinning toy that vibrated and lit up, a bouncy ball, and a stuffed animal. During demand conditions standard poker chips and a small can with a hole in the lid were presented as task materials. Kathy's purse was used during tangible sessions. Therapists brought reading materials into the observation room during attention and tangible sessions but these were not available to Kathy.

Target Behaviors

All target behaviors were scored using duration recording. Operational definitions for Kathy's self injury were based on definitions of her target behaviors in her positive behavioral support plan and clinical observations by the research team. Skin picking and chewing were combined for data analysis, as they appeared to occur under similar circumstances and produced

similar outcomes. The onset of skin picking was scored when contact between the fingernail(s) and the skin was observed, and the offset was scored when contact was broken. Topographies that were observed included using one or more fingers to pick a sore, scab, or callus on the same/opposite hand in an upward scraping motion, using two fingers in a pinching motion to pick an area on the other hand, or picking the inside of her nostril(s). Chewing was defined as contact between the upper and lower front teeth and fingertips, calluses, or scabs; the onset of chewing was scored when Kathy exhibited repeated up and down jaw motion within one second of contact and the offset was scored when that motion or contact ended. Kathy's skin picking/chewing was directed almost exclusively toward her hands, arms, fingers and wrists; during one session, Kathy was observed to pick at a scab on her knee.

Hand biting was defined as contact between the top and bottom teeth and any part of the hand or fingers, ending when contact was broken. This definition excluded instances in which the participant was chewing (as defined above), picking her teeth, or licking her finger(s). The most frequently observed topography of hand biting observed was insertion of two or more fingers past the plane of the lips followed by clenching of the teeth, which often occurred while Kathy pointed to the floor with her free hand.

Therapist Behavior

Several therapist responses were scored in order to evaluate procedural fidelity. Attention delivery, demands presented, and delivery and removal of tangible items were recorded. Duration of therapist attention was defined as any instance in which the therapist was speaking in an experimental session (demands were not scored as attention). Frequency of therapist demands was scored every time the therapist stated "put the poker chip in the can."

Each time the therapist handed the purse to Kathy tangible delivery was scored. Duration of tangible removal was tracked to ensure Kathy was not accessing the tangible item by struggling with the purse when the therapist removed it. Duration of removal started when the therapist touched the purse and ended when Kathy was no longer touching it.

Observation Procedures

Target behaviors and therapist behaviors were recorded by trained graduate students using handheld computers. Possibly due to a history of punishment, Kathy engaged in covert episodes of skin picking at times when therapists were present. Some examples of these covert instances include placing both hands in her lap and picking the tips of her fingers while concealed under the table and placing her hands in her coat pockets to engage in skin-picking. For this reason, the table in the observation room was placed against the one-way mirror so data collectors had optimal viewing of her hands. Kathy was also required to remove her coat before each experimental session.

Interobserver Agreement (IOA)

A second trained graduate student collected data during 54.4 % of Kathy's EFA sessions. IOA was calculated by dividing each session into one second intervals, summing the number of intervals in which the primary and secondary observers agreed on the occurrence and non-occurrence of the target behavior, dividing the result by the total number of intervals in the session and multiplying the outcome by 100. The mean IOA during the EFA was 97.01%, with a range of 82.5% - 100%). The mean IOA during the treatment analysis was 97.8 %, with a range of 85 % - 99.9 %).

Experimental Functional Analysis (EFA) Procedures

An EFA (Iwata et al., 1982/1994) was conducted in order to determine the variables maintaining Kathy's hand biting and skin picking/chewing. Four types of sessions (described below) were presented within a multi-element design (Sidman, 1960). The number of sessions conducted each day was arranged such that each day started on a different experimental condition to prevent sequence effects. Sessions were conducted in the order in which they appear below. Prior to each session a data collector stated "we have something to do, let's put your purse right over here for a while" and calmly removed her purse from her possession. If hand biting occurred following the removal of the purse prior to the session Kathy was placed in the observation room for a minimum of 3 minutes. If Kathy engaged in hand biting any time in the last 60 s of this interval, the interval was reset for an additional 60 s. When 60 s elapsed without any occurrences of hand biting the session was started. This was done to decrease the likelihood that ongoing hand biting that was unrelated to upcoming experimental contingencies would occur during sessions. Three to five 10-min sessions were conducted 3 to 4 days per week, for a total running time ranging from 30 min to 50 min daily. Graduate students trained in the management of aggressive behavior, protection of human subjects, and cardiopulmonary resuscitation served as therapists.

Experimental Conditions

Alone

Kathy was seated in the observation room alone. The room contained the participant's wheelchair, a chair, and a small table. Kathy received no instruction prior to or during the session and no consequences were provided for problem behaviors. The purpose of this

condition was to evaluate whether Kathy's problem behaviors were maintained by non-social reinforcement.

Attention

Kathy was seated in the observation room with the therapist. No recreational or leisure items were present. Upon entering the observation room the therapist signaled the availability of social reinforcement by saying "Hey Kathy I've got some work to do but if you need anything I'll be right here". The therapist delivered a verbal reprimand (e.g., "Don't do that. You are going to hurt yourself.") following each occurrence of skin picking/chewing or hand biting. All other behaviors were ignored and the therapist pretended to read. The purpose of this condition was to evaluate whether Kathy's problem behaviors were maintained by social positive reinforcement in the form of reprimands.

Tangible

A multiple stimulus without replacement (MSWO) preference assessment (DeLeon & Iwata, 1996) conducted prior to the EFA identified magazines and a purse as highly preferred items. At the time of referral anecdotal reports from significant others in Kathy's life indicated that taking Kathy's purse away occasioned episodes of self-injury. In addition, caregivers and Kathy's parents reported that her purse was a highly preferred item; therefore, Kathy's purse was used during the tangible condition.

Prior to the session the therapist presented the purse to Kathy for five seconds and then removed it. After the session began the purse was delivered to Kathy contingent upon each occurrence of skin picking or hand biting. After five seconds elapsed the therapist removed the

purse without saying anything and returned to the seat. If the participant engaged in either problem behavior before five seconds of access time elapsed or when the therapist attempted to remove the purse, the access interval was reset. The purpose of this condition was to evaluate whether Kathy's problem behaviors were maintained by social positive reinforcement in the form of access to her purse.

Play

Kathy and the therapist were seated in the observation room. Magazines, a bouncy ball, a stuffed animal, a spinning toy, some beads, and cards were available for Kathy and the therapist to manipulate. Continuous attention was delivered by the therapist in the forms of comments, conversation, and physical touch. No consequences were delivered contingent upon problem behaviors, and attention was provided independent of Kathy's behavior. The purpose of this condition was to serve as a control against which to compare response measures from other conditions.

