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Side effects of contingent shock treatment

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Abstract

In this study, the side effects of contingent shock (CS) treatment were addressed with a group of nine individuals, who showed severe forms of self-injurious behavior (SIB) and aggressive behavior. Side effects were assigned to one of the following four behavior categories; (a) positive verbal and nonverbal utterances, (b) negative verbal and nonverbal utterances, (c) socially appropriate behaviors, and (d) time off work. When treatment was compared to baseline measures, results showed that with all behavior categories, individuals either significantly improved, or did not show any change. Negative side effects failed to be found in this study.

Keywords: Contingent shock; Side effects; Collateral behavior; Punishment

Severe problem behaviors (e.g., self-injurious behavior [SIB] and aggressive behavior) can threat students' and staff members' health and well-being. Several $n = 1$, some $n > 1$ studies (Duker & Seys, 1996, 2000; Linscheid & Reichenbach, 2002; Ricketts, Goza, & Matese, 1992, 1993; Williams, Kirkpatrick-Sanchez, & Crocker, 1994), and meta-analyses (e.g., Didden, Duker, & Korzilius, 1997; Scotti, Evans, Meyer, & Walker, 1991) have demonstrated the superiority of contingent shock (CS) over other behavioral and nonbehavioral procedures (e.g., nonaversive procedures, pharmacology) in decelerating severe problem behaviors. In spite of these results, CS is often criticized in that it induces a number of negative side effects including increases in aggression, escape behavior, and negative emotional responses (for a review, see Lerman & Vorndran, 2002).

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Although several studies have mentioned the side effects of CS, few have systematically investigated these effects. Generally, it is reported that the positive side effects outnumber the negative side effects. For example, Matson and Taras (1989) reviewed 56 applied studies and reported that 96% of the side effects were positive (i.e., increased social behavior, increased activity levels, increased eye contact). Ball, Sibbach, Jones, Steele, and Frazier (1975) reported that individuals who were treated with CS became more affectionate and socially responsive. Mudford, Boundy, and Murray (1995) found their participants to be calmer, happier, and less clingy to people during treatment, as compared to baseline. Ricketts et al. (1992, 1993) reported that participants more often smiled and emitted happy vocalizations during CS treatment than during baseline. Also, distressed vocalizations (e.g., crying, whining) decreased during CS treatment. Linscheid, Pejeau, Cohen, and Footo-Lenz (1994) and Linscheid and Reichenbach (2002) found an increase of behaviors that may indicate a positive affective state (e.g., laughing, smiling, self-initiated toy play) during CS treatment, as compared to baseline. Negative side effects (e.g., increase of crying and whining) of CS failed to be mentioned in any study. Duker and Van den Munckhof (2007) demonstrated with five individuals who were treated with CS, that wearing a CS device lowered their heart rate, probably indicating lowered stress levels.

In this study, we addressed the side effects of CS treatment with a group of nine individuals who showed severe forms of SIB and aggressive behavior. Data were collected using a nonconcurrent, quasi-multiple baseline design across participants (Watson & Workman, 1981). Results were analysed using visual analyses conducted by seven clinicians.

1. Participants and setting

Participants were nine students (i.e., five boys and four girls) of the Judge Rotenberg Educational Center (JRC) in Canton, MA. Participants' chronological ages ranged from 8 to 30 years (M = 16.2, S.D. = 5.5) at the start of the study. All of them showed high frequencies and severe forms of SIB and aggressive behavior. Functional assessments were conducted to assess which factors might cause or maintain participants' target behaviors, revealing that the behaviors were either multiply controlled or controlled by unknown causes. Physicians had excluded medical causes of the target behaviors.

