International Handbook of Occupational Therapy Interventions

Chapter 32
Strategies for Curing with Self-Speech in People Living with Parkinson's Disease

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I can turn and not shuffle when I say three times "Turn-Turn-Turn"; this is wonderful.

—Client

Abstract Strategies for cuing with self-speech (known as the RehabSelfCue-Speech program) is a systematically organized intervention. It addresses how clients living with Parkinson's disease learn to use self-cuing to initiate movement-related actions (Maitra, 2007; Maitra and Dasgupta, 2005). The client reads action-words, which are semantically related to occupational performance of daily living tasks (e.g., get up from a chair, reach tools or food, or grasp a pen and a paper). The RehabSelfCue-Speech program is based on Pulvermüller et al.'s (2005) language-perception-action theory and empirical data on movement disorder related to Parkinson's disease (Maitra, 2007; Maitra et al., 2006).

Keywords Activities of daily living • Attention • Cuing • Dyskinesia • Self-speech

Definition

Parkinson's disease is a common neurodegenerative disease characterized by tremor, rigidity, slowness of movement (bradykinesia), and postural instability (Murphy and Tickle-Degnen, 2000). Progressive difficulty in movement initiation and bradykinesia affect sequential arm movements necessary for optimally performing many common occupations involving upper extremity, including cooking, eating, dressing, or grooming (for a review, see Murphy and Tickle-Degnen, 2000). Parkinson's disease is caused by a degenerative lesion in the substantia nigra, a basal ganglia component in the brain. The dopamine-producing ability of the substantia nigra progressively declines, resulting in typical symptoms of Parkinson's disease (Steece-Collier et al., 2002). The predominant pharmacologic intervention is levodopa (or dopamine replenishment) therapy, and most of the parkinsonian symptoms are highly responsive to this therapy. However, following long-term use,

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both effectiveness (quality of life) and longevity (the duration of the effect) of levodopa diminish, and the risk of developing drug-induced dyskinesia increases (Marsden and Parkes, 1977). Furthermore, although there is an immediate and significant improvement of quality of life following pharmacologic intervention, difficulties in performing activities of daily living, including gait and balance problems, still persist (Nieuwboer et al., 2007). For example, spatial characteristics (e.g., stride length) but not temporal characteristics (e.g., stride cadence) of gait improve with drug therapy (Nieuwboer et al., 2007). Therefore, there is a consistent need for physical and occupational therapy in Parkinson's disease patients to address issues of activities of daily living (ADL) and instrumental activities of daily living (IADL). With the increased understanding of pathophysiology of the disease, a range of efforts is being pursued to develop effective rehabilitative programs that work in conjunction with dopaminergic therapy.

External Cuing

Clients with Parkinson's disease have specific difficulty in internally generating motor actions in a timely manner (Praamstra et al., 1998). To address the temporal difficulty in initiating movement, over the past several years, one important aspect of Parkinson's disease rehabilitation research involves experimenting with the use of an *external cue* to initiate gait movement and gait training. These experiments suggest that *external cuing* may significantly and immediately improve gait initiation and gait performance in people with Parkinson's disease (for more discussion on cuing, see Background, below). As Lim et al. (2005) pointed out, a precise definition of *cue* needs to contrast with that of simple stimuli. This is because *cues* provide "information about how an action should be carried out and hence [is] more specific than a simple stimulus" (Lim et al., 2005). For the purpose of the present protocol, *cuing* is defined as "temporal or spatial stimuli associated with the initiation and ongoing facilitation of motor activity" or movement (Lim et al., 2005; Nieuwboer et al., 2007).

Cognitive Impairment and Parkinson's Disease

It is also now widely recognized that clients with Parkinson's disease exhibit *cognitive impairment* as a central feature of the disease even in its early stage (Mindham and Hughes, 2000). A number of cognitive difficulties that include attention, working memory, learning, visual perception, and visuospatial and executive skills have been described in Parkinson's disease (Mindham and Hughes, 2000). These cognitive impairments also contribute to the difficulties in ADL and IADL performance. For example, executive skills, specifically sequencing ability, was found to be a significant predictor of IADLs, and simple motor functioning was found to be a significant predictor of physical ADLs (Cahn et al., 1998).

Background

Parkinson's disease is a chronic and progressive neurologic disorder resulting in significant motor and cognitive disability. Parkinson's disease is associated with progressive loss of independence and increasing financial burden. Although mortality and morbidity of Parkinson's disease are delayed with modern pharmacologic intervention, a high rate of decline in motor ability and an increase in disability make the disease a public health concern (Nieuwboer et al., 2007). Nonpharmacologic interventions such as occupational, physical, and speech therapy are therefore sought to promote independence and functionality (Johnson and Almeida, 2007).

