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TREATMENT OF SELF-RESTRAINT ASSOCIATED WITH THE APPLICATION OF PROTECTIVE EQUIPMENT

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The current investigation assessed the effectiveness of protective equipment, specifically arm splints, in reducing the occurrence of severe self-injurious behavior (SIB). Although the protective equipment reduced rates of SIB to near-zero levels, self-restraint subsequently emerged. In an attempt to reduce self-restraint while maintaining reductions in SIB, we provided noncontingent access to preferred stimuli. The presentation of preferred stimuli along with the use of protective equipment reduced both the rate of SIB and the duration of self-restraint.

DESCRIPTORS: protective equipment, self-injurious behavior, self-restraint

Self-injurious behavior (SIB) includes behavior in which individuals produce physical damage to their own bodies, and includes a variety of topographies (e.g., head banging, self-hitting, self-biting, self-pinching, self-scratching, eye poking; Rojahn & Esbensen, 2002). The deleterious side effects of SIB range from temporary bruising and severe tissue damage to death. Although the emergence of functional analysis methodologies has allowed the identification of environmental variables that maintain SIB (Hanley, Iwata, & McCord, 2003), in some cases it may be necessary to use protective equipment (e.g., mechanical restraints, helmets) to reduce the risk of physical injury associated with SIB (e.g., Paul & Romanczyk, 1973; Van Houten, 1993). Nevertheless, the use of protective equipment may be associated with certain side effects, including muscle atrophy, restricted adaptive functioning, and adverse effects on social acceptability (e.g., Fisher, Piazza, Bowman, Hanley, & Adelinis, 1997).

A number of variables, including magnitude, delay, and response effort, can influence responding when reinforcers are concurrently available. Zhou, Goff, and Iwata (2000) demonstrated that when reinforcement following item manipulation and self-injury were concurrently available, 2 of 4 participants engaged in item manipulation and self-injury decreased. For the other 2 participants, it was necessary to increase the response effort required to engage in self-injury by applying arm restraints to decrease occurrences of self-injury. Zhou et al. suggested that future research should evaluate the effects of protective equipment on the occurrence of SIB in the absence of leisure items. The present

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study extends the findings of Zhou et al. by evaluating the effects of protective equipment alone on occurrences of self-injury.

In the present analysis, protective equipment (i.e., arm splints) was used to decrease the occurrence of severe SIB. However, a novel form of problem behavior (i.e., self-restraint) was associated with the use of protective equipment. *Self-restraint* is a term applied to a class of behavior that is generally incompatible with an individual's SIB and may include the entanglement of the hands or limbs in clothing, materials, or other body parts (Smith, Iwata, Vollmer, & Pace, 1992). Like SIB, self-restraint is associated with a variety of side effects including arrested muscle development, muscle atrophy, and decreased circulation. Thus, in the current investigation, once self-restraint emerged, additional strategies were developed to decrease both the occurrence of SIB and self-restraint.

METHOD

Participant and Setting

Gail was a 16-year-old girl who had been diagnosed with moderate mental retardation, generalized anxiety disorder, and cerebral degenerative chorea. Gail was nonambulatory and possessed limited self-help skills. However, she could communicate through brief (one- to two-word) utterances and idiosyncratic gestures. She had been referred to a day-treatment program for the assessment and treatment of SIB by face punching and attended a full-day (6-hr) treatment program, 5 days per week, during and following the investigation. She had been admitted to the program based on the severity of her SIB, which had resulted in prior hospitalizations, a slight fracture of her supraorbital foramen, and had placed her at immediate risk of a detached retina.

During all sessions, Gail was seated in a wheelchair equipped with a padded lapboard (approximately 50 cm across). All sessions were conducted in a padded room (3 m by 3 m) that was equipped with a one-way observation window. Based on the severity of her SIB, one to three sessions were conducted daily and all sessions lasted 10 min. In addition, a nurse observed all sessions to monitor the occurrence of SIB and to provide medical intervention if necessary.

Response Measurement and Reliability

The primary topography of SIB was *face punching*, defined as contact of a closed fist or her forearm to the eyes, ears, nose, cheeks, mouth, forehead, or side of the head from a distance of approximately 15 cm or more. *Self-restraint* was defined as Gail wrapping the hook-and-loop straps from her protective equipment (arm splints) around her fingers and hands. *Item interaction* was defined as manipulating an item in its intended manner (e.g., rolling a ball on the wheelchair lapboard). Frequency data were collected on the occurrence of SIB, and duration data were collected on the occurrence of self-restraint and item interaction. For the purpose of data analysis, frequency data were converted to a response rate by dividing the number of responses by the length of the session (in minutes) to yield the number of responses per minute. Duration data were expressed as a percentage of session time by dividing the amount of time that the behavior occurred (in seconds) by the total length of the session (600 s), multiplied by 100%.

