The Effect of of Contingent Skin Shock on Treated and Untreated Problem Behaviors

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Abstract

We evaluated the effectiveness of contingent skin shock (CSS) in directly reducing the frequency of targeted aggressive, health dangerous, and major disruptive behaviors of a student who had not improved with the use of pharmaceutical treatment, positive behavioral treatments using antecedent and consequence manipulations, or behavioral treatments based on behavior function. We also evaluated the indirect effect of the CSS intervention on the frequency of other topographies of problem behaviors that were not directly targeted for treatment with the CSS intervention, and on the frequency of physical restraints. The results suggest that CSS, when used as a supplement to a comprehensive behavioral program, primarily based on positive programming, did the following: (1) it was extremely effective in reducing the frequency of targeted, directly treated problem behaviors; (2) it had a significant decelerative effect on other problem behaviors that had not been directly targeted for treatment; and (3) it eliminated completely the need for physical restraints.

The Direct and Indirect Effects of Contingent Skin Shock

Contingent skin-shock (CSS) as a decelerative procedure, used in concert with positive reinforcement and educational procedures, is extremely effective in treating severe and/or intractable problem behaviors. Aggression (Foxx, McMorrow, Bittel, & Bechtel, 1986), various topographies of self-injury (Salvy et al., 2004; Linscheid & Reichenback, 2002; Duker & Seys, 2000), and rumination (Wright, Brown, & Andrews, 1978) are all examples of problem behaviors that have been effectively treated using contingent skin-shock combined with reinforcement procedures. Despite assertions to the contrary (Donnellen & LaVigna, 1990), there is no evidence that severe problem behaviors of all individuals can be successfully treated without using punishment procedures. Indeed,

punishment may be indicated when interventions based on function fail to reduce the problem behaviors to clinically significant levels (Grace, Kahng, & Fisher, 1994) or when a problem behavior must be reduced immediately for health and safety reasons (Dura, 1991). Evidence is lacking to support the claim that all severe problem behaviors can be successfully treated without the use of punishment (Foxx, 2005).

The indirect effects of punishment have been summarized by Lerman and Vorndran (2002). In their review they note that when targeted problem behaviors are decelerated through the use of punishment, other appropriate and inappropriate behaviors can accelerate (contrast), decelerate (induction), or remain unchanged. Linscheid et al. (1994) point out that most of the studies conducted using CSS as a decelerative procedure contain anecdotal reports of contrast associated with positive behaviors and induction associated with inappropriate behaviors other than those directly treated with CSS. Furthermore, they systematically demonstrated that behaviors such as self-initiated toy play, smiling, and laughing increased when an 8-year-old boy's head-banging was treated with CSS.

We describe the direct effect of CSS on three categories of targeted problem behaviors exhibited by a single student when it was made contingent on those behaviors. In addition, we also describe the indirect effect of CSS on other topographies of problem behavior that were not targeted for treatment with CSS as well as on the need for mechanical restraints.

Method

Participants and Setting

The participant, J.B., was a 14-year-old male student at the Judge Rotenberg Center (JRC) who had been diagnosed with Autism and Severe Mental Retardation. Prior to his arrival at JRC, J.B. had been enrolled in a number of special education settings. He was placed in psychiatric hospitals on several occasions because of aggression and other problem behaviors. Examples of his problem behaviors included the following: hitting

and biting his teachers, bus driver, and family members; incessant cursing; bolting into the street; property destruction at home and school; and sexually inappropriate behaviors.

His medication history included various doses and combinations of the following drugs, none of which were effective in treating his behaviors: Zyprexa, Concerta, Adderall, Seroquel, Ritalin, Abilify, Zoloft, Inderal, Keppra, and Risperdal. A variety of treatments and environmental arrangements (e.g., 1:1 staffing, 1:1 instruction, occupational therapy, speech therapy, and interventions based on a Functional Behavior Assessment had also been tried in his prior placements and had failed to reduce the frequency of his problem behaviors to acceptable levels. As a result, after being hospitalized because of the intensity of his problem behaviors, he was referred to JRC.