Each participant was consulted by a psychiatrist to assess his or her diagnosis. Preference assessment was conducted with all participants. Reinforcement procedures (e.g., differential reinforcement of other behaviors, differential reinforcement of alternative behaviors), and aversive procedures (e.g., token fines and reprimands) had failed to decelerate the participants' problem behaviors. Pharmacological treatments (e.g., antipsychotics, antidepressants) had been tried unsuccessfully in programs the participants attended prior to coming to JRC. Participants lived in JRC-staffed residential homes and attended JRC's day school program. Informed consent for the use of CS with the participants was obtained from their parent(s) or guardian(s). All treatment teams overseeing a participant's treatment program were headed by a doctoral level clinician who was responsible for writing a plan that listed specifically which behaviors would be treated with CS. In addition, JRC sought and obtained permission from the Bristol County, MA Probate Court for each participant involved to use CS to decrease their problem behaviors. Four participants received one-to-one coverage 24 hrs/day, two participants received coverage 16 h/day, and the other participants were treated on a one-to-three basis. For demographical information, see Table 1.

Table 1
Demographic information

Participant	Gender	Age	IQ/mental age	Diagnosis	Medication
1. S.S.	F	13;0	Moderate	Autism	–
2. T.F.	M	12;1	88	ADHD; ODD; IED	–
3. G.B.	M	15;11	81	Depressive disorder NOS; IED	–
4. A.J.	F	19;9	Full scale-80	Bipolar disorder; PTSD	–
5. T.E.	F	23;2	Mild	IED	–
6. E.L.	M	19;2	Full scale-75	Mood disorder NOS	–
7. K.F.	M	11;1	Mild	ODD	–
8. B.S.	M	18;4	Severe	PDD	–
9. R.S.	F	13;9	Severe	Autism	–

Note. M: male; F: female; age in years and months; ADHD: attention deficit hyperactivity disorder; ODD: oppositional defiant disorder; IED: intermittent explosive disorder; PTSD: post traumatic stress disorder; PDD: pervasive developmental disorder.

2. Device

Skin shocks were administered using the graduated electronic decelerator (GED) which is manufactured by JRC, consists of: (a) a remote control transmitter, which transmits an uniquely coded RF signal; (b) a receiver/stimulator, which receives a coded signal from the transmitter and generates a skin shock; (c) a battery pack; and (d) a set of electrodes, which are attached to participant's skin. Electrodes were either concentric (i.e., Tursky electrodes) or spread with two button electrodes separated by up to 6 in. One type of devices was used: the GED-1, which delivers a 2 s DC shock with a mean current of 15.5 mA (peak 30 mA), a voltage of 60 V, at a measured skin resistance of 4 $k\Omega/cm^2$. Devices generate a square wave at 83 pulses per second (pps). Depending upon the severity of the individual's problem behaviors, each participant wore one to five sets of electrodes at the same time, with the shock being delivered to only one of the set of electrodes as a consequence for a particular behavior.

3. Response definitions

Four mutually exclusive categories of target behaviors were defined: (a) positive verbal and nonverbal utterances (PVNU), such as appropriate smiling, dancing, singing or talking (e.g., ''I am so happy,'' ''Oh, yes!''); (b) negative verbal and nonverbal utterances (NVNU), such as crying, making whining noises, spitting, stamping feet, smearing faeces, screaming, swearing, making obscene gestures, shrugging shoulders, uttering racial comments, making negative facial expressions (e.g., rolling eyes), and imitating others; (c) socially appropriate behaviors (SAB), such as raising one's hand in the classroom, greeting others, politely asking the teacher for help, following directions, and appropriately responding to the teachers' and staff members' instructions; and (d) off task (OT) behaviors, such as placing one's head down on the table, rejecting academic tasks, and turning one's head away when a staff member offers beverages or edibles. Target behaviors were selected by interviewing participants' teachers and staff members, record reviews, and direct observation.

4. Recording

During baseline and treatment, participants were videotaped for 10 min, 5 days per week. Participants were videotaped at randomly chosen points in time, but always during times when

teachers and staff members were not applying reinforcing contingencies. Using a 10-s partial interval recording system, observers assigned each target behavior to one of the above four behavior categories. All target behaviors that occurred during videotaping were assigned to a category, even when behaviors occurred simultaneously. The number of video-taped 10-min sessions for the participants across phases of baseline and treatment ranged from 24 to 51 ($M = 30.22$, $S.D. = 8.15$).