Demand

The participant was seated in the observation room with the therapist. Work task items were present. Every 30 s the therapist asked the participant to put a poker chip into a coffee can using a three-step prompting procedure. This task was chosen because it closely replicated the types of activities that were typically presented during Kathy's leisure skills training program. If the participant complied with the request with in three seconds the therapist delivered brief verbal praise. If the participant did not comply within three seconds of the first prompt the request was restated and the therapist delivered a modeling prompt, saying "put the poker chip in

the can like this." If Kathy did not comply within three seconds the therapist physically prompted her to put the poker chip into the can, saying "put the poker chip in the can like this." If either problem behavior occurred during a request, the task materials were withdrawn, the therapist said "Ok, you don't have to," and the therapist did not place another demand for 30 s. If the participant engaged in either problem behavior at the time a demand was to be placed, the request was delayed for an additional 30 s. The purpose of this condition was to evaluate whether these behaviors were maintained by social negative reinforcement in the form of escape from, or the delay of demands.

Treatment Analysis Procedures

Following the EFA, a series of baseline and intervention conditions was implemented in order to evaluate the effects of treatments corresponding to the outcomes of the EFA.

Baseline – Tangible

Sessions in this condition were identical to the tangible condition from the EFA. The first 11 tangible baseline sessions were derived from the original EFA, and four additional sessions were conducted following completion of the EFA. During the EFA, the tangible item was delivered contingent on either hand biting or skin picking/chewing.

Because skin picking/chewing was observed to occur infrequently during tangible (hand biting and skin picking/chewing) sessions, and in order to isolate the effects of the tangible contingency on hand biting, only hand biting produced access to the tangible item during this condition.

Baseline – Alone

This condition was identical to the alone condition of the EFA. Kathy was alone in the observation room with no activities or leisure items. No consequences were provided contingent upon the occurrence of target behaviors. The first 11 alone baseline sessions were derived from the original EFA, and four additional were conducted following completion of the EFA.

Differential Reinforcement of the Omission of Behavior (DRO)

A differential reinforcement of the omission of behavior (DRO) intervention was implemented during tangible sessions. During DRO, the therapist delivered the purse contingent upon the absence of biting for a predetermined amount of time (15 s, 30 s, or 10 min). Sessions began after 15 s pre-session of noncontingent access to the purse. The therapist then removed the purse and stated, "Ok, let's put your purse right over here for a minute". The purse was placed in the far right corner of the table so that Kathy could see it but could not reach it. If a predetermined amount of time (15 s, 30 s, or 10 min) elapsed during which hand biting did not occur, the therapist delivered the purse without saying anything. Kathy was initially given 15 s access to the purse after meeting the DRO criteria; however, this contingency produced an increase in hand biting, possibly because the duration of access was too brief to function as reinforcement. Therefore, the duration of access to the purse was increased to 120 s for the remainder of the study. If hand biting occurred the DRO interval was reset. A brief reversal to baseline - tangible (hand biting) was implemented following the first 15 s/120 s DRO phase, which was followed by a return to DRO 15 s/120 s. The DRO interval was subsequently increased to 30 s and, finally, 600 s.

Noncontingent Access to a Competing Stimulus

A competing stimulus intervention was implemented across experimental conditions in a multiple-baseline design first during alone, then during tangible sessions. Competing stimulus assessments (Piazza et al., 1996) were conducted to identify an item that could effectively suppress self injury. The competing stimulus and the hypothesized reinforcer were made available the entire session and data collectors scored the duration of skin picking and engagement with the item. Item interaction was defined as "Any time the participant is touching the item with her hand(s)". No consequences were provided contingent upon skin picking or hand biting. Assessments revealed that access to magazines suppressed skin picking by 100% and duration of interaction with the magazine was the highest of all stimuli assessed. After assessment was complete, the competing stimulus was incorporated in the alone condition, while DRO sessions in the tangible condition remained unchanged. Finally, the competing stimulus intervention was implemented during tangible sessions.

Alone + Competing Stimulus

The competing stimulus was first implemented on the alone baseline. This was done to see if treatment effects would be observed in the absence of socially mediated contingencies. This condition was identical to the alone sessions except there were two magazines present throughout sessions. Kathy was seated in the observation room alone, with no materials present. Immediately prior to the session the therapist opened the door, placed the magazines on the corner of the table without saying anything or making eye contact, and left the room. The magazines remained available for the entire session. If at any time the magazines or a page from them fell to the floor the therapist entered the room, placed them back on the corner of the table

without saying anything or making eye contact, and left the room. This was done to ensure that Kathy retained access to the competing stimulus for the entire session. Data collectors scored the duration of skin picking and hand biting.

DRO + Competing Stimulus

These sessions were identical to the DRO condition except that magazines were available throughout the entire session. Kathy was seated in the observation room with no materials present, the therapist opened the door and placed the magazines on the table, then entered the room and delivered the purse for 15 s pre-session access time. The session began when the pre-session access time ended and the therapist removed the purse, placing it on the far right corner of the table. The magazines remained available for the entire session. If at any time the magazines or a page from them fell to the floor the therapist immediately picked them up and placed them back on the corner of the table. This was done to ensure that Kathy retained access to the competing stimulus for the entire session. After 10 min elapsed with zero occurrences of hand biting, the therapist gave Kathy access to the purse for 120 s.

CHAPTER 3

RESULTS

Experimental Functional Analysis

Results of the experimental functional analysis (EFA) are displayed in Figures 1 and 2. The duration of hand biting and skin picking/chewing were graphed separately to generate hypotheses about the function of each behavior. Figure 1 displays the total duration of hand biting across each condition of the EFA. The first 9 sessions of the EFA included programmed contingencies for skin picking/chewing only (these responses were the focus of Kathy's initial referral, and hand biting was added as a target behavior when it was observed to occur during the EFA). It should be noted that Kathy attempted to covertly engage in skin picking/chewing during EFA conditions in which a therapist was present. During periods of little or no social or activity engagement Kathy was observed skin picking while trying to position her hands in such a way that prevented the therapist from seeing it (e.g., picking her hand at her side where the therapist could not see). During Session 8 hand biting occurred at high levels following the removal of the tangible item. Thereafter, contingencies were programmed for both hand biting and skin picking/chewing during the EFA. Hand-biting occurred almost exclusively during tangible sessions and produced a mean of 88.83 s per session. Hand biting occurred at low levels during alone sessions (M = 16.57 s per session). Play, demand, and attention sessions produced near zero levels of hand biting, with a total duration of 3 s or less in each condition. These results suggested that hand biting was likely maintained by social positive reinforcement in the form of access to tangible items.

