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COMPARATIVE STUDY OF BEHAVIORAL METHODS OF TREATING SEVERE SELF-INJURY

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Nine retarded or autistic persons exhibiting very serious self-injury were treated with several types of reinforcement procedures in a comparative study. During the baseline level of instructional prompting, self-injury occurred during 55% of the observation intervals, 57% during social extinction, 34% during differential reinforcement for non-self-injury (DRO), 28% during differential reinforcement of incompatible behavior (DRI), 25% during response interruption, and 6% during combined DRI-Interruption. Extended application of the DRI-Interruption procedure in the ward and class situations showed a mean level of 12% self-injury on the first day and 0-10% each month for durations up to 48 months while performed by the regular institutional staff. The DRI-Interruption procedure was more effective than the alternatives for most subjects and within 4% of the next most effective procedure for the others. The DRI-Interruption procedure offers a training method that is fairly rapid, applicable to diverse and severe cases, substantial in the degree of benefit, enduring in effectiveness under extended maintenance, and more effective than the alternatives considered here. Its principal disadvantages appear to be the greater training time required as compared with physical punishment and the extensive manual contact required by the interruption component.

INTRODUCTION

Self-injurious behavior is a serious problem for severely retarded and autistic persons that has received much attention in behavioral treatment research because of its inherent danger to the individual (see reviews by Pecker, Poling, & Parker, 1979; Carr, 1977; Horner & Barton, 1980; Johnson & Baumeister, 1978; Schroeder, Rojahn, & Mulick, 1981). Early studies by Lovaas and associates indicated that a nearly immediate and virtual "cure" had been discovered for this problem through the use of pain-shock punishment (Lovaas & Simmons, 1969; Lovaas, Schaeffer, & Simmons, 1965; Lovaas, Freitag, Gold, & Hassorla, 1965). These dramatic results have been replicated by other studies using physical punishment (Tate & Baroff, 1966; Corte, Wolf, & Locke, 1971; Yeakel, Salisbury, Greer, & Marcus, 1970; Prochaska, Smith, Marzilla, Colby, & Donovan 1974). Yet the pain-shock method does not appear to have been widely adopted. One of the possible explanations for this is that it embodies society's fear that pain has been inflicted on a nonconsenting person in the guise of therapy with a possibly secondary abusive intent similar to child abuse being justified as being for the ultimate good of the child. Behavioral research on self-injury has continued with the goal of finding alternative methods that might be equally effective yet less inherently painful and intrusive.

Several types of stimuli less painful than shock have been found to be somewhat effective when scheduled as a punisher for self-injury such as slapping (Duker, 1975), noxious odors (Tanner & Zeiler, 1975), bitter tasting substances (Altman, Haavick, & Higgins, 1983; Mayhew & Harris, 1979), and water spray (Dorsey, Iwata, Ong, & McSwean, 1980; Bailey, Pokrzywinski, & Bryant, 1983; Singh, Watson, & Winton, 1986). Similarly, punishment has been scheduled using events that are quite intrusive and intended to be very annoying although not using inherently painful physical stimuli. These annoying consequences include facial screening (Lutzker, 1978; Winton, Singh, & Dawson, 1984; Singh et al., 1986), seclusion in a time-out room (Wolf, Risley, & Mees, 1964), and mechanical restraints (Parrish, Iwata, Dorsey, Bunck, & Slifer, 1985; Newfeld & Fantuzzo, 1984; Flemming & Nolley, 1981; Dorsey, Iwata, Reid, & Davis, 1982; Schroeder, Peterson, Solomon, & Artley, 1977).

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The overcorrection (Azrin & Besalel, 1980) and Positive Practice (Azrin & Besalel, 1981) procedures were developed initially as

a means of arranging a type of negative consequence that was not physically painful or intended to be primarily annoying. Rather, these procedures were designed to be primarily reeducative, and only secondarily annoying, and consisted of a contingent period of required practice in correcting or overcorrecting a negative response, or practicing positive responses. Thus, in its initial application with toilet training (Azrin & Foxx, 1971, 1973, 1974) and bed-wetting treatment (Azrin, Sneed, and Foxx, 1973; Foxx and Azrin, 1978), overcorrection required the individuals to clean up after an accident and Positive Practice required them to practice correct toileting behaviors. In subsequent applications to aggression (Foxx and Azrin, 1972) and self-stimulation (Azrin, Kaplan & Foxx, 1973; Foxx and Azrin, 1973), the Overcorrection/Positive Practice procedures were quite effective but occasionally produced strong negative emotional reactions due to the manual guidance needed to require the performance of the correct or corrective behaviors. To minimize the strong negative reactions, a Required Relaxation procedure was developed for use with agitated-disruptive behaviors, including self-injury (Webster & Azrin, 1973). This procedure arranged a required 2-hour period of bed-rest after each episode under the rationale that this would interrupt and reverse, that is overcorrect, the agitation. The procedure was quite effective, but still produced undesired strong negative emotional reactions from 2 out of the 9 subjects. The procedure was therefore modified in an application to self-stimulatory adults by reducing the interruption duration to a 2-minute period and initiating the training while the individual was seated in a structured situation that permitted gentle, yet effective implementation of the relaxation component. The result of this effort (Azrin & Wesolowski, 1974) was elimination of the behavioral stereotypies without the strong negative emotional reactions.

The possibility of treating self-injury by the brief interruption/relaxation method was then evaluated with 2 severe self-injurious adults in a preliminary study (Azrin, Besalel, & Wisotzek, 1982). The small number of subjects in that study did not permit conclusions regarding the general applicability of the method to severe self-injurious persons. Yet, the substantial effect of this relatively nonintrusive consequence warranted study of its effect with a larger sample of persons. Also of great relevance to the possible general utility of the method are the questions of applicability to the individual's general living environment, the durability of effectiveness, and a comparison of its effect with other nonintrusive

and nonphysically painful procedures. Such procedures would include: social extinction which also has been found effective in individual cases (Lovaas & Simmons, 1969; Jones, Simmons, & Frankel, 1974; Ross, Meichenbaum, & Humphrey, 1971), as has also differential reinforcement of non-self-injury (Peterson & Peterson, 1968; Repp & Deitz, 1974; Brawley, Harris, Allen, Fleming, & Peterson, 1969) and differential reinforcement of incompatible behaviors (Tarpley & Schroeder, 1979; Azrin et al. 1982). Previous studies of these and other procedures for self-injury have generally included only 1 or 2 subjects.

The present study extended the previous preliminary study (Azrin et al., 1982) and evaluated the effectiveness of the brief passive interruption procedure with a larger sample of self-injurious residents, compared it with several other nonintrusive procedures, combined it with one of the more effective of these procedures (DRI) and evaluated its utility for long term treatment throughout the day in the individual's school and ward environment.

METHOD

Experimental Design

The first part of the procedure was a procedural comparison phase in which the experimental design was both a within- and between-subjects comparison of six procedures: (1) Social Extinction, (2) Instructional Prompting, (3) DRO, (4) DRI, (5) Interruption, and (6) DRI plus Interruption. Ten hours of training were scheduled for each procedure, consisting of several hours each day dependent upon the subject's availability. The time also depended on subject safety factors (see below). The six procedures were given in a different order for each subject in a modified Latin Square design, the major departures from which were (1) the DRI plus Interruption procedure was more often given as the final procedure since it was a combination of two others, and (2) the Instructional Prompting was also given at the start since this procedure corresponded closely to the normal baseline condition. The experimental design also included a within-subject multiple baseline design across situations by also recording for each subject the self-injury responses in the cottage situation where no treatment was initially given. The level of responses in the untreated cottage

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situation could then be compared to that in the treated class situation to determine the situational specificity of the procedural effect.