Throughout the analysis, a second observer simultaneously collected data on 27% of all sessions. Interobserver agreement was measured by dividing each session into successive 10-s intervals. Agreement coefficients were computed by dividing the number of 10-s intervals with observer agreement (i.e., two observers recording the same frequency or duration of responding within a given 10-s interval) by the number of 10-s intervals with agreements and disagreements, and multiplying the quotient by 100%. Agreement averaged 97% for SIB, 95% for self-restraint, and 99.8% for item interaction.

Procedure

The effects of the protective equipment, the protective equipment with preferred toys, and

preferred toys alone were compared to baseline probe sessions in a reversal (ABABCBCDC) design. Across all conditions, a therapist was seated in a chair directly beside Gail's wheelchair. The therapist provided no interaction with Gail; however, the therapist replaced items on the lapboard if they fell during conditions in which preferred items were used.

Baseline probes. Based on the severity of Gail's SIB, baseline probes were conducted to establish comparative rates of SIB in the absence of protective equipment and to demonstrate experimental control of the application of protective equipment and the provision of toys. During the baseline probes, the therapist sat in a chair next to Gail. There was no protective equipment or preferred items present, nor were any programmed contingencies in place for the occurrence of SIB.

Protective equipment. Due to the severity of her SIB, the immediate goal of Gail's admission was to stabilize her rates of SIB such that she could safely undergo various therapy and educational services. Thus, Gail wore protective equipment that consisted of double-chamber plastic arm splints molded specifically for her arms. The front and back chambers were held in place on her arms by hook-and-loop straps. The splints were rigid such that they prevented Gail from engaging in SIB directed toward her eyes. It should be noted that other forms of SIB (e.g., hitting the forehead or side of the head) were still possible while the protective equipment was present. The protective equipment condition was conducted in a manner similar to the baseline probes. However, during this condition, the protective equipment was worn throughout the session, and there were no programmed contingencies in place for the occurrence of SIB or self-restraint.

Protective equipment with toys. During the protective equipment with toys condition, Gail wore protective equipment throughout the session and received continuous access to five preferred items placed on her lapboard throughout the session. The preferred items had been identified prior to each session based on the results of a preference assessment (DeLeon & Iwata, 1996). All other procedures were similar to those implemented during the baseline and protective equipment conditions.

No protective equipment with toys. In this condition, Gail received continuous access to five preferred items on her lapboard throughout the session; however, the protective equipment was not placed on her arms. Otherwise, this condition was identical to those described above.

RESULTS AND DISCUSSION

The results of the analysis for SIB and self-restraint are presented in Figure 1. Across all baseline probes, high rates of SIB occurred (M = 103.3 responses per minute). It should be noted that self-restraint could not occur in this condition because the protective equipment was not yet present; by definition, self-restraint occurred only in the presence of the protective equipment. The addition of protective equipment reduced rates of SIB significantly (M = 0.3 responses per minute); however, Gail began removing the straps that held her protective equipment on her arms and wrapping the straps around her fingers (M = 97% of session). Engagement in self-restraint involved Gail twisting her fingers in the straps; this could result in a loss of circulation to her fingers. In addition, this form of self-restraint interfered with her ability to use her hands and fingers to engage in appropriate, adaptive behaviors (e.g., self-feeding, object manipulation, educational activities). To reduce the occurrence of self-restraint while maintaining low levels of SIB, preferred toys were placed on Gail's lapboard. The presentation of preferred toys decreased both SIB and self-restraint to zero levels, while high levels of item interaction occurred (M = 99% of session). The no protective equipment with toys condition was probed to determine whether the preferred items reduced SIB in the absence of protective equipment. Rates of SIB in this condition were near baseline levels.