Figure 2 shows the duration of skin picking/chewing across conditions of the EFA. High and variable levels of skin picking/chewing were observed during alone sessions, whereas

consistently low levels of skin picking/chewing were observed during sessions in the attention, demand, and tangible conditions. The average duration of skin picking/chewing across alone sessions was 73.43 s per session, with a range of zero to 321 s. Skin picking/chewing was scored at low durations during demand sessions (M = 6.17 s per session), tangible sessions (M = 2.4 s per session), and attention sessions (M = 2.43 s per session). No occurrences of this topography were observed during play sessions. These outcomes showed that skin picking/chewing occurred frequently, and for longer durations, in the absence of social attention and structured activity, suggesting that skin picking/chewing was maintained by automatic reinforcement in the form of some type of sensory feedback.

Competing Stimulus Assessments

Results for each of the six competing stimulus assessment sessions are presented in the top panel of Figure 3. Panels on the left side show results for the first group of stimuli assessed. During these assessments skin picking/chewing occurred at variable and consistently high durations. More than 60% of the session was spent skin picking/chewing when Kathy was provided with access to the OT brush, the book, the velcro, or the tabs during competing stimulus assessments. The Bumball, Tangle, and Twirler showed slightly more suppression of skin picking/chewing with near 50% of the total session spent engaging in self-injurious behavior. Item interaction occurred at higher durations than skin picking/chewing in 2 of 15 trials. The Bumball and the Twirler produced the highest durations of item interaction and the lowest durations of skin picking /chewing. Unfortunately in both trials, item interaction was only slightly higher than 50% of the total trial duration. Because Kathy frequently threw the Bumball out of reach only the Twirler stimulus was selected for further analysis.

Panels on the right side display results for the second group of stimuli. These assessments showed that when magazines were available skin picking/chewing never occurred and item interaction was observed for nearly 100% of session time. When the Magnadoodle was available skin picking/chewing was observed an average of 83 s per session; however, slightly lower measures of item interaction were observed relative to interaction with magazines. While this assessment showed promising results, the Magnadoodle did not remain consistently effective as shown in competing stimulus assessments 4 and 6, during which item interaction fell below one minute and skin picking/chewing was elevated.

The average durations of skin picking/chewing and item interaction across competing stimulus assessments are represented in the bottom panel of Figure 3. Mean durations of item interaction were below two min for all stimuli with exception of magazines. Furthermore, skin picking/chewing occurred in the presence of all competing stimuli, excluding the magazines. Across competing stimulus assessments, Kathy interacted with magazines for an average of 290 s and engaged in zero seconds of skin picking/ chewing. These results indicated magazines represented a promising source of competing stimulation that could produce complete suppression of skin picking/chewing while maintaining near constant item interaction.

Treatment Analysis

Differential Reinforcement of the Omission of Behavior

The top panel in Figure 4 shows the duration of hand biting during the hand biting treatment analysis. Baseline Sessions 1 through 24 display the results of tangible sessions from the EFA. Baseline Sessions 25 through 32 display data from tangible and alone sessions which were conducted following the discontinuation of the other EFA conditions. The results from

baseline showed an average duration of hand biting during tangible sessions of 116.25 s per session.

The differential reinforcement of the omission of behavior treatment (DRO) was implemented in the tangible condition. Initially, if Kathy exhibited no hand biting for 15 s she obtained access to the purse for 15 s. Implementation of DRO 15 s/15 s produced a sharp increasing trend in hand biting. The mean duration of hand biting per session was 174 s. The results of DRO 15 s/120 s, combined with observations that Kathy emitted emotional responses when the tangible item was removed, suggested that 15 s of access represented an inadequate amount of reinforcement; therefore, access to the purse was increased from 15 s to 120 s (DRO 15 s/120 s). Although several "spikes" in hand biting occurred during the initial implementation of DRO 15 s/120 s, 11 of 17 sessions in produced near-zero levels of hand biting and an overall decreasing trend was observed. Total duration of hand biting ranged from 0 to 289 s, with a mean duration of 77.76 s per session.

A reversal to the baseline (tangible) condition was implemented following the 15 s/120 s DRO condition. Hand biting immediately increased and remained high across four sessions. The range in duration of hand biting was 79 s to 255 s, with mean duration of 165.75 s per session. DRO 15 s/120 s was reinstated at Session 85, and no hand biting occurred during four sessions at this DRO value. Based on this outcome, the DRO interval was increased to 30 s; again, no hand biting was observed across four sessions. Finally, the DRO interval was increased to 600 s (10 min); Kathy's hand biting remained at 0 with the exception of one occasion (Session 122) in which 10 s of hand biting occurred.

The bottom panel of Figure 4 shows the duration of hand biting across alone sessions. These sessions were conducted concurrently with those depicted in the top panel and, as in the

top panel, the baseline data was derived from the multielement EFA. This figure shows that hand biting remained at or near zero in most alone sessions. The 2 sessions in which unusually high levels of hand biting were observed (Sessions 39 and 56) were conducted shortly after DRO sessions in which high levels of biting had occurred; therefore, it is possible that these data reflect a carryover effect from immediately prior conditions.

Competing Stimulus Intervention

The top panel in Figure 5 displays the duration of skin picking/chewing across alone sessions. As in the graphic display for the DRO intervention, the first series of baseline sessions were derived from the multielement EFA. Throughout most of baseline skin picking/chewing occurred at a mean duration of 175.61 s per session, with a range from 8 s to 443 s. Skin picking/chewing occurred at high and variable durations throughout the last 4 sessions of baseline, with a mean duration of 336.49 s per session and a range from 0 to 600 s.

The competing items intervention was implemented on Session 112 during the alone condition first. When continuous noncontingent access to magazines was provided to Kathy, durations of skin picking/chewing decreased to zero with the exception of one session. During Session 125 Kathy dropped the magazine and engaged in skin picking/chewing momentarily. When the magazine was returned skin picking/chewing again decreased to 0.

