JOURNAL OF APPLIED BEHAVIOR ANALYSIS 1993, 26, 197–203 NUMBER 2 (SUMMER 1993)

# THE USE OF WRIST WEIGHTS TO REDUCE SELF-INJURY MAINTAINED BY SENSORY REINFORCEMENT

RON VAN HOUTEN
MOUNT SAINT VINCENT UNIVERSITY

The participant in this study was a boy with a long history of self-injurious face slapping. Following a functional analysis indicating that face slapping was maintained by sensory consequences, the participant was given soft wrist weights to wear for progressively longer periods. Data on the frequency of face slapping were collected 5 min before the weights were put on, while the weights were on, and 5 min after the weights were removed. At all other times a protective helmet was placed on the participant's head for 30 min contingent on face slaps. When weights were worn for 30 min each day, face slapping decreased during 5-min observation periods before and after wearing the weights. The use of protective headgear was eliminated by the end of the study. Face slapping did not occur during a follow-up check conducted 5 months after completion of the study.

DESCRIPTORS: self-injury, weights, response cost

Some self-injurious behavior (SIB) has been shown to be a function of automatic positive reinforcement from the sensory consequences it produces (Iwata, Vollmer, Zarcone, & Rodgers, in press). One way to reduce the frequency of SIB maintained by automatic positive reinforcement is to provide noncontingent stimulation to produce satiation. Wells and Smith (1983) treated face slapping by stimulating the area slapped with a vibrator and by providing other forms of stimulation during a 30-min daily treatment session. The noncontingent delivery of stimulation resulted in a reduction in the number of episodes of SIB in each of 4 residents. Bailey and Meyerson (1970) also used noncontingent vibratory stimulation to reduce head banging.

Another approach to the treatment of self-injury maintained by sensory reinforcement is to identify the form of stimulation maintaining the behavior and use a sensory extinction procedure. Dorsey, Iwata, Reid, and Davis (1982) used a helmet and foam-padded gloves to extinguish head banging in several clients. Although continuous protective equipment was associated with lower levels of SIB, this condition was not followed by a return to the baseline condition. Instead, a contingent protective equipment plus differential reinforcement of other behavior (DRO) condition was introduced for all participants. Although padded helmets may reduce or eliminate SIB in some clients, the effects may not persist when the client discriminates the absence of the helmet. The participant in the present study seemed to have formed such a discrimination, because he did not engage in face slapping when the helmet was on but resumed face slapping whenever it was removed.

Another way to reduce face slapping might be to place soft wrist weights (commonly used by joggers)on both wrists. There are several processes by which requiring a client to wear wrist weights could reduce face slapping. First, the increased effort required could reduce or eliminate the response. A number of studies have demonstrated a negative functional relationship between response effort or efficiency and response rate (e.g., Horner & Day, 1991; Notterman & Mintz, 1962; Schroeder, 1972). Schroeder demonstrated that increasing the response force required to operate a tool used in a sheltered workshop task decreased the work rate of adults with developmental disabilities working on a token economy. More recently, Luiselli (1991)

This research was supported in part by Grant 410-90-1565 from the Social Sciences and Humanities Research Council of Canada. I thank Paul Rhindress, Barbara Walls-Nini, Sharon McLeod, and Janet Bray for their valuable assistance.

Reprints may be obtained from Ron Van Houten, Psychology Department, Mount Saint Vincent University, Halifax, Nova Scotia, B3M 2J6 Canada.

employed a helmet with a face shield to reduce face slapping in a woman with impaired hearing and vision and moderate to severe mental retardation. The woman could slap her face by lifting the helmet. Over time, face slaps declined and the helmet was faded. Second, the weights could slow down the terminal velocity of the slapping response, thereby altering the sensory consequences (i.e., reduce vibration and noise) so that the response no longer produces a reinforcing outcome.

## METHOD

### *Subject and Setting*

The participant was a 10-year-old boy (Tom), diagnosed as having a severe developmental disability with autistic features. Tom was nonvocal but had acquired several signs he rarely used spontaneously. He had lived in a children's training center since he was 5 years old. A variety of activities were scheduled throughout the day, including instructional sessions (for personal care, vocational skills, and communication) and leisure periods in a playroom with other residents. In addition, planned recreational activities (such as swimming and skating) occurred four times per week.

Tom engaged in SIB consisting of hard face slaps that led to bruising, swelling, and hair loss. Tom typically held his right hand over his ear while he slapped his face with his left hand. These slaps contacted his face on the upper portion of his cheekbone or on his scalp just above the temples. Slaps always produced a loud noise and were almost always associated with yelling. Face slapping occurred throughout the day, including mealtimes.