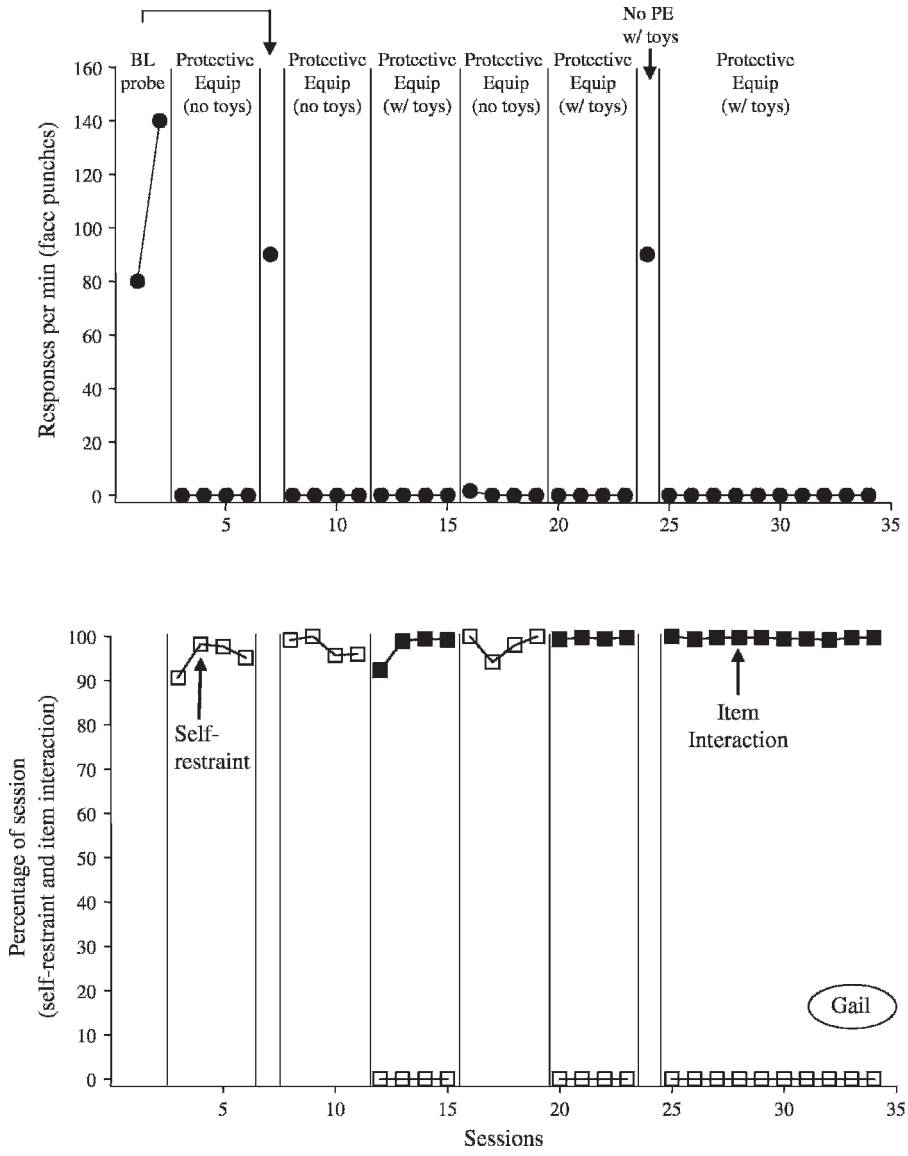

Figure 1. Responses per minute of SIB (top) and percentage of session with self-restraint and item interaction (bottom). BL = baseline; PE = protective equipment.

The current analysis demonstrated a functional relation between protective equipment and self-restraint in the absence of toys. An additional functional relation was suggested by the inverse relation between item engagement and self-restraint. One potential limitation of the current analysis is that the effects of toys as a competing source of stimulation for SIB were not evaluated prior to the introduction of protective equipment. It is possible that the presence of toys alone could have reduced the occurrence of SIB, which would have obviated the need for protective equipment. However, based on the severity of Gail's SIB, it was deemed necessary to introduce an intervention immediately (i.e., protective equipment) that would prevent further physical injury. Finally, the current results should be interpreted with

caution due to the brevity of the baseline condition. Based on the risk for significant tissue damage associated with SIB, we were unable to conduct an extended evaluation of SIB in the absence of protective equipment. It is possible that rates of SIB would have decreased over an extended phase of baseline sessions. It should be noted that following the current analysis, we successfully implemented a restraint-fading procedure (based on Fisher et al., 1997) and conducted multiple functional analyses to identify the operant reinforcement contingencies that maintained Gail's SIB. Results of each subsequent functional analysis (data available from the second author) suggested that her SIB was maintained by automatic reinforcement.

This study extended the procedures of Zhou et al. (2000) by assessing the effects of protective equipment alone on occurrences of self-injury. In summary, the addition of protective equipment immediately reduced the occurrence of SIB; however, self-restraint emerged with the presentation of the protective equipment. These results replicate previous literature (e.g., Smith et al., 1992) in that an inverse relation between SIB and self-restraint was observed. The presentation of preferred stimuli alone did not result in a reduction in SIB; it was only when the toys were provided in conjunction with the protective equipment that clinically significant reductions in both SIB and self-restraint were observed.

Future research should further evaluate the relation between SIB and self-restraint to determine the extent to which these responses are maintained by similar or dissimilar operant functions. In addition, an evaluation of the extent to which self-restraint is linked to specific idiosyncratic stimuli should be evaluated. Previous research (Van Camp et al., 2000) has shown that the presence of specific stimuli (e.g., vibration) may occasion problem behavior. It is possible that the straps used in Gail's protective equipment served as an establishing operation for her self-restraint, which could have been addressed by preventing access to and subsequent removal of these stimuli (e.g., covering the straps or blocking attempts to remove the straps). Alternatively, the concurrent availability of preferred toys in the current analysis appeared to compete with the occurrence of self-restraint while also producing low levels of SIB, suggesting that item interaction may have been a preferred response relative to self-restraint.

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