Next, the competing stimulus intervention was implemented during tangible sessions (Session 122). The bottom panel in Figure 5 displays the duration of skin picking/chewing across tangible sessions. As with previous displays, the first series of baseline data were derived from the multielement EFA. Across all baseline sessions, skin picking/chewing occurred at an average duration of 5 s per session. Skin picking/chewing occurred at low levels during baseline

tangible Sessions 1 through 43, with an average duration of 14.19 s per session and a range from 0 to 92 s. During baseline (Sessions 44 through 119) clusters of sessions showing near-zero levels of skin picking/chewing alternated with clusters in which high and variable levels of responding were recorded. These patterns appeared to roughly correspond with changes in contingencies for hand biting. For example, 0 levels of skin picking/chewing were observed during Sessions 72 through 85, during which baseline (tangible) contingencies were in place for hand biting. However, upon implementation of the DRO intervention, increases in skin picking/chewing were observed. Thus, comparison of outcomes for skin picking/chewing and hand biting during tangible sessions shows negative covariance between the behaviors, with increases in hand biting associated with decreases in skin picking/chewing. Furthermore, a sustained period of high skin picking/chewing was observed during the DRO 600 s/120 s condition, which was characterized by low levels of hand biting and extended periods of inactivity.

When noncontingent access to magazines was implemented in tangible sessions Kathy's skin picking/chewing immediately decreased and remained at near zero levels. Skin picking/chewing occurred at a mean of .8 s per session during this intervention, with a range from 0 to 3 seconds. The graphs in Figure 6 show the duration of both hand biting and skin picking/chewing across tangible (top) and alone (bottom) sessions. This figure was created in order to more clearly illustrate potential carryover effects produced by the DRO or the competing stimulus interventions on either topography of SIB. During baseline duration of hand biting was higher than that of skin picking/chewing in 10 of 16 sessions. The DRO intervention was implemented on the tangible baseline at Session 36. When the competing stimulus intervention

was implemented on the tangible baseline, Kathy engaged in one occurrence and total hand biting was 10 s in duration. Subsequently, no other instances of hand biting were observed.

The bottom panel in Figure 6 displays the duration of both topographies of SIB across alone sessions. Alone sessions produced fairly clearly differentiated data paths for each topography. During baseline hand biting remained low consistently, while skin picking/chewing occurred at high and variable durations. When the competing stimulus intervention was implemented both topographies remained near zero throughout with the exception of Session 125.

CHAPTER 4

DISCUSSION

The purpose of the present study was to identify the functional properties of multiple topographies of self-injurious behavior through experimental functional analysis and to assess separate interventions that targeted topographies of self-injurious behavior (SIB) according to the identified function. During the experimental functional analysis (EFA) procedures similar to that of Iwata et al, (1982/1994) were implemented and each response topography was graphed separately. Initially, experimental contingencies were arranged for skin picking/chewing only. Later, the second response topography, hand biting, was included in the EFA. Clearly differentiated patterns emerged for both response topographies. Next, a differential reinforcement of other behavior intervention, designed to address a social-positive reinforcement (tangible) function for hand biting effectively reduced hand biting to zero. Finally, a noncontingent reinforcement schedule of competing stimulus presentation, using a stimulus identified as a potentially substitutable reinforcer for skin picking/ chewing, was implemented, resulting in complete and immediate suppression of skin picking/chewing.

By separating topographies of SIB for analysis during the initial EFA, it was possible to observe evidence of multiple control by topography. Hand biting persisted at high durations during tangible conditions of the EFA, indicating maintenance by social positive reinforcement in the form of access to tangible items. Hand biting was rarely observed to occur in other conditions. Variable but low levels of skin picking/chewing were observed across demand, tangible, and attention conditions and consistently high levels were observed during alone sessions, suggesting that this response topography was maintained by its automatically occurring consequences. These findings are consistent with those of Derby and colleagues (1994)

indicating that separate response topographies may be maintained by separate reinforcement contingencies.

During Sessions 1 through 10, skin picking/chewing occurred during tangible sessions as well. Within-session analysis shows that in both tangible sessions only 1 second of skin picking/chewing actually produced access to the tangible item; thus, nearly all skin picking/chewing occurred during intervals in which Kathy had access to the tangible item. Attempts to remove the tangible item were closely followed by episodes of hand biting, and Kathy successfully avoided the removal of the item several times in each session by emitting hand biting as the experimenter approached.

The current data support the notion that problem behavior maintained by multiple sources of reinforcement requires a multiple-component approach to treatment. The importance of accounting for multiple controlling variables was illustrated in the negative covariance observed between hand biting and skin picking/chewing during the DRO treatment. This relationship is most clearly seen in Figure 6, which permits a direct comparison of levels of the two topographies of behavior. The top panel of this figure shows that when contingencies were changed for hand biting, there were resulting changes in levels of both hand biting and skin picking/chewing. In general, these changes were in opposite directions, with increases in hand biting associated with decreases in skin picking/chewing and vice-versa. Similarly, the two single-session spikes in hand biting observed during the alone baseline (refer to Figure 4) were associated with corresponding decreases in skin picking/chewing. The specific reasons for negative covariation between hand biting and skin picking/chewing are not entirely clear; however, a reasonable account of this relationship is simply that conditions associated with decreases in hand biting were also associated with more “free time” that could be allocated

toward self-stimulatory skin picking/chewing. This account is consistent with the outcomes of the EFA, showing that conditions that promoted active responding by Kathy (e.g., demand and play conditions) were associated with the lowest levels of skin picking/chewing, whereas the most skin picking/chewing was observed in the absence of sources of ambient stimulation (alone). These outcomes illustrate that reductions in problem behaviors maintained by a particular operant contingency can be associated with worsening of behavior maintained by other sources of reinforcement. Clearly, practitioners should be vigilant of such relationships and should develop treatments that address all suspected operant functions of problem behavior.

The treatment analysis in the current study showed that the different topographies of problem behavior decreased only when interventions were in place that corresponded to the suspected operant function associated with that topography. That is, hand biting decreased only when the DRO (attention) was in place and skin picking/chewing decreased only when the competing stimulus intervention was in place. It is noteworthy that the baselines associated with each operant function (tangible and alone) were also associated with low levels of the non-targeted topographies of SIB. That is, hand biting rarely occurred during the alone baseline and skin picking/chewing was observed at low levels during the tangible baseline. The potential reason for low levels of skin picking/chewing was discussed previously. A reasonable account for the near-absence of hand biting during the alone baseline is the inclusion of a contingency in which EFA sessions were not initiated until at least one min elapsed without problem behavior and any hand biting that did occur during alone sessions did not result in delivery of the purse.

Prior researchers have suggested that differential reinforcement of alternative behavior (DRA) contingencies, in which participants learn to emit alternative responses to obtain the reinforcer identified to maintain problem behavior, are preferred, as they permit more control

over reinforcement by the participant (Vollmer, Roane, Ringdahl, & Marcus, 1999). In this case DRO was chosen because there were specific times when it was not possible for Kathy to regain access to her preferred tangible item (e.g., during bathing, medical examinations, swimming, and other adaptive programming routines). The tangible item used during DRO sessions was functionally related to the occurrence of hand biting (as indicated in the EFA). By implementing a DRO contingency it was possible to teach Kathy to tolerate necessary delays to the return of her preferred item. Anecdotal staff reports indicate that hand biting has remained low since the DRO intervention. Kathy has successfully attended several dental and medical appointments which required the removal of her purse.