A generalization phase of the study followed the procedural comparison phase described above. In the generalization phase, the DRI plus Interruption procedure was extended to the cottage situation and to the regular group class situation where the regular teachers and cottage employees were taught to employ the procedure. The experimental design in this phase was a within-subjects AB design for the cottage situation as well as a multiple baseline design across situations (cottage versus experimental classroom) for the initial part of this phase. The general guideline of this phase was to conduct the DRI+I training in the individual class-like situation for as many days as was necessary to reduce the self-injury to a near-zero level while recording the untreated behavior in the cottage. The study trainers then conducted the procedure in the ward and regular class situation until the self-injury was also near-absent in those situations, at which time the regular cottage employees and class teachers were instructed in the use of the procedure and supervised in its use as part of their normal job duties. The study trainers reduced their supervision of the employees gradually to the point where it was provided only on an occasional basis. Recordings continued to be taken at least once per month. Additional training was given in the employees/teachers when these recordings showed a resumption of self-injury.

SUBJECTS

Nine subjects participated in this study, all but one of whom, Subject 4, were residents of a State institution for retarded persons; Subject 4 was a resident of a State institution for the mentally ill. The criteria for inclusion were that (1) visible and continuous tissue damage resulted from the self-injury, (2) the self-injury occurred at a high rate (i.e., during at least 25% of the consecutive 15-sec observation intervals), (3) the self-injury had endured for at least 5 years as indicated by existing records, (4) the self-injury had been sufficiently severe to require institutionalization for at least 5 years, and (5) previous treatment programs had been implemented. These criteria were intended to include only the most serious cases of self-injury so as to provide a strong test of the treatment procedures. No eligible person was excluded because of

concurrent physical disabilities, nonambulation, low intelligence level, high aggressiveness, unmanageability, or seizure activity inasmuch as these characteristics often accompany the most severe cases of self-injury.

Table I lists several of the relevant characteristics of the 9 subjects. Eight were diagnosed as profoundly retarded with Vineland Social Age Equivalent scores (Sparrow, Bella, & Cicchetti, 1984) from 1.06 yrs. to 2.6 years, averaging 1.54 years for the 7 subjects for whom test scores were obtained. One subject, Subject 4, was diagnosed as autistic schizophrenic. Six were male; three were female. All were adults over 20 years of age except for the 13-year-old autistic girl; the average age was 27 years. All had been institutionalized for at least 7 years with an average of 15 years, representing 56% of their life. Four suffered from seizure activity. Only 1 of the 9 subjects, Subject 4, had expressive language. All were receiving psychoactive medication, again except for Subject 4 whose parents refused to give permission for its use. All but one subject had at times some type of protective equipment (i.e., helmet and gloves) to reduce the impact of the self-injury. Five subjects were physically aggressive; 2 others were resistant and actively noncompliant to staff members' requests. The form of self-injury included the more usual forms of slapping or punching one's head, but also included striking the head against walls and hard surfaces, gouging one's eyes or throat, biting one's hands or arms or shoulders, etc. Tissue damage, deformity, bruises, bleeding, partial blindness, deafness, or swelling were evident for all subjects. All were ambulatory.

A brief description follows for each subject:

Subject 1

Subject 1 was a 33-year-old man diagnosed as profoundly retarded with a Vineland Social Age Equivalent of 1.8 years. He had been institutionalized for 10 years with a primary disability of mental retardation. He was ambulatory, had several physical anomalies associated with Down's syndrome, such as cleft palate, deformities of the digits on his hands and feet, and exhibited no evidence of speech. Some receptive language was indicated by his ability to follow simple commands such as "sit down," "stand up," and "stop." Subject 1 displayed several forms of severe self-injurious behavior that have since caused severe and permanent

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Table 1. Several of the Relevant Characteristics of the Nine Subjects.

Subject	Diagnosis	Sex	Age (yr)	Years in Institution	Seizures	Age (mo)	Receptive Language	Psychotropic Medication	Prostheses	Aggressive Behavior	Topography of Self-Injury	Tissue Damage
1	MR	M	33	10	yes	1.9	none	yes	helmet	none	HITS EARS	Cauliflower ear hematoma on hand
2	MR	M	29	17	no	1.2	none	yes	helmet	moderately	CHIN, HEAD EYE, THROAT	Scar on head, chin, eye, throat
3	MR	M	26	15	no	2.6	none	yes	helmet	mild	EARS, FACE & CHIN	cauliflower ears
4	Aut.	F	13	7	yes	----	yes	nons	helmet- restraint	highly	HEAD	headband of brow broken nose
5	MR	M	35	17	yes	1.06	none	yes	helmet	mild	HEAD & HAND	hematoma on brow and hands
6	MR	F	35	16	no	1.1	none	yes	helmet	none	FACE	hematoma on both cheeks
7	MR	F	20	24	yes	1.35	nons	yes	helmet	moderately	EAR, EYE, FACE & HAND	detached retina cauliflower ear scar face, hands
8	MR	M	25	13	no	1.7	none	yes	helmet gloves	highly	EAR	partially detach ear
9	MR	M	21	16	no	----	none	yes	none	highly	HEAD, FACE & HAND	scar on hand & face
10	MR	M	27	15	yes	1.36	1 yes 3 no	1 yes 1 no	1 yes 1 no	7 yes 2 no		

damage to his ears and hands. He forcefully and repeatedly struck his ears with his closed fists. The flurry of responses involved the use of either hand or both hands striking both his ears at the same time. At times the behavior was so severe that bleeding would occur from both his ears and from his knuckles. These episodes were usually in response to demands being placed on him, and required medical attention due to the tissue damage. Even when left alone, the behavior was still evident, but in a less intense manner. The intensity even during this situation was great enough that every hand-ear contact could be heard across the cottage day-room. Other forms of self-injury that occurred less frequently included head banging either on a table while seated, or against the wall. This usually took place if the subject was frustrated, or if self-injury was blocked by the trainer.

Subject 2

Subject 2 was a 29-year-old man diagnosed as profoundly retarded with a Vineland Social Age Equivalent of 1.2 years. He had been institutionalized for 17 years with a primary diagnosis of mental retardation. Subject 2 was ambulatory, had no physical disabilities, and displayed no evidence of speech. He possessed minimal receptive language abilities, as evidenced by his responding to simple commands. He exhibited several forms of self-injury that included faceslapping with an open or closed fist, chinbanging, throat and eye gouging, self-pinching, arm and hand biting, and elbow banging. Evidence of tissue damage was visible by scar tissue and sores present around the forehead, cheeks, chin, hands, arms, and elbows. The behavior would occur in a flurry involving all the above stated forms of behavior being exhibited in a varied sequence. Self-injury seemed to be a means of obtaining attention from staff and visitors. Although the behavior sometimes occurred when no staff member was present, usually he did so when one was present. Further, it was observed that eye contact was made by him just prior to and during his exhibiting major episodes of self-injury as if to assure that his self-injury would be observed. At times the intensity was so severe, that the behavior could be heard across the cottage in which he resided.

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Subject 3

Subject 3 was a 26-year-old man diagnosed as profoundly retarded with a Vineland Social Age Equivalent of 2.6 years. He had been institutionalized for 15 years with a primary disability of mental retardation. Subject 3 was ambulatory, had no physical disabilities, displayed no evidence of speech, and had limited receptive language abilities. He would respond to simple commands such as sit down, stop, and stand up. Several forms of self-injury were displayed, including faceslapping with an open or closed hand, earbanging, headbanging, and chinbanging. His hand would remain open during a majority of the observed episodes. It was observed that these behaviors occurred in response to frustration when placed in demand situations, and at times as a means of obtaining staff attention such as while placing pegs in a peg board during repeated trials he would strike himself. In addition to being self-injurious, the subject also was highly aggressive, striking at staff members or destroying property. Tissue damage was evidenced by "cauliflower" ears, often swollen and bleeding, redness of the cheeks, and callous tissue on the chin and hands. At times the behavior would occur in a flurry with multiple impacts to the ears or cheeks. He would resist attempts to block the self-injurious response. During these episodes, the response could be heard clearly across the cottage dayroom. Medical attention was required almost on a daily basis due to the intensity of the behavior.