Because Tom's face slapping, which had been increasing in intensity during the 6 months before the intervention, was leading to tissue damage, a padded boxer's helmet was placed on his head for 30 min contingent on face slaps. Because of the high frequency of face slapping, Tom wore the helmet the entire day, except for brief periods every half hour when staff attempted to take the helmet off. When the helmet was first introduced, Tom struck the helmet several times but was never observed to slap the helmet thereafter. It was hypothesized that slaps were extinguished when the helmet was on because they no longer produced a loud noise.

### *Measurement*

*Face slaps* were defined as any blow to the face or head area with either hand. Face slapping was recorded by tallying its frequency during successive 10-s intervals. *Toy play* was defined as manipulating a toy in a manner consistent with its intended use. Toy play was measured by a 10-s partial-interval recording procedure during one assessment session.

### *Preliminary Assessment*

*Functional analysis.* Tom did not wear his helmet during functional analysis sessions. This analysis followed the protocol of Iwata et al. (in press) and involved presenting the following conditions for 15-min periods over 2 hr: high demand (motor imitation and sign training), no demand (free to wander around the room and play with toys), attention following face slaps, ignore face slaps, and alone (in a playroom by himself). The rate of face slaps remained constant across conditions, averaging about 4.3 slaps per minute (range, 0 to 22). We therefore hypothesized that face slapping was maintained by automatic positive reinforcement (Iwata et al., in press). The elimination of face slapping when a padded helmet was worn supported this hypothesis.

We conducted an additional functional analysis session to determine whether the vibration or noise produced by the slap was the automatic consequence maintaining face slaps. We alternated brief 5-min conditions in which a vibrator, placed over the parts of Tom's face that he slapped, was switched on and off. Tom slapped his face an average of 3.7 times per minute when the vibrator was off, and he did not slap his face when the vibrator was switched on.

*Wrist weight assessment.* Because the previous assessment suggested that face slapping was maintained by automatic positive reinforcement, we conducted a preliminary assessment of the effects of

wrist weights on Tom's face slaps. We used wrist weights because of their potential to attenuate the sensory reinforcement of noise and vibration from face slaps through slowed movement. In addition, wrist weights would not attract undue attention, would not produce irritation, were difficult to remove or destroy, and did not involve the production of a custom device or the frequent replacement of batteries. The pair of Marksport® neoprene wrist weights (0.68 kg or 1.5 pounds each) were made of soft material and were held on the wrists with Velcro® straps. During the 35-min assessment session, we alternated the presence and absence of weights on both wrists during successive 5-min periods.

*Toy play assessment.* We conducted a 21-min assessment to determine the effect of the wrist weights on the occurrence of toy play. Tom was seated at a table with tinker toys, toy cars, and several other toys. (We selected these toys because Tom usually played with them when they were offered.) We alternated the presence and absence of weights during successive 3-min periods. Toy play and face slaps were recorded using a 10-s partial-interval recording procedure (rather than frequency within intervals, as used previously).

All functional analysis sessions were kept brief to prevent Tom from injuring himself. We observed that Tom's injuries were not the result of a few very hard blows but were instead the cumulative effect of repeated blows. The use of the helmet during the period prior to the study allowed the injuries to heal. By keeping assessment sessions brief, the duration of face slapping was not long enough to cause serious injury. Although Tom's face was red after some of the assessment sessions, no sign of serious injury was observed.

### *Procedure*

Following the assessments, staff members conducted one 20-min session each day, 7 days per week. The staff member took off Tom's helmet and recorded face slapping during (a) a 5-min baseline, (b) a 10-min period in which the wrist weights were placed on Tom, and (c) another 5-min baseline. Therefore, sessions initially lasted 20 min. The staff member put the helmet back on Tom after the second 5-min baseline.

After 16 sessions in this condition, the period of time the weights were worn was increased to 20 min, thereby increasing session length to 30 min per day. After eight more sessions, the period that the weights were worn was increased to 30 min, resulting in sessions lasting 40 min each day. After five more sessions, the time the weights were worn was increased to 60 min (total session length was 70 min). At the end of the study, staff members were told they could put the weights on Tom for 30 min twice a day following face slaps. This was done only occasionally for 3 weeks and was not required after that. Follow-up data were collected 5 months after the completion of the experiment. An observer recorded the number of face slaps during a 30-min observation period for 5 consecutive days.

