1981

Treatment of severe self-injurious behavior among the institutionalized retarded using a combination of overcorrection, contingent restraint, and increased interaction: a thesis...

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TREATMENT OF SEVERE SELF-INJURIOUS BEHAVIOR AMONG THE INSTITUTIONALIZED RETARDED USING A COMBINATION OF OVERCORRECTION, CONTINGENT RESTRAINT, AND INCREASED INTERACTION

A Thesis
Presented to
the Faculty of the Graduate School
University of the Pacific

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts

by
Robin S. Ross
July 1981
This thesis, written and submitted by

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is approved for recommendation to the Committee on Graduate Studies, University of the Pacific.

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Dated 7/28/81
ACKNOWLEDGMENTS

Grateful acknowledgment for support and assistance in conducting the study are offered to Olivia Constant, Clinical Psychologist and Louie Gray, Unit Supervisor at Program 4, Stockton State Hospital. Special thanks are offered to Annie Omiya, Lisa Villiers, and Bob Kunze, student assistants in the project.
ABSTRACT

Three severely developmentally delayed institutionalized adolescent individuals were treated for severe self-injurious behavior over a three month period. Treatment consisted of positive practice overcorrection, restraint delivered as a reinforcer for an absence of self-injury, and increased interaction during task training sessions. Treatment was faded for two of the individuals in successive steps involving decreased restraint and interaction. Self-injurious behavior was reduced in all cases. Prosocial behaviors increased with reductions in self-injurious behavior.
In order to effectively treat severe self-injurious behavior, several outcomes of treatment must be achieved. First, in order to prevent injury resulting from intense episodes of the behavior, self-injury must be completely eliminated. Second, to prevent future injury resulting from sudden escalation of self-injurious behavior, suppression must be maintained over an extended period of time. Finally, in order to facilitate inclusion and transfer into the less restrictive environments from which self-injurious persons are often barred, treatment must result in the individual's ability to function under conditions which approximate target environments. This study tested a treatment program designed to achieve the goals outlined above.

In designing a treatment package which will meet the treatment goals described, the efficacy of previously published treatments must be examined. The treatment which has been shown most effective in producing suppression of severe self-injury, maintenance, and generalization is response-contingent electric shock (Browning, 1971; Bucher & Lovaas, 1968; Corte, Wolfe, & Locke, 1971; Hall, Thorne, Shindeling, & Sagers, 1973; Lovaas & Newsom, 1976; Muttar, Peck, Whitlow, & Fraser, 1975; Prochaska, Smith, Marzilli, Colby, & Donovan, 1974). Current legal and professional limitations, however, preclude use of this technique except
in the most severe of cases. Research efforts over the past decade have therefore focused on the development of more positive treatment approaches. None have proven as effective as shock, but the data available on three such treatments are relatively encouraging. These treatments are differential reinforcement, positive practice overcorrection, and increased interaction.

Differential Reinforcement

Numerous studies have been conducted using differential reinforcement for the treatment of severe self-injurious behavior. With one exception (Weiher & Harman, 1975), differential schedules of reinforcement have not been reported effective in producing total suppression. However, both differential reinforcement of incompatible behaviors (DRI) and differential reinforcement of zero rates (DRO) have been effective in producing significant reductions in the frequency of self-injury (Favell, Jones, & McGimsey, 1978; Measel & Alfieri, 1976; Tarpley, 1976).

Differential reinforcement of zero rates using restraint as the reinforcer offers a unique and potentially effective means of reducing self-injury rates in subjects with long histories of restraint used to prevent the behavior. On the basis of experimental results, Favell et al. (1978) hypothesized that restraint delivered contingently may take on reinforcing value by providing escape from the opportunity to engage in self-injury.
Overcorrection

Recently, overcorrection has received attention as a mildly aversive or educative technique designed to reduce or eliminate inappropriate behaviors by having the subject engage in a series of actions deemed incompatible with the target behavior. A form of overcorrection, referred to as positive practice, typically involves first instructing the subject to engage in the desired movements, then providing graduated guidance when he or she does not comply with instructions to perform those movements. Positive practice is the type of overcorrection most commonly used to treat self-injury. Harris and Romanczyk (1976) reported complete suppression of head banging using five minutes of overcorrection contingent upon each occurrence of the behavior. This is, however, the only reported case in which severe self-injurious behavior was suppressed using overcorrection as the sole treatment.

Overcorrection and Differential Reinforcement

A more common approach to the treatment of severe self-injury is a combination of overcorrection and differential reinforcement. Several research teams have reported success in producing total suppression of severe self-injury using this combination. DeCatanzaro and Baldwin (1978) eliminated eye and ear punching in two profoundly retarded boys using a combination of overcorrection and a DRO schedule of reinforcement. Overcorrection consisted of arm movements
over the head, lowered to the sides, and raised to shoulder height. Suppression was achieved in all training settings. Similar results were reported when arm movement overcorrection was used in combination with differential reinforcement of incompatible behaviors to suppress head banging and self-hitting, with total suppression obtained for four of eight subjects (Azrin, Gottlieb, Hughart, Wesolowski, & Rahn, 1975). Similar but less successful results have been reported using overcorrection and DRI to treat mild face slapping, with table task performance used as the incompatible behavior (Measel & Alfieri, 1976).

**Increased Interaction**

Task training sessions offer numerous opportunities for the development of appropriate alternative behaviors, insofar as behaviors involved in task performance are considered incompatible with self-injury. There is evidence to suggest, however, that self-injurious behaviors occur with greater frequency in task than non-task situations. Although the available data relates only to language training (Carr, Note 1; Carr, Newsom, & Binkoff, 1976; Durand, Note 2), the evidence suggests that self-injury may function as escape from demands in training sessions. Within task sessions, interaction with the subject is typically minimized between trials in order to increase the discriminability of the presented stimuli. Prompts for appropriate behavior and reinforcement delivered following correct responses constitute the only interaction outside the task trial. It
follows that by engaging in self-injury prior to or following task presentation, the subject is reinforced for self-injury through avoidance or escape from demands and increased therapist attention.