As mentioned earlier, external cues have been found useful in helping clients with Parkinson's disease to initiate movements. Many of these studies involved gait performance. External cues used for clients with Parkinson's disease for gait improvement were generally of three types: visual, auditory, or somatosensory. Examples include the following: (1) mild *tactile sensory shock* as a somatosensory cue (Burleigh-Jacobs et al., 1997), (2) rhythmi*c* auditory cues using a metronome (Enzensberger and Fischer, 1996), and (3) *visual step cues of* high-contrast transverse lines on the floor (Majsak et al., 1998).

The intervention of the RehabSelfCue-Speech program as presented below is based on these concepts of cuing movement initiation by self-cuing via semantically related words (see Evidence for Practice, below, for further information).

Purpose

Clients with Parkinson's disease have difficulty in performing many ADLs, despite medication, due to cognitive impairments and impairments in movement initiation and performance. The purpose of the RehabSelfCue-Speech intervention is to utilize the client's semantic memory to facilitate everyday motor performance necessary for completing ADLs and IADLs.

Method

Candidates for the Intervention

The RehabSelfCue-Speech program is aimed at people who are in the mild to moderate stages of Parkinson's disease or if stage III on the Hoehn and Yahr scale. The Hoehn and Yahr scale (Hoehn and Yahr, 1967) is commonly used to classify the stages of disability with Parkinson's disease. The scale rates the severity of Parkinson's disease from 0 to 5 as follows:

- Stage 0: no disability or symptoms
- Stage 1: symptoms are present only on one side of the body

- Stage 2: symptoms are present on both sides of the body, but there is no impairment in balance
- Stage 3: the disease is at the mild to moderate stage, with balance impairment, but the patient is still independent
- Stage 4: the patient is severely disabled but is still able to walk or stand without assistance
- Stage 5: the patient is wheelchair bound

Epidemiology

Parkinson's disease occurs worldwide in all ethnic groups and socioeconomic classes. The incidence and occurrence of Parkinson's disease increases with age and is about 1% in people over the age of 65 years around the world (Singhal et al., 2003). Parkinson's disease and other neurodegenerative diseases (e.g., Alzheimer's disease) combined could surpass cancer as the second most common cause of mortality by 2040 (Singhal et al., 2003). Despite extensive and focused research, causes of Parkinson's disease remain unresolved, although genetic and environmental factors such as exposure to pesticides have been strongly suspected (Steece-Collier et al., 2002).

Settings

The RehabSelfCue-Speech intervention is a technique of promoting functional independence utilizing one's own semantic memory to facilitate one's motor performance. The technique does not require any equipment or specific environment. Thus, the client can practice the technique in any setting—at home, in the clinic, or in the community—to initiate and maintain a motor performance.

The initial RehabSelfCue-Speech technique is used in clinical settings to facilitate upper extremity and lower extremity dressing, and simple meal preparation.

The Role of the Occupational Therapist

The role of occupational therapist (OT) is to organize the context in which the client practices the RehabSelfCue-Speech intervention technique. Following client-centered practice principles, the OT collaborates with the client to choose the tasks that the client is interested in performing. For example, if the client chooses to perform tasks of simple meal preparation, the OT helps the client to select action words the client needs to read aloud during the activity to facilitate the performance.

Results

A Brief Guide to Clinical Application

RehabSelfCue-Speech techniques can be applied to facilitate ADL, work, or leisure activities. OTs use motor learning principles to organize individual training sessions to the three times a week for 30 minutes to 1 hour each time. Clients read aloud different action words three times and will then perform the action with three repetitions.

The practice of RehabSelfCue-Speech for a client with Parkinson's disease is organized along the following guidelines:

To get up from a chair, the action word is *SWAY* and then *RISE*. The OT shows a card with the word *SWAY* on it. The client reads the word aloud three times, and then does a swaying motion while sitting on a chair. This action is repeated three times. After three sways the OT shows the client another card with the words *SWAY* and *THEN RISE*. The client reads the words aloud three times and tries to rise from the chair following the sway. The client does three attempts to perform this action (Fig. 32.1). This strategy of priming the action with words can be applied to any daily tasks, such as dressing, self-care, or preparing a light meal

Fig. 32.1 The client is swaying by reading aloud the word *SWAY* three times in preparation to rise from the toilet seat.