5. Reliability of recording

Interrater agreement between two observers, one of whom was kept naive as to the purpose of the study, was conducted in 26% of the recording sessions, which were approximately equally distributed across baseline and treatment phases. Agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements, multiplied by 100. Interrater reliability ranged from 93.48 to 97.76% ($M = 95.48$, $S.D. = 1.85$). Percentages were then converted into a kappa coefficient (Cohen, 1960), a statistic that takes chance agreement into account. Kappa scores ranged from .92 to .97 ($M = .94$, $S.D. = .19$).

6. Procedure

6.1. Baseline

During baseline, CS treatment was withheld. During this phase, (a) differential reinforcement of other behaviors with intervals ranging from 5 min to 7 days, (b) a token system for completing academic tasks and/or for intervals of appropriate behavior, and (c) a response cost system were in effect. Moreover, mild aversive procedures and response contingent restraints were in effect. Duration of mechanical (e.g., mitts, restraint chair) or physical restraint (i.e., holding arms, legs, and upper part of the body) could extend up to 6 h, depending upon whether participant's problem behaviors recurred during the restraint. The above procedures were carried out on a 365 days per year, 24 h per day basis, and were administered in all of each participant's settings (i.e., in the classroom, during transportation, and in the residential home).

6.2. Treatment

While the above procedures continued, SIB and aggressive behavior were immediately followed by a single administration of an electrical skin shock. Following this, the staff member or teacher involved would inform the participant verbally and briefly why the shock had been administered. Then, if necessary, the participant was prompted to continue his/her task. Finally, the staff member rotated the electrodes a few centimeters away from their previous locations on participant's body and recorded the time of shock administration.

7. Design

Data were collected using a nonconcurrent quasi-multiple baseline design across participants (Watson & Workman, 1981), in which the length of the baseline phase was determined on a random basis. For each participant, the date at which the treatment phase began was determined by the date at which JRC happened to obtain court approval for skin-shock treatment for that participant.

8. Results

Table 2 shows *M*, S.D., and range of participants' PVNU, NVNU, SAP, and OT percentages during baseline and treatment. Figs. 1–4 display in graphical form the percentages of these behaviors per 10-s interval for all participants. Graphs are ordered per

Table 2
Means, ranges, and standard deviations of PVNU, NVNU, SAB, and OT percentages for 10-min intervals during baseline and treatment

Participant	Baseline				Treatment			
	No. of intervals	*M*	Range	S.D.	No. of intervals	*M*	Range	S.D.
PNVU								
S.S.	3	1.01	0.00–3.03	1.75	45	7.81	0.00–55.00	13.73
T.F.	7	7.29	0.00–20.00	6.74	19	5.2	0.00–24.14	6.75
G.B	11	2.89	0.00–26.67	7.93	17	1.96	0.00–28.57	6.89
A.J.	4	15.68	6.00–31.67	11.12	22	4.67	0.00–26.67	2.87
T.E.	10	5.97	0.00–15.00	4.61	20	2.98	0.00–10.17	3.46
E.L.	5	1.38	0.00–3.70	1.52	22	1.97	0.00–29.41	6.23
K.F.	5	4.84	1.69–11.11	3.69	17	5.9	0.00–17.50	5.85
B.S.	11	4.00	0.00–11.59	3.88	30	13.66	0.00–43.33	14.16
R.S.	14	8.25	0.00–27.12	8.04	11	11.15	0.00–33.33	9.56
NVNU								
S.S.	3	31.6	1.61–56.82	27.91	45	13.70	0.00–95.59	20.30
T.F.	7	9.00	0.00–36.67	13.28	19	0.79	0.00–3.33	1.16
G.B	11	1.70	0.00–15.25	4.55	17	0.52	0.00–7.14	1.75
A.J.	4	6.59	0.00–18.00	8.12	22	2.19	0.00–8.33	2.76
T.E.	10	0.51	0.00–3.39	1.15	20	0.38	0.00–4.00	1.02
E.L.	5	0.67	0.00–3.33	1.49	22	0.00	0.00–0.00	0.00
K.F.	5	17.04	0.00–41.30	15.58	17	4.60	0.00–20.00	5.95
B.S.	11	0.45	0.00–3.33	1.08	20	0.17	0.00–1.67	0.51
R.S.	14	13.95	0.00–32.76	12.68	11	3.33	0.00–12.67	4.35
SAB								
T.F.	7	2.60	1.39–5.00	1.39	19	0.78	0.00–20.00	6.74
G.B	11	1.70	0.00–15.25	4.55	17	4.75	0.00–25.93	7.16
A.J.	4	1.00	0.00–4.00	2.00	22	2.19	0.00–8.33	2.76
T.E.	10	0.00	0.00–0.00	0.00	20	0.13	0.00–2.50	0.56
E.L.	5	2.94	0.00–6.67	2.65	22	3.87	0.00–25.00	7.20
K.F.	5	2.36	0.00–6.78	2.84	17	8.81	0.00–20.93	7.47
B.S.	11	0.15	0.00–1.67	0.50	20	0.00	0.00–0.00	0.00
R.S.	14	27.20	3.39–47.37	12.61	11	11.54	0.00–26.51	9.53
OT								
S.S.	3	41.82	30.30–50.00	10.27	45	7.47	0.00–71.67	16.90
T.F.	7	43.61	19.05–76.67	22.18	19	13.59	1.67–35.48	8.34
G.B	7	67.52	0.00–100.00	40.00	17	6.38	0.00–44.62	11.05
A.J.	4	92.06	84.75–100.00	6.37	22	29.55	1.59–100.00	23.77
T.E.	10	3.37	0.00–10.00	3.56	20	2.47	0.00–12.00	3.04
E.L.	5	8.40	1.82–17.02	5.50	22	2.94	0.00–24.13	5.30
K.F.	5	59.90	46.15–84.75	16.71	16	34.99	6.00–83.87	23.14
B.S.	11	31.55	7.14–48.15	11.06	20	21.69	1.67–50.00	15.43
R.S.	14	27.20	3.39–47.37	12.61	11	11.54	0.00–26.51	9.53

