

Guidelines for Speech-Language Therapy in Parkinson's Disease

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Preface to the English translation

The English version of this guideline is a direct translation of the complete Dutch text published in 2008 (see copyright & credits), except for a few minor corrections and adaptations to increase comprehension.

The guideline has been developed in accordance with international standards for guideline development. In addition to internationally published evidence and expert opinion, the expert opinion of the Dutch guideline working group has been used for development of the recommendations. Accordingly, the specific vision and context of speech-language therapy in the Netherlands may emerge in the choice of key questions, in the reference to Dutch handbooks and under “other considerations” (e.g. concerning the organization of healthcare or the availability of resources, and training of therapists). The user of this guideline should bear in mind that this context may differ from the context in other countries. Nevertheless, we believe that this guideline is the first to describe best practice in speech-language therapy in Parkinson’s disease rehabilitation, according to international standards of guideline development and covering both assessments and interventions.

Preface

With justifiable pride, we recommend this guideline to you.

The fact is that this is not just any guideline. It is an evidence-based guideline for speech-language therapy. What's more, it has a "twin" in occupational therapy. As far as we know, it is unique for two monodisciplinary evidence-based guidelines in allied health professions to come out at the same time: *Occupational Therapy in Parkinson's Disease* and *Speech and Language Therapy in Parkinson's Disease*, guidelines from the Dutch Association of Occupational Therapy (*Ergotherapie Nederland*) and the Dutch Association of Logopedics and Phoniatics (*Nederlandse Vereniging voor Logopedie en Foniatrie; NVLF*). These guidelines were developed simultaneously and in close collaboration.

The primary aim of developing a guideline is to guarantee the level of care and, where possible, to improve it by making it more efficient and effective. By effective, we mean safer, more acceptable to both the person providing treatment and the client; and more applicable and practicable. In other words, guidelines are necessary and useful because they create standards for the content, provision and organization of care.

A new guideline is an important innovation because it bundles the best available scientific evidence. It is innovative in the sense that the evidence is viewed from a practical perspective. A guideline provides professionals with valuable recommendations about good and proper care. A practical guideline describes the care content from the available scientific evidence and incorporates the experiences of therapists and clients. The provision of care is, after all, based on a partnership between the client and therapist. Moreover, it is aimed at participation and is thus context-oriented. But this guideline offers even more than this. The group of researchers and professionals from Nijmegen collaborated intensively on these guidelines. Not only does the correlation between the guidelines and the *Parkinson's Disease Guideline of the Royal Dutch Society for Physical Therapy (KNGF)* from 2004 provide a solid foundation for monodisciplinary treatment, it also facilitates the collaboration between the various allied health disciplines. It is precisely this collaboration that is a critical factor of success for the provision of good care in which the needs of the client are served. Integrated care plays an increasingly important role in how the quality of care is experienced.

As Cervante's character, Don Quixote, said in 1605, "the proof of the pudding is in the eating." This guideline's value will have to be proven in practice. Before that happens – before speech-language pathologists actually begin to apply the guideline in practice – an implementation process will have to be completed. This is an important task for the professional associations.

To our great satisfaction, steps have already been taken to evaluate the use of the guidelines through scientific study. This will make it possible to determine the extent of the application of the guidelines in detail and, for example, to study the relationships between the application of the guidelines and the outcome of the care.

We would like to pay our compliments to the following individuals in this classic example of strengthening care - its content, provision and organization - through collaboration!

Dr. Chris Kuiper, Scientific director
The Dutch Association of Occupational Therapy (Ergotherapie Nederland)

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PART I

Introduction and summary

Speech-language pathology in Parkinson's disease

This is Part I, an introduction to and summary of the “Guideline for speech-language pathology in Parkinson's Disease” from the Dutch Association of Logopedics and Phoniatics (NVLf), which can be read separately from the guideline itself. Part II of the guideline consists of the full justification, the backgrounds to the recommendations and the appendices.

Part I consists of three sections: (1) the speech-language pathology domains in Parkinson's disease (PD), (2) patient management and (3) a summary of all key questions and recommendations.

1. Speech-language pathology domains in Parkinson's disease

With respect to Parkinson's disease, speech-language pathology focuses on three domains:

- difficulty with speech: hypokinetic dysarthria and the influence of cognitive impairments on language comprehension, language use and communication skills
- difficulty with chewing and swallowing: dysphagia, choking and slow chewing and swallowing
- difficulty with controlling saliva: drooling or dribbling of saliva

For the rehabilitation of persons with Parkinson's disease (PwP), Morris & Iansek (1) have described a theoretical model which has been met with positive experiences in large Parkinson's centers abroad. This model consists of the following five basic assumptions (p. 12):

1. “Normal movement is possible in Parkinson's disease; what is required is appropriate activation. The skilled therapist is able to determine the most effective methods to activate normal movement.
2. Complex movements need to be broken down into smaller components. This is to avoid motor instability and to take advantage of increased amplitude at the beginning of movement sequences.
3. Each component of a task needs to be performed at a conscious level. Conscious attention appears to bypass the basal ganglia and restore movement towards normal.
4. External cues may be used to initiate and maintain movement and cognitive processes. Visual, auditory or proprioceptive cues may be used. Cues indicate the appropriate movement size and appear to activate attentional motor control mechanisms.
5. Simultaneous motor or cognitive tasks are to be avoided. This is because the more automatic task is not executed properly and only the task demanding attention is satisfactorily completed.”

