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Promoting Adaptive Hand Responding and Reducing Face Hiding in a Woman with Profound Developmental Disabilities Using Microswitch Technology

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Abstract. We assessed the use of a microswitch cluster (i.e. a combination of two microswitches) plus contingent stimulation for promoting adaptive responding and reducing aberrant behaviour in a woman with profound developmental disabilities. The woman was initially taught an adaptive hand response that activated a pressure microswitch and produced preferred stimuli. Subsequently, her hand response led to preferred stimuli only if it occurred free

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from face hiding (i.e. aberrant behaviour detected through a mercury microswitch). The study also included a 3-month post-intervention and generalization check, and a social validation assessment. Data showed that the woman increased her adaptive responding, learned to perform this responding largely free from aberrant behaviour, and maintained and generalized the new performance across settings. Forty-five psychology students provided positive social validation of the woman's new performance and the use of microswitch-cluster technology.

Keywords: Microswitch cluster, adaptive responding, aberrant behaviour, developmental disabilities.

Introduction

Persons with profound and multiple disabilities can have very few adaptive responses and minimal interaction with their environment (Holburn, Nguyen and Vietze, 2004). They may also present with aberrant behaviour, such as tongue protrusion, finger mouthing or face hiding, which can hinder their functioning and appearance and further complicate their situation (Luiselli, 1998; Wacker et al., 1998).

Microswitch-based programmes can be a valuable strategy for helping these persons acquire adaptive responses and access preferred stimuli (Holburn et al., 2004). Once they have consolidated adaptive responding, they may learn to combine this with control of aberrant behaviour. For example, a person might be initially taught to perform adaptive foot movements to produce preferred stimuli. Subsequently, the person may receive the stimuli only if the foot movements occur free from (i.e. in the absence of) aberrant behaviour (Lancioni et al., 2004, in press).

This dual goal of promoting adaptive responding and reducing aberrant behaviour might be pursued through microswitch clusters (i.e. combinations of microswitches) that allow (a) concurrent monitoring of adaptive and aberrant responses and (b) delivery of preferred stimuli only for adaptive responses occurring free from aberrant ones. This study assessed microswitch-cluster technology for enhancing an adaptive hand-pushing response and reducing face hiding in a woman with profound developmental disabilities. The hand-pushing response was selected because it appeared highly practical and moderately demanding for the woman (Lancioni, Singh, O'Reilly and Oliva, 2005). Face hiding was considered a serious problem that jeopardized the woman's social image and interaction opportunities (Lancioni, Smaldone, O'Reilly, Singh and Oliva, 2005; Reed, Ringdahl, Wacker, Barretto and Andelman, 2005). The woman's performance data were supplemented with social validation data provided by psychology students.

Method

Participant

The woman (Kathy) was 41 years old and had Down syndrome. She was very passive and sedentary, and tended to keep her head down, hiding her face. No formal psychological assessment or IQ scores were available for her. However, she was considered to function within the profound intellectual disability range and possessed only minimal communication skills (i.e. could follow a few basic instructions and could emit only a few word-like utterances). She attended a day activity centre for persons with severe/profound developmental disabilities,

but she usually failed to engage in activity and spent her time sitting at a table. She could show some brief moments of attention, raising her face and producing brief smiles, when presented with preferred stimuli such as music and songs or vibratory inputs. Her parents and caregivers had provided informed consent for her participation in this study. According to the Italian law, this consent is considered acceptable for the study. They had also expressed full support for the study as they considered it highly respectful of Kathy's condition and consistent with her educational plan.

Responses, microswitch cluster, electronic control system, and stimuli

The responses recorded during the study were hand pushing and face hiding. The first consisted of pushing with the hand(s) on a little board, which was placed on the table in front of Kathy; the second consisted of keeping the face near the tabletop (often behind the hand or arm). The microswitch cluster consisted of the combination of a pressure microswitch attached to the aforementioned board and a mercury microswitch kept at the side of Kathy's head through a headband. The first microswitch was activated by the hand-pushing responses; the second microswitch was activated when Kathy raised her face making an angle between the face and the tabletop greater than 35 degrees.