Subject 4

Subject 4 was a 35-year-old man diagnosed as profoundly retarded with a Vineland Social Age Equivalent of 1.06 years. He has been institutionalized for 17 years with a primary disability of mental retardation. Subject 4 was ambulatory, displayed no physical disabilities, was prone to severe seizures, and displayed no evidence of speech. Medical records reported a history of epilepsy and cerebral palsy. Assessment of his receptive language abilities was hampered by his noncompliance to instructions. He exhibited several forms of self-injury which included headbanging of the forehead with his fists, knee, or any hard object (i.e., table, wall, etc), and hand biting. Evidence of tissue damage was most

apparent by two large hematoma and callous tissue which protrude approximately three to four inches from the forehead. These protusions often would bleed and require medical attention. Both hands had become deformed and evidenced large callouses limiting the normal use of his hands. He was extremely noncompliant. This was evidenced by his stiffening his body like a board, and attempt to slide from his chair during training in order to avoid interaction. He appeared to dislike physical interaction by the trainer as indicated by a noted increase in self-injurious behavior immediately upon being touched or stroked during intended tactile reinforcement from the trainer. The self-injurious behavior would often occur in a flurry, continuing until a staff member intervened. The self-injury was observed to occur even during meal times.

Subject 5

Subject 5 was a 35-year-old woman diagnosed as profoundly retarded with a Vineland Social Age Equivalent of 1.1 years. She had been institutionalized for 16 years with a primary disability of mental retardation associated with Down's syndrome. Subject 5 was ambulatory, diagnosed as having fibrosis of the left lung, had chronic nasal congestion, and gave no evidence of speech. Her receptive language was limited to only several commands such as, "no" and "sit down." She exhibited one primary form of self-injury that consisted of her hitting either cheek just below the eyes with her closed hands. Tissue damage was evidenced by the reddened, callous skin around the cheek and callous scar tissue around her hands. Multiple self-injurious responses would occur as a means of avoiding staff intervention, or when placed in demand situations such as programmatic training. Self-injury also would occur as a response to frustration, such as a delay in the delivery of lunch. It appeared that though she avoided staff interaction, she found tactile contact reinforcing. She would attempt to hold the hands of the trainer and visitors upon their entering the cottage. Yet, even at these times, her other hand would repeatedly strike her face.

Subject 6

Subject 6 was a 28-year-old woman diagnosed as profoundly retarded with a Vineland Social Age Equivalent of 1.3 years. She

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Subject 6

Subject 6 was a 28-year-old woman diagnosed as profoundly retarded with a Vineland Social Age Equivalent of 1.3 years. She

had been institutionalized for 24 years with a primary disability of mental retardation due to prenatal injury. She was ambulatory, left hemiplegic, having only partial use of her left leg and almost no use of her left arm, and was diagnosed as having epilepsy. She displays no evidence of speech, but did yell and groan at times. Limited receptive language was evidenced by a lack of responding to verbal commands. Subject 6 exhibited several forms of self-injury that included earbanging, headbanging, faceslapping, hand biting, and eye gouging. Evidence of tissue damage consisted of callous tissue and reddening of the forehead, cheeks, ears, and hands, "cauliflower" ears, and a partially detached retina. In addition to self-injury, she would often engage in self-stimulatory behavior such as body rocking, hand flapping, head weaving, and vocal humming. This often disrupted her classroom training. The limited use of her left hand also posed a problem during table-top activities limiting the tasks she could perform. Though she had no use of this arm, she would raise it sufficiently to bite her hand when frustrated. Subject 6 would often become frustrated and aggressive, throwing the training materials off the table, overturning the table, and attempting to bite the trainer. The intensity of the faceslapping would at times be so great that it could be heard across the cottage dayroom.

Subject 7

Subject 7 was a 25-year-old man diagnosed as profoundly retarded with a Vineland Social Age Equivalent of 1.7 years. He had been institutionalized for 13 years with a primary disability of mental retardation. He was ambulatory, had no physical disabilities, and displayed no evidence of speech, yet did make sounds such as grunts and groans. He displayed good receptive language abilities by his responding to most verbal commands to perform various tasks. The type of self-injury that was exhibited was both severe and life-threatening. Subject 7 would pull and dig at the skin behind his ears, which resulted in almost total detachment of his outer ears. Minor surgery was required on several occasions to re-attach the ear. Medical attention was required almost daily due to the severity of his self-injury. He was required to wear a protective helmet and gloves to prevent the occurrence of the behavior after surgery in order to facilitate the healing process. During observations, the behavior appeared to occur as a means of obtaining

staff attention; yet, the behavior also occurred during regular sleeping hours when alone. The subject posed a severe management problem as well, due to his size and strength, and highly aggressive and destructive behavior. Subject 7 would strike staff and overturn furniture during training sessions, often requiring assistance from other staff members.

Subject 8

Subject 8 was a 21-year-old male diagnosed as profoundly retarded, but he exhibited many autistic-like behaviors such as: echolalia, lack of eye contact, and repetitious self-stimulatory behaviors. A Vineland Social Age Equivalent score was not obtained since his continuing and severe aggression effectively precluded meaningful appraisal of positive abilities. He had been institutionalized for 16 years with a primary diagnosis of mental retardation. Subject 8 was ambulatory, had no physical disabilities, and displayed no true speech. He did at times make sounds that somewhat approximated words, but mostly consisted of groans, grunts, and screams. Receptive language appeared excellent. He responded to most commands, including some complex directions such as "Go and throw the garbage into the dumpster." He exhibited several forms of self-injury that included: headbanging with his fist or against any hard object, earbanging, faceslapping, elbow banging on any hard object, and handbiting. A less frequent form of self-injury that was observed was rectal digging, that caused intestinal bleeding. Tissue damage was evident, with scar tissue around the ears, head, facial area, elbows, and hands. The self-injury would frequently occur in a flurry, continuing until physically controlled. The intensity of the response was such that each headbanging episode against the wall usually resulted in a hole or cracked plaster in the wall. The elbow banging against the table was also forceful that at times it resulted in the table splitting and requiring replacement. The behavior would often occur as a response to frustration or as a means of obtaining attention from staff. In addition to the self-injury, he was aggressive and a management problem, especially because of his large size and strength. As a result of his aggression, staff members often received injuries. During his aggressive or destructive episodes, often as many as five staff members and security officers were required in order to gain control. Often these episodes, as well as those involving self-

staff attention; yet, the behavior also occurred during regular sleeping hours when alone. The subject posed a severe management problem as well, due to his size and strength, and highly aggressive and destructive behavior. Subject 7 would strike staff and overturn furniture during training sessions, often requiring assistance from other staff members.

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injury, would occur for no apparent reason. These episodes usually resulted in the administration of sedation.

Subject 9

Subject 9 was a 13-year-old girl diagnosed as autistic. She had been institutionalized for 7 years. She was ambulatory and had no physical disabilities. She was able to engage in simple conversations, which often consisted of repeating the same statement or request. She often cursed for no apparent reason both when alone or in the presence of staff. Subject 9 was able to express herself freely, and would often express her fear of hearing voices, usually "the devil" telling her to hit herself, perhaps because of her experience with exorcists who had recently been enlisted to cure her. She responded to most commands or dialogues. She could respond in either English or French which were the languages spoken at home as a child. She exhibited a bewildering variety of forms of self-injury which consisted of her banging her head against a wall, table, any hard object, even striking herself with her knee, and most often her fists. Usually, no more than a few seconds elapsed between the blows. The severity of the behavior required a helmet being worn 24 hours a day, as well as remaining in four-points restraint in bed. Evidence of tissue damage consisted of a disfigured nose that was repeatedly broken, scar tissue covering most of her forehead, and scar tissue on both hands. In addition to the severe self-injurious behavior, Subject 9 presented a severe management problem. She was extremely aggressive and destructive, often physically attacking staff violently. This aggression consisted of kicking, scratching, biting, pinching, punching, and banging her head against the heads of staff.