J.B. entered JRC in October, 2005. A staff member was assigned to work with him on a 1-1 basis, and a wide variety of consistently applied positive behavioral programming procedures were employed to treat his major problem behaviors for periods ranging from 40-53 weeks. These procedures included the following: educational procedures to teach replacement and incompatible behaviors; intermittent positive reinforcement (with tokens and verbal praise) for replacement behaviors and for behaviors incompatible with the target behaviors; teaching him how to ask for attention, privileges or things in an appropriate manner and giving him frequent opportunities to do so; DRO contracts; DRA contracts; planned ignoring; verbal redirection; physical redirection; token reinforcement; and being placed on minimal demands at times. Tokens could be exchanged for special foods, activities and privileges, as well as for access to an in-classroom lounge/reward area, an in-classroom box of rewarding items that could be earned, an all-school arcade-type rewards lounge, and an in-school retail store where desired personal items could be purchased.

Eventually these procedures proved to be insufficiently effective by themselves and had to be supplemented with the use of CSS. Prior to the introduction of CSS into J.B.'s program, the following safeguards were followed: (a) the parent/guardian gave written informed consent; (b) a doctoral level clinician composed an appropriate treatment plan; (c) a peer review committee reviewed the plan and deemed it appropriate; (d) a physician

certified the absence of medical contraindications to the use of CSS with J.B.; (e) a psychiatrist certified the absence of psychiatric contraindications to the use of CSS with J.B.; (f) a human rights committee approved the treatment plan; (g) the treatment plan was authorized by a Massachusetts Probate Court; and (h) a psychologist, retained by the attorney to represent J.B.'s interests in the Probate Court action, approved of J.B.'s treatment plan. The entirety of J.B.'s program, excluding areas of the bathroom, was monitored by highly experienced monitoring and supervisory staff, on a 24-hours a day, 7 days per week basis. This monitoring included the use of video cameras and microphones mounted in all locations, including the school, residences and transportation vehicles, as well as digital video recording equipment that enabled real-time monitoring of the student at remote locations using the internet.

Topographies and Data Collection

Based on observations of J.B. and historical records, the attending clinician assigned J.B.'s problematic behavior topographies to the following seven categories:

1. "Aggressive" was composed of biting, punching, hitting, kicking, pushing, spitting, and throwing objects at others.
2. "Health Dangerous A" was composed of vomiting (when not ill) and open or closed hand-hitting to chest or stomach (to induce vomiting).
3. "Health Dangerous B" was composed of running from supervision, licking floor, dropping self to the floor, and placing an entire inedible object in mouth.
4. "Major Disruptive" included only the single topography of emitting a particular curse word.
5. "Noncompliant" included only the topography of refusing to follow a learned direction after two verbal prompts and one physical prompt.
6. "Destructive" was composed of tearing/ripping objects, banging/kicking objects, biting clothing, and spilling liquid intentionally.
7. "Educationally/Socially Interfering" included behaviors that interfered with education and social development, such as sucking thumb/fingers, hand clapping, and stopping work for longer than 10 seconds.

In each case the topography included not only the complete execution of the behavior but also attempts, and shaped down versions (topographies that changed their form as the behaviors decelerated). Frequency data was collected by direct care staff 24 hours per day. Each staff member was trained to tally each behavior as it occurred on recording sheets segmented by hour. Hand counters were used to count high frequency behaviors. Physical restraints were counted on a daily basis.

