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Promoting independent ambulation: A case study of an elementary school student with developmental disabilities

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ABSTRACT

The limited independent ambulation of individuals with developmental disabilities may be improved with the utilization of support walker devices. In the present study, a forward chaining procedure with an embedded changing criterion component was used to teach an elementary school student with multiple disabilities to acquire and maintain the skills needed to use his walker device successfully, and to increase his total distance walked while using his walker device. Results indicated that the student quickly acquired three of the four requisite steps necessary to use the walker device, but eventually acquired all four steps after procedural modifications. After mastering the four steps, the student gradually increased his total distance walked. Results were maintained when assessed two months post-intervention. Limitations and directions for future research are discussed.

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What this paper adds

This paper provides a replicable method for which independent ambulation of students with developmental disabilities may be promoted in a school setting. This paper describes the development and validation of a task analysis used to denote the requisite steps necessary to use a walker device successfully and describes the procedures used to systematically increase the total distance walked by the student. Finally, this paper adds to the paucity of research assessing whether, and the extent to which, improvements in this regard are maintained after the removal of the intervention.

1. Introduction

Motor skills of individuals with multiple disabilities are often limited (e.g., Houwen, van der Putten, & Vlaskamp, 2014), reducing lower limb activation and movement, and therefore, independent ambulation (Lancioni et al., 2007). Limited independent ambulation results in a variety of negative outcomes, such as restricted interaction with the surrounding environment, reduced opportunities to engage in social activities, and increased occurrence of problem behaviors (Houwen et al., 2014; Jones et al., 2007). Support walker devices may be utilized to promote mobility and greater independence of some individuals (e.g., Broadbent, Woollam, Major, & Stallard, 2000; Winkler, Arnold, & Russell, 1986), and may promote social, emotional, and cognitive development (e.g., Diamond, 2000).

Several procedures have been identified as useful for promoting mobility in individuals with disabilities, particularly in school settings. For example, partial body weight supported treadmill training (PBWSTT), in which an individual is placed

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in a harness that supports a portion of their weight while walking on a treadmill, resulted in increased walking speed and distance covered by children with cerebral palsy when implemented in a school setting (Dodd & Foley, 2007). Although initial evidence indicates that PBWSTT may hold promise for use within educational environments, several limitations must be noted. First, use of PBWSTT has not been found to consistently result in improved outcomes over traditional over-ground gait training (Dobkin & Duncan, 2012). Second, use of PBWSTT requires specialized high-technology aids (e.g., harness, treadmill) that are not typically available within school settings. As such, it is necessary that research identify procedures that may be utilized within school settings that are feasible given the limited availability of resources within typical educational settings.

One procedure that requires few additional resources, and may therefore be particularly applicable within school settings, is the combination of two behavioral strategies: forward chaining and contingent reinforcement (e.g., Houwen et al., 2014). Forward chaining describes the process of breaking a complex task (e.g., walking while utilizing a support walker device) into smaller steps (e.g., place the right hand on the right handle of the walker) and teaching the steps in their naturally occurring sequence (Cooper, Heron, & Heward, 2007). Strawbridge, Drnach, Sisson, and Van Hasselt (1989) utilized a forward chaining procedure in conjunction with contingent reinforcement to teach a 9-year-old boy with multiple disabilities to use his walker. Contingent reinforcement (i.e., audio recording of folk songs) was delivered upon successful completion of a step in the behavior sequence. Results of the study indicated the utility of forward chaining and contingent reinforcement in training use of the walker device as well as increasing the number of steps taken, with results maintained at a 1-year follow-up.

Several studies have examined the utility of automatically-delivered contingent reinforcement on walker-assisted ambulation. Lancioni et al. (2004) utilized microswitch clusters placed at an individual's heels to detect body posture and deliver automatic reinforcement for each step taken with appropriate posture. Results indicated a large and immediate increase in appropriate posture during walking, with effects maintained at a 3-month follow-up. Results of subsequent studies supported the use of automatically-delivered contingent reinforcement to increase the frequency of steps when using a walker in individuals with multiple disabilities of diverse ages (e.g., Lancioni, Singh, O'Reilly, Campodonico, Oliva, & Vigo, 2005; Lancioni, Singh, O'Reilly, Camodonico, Piazzolla et al., 2005; Lancioni et al., 2013).

Although recent research has found walker-assisted ambulation to improve through delivery of contingent reinforcement, only 60% of research has reported maintenance of motor skill improvements (Houwen et al., 2014). In one example, Lancioni et al. (2007) found increases in ambulation to be maintained over an extended period of time, but only while automatically-delivered contingent reinforcement was in place. Despite the importance of fading contrived contingencies (Cooper et al., 2007), little research has evaluated whether improvements in ambulation, achieved through contingent reinforcement delivered by a therapist or automatically via mircoswitch, may be maintained under less dense schedules of reinforcement. Only one study showed maintained improvements in walker-assisted ambulatory behavior in an individual with multiple disabilities following termination of contingent reinforcement (Strawbridge et al., 1989). It is unknown whether, and to what extent, the effects of contingent reinforcement on walker-assisted ambulation may be maintained when reinforcement is delivered less frequently, i.e., a thin schedule of reinforcement (Lancioni et al., 2013). Although some suggest that greater access to the surrounding environment may provide sufficient reinforcement to maintain newly-acquired ambulatory behavior (e.g., Manella & Varni, 1984), response effort of individuals with multiple disabilities associated with ambulation may limit such behaviors during thin schedules of reinforcement (Lancioni, Sigafoos, O'Reilly, & Singh, 2012).

Given the limited research evaluating the maintenance of walker-assisted ambulatory behavior in individuals with multiple disabilities, the purpose of the present study was to evaluate the effects a forward chaining procedure in conjunction with contingent reinforcement during both an intervention and a maintenance phase. Replacement of contrived contingencies with naturally maintaining contingencies represents an important goal in behavior modification. The current study sought to extend the literature through evaluation of maintenance of ambulatory behavior under a thin schedule of reinforcement. In addition, this study aimed to extend the literature through evaluation of procedures that may be replicated in school or other settings in which access to technology such as microswitches for automatically-delivered stimulation and equipment of PBWSTT are not available. The current study was designed to answer the following research questions:

1. Does implementation of a forward chaining procedure incorporating contingent reinforcement result in acquisition of a walker support device behavior sequence?
2. Does implementation of a forward chaining procedure incorporating contingent reinforcement result in an increase in the distance walked using a walker support device?
3. Are changes in use of a walker support device behavior sequence and distance walked maintained under a thin schedule of therapist-delivered contingent reinforcement?

2. Method

2.1. Participant

Jake was an 8 year, 1-month old African American male who received special education services under the disability category of Developmental Disability. Jake spent his entire school day in a self-contained classroom that included one female special education teacher, one teaching assistant, and six other students with severe disabilities. Information regarding Jake's cognitive, developmental, adaptive, and language abilities was collected from his most recent Individualized Education Program (IEP) and a recently completed multi-disciplinary team assessment report. The results of disparate assessment