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# *USING NONCONTINGENT REINFORCEMENT TO INCREASE COMPLIANCE WITH WEARING PRESCRIPTION PROSTHESES*

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We evaluated the effects of noncontingent reinforcement (NCR) on compliance with wearing foot orthotics and a hearing aid with 2 individuals. Results showed that NCR increased the participants' compliance with wearing prescription prostheses to 100% after just a few 5-min sessions, and the behavior change was maintained during lengthier sessions. The results are discussed in terms of the potential value-altering effects of NCR.

*Key words:* compliance, foot orthotics, hearing aids, noncontingent reinforcement, prescription prostheses

DeLeon et al. (2008) recently evaluated the use of noncontingent reinforcement (NCR) for increasing compliance with wearing eyeglasses by four individuals. DeLeon et al. found that NCR increased compliance for one participant; however, NCR plus response blocking and response cost were required for the other three participants. The purpose of the present study was to evaluate the use of NCR to increase compliance with wearing prescription prostheses by two individuals with developmental disabilities. Based on informal observations, it was assumed that each participant's noncompliance was maintained by social negative reinforcement in the form of escape from aversive stimulation (e.g., foot discomfort) that was produced by wearing the prosthetic correction. To extend the results of DeLeon et al., we did not block either participant from removing his prosthetics.

## METHOD

### *Participants and Settings*

Jared was an 11-year-old boy with Down syndrome as well as equinovarus and instabilities of the foot and ankle with functional hallux limitus. To address the latter diagnosis, a podiatrist had prescribed orthotics for Jared's shoes. Jared had been referred for intervention by his parents based on a 3-month history of refusing to wear his prescription orthotics. His communication skills were limited to a few partial-utterance vocal mands (e.g., "ug" for hug or "nee" for brownie). We conducted training sessions once per day, 3 to 4 days per week, in a room (3 m by 3 m) located in a public elementary school.

Brian was a 6-year-old boy with autistic disorder as well as bilateral conductive hearing loss, primarily in his left ear, for which an audiologist had prescribed an in-the-canal hearing aid. His communication skills were limited to a few manual signs (e.g., requesting "more" or "eat"). He had been referred for treatment after several unsuccessful attempts by his parents and staff to teach him to wear the hearing aid. Training sessions were conducted in a room (5 m by 5 m) located in his home. Sessions were conducted one to three times per day, 2 to 4 days per week.

### *Response Measurement and Reliability*

For Jared, we targeted wearing the foot orthotics, defined as correct placement of both shoes containing foot orthotics on the feet such that each entire foot was inside the shoe without

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the heel visible. For Brian, we targeted wearing his prescription hearing aid, defined as correct placement of the hearing aid inside the left ear canal such that the entire canal portion of the device was inside the ear canal with no part visible.

Observers used laptop computers to collect data on independent wearing of foot orthotics (Jared) and independent wearing of the hearing aid (Brian); the computers were equipped with a program that permitted duration recording. Observers scored the duration of each participant's target behavior in real time by recording the onset and offset of the behavior. These data were converted to a percentage of time by dividing the number of seconds of the event by the total number of seconds in the session and then multiplying that value by 100%. Interobserver agreement scores were obtained by having a second independent observer collect data in vivo or from videotaped sessions. To calculate interobserver agreement, each session was partitioned into successive 10-s bins and the two data records were compared on a bin-by-bin basis (see Mudford, Taylor, & Martin, 2009). For Jared, interobserver agreement was assessed for 47% of the total number of sessions, and the mean agreement score for independent wearing of foot orthotics was 97% (range, 89% to 100%). For Brian, interobserver agreement was assessed for 44% of the total number of sessions, and the mean agreement score for independent wearing of the hearing aid was 90% (range, 83% to 97%).

*Design and Procedure*

The effects of NCR on compliance with wearing foot orthotics and the hearing aid were evaluated using a nonconcurrent multiple baseline design across participants. We also evaluated the extent to which the participants' compliance persisted after toys were removed.

*Preference assessment.* A free-operant stimulus preference assessment (Roane, Vollmer, Ringdahl, & Marcus, 1998) was conducted with Jared to identify preferred objects for the NCR phase. Jared participated in three 15-min assessments that were conducted on separate days. For Brian, during the NCR phase, we provided access to all of the toys and music assessed during a series of free-operant stimulus preference assessments, because a preference for specific item was not clearly demonstrated.

*Escape.* One or two experimenters were present in the room for each 5-min session. For Jared, each session began when the experimenter placed both shoes with orthotic supports onto Jared's feet. Each time Jared removed his shoes, the experimenter waited for 15 s (the escape period) and then placed both shoes back on his feet. For Brian, each session began when the experimenter placed the hearing aid inside of Brian's left ear canal. As with Jared, the experimenter waited for 15 s each time he removed the hearing aid and then placed the hearing aid back into the left ear canal. For both participants, other forms of problem behavior were ignored. This condition served as baseline.