These assumptions are also relevant in speech-language treatment (2).

Evaluation and treatment of limitations in speech

Subtle changes in a patient's speech and cognition can have a large impact on the degree to which the patient feels comfortable with speaking (already early in the disease) (3). This underscores the importance of early referral and timely attention from a speech-language pathologist (SLP).

The current speech-language treatment techniques related to hypokinetic dysarthria focus on an intensive stimulation of the intensity of the speech, over a period of at least four weeks. This kind of approach is specific for PD, because it puts demands on the – to a certain extent – normal motor skills by activating and stimulating them with cues. Various studies (4) have shown the value of this approach for patients with Parkinson's disease.

PwPs vary significantly with respect to the severity of the disease, physical and cognitive capacity, dysarthric features and expectations regarding verbal communication. This means that the treatment to improve intelligibility can range from a one-time consultation with recommendations to intensive treatment of at least three sessions per week over the course of at least four weeks, to periodic consultations with a focus on supervising and instruction of caregivers (conversational partners). The treatment of communication disorders resulting from cognitive deterioration and language impairments is limited to recommendations and specific modifications. A physician, referring a patient with PD may expect that an SLP with experience in PD is capable of evaluating whether, and in what way, treatment is worthwhile and carrying out this treatment.

Evaluation and treatment of limitations to swallowing

Choking, slowness of chewing and other typical swallowing problems in PD can be worrisome and a burden to the patient and his caregivers (5). After an efficient assessment, SLPs who have experience with the treatment of dysphagia related to PD are capable of providing adequate exercises, modifications, cues and movement strategies. The treatment that follows will generally consist of a one-time session or a short treatment period, if necessary in the domestic setting.

Evaluation and treatment of limitations in saliva control

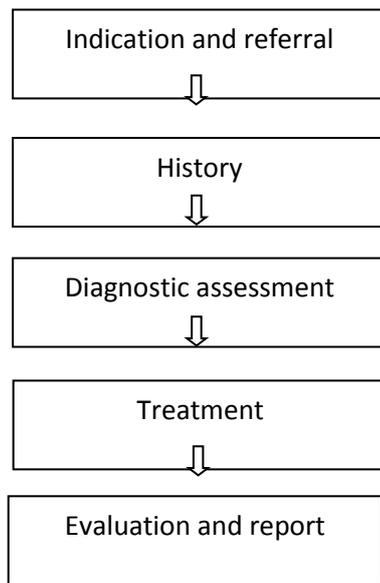
Drooling is an unpleasant problem that appears primarily in the later phases of the disease. SLPs experienced in the treatment of drooling can determine the severity of the problem and to what extent it can be treated. Treatment generally consists of either one-time recommendations or a short treatment period, when needed in the domestic setting. If speech-language therapy is ineffective, the SLP will refer the PwP back to the neurologist for medical treatment (e.g. injections with botulinum-neurotoxin).

2. Patient management

The patient management in speech-language therapy is described in the Speech-Language Pathology Standards (*Logopedische Standaarden*) for the various fields in which the speech-language pathologist can work (NVLF, 1996).

The key questions and recommendations of the guideline generally follow these steps in patient management (see Fig. 1):

Figure 1. The phases of patient management



In 2009 a multidisciplinary guideline for the assessment and treatment of PD (*Multidisciplinaire richtlijn voor diagnostiek en behandeling van de ziekte van Parkinson*) was published under the direction of the Dutch Institute for Healthcare Improvement (CBO) (6). Among other things, this guideline describes the indication for the various disciplines in PD and agreements on the reporting between the referrer and the health professionals. For this reason, the recommendations regarding the indication for speech-language treatment in PD and the reporting between the referrer and the SLP have been included in this guideline (according to the structure of the recommendations, see Part II, Chapter 1).

Question 1

What are the indications for referral to a speech-language pathologist?

Other considerations

The draft of the PD-guideline (*Logopedie bij de ziekte van Parkinson*) from the Dutch Association of Logopedics and Phoniatics (NVL) was followed in formulating this recommendation.

Recommendation 1

Indications for referral to a speech-language pathologist are:

1. The presence of limitations in speech or communication.
2. The presence of limitations in swallowing (with drooling as a possible result) or problems with eating/drinking due to dysphagia (with aspiration pneumonia or weight loss as a possible result).
3. The need for advice and the use of aids to facilitate communication.

Question 2

What are the conditions for working agreements between the health professionals involved? The multidisciplinary guideline includes recommendations on the manner of reporting, meaning which information the SLP may expect from the referrer and which information does the referrer like to receive back from an SLP in a treatment report or letter.

Other considerations

To guarantee optimal continuity of care, good working agreements between the health professionals involved are essential, in which the PD nurse or care coordinator plays a key role.

Recommendation 2a

The letter of referral to a health professional involved in the indication should at least contain: (a) the medical case history, (b) the comorbidity, (c) the current medication and, preferably, the previously used medication (including the reasons for discontinuation), (d) the assessment conclusion and (e) the nature of the referral (a one-time advisory consultation or the initiation of an intervention).