Carr (Note 1) and Durand (Note 2) demonstrated that by increasing the amount of interaction within a session, the frequency of self-injury was significantly reduced. In each case, task presentation was inserted into the context of a series of interactive statements made by the therapist. The increased interaction reduced, but did not eliminate self-injury. Increases in compliance and social interaction were observed concurrent with decreases in self-injury. The authors hypothesized that when the amount of interaction within a session was increased, the demand characteristics of the task were reduced. Whether reduced self-injury rates occurred as a function of increased interaction or the fact that demands were "disguised" was undetermined. Because this strategy has been employed only in language training sessions, its efficacy in other training sessions is unknown.

Combined Treatments

Given the available data, it appears that the most effective treatment for severe self-injurious behavior may be one which involves combined usage of the several techniques discussed previously. Numerous reviewers have advocated incorporating adaptive behavior training into treatment programs for inappropriate behaviors to assure a sufficient repertoire of
behaviors incompatible with self-injury (Bachman, 1972; Baumeister & Rollings, 1976; Corbett, 1975; Frankel & Simmons, 1976; Harris & Herschfield, 1978; Miron, 1971). Within the context of the present study, the absence of self-injury was reinforced (DRO), occurrences were conseuated (over-correction), and training sessions were conducted to minimize the probability of self-injury motivated by escape and/or avoidance of demands (increased interaction). It was expected that the combined treatment package would produce reduction or suppression of self-injury while promoting development of alternative behaviors in the form of task performance. In addition to degree of suppression, it was expected that the rate of suppression would be quite rapid, thereby increasing the utility of the treatment package for use in applied settings.

To date, neither differential reinforcement, over-correction, nor their combination have been used in conjunction with increased interaction and task-centered treatment for self-injurious behavior. It is hypothesized here that increased interaction, incorporated into training sessions within which appropriate behavior is reinforced and self-injury conseuated with overcorrection will contribute to the effective suppression of self-injurious behavior, while promoting increases in prosocial behavior. Increased interaction is expected to enhance the effectiveness of both differential reinforcement and overcorrection by producing a
reduction in frequency of self-injury below that which would be produced by the two treatments used together. With decreases in self-injury, the amount of time spent engaging in task performance and social interaction is expected to increase, resulting in increased opportunities for reinforcement contingent upon task performance as well as restraint contingent upon an absence of self-injury.

**Maintenance**

In order for treatment gains to have clinical relevance, they must be maintained over time in the absence of treatment. To facilitate maintenance of gains made in the treatment portion of the present study, provisions were made to fade two of the three treatment components in defined stages, with positive practice remaining a constant component of treatment. It was expected that fading treatment prior to termination would result in maintenance of gains at or near treatment levels during follow-up observations.

**Description of Study**

A treatment package consisting of overcorrection, restraint delivered as a reinforcer (contingent restraint), and increased interaction was implemented, then systematically faded using a multiple baseline design across subjects. Treatment was conducted within task training sessions. If initial suppression was not maintained as treatment was faded, use of a procedure in which major treatments were
systematically faded would suggest which components of
treatment should be examined in future studies for the con-
trol each exerts over self-injurious behavior. If self-
injury was eliminated with suppression maintained across
all phases, the use of a multiple baseline design would al-
low stronger statements to be made regarding the suppressive
effects of treatment than would simultaneous implementation.
More importantly, fading in defined stages permitted assess-
ment of maintenance of treatment gains.

In fading treatment components, contingent restraint
and increased interaction were faded, while the use of over-
correction remained constant. Overcorrection was consistently
implemented for two reasons. First, if suppression was main-
tained across fading stages as demand conditions increased
and the frequency of positive interactions and reinforce-
ment decreased, there would be no need to implement over-
correction. Second, it was thought that staff in treatment
facilities typically respond more consistently to inappropriate
than appropriate behaviors. Therefore, the positive com-
ponents of treatment were faded to levels considered realis-
tic in terms of consistent application if staff were required
to implement the program.
METHOD

Subjects

Three developmentally delayed individuals were recruited from Program 4 at Stockton State Hospital to serve as subjects. The first, who will be referred to as Debra, was a 15 year old female, diagnosed as severely developmentally delayed. She exhibited high-intensity self-hitting to the head which had resulted in a broken nose, numerous raised areas on her head, and corneal scarring in both eyes. She had a history of restraint and would self-restrain by inserting both arms into one sleeve of her shirt. When made to remove her arms from her shirt, Debra would typically hit her ears and eyes, then attempt to scratch or bite staff. Aside from a controlled seizure disorder and constipation, there were no chronic medical problems.

The second individual, who will be called Joey, was a 14 year old male with severe developmental delay resulting from prenatal drug intake. He exhibited self-hitting to the arms, legs, torso, and head which resulted in cuts, bruises, and a chronic cellulitis condition on his left arm. Joey had a long history of restraint used to terminate aggression. If permitted, Joey would self-restrain by wrapping himself in blankets. On the unit, aggression against staff and other clients covaried positively with self-injury. Joey was on a
stable regimen of Thorazine prior to baseline. This medication was discontinued two and one-half weeks into baseline. With the exception of a controlled seizure disorder, periodic headaches, and constipation, there were no chronic medical problems.

The third individual, who will be called Mark, was a 16 year old male, diagnosed as profoundly developmentally delayed. Self-injury took the form of self-choking, which involved placing the palms or thumbs against the carotid artery and vein of the throat, then leaning the elbows against a table, chair, or bed. The choking had resulted in severe loss of oxygen and bruises to the throat in the past. When combined with twirling, self-injury formed part of a chain of behavior which terminated with grand mal seizures if not interrupted. Mark had no history of restraint to prevent self-injury or other behaviors. He was on a stable medication regimen to control seizures. Aside from a seasonal allergic rhinitis condition, Mark had no other chronic medical problems. He did, however, have impaired hearing, and responded primarily to physical gestures, facial expression, and simple words which he could lipread at a rudimentary level.