The microswitch cluster was connected to a battery-powered, electronic control system that served to (a) turn on preferred stimuli, such as songs, voices and vibratory inputs, for 5 seconds contingent on the hand responses (i.e. according to the procedural conditions described below) and (b) record these responses and whether they occurred free from face hiding.

Experimental conditions

The study was carried out in a quiet activity room, according to an ABB^1AB^1 design in which A represented the baseline, B represented the intervention for hand pushing, and B^1 represented the intervention for both hand pushing and face hiding (Richards, Taylor, Ramasamy and Richards, 1999). The first B^1 phase was introduced once Kathy's hand-pushing responses had been consolidated. At the start of this (B^1) phase, a set of sessions occurred in which guidance was used for reducing face hiding (see below). To control for the overall impact of these sessions, matching guidance sessions were also used during the B phase. A social validation assessment was conducted shortly after the second B^1. A post-intervention and generalization check occurred 3 months after the second B^1. Sessions lasted 5 minutes and occurred three to nine times a day. Hand responses and whether they occurred free from face hiding were automatically recorded through the control system. In addition to this automatic recording in relation to hand responses, face hiding was also recorded by research assistants according to a momentary time sampling procedure, at intervals of 10 seconds. Their mean interrater reliability checked over 25% of the sessions exceeded 93%.

Baseline phases (A). The two baseline phases included 10 and 12 sessions, respectively. During these phases, the microswitch cluster (i.e. the pressure and mercury devices) and the control system were available as during the intervention phases. However, no stimuli were provided for the hand-pushing responses. At the start of the sessions, Kathy was guided to perform a hand-pushing response.

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Intervention for hand pushing (B). The B phase differed from baseline in that hand-pushing responses produced preferred stimuli regardless of whether they occurred free from face hiding or not. Seventy-four regular intervention sessions were used. Prior to the last third of them, 15 sessions with guidance occurred. These sessions included four to eight instances of physical and verbal guidance (i.e. of encouragement and direct support by a research assistant) aimed at preventing face hiding in relation to hand-pushing responses.

Intervention for hand pushing and face hiding (B^1). The two B^1 phases included 51 and 41 sessions respectively. During these phases, the hand-pushing responses were followed by preferred stimuli only if they were free from face hiding. Fifteen sessions with guidance (like those described above) were available at the start of the first B^1 phase.

Post-intervention and generalization check. Kathy continued to receive sessions like those of the last B^1 phase regularly. Three months after the end of this phase, 12 sessions were recorded in the same activity room and 12 sessions (interspersed with the aforementioned ones) were recorded in a new activity room to check maintenance and generalization.

Social validation assessment. Forty-five psychology students with a mean age of 23 years were shown pairs of 3-minute video-clips concerning Kathy during B and B^1 sessions, respectively. The students scored the clips in terms of Kathy's happiness in the two types of sessions as well as in terms of the perceived social benefits and of the rehabilitation worth of these sessions. Scores could vary from 1 to 5, which indicated least and most positive values respectively, on each of the three aspects being rated.

Results

During the initial baseline, Kathy's mean frequency of hand-pushing responses was about 5 per session (see Figure 1). The mean frequency of responses increased to 29 per session during the B phase. Less than 25% of the responses and of the observation intervals run in the sessions were free from face hiding. There were no positive trends in the percentages before or after the sessions with guidance (not reported in the graph). During the first B^1 phase, the mean frequency of responses was 28 and the mean percentages of responses and observation intervals free from face hiding were about 70. Frequency and percentages declined during the next baseline to increase again during the second B^1 phase as well as the post-intervention and generalization check in which they exceeded 30 and 90, respectively. Data for the post-intervention and generalization sessions were comparable and thus are presented together in Figure 1. The percentages obtained for the B^1 phases and the post-intervention and generalization check were significantly higher ($p < .01$) than those obtained for the B phase on the Kolmogorov-Smirnov test (Siegel and Castellan, 1988).