The self-injurious response appeared to be maintained by staff attention; yet it also appeared to occur as a reaction to frustration or as a means of escape from demand situations when she was given instructions. Tactile contact appeared to be highly reinforcing, especially hugs and holding her hands which she requested frequently, perhaps because of her history of being placed in restraints.

RECORDING

An observer recorded on a prepared recording sheet whether the self-injurious behavior occurred during consecutive 15-second

intervals, indicating for each interval whether self-injury occurred but not the number of responses. This partial interval recording was more meaningful than a frequency count inasmuch as the responses were often at such a high rate as to making counting impossible. Observer reliability was ascertained for every recording session during the experimental phase by two observers. The reliability during this phase averaged 92%. During the maintenance phase, the reliability averaged 89%, using the trainers and the institutional employees. Reliability was obtained on at least 20% of the observational intervals.

EXPERIMENTAL SETTING-PROCEDURAL COMPARISON PHASE

The procedural comparison study was the first phase of this study and took place in a classroom-type setting. It involves the subjects manipulating various teaching materials such as puzzles, blocks, and objects, while seated behind a large table. This situation was identical to that of the class situation that all residents attended on a regularly scheduled basis; the difference being that here the subject was not in the company of his peers and had one-to-one attention by the trainer. These sessions were approximately two to three hours in duration and occurred in the morning and the afternoon. The situation was structured so as to provide maximum control. The table was large and heavy and therefore not easily overturned or moved. The chair had firm armrests and was positioned close to the table so as to make unauthorized exit from the chair more difficult. The trainer stood behind and slightly to the side of the seated subject, thus minimizing possible attacks by the subject, and allowing easier blocking of self-injury and prevention of unauthorized departure.

Baseline or Instructional Prompting

The baseline-instructional prompting procedure involved no general interaction by the trainer, with the exception of a brief verbal prompt or command given to the subject to interact with the training materials or to return to the seat at the table if he/she had left the table. These prompts were given at one minute inter-

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vals. No reinforcement was given nor any reprimand or interruption of self-injury, only the verbal prompt every 1 minute.

Social Extinction

The Social Extinction procedure involved no interaction with the subject by the trainer except for momentary blocking (sufficient to protect him/her) if the intensity or frequency of self-injury endangered the individual. No interaction or prompts were given to perform the table-top tasks. The only form of interaction was that of guiding the subject back to the chair, if he/she had left it.

Differential Reinforcement of the Absence of Self-Injury (DRO)

The DRO procedure provided reinforcement to the subject following periods, the DRO interval, in which there was no exhibition of self-injurious behavior. The DRO interval at the start of this procedure was determined as one-half of the average duration between self-injurious responses as previously determined during the baseline recording. Reinforcement was delivered at the end of the DRO interval if no self-injury occurred. If self-injury did occur, the interval was restarted. When reinforcement was received for five consecutive intervals (no self-injury for five intervals, the DRO interval was doubled. Further doublings occurred whenever five additional consecutive intervals elapsed without self-injury to a maximum of five minutes. If the subject failed to receive a single reinforcement for a duration equal to five times the DRO interval, the DRO interval was halved. The minimum DRO interval was five seconds. The subject was given the opportunity to interact with training materials, but the delivery of reinforcement was contingent only on the absence of the self-injurious response. Upon the delivery of reinforcement, the trainer stated, "Good, you did not hit yourself, here is 'reinforcer name'."

Differential Reinforcement of Incompatible Behavior (DRI)

The DRI Procedure provided the reinforcement and prompting of positive behaviors that were incompatible with self-injury,

in addition to requiring the absence of the self-injurious behavior. Otherwise the procedure was the same as the DRO. The subject was verbally prompted or physically guided, when necessary, to engage in table-top activities. When the specified DRI interval had elapsed without self-injury, reinforcement was delivered immediately upon the occurrence of the incompatible behavior, while stating, "Good, 'behavior', and you didn't hit yourself." The incompatible responses were individualized according to the capabilities of each of the subjects. Examples of these positive responses included: playing with games, toys, puzzles, and blocks while seated; subsequently, skills such as dressing, feeding, tidying the room, setting the table, etc. might be used if the level of self-injury and behavioral manageability permitted.

As in the DRO procedure, the initial DRI interval duration was determined by taking one-half of the average interval of time between self-injurious responses. Similarly, following five consecutive intervals without self-injury, in which the subject received reinforcement, the DRI interval was doubled and continued to be doubled as long as the subject completed five consecutive intervals with reinforcement. When the subject engaged in any self-injurious behavior, the DRI interval was reset, requiring the subject to refrain from the self-injury for an entire additional DRI interval in order to receive reinforcement. In the event the subject failed to receive a single reinforcement for a duration equal to five consecutive intervals, the DRI interval was halved until the subject earned a reinforcer.

Interruption Procedure (Int)

The Interruption Procedure was identical to the Social Extinction Procedure, except that self-injury resulted in an interruption of activity. In this procedure, the trainer immediately blocked the self-injurious behavior and using manual guidance, guided both of the subject's hands downward to, or near, the lap, where they remained for two minutes. The trainer minimized the physical contact with the subject so as to reduce the likelihood of tactile reinforcement. Guidance was gradually faded as the subject demonstrated the ability to maintain their hands on or near their lap. The trainer "shadowed" the subject's hands once they were on the lap, lightly touching them only if the subject at-

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tempted to raise them. During this procedure the trainer remained behind the subject who of course was seated at the table. At the moment of self-injury, the trainer stated in a loud, firm voice, "Stop, you hit yourself; put your hands down" then proceeded to quickly guide the hands downward to the lap and maintain them there for the two minutes with no further comment. Any attempts at further self-injury during the two-minute period were blocked, still with no comment by the trainer. If the subject was not calm at the end of the two-minute interval or attempts of self-injury were being made, the trainer extended the two-minute duration, waiting for five seconds of calm before terminating the interruption interval. At the end of the two-minute interruption interval, the trainer refrained from praising the subject so as to prevent the experience from becoming a conditioned reinforcer. Instead the trainer moved back slightly freeing the subjects hands to engage in activities. The subject was to be left to himself as long as no self-injurious behavior was exhibited. No prompting was given to play or engage in any other activities.

Differential Reinforcement of Incompatible Behavior plus Interruption Procedure (DRI + I)

The DRI+I Procedure was a combination of the DRI and Interruption Procedure. Each self-injurious response was immediately blocked by the trainer and both the subject's hands manually guided down towards the lap. Also, at this moment, the subject was instructed not to self-injure and to put his/her hands down. No other verbal interaction took place for the remainder of the two-minute interval just as had been described above for the Interruption Procedure. Upon completion of the two-minute interruption period, the subject was guided back to the assigned task, previously engaged in prior to the interruption, and reinforced according to the DRI schedule of reinforcement using the same procedure described above in which the subject was reinforced for incompatible behaviors.

DRI + I during Generalization

During the generalization phase of the study, the DRI plus Interruption procedure was implemented by the regular cottage

employees and teachers in a less structured and more occasional manner inasmuch as they were engaged in other duties with other residents/students. Although they were instructed to reinforce frequently and to interrupt all self-injurious episodes, in practice they did so only as their time, proximity to the subject, and motivation permitted. This occasional use of the DRI and Interruption procedure in the ward and class situation was anticipated but was expected to be sufficient if the self-injury had been first reduced to a zero or near-zero level by the project trainer in those situations. When applied by the regular employees, the DRI interval was not systematically increased or decreased as described above for the structured procedural comparison phase. Rather, the employee/teacher occasionally praised and/or stroked the subject for some positive behaviors such as sitting quietly, keeping the hands on one's lap, being well dressed or groomed, toileting, walking, responding to a request, eating properly, etc. When self-injury was observed, the staff member implemented the Interruption Procedure as had been described, except that the subject was first seated in any nearby chair if the self-injury occurred while standing.

