

Speech and Cognitive Rehabilitation Therapy in Parkinson's Disease

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ABSTRACT

Parkinson's disease involves a gradual and progressive loss of motor, communication, swallowing and cognitive functions with a variable rate and speed of progression. Rehabilitation therapy has proven effective in maintaining functions and autonomy for longer and in some cases also in improving these skills. Given the impairment and slowing down of numerous functions of the central nervous system, rehabilitation must be a process integrated by multi-professionalism and interdisciplinary within an individual rehabilitation project. Neuromotor and occupational rehabilitation are planned for motor and ADL autonomy, speech therapy rehabilitation for verbal communication skills and swallowing, neuropsychological rehabilitation for higher cortical functions and cognitive decline. Social and work rehabilitation will also be necessary to facilitate reintegration.

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SPEECH THERAPY

Efficacy Evidence: Dysarthria and Parkinson's Disease

During the course of the disease, 90% of patients develop voice and speech problems (Sapir 2011). The presence of hypokinetic dysarthria and amimia contribute to limiting communication in most patients with Parkinson's disease (Sapir 2011, Zarzur 2010).

Reduced speech intelligibility significantly affects psychological, emotional, social, relational, and occupational domains. Voice problems can cause social isolation, depression, reduced quality of life, and work absenteeism (Cohen 2006). Patients and caregivers often identify speech problems as "the most significant issues of the disease" (Miller 2006). Improving and maintaining communication abilities in patients with degenerative CNS diseases means preserving a better and more

adequate quality of life for as long as possible. Today, speech therapy intervention is one of the therapeutic options within a comprehensive program aimed at slowing symptom progression.

In most cases, in akinetic-rigid syndromes, speech disorders manifest as the disease advances. The nuances of inflection to emphasize certain points in speech disappear, voice volume decreases, consonant pronunciation becomes defective, and utterances often end in mumbling. From a weak, monotonous voice lacking frequency variation, there is a gradual progression of dysarthria to speech that is often neither audible nor intelligible. While general slowness of movement can explain slowed speech in some cases, others speak rapidly, with words running together, as if patients wish to conserve energy and quickly finish their statements. Some show a progressive acceleration of words toward the end of sentences, comparable to festination in their gait.

Hypokinetic Dysarthria

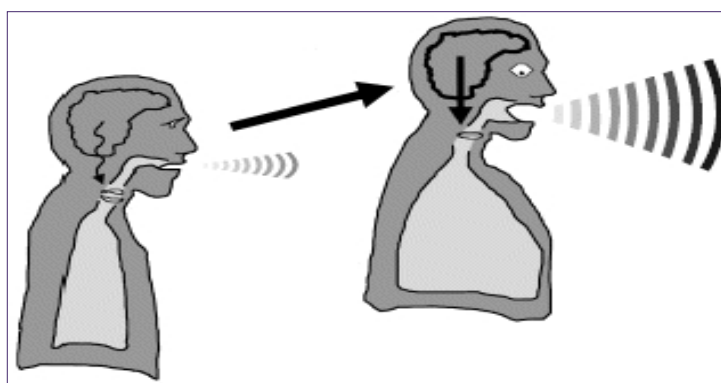
Darley, Aronson, and Brown (1969) classified the speech of 212 patients according to a predefined list of perceptual characteristics. Among the 32 Parkinsonian patients, the most relevant features were prosodic and phonatory alterations. There is reduced airflow resistance due to abnormal movement of the vocal folds and supraglottic structures and/or abnormal thoracic wall movements and altered activation patterns of respiratory muscles.

Voice alterations are present in 86–89% of cases: breathy, hoarse, harsh, or tremulous voice (Logemann 1978, in 200 patients). Phonation problems are early: they appear at the initial stages of PD (Ho 1998, Sapir 2002). Articulation impairment follows, along with prosodic and fluency issues. These are often associated with respiratory problems: reduced respiratory capacity, abnormal expiratory flows (Vincken 1984), poor pneumo-phonetic coordination (De Letter 2007), and reduced intraoral pressure during the production of vowels and consonants.

Rhythm and Fluency

Rhythm: variable, often excessive speed, short bursts (Darley 1969). Disfluencies: present in 28% (palilalia and stuttering). Benke (2000) found verbal repetitions in 15 out of 53 PD patients, with two forms: palilalia (poorly articulated, accelerating rhythm, decreasing volume) and stuttering (well articulated, constant rhythm and volume). Both forms can coexist in the same patient. The type of verbal task influences the severity, with more demanding tasks causing more disturbance.