Setting

Treatment was conducted in a small room located off the unit's dayroom. The room was sufficiently large to contain three chairs and a small table comfortably. Outdoor recreation areas were used for restraint intervals with Joey
and indoor dayrooms were used with Debra and Mark. Toys, music, games, and physical contact were used as reinforcers for appropriate behavior in the restraint settings whenever possible.

Staff Involvement

With administrative cooperation, the staff of the treatment facility were informed about the study. The purpose, rationale, and specifications for measures and procedures were explained in small group meetings where all procedures were described, then modeled. Staff were invited to observe, but not participate in treatment. Staff participated in the development and implementation of transition programs to the unit and school after the study was finished.

Design

Treatment for self-injurious behavior was implemented within a multiple baseline design across subjects. Baseline began simultaneously for all subjects. The first treatment phase was then implemented sequentially across subjects. Movement to and through succeeding phases was determined on the basis of each subject's performance, allowing for different rates and amounts of progress. Treatment began on the tenth day of the study for Mark, on the seventeenth day for Debra, and on the twenty-first day for Joey.

Measures

Measures of self-injurious and prosocial behavior were taken in daily treatment sessions. Four measures were used:
1) **Frequency of self-injury.** The topography of self-injurious behavior was individually defined for each participant, with occurrences of the behavior recorded. The definitions are presented below:

Debra: self-hitting, defined as hits to any part of the head with one or both hands, or with an object held in the hand(s).

Joey: self-hitting, defined as hits to any part of the body involving use of one or both hands, irrespective of force or angle of descent.

Mark: self-choking, defined as any time the thumb or heel of one or both hands was placed against the throat.

2) **Severity of self-injury.** Severity of self-injury was determined on the basis of the type of wound(s) resulting from each occurrence/episode of the behavior. A numerical wound scale was developed for use in recording intensity of self-injury to facilitate identification of sudden changes in intensity. Because no such changes were observed, the definitions for each category of wound(s) incurred are not presented here. The categories, however, were used in recording frequency of self-injury by severity category.

3) **Percentage task demand compliance.** Task demands and compliance were recorded as frequency measures, then converted to percentage demand compliance. Percentage compliance was included as a measure in order to identify effects of treatment on the prosocial behaviors of the subjects, both in initial treatment and as restraint and interaction
density were faded.

4) **Social tolerance/initiation.** The frequency with which the participant approached the therapist or tolerated approach and physical contact in work intervals was recorded. Approach was defined as any time the subject moved, reducing the distance between him/herself and the therapist without engaging in self-injury or aggression. Tolerance of physical contact was defined as any time the therapist touched the subject, took his or her hand, or hugged him or her without occurrence of aggression, avoidance, or self-injury. Approach and tolerance of physical contact were recorded in the same category.

**Observer and Therapist Training**

Four student assistants were recruited from a pool of students previously trained by the author in psychology courses at the University of the Pacific. Training proceeded according to the specifications of the training package in Appendices A and B. Once training was complete, ten minute observations were conducted in the subjects' living unit until a criterion of 85% agreement for each of the four measures collected simultaneously was obtained for one hour per subject. Occurrences and non-occurrences of each behavior recorded were included into the computations for percentage reliability. For each pair of observers, percentage agreement was computed using the following formula:
number of agreements
number of agreements + disagreements X 100 = % agreement

Procedures

Pre-treatment Assessment

Reinforcer survey. Reinforcers (including praise, physical contact, edibles, and toys) for use in reinforcing correct task performance within sessions were surveyed. Also included in the survey were restraints for use in reinforcing work intervals in which no self-injury occurred. Since none of the participants had the expressive abilities necessary to indicate preferences, a contingent reinforcer survey was conducted. Tasks on which participants had demonstrated competency on classroom measures and which were different from those used in treatment were presented and various reinforcers offered in randomized order, one per trial, contingent upon correct responses. Subjects were shown the reinforcer before each trial began. A minimum of three tasks was used, with each participant. Each edible was tested using ten trials per task, and each liquid was presented 5 times per task. Data was collected on percentage correct responding for each reinforcer on each task over a two day period. Those reinforcers associated with performance 20% or more above other reinforcers were selected for use. Because training was conducted during the breakfast hour for Debra, breakfast foods were assessed as reinforcers, along with additional food items. Alterations were made in the food order for her meal
according to the results of the survey.

The reinforcers selected for use are listed in Appendix C.

Receptive language assessment. Subjects' receptive language repertoires were assessed as they pertained to the treatment procedures. They were asked to follow simple one-part commands pertaining to table tasks which did not require therapist assistance, and which could be performed independently as interaction density was faded later in the study. A minimum of three commands (or gestures) were selected for use with each participant. Commands and tasks were selected for incompatibility with self-injury. For example, if a subject engaged in self-hitting, he or she would not be asked to perform tasks which required hitting (e.g. musical instruments, prevocational tasks). The commands and tasks used with each participant are listed in Appendix D.

Determination of inter-self-injury latencies. Observations were conducted using a tape recorder, with occurrences of self-injury recorded as a count on tape. Observers then measured and recorded the time between counts on the tapes. The mean of all latencies of greater than fifteen seconds was determined for each subject. This value was then used in determining the length of initial work intervals for that subject. Five minute restraint intervals were used because the mean inter-self-injury interval was less than 5 minutes for all subjects.
Restraint assessment. The efficacy of air splints and wrist cuffs with soft ties used as restraints to prevent self-injury was tested. These restraints were selected because they allowed systematic decreases in the amount of restriction imposed as measured by air pressure for splints and soft tie length for wrist cuffs. Air splints proved effective in preventing self-injury for periods of five minutes at a time with Debra and Mark, but did not with Joey. Wrist cuffs attached to the leg with six foot cloth straps were tested and found effective with Joey.

Following effectiveness tests, restraints were tested as reinforcers, using on-task behavior for the same tasks used in the reinforcer survey (puzzles, busy box, eye contact, clothespins inserted into a coffee can) as the reinforced behavior. On-task behavior for two minutes was reinforced with restraint and praise. If two minutes of on-task behavior occurred immediately, restraints were delivered without further delay. If not, the work was continued until two minutes of on-task behavior occurred. Percentage on-task behavior was computed on the basis of the percentage of time spent on-task. If the percentage of the time spent on-task increased by 20% or more from the first to the last ten minutes of a thirty minute test, restraint was judged a reinforcer. On the basis of the assessment, restraint was deemed a reinforcer for all three participants.