Materials

CSS was administered by means of a remote control skin-shock device developed by JRC and called the Graduated Electronic Decelerator (GED). It consisted of a transmitter, a receiver/stimulator, a battery, an electrode and associated cables. The transmitter, a SECO-LARM (model SK-919TD2A) two-channel RF transmitter, operated at 315 MHz and had over 68 billion possible codes. It was housed in a lexan box with the participant's name and photo on the outside. The receiver/stimulator consisted of a receiver (SECO-LARM model SK-910) set to the same code as the transmitter, a shock controller circuit board that generates the shock stimulus, and a stimulation indication beeper (Mallory piezoelectric ceramic buzzer model PLD-27A 35W). A 12 V rechargeable NiCAD battery (Panasonic P/N N124) provided power to the stimulator. The electrodes consisted of two stainless steal buttons (diameter 9.5 mm, thickness 3.25) mounted up to 6 inches apart on flexible nonconductive material. An electrical cord (Hirose Electric Co., Ltd., Part # H0063-ND) connected the battery to the stimulator and the stimulator to the electrode. The battery and stimulator were carried in a backpack worn by the student.

The GED produced a direct current with an average voltage of 60 V RMS with a current of 15 mA when applied to a 4kΩ (typical skin resistance for the GED) resistor. A GED application lasted for 2 seconds (fixed by the circuitry). The GED stimulus consisted of a square wave with a duty cycle of 25%, and a pulse repetition frequency of 80 pulses per second.

Procedure

To evaluate the direct effects of CSS on the behaviors that were directly treated, a quasi-multiple baseline design across behaviors was utilized. To evaluate the indirect effects of CSS on untreated problem behaviors, visual inspection of date-aligned behavior frequency charts was used.

Baseline (Positive Programming). Upon admission, J.B.'s attending clinician completed an initial functional assessment. Based on this initial assessment and on a continuing ongoing functional assessment facilitated by daily charting of the behavior frequencies, the attending clinician implemented, and continually adjusted, combinations of antecedent, reinforcement, extinction, and response cost procedures. All of J.B.'s environments were arranged so that problem behaviors resulted in minimal or no escape from demands, no access to preferred items, and minimal attention. Dangerous behaviors were contained using emergency restraint. All psychotropic medications were gradually phased out during J.B.'s 23 weeks at JRC under the supervision of a psychiatrist.

Treatment (Addition of Skin Shock). During this phase, the attending clinician continued to adjust antecedent, reinforcement, extinction, response cost and other procedures. In addition, each instance of any targeted topography in the categories of Aggression, Health Dangerous A, Health Dangerous B, and Major Disruptive Behaviors was consequated with a single GED application to his left arm, right arm or torso, starting 40, 40, 46, and 53 weeks after admission, respectively. Health Dangerous A behaviors (vomiting when not ill, and open or closed hand-hitting to chest or stomach to induce vomiting) were not treated as problem behaviors, and therefore were not counted, until the treating clinician became certain, based on numerous medical evaluations and behavioral assessments, that they had no medical foundation. Thus, only 13 full weeks of baseline data were collected for this category. Only two weeks of baseline data are presented for Major Disruptive Behaviors, because prior to those two weeks, the single topography that comprises this category, a certain curse word, was not tracked separately.

Results

The direct effects of CSS on the Aggressive, Health Dangerous A, Health Dangerous B, and Major Disruptive behavior categories are presented in Figure 1. Prior to the addition of the CSS, Aggressive, Health Dangerous A, Health Dangerous B, and Major Disruptive Behaviors were occurring at mean weekly frequencies of 101.3, 64.14, 117.65, and 325.5 times per week, respectively. After CSS was added as a consequence, the frequency of these behaviors dropped to mean weekly frequencies of 0.15, 0.09, 1.91, and 0.18 times per week, respectively. In each case in which CSS was added to a given behavior category, the intervention change was made in the middle of the week. Thus, the total for that particular week (which is represented by the data point through which the intervention phase line passes) is based on a certain number of days during which the baseline condition was still in effect and a certain number of days during which the treatment (CSS) condition was in effect.