Note. *M* = mean; S.D. = standard deviation.

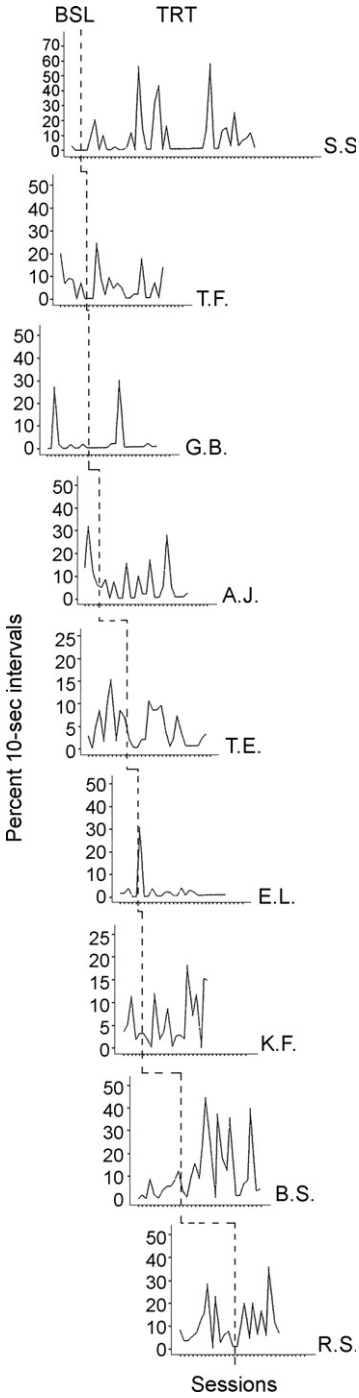

Fig. 1. Percentage PNVU per 10-s intervals during baseline and treatment sessions.