Baseline. The baseline phase was conducted in the treatment room used throughout the study. Data were collected on
the frequency of self-injury and resulting wounds, percentage compliance, and the frequency of approach and/or tolerance of physical contact. Baseline was extended until stability in the range of the rate of self-injury was observed, or until a trend in an upward direction was noted. Discontinuation of medication for Joey midway through baseline mandated extension of this phase until stable rates were once again obtained.

Within baseline sessions, tasks with which participants were familiar, but not competent as determined by classroom measures were presented. Participants were reinforced for completing portions of the presented task with edibles and praise. A variable ratio three schedule of reinforcement was used in reinforcing correct task completion, with delivery of reinforcement determined on the basis of the number of pieces of a given task presented at the beginning of each trial (e.g. pegs from a pegboard). A predetermined schedule was used in determining the number of pieces presented per trial. All pieces presented had to be completed before reinforcement was delivered.

For each task trial, the subject was given a command and a specified segment of the table task. Incorrect responses were followed by delivery of a slight physical prompt (e.g. moving the subject's arm in the desired direction) and repetition of the original command. Correct responses were followed by delivery of edibles and praise once all portions of the task presented were completed.
Treatment Session Description

Upon entering the treatment setting, interactive statements were made by the therapist regarding daily events, the participant's dress or activities, and facial expressions. The therapist continued talking to the subject for one to two minutes, then presented the first task trial, using a table task. Task trial procedures were identical to those used in baseline. Following reinforcement for correct task completion, the therapist again directed a series of interactive statements toward the subject before presenting a new task trial.

The session continued as described above until the required self-injury free time passed. Debra and Joey were each required to work for at least ten minutes of a thirty minute work interval, the length of which remained constant throughout the study. Mark was initially required to work for three ten minute intervals, each of which was followed by a restraint interval. The length of Mark's work intervals were extended to twenty minutes, and the number of intervals reduced to two in the first treatment phase. If no self-injury occurred within the entire work interval, the therapist praised the participant for keeping his or her hands down, placed the restraints previously selected on the subject's arms, and made several more interactive statements before leaving the treatment room with the subject. Therapist and subject spent the five minute restraint interval in a recreational setting until the required time passed, at which time
the participant was returned either to the dormitory (Debra and Joey) or to the treatment room for another session (Mark).

Occurrences of self-injurious behavior within work intervals were consequated by implementation of overcorrection in which the participant was first reprimanded in a firm voice ("no hitting/choking"), then guided through five minutes of continuous arm movement over the head, to the side at shoulder level, then down to waist level. Due to extensive resistance, only one arm was used in overcorrection for Debra and Joey, while a second therapist prevented further self-injury with the other hand by placing his or her hand slightly above the subject's hand and catching it when necessary, then replacing the hand in the subject's lap. Once overcorrection was completed, the participant's hands were placed in his or her lap and the work interval time reset for the amount of time required to earn restraint. The above procedures were repeated as many times as necessary until restraint was earned and delivered.

Occurrences of self-injurious behavior within restraint intervals were consequated by returning the subject to the treatment room immediately, implementing overcorrection, and beginning a new work interval.

Because the rate of self-injury was high, work and (when earned) restraint intervals were run continuously with ten minute breaks for toileting every two hours for the first three treatment days. Treatment sessions were continued until suppression was achieved in three consecutive ten minute
work intervals. On the fourth treatment day, the regular work-restraint interval length was reinstituted.

**Treatment components used in all sessions.** The fading procedure designed for this study required that overcorrection be used in all treatment sessions, while contingent restraint and increased interaction were to be faded. The assumption underlying consistent inclusion of overcorrection was that use of this technique would not be required if self-injury was completely eliminated. Should self-injury be reduced but not eliminated, overcorrection would be required only on an occasional basis.

Task trial procedures were also held constant throughout to control for the possibility of introducing another treatment component.

**Treatment Sequence**

**Mark.** Initial treatment, labeled Phase I, consisted of the full treatment package. Interactive statements were made at a near-continuous level, with the maximum latency between them set at one minute. Task demands were introduced into a series of interactive statements, with the number of demands per session held relatively constant. At the end of a work interval in which no self-injury occurred, restraint was delivered with the minimum freedom possible. Occurrences of self-injurious behavior in this and all subsequent treatment phases were consequated with overcorrection. This phase was continued until complete suppression of self-injurious behavior
was achieved and maintained over four consecutive days.

Once Mark met criterion for Phase I, the length of his work intervals was increased from ten to fifteen, then twenty minutes. Use of contingent restraint and increased interaction remained constant as work interval length was extended. The criterion for termination of each time-extension portion of Phase I was three consecutive days in which no self-choking occurred. Once criterion had been met for twenty minute sessions, Mark progressed to Phase II of treatment.

Phases II, III, and IV were concerned with fading the amount of restriction imposed by restraints. Within these phases, interaction density and the amount of time required to earn restraint were held constant at previous levels. The amount of restriction imposed as measured by air pressure gauge readings on the air splints was systematically decreased in three steps to 75% of full restraint in Phase II, 50% of full restraint in Phase III, and 0% of full restraint in Phase IV. At 0% of full restraint, the restriction imposed was so limited that it would not prevent self-injurious behavior. The criterion for termination of each of these phases was three consecutive days in which no self-injury occurred during treatment sessions. Once Mark met criterion for Phase IV, he progressed directly to Phase V.

In Phases V, VI, and VII, the density of interactions delivered to Mark concurrent with task demands was systematically faded. Within these phases, restriction imposed by restraint was held at 0% of full restraint. In Phase V,
the latency between interactive statements was increased from one to three minutes, but still immediately preceded and followed each demand. In Phase VI, the latency between interactive statements was held constant at three minutes, but task demands were now presented within that non-interactive time rather than inserted into a series of interactions. In Phase VII, a three minute latency preceded and followed both demands and interactive statements, so that the subject was required to work for three minutes at a time without any interaction and could not predict the type of interaction which would be forthcoming. The criterion for termination of each of these three phases was three consecutive days in which no self-injury occurred. Mark entered but did not complete Phase VII in the available time.

