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Three non-ambulatory adults with multiple disabilities exercise foot–leg movements through microswitch-aided programs

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ABSTRACT

This study assessed the use of microswitch-aided programs to help three non-ambulatory adults with multiple disabilities exercise foot–leg responses. Those responses served to activate a largely neglected part of the participants' body, with possibly positive physical implications (e.g., for blood circulation, swelling, and muscle strength). Intervention focused on the left and right foot–leg response, separately. Eventually, sessions with one response were alternated with sessions with the other response. Responses were monitored via microswitches and followed by 8 s of preferred stimulation (e.g., music and vibrotactile stimulation), which was automatically delivered. The results showed that all three participants had high levels of foot–leg responses during the intervention phases and a 3-week post-intervention check. The participants also displayed expressions of positive involvement during those study periods (i.e., engaged in behaviors, such as music-related head movements, smiles, or touching the vibratory devices) that could be interpreted as forms of interest/pleasure and happiness. These results are in line with previous findings in this area and can be taken as an important confirmation of the strength and dependability of the approach in motivating non-ambulatory persons with multiple disabilities to engage in foot–leg movements. The practical implications of these findings are discussed.

1. Introduction

Non-ambulatory adults with severe and profound multiple disabilities (i.e., persons with combinations of motor and intellectual impairments) (a) are often unable to engage in recognized forms of activity and communication and (b) tend to spend most of their time in a wheelchair or in bed, in a passive and detached condition (Blain-Moraes & Chau, 2012; Bunning, Smith, Kennedy, & Greenham, 2013; Helton, 2011; Kinshore, 2011; Lancioni, Sigafoos, O'Reilly, & Singh, 2012). Usually, the emphasis of their daily programs is on general stimulation and physiotherapy (Boland, Daly, & Staines, 2008; Castro, Cieza, &

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Cesar, 2011; Green & Reid, 1999; Lancioni, Sigafoos, et al., 2012; Munde, Vlaskamp, Ruijssenaars, Maes, & Nakken, 2012; Ten Brug, van der Putten, Penne, Maes, & Vlaskamp, 2012; Van Rensburg, 2007).

General stimulation (i.e., presentation of various stimuli during different daily sessions) is aimed at enriching their sensory input and improving their mood or positive involvement with the stimulus material and the context (Dillon & Carr, 2007; Green & Reid, 1999; Lancioni, Sigafoos, et al., 2012). However, general stimulation strategies do not normally promote specific responding and self-determination and, thus, do not modify the overall passive role of the person (Lancioni, Sigafoos, et al., 2012; Saunders et al., 2007). Physiotherapy is considered to be critical to help them improve their motor condition and facilitate their performance of adaptive responses and motor schemes. However, physiotherapy sessions without subsequent, extended practice of the responses (motor schemes) targeted within those sessions are unlikely to ensure positive changes with lasting implications for the person's physical/health condition (e.g., blood circulation and muscle strength) (Gardner et al., 2001; Klonizakis, 2012; Lin, Chen, & Cho, 2012; Nijs et al., 2011; Nyberg et al., 2012).

One intervention approach that might (a) allow extended practice of adaptive responses and motor schemes with minimal staff costs and, at the same time, (b) ensure stimulation enrichment and self-determination is represented by microswitch-aided programs (Lancioni, O'Reilly, et al., 2008; Lancioni, Sigafoos, et al., 2012; Lancioni, Singh, O'Reilly, & Sigafoos, 2011). Those programs involve the use of (a) microswitches (i.e., sensor devices) to monitor the participant's target responses and (b) a computer system to control stimulus sources and provide a brief period of stimulation after each response instance (Lancioni, O'Reilly, et al., 2008; Lancioni, Sigafoos, et al., 2012). This technology can be (a) accurate in detecting response occurrences, (b) rapid in providing stimulation contingent on such occurrences (i.e., thus ensuring the participant's motivation to respond independently of staff intervention), and (c) suitable for extended use. Such use could be practically sustainable and technically viable for ensuring therapeutic effects (Lancioni, O'Reilly, et al., 2012; Lancioni, Singh, et al., 2012).

A number of studies have reported the feasibility of such an approach for practicing relevant responses that physiotherapy alone cannot realistically consolidate (e.g., head lateral movements, hand and arm raising/reaching responses, hand–eye coordination, as well as foot–leg movements) (Lancioni et al., 2004, 2005; Lancioni, O'Reilly, et al., 2012; Lancioni, Singh, et al., 2008; Lancioni, Singh, et al., 2012; Lancioni et al., in press). The largely encouraging results of the studies and the potential implications of those results for the participants involved and other persons with similar conditions and life experience seem to call for two lines of research. The first line is concerned with an extension of the research conducted so far. New research efforts might be focused particularly on responses that have been only marginally investigated in spite of their relevance in terms of participants' physical/health condition (e.g., foot–leg movements for wheelchair users; see Lancioni et al., 2005, in press). The second line of research is concerned with finding ways to (a) ensure the transfer of the technology and the intervention procedures into daily contexts and (b) measure the effects of such transfer over the short term as well as the long term (Kazdin, 2001; Kennedy, 2005; Ormel, Pareja Roblin, McKenney, Voogt, & Pieters, 2012; Weisz, Ugueto, Cheron, & Herren, 2013).

This study was consistent with the first line of research mentioned above, and it was to extend the investigation of one type of response that is virtually ignored by non-ambulatory persons, that is, foot–leg movement. Practicing such a response was considered relevant for the participants (a) to activate a largely neglected part of their body with possibly positive implications for their physical condition (e.g., blood circulation and muscle strength) and also (b) to increase their self-determination and enrich their stimulation input (Lancioni, Sigafoos, et al., 2012).

2. Method

2.1. Participants

The participants (Edith, Liam, and Phyllis) were 37, 42, and 22 years old, respectively, and had a diagnosis of congenital encephalopathy and multiple disabilities. All three were non-ambulatory, presented with epileptic seizures only partially controlled through medication, and were rated in the profound range of intellectual disability, although no IQ scores were available and no formal testing was possible. They did not possess speech abilities or other specific forms of communication and lacked sphincteric control. Their motor condition was defined as spastic tetraparesis combined with physical malformations of feet and knees (Edith and Phyllis) and functional disabilities such as ataxia probably related to anti-epileptic medication (Liam). Their sensory condition was also seriously affected. In fact, Edith was totally blind, Phyllis had minimal residual vision, and Liam was blind and reportedly had severe hearing loss also. The participants attended centers for persons with profound and multiple disabilities, in which they were provided with small occupational/stimulation events (e.g., music, fiber-optic lights, or stroking) as well as physiotherapy sessions. Foot and leg movements were part of their physiotherapy program. It was considered important that all three increased the active performance of these movements beyond the physiotherapy sessions. The participants' legal representatives had provided formal consent for their involvement in this study, which had been approved by a scientific and ethics committee.

2.2. Foot–leg responses, microswitches, control system, and stimuli

Participants sat in their wheelchairs during all sessions. Edith's foot–leg responses consisted of lifting the right or the left foot about 8 cm after a partial extension of the related leg. Liam's responses consisted of a forward movement of the right or