Initially Kathy was provided 15 s access to the purse contingent on the absence of hand biting for 15 s in the DRO treatment analysis. Instances of hand biting increased sharply when this DRO schedule was implemented. It is probable that Kathy retained access to this tangible item for longer durations in the natural environment and that 15 s access simply did not function as a reinforcing event. Thus, removing the item after only 15 s of access may have functioned as an establishing operation (EO) that set the occasion for the sharp increase in behavior maintained by the tangible reinforcer. When access to the tangible item was increased to 120 s there was an immediate reduction in hand biting, with 11 of the 17 sessions in this condition producing zero or near-zero measures of hand biting.

Skin picking/chewing was targeted with a competing stimulus intervention which provided non-contingent, continuous access to magazines in the absence of social contingencies. This intervention produced immediate and consistent suppression of skin picking/chewing across both alone and tangible baseline conditions. Anecdotal reports from staff indicate that the wounds on Kathy's arms and hands have healed and that her arms remain free of wounds since

intervention. The stimuli selected for use in the current study were identified via an assessment of competing stimuli, as described by Piazza and colleagues (Piazza et al., 1996). Interestingly, the stimulus identified to most effectively compete with problem behavior in the current experiment did not appear to share a similar stimulus features with that produced by the problem behavior. In this case it would not be acceptable to identify a functional "match" for skin picking/chewing as this results tearing of the skin. Previous research has indicated that matched stimuli are effective as competing stimuli; however, the current results showed that the availability of magazines resulted in near-complete elimination of Kathy's skin picking/chewing when identifying a matched stimulus was contraindicated.

The current study replicates the findings of previous research (e.g., Favell et al., 1982) and supports the use of non-contingent access to leisure items to reduce self-stimulatory problem behavior. However, as pointed out by Iwata and Kahng (2005), non-contingent reinforcement does not typically produce extinction bursts and often results in rapid behavior change, it can produce unwanted effects. One such undesired effect of non-contingent reinforcement (NCR) in the natural environment, adventitious reinforcement, may occur when the delivery of the reinforcer follows occurrences of problem behavior closely in time. This can often simulate an intermittent schedule of reinforcement which can result in strengthening, rather than suppression of problem behavior. Despite this potential problem, many researchers who have investigated the effects of NCR in the treatment of problem behavior have shown little or no evidence of such an effect (e.g., Vollmer et al., 1993), and no evidence of adventitious reinforcement effects were observed in the current study.

The results of the present study should be evaluated with caution for several reasons. First, only one individual participated in this study. However, Gonzales (1998) also investigated

separate functions of multiple topographies of SIB, showing that providing leisure items in demand and alone conditions effectively treated automatically maintained and escape maintained behaviors. The experimenters suggested that the leisure items functioned as an abolishing operation (AO) for escape behavior and provided a competing stimulus which suppressed automatically reinforced behavior. These outcomes indicate that, in some cases, it is possible to address multiple topographies and functions of problem behavior with a single, relatively easily implemented intervention. Future investigations should continue to attempt to identify efficient, effective, and practical means of treating multiple topographies maintained by separate reinforcement contingencies.

The current investigation did not demonstrate maintenance of behavior change across time. In addition to determining the generality of findings as it applies to other topographies and functional categories of behavior, future research should evaluate maintenance over long periods of time in natural environments. For example, it is possible that competing stimulus interventions are susceptible to the effects of satiation or habituation over prolonged use. Thus, it may be necessary to continue to conduct competing stimulus assessments intermittently in order to evaluate changes in preferences and to insure that the most potent competing stimuli can be provided. Similarly, the maintenance of effects seen in the DRO intervention needs to be evaluated, as variables such as changes in reinforcement sensitivities and implementation fidelity lapses may result in decreases in DRO effects over time. For example, if caregivers accidentally reinforce hand biting with the delivery of a tangible item, thereby accidentally implementing an intermittent reinforcement schedule, behavior may increase and the problem behavior may show even greater resistance to future extinction efforts.

Despite these limitations, the current study demonstrates that a multiple-component approach can be effective to treat separate topographies of problem behavior maintained by different consequences. In addition, the current interventions were relatively straightforward and easily implemented by caregivers. Future efforts should continue to investigate approaches to the assessment and treatment of multiply controlled problem behaviors in order to further improve our understanding of this complex and challenging behavioral phenomenon.