Recommendation 2b

The health professional to which the patient has been referred reports to the referrer (and to the PD nurse) when the treatment is completed. If a treatment spans a longer period, the health professional will also make interim reports (at least once per year). In the report, the health professional will state at least the implemented intervention(s), the treatment period and frequency, the effect and the expected prognosis. If possible, the intervention results should be supported by values derived from measuring tools used. The significance of these values should be succinctly – but clearly – described. If a monodisciplinary guideline is available, the reporting and the selection of measuring tools should be in accordance with this guideline. When psychosocial problems and/or fluctuations in response to medication are observed, this is reported to the PD nurse or care coordinator.

Below, for each area, the guideline provides recommendations on speech and language pathology assessment and the intervention options offered by SLPs. The recommendations on the assessment include relevant questions for case history interview, measuring tools, severity indicators, standardized observations and instrumental assessment. Recommendations on the intervention describe the various methods and techniques, the intervention frequency and the role of the caregiver. The following is a summary of all key questions and recommendations.

3. Overview of the recommendations

This guideline consists of a total of 40 key questions and 60 recommendations. The following is an overview of the key questions and recommendations:

- Evaluation speech and communication (Part II, Section 3.1)
- Treatment of dysarthria and communication problems (Part II, Section 3.2)

- Evaluation of chewing and swallowing (Part II, Section 4.1)
- Treatment of oropharyngeal dysphagia (Part II, Section 4.2)
- Evaluation of saliva control (Part II, Section 5.1)
- Treatment of drooling (Part II, Section 5.2)

Evaluation of speech and communication

Question 3

In reviewing a PwP's history with respect to speech problems, what must at least be addressed?

Recommendation 3a

While reviewing a patient's history of speech problems, the speech-language pathologist should:

- a. inquire about problems at the function level, activity level and participation level
- b. inquire about problems both with respect to speech (voice, intelligibility) and communication skills (e.g. finding words, starting a conversation)
- c. inquire about the problems and experiences of the patient as well as the experiences of the conversational partner and/or caregivers.

Recommendation 3b

The speech-language pathologist should consider having a PwP complete a standardized questionnaire before the first session.

Question 4

What is the best way to quantify the severity of the speech problems?

Recommendation 4

The SLP should consider rating the severity of the effects of the dysarthria on the intelligibility and communicative effectiveness according to the Dutch version of the intelligibility subscale of the Therapy Outcomes Measures (TOM).

Question 5

What is specific to the dysarthria evaluation in PwPs?

Recommendation 5

It is recommended to limit the clinical dysarthria evaluation of patients with Parkinson's disease to:

- a. an evaluation of spontaneous or unstimulated speech and
- b. an evaluation of the stimulability of the various speech features by using maximum performance tests.

Question 6

What is the best way to evaluate spontaneous speech in a PwP?

Recommendation 6

It is recommended to evaluate the spontaneous speech of a PwP by assessing common speech features, such as breathing, phonation, articulation, resonance and prosody. In the interpretation, it is important to know whether the patient has been observed during an *on* period or an *off* period.

Question 7

What is the best way to quantify the severity of a hypokinetic dysarthria?

Recommendation 7

The SLP can consider rating the severity of the dysarthria with the Dutch version of the dysarthria subscale of the Therapy Outcomes Measures (TOM).

Question 8

What is the best way to evaluate the stimulability of speech in a PwP?

Recommendation 8

It is strongly recommended to use one or more of the following maximum performance tests to evaluate the stimulability of the intensity and quality of the speech of a Parkinson's patient:

- 'automatic' speech tasks
- maximum phonation time
- pitch range and calling

In the interpretation, it is important to know whether the patient has been observed during an *on* period or an *off* period.

Question 9

Which audiovisual registrations are important for PwPs with speech problems?

Recommendation 9a

It is recommended to make an audio or video recording of the spontaneous speech for each PwP in order to record the initial situation and to give the patients feedback regarding their intelligibility.

Recommendation 9b

It is recommended to record the intensity of the spontaneous speech with a dB meter during the first session.

Question 10

When is it important for PwPs with voice complaints to be examined by an otolaryngologist?

Recommendation 10

It is recommended that the SLP should propose a laryngoscopic examination by an otolaryngologist for a PwP with a hypokinetic dysarthria only when vocal fold pathology is suspected which is unrelated to PD.

Question 11

What is the best way to evaluate language impairments and/or communicative problems among PwPs?

Recommendation 11

The SLP should explicitly ask PwPs about difficulty in finding words and participating in conversation. As yet, it is not recommended to administer a formal language test.

Question 12

What are the results of treatment with LSVT and PLVT?

Recommendation 12

It is strongly recommended to administer PLVT or LSVT to PwPs with hypokinetic dysarthria who satisfy the indications for intensive treatment.

Question 13

What is the optimal treatment intensity for PLVT/LSVT?

Recommendation 13a

It is recommended to administer PLVT/LSVT to patients indicated for it with a treatment frequency of at least three times a week for thirty minutes over at least four weeks. A lower treatment frequency is discouraged.

Recommendation 13b

It is also recommended to plan PLVT/LSVT in such a way that it is feasible for both the patient and the SLP to practice for at least four consecutive weeks and that this preferably does not coincide with other allied health interventions, which also demand a lot of time and energy.

Question 14

When is treatment with PLVT/LSVT indicated for a PwP?

Recommendation 14a

Treatment with PLVT/LSVT is advised to be given to PwPs with hypokinetic dysarthria if:

- the voice quality – loudness, clarity and pitch – can be sufficiently stimulated;
- the patient has enough intrinsic motivation to practice intensively, based on the severity of the problem and the expectations of the communicative performance;
- the patient is (cognitively) able enough to learn a new technique;
- the patient has enough energy to practice intensively.