How the Intervention Eases Impairments, Activity Limitations, and Participation Restrictions

RehabSelfCue-Speech is intended primarily for clients with Parkinson's disease to compensate for dysfunctions including body structures of brain (International Classification of Functioning, Disability, and Health [ICF] codes 1100 to 1103) and specific mental functions (ICF 34 b140 to b189) (World Health Organization, 2007).

Evidence-Based Practice

Recent reviews of experimental studies suggest that external cues are effective for short-term improvement of gait performance, especially in walking speed, step length, and step frequency (Lim et al., 2005; Rubinstein et al, 2002). Dam et al. (1996) compared sensory-enhanced gait therapy with conventional therapy in gait training in clients with Parkinson's disease. Sensory-enhanced therapy included both external visual cues, such as footprints on which patients walked, and auditory cues, such as high and low tones synchronized with foot lift and foot drop. Although both conventional and sensory-enhanced therapy produced significant improvement in gait characteristics, the improvements were maintained longer in sensory-enhanced therapy (12 months) than in conventional therapy (4 months).

Positive effects of exercise and external cuing on motor performance, ADLs, and cardiovascular fitness in clients with Parkinson's disease has also been reported (Gage and Storey, 2004). Most of the studies involving external cuing are a single-session experimental study, and long-term training effects of cues for ADLs and gait in familiar contexts, such as the home, are not substantiated. One study systematically investigated a 3-week home cuing program for gait training followed by 3 weeks without training among 153 clients with Parkinson's disease. Small but significant improvement in posture and gait scores was found (Nieuwboer et al., 2007). The study raised the possibility that cuing training may have long-term therapeutic benefit in the management of ADLs at home.

Cues are contextually or spatially relevant stimuli that, through experience, are associated with expected behavior. External and contextually relevant cues have been theorized to guide internally the cognitive functions necessary for ADL and IADL performances (Gage and Storey, 2004; Praamstra et al., 1998). Neurologic and motor control research has shown that the brain goes through cognitive programming or ideation before making any action or movement. Within the past few years, priming of this cognitive programming is possible through *external cuing* via semantically related language (Gentilucci, 2000; Gentilucci and Dalla Volta, 2008; Maitra and Telage 2004; Maitra et al., 2003; Manita and Dasgupta, 2005; Manita, 2007).

For example, participants performed reaching and grasping tasks with a wooden block while they silently read the words *near, far, small*, and *large* written on the block. Results of this study showed that the participants reached faster when they reach for a block with the word *far* written on it compared to reaching for a block

with word *near* written on it. Similarly, the grasping aperture was larger when the participant grasped a block with the word *large* on it than when the word *small* was written on it. The conclusion was that the participants automatically associated the meaning of the word with the planning of the action (Gentilucci et al., 2000).

Studying clients with Parkinson's disease and stroke (Maitra et al., 2006), the results showed that prereading of the word is semantically related to the expected motor performance, which was performed faster, and thus positively influences the performance. Speed and smoothness of the reaching or grasping task ($n = 24$) were significantly facilitated when the words *REACH* or *GRASP* were preread (Grossi et al., 2007). The word-based contextual cues have to be in congruency with the movement performances if the expected effect is to provide the contextual cues to prime the cognitive processes related to performance. For example, a reaching performance is not influenced by an unrelated action word such as *RETURN* or nonsense word such as *GA* (Miller et al., 2005).

Pulvermüller et al. (2005) explained the mechanism by which action words can cue and facilitate a motor performance. He proposed that words are represented in the brain by a neuronal network (or cell assemblies). The network is formed by neurons that represent a word's meaning (sensory perception) as well as the neurons that represent the word's content (motor action). Thus, for example, visually seeing the word *REACH* (perception), or saying the word *REACH* would stimulate the neural network governing the reach action, which is proved by the use of functional magnetic resonance imaging (fMRI) data of the brain. Here, the subjects read the words *lick, pick*, and *kick*. The fMRI showed activation in the sensory association areas of the mouth (for *lick*), hand (for *pick*), and leg (for *kick*) for interpretation of the meaning of the word. The fMRI also showed simultaneous activation of the motor areas of the mouth, hand, and leg responsible for licking, picking, and kicking actions (Pulvermüller et al., 2005). These studies provide a strong rationale for the present protocol.

Conclusion

The evidence for the RehabSelfCue-Speech program is supported by studies with people suffering from stroke (Maitra et al., 2006) or Parkinson's disease (Maitra, 2007), and several empirical studies with older adults provided sufficient rationale to use the protocol in practice (Grossi et al., 2007; Maitra et al., 2003; Maitra and Telage, 2004).

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