Joey. Initial treatment for Joey was identical to that used with Mark, except that the definition of self-hitting was changed from one which defined hits on the basis of angle of descent to one which included all hits, irrespective of angle of descent. Because Joey worked for 30 consecutive minutes in baseline and treatment, no steps were taken to increase session length.

The procedures used in Phases II, III, and IV were identical to those used with Mark, except that restriction imposed by restraint was measured by soft tie strap length rather than air pressure. Joey entered, but did not reach criterion for termination of Phase IV. He therefore did not progress to Phases V, VI, and VII, as Mark did.
Debra. Initial treatment procedures were identical to those used with Mark and Joey until Debra's failure to perform table tasks without engaging in self-hitting was recognized. The procedures for Phase I were therefore modified to train appropriate task performance, first by training Debra to keep her hands down away from her head, then by training hands in lap, and finally training task performance, replacing her hands in her lap once the task was completed. During training for task performance, a "shadowing" procedure was used in which the trainer held her hands one inch above Debra's hands in order to redirect all hand behaviors except self-hitting to task completion. Because the "shadowing" procedure used in teaching hands down and hands in lap precluded many social interactions and did not allow for task demands, there were no occurrences of either approach/tolerance or compliance to task demands during these portions of Phase I training. The time involved in teaching appropriate task performance precluded Debra's progression into subsequent treatment phases.

Follow-up. At the end of three months, all subjects remained in the last phase they had reached in the treatment sequence until at least one day with no occurrences of self-injurious behavior was achieved. At that time, bi-weekly follow-up observations were initiated using procedures identical to those used in baseline recording. Follow-up observations were conducted for one month for Joey and Mark
following termination of treatment. Debra participated in only one day of follow-up observations because both the frequency and intensity of self-injury escalated markedly during the follow-up session. After Debra's follow-up session, treatment was once again implemented at the level used immediately prior to follow-up.
RESULTS

Rate of Self-Injurious Behavior

Percentage interobserver agreement was calculated and averaged for all sessions in which reliability observations were conducted. The mean percentage agreement for the frequency of self-injurious behavior was 100% for Mark, 99.7% for Debra, and 95.8% for Joey, with an overall average of 98.5% agreement for all subjects combined. Reliability observations were conducted for 31.6% of Mark's sessions, 27.7% of Debra's sessions, and 39.4% of Joey's sessions.

The frequency recordings for self-injurious behavior were converted to rate per hour for baseline, treatment, and follow-up phases. Data for the rate of self-injury was then smoothed by medians of three (Tukey, 1977) and plotted for all subjects. The graphed data is presented in Figure 1. The average rate of self-injurious behavior decreased between baseline and the combined treatment phases for all participants. The mean self-injury rate decreased from 543 hits per hour in baseline to 2.72 hits per hour in treatment for Debra, and from 123.3 hits per hour in baseline to 3.29 hits per hour in all treatment phases for Joey. The average rate of Mark's self-choking decreased from 65 occurrences per hour in baseline to 0.34 per hour across treatment phases.
Mean rates of self-injurious behavior between Phase I of treatment and subsequent phases in which treatment was faded were compared for Mark and Joey. For Joey, Phase I was compared with the combined data from Phases II, III, and IV in which restraint was faded. No major differences in the average rate of self-injury were apparent. For Mark, the average rate of self-choking in Phase I was compared with that in Phases II through IV in which restraint was faded, and with that in Phases V through VII in which interaction density was decreased. The average rate of self-choking in Phase I was 0.78 occurrences per hour as compared with 0.4 per hour in Phases II through IV and 0.26 in Phases V through VII. The comparison was not made for Debra, as she remained in Phase I throughout the treatment phase of the study.

In the single follow-up session, Debra's rate of self-hitting was 209 hits per hour, as compared with an average rate of 36.5 occurrences per hour when treatment was reinstated. Both rates were higher than the original treatment mean, but much lower than the baseline average. The average rate of self-hitting for Joey was 17.88 hits per hour in follow-up, which was again higher than treatment but lower than baseline. The average rate of Mark's self-choking was 0 occurrences per hour in follow-up, a level which was lower than both baseline and treatment.
Injuries

None of the participants incurred major injuries as a function of self-injurious behavior during the course of the study. Injuries were limited to self-scratching on the part of Joey. This behavior occurred during aggressive episodes, two of which occurred in treatment sessions, with six more recorded by staff using the unit's recording system. No other injuries were incurred by any of the subjects either in treatment sessions or on the unit.

The low injury level in treatment is not unexpected because each occurrence of self-injury was immediately consequated with overcorrection, thus preventing escalation into further occurrences of self-injury at higher intensity levels. The low frequency of scratches incurred by Joey in the living environment is, however, somewhat surprising, since no steps were taken to prevent either self-injury or aggression with restraint. Criterion level reliability observations conducted on the unit prior to baseline indicated that self-hitting and scratching combined occurred an average of 56.7 times per hour.

Prosocial Behaviors

Percentage compliance. Percentage interobserver agreement for the frequency of demands and compliance to demands was computed for each participant and averaged across subjects. Interobserver agreement for the frequency of demands averaged 96.3% for Mark, 97.5% for Debra, and 93.2% for Joey.
The mean percentage agreement for the frequency of compliance to demands was 96.1% for Mark, 97.2% for Debra, and 91.2% for Joey. Overall reliability across subjects averaged 95.7% agreement for demands, and 96% agreement for compliance.