During the social validation assessment, the students' scores were significantly higher in relation to the B^1 clips as confirmed by a multivariate analysis of variance (MANOVA). The Wilks' lambda $(3, 42) = 0.24$ ($p < .01$) indicated that the scores for all three aspects rated (i.e. happiness, social benefits, and rehabilitation worth) had a significant and congruent contribution to the final outcome (Tabachnick and Fidell, 1996).

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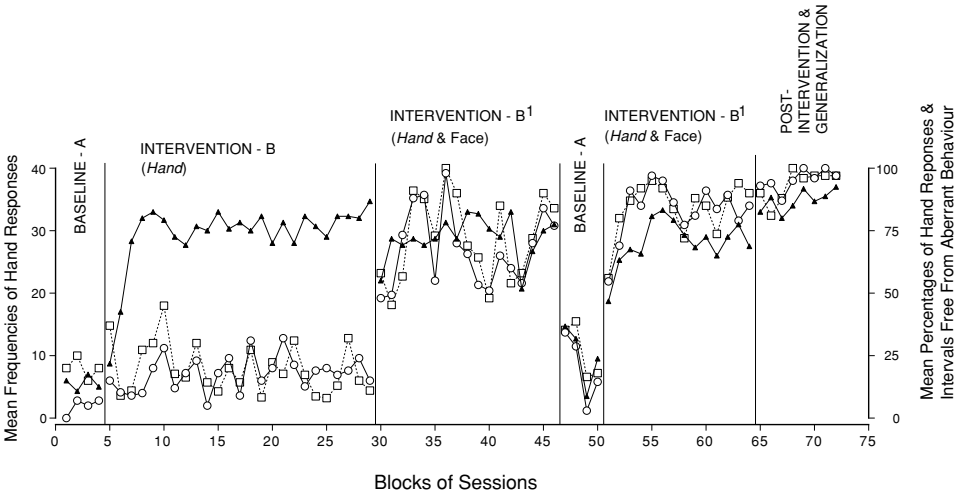

Figure 1. The black triangles represent mean frequencies of hand-pushing responses over blocks of three sessions. Only the last two triangles of the first baseline and the last triangle of the B and first B^1 phases concern blocks of two sessions. The circles and squares represent mean percentages of hand-pushing responses and of observation intervals free from face hiding within the same blocks of sessions, respectively. The graph does not include the sessions with guidance used during the B and first B^1 phases.

Discussion

In view of the findings, three considerations may be in order. The first consideration concerns the fact that this approach led Kathy to achieve a self-managed control of her aberrant behaviour in combination with increased adaptive responding. Such an achievement seems to represent a great personal and practical advantage over any form of outside attempt to reduce negative behaviour in isolation and through containment strategies (Kazdin, 2001; Lancioni et al., in press). The positive outcome could most probably be explained by the fact that the stimuli used for adaptive responses had a strong reinforcing value and Kathy could discriminate the responses performed with and without face hiding (see Borrero and Vollmer, 2002; Kazdin, 2001). The sessions with guidance may have contributed to speed up the improvement in the first B^1 phase but alone could not have accounted for it as shown by the data of the B phase.

A second consideration concerns the usability and practicality of the microswitch cluster adopted for Kathy. With this regard, one can argue that the cluster was quite simple in terms of microswitches involved and the way they worked. Such simplicity can be important to extend the number of clients who can be exposed to and benefit from this technology and the number of staff and parents who may be eager to apply the technology daily (LoPresti, Mihailidis and Kirsch, 2004; Ostensjo, Carlberg and Vollestad, 2005; Parette, Huer and Hourcade, 2003).

A third consideration concerns the fact that the sessions were fairly short. Only if repeated various times during the day could they have a real impact on the person's overall appearance and social acceptance. To avoid a mere repetition of the same sessions, one could introduce a second cluster for a second adaptive response and alternate sessions with the two clusters.

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In conclusion, new research would need to (a) tackle the aforementioned issue of frequent and varied daily sessions to optimize intervention effects and (b) extend the evaluation of microswitch-cluster technology to other clients to determine its level of applicability and potential limits.

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