JVIB

February 2005 • Volume 99 • Number 2

Research Report

Promoting Walker-Assisted Step Responses by an Adolescent with Multiple Disabilities Through Automatically Delivered Stimulation

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Persons with multiple disabilities often have limited functioning of their lower limbs and tend to spend large amounts of time sitting in a wheelchair (Lancioni, Oliva, & O'Reilly, 1997; Pfister et al., 2003). Efforts to enable some of these persons (that is, those who are in better overall physical condition) to make some use of their legs may involve the use of support walkers (Broadbent, Woollam, Major, & Stallard, 2000; Stallard, Major, & Farmer, 1996).

The availability of support walkers is not a guarantee, however, that persons with multiple disabilities will manage to stay active and perform many steps (see

Broadbent et al., 2000; Lalli, Mauk, Goh, & Merlino, 1994; Strawbridge, Drnach, Sisson, & Van Hasselt, 1989; Tarnowski & Drabman, 1985). The risk may be even greater if the disabilities include blindness, which may increase a person's level of difficulty or insecurity in taking steps and thus reduce his or her motivation to try to do so (Lancioni, O'Reilly, Oliva, Bianchi, & Pirani, 2000; Strawbridge et al., 1989). A possible strategy for dealing with such a prospect involves the use of favorite stimuli that are contingent on the step responses that an individual performs independently while using a walker (Horton & Taylor, 1989). Such a strategy may be viewed within the framework of conventional behavioral intervention for the acquisition and maintenance of specific responses (Miltenberger, 1997). To make this strategy more practical, one may ensure that the favorite stimuli are automatically delivered when the participant takes a step (Lancioni et al., 2004).

Recently, a study was conducted in which a walker was used in conjunction with the automatic delivery of contingent stimuli with two participants (Lancioni et al., 2005). As a result of this intervention, both participants increased the frequency of their steps, and their moods improved. The aim of the study reported in this article was to extend the previous research with a new participant with multiple disabilities, including blindness. This participant also used a walker and received a brief period of favorite stimulation at each step that he performed. A positive outcome with this

participant was thought to be important to support the generality of the previous findings and the overall suitability of the intervention strategy (Richards, Taylor, Ramasamy, & Richards, 1999).

Method

Participant

The participant was a boy aged 13 years, 1 month, who was rated in the profound intellectual disability range, although no IQ scores were available. He was blind (with reported cortical blindness), had apparently typical hearing, had spastic tetraparesis (partial paralysis of all four limbs) and scoliosis, and lacked speech and self-help skills. He received antiepileptic medication for seizure disorders (carbamazepine, clonazepam, and topiramate) and could stand and briefly walk with extensive physical support from a person or when using a conventional four-wheel support walker. His performance with the support walker was considered modest, in that the frequency of his steps was relatively low. The boy was attending a center for persons with multiple disabilities and had extensive and satisfactory experience with microswitches (sensors with a switch that is sensitive to a force, such as touch, that are used to activate favorite environmental stimuli). His parents and the staff had provided formal consent for the boy to participate in this study.

Equipment and favorite stimuli

During the study, the walker that the participant normally used was fitted with a lateral plastic panel running between the front and back right wheels. Attached to this panel, there was an optic sensor (a photocell) that detected steps that the participant made with his right foot. The participant also had a mini optic sensor strapped by Velcro to his left shoe to detect steps that he made with his left foot. The optic sensors were linked via wire to a battery-powered electronic control system, similar to that used by Lancioni et al. (2003), which was placed in a pocket attached to the walker's frame. This system, in turn, was connected to a series of favorite stimuli. During the intervention, the occurrence of a step (activation of an optic sensor) led the control system to turn on one or more of the participant's favorite stimuli for three seconds.

Favorite stimuli (stimuli that were considered to be pleasant for the participant) were selected through stimulus-preference screening (that is, a procedure used to determine the attractive value of environmental stimuli) (Crawford & Schuster, 1993). The screening covered multiple stimuli; each stimulus was presented 15–35 nonconsecutive times. Only the stimuli that were followed by the participant's positive reactions (alerting, orienting, or smiling) in 70% or more of the presentations were selected. The stimuli selected for the study included music and songs, various types of

noise, encouragement messages, air blowing, and various combinations of vibrating input. The stimuli were linked to the walker or to the participant. For example, modified audiocassette recorders with recordings of music and messages were placed in the pocket attached to the walker's frame, vibrating boxes were strapped to the upper ring of the walker's frame, and minivibrators were attached to the participant's belt or placed in his shirt pocket. The screening procedure was repeated two more times during the study to select positive variants of the already-available stimulus events (such as different types of music and noise) that could be added to the pool to reduce the risk of satiation (Lancioni et al., 2003).