### *Interobserver Agreement*

Two independent observers recorded face slaps during all preliminary assessment sessions and during 6 of 60 treatment sessions. An agreement was defined as both observers tallying the same number of face slaps during a 10-s interval (or both observers identically scoring the occurrence or nonoccurrence of face slapping during the 10-s interval in the toy play assessment). Interobserver agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. Interobserver agreement on face slapping was always 100%. Interobserver agreement on the occurrence of toy play during the single toy play session was 100%.

## RESULTS

Figure 1 shows the results of the wrist weight assessment. Tom did not slap his face when the weights were on. When the weights were off, the number of slaps per minute ranged from 1 to 18.

The results of the toy play assessment are presented in Figure 2. When the weights were on, Tom played with the toys during 100% of the intervals and never slapped his face. When the

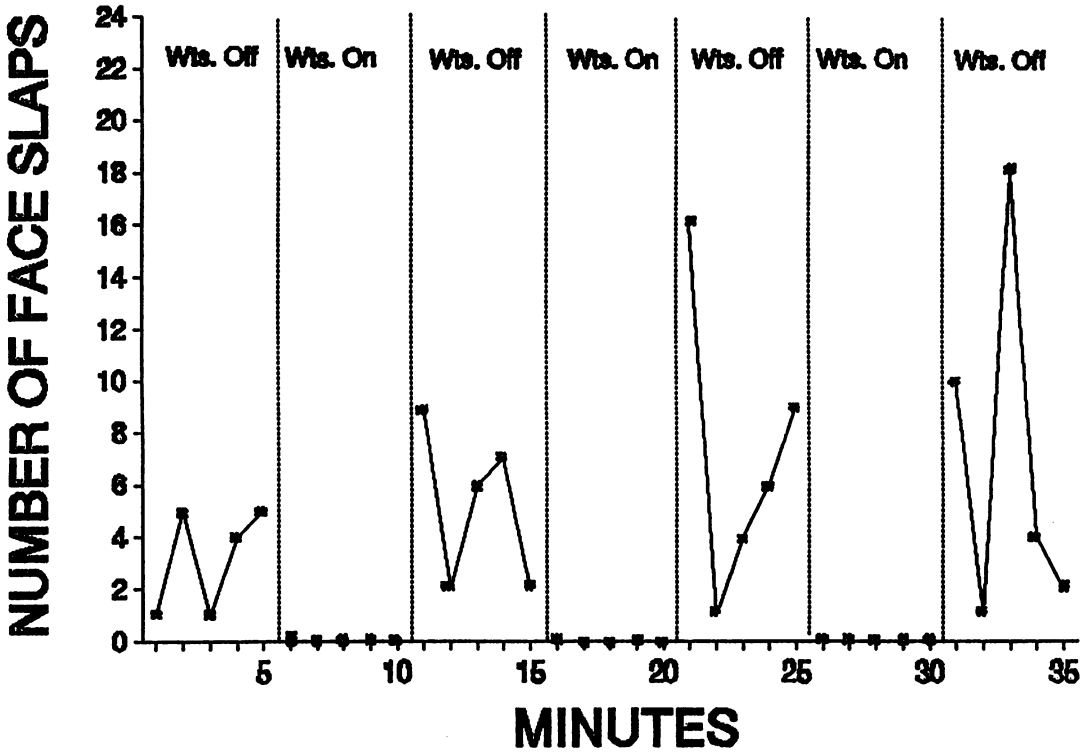


Figure 1. The number of face slaps per minute when the wrist weights were on and when they were off.

weights were off, Tom played with the toys during 89% of the intervals and slapped his face during an average of 46% of the intervals. Thus, the weights did not interfere with Tom's play behavior. Tom spent most of his time playing with the tinker toys during all conditions, and the observers did not notice any change in the way Tom played with these toys under the two conditions.

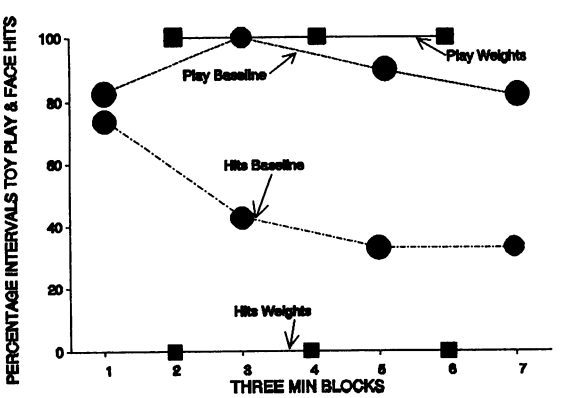


Figure 2. The percentage of intervals during which Tom hit his face and played with toys when he did or did not wear wrist weights.