Reinforcers consisted of (1) descriptive praise (i.e., "Good, you put the peg in the pegboard, and you didn't hit yourself"), (2) tactile reinforcement (strokes to the back), plus (3) snack items (raisins, cereal, candy, drinks, cookies). Reinforcers were empirically determined for each subject and were varied somewhat in order to prevent satiation. However, all three types of reinforcers were given concurrently when scheduled, during the DRO, DRI, and DRI plus Interruption Procedures.

Subjects' Safety

Because of the severity of the self-injury, the safety of the subjects was paramount. Medical treatment was obtained whenever physical injury resulted. Also, the 10 hours scheduled for a specific training procedure were immediately foreshortened if the responses threatened the safety of the subject. The procedure would then be attempted again at a later time, but again immediately stopped if the subjects safety seemed at issue. At the start of the study some subjects wore gloves or a helmet. Since these protective items precluded a true picture of unconstrained self-injury, they were removed during the training procedure. Here

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again, the safety of the subjects dictated that the protective items be restored immediately upon the first indication of physical damage or increased threat to their health. During the interruption Procedure and the DRI + I Procedure, the subject's safety was not a major problem since the interruption component inherently prevented damage. During the other procedures, the trainer momentarily blocked a movement that appeared likely to cause severe damage. If such actions persisted, of course, the procedure was terminated as noted above and the subject returned to the protective restraints or situation in which severe self-injury did not occur.

RESULTS

Figure 1 shows the overall treatment effectiveness for 11 subjects; nine of them were in the present study and the two additional subjects (Subjects 10 and 11) were included from the previous study using the same procedural design (Azrin et al., 1982). The data are expressed as the mean percent of intervals with self-injury during each of the six procedures. The mean percent of intervals with self-injury was 57.2% during the Social Extinction Condition, 54.8% during Baseline Instructional Promptings, 33.7% during DRO, 27.9% during DRI, 24.9% during the Interruption Procedure. The combination procedure of the DRI plus Interruption resulted in a mean of 5.9%. These results showed that overall, the DRI + I Procedure was the most effective, the Social Extinction and Baseline Prompting were the least effective, and the DRI and DRO were intermediate and fairly equivalent, whereas the Interruption Procedure was more effective than the DRI or the DRO Procedures. The level of self-injury during the most effective procedure (DRI + I) was about one-tenth of the level during the least effective procedure (Social Extinction) (i.e., 5.9 vs. 57.2%).

Table II shows the within subjects effect of the six procedures. The table presents the level of self-injury of each of the six procedures for each subject. Again the data are expressed as the mean percent of interval in which self-injury was exhibited. It can be seen that the most effective procedure was the DRI plus Interruption Procedure for 8 of the 11 subjects, social extinction for 2 subjects (Subjects 1 and 3) out of the 11, and DRO for 1 subject (Subject 9) out of the 11. For the three subjects for whom the

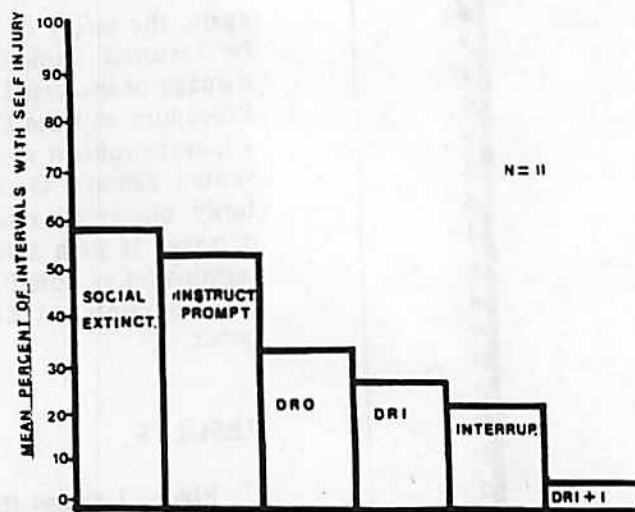


Fig. 1. The mean percentage of observation intervals in which self-injury occurred during 6 procedures, averaging for 11 Subjects. DRO indicates differential reinforcement for the absence of self-injury, DRI indicates differential reinforcement for the incompatible responses, DRI + Int. indicates the combination of the DRI and the Interruption Procedure.

DRI + I was not the most effective, it was the next most effective, and was within four percentage points of the most effective procedure, making the difference relatively negligible. Social Extinction was the least effective, or next to least effective, for 9 of the 11 subjects (Subjects 2, 4, 5, 6, 7, 8, 9, 10, & 11). Similarly, Instructional Prompting was the least, or next to least, effective for 10 of the 11 subjects (Subjects 1, 2, 4, 5, 6, 7, 8, 9, 10, & 11).

Figure 2 shows the results in the cottage situation during the generalization phase of the study for the DRI + I procedure after the treatment comparison phase had been completed in the class situation. The results are presented for eight subjects inasmuch as the procedure for Subject 9 did not include this phase in a comparable manner as was also the case for Subjects 10 and 11 for the previous study. It can be seen that the mean percent of intervals with self-injury decreased from a mean baseline level of 62% to a mean percent of 10.7%, on the first day of training which is a mean percent reduction of over 83%. Self-injury decreased further on consecutive days during the first 7 days to a level of 2.5% on the seventh day, constituting a mean reduction of 96% from the baseline level. During this time the assigned trainer was instructing

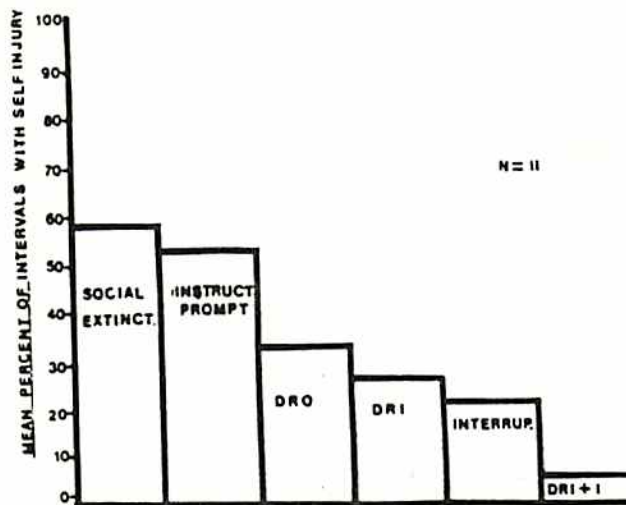


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Table II. Within-subject Comparative Procedure Effectiveness. The Mean Percentage of Intervals with Self-injury Is Shown for Each of the Six Procedures for Each of the 11 Subjects.

SUBJ	BASLINE	SOCIAL EXTIN	DRO	DRI	INTERRUPT	DRI+INT.
S1	23.2	1.0	1.9	4.9	4.7	4.6
S2	53.0	24.0	46.0	25.0	17.0	1.4
S3	11.1	1.2	93.0	11.5	2.8	3.9
S4	92.7	39.4	43.3	7.2	16.8	4.0
S5	61.7	52.6	13.2	42.0	20.9	11.4
S6	25.8	23.4	16.2	16.2	11.7	6.1
S7	100.0	100.0	20.0	85.0	50.0	6.5
S8	53.0	30.0	23.0	11.0	19.0	4.5
S9	100.0	100.0	0.0	10.0	100.0	3.0
S10	53.0	53.0	30.0	60.0	25.0	15.0
S11	30.0	30.0	25.0	27.0	7.0	5.0
\bar{X}	54.2	57.2	33.7	27.9	24.9	5.9

the cottage staff members to implement the procedure. After the first month, the procedures were implemented entirely by the regular staff members as part of the general supervision of all residents. The level of self-injury remained at a level below 10% during the 48-month period. The data were available and presented for all 8 subjects, for the first 11 months, 7 subjects for 30 months, 5 subjects for 36 months, 4 subjects for 42 months, and 2 subjects for 48 months.