Recommendation 14b

In case of doubt regarding the indication for PLVT/LSVT, it can be worthwhile to first conduct a trial treatment of, for example, a week.

Recommendation 14c

It can also be worthwhile to have the patient practice with the assistance of a caregiver as co-therapist during the treatment period.

Recommendation 14d

It is recommended to schedule a follow-up 6 to 12 months after initial treatment with PLVT/LSVT.

Question 15

What is the best treatment for a PwP when PLVT/LSVT is not indicated?

Recommendation 15

When intensive treatment is not indicated for PwPs, it is recommended to still treat them with PLVT/LSVT techniques but with less intensity. At the same time, the SLP trains the caregivers to take over cueing when necessary.

Question 16

What is the value of other speech-language treatments of hypokinetic dysarthria?

Recommendation 16

In the treatment of PwPs with clear hypokinetic dysarthria there is perhaps no room for general exercises for oral motor skills or articulation.

Question 17

What can be expected from treatment of hypomimia?

Recommendation 17

In considering the use of PLVT/LSVT, it can also be taken into account that this treatment can have a favorable effect on non-verbal communication. Facial massage or the isolated practicing of facial expression in PwPs can be considered to temporarily reduce the rigidity of the facial muscles, but it does not seem worthwhile for improving facial expression.

Question 18

What is the value of group treatment?

Recommendation 18

If circumstances permit it, group treatment can be considered for PwPs with dysarthria and communication problems.

Question 19

In what way should the SLP take the influence of medication into account?

Recommendation 19a

It can be worthwhile to start the speech-language treatment only after the medication has been well regulated.

Recommendation 19b

It is recommended to take the patient's *on* and *off* periods into account during treatment.

Question 20

What is the value of instrumental aids in influencing the intelligibility of PwPs?

Recommendation 20a

When PLVT/LSVT does not sufficiently help to counteract accelerated speech, the use of a pacing board or metronome can be considered.

Recommendation 20b

Only when treatment techniques such as PLVT/LSVT are insufficient in helping to regain an acceptable voice volume *and* when the quality of the articulation permits it, can the use of a portable amplification system be considered.

Question 21

What are the treatment options for communication problems resulting from language impairments in PwPs?

Recommendation 21

The SLP has a task in understanding and identifying compensation strategies for language impairments and communication problems that are not caused by poor intelligibility.

Question 22

What place do communication aids have as a replacement for speech in Parkinson's disease?

Recommendation 22

For PwPs with very severe dysarthrias, but with a useful hand-arm function, it is recommended that the SLP advises and supports the use of AAC.

Question 23

What is the role of the caregiver(s) in the treatment of dysarthria and communication problems?

Recommendation 23

The SLP is advised to actively involve the caregivers in the treatment of the dysarthria and communicative slowness. The caregiver can perform three tasks (roles):

1. co-therapist during intensive PLVT/LSVT;
2. trained conversational partner in intelligibility problems: using cues to facilitate the learned technique for producing more intelligible speech;
3. trained conversational partner in communication (cognitive) problems: assisting during conversations by, for example, repeating questions.

Question 24

What are the best tools for determining the treatment results?

Recommendation 24

It is recommended that the treatment results be determined by:

- objectively evaluating the intensity of spontaneous speech with a dB meter or video recording
- subjectively evaluating the dysarthria and intelligibility during spontaneous speech with the TOM scales
- discussing with the patient and caregivers the extent to which the initial treatment goals have been achieved

Question 25

In reviewing the PwP's history with respect to chewing and swallowing problems, what must at least be addressed?

Recommendation 25a

It is recommended that, when reviewing the patient's history of oropharyngeal dysphagia, the SLP inquires about the specific problems and their progression at the function level (swallowing, slow eating), activity level (avoiding difficult food consistencies) and participation level (eating with others).

Recommendation 25b

The SLP should consider having a PwP complete a standardized questionnaire before the first session.

Question 26

Which swallowing assessment is relevant to PwPs?

Recommendation 26a

For PwPs with swallowing problems, it is recommended that the SLP should :

- a. observe spontaneous drinking
- b. evaluate the stimulability of drinking by using a maximum performance test (maximum swallowing volume and/or swallowing speed)

Recommendation 26b

With respect to problems related to regular feeding, it is recommended that the SLP observe a meal and evaluate the influence of instructions and cues.

Question 27

When should the SLP recommend instrumental assessment for a PwP with swallowing problems?

Recommendation 27

For a PwPs with dysphagia whose characteristic and severity is unclear, the SLP can consider advising a supplementary assessment using VFS or FEES.

Question 28

What are important elements of instruction and education?

Recommendation 28

To increase understanding and motivation, it is recommended to explain the normal process of chewing and swallowing to patients and caregivers and to point out what is their case has going wrong.

Question 29

What are useful techniques for reducing choking on fluids?

Recommendation 29a

For PwPs who have a history of choking but who do not choke during a swallowing evaluation and provocation test, it is recommended:

1. to explain choking as a result of double tasking, and
2. by means of practicing, make them aware of safe swallowing with attention.

The SLP should only consider other interventions after this has not resulted in enough improvement.

Recommendation 29b

For a PwP who easily chokes on fluid, it is recommended that the SLP evaluates whether a chin tuck is an adequate compensation and can be maintained.