The results of the weights treatment are presented in Figure 3. Initially, Tom slapped his face an average of 5.3 times per minute during the 5-min period before the weights were put on. During the 10-min period when the weights were on, Tom slapped his face an average of 0.1 times per minute. In each instance, these slaps occurred during the first minute after the weights were put on. During the 5-min period after the weights were removed, face slaps averaged 4.9 times per minute. When the weights were worn for 20 min, there was little change in the number of face slaps during baseline conditions. When the weights were worn for 30 min, the baseline level of face slaps started to decline. When the weights were worn for 60 min, face slaps increased somewhat during Baseline 1 and Baseline 2 for five sessions, and then remained low during the remainder of the condition. During the last 15 sessions of the study, the contingent

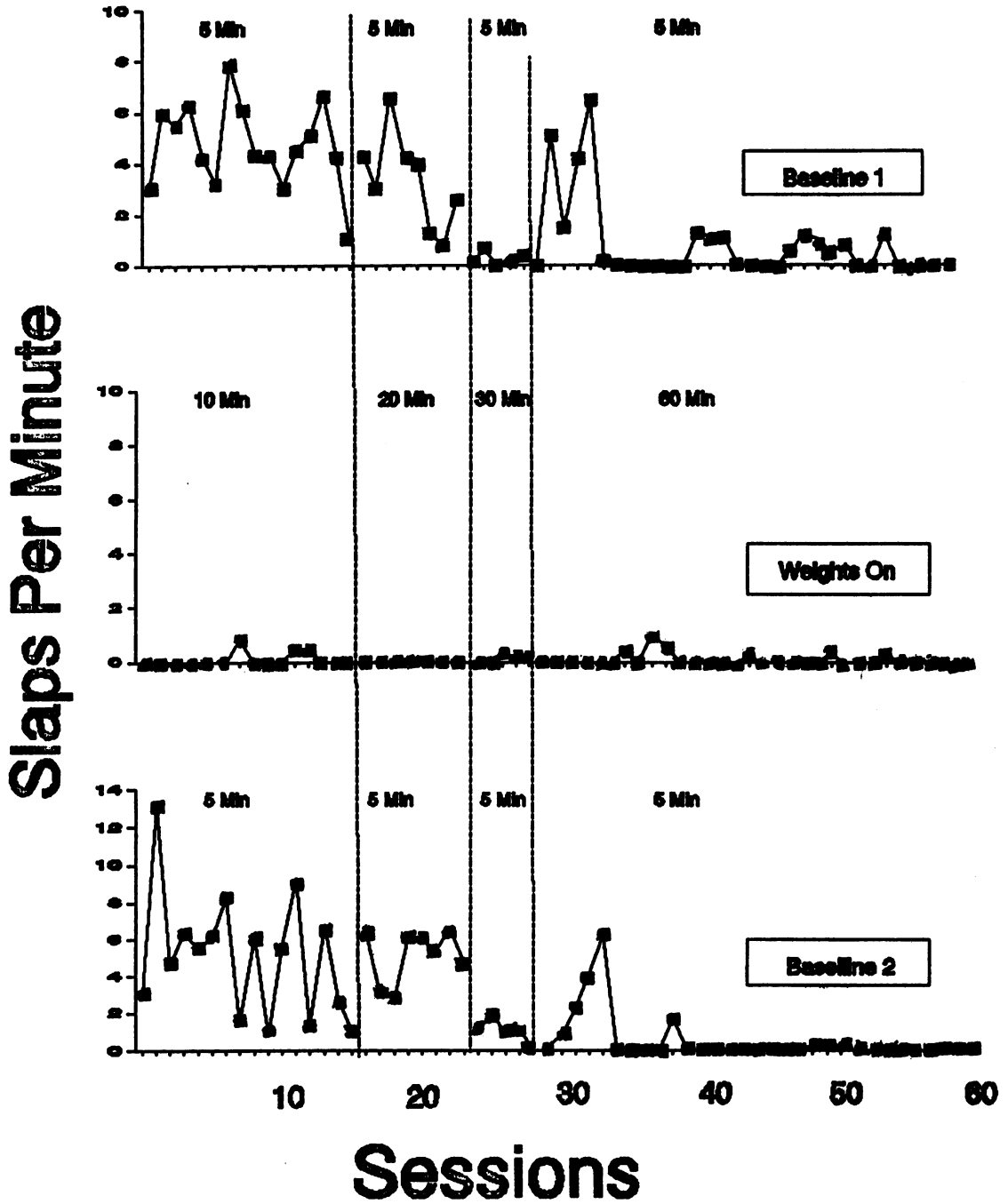


Figure 3. The number of face slaps per minute during the 5-min periods before wrist weights were put on (upper panel), during the use of wrist weights (middle panel), and during the 5-min periods after wrist weights were removed (lower panel).

helmet procedure was discontinued and no increase in face slapping was observed. It is interesting to note that face slaps declined during the first baseline (preweights) before they declined during the second baseline (postweights). These results parallel the increase in face slaps during the weights-off condition (Figure 1) and may be the result of a contrast effect. No face slaps were observed during the 5-month follow-up.