Figure 3 is included for one sample subject (Subject 7) to illustrate the time course of the changes in the two phases of the study. The data in the upper part of the figure were obtained in the classroom-like setting for the procedural comparison phase, whereas the data in the lower part of the figure are for the cottage situation generalization phase. It can be seen that the baseline level of self-injury in the untreated cottage situation (lower part of the figure) remained at a high level exceeding 65% and did not co-vary systematically with the level produced by the training procedures

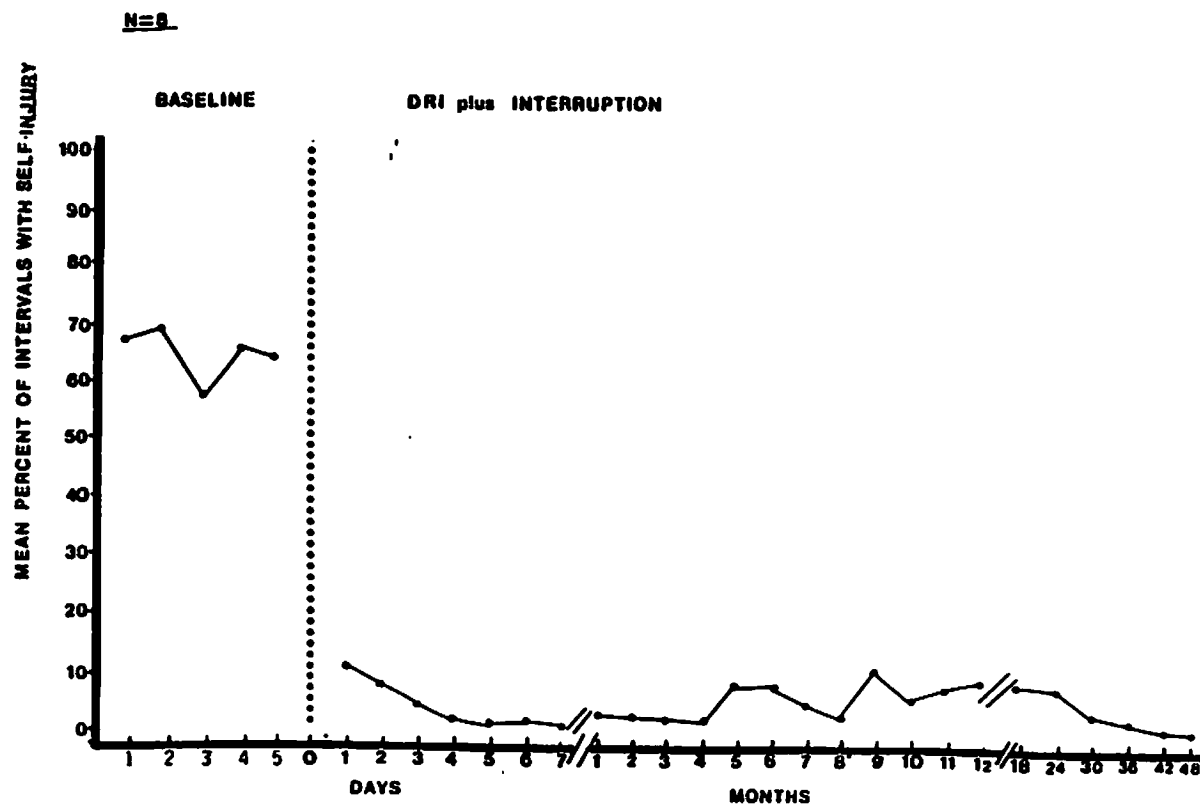


Fig. 2. The mean percent of self-injury in the cottage situation during the generalization phase of the study for the DRI + I procedure after the treatment comparison phase had been completed in the class situation. The results are presented for 8 subjects for the first 11 months, 7 subjects for 30 months, 5 subjects for 36 months, 4 subjects for 42 months, and 2 subjects for 48 months.

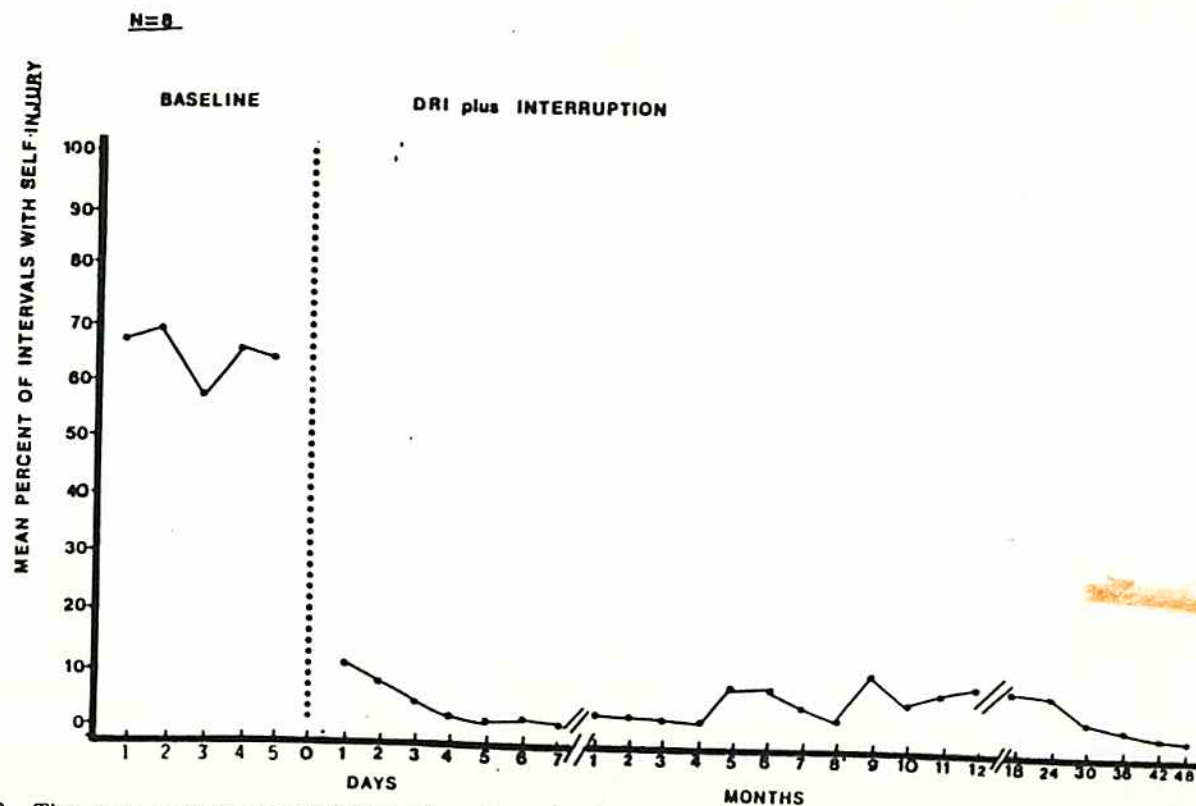


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Fig. 3. The mean percent of self-injury in the cottage situation during the generalization phase of the study for the DRI + I procedure after the treatment comparison phase had been completed in the class situation. The results are presented for 8 subjects for the first 11 months, 7 subjects for 30 months, 5 subjects for 36 months, 4 subjects for 42 months, and 2 subjects for 48 months.