Figure 1

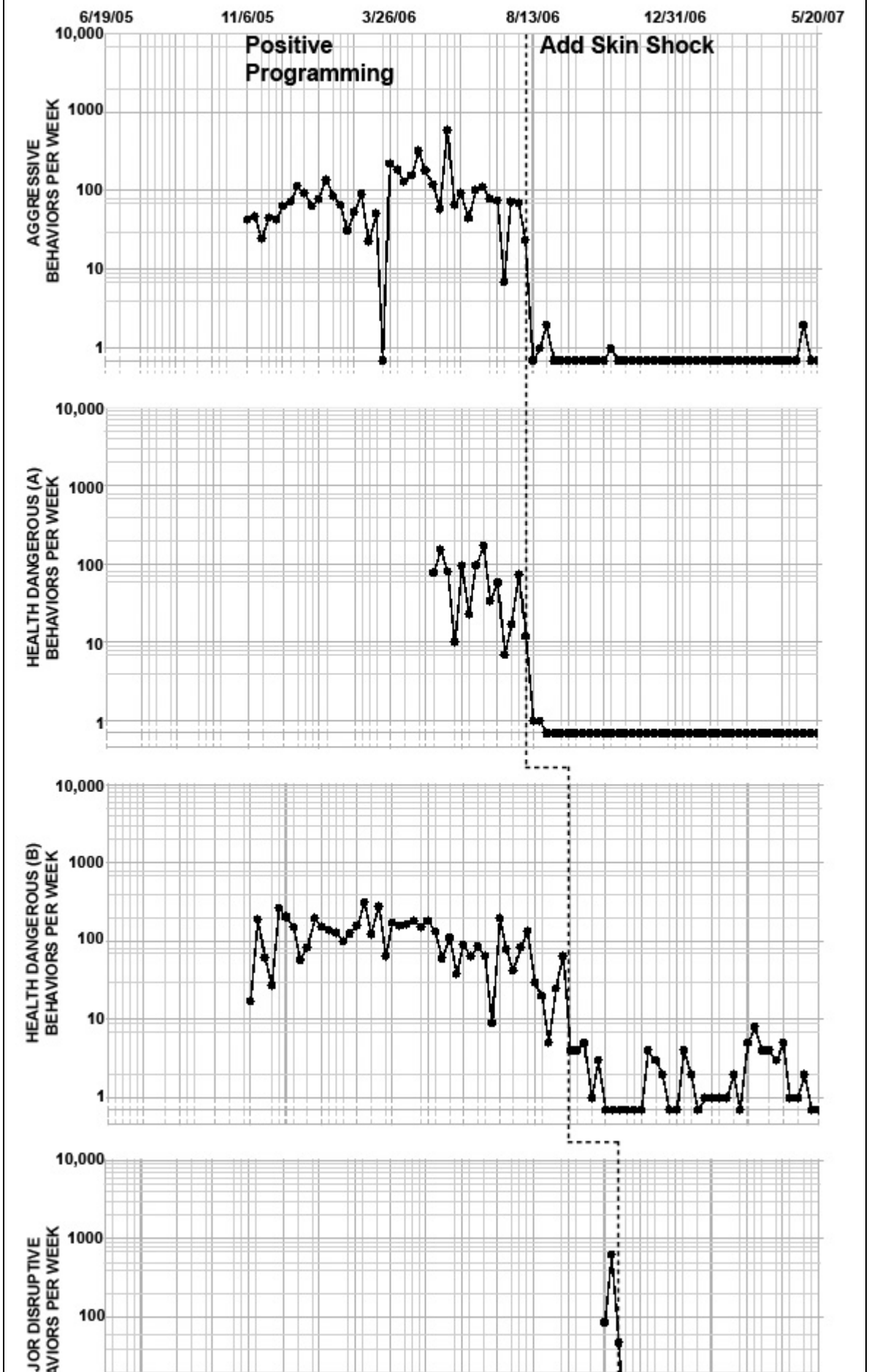
6/19/05
11/6/05
3/26/06
8/13/06
12/31/06
5/20/07
Positive Programming
Add Skin Shock
AGGRESSIVE BEHAVIORS PER WEEK
HEALTH DANGEROUS (A) BEHAVIORS PER WEEK
HEALTH DANGEROUS (B) BEHAVIORS PER WEEK
10,000
1000
100
10
1