*Escape plus NCR.* Sessions in this phase were identical to those in the escape phase except that the participants received noncontingent continuous access to either three (Jared) or six (Brian) preferred items, continuous music, and approximately 5 s of attention on a fixed-time (FT) 15-s schedule throughout the session. The preferred items generated various types of stimulation (e.g., visual, auditory, tactile). Each participant manipulated multiple items throughout the majority of each session. Attention from the experimenter included statements pertaining to toy manipulation and play but did not include statements pertaining to the wearing of the prostheses. Sessions in this phase were 5 min to 30 min in duration. The session length was increased following three consecutive sessions in which the participant wore the prosthetic for at least 95% of the session.

*Escape plus NCR (attention only).* Sessions in this phase were the same as those in the escape

phase except that the experimenter provided approximately 5 s of attention on an FT 30-s schedule during one 30-min session that was conducted in the session room and one 5-min session that was conducted in the hallways of the school (Jared) or in the general living area in the home (Brian) on a different day. During the 5-min hallway session (Jared only), Jared was verbally prompted to walk around the hallways of his school with an experimenter. Immediately after the hallway session, Jared was returned to his classroom while he was still wearing his shoes. No differential attention was provided for compliance with wearing the orthotics. The teacher conducted normal classroom activities. This classroom session lasted for 3 hr. During the 5-min living area session (Brian only), Brian was allowed to walk around the living room, kitchen, and bathroom areas of his home while still wearing the hearing aid. After the living area session, Brian's mother conducted a 3-hr session while the experimenter took a frequency count if Brian removed his hearing aid; however, differential attention was not provided for compliance with wearing the hearing aid. His mother conducted normal daily activities (e.g., preparing dinner and cleaning the living area). The purpose of this phase was to assess the generalization and maintenance of compliance with wearing the prostheses.

## RESULTS AND DISCUSSION

Figure 1 (top) shows the percentage of time Jared wore his shoes (with orthotics) across phases. During the escape phase, he wore his shoes for a low percentage of time ($M = 3\%$). This percentage increased to 100% ($M = 98\%$) during the escape plus NCR phase. Jared continued to wear his shoes as the session length was increased to 15 min (Sessions 13, 14, and 15) and 30 min (Session 16). In the escape plus NCR (attention only) phase, Jared wore his shoes for 30 continuous minutes (Session 17) in the session room, 5 continuous minutes while walking through the hallways of his school (Session 18), and 3 continuous hours in his classroom (Session 19).

Figure 1 (bottom) shows the percentage of time that Brian wore his hearing aid across phases. During the escape phase, he wore his hearing aid for a low percentage of time ($M = 36\%$). Compliance with wearing the hearing aid increased to 100% ($M = 87\%$) during the escape plus NCR phase. Brian continued to wear his hearing aid as the session length was increased to 10 min (Sessions 15, 16, and 17) and 30 min (Session 18). In the escape plus NCR (attention only) phase, he wore his hearing aid for 30 continuous minutes (Session 19) in the session room, 5 continuous minutes while walking throughout the general living area in his home (Session 20), and 3 continuous hours in his home (Session 21).

The results show that NCR increased compliance with wearing prescription prostheses for both participants. In addition, the participants continued to wear their prostheses when only FT attention was provided. As suggested by Wilder, Normand, and Atwell (2005), it is possible that NCR abolished the removal of the prosthetic as a negatively reinforcing event. That is, when toys were present, wearing the prosthetic was a less aversive event. Given that Jared and Brian each continued to wear his prosthetic even after NCR was thinned to only attention, it is possible that they habituated to the stimulus that formerly evoked their noncompliance. Alternatively, it is possible that compliance was adventitiously reinforced by access to preferred items (see Carr et al., 2000); however, this interpretation seems less plausible because both boys received continuous access to preferred items even after removing their prosthetics during the first NCR session. Finally, due to the sequence of the phases, it is possible that NCR and escape (attention only) could have been effective. Similarly, it is possible that NCR with attention only could have been effective without the additional escape component.