The data for percentage compliance was smoothed by medians of three (Tukey, 1977) and plotted. The graphed data is presented in Figure 2. Percentage compliance increased notably between baseline and treatment for all participants. The average percentage compliance increased from 69.5% in baseline to 93.3% in treatment for Debra. The data were based on a comparison between baseline and the last four weeks of treatment because the "shadowing" procedures used in early stages of shaping task performance precluded use of task demands with which Debra could comply. The average percentage compliance increased from 65.5% in baseline to 83.6% in treatment, with a slight decrease in follow-up to 79.5% for Joey. For Mark, the mean percentage compliance increased from 53.8% in baseline to 82.4% in treatment, with a further increase to 86% in follow-up.

A comparison was also performed between Mark's average percentage compliance in initial treatment (Phase I), fading restraint (Phases II through IV), and fading interaction conditions (Phases V through VII). The mean percentage compliance in Phase I was 85.7%, as compared with 76.43% in Phases II through IV, and 73.9% in Phases V through VII, reflecting a slight decrease as treatment was faded. Interestingly, percentage compliance was highest when session length was
extended, averaging 93.7%.

A significant inverse correlation was obtained for all subjects between the rate of self-injury and percentage compliance in treatment sessions \((r = -0.81, t = 3.1, p < .05\) for Debra; \(r = -0.79, t = 9.17, p < .001\) for Joey; \(r = -0.79, t = 3.1, p < .05\) for Mark), indicating that as self-injury decreased, percentage compliance increased. The inverse correlation is evident in the mean values for the rate of self-injury, percentage compliance, and rate of approach/tolerance under baseline, treatment, and follow-up conditions presented in Table 1.

**Rate of Approach and/or Tolerance of Physical Contact**

Percentage interobserver agreement was calculated and averaged for all sessions in which reliability observations were conducted. The mean percentage agreement for the frequency of approach and/or tolerance of physical contact was 93.7% for Mark, 91.6% for Debra, and 91.8% for Joey. Overall reliability across subjects averaged 92.4%.

The data for frequency of approach/tolerance was converted to rate per half-hour, smoothed by medians of three (Tukey, 1977) and plotted. The graphed data is presented in Figure 3. A notable increase in the rate of approach and/or tolerance of physical contact was obtained for all participants. The mean rate of approach/tolerance increased from 7.53 in baseline to 12.29 per half-hour in the last seven weeks of treatment (in which "shadowing" procedures
TABLE 1
Mean Values of Self-Injury and Prosocial Behaviors in Baseline, Treatment, and Follow-Up

<table>
<thead>
<tr>
<th>Condition</th>
<th>Mark</th>
<th>Debra</th>
<th>Joey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Injury in Rate per Hour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>65</td>
<td>543</td>
<td>123</td>
</tr>
<tr>
<td>Treatment</td>
<td>0.34</td>
<td>2.72</td>
<td>3.29</td>
</tr>
<tr>
<td>Follow-Up</td>
<td>0.0</td>
<td>36.5</td>
<td>17.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Percentage Compliance in Sessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
</tr>
<tr>
<td>Treatment</td>
</tr>
<tr>
<td>Follow-Up</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rate of Approach/Tolerance of Physical Contact per Half-Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
</tr>
<tr>
<td>Treatment</td>
</tr>
<tr>
<td>Follow-Up</td>
</tr>
</tbody>
</table>
were eliminated, allowing for interaction), for Debra from 8.3 per half-hour in baseline to 18.6 in combined treatment phases for Joey, and from 21.33 per half-hour in baseline to 67.05 in combined treatment phases for Mark. Under follow-up conditions, the average rate of approach/tolerance decreased below treatment levels for all three participants, and below baseline levels for Debra (4.5 per half-hour for Debra, 9.6 per half-hour for Joey, and 24.8 per half-hour for Mark).

For Mark, the mean rate of approach/tolerance was again compared between Phase I, Phases II through IV in which restraint was faded, and Phases V through VII in which interaction density was decreased. The average rate of approach/tolerance in Phase I was 88.3 per half-hour, as compared with 82.5 per half-hour in Phases II through IV, and 45 per half-hour in Phases V through VII. The lower rate of approach/tolerance under fading interaction conditions is not unexpected, given that he was not approached by the trainer and approaches by Mark were not responded to during non-interactive time. Approximately five minutes of a twenty minute session were devoted to interaction. When the average rate of approach/tolerance is converted to represent the same amount of time available for interaction, the average rate is much higher than in other treatment phases, indicating that no major decreases in the rate of approach/tolerance occurred as interaction density was faded.
Significant inverse correlations were also obtained between the rate of self-injurious behavior and approach/tolerance in treatment sessions for two of the participants ($r = -0.76, t = 2.62, p < .05$ for Debra; $r = -0.76, t = 3.11, p < .02$ for Mark). A slight but nonsignificant correlation was obtained for Joey ($r = -0.51, t = 2.05, p < .1$).
DISCUSSION

The results indicate that the primary goal of achieving complete elimination of severe self-injurious behavior was not met for any subject. Nevertheless, it appears that treatment did produce clinically significant reductions in self-injury as determined by the frequency and severity of the behavior as well as the amount of time spent engaging in adaptive tasks for all participants in treatment and follow-up conditions. The extent to which self-injury was reduced is similar to results reported for use of restraint alone (Favell et al., 1978), overcorrection alone (Harris & Romanczyk, 1976), and combined use of differential reinforcement and overcorrection (DeCatanzaro & Baldwin, 1978; Measel & Alfieri, 1978). The amount of time required to achieve reductions in the rate of self-injury for Mark is similar to that reported by other researchers (Harris & Romanczyk, 1976). Thus, the treatment package tested in this study cannot be said to be any more effective in eliminating severe self-injury than less complex treatments using one or more of the treatment components. Because the results obtained are comparable, but not better than those reported for combined use of differential reinforcement and overcorrection, it does not appear that the addition of increased interaction produced a summative effect greater than
that produced by the other two treatments, as originally hypothesized. It is unknown whether the same conclusion would be possible if treatment components were used in a design which permitted more systematic examination of the effects of each treatment variable.