Recommendation 29c

For a PwP who easily chokes on fluids, it is recommended that the SLP tries out whether smaller volumes and/or thicker consistencies are sufficient for preventing choking on fluids.

Question 30

What are useful techniques for improving lengthy chewing and slow initiation of swallowing?

Recommendation 30a

The SLP can consider evaluating the result on the initiation of swallowing when activation exercises are performed prior to each meal.

Recommendation 30b

For PwPs who chew too long (hypokinesia) and/or keep food in their mouth without swallowing it (akinesia), it can be useful to see whether the patient can learn to perform the process in conscious steps and by using specific cues.

Recommendation 30c

When it proves difficult to improve lengthy chewing and the initiation of swallowing from a behavioral perspective, it is recommended to advise easier food consistencies.

Question 31

What are useful techniques for reducing pharyngeal residue?

Recommendation 31a

It is recommended for the SLP to teach PwPs with reduced pharyngeal transport to swallow harder in a conscious and consistent manner.

Recommendation 31b

When it proves difficult to improve reduced pharyngeal transport from a behavioral perspective, it is recommended to advise easier food consistencies.

Recommendation 31c

When the SLP advises the patient to modify food consistencies, it is recommended to ask a dietitian to advise the patient on the best way to maintain a wholesome diet.

Question 32

What is the value of LSVT in hypokinetic dysphagia?

Recommendation 32

For PwPs with dysphagia and hypokinetic dysarthria, the SLP can consider to give only the necessary advice and to reevaluate the chewing and swallowing after treatment with PLVT/LSVT.

Question 33

What are useful techniques for facilitating the swallowing of pills?

Recommendation 31

Given the various causes of difficulty with swallowing pills, it is recommended that the SLP comes up with and evaluates appropriate advice, based on individual observation of the patient swallowing pills and on the existing treatment techniques for swallowing disorders.

Question 34

What is the value of multidisciplinary collaboration on dysphagia?

Recommendation 34

In the treatment of dysphagia, it can be useful for the SLP to collaborate with a dietitian, nurse, occupational therapist or physical therapist.

Question 35

What is the role of the caregiver(s) in the treatment of dysphagia?

Recommendation 35

The SLP is advised to actively involve the caregivers in the treatment of dysphagia, especially when the PwP is dependent on external cues.

Question 36

In reviewing a PwP's history with respect to drooling, what must at least be addressed?

Recommendation 36a

In reviewing the patient's history with respect to drooling, it is recommended for the SLP to inquire about complaints at the function level, activity level and participation level. Understanding exactly when drooling occurs can also provide a basis for the treatment.

Recommendation 36b

The SLP should consider having a PwP complete a standardized questionnaire for the first consultation.

Question 37

What is the best way to quantify the severity of drooling?

Recommendation 37

The use of the DSFS-P to quantify the severity of the drooling can be considered.

Question 38

Which contributing factors to drooling can be examined in PwPs?

Recommendation 38

It is recommended to analyze what the treatable causes of the drooling are, such as closing the mouth, adequate swallowing, head and body posture and the extent to which the patient can be instructed and is able to put this instruction into practice and maintain it (if necessary with the help of a caregiver).

Question 39

What is the value of speech-language treatment of drooling?

Recommendation 39a

For PwPs with drooling complaints, it is recommended that the SLP explains the causes of drooling and attempts to positively influence these by providing instructions about swallowing and movement strategies.

Recommendation 39b

Because data are lacking regarding the added value of specific treatment techniques, terminating treatment can be considered when there has been no clear improvement after two or three sessions.

Recommendation 39c

If behavioral treatment produces insufficient results, it is recommended that the SLP refers the PwP back with a report for possible medical treatment.

Question 40

What is the role of the caregiver(s) in the treatment of drooling?

Recommendation 40

The SLP is advised to actively involve the caregivers in preventing drooling, especially when the PwP is dependent on external cues and movement strategies.

Summary card for speech problems (*numbers of the recommendations)

History and dysarthria evaluation (3 – 11)	Possible conclusions	Treatment (12 – 24)*
<p>Inquire (using standardized questionnaires) about complaints related to:</p> <ul style="list-style-type: none"> - voice - intelligibility - difficulty having a conversation <p>Observe spontaneous, unstimulated speech, if necessary using audio/video recording and/or dB meter.</p> <p>Determine the degree of stimulability (through “automatic speech” series or sustaining a vowel).</p> <p>When in doubt about the nature of the dysarthria: oral exam, or diadochokinetic rates.</p>	Minimal hypokinetic dysarthria, without any burden; patients can cue themselves, when necessary, by speaking with more intensity.	Advice during one-time consultation.
	Clear mild to moderate hypokinetic dysarthria; the patient can easily be cued, is motivated, has enough energy and learning ability.	PLVT/LSVT at least three times a week for at least four weeks (if necessary with a co-therapist).
	Moderate to severe hypokinetic dysarthria which can be cued to a certain extent; the patient has little energy and/or has limited learning abilities.	PLVT/LSVT with an emphasis on external cueing for louder speaking; teach conversational partner and/or caregivers to take over and consistently apply the best cue.
	Very severe hypokinetic dysarthria for which treatment is poorly or not effective.	Supervision and instruction of conversational partners, aimed at cueing a partial utterance. If possible (in light of hand motor skills and cognition), provide alternative means of communication.
	Primarily cognitive and word finding problems.	Apply and evaluate compensation strategies with the patient and conversational partner.
	The patient hardly speaks any more, remains silent (apathy).	Explanation, acceptance.