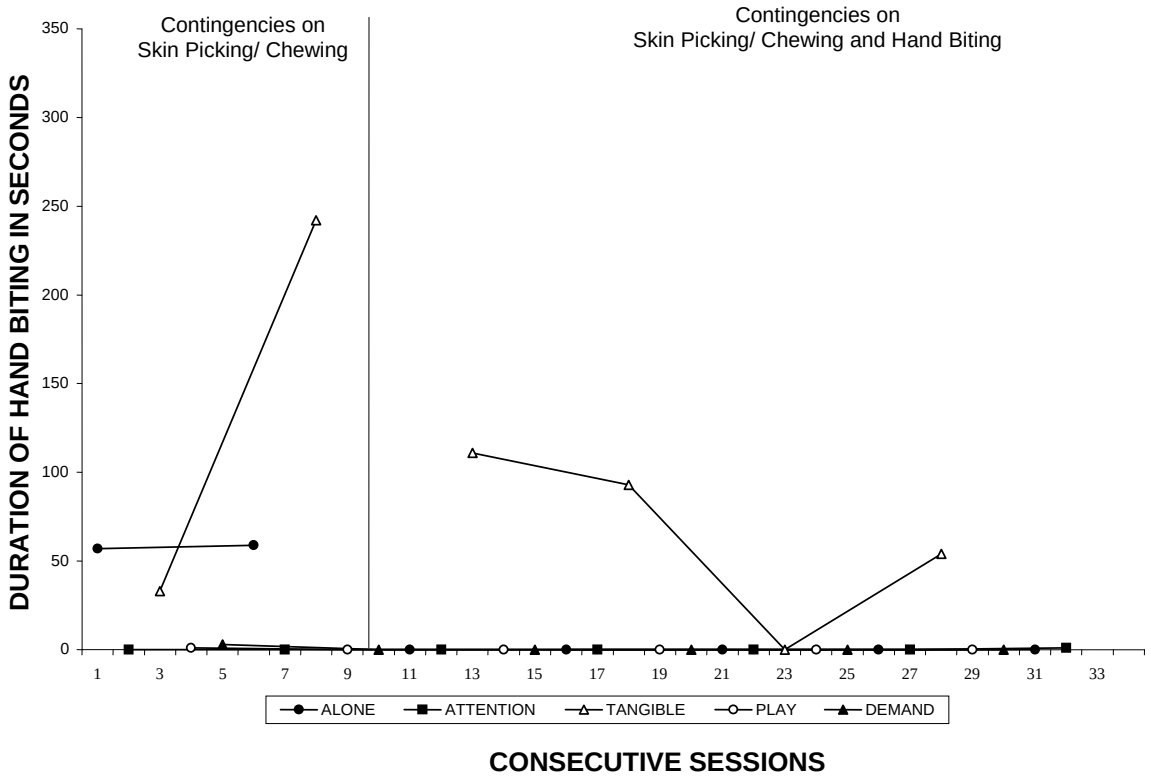

Figure 1. Functional analysis of hand biting.

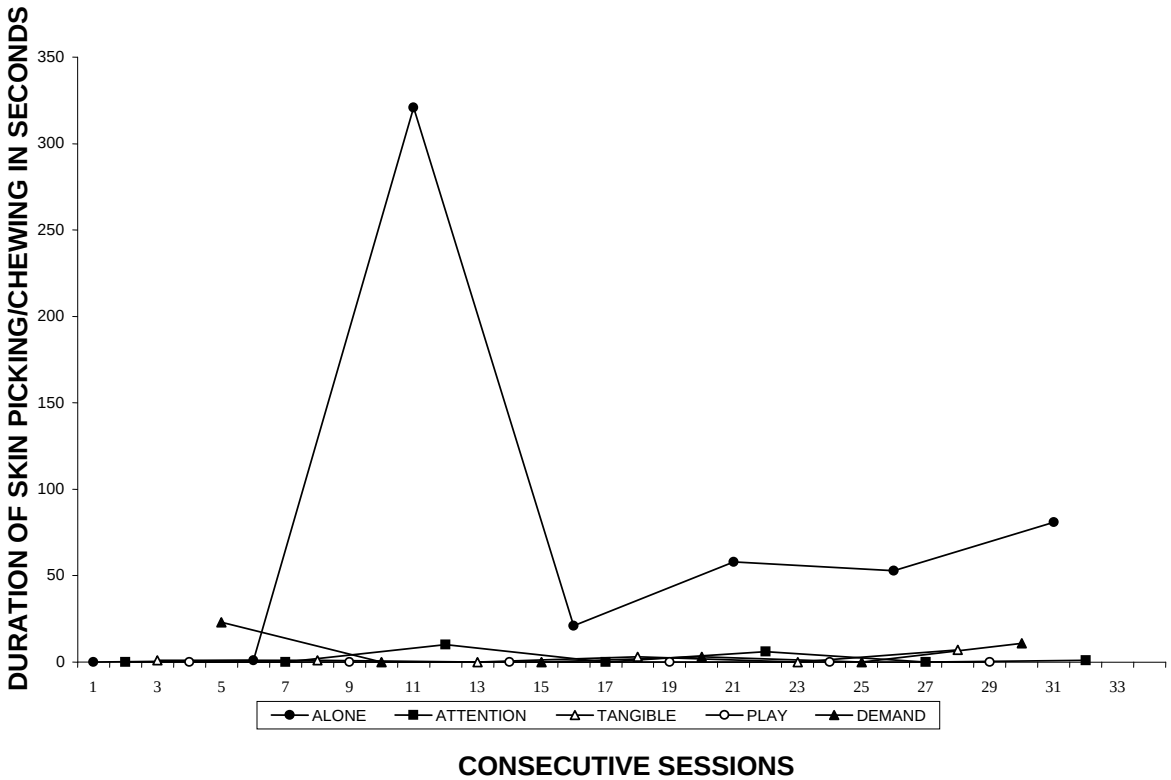

Figure 2. Functional analysis of skin picking/chewing.