Mean rates of self-injurious behavior remained stable at or near initial treatment levels for both Joey and Mark as the restraint component of treatment was faded, and for Mark as interaction density was faded. Maintenance of gains under fading conditions provides initial demonstration that these components of treatment can be effectively faded, thus fulfilling the second purpose of the study. The data for maintenance of gains in follow-up is concurrent with that reported by other researchers (Harris & Romanczyk, 1976; Measel & Alfieri, 1978; Weiher & Harman, 1975), although the amount of time spent in follow-up is less than that typically reported.

Initial demonstration that treatment gains can be maintained under low interaction conditions which approximated the unit and classroom settings was provided by the fact that Mark's rate of self-injury did not increase as interaction density was decreased. Because the available literature does not include reports of fading treatment, replication with other subjects is required before strong statements regarding the applicability of treatment for use in applied settings can be made.
An additional positive outcome of treatment can be seen in the fact that increases in prosocial behaviors were observed concurrent with decreases in the rate of self-injury, reflecting a positive social effect of treatment. The inverse relationship between occurrence of self-injury and the prosocial behaviors recorded is consistent with results reported elsewhere (Carr et al., 1976; Durand, Note 2; Weiher & Harman, 1975). It is unknown whether the increases in prosocial behaviors occurred as a function of treatment or of the increased interaction provided by the therapist in treatment phases, since the approach/tolerance data did not allow for differentiation between interactions initiated by therapist and subject.

The fact that substantial reductions in the rate of self-injury were obtained much more quickly for Mark than for Debra and Joey would seem to indicate that an unidentified factor may have operated to influence the rate of change. Slow rates of change in Debra's case may in part be attributed to her failure to perform any table task without hitting herself, which mandated changing procedures to teach the necessary discrimination. It is also possible that the differences in the topographies and targets of self-injury influenced the rate of change by increasing the number of discriminations required to meet the reinforcement contingencies for Debra and Joey. While Mark exhibited a single type of self-choking (placing both hands on his
Debra and Joey exhibited numerous types of self-hitting (one or both hands, open or closed hand, using hand held objects). Debra and Joey also engaged in hits of several different areas, where Mark placed his hands only at his throat. Perhaps the process of using behavioral contingencies to treat self-injury is influenced by the subject's ability to discriminate which behaviors are considered acceptable and which are not. The fact that Joey's rate of self-injury did not decrease until the definition of self-hitting was changed would seem to support the contention that he was unable to discriminate which kinds of self-hitting would be consequated with overcorrection and which would not. It is also possible that Debra and Joey experienced difficulty in discriminating the entire class of self-hitting behaviors and may have formed the discrimination for each individual target behavior. For example, Debra may have formed the initial idea that hits to the cheeks and chin would be consequated, but did not form the same conclusion for hits to the eyes, ears, nose, and mouth. If the rate of behavior change is affected by a participant's ability to form the discriminations required under the contingency being used, this would suggest that contingencies used in treatment of self-injury should be as simple as possible to facilitate rapid learning. At this point, the available literature does not include examination of this parameter of treatment effectiveness. Certainly, further study into the relationship between
discrimination skills, rate of behavior change, and complexity of treatments is needed before any definitive statements can be made.

Medical or physiological factors unrelated to treatment may have served to increase the rate of self-injury in both baseline and treatment for all participants. A functional analysis was conducted to identify possible antecedents to sudden escalation in Joey's rate of self-hitting and aggression. Student observers not recording treatment data conducted four days of observation in baseline, with four more in treatment. The data indicated that Joey responded consistently to sudden increases in noise levels with aggression, which was followed by self-hitting if the noise source was not eliminated quickly. It is unknown whether treatment would have been equally effective if the entire study had been conducted under high noise or more effective under low noise conditions. Debra demonstrated a cyclic pattern of increased self-injury every three days, which was concurrent with a documented cycle of constipation. Because of Debra's limited food preferences and refusal to eat nonpreferred foods, alterations in diet to reduce constipation were not possible. The physician did not consider pharmacological treatment advisable. Mark had an allergic rhinitis condition which, when aggravated, resulted in ragged breathing, difficulty in sitting up, and ultimately, grand mal seizures.
Rhinitis attacks typically occurred after Mark had been outside for more than one hour. Because of the intermittent nature of the attacks, the physician did not consider pharmacological treatment advisable. Mark typically engaged in elevated rates of self-choking at the end of a sequence of rhinitis attack, stumbling, and grand mal seizures. Because of the danger imposed by grand mal seizures in a small treatment room, Mark did not participate on days when he exhibited ragged breathing and difficulty sitting up. Two days in baseline and four in treatment were eliminated due to health problems.

Several potential threats to the internal validity of this study can be identified. The first and strongest of these is the possibility that both baseline and treatment rates were lowered by the use of structured one-to-one sessions. It is unknown whether a treatment consisting solely of structured sessions would have proven equally effective. The second threat to internal validity arises from compensatory rivalry for two of the participants. Because all subjects resided in the same dormitory and were taken into sessions in a predetermined order, it is possible that Joey and Mark (who were taken in after Debra) observed the positive interactions between Debra and the therapist as they returned and attempted to obtain similar responses by interacting more, resulting in improved behavior in treatment sessions. Resentful demoralization represents a third source of threat to the internal validity of the study. At
least one staff member was heard to comment that she did not believe the treatment was working. Shortly thereafter, she was observed to increase her negative interactions with all participants to the point where she was reported for potential abuse. The increase in negative interactions in the dormitory may have created a contrast effect between the dormitory and treatment room, with subjects exhibiting improved behavior in treatment as a means of avoiding return to the dormitory.

The external validity or generalizability of results is threatened by both setting and selection effects. The generalizability of obtained results is limited to settings which are similar or identical to the living unit and treatment room used in this study. Generalizability is likewise limited to subjects with similar histories of self-injury and treatment efforts, who exhibit similar forms of self-injurious behavior at high intensity levels.