Summary card for swallowing problems (*numbers of the recommendations)

History and swallowing evaluation (25 – 27)*	Possible conclusions	Treatment (28 – 35)*
Inquire (using standardized questionnaires) about complaints related to: <ul style="list-style-type: none"> - choking, difficulty with swallowing - impact on diet and eating with others 	Minor dysphagia, influence of dual tasks, inadequate head posture, etc.	Teach compensation strategies (e.g. posture, volume) and cues to limit or prevent choking and difficulty with swallowing pills, etc.
Observe spontaneous, unstimulated swallowing. If necessary, observe during a meal at home. Determine the degree of stimulability by using, for example, swallowing tests.	Moderate to severe dysphagia, including slow eating and/or aspiration risk.	Modify food consistencies and/or provide more assistance or cues to maintain an acceptable speed and limit fatigue. If needed, consultation with a dietitian and occupational therapist.

Summary card for saliva control problems

History and observation of drooling (36 – 38)*	Possible conclusions	Treatment (39 – 40)*
Inquire (using standardized questionnaires) about complaints related to: <ul style="list-style-type: none"> - severity of drooling and times when drooling occurs 	Only a feeling of accumulating saliva.	Explain the importance of swallowing in time.
Observe the spontaneous, unstimulated saliva control. Determine the degree of stimulability (possible treatable factors).	Historical or observable drooling.	Apply modifications and cues, such as a cue for closing the mouth, swallowing before standing up and so on. When results are insufficient, refer back to the neurologist.

PART II

Explanation and justification

1. General introduction and justification

1.1 Background and motivation

Parkinson's disease is an incurable neurodegenerative disorder, but thanks to advances in medical treatment, the symptoms of the disease can be kept under control for a longer period of time (see also Chapter 2). Nevertheless, it is a progressive disease accompanied with increasingly difficult oral motor problems. These can be grouped under the following three main problems: difficulty with speech (hypokinetic dysarthria with or without slowness in finding words due to cognitive deterioration), swallowing complaints and drooling. Almost forty years ago, the treatment of patients with Parkinson's disease (PwP) with speech-language therapy was "well known to be unproductive" (7). Since then, various forms of useful voice, speech and swallowing treatments have been developed for PwPs which are being discussed in an increasing number of reviews (4, 8, 9). The growing perspective is that PwPs in particular can benefit during all phases of the disease from specific allied health interventions including speech-language treatment (1,10,11).

However, there are indications that the knowledge regarding the treatment of PwPs by speech-language pathologists (SLP) in the Netherlands was less than perfect. A survey-based study (12) conducted among a representative group of SLPs showed that only 14% of PwPs are being treated by a SLP. The same study shows that the majority of SLPs (93%) find themselves lacking the expertise to treat PwPs. A more comprehensive study from 2007 involving 157 SLPs who treat PwPs showed that only 31% find themselves to have enough expertise to adequately treat this patient group (13). This means that PwPs cannot go to an SLP who has specific expertise in treating the speech and language-related effects of this clinical picture. In the Netherlands, the speech-language treatment of dysarthria and dysphagia is less developed and, what's more, inadequately documented in comparison to other SLP domains. In addition to the lack of treatment, there is clearly an undesirable variation in the speech-language pathology care provided for this patient group.

Evidence-based guidelines are "scientifically substantiated, nationally applicable, professional recommendations for optimal care" and aim to (14,15):

- make the flow of scientific information manageable
- enable clinical treatment to be more based on scientific evidence than on experience and opinions only
- reduce undesirable variation in care provided by health professionals
- facilitate transparency, for referrers, patients and those who pay for it.

Guidelines are a way of explaining the best care based on two different sources: scientific evidence and the expertise of specialists in the profession.

Scientific evidence at the highest level can be found in the form of the systematic reviews conducted by the Cochrane Collaboration. So far, three reviews have been published (all in 2001) on speech-language pathology interventions in Parkinson's disease. In two reviews, Deane et al. (16, 17) conclude that the included studies on the effect of dysarthria treatment were of insufficient methodological quality to be able to determine whether speech-language pathology is effective in the treatment of dysarthria in Parkinson's disease. The review of the

speech-language treatment of dysphagia resulted in the same conclusion (18). The substantiation of speech-language interventions in Parkinson's disease is thus based on individual studies.

Despite the lack of solid scientific evidence, guidelines can make a positive contribution to the systematic increase of the quality of care and the decrease of undesirable variation as long as the development of the guideline incorporates the expertise of experienced practitioners and a broad field of professionals supports the outcomes. This thought is strongly supported by positive experiences with the recently developed guideline for physical therapy in Parkinson's disease (19). Moreover, a guideline provides an important base for new scientific research in which the effectiveness of speech-language pathology in Parkinson's disease rehabilitation can be tested. This guideline was developed at the same time as the occupational therapy guideline by order of the Dutch Association of Occupational Therapy (*Ergotherapie Nederland*) (20).