Sessions, measures, and data collection

The sessions lasted five minutes and were conducted two to four times a day in a long corridor that was familiar to the participant. A research assistant ensured that the walker was going in the proper direction during the sessions, without any direct contact with the participant. The measures were the number of steps the participant performed and his mood (indices of happiness). Indices of happiness were defined as smiling or excited vocalization (Green & Reid, 1999; Lancioni et al., 2003). The steps were automatically recorded via the electronic control system. The indices of happiness were recorded from videotapes of the sessions. This recording process occurred according to a partial-interval strategy in which 10-second

observations were followed by 5-second recordings. Interrater agreement on the indices of happiness (checked in about 15% of the sessions) was computed by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. The percentages computed for single sessions (or combinations of two sessions in the case of low frequencies) were within the 75–100 range, with a mean of about 94.

Experimental conditions

The study was conducted according to an ABAB design, in which A represented the baseline phases and B represented the intervention phases (Richards et al., 1999).

Baseline phases. The two baseline phases included 20 and 18 sessions, respectively. During the baseline sessions, the participant used the walker fitted with the equipment for the automatic recording of steps and the delivery of stimulation. However, his performance of steps did not produce any stimulation. A research assistant provided verbal and physical prompts to promote a step at the beginning of the sessions and at one-minute intervals during the sessions if the participant was inactive.

Intervention phases. The two intervention phases included 43 and 116 sessions, respectively. During the intervention sessions, procedural conditions were the

same as in the baseline sessions with one exception: The participant's performance of steps produced stimulation, as was reported in the description of the equipment.

Results

The study lasted about four months. During the first baseline phase, the mean frequency of steps was about 45 per session (see the upper graph of Figure 1), and the mean frequency of observation intervals with indices of happiness was about 3 per session (see the lower graph of Figure 1). During the first intervention phase, those mean frequencies increased to about 105 and 7 per session, respectively. During the second baseline phase, there was a declining trend, particularly in the frequency of steps. During the second intervention phase, the mean frequencies increased above the levels of the first intervention phase. The Kolmogorov-Smirnov test showed that the increases that occurred from the first baseline to the first intervention phase, as well as from the second baseline to the second intervention phase, were significant for both the steps and the indices of happiness ($p < .01$) (Siegel & Castellan, 1988).

Discussion

These data indicate that the use of favorite stimuli contingent on the performance of independent steps had a positive impact on the frequency of steps

performed, as well as the frequency of intervals with indices of happiness. This outcome is in line with previous findings (Lancioni et al., 2005) and underlines the usefulness of the reported intervention strategy for promoting some relevant activity with persons with multiple disabilities, including blindness (see Lalli et al., 1994; Lancioni et al., 2000; Strawbridge et al., 1989).

The participant's self-determination in engaging in basic ambulatory behavior reflects a new, highly constructive attitude toward movement in general. This new attitude may lead to a general increase in his opportunities to ambulate and to stay active, with possible benefits for his physical and occupational condition, and without taxing physical costs for caregivers (Bartlett & Palisano, 2002; Ketelaar, Vermeer, Hart, van Petegem-van Beek, & Helders, 2001).

The increase in the participant's indices of happiness indicates that the participant found the stimulation available for his step responses to be highly desirable and that the efforts required for such responses were not excessive. It may be noted here that the increase cannot be related to the research assistant ensuring the proper direction of the walker, since this person was present during both the baseline and intervention sessions and did not have direct contact with the participant. The implications of this outcome can be considered relevant for enhancing the participant's

general quality of life (Schalock et al., 2002). Promoting an enhanced quality of life is undoubtedly a major objective of intervention programs for persons with multiple disabilities like the participant in this study (Lancioni et al., 2003).

In conclusion, one may argue that the present findings, combined with those of the previous study (Lancioni et al., 2005), are encouraging. However, additional data need to be collected before general conclusions can be drawn about the technology and procedural conditions that were used (Richards et al., 1999). A social validation assessment may also be warranted to determine how the staff and parents view the participant's behavioral changes that were observed during the study.

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