Figure 1. **The effect of CSS on the weekly frequency of Aggressive, Health Dangerous A, Health Dangerous B, and Major Disruptive behaviors.**

The indirect effects of CSS on behaviors that had not been specifically targeted for treatment are shown in Figure 2., which contains four charts aligned vertically by date. This figure shows the effect that CSS introduction had on physical restraint frequency as well as on the behavior categories of Property Destruction, Noncompliance and Educationally/Socially Interfering behaviors. Each chart contains three dotted phase lines that are common to all four charts. These three phase lines indicate, respectively, the dates on which CSS was added to directly treat the following categories: (1) Both Aggressive and Health Dangerous A; (2) Health Dangerous B, and (3) Major Disruptive.

Figure 2

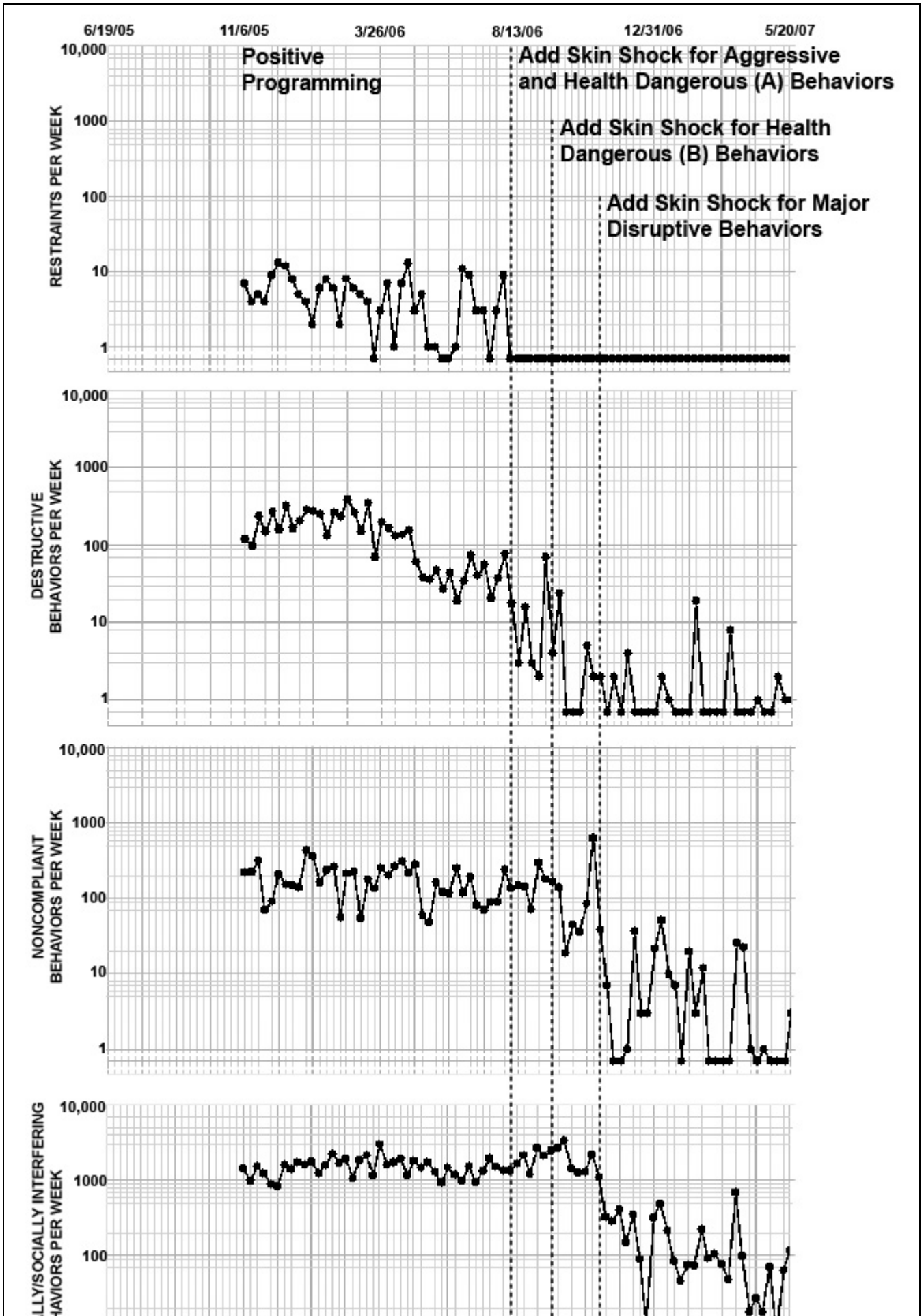
6/19/05
11/6/05
3/26/06
8/13/06
12/31/06
5/20/07
Positive Programming
Add Skin Shock for Aggressive and Health Dangerous (A) Behaviors
Add Skin Shock for Health Dangerous (B) Behaviors
Add Skin Shock for Major Disruptive Behaviors
RESTRAINTS PER WEEK
DESTRUCTIVE BEHAVIORS PER WEEK
NONCOMPLIANT BEHAVIORS PER WEEK
10,000
1000
100
10
1