1.2 Aims of the guideline

This guideline is a systematically developed set of recommendations for optimal speech-language treatment for PwPs and their caregivers and is based on the current scientific literature and insights within the profession as of 2008. Its general aims are:

- to improve the quality of the care provided
- to benefit the health of patients
- to increase the efficiency of the care
- to increase the job satisfaction of therapists
- to improve multidisciplinary collaboration

The guideline answers the following overall key questions:

- What are the best and most useful assessment techniques in the areas of speech, swallowing and saliva control related to PD?
- What are the best techniques for treating dysarthria, dysphagia and drooling in PD, including an indication for starting, stopping, frequency and duration of treatment?

In this guideline, it was not yet possible to formulate key questions in more detail beforehand, because a broad discussion had not previously been held on worthwhile speech-language treatment involving PD. This will, however, be possible in the revision of the guideline.

1.3 Target group

The guideline makes recommendations on the speech-language assessment and treatment of patients with PD, living at home or in a care institution, as well as their caregivers.

The guideline does not apply to atypical parkinsonisms, such as Multiple System Atrophy (MSA), Progressive Supranuclear Palsy (PSP), vascular parkinsonism or Dementia with Lewy Bodies (DLB). The guideline mentions specifications for the various parkinsonisms only where necessary.

1.4 Intended users

This guideline of the Dutch Association of Logopedics and Phoniatics (NVLf) is intended for SLPs who treat PwPs in primary, secondary and tertiary care. However, the guideline is not a manual and accordingly, does not serve as a replacement for study manuals, courses or training programs. With the same restriction, the guideline is an important basic document for students of speech-language pathology.

The guideline is also informative for physicians, such as neurologists, specialists in rehabilitation medicine, geriatricians, specialist physicians in nursing homes and general practitioners, who refer PwPs to SLPs and for other health professionals who collaborate with SLPs.

1.5 Quality requirements

The guideline must satisfy the following quality requirements:

- The recommendations are developed in accordance with the current situation in evidence-based guideline development (EBRO), as formulated by the Dutch Institute for Healthcare Improvement (CBO) (14).
- It meets the criteria of the AGREE instrument (21).
- It is clearly formulated and feasible for the intended users.

1.6 Patient's perspective

The patient's perspective is included in the guideline by taking relevant literature into account, which addresses the patient's perspective. A panel of patients and caregivers from the Dutch Parkinson Association (*Parkinson Vereniging*) has also evaluated the draft of the guideline from their perspective. One of the most important outcomes of the discussion was that at the end of each chapter a separate recommendation has been formulated regarding the contribution of the caregiver.

1.7 Primary contributors to the guideline

The initiative for developing and implementing a national guideline for speech-language pathology came from the Parkinson Centrum Nijmegen (ParC). The project leaders are Prof. B.R. Bloem, medical director of ParC, and Dr. M. Munneke, scientific director of ParC. Together with J.G. Kalf, SLP and clinical researcher, who was responsible for finding the scientific evidence as well as the actual development and final editing of the guideline and B.J.M. de Swart, speech-language pathologist and lecturer in Neurorehabilitation at the HAN University of Applied Sciences, they comprised the project group, which was responsible for the final version of the guideline and all publications related to the guideline.

The guideline was developed under the auspices of the Dutch Association of Logopedics and Phoniatics (NVLf). This means that the NVLF is the commissioning party and the owner of the guideline. The drafts of the guideline were written in collaboration with a primary working group of five content experts (see Appendix 1). The members of the project group and the primary working group were joint authors of the guideline. In putting together the primary working group, an attempt was made to appoint representatives of various settings and regions. The development of the guideline was supervised by a steering committee consisting of representatives from the Dutch Parkinson Association, the

universities of professional education with a speech-language pathology program and the NVLF (see Appendix 1).

All members of the project group, the primary working group and the steering committee have declared to have no conflicts of interests in developing the guideline.

1.8 Methodology

The guideline development consisted of the following phases.

Identifying clinical questions

In December 2006, the executive researcher proposed the areas of attention for speech-language pathology in Parkinson's disease and, based on this, a division of chapters. For each chapter, a list of questions regarding assessment and treatment was drawn up. Together with the proposed methodology, this list formed the guideline proposal that was established with the primary working group.

Developing the guideline

The executive researcher systematically searched the scientific literature to find all relevant evidence and the first draft guideline was written based on this evidence. In cases where no evidence was available, the executive researcher proposed recommendations based on published expert opinions. The working group members brought in their knowledge and experience in order to come to a consensus regarding the formulation of the texts and the recommendations. In response to feedback and discussion, the researcher modified the draft guideline again and again (in versions A1, A2, etc.) until draft B was ready in the summer of 2007.

Feedback rounds

Draft B was submitted to the secondary working group, which consisted of 15 SLPs spread out across the country and in various fields, other health professionals and a group of patients and caregivers (from the PPV). All experts (see Appendix 1) were asked to evaluate the guideline for relevance, completeness and usefulness from the perspective of the group they represent. The researcher then incorporated all responses into a revised version of the guideline into draft C.

Testing the guideline (field-testing)

Draft C served as the guide for the ParkinsonNet training, which was given to 59 SLPs, in 16 regions in the Netherlands in September 2007. These tested the guideline for readability and usefulness. Their comments were incorporated into the guideline and concept version D was used in April and May 2008 for the training group of 55 SLPs in the southern regions of the Netherlands (Zeeland, Brabant and Limburg). All, apart from those who had not yet treated enough PwPs, were satisfied with the guideline's content, readability and applicability. Following a final discussion with the primary working group in July 2008, the provisional guideline was decided.