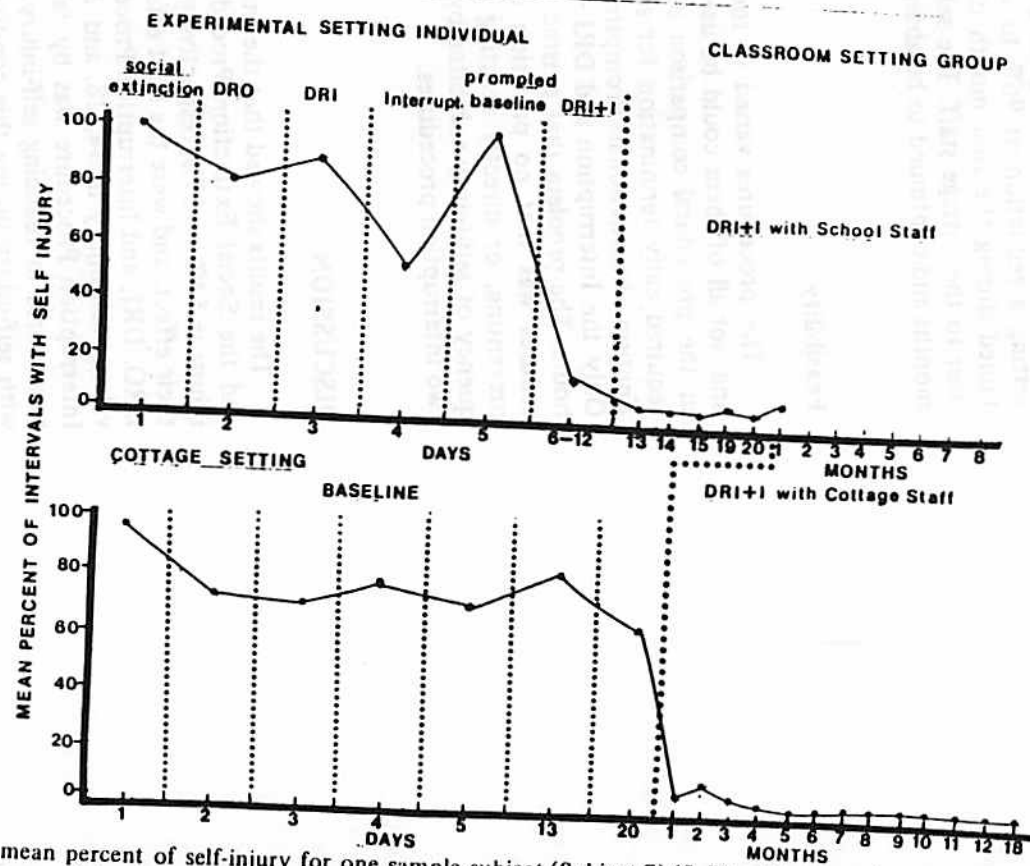


Fig. 3. The mean percent of self-injury for one sample subject (Subject 7) (S-7) to illustrate the time course of the changes in the two phases of the study. The data in the upper part of the figure were obtained in the class-like situation and the lower part of the figure presents the data from the cottage situation. The upper and lower right part of the figure presents the data during the generalization phase of the study.

at the same time in the experimental setting in the individualized class-like setting (upper left part of figure). It can also be seen that self-injury decreased to a near-zero level when the DRI + I was permanently implemented, both in the cottage setting (lower right) as well as in the regular group (upper right). In the cottage setting a reduction of 96% to a mean percent of 4.3% was obtained during the first month of phasing the subject's treatment over to the cottage staff. The self-injury was eliminated after four months and continued to be absent for the 18-month period.

Feasibility

The procedures varied in their feasibility of implementation and not all of them could be used for the full 10 hours scheduled in the procedural comparison phase. The safety of the subjects required early termination for several subjects of the Social Extinction, Instructional Prompting, DRO, and DRI Procedures. Only the Interruption and DRI + I could be used for the full 10 hours. The problem that existed in the four non-interruption procedures was that no provision existed in those procedures for preventing, or directly reacting to, severe instances or high frequency of self-injury exhibited by these subjects in contrast to the two interruption procedures.

DISCUSSION

The results showed that the Instructional Prompting Procedure and the Social Extinction Procedure were fairly equivalent (self-injury in 54% vs. 57%, respectively, of the observation intervals) in their effect, and were the least effective of the six procedures. The DRO, DRI, and Interruption Procedures were similarly fairly equivalent: self-injury in 34, 28, and 25%, respectively. The DRI plus Interruption Procedure was by far the most effective of the six procedures in reducing self-injury. The mean percent of intervals with self-injury during this condition was only 6%, which is about one-tenth of the levels observed during the two least effective procedures and about one-fifth of the levels observed during the three intermediate procedures. It appears it is the treatment of choice of the six procedures.

at the same time in the experimental setting in the individualized class-like setting (upper left part of figure). It can also be seen that self-injury decreased to a near-zero level when the DRI + I was permanently implemented, both in the cottage setting (lower right) as well as in the regular group (upper right). In the cottage setting a reduction of 96% to a mean percent of 4.3% was obtained during the first month of phasing the subject's treatment over to the cottage staff. The self-injury was eliminated after four months and continued to be absent for the 18-month period.

Feasibility

The procedures varied in their feasibility of implementation and not all of them could be used for the full 10 hours scheduled in the procedural comparison phase. The safety of the subjects required early termination for several subjects of the Social Extinction, Instructional Prompting, DRO, and DRI Procedures. Only the Interruption and DRI + I could be used for the full 10 hours. The problem that existed in the four non-interruption procedures was that no provision existed in those procedures for preventing, or directly reacting to, severe instances or high frequency of self-injury exhibited by these subjects in contrast to the two interruption procedures.

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Inasmuch as several of the training procedures differed in only one respect from one of the others, the present results permit conclusions about that one factor. Social extinction is the clear reference point since that procedure by definition involves neither instructions nor reinforcement for noninjury, nor positive behavior, nor interruption of the self-injury. The addition of instructions in the Instructional Prompting Procedure had a positive, but very slight effect, reducing the self-injury from a 58% level to 55%. Adding reinforcement for noninjury to the Instructional Prompting Procedure was the only difference in the DRO procedure; this had a large effect: 33% in the DRO procedure versus 55% during the Instructional Prompting Procedure. The further addition of a response-contingency for positive behaviors (DRI procedure versus DRO procedure) had a slight but positive effect: 28 versus 34%, respectively. The effect of the interruption component alone is evidenced by comparing the Interruption Procedure with Social Extinction and was very substantial: 25 vs. 58%. These comparisons show that instructions alone are of slight value, reinforcement for noninjury is important, reinforcing further for positive behaviors is only slightly beneficial, and interruption of the self-injury is very beneficial. Further, the effects of instructions, reinforcement for noninjury, reinforcement for positive behaviors, and interruption of self-injury seem to be additive as seen by the maximum benefit of the DRI plus Interruption Procedure that included all of these components.

Individual differences existed between subjects with regard to the differential effectiveness of the procedures, suggesting that knowledge of the average effect across subjects is meaningless in planning treatment for an individual. This conclusion is unwarranted, however, since one procedure was found to be more effective, or equal in effectiveness, to the others for all persons. Specifically, the DRI plus Interruption Procedure was either more effective or only slightly (4%) less effective than all other procedures for each subject, as well as being more effective for the group average. Conversely, the Instructional Prompting Procedure was either the poorest or next-poorest procedure for every subject, as well as for the group average. Social extinction resulted in less self-injury than any other procedure for two subjects in spite of being the least effective for the group average; but the procedure is not a realistic treatment since, as used here, it excluded the use of instructions that would be essential in daily functioning in the cottage and classroom. Therefore, in spite of the individual

differences, a treatment plan based on the present results would use the DRI plus Interruption Procedure for all self-injurious persons; completely ignoring (Social Extinction) or simply giving instructions to perform positive behaviors (Instructional Prompting) would not be used for any self-injurious persons.

The existence of the individual differences in the present study highlights the risk of drawing conclusions as to the general efficacy of a procedure based on the results with few subjects, especially inasmuch as almost all self-injury outcome studies have used only one or two subjects. Social extinction (Lovaas & Simmons, 1969), DRO (Peterson & Peterson, 1968), and DRI (Tarply & Schroeder, 1979) have each been found effective in such controlled case studies; yet the present findings are that these three procedures are not very effective relative to other procedures for most self-injurious persons.