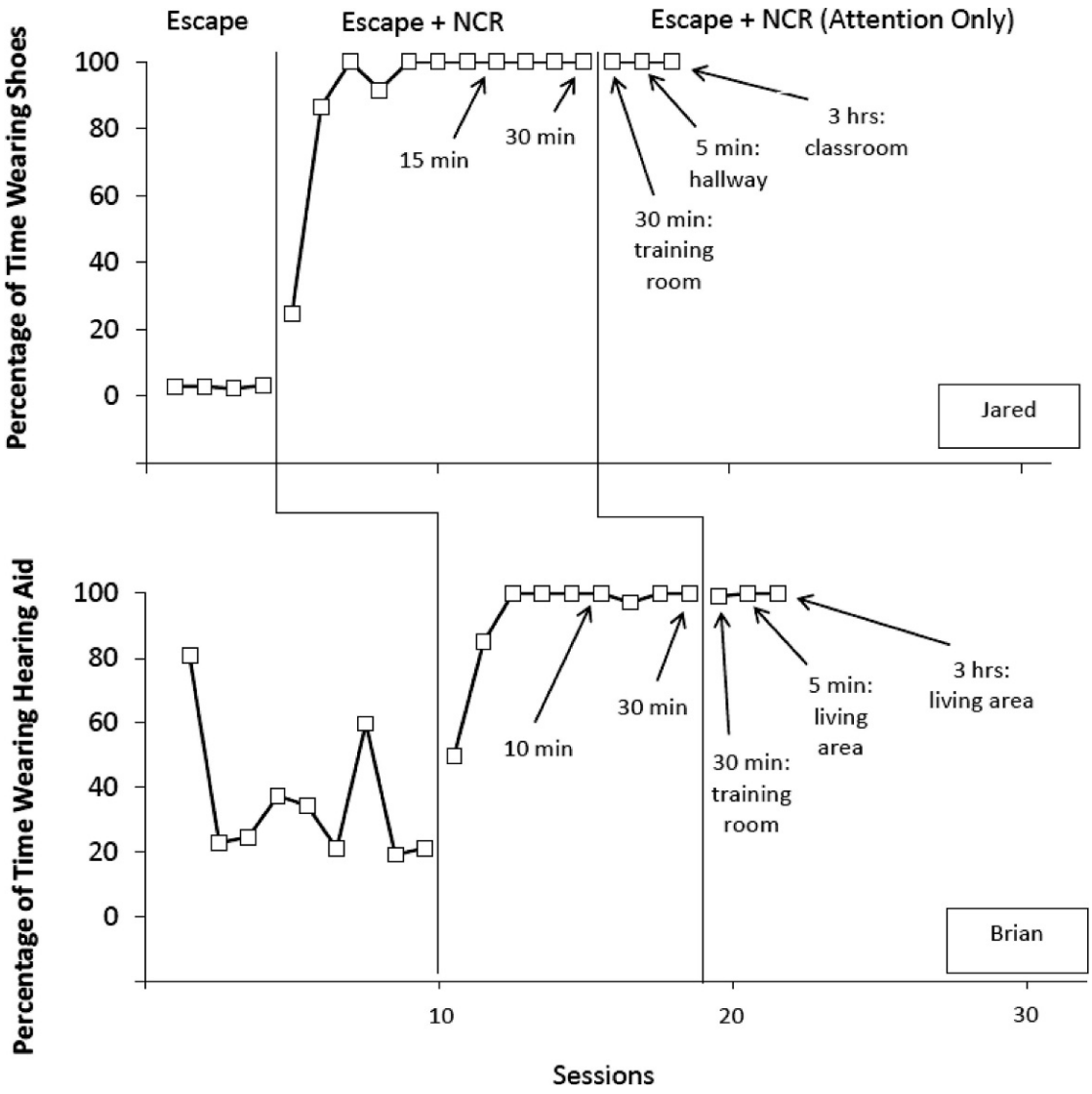


Figure 1. The percentage of time Jared wore his shoes across phases (top). The percentage of time Brian wore his hearing aid across phases (bottom).

It is not clear why NCR alone increased compliance for the participants in this study but 3 of the 4 participants in DeLeon et al. (2008) required additional treatment components to increase compliance with wearing eyeglasses. Although DeLeon et al. did not specify the nature of the noncontingent stimulation, providing the type of stimulation that was enhanced by wearing a hearing aid (e.g., auditory stimulation from music) may have increased the effectiveness of NCR for Brian. Although the mechanism that facilitated the behavior change is not clear for either participant, the results do suggest that NCR altered the value of engagement in negatively reinforced noncompliance.

A potential limitation was that a formal functional analysis was not conducted to rule out other social or nonsocial variables that may have contributed to the participants' noncom-

pliance (e.g., Iwata, Dorsey, Slifer, Bauman, & Richman, 1994/1982). However, the participants engaged in high rates of noncompliance when brief escape was provided contingent on removal of the prosthetic, suggesting that noncompliance was, at least in part, sensitive to negative reinforcement in the form of escape from wearing the prosthetic. Given that noncompliance decreased with the provision of attention in both conditions, it is possible that attention from caregivers during placement of prostheses initially maintained prostheses removal. However, this account seems less tenable because removal of the prosthesis was not immediately followed by the delivery of attention during the baseline phase. Future research should determine the extent to which NCR increases compliance with other medical-related responses (e.g., ingesting liquid medication) and hygiene tasks (e.g., remaining seated during haircuts) for young children with developmental disabilities.

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