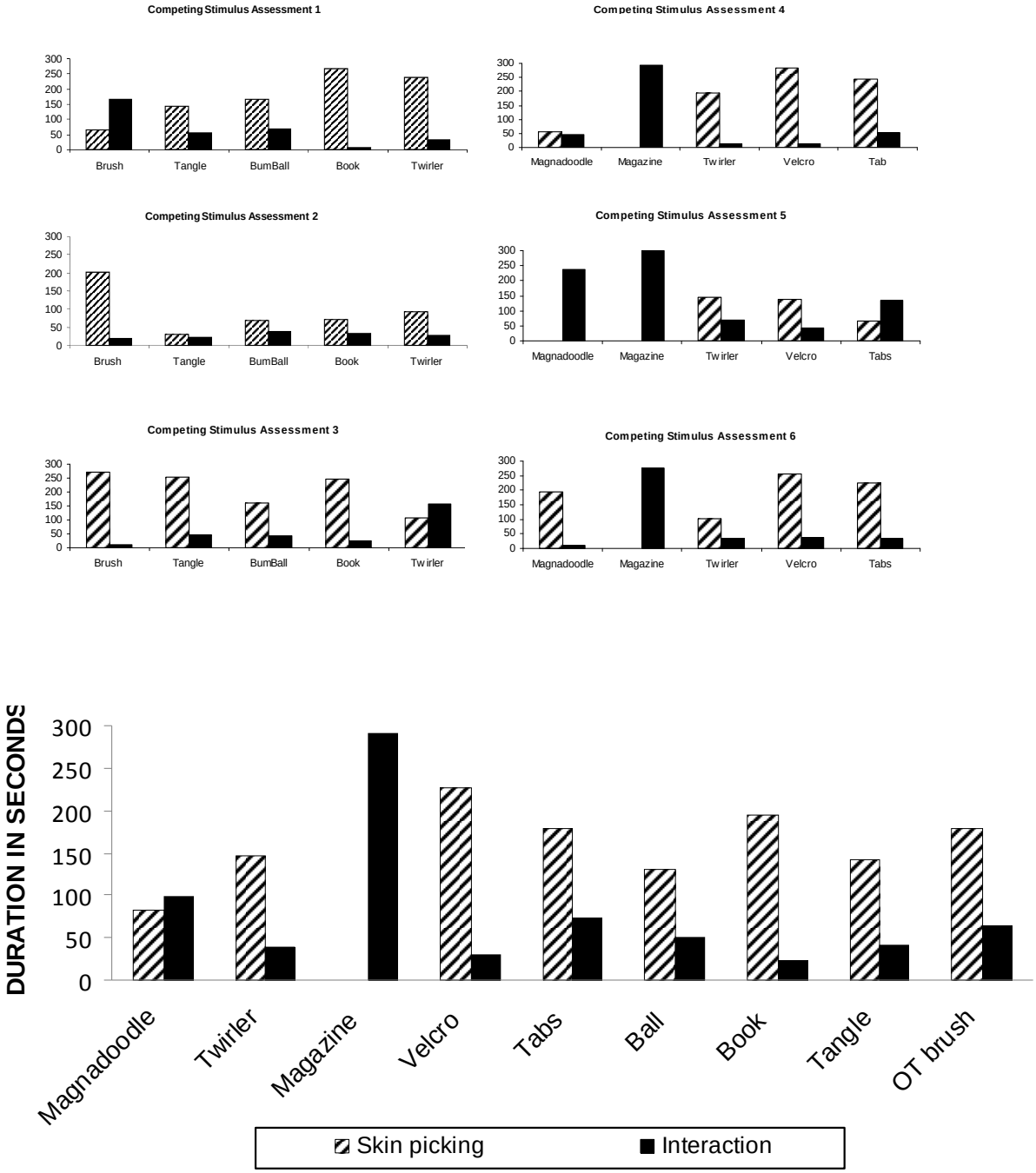

Figure 3. Competing stimulus assessment.

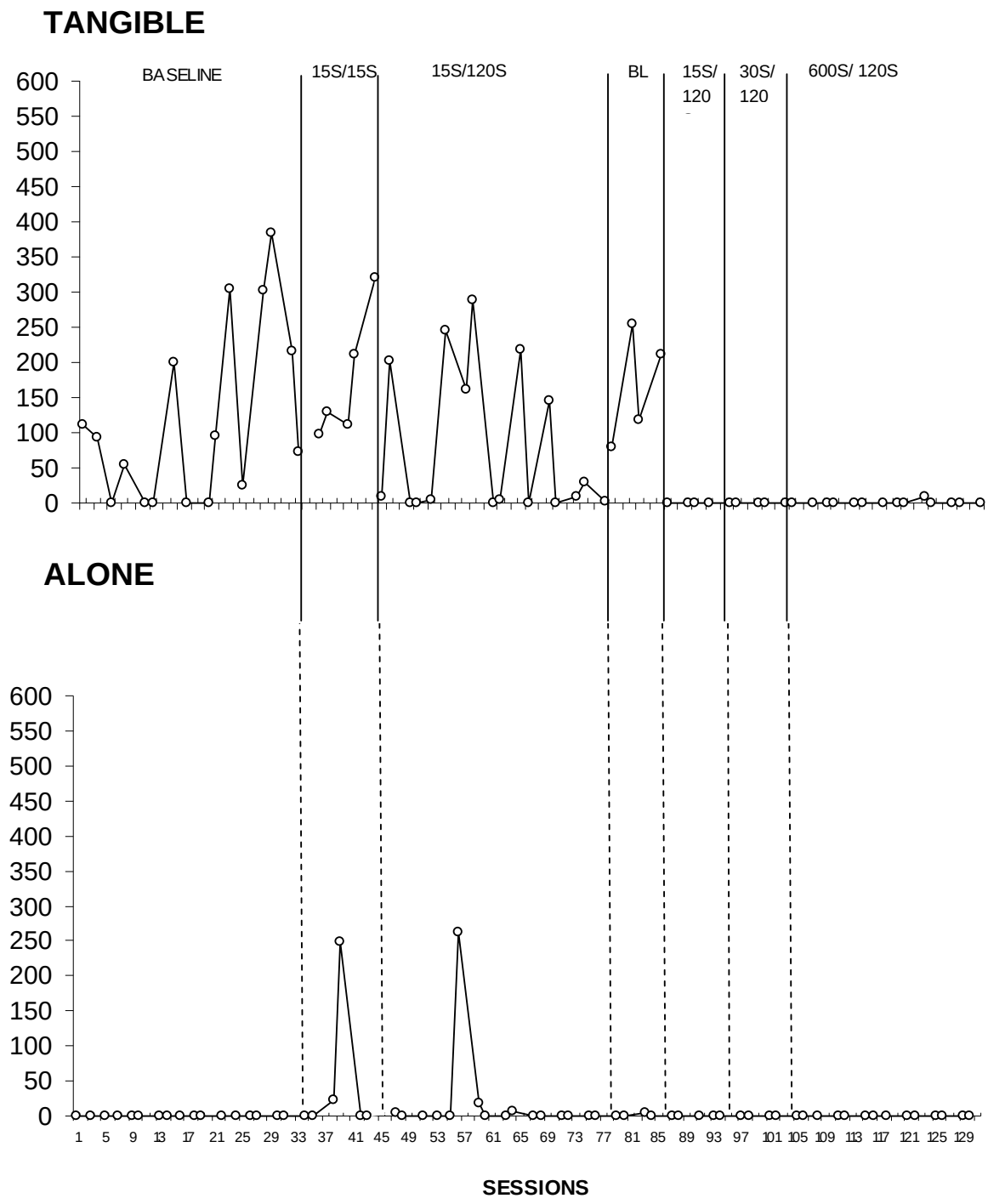

Figure 4. Hand biting treatment analysis.