The choice of a procedure for a given person must also depend on safety considerations, especially when the nature of the self-injury is severe as was true for all persons in the present study. Because of the severity, the DRO, DRI, Social Extinction, and Instructional Prompting Procedures each could not be used with some persons for an extended period. Only the two procedures involving interruption could be used for the scheduled duration with all persons since self-injury episodes were immediately interrupted. These results suggest that reinforcement or extinction procedures may require such a long treatment duration with only a partial immediate reduction that they are not feasible for cases of very severe self-injurious behavior. In the present study, the length of treatment required was a factor that would not permit their extended use, due to the severity of the behavior. The addition of the interruption procedure serves to reduce the risk to the subject of serious self-injury during an episode as well as reducing the frequency of the behavior.

The present findings confirm the findings of previous studies that a required period of interruption is effective for reducing self-injury. Though there are several qualitative differences and different designations used, the basic concept of response-interruption and reduced body activity is a common element. Webster and Azrin (1973) used an extended period of relaxation for one subject. Azrin, Gottlieb, Hughart, Wesolowski, and Rahn (1975) held the arms of the person for an extended period upon a self-injurious response in a "reeducative" procedure. Lancioni, Smeek, Ceccarani, Capodaglio, and Campanari (1984) using a "restraint"

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procedure, physically held down one subject's hands for 15 seconds after a self-injurious response. Repp & Deitz (1974) reduced aggression and self-injury in two subjects using a "time-out" procedure in which one subject was physically restrained for 30 seconds and a second subject was physically restrained for an unspecified period of time. Additional researchers have used this interruption-immobilization in various ways designating it as "contingent restraint" (Schroeder et al., 1977), "physical restraint" (Shapiro, Barrett, & Ollendick, 1980), "response suppression" (Dorsey et al., 1980), "response-contingent immobilization" (Luiselli, 1981), and "contingent restraint" (Gaylord et al., 1983). These investigators have reported substantial results in reducing the self-injurious behavior of their subjects similar to the reduction by the "Interruption" procedure in the present study and its earlier preliminary application (Azrin et al., 1982). In a comparison study, Gaylord et al. (1983) also found the interruption procedure more effective than the DRO or DRI.

In the generalization phase of the present study the DRI plus Interruption Procedure was found to be immediately and substantially effective in the everyday cottage and group class situation. Self-injury was reduced by 83% on the first day and by 96% on the 7th day. At the end of one month, when the regular cottage staff and class teachers were implementing the procedure, the self-injury continued to be reduced by at least 90% and remained at a greatly reduced level for the duration of the observations, which was up to 48 months for some of the subjects. These results indicate that this reinforcement-interruption procedure is a practicable method for extended usage.

Some problems in extended use in the cottage/class arose: new untrained employees were assigned, other duties took precedence, some employees were disinterested, the edible snack reinforcers mysteriously disappeared, complacency occurred when self-injury was absent for long periods, and normal employee turnover and other similar problems normally encountered in long-term institutional care. To minimize the effort required, the initial training was conducted by the project trainer until the self-injury was absent or near-absent so that little effort would be needed. To ensure competence of the initial employee/teachers, they assisted the project trainer in the intensive training. To ensure continued competence, the project trainer provided "in-service" training to new employees, periodically observed, supervised, and encouraged the employees/teachers, and provided "booster" sessions when

self-injury reappeared. To facilitate communication, one cottage employee was designated as the liaison to the project trainer. To decrease the effort required, the interruption duration was specified as being the duration required to produce calmness, the use of snack reinforcers was omitted and the praise and stroking reinforcers were to be given at all "natural" moments of proximity to the subject rather than at specified time periods. The cottage maintenance procedure appeared to be quite feasible with these precautions and modifications. The procedure required fewer compromises in the regular class situation which was more structured, had a higher staff/resident ratio, less staff turnover and always involved a professional person—the teacher. The interruption component, in particular, seemed reasonable and natural to the employees in the immediate blocking of a self-injurious action or episode followed by a calming period while continuing to protect the person from further self-injury.

The present reinforcement-interruption procedure seems to have advantages and disadvantages over procedures other than those evaluated here that have received extensive evaluation. The Positive Practice Procedure (Azrin et al., 1975) was also found immediately and substantially effective for a relatively large sample of severe self-injurious residents, but required an extensive period of arm exercises that is more intrusive and effortful. Similarly, the Required Relaxation Procedure (Webster & Azrin, 1973) required an extended period of supervision of the person during the bed-rest provided after each episode. Pain-shock (Lovaas & Simmons, 1969) has the apparent advantage of being effective far more immediately and to a greater extent and does not require manual contact and restraint. Its principal disadvantage is that it inflicts physical pain. The present method was developed as a possible alternative to pain-shock punishment for those situations in which personal/social/legal constraints preclude use of the pain-shock method.

INTERRUPTION AS A REINFORCER

A serious concern in the use of the Interruption procedure was that it would constitute a positive rather than negative consequence for those individuals for whom manual contact, restraint (see Favell, Mc Gimsey, & Jones, 1978), or attention was a positive reinforcer. The results showed no such effect that would have

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been evidenced for a given subject by a higher level of self-injury during the Interruption Procedure relative to the Social Extinction Procedure. The results showed only two subjects having a higher level during Interruption, but the difference was less than 4% for each of them. Yet, incidental observations strongly indicated touch contact or restraint was reinforcing for several of the subjects treated here. The explanation may be that touch contact was minimized, deliberately 80, by the Graduated Manual Guidance and "shadowing" technique. If so, this component is critical to the effective use of the Interruption procedure. Similarly, the neutral role of the trainer during the two-minute interruption period may have been critical in avoiding possible reinforcement from the interruption intervention, as this feature was intentionally designed to do.

The DRI Interruption Procedure appears to be so effective because it eliminates or reverses many of the causes of self-injury. Because of the ethical need for caretakers to intervene to prevent tissue damage, inadvertent positive reinforcement of self-injury results from the caretaker providing positive attention when self-injury occurs and negative reinforcement of self-injury results from the termination of aversive demands by the caretaker. The interruption component of the DRI Interruption Procedure inherently prevents continued tissue damage, thereby eliminating this control over the caretaker. Instead, the DRI component of the procedure enables positive attention to be given at a high rate for the absence, rather than the presence, of self-injury. Similarly, the instructional prompts, which are a component of the DRI, can continue to be given by the caretaker and assume reinforcing properties as the discriminative stimulus for the positive reinforcers in the DRI schedule.

Another likely cause of self-injury may be the elicitation of aggression, inwardly directed, from either pain or "frustration." The DRI schedule provides positive reinforcers, rather than painful or aversive events. Furthermore, these positive reinforcers are inherently postponed by self-injury in the DRI schedule thereby providing an indirect time-out punishment for such aggression as it is elicited. This same time-out punishment effect should also suppress self-injury that may exist simply as an extremely intense form of self-stimulation, or as arising from an elevation of the physiological pain threshold.

Another explanation of self-injury (Azrin et al., 1975) is that it arises as a form of self-stimulation due to the absence of normal stimulation from outward-directed sensory and motor activities. The DRI schedule intensively reinforces outward directed behaviors and attention and should thereby reduce the need for inward-

ly directed stimulation. Still another plausible cause of self-injury may be an agitated emotional state. If so, the gentle calming during the interruption period should reduce this agitation (Webster & Azrin, 1973).

Several of these causes of self-injury seemed to be applicable to the present subjects. As noted in the subjects' description above, several of them seemed to self-injure to obtain attention, to discourage caretaker demands, when frustrated, when agitated emotionally, or even in the absence of other persons as a form of stimulation otherwise not available because of severe limitations in social, verbal, and motor functioning. Since several of these apparent contributory factors often existed for the same individual, the combined procedure of DRI and Interruption would be more effective than a single procedure directed at only one contributory factor.

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