FOCUS ON VOICE: “THINK LOUD! SPEAK LOUD!”



A single goal triggers a complex mechanism, with effects on:

- Respiration
- Articulation
- Prosody
- Intelligibility
- Facial mimicry
- (Swallowing)

ISS Guidelines

Question 26: Is there evidence supporting the efficacy of speech therapy rehabilitation in treating disorders such as dysphagia, dysphonia, and communication disorders in Parkinson's disease?

Summary: The evidence identified documents that only Lee Silverman Voice Treatment (LSVT) has some utility in treating dysphonia and communication disorders in Parkinson's disease (Evidence B).

Lee Silverman Voice Treatment (LSVT)

LSVT is based on the characteristics of voice and speech problems in PD: reduced amplitude of movement and deficits in self-feedback of vocal quality.

Vicious Circle: Reduced oral mechanism amplitude → weak, monotone voice → unawareness → no self-correction. Motor exercises plus sensory awareness training = LOUD VOICE – SELF-CONTROL (the patient learns to self-instruct “LOUD,” breaking the vicious circle).

Voice is a key element in treating motor speech disorders (Ramig et al.):

- It is the central theme of motor organization
- Has maximum impact on all aspects of speech (articulation, vocal quality, intonation, speed)
- Minimal cognitive effort: a single, simple instruction
- Modeling (imitation and reinforcement) plus tactile and visual cues

Avoid hyperkinesia (do not shout). Improving vocal fold adduction and generating adequate intensity improves coordination (indirect activation of respiratory support), with few words modeled.

INTENSITY

- 4 consecutive days per week for 4 weeks (16 sessions in a month)
- Repetition of tasks and stimuli

- Maximum perceived effort at each session (even 8–9 on a scale of 0–10)
- HIGH EFFORT, “POSITIVE FATIGUE!”
- Maintain effort level through graded tasks and materials
- Tasks: Repetition (if necessary), prolonged phonation, reading, conversation, effort judgment (0–10 scale)

SENSORY CALIBRATION

Self-monitoring: the patient must learn that a high effort level is normal. Constant feedback (from therapist and patient). Generalization: bring the effort level outside the clinic, “beyond the parking lot,” with home tasks and constant positive reinforcement.

QUANTIFICATION

Constant throughout treatment:

- Intensity, duration, frequency
- Tools: volume meter, stopwatch, frequency meter
- Continuous feedback for patient motivation

LSVT Effects in Parkinson's Disease

- Significant increase in intensity (5–12 dB at 6, 12, and 24 months for all tasks: /a/, monologue, reading)
- Improved intelligibility as judged by family (visual analog scales)
- Improved short-term quality of life (Sickness Impact Profile)
- Improved swallowing: oral and pharyngeal phases (El Sharkawi 2002)
- Improved orofacial movements, reflected in articulation (Dromey 1995), tongue motility and strength (Ward 2000), verbal rhythm (Ramig 1995), facial expression (Spielman 2003)
- Improved vocal quality due to reduced centralization (Sapir 2007–2010)

Caution: Eating and drinking can be risky due to high risk of aspiration, leading to serious bronchopulmonary infections, often fatal. Altered muscle synergies and timing in the oral-lingual and laryngo-pharyngeal muscles result in a motor mechanism termed bradyphagia.

Compensatory Interventions for Dysphagia: Postural and Consistency Modifications

A multicenter study (1998–2005, Logemann 2008) evaluated short-term effects in 711 patients with liquid aspiration on videofluoroscopy (VFG), including those with Parkinson's and/or dementia. Three conditions were tested in random order:

- Chin-tuck with liquid
- “Nectar” consistency
- “Honey” consistency

Results: “Honey” consistency was the most successful strategy, though patients preferred chin-tuck. A randomized trial (Robbins et al. 2008) with 515 patients compared chin-tuck and consistency modifications (“nectar” and “honey” subgroups). Results: no differences between strategies in preventing aspiration pneumonia.

Effect of Bolus Consistency on Swallowing Time and Safety in Parkinson's Disease

Objective: Quantify changes related to bolus consistency in oral and pharyngeal phases of swallowing. Findings: Longer oral transit time for pudding; more festinations for pudding; lower penetration/aspiration for pudding. The oral phase is influenced by bolus consistency. Festinations cause deficits in anteroposterior bolus pumping and reduced pharyngeal propulsion. The number of festinations is influenced by oral transit time and is lower for liquids, possibly due to less resistance. No significant difference between consistencies for pharyngeal transit time.

In conclusion, Consistency is important-thickening is appropriate in advanced dysphagia.