Figure 2. **The indirect effect of CSS on the weekly frequency of Restraints, and on Destructive, Noncompliant, and Educationally/Socially Interfering behaviors.**

The top chart in Figure 2. shows that physical restraints ceased immediately and totally as soon as CSS was added to the categories of Aggressive and Health Dangerous A.

The second chart from the top suggests that Property Destruction decelerated each time CSS was added to another category of problem behavior. The third chart shows that noncompliant behaviors did not decelerate until the Health Dangerous B category was consequated with CSS and then showed further deceleration when Major Disruptive Behaviors was also consequated with CSS. The fourth chart shows that Educationally/Socially Interfering behaviors did not decelerate until Major Disruptive Behaviors were treated with CSS and that Educationally/Socially Interfering Behaviors showed a steady deceleration after that point.

Discussion

These results suggest that the direct effect of CSS, delivered by means of the GED skin-shock device, was an immediate reduction, to zero or near-zero, in the frequency of each of the behavior topographies that were targeted for treatment with CSS. The results also suggest that CSS can result in the positive side effects of eliminating the need for restraint and of inducing further decelerations of other problem behaviors that are not directly targeted for treatment with CSS, in one case to a near-zero level. All of these behaviors were ones that had not been successfully treated with medications or other behavioral interventions in the student's previous placements and in his history at JRC prior to the introduction of the CSS.

This study had a number of limitations. First, information regarding reliability was not formally collected. Although those who counted problem behaviors completed a significant amount of training, although the clinicians considered the data to be reliable enough to base their day-to-day intervention decisions on that data, and although there were various mechanisms within the program to maintain treatment integrity, formal measures of reliability of the counted behavior frequencies were not taken. Second, some of the categories of problem behaviors contain multiple topographies. Thus, one cannot ascertain the precise frequency of each individual topography in most cases. Third, information related to immediate side effects were not formally collected. Although these side effects were assessed daily by the attending clinician, supervising staff, and nursing professionals, no formal data on them is presented.

In summary, this study was not a controlled, rigorous investigation; however, we believe it to have heuristic value in several respects. First, the data suggest that when CSS is added to a comprehensive behavioral program using primarily positive programming, it can decelerate or eliminate long-standing problem behaviors that have not been effectively treated with medications and intensive behavioral intervention that did not

include CSS. Second, these data provide another applied example of significant induced reductions in problem behaviors that were not directly targeted for treatment with CSS. Finally, these data provide an example of the immediate elimination of physical restraint that is made possible by the appropriate addition of CSS to an ongoing program consisting of positive behavioral interventions.

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