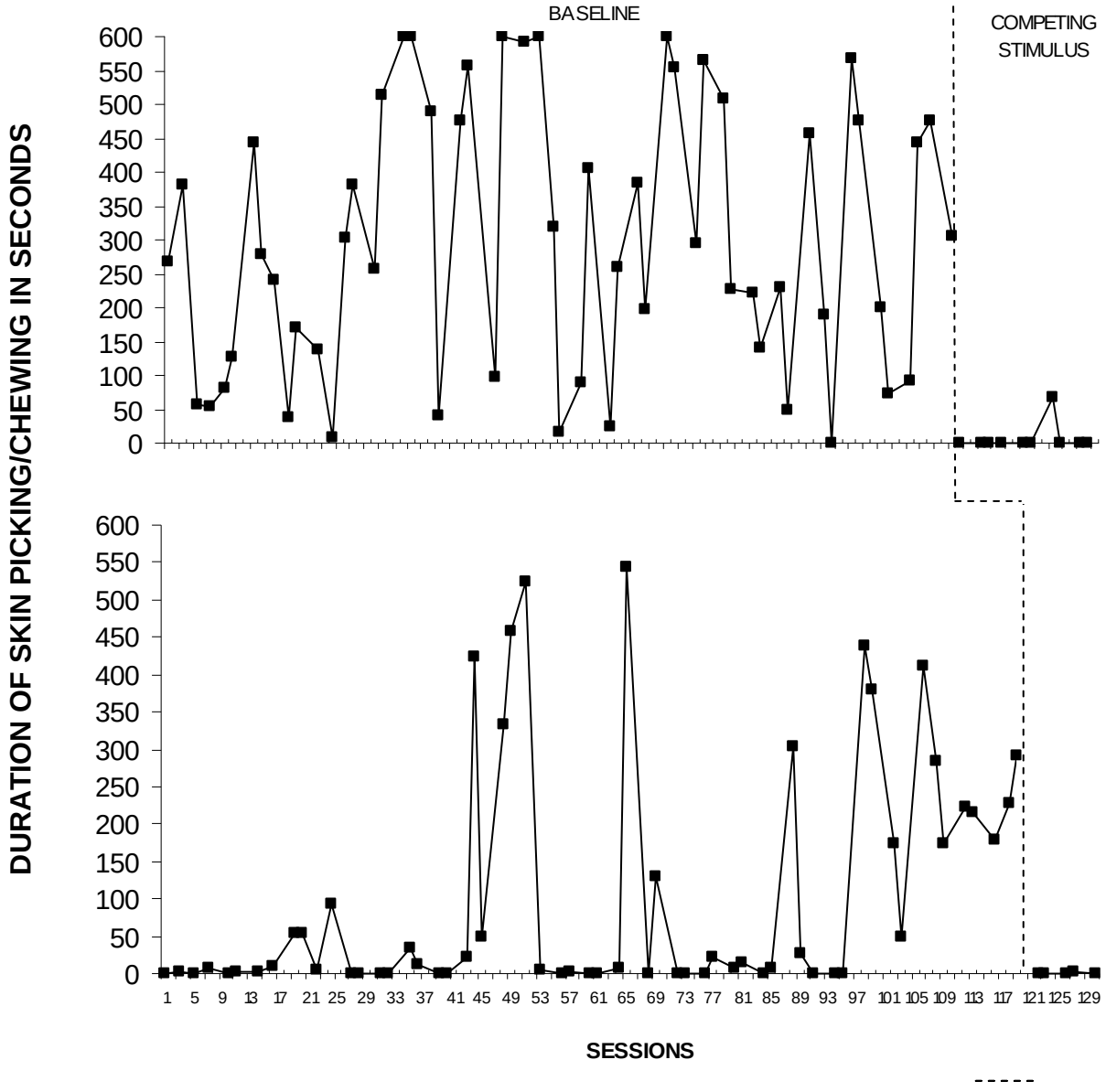

Figure 5. Skin picking/chewing treatment analysis.

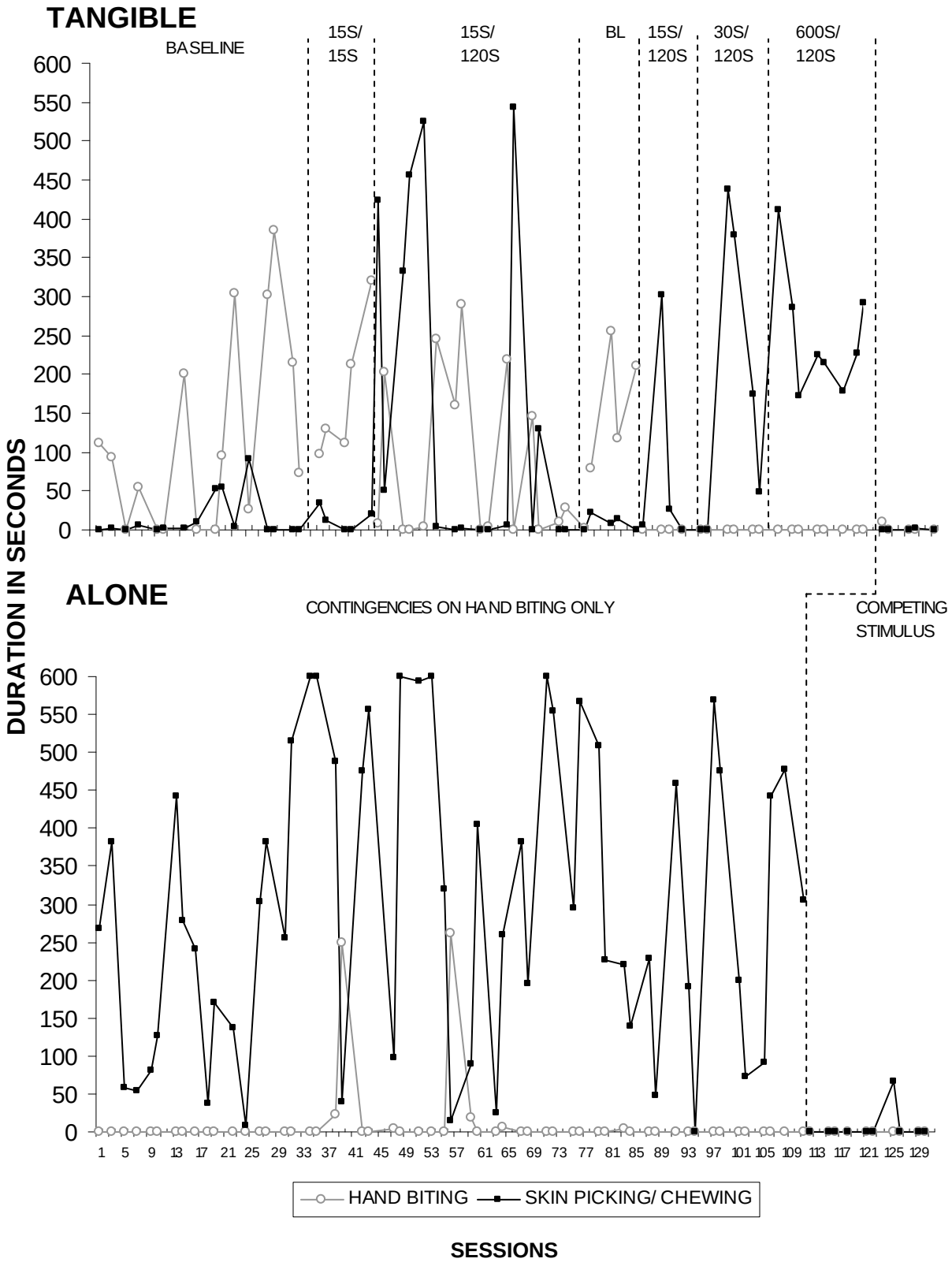

Figure 6. Hand biting and skin picking/chewing treatment analysis.

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