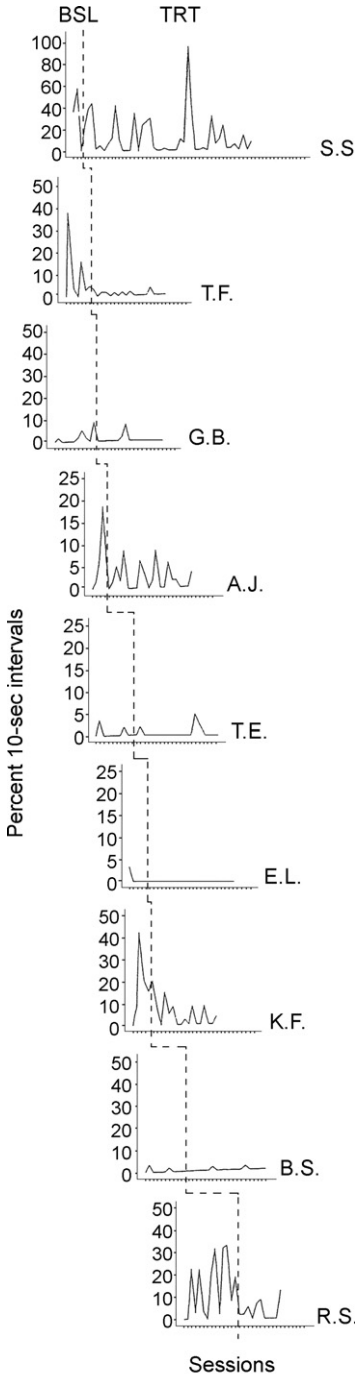

Fig. 2. Percentage NVNU per 10-s intervals during baseline and treatment sessions.

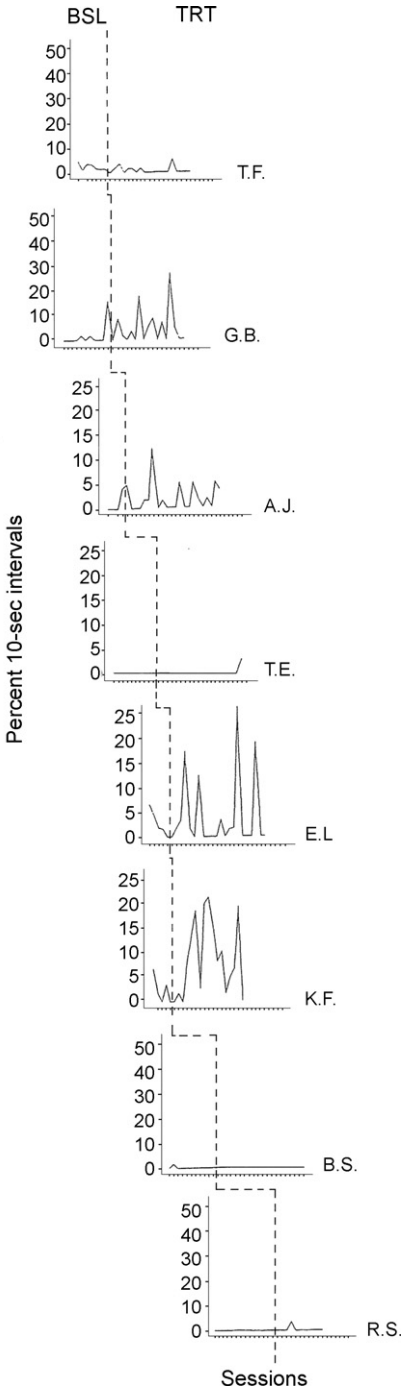

Fig. 3. Percentage SAB per 10-s intervals during baseline and treatment sessions.