## DISCUSSION

The results of a functional analysis indicated that face slapping was maintained by automatic reinforcement. One strategy for eliminating behavior maintained by automatic reinforcement is the use of a sensory extinction procedure. Wrist weights were hypothesized to slow down the acceleration of the slaps and thereby change the consequence of the face-slapping behavior and lead to extinction. However, the instant reduction in self-injury following the application of the weights suggested that they may have reduced face slaps primarily through the increased response effort required. Alternatively, the weights could have functioned as a partial restraint. Tom did not slap his face when someone was holding on to his hands; perhaps the sensations of increased resistance associated with moving his hands when he was wearing the weights were similar to the sensations produced when a staff member held his hands. However, if either of these related hypotheses were correct, sensory extinction may have played a role on the occasions when Tom did slap his face during the treatment condition. Unfortunately, the design does not allow a definitive conclusion about the operative mechanisms or processes that contributed to the behavior change.

The data collected on toy play and self-injury suggested that the application of the weights did not have any effect on toy play involving fine muscle movement. Informal observation in the outdoor play area also revealed no decrease in the use of outdoor play equipment when the weights were on. Therefore, if the use of the wrist weights stopped face slapping through reducing response efficiency, it appears to have done so without affecting other activities.

Perhaps the most interesting finding of this study was the gradual decline in face slapping observed during periods when the helmet was removed in Baseline 1 and after the weights were taken off in Baseline 2. When the weights were worn for 30 min, Tom began to slap his face less at other times during the day and, as a result, was not wearing his helmet all the time. It was clear that the presence and absence of the helmet had developed perfect stimulus control over face slapping before the start of the study. Perhaps the weights led to a change in stimulus control so that removing the helmet was no longer discriminative for face slapping.

Some cautions in interpreting these data should be noted. First, replication is needed with other children exhibiting face slapping that has been demonstrated to be maintained by sensory reinforcement. Second, the design did not demonstrate conclusively why the weights were effective in reducing face slapping. It is not clear whether the weights were effective because they decreased the efficiency of face slapping (response cost), attenuated the effects of the slaps (sensory extinction), represented a partial restraint procedure, or because they combined several of these functions. Future work is needed to delineate more clearly how wrist weights reduce face slapping maintained by sensory reinforcement.

## REFERENCES

Bailey, J., & Meyerson, L. (1970). Effects of vibratory stimulation on a retardate's self-injurious behavior. *Psychological Aspects of Disability, 17,* 133–137.

Dorsey, M. F., Iwata, B. A., Reid, D. H., & Davis, P. A. (1982). Protective equipment: Continuous and contingent application in the treatment of self-injurious behavior. *Journal of Applied Behavior Analysis, 15,* 217–230.

Horner, R. H., & Day, H. M. (1991). The effects of response efficiency on functionally equivalent competing behaviors. *Journal of Applied Behavior Analysis, 24,* 719–732.

Iwata, B. A., Vollmer, T. R., Zarcone, J. R., & Rodgers, T. A. (in press). Treatment classification and selection based

on behavioral function. In R. Van Houten & S. Axelrod (Eds.), *Behavior analysis and treatment*. New York: Plenum.

Luiselli, J. K. (1991). Behavioral-pharmacological treatment of severe self injury in an adult with dual sensory impairment. *Journal of Behavior Therapy and Experimental Psychiatry, 22,* 233–238.

Notterman, J. M., & Mintz, D. E. (1962). Exteroceptive cueing of response force. *Science, 135,* 1070–1071.

Schroeder, S. (1972). Parametric effects of reinforcement frequency, amount of reinforcement, and required response force on sheltered workshop behavior. *Journal of Applied Behavior Analysis, 5,* 431–442.

Wells, M. E., & Smith, D. W. (1983). Reduction of self-injurious behavior of mentally retarded persons using sensory-integrative techniques. *American Journal of Mental Deficiency, 87,* 664–666.

*Received November 25, 1991*
*Initial editorial decision February 3, 1992*
*Revisions received April 8, 1992; June 17, 1992; January 19, 1993*
*Final acceptance January 19, 1993*
*Action Editor, Robert Horner*