Approving the guideline

In August 2008 the provisional guideline was submitted to the NVLF for approval. Following approval, the definitive guideline is published on the NVLF website.

1.9 Scientific base

The guideline texts are structured according to the following format (14):

Question

The key question and the background or relevance of the question.

Literature review

A summary of the literature and a description of the best evidence.

Conclusion(s)

The conclusion based on the above scientific evidence with the level of evidence and a listing of classified studies (see Tables 1.1 and 1.2).

Other considerations

Descriptions of other aspects for which there is no evidence, but which are relevant for the selection for a particular diagnostic or therapeutic intervention. Examples include costs, availability of adaptations and the patient's perspective, professional perspective or legal perspective. The section also includes opinions and proposals from the working group with respect to assessment and treatment.

Recommendations

This is where everything is tied together in clearly formulated strong, moderately strong or weak recommendations. The strength of the recommendations is determined based on a weighing of both the scientific evidence and other considerations (see Table 1.3).

Table 1.1 Levels of evidence

	Intervention	Evaluation of assessment precision	Harm, side effects, etiology, prognosis
A1	Systematic review of at least two independently conducted A2 level studies		
A2	Randomized(double-blind) controlled clinical trial of sufficient quality	Study comparing an index test with a reference test with predefined cut-off values and an independent evaluation of the results of the index test and the reference test, involving a sufficiently large series of successive patients who have all undergone the index and reference test.	Prospective cohort study of sufficient size and follow-up, in which confounding has been adequately controlled and selective follow-up has been sufficiently excluded.
B	Comparative study, but not with all the characteristics listed under A2 (including case- control study and cohort study)	Study comparing an index test to a reference test, but not with all the characteristics listed under A2	Prospective cohort study, but not with all the characteristics listed under A2 or retrospective cohort study or case-control study
C	Non-comparative study		
D	Expert opinion		

Note: There is no classification of evidential value for clinimetric study on the reliability and validity of rating scales or questionnaires. Thus, such studies cannot be classified in the guideline. They are therefore listed under Level C and are not included in the evidence tables.

Table 1.2 Conclusions on levels of evidence

	Level of evidence	Description of conclusion and advice
1	Supported by at least one SR at Level A1 or at least two independently conducted studies at Level A2	It is has been demonstrated that... <i>or</i> One needs to....
2	Supported by at least two independently conducted studies at Level B	It is likely that... <i>or</i> One should....
3	Supported by one study at Level A2 or B or by studies at Level C	There are indications that... <i>or</i> One can....
4	Based on the opinion of experts, such as members of the working group	Experts believe that ...

Table 1.3 Strength of the recommendations

Strength of the recommendation	Preferred phrasing in the formulation
Strong	<i>Positive recommendation:</i> Strongly recommended/should/must/is the first choice/has been indicated/is required/is the standard <i>Negative recommendation:</i> Strongly advised against/should not/must not/is not an option/is contraindicated
Moderately strong	<i>Positive recommendation:</i> Recommended/advisable/preferable/aspires to/deserves recommendation <i>Negative recommendation:</i> Not recommended/is discouraged/does not deserve recommendation
Weak	<i>Positive recommendation:</i> To be considered/is an option/can/there is possibly room/can be worthwhile <i>Negative recommendation:</i> There is perhaps no room/it does not seem worthwhile/restraint is called for
None	No advice or recommendation can be given/not possible to make a choice/no preference can be stated

1.10 Sources and search criteria

Various search strategies were used with the databases PubMed, Cinahl and Doonline. References were used to search for other potentially useful articles. Volumes of *Logopedie en Foniatrie* from 2000 to present were manually searched. In addition, members of the

project group and the primary working group searched for relevant gray literature (course folders, study manuals and dissertations) in their personal files.

For the domain of speech, the following search strategy was used and stored: [("Parkinson Disease"[MESH] OR "Parkinsonian Disorders"[MESH]) AND (Voice Therapy OR "Speech Therapy"[MESH] OR "Rehabilitation of Speech and Language Disorders"[MESH])].

Automatic weekly updates from the search request through June 2008 generated a few specifications but no new evidence that impacted the recommendations. Supplementary search strategies turned out to be necessary to find substantiation for assessment techniques, particularly in the areas of dysarthria and voice disorders. For treatment techniques, separate searches had to be performed for studies on communication aids.

For the domain of swallowing, the following search strategy was used and stored: [("Parkinson Disease"[MESH] OR "Parkinsonian Disorders"[MESH]) AND ("Deglutition Disorders" [MESH] OR "dysphagia")]. The weekly updates generated two new relevant studies for Section 4.2 on treatment. For assessment and treatment, a secondary search was made in more general literature on dysphagia.

For the domain of saliva control, the following search strategy was used and stored: [("Parkinson Disease"[MESH] OR "Parkinsonian Disorders"[MESH]) AND ("drooling" OR "sialorrhea")]. The weekly updates did not generate any new insights.

Since speech-language pathology search terms are not well-indexed in biomedical databases, it cannot be ruled out that relevant studies have been missed – despite the meticulous searches.

Initially, only comparative studies which address clinimetrics and the effect of treatment in the intended areas *and* which apply to patients with Parkinson's disease were selected and evaluated (see evidence tables). Where evidence was lacking, non-comparative studies were also included or as-of-yet unpublished Dutch material was used. As such, it was decided -- for lack of an alternative -- to include the recently developed speech-language therapy questionnaires from the Parkinson Centrum