Restorative-Rehabilitative Interventions

Nagaya (2000): 10 patients with delayed oro-pharyngeal transit on EMG and VFG improved swallowing after 20 minutes of training, including:

- Tongue movements (alternately elevating tongue tip and base with mouth open for 1 minute, 5 repetitions)
- Resistance exercises (pressing tongue tip and sides against tongue depressor, 5 repetitions)
- Vocal fold adduction via pushing (forceful vocal onset on /a/ after forceful exhalations, 5 repetitions)
- Mendelsohn maneuver
- Head-neck-shoulder stretching exercises (5 repetitions)

LSVT Efficacy on Swallowing and Voice: Pilot Study (El Sharkawi 2002)

Objective: Efficacy of LSVT on swallowing 8 patients underwent LSVT with VFG (oral and pharyngeal transit time, vallecular residue) pre/post treatment, and voice recordings pre/post.

Results: 51% reduction in swallowing abnormalities post-treatment (due to improved motor control/retraction and strength).

- Significantly reduced oral and pharyngeal transit times for all volumes and consistencies
- Reduced oral residue after swallowing for all consistencies and volumes
- Improved oro-pharyngeal swallowing efficacy (OPSE) for all consistencies except cake
- Larger bolus volume had a positive effect on swallow reflex (greater volume, faster reflex)

No previous validation studies existed (as of 2002).

PD involves multiple swallowing disorders (no evidence of cricopharyngeal muscle problems). LSVT activates the neuromuscular control system of the aerodigestive tract, increasing anterior and posterior tongue functionality during oral and pharyngeal phases. This is a reflex of increased phonatory effort and awareness of the vocal tract. LSVT (PET on voluntary swallowing) activates primary sensorimotor areas (laryngeal and pharyngeal representation), right anterior insula (phylogenetically older communication system). This area changes most with LSVT.

Exercises to improve tongue, lip, and laryngeal elevation range of motion:

- Forceful swallowing and Mendelsohn maneuver
- Forceful exhalation and falsetto
- Daily for 10–12 minutes

Rehabilitation Activities Must be Diversified for on and Off Phases

Proper implementation of the treatment plan requires distinguishing disabling impairments based on their timing (disease stage), to better plan therapeutic administration and reduce disability.

The treatment plan should follow clinical best practice guidelines and scientifically validated treatments, ensuring interventions are effective, efficient, equitable, and appropriate (resource rationalization).

Motor, Perceptual, Speech, Cognitive, Respiratory, Cardiovascular, Swallowing, And Psychological Rehabilitation... And The Family?

Health education courses for families and caregivers provide practical and daily relief and information. The rehabilitation project and program are compiled by the team after initial functional assessments and shared with the patient, family, and caregiver. The process is goal-oriented with set timelines, outcome verification, and reformulation of subsequent treatment objectives. Periodic meetings of the team with family members and caregiver are scheduled.

The correct implementation of the treatment plan requires the distinction of disabling impairments based on the time of onset (disease phase), to better plan the therapeutic administration over time and reduce the disability.

- The treatment plan must be proposed following scientifically validated good clinical practice and treatment guidelines, to propose treatments that, in addition to being effective and efficient, are fair and appropriate (rationalization of resources).

COGNITIVE AND BEHAVIORAL DISORDERS

They will be assessed by the neuropsychologist. A preliminary careful study of all cognitive domains is necessary with a general informal qualitative assessment and a standardized assessment with psychometric tests and batteries for a quantitative assessment of the deficit also in order to exclude signs and symptoms of cortico-basal degeneration and dementia.

Cognitive neurostimulation will be conducted by the cognitive rehabilitation specialist, with cognitive stimulations that invest the main domains involved in the deficit, also with repeated daily sessions, in the presence of visuospatial deficits, divided and sustained attention and with multitasking tasks.

Hemispheric cortical activation tools are used with mindlenses technology that exploits the prismatic deviation of the gaze and adaptation for the purposes of activation and smart games to train the mind.

Other methods of neuromodulation and non-invasive brain stimulation can also be used, such as tDCS and TMS.

These NIBS methods are useful for enhancing specific cortical activities that are selectively slowed or compromised by the disease.

Bradypsychism and ideomotor slowing negatively affect social and family relationships, increasing the sense of frustration that can lead to depression.

CONCLUSIONS

Speech therapy and neuropsychological rehabilitation are an integral part of a multidisciplinary rehabilitation approach in Parkinson's disease, just like neuromotor and occupational rehabilitation.

An integrated vision, centered on the person and the different aspects of their disability, allows for a more effective recovery and a longer maintenance of autonomy.

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