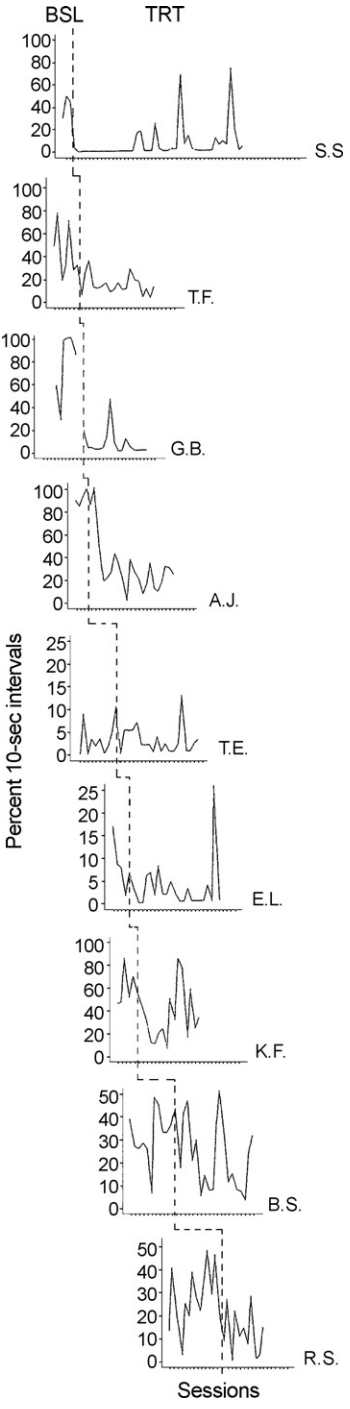

Fig. 4. Percentage OT per 10-s intervals during baseline and treatment sessions.

behavior category and portray the character of the multiple baseline design in which the data were collected.

Data were examined on an individual basis, using visual analysis. Seven clinicians independently judged, for each graph in Figs. 1–4, whether there was a significant change or not in percentages between baseline and treatment phase. For all PVNU graphs, a mean agreement of 78% across clinicians was obtained. Participant B.S. significantly increased (100% agreement) the percentage of intervals of PVNU, when treatment phase was compared to baseline phase. No changes were recorded for the other participants. For all NVNU graphs, a mean agreement of 92% across clinicians was obtained. Participants T.F. (100% agreement), A.J. (71% agreement), K.F. (100% agreement), and R.S. (100% agreement) significantly decreased the percentage of intervals of NVNU, when treatment phase was compared to baseline. No changes were recorded for the other participants. For all SAB graphs, a mean agreement of 91% across clinicians was obtained. Participants G.B. (71% agreement), E.L. (100% agreement), and K.F. (100% agreement) significantly increased the percentage of intervals of SAB, when treatment phase was compared to baseline phase. No changes were recorded for the other participants. For all OT graphs, a mean agreement of 89% across clinicians was obtained. Participants T.F. (86% agreement), G.B. (100% agreement), A.J. (100% agreement), and R.S. (86% agreement) significantly decreased the percentage of intervals of OT, when treatment phase was compared to baseline phase. No changes were recorded for the other participants.

9. Discussion

In this study, we addressed the occurrence of potential side effects of CS treatment with a group of nine participants, who showed severe forms of SIB and aggressive behavior. In all behavior categories (i.e., PVNU, NVNU, SAB, and OT) participants either significantly improved, or did not show any change, when the treatment phase was compared to baseline. Negative side effects were not observed. These results are supported by findings of Ball et al. (1975), Linscheid et al. (1994), Linscheid and Reichenbach (2002), Mudford et al. (1995), and Ricketts et al. (1992, 1993).

Some limitations may affect the conclusions of this study. First, no statistical analysis was conducted, due to the short baselines employed with some of the participants. Some forms of SIB and aggressive behavior of these participants were of such severity, that CS treatment had to be initiated immediately following court permission. With pre-determined baseline lengths, reactive intervention as a possible invalidating factor would have been controlled. As an alternative, visual analysis was conducted by seven clinicians, whose agreement ranged from 57 to 100%.

Second, analyses failed to be conducted at the group level across behavior categories, because the four categories of behavior were not applicable in the same degree to all participants. For example, participant S.S. was a girl with severe mental retardation, and who, by definition, failed to show any form of SAB. Participant E.L., who was a man with normal intelligence, hardly showed any form PVNU during his academic work, because he was working on his tasks with steady concentration most of the time. These observations suggest that if side effects are present during CS treatment, the specific forms may differ across individuals.

Third, participants may have been aware of the video recording, which may, therefore, have caused bias in data collection. However, participants were naïve as to the purpose of the study. In addition, the participants were used to being video-recorded, because all students and staff members were routinely monitored by video cameras in school and residential houses 24 h per day.

The objection that CS should not be used due to associated negative side effects, fails to be inconsistent with the results of this study. By contrast, according to previous research, the present study demonstrates that positive side effects are probably more common than negative side effects.

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