Construct validity may also be threatened by confounding effects of constructs and constructs. The three treatment components used together effectively reduced the rate of self-injurious behavior for all three subjects, with the restraint and interaction density components effectively faded for one subject. Since no increases in self-injury were observed as restraint and interaction density were faded, the intensity level at which each component is effective is unknown.
The present study provides initial demonstration that the treatment package used can effectively decrease the rate of self-injurious behavior while promoting increases in pro-social behavior. Future studies should include replication with a larger number of subjects, first with those who engage in similar forms of self-injury (with limited topographies and targets of the behavior) and later with those who exhibit a wider variety of self-injurious behaviors. Replication should also include systematic examination of setting and therapist variables, such as proximity and similarity to the living environment, noise levels, therapist gender, and verbal patterns. In order to develop a treatment package which is maximally useful in applied settings, future experimentation could also focus on the amount of time and treatment required to effectively control self-injury. It may be the case that one or more of the treatment components is effective at lower levels, or that less time is required to obtain similar treatment effects.
REFERENCE NOTES


REFERENCES


Browning, R. M. Treatment effects of a total behavior modification program with five autistic children. Behavior Research & Therapy, 1971, 9, 319-327.


APPENDIX A

OBSERVER TRAINING

Observers were first trained in techniques commonly used to maximize unobtrusive recording, including positioning, organization of materials, and absence of conversation during observation. Observers were also given copies of professional behavior guidelines and discussed them with the experimenter in group meeting.

Once observers were instructed in unobtrusive techniques, the operational definitions were presented for self-injury, wounds, and prosocial behaviors in that order. After memorizing the definitions, observers practiced recording occurrences and nonoccurrences in role-play situations, using behavior data sheets. Observers recorded occurrences of self-injury using the wound scale, frequency of demands, compliance, and approach/tolerance simultaneously. Once observers reached a criterion of 90% accuracy or better in role-play, they collected the same data on the participants' living unit until a criterion of 85% agreement on all four measures was met for one hour per subject.

During the time that reliability observations were being conducted on the unit, observers were paired into teams for latency recording. These pairs recorded all latencies between occurrences of self-injury which were greater than fifteen seconds in length using the tapes
made by the experimenter. Recording was done during the evening hours, and was continued until a criterion of 80% agreement or better was reached, using the following formula:

\[
\frac{\text{agreement in number of seconds}}{\text{agreement} + \text{disagreement in seconds}} \times 100
\]
PROFESSIONAL BEHAVIOR GUIDELINES

1. **Punctuality.** You are expected to arrive on time or to call if you are going to be more than ten minutes late.

2. **Preparation.** Upon arrival, make sure all materials are prepared for the day's work, including data sheets, reinforcer preparation and organization of materials.

3. **Cleanup.** At the end of the day, make sure all materials are cleaned up sufficiently to allow the janitor to the clean the treatment room.

4. **Data Collection.** Make sure you review the operational definitions used in data collection before your shift. While recording, talk only when it is absolutely necessary.

5. **Program Implementation.** Provide assistance only when it is requested. When assisting with overcorrection, make sure you follow the procedures as defined; do not make changes without permission.

6. **Conduct.**
   
a. **Dress appropriately.** Jeans are fine, but should not be torn or patched. Women should wear shirts that are not low cut or have buttons down the front, as they may be torn open.

   b. **Interactions with Staff** should never include disputes or criticism. If problems arise, call the experimenter over.

   c. **Interactions with Other Observers or Therapists** should not include criticism. If you think an error has been made, tell the experimenter.

   d. **Assist Staff** when they request it unless you are involved in a task related to the study. If this is the case, refuse to help in a polite manner, and tell them you will be there in a moment.

7. **Data Summary.** Before you leave, make sure you summarize all data on the summary sheets, then graph the self-injury rate for each subject. If a reliability observation has been done, compute the percentage agreement for self-injury, demands, compliance, and approach/tolerance and record it on the reliability summary sheet.
8. **Feedback.** You will receive both positive and corrective feedback on your performance in role play and on-site work. When corrective feedback is given, you are expected to respond by trying to conform with suggestions given. However, if you feel feedback was given in error, your comments will be appreciated and, if correct, responded to. If a problem in program implementation persists, special training will be given.
Because the same undergraduates who served as observers were required to assist in certain aspects of therapy, their training included specifics for the required assistance as well as rationale for the study.

Introductory Meeting

Introduction to the study began with a discussion of self-injurious behavior, the dangers it poses to subjects, and limitations it imposes on daily life. The three purposes of the study were then presented: a) to achieve suppression of self-injury, b) to maintain treatment gains as treatment was faded, and c) to fade treatment to the point where subjects work without engaging in self-injury under conditions which approximate normal unit or classroom conditions.

Treatments published in the literature were reviewed in the context of the goals of the study. The three components of the treatment package were then named, described, and role played, with discussion of the rationale behind each. Specific requirements for student therapist participation were then presented, with role play for each technique alone and in combination.
Training Meetings

Discussion in the first training meeting centered upon the use of increased interaction. Student therapists were instructed to minimize the amount of interaction with the experimenter during baseline and treatment sessions so as not to distract the subjects from interaction with the experimenter. Hand signals were developed for use in communication between the experimenter and student(s) regarding data collection, assistance in materials management, and treatment implementation. Signals were developed for the following communications:

- stop talking
- intensity levels for wounds
- shift position for better observation
- remove edibles and materials from work table
- assist in overcorrection
- move the table away from the subject

Following discussion, observer/therapist roles during sessions using increased interaction as the sole treatment were role played until all students performed to satisfaction.

Discussion in the second meeting centered upon use of contingent restraint. Student observer/therapists were instructed in procedures to facilitate delivery of restraint by the experimenter while preventing self-injury. Student actions were described, then role played in practice sessions using both increased interaction and contingent restraint as the primary treatments, and continued until all
students performed to satisfaction.

Discussion in the third session centered upon use of positive practice overcorrection. Student therapist roles in implementing overcorrection were specified, modeled, and role played until all students performed this component of treatment to satisfaction. The fourth, fifth, and sixth training sessions were spent role playing student roles in treatment sessions using the three components of treatment simultaneously. One of the four student therapists was required to participate in additional training for implementation of overcorrection.

The seventh and eighth training sessions were spent explaining, modeling, and role playing the process of fading treatment. Specifications for student roles in fading conditions were given both during training sessions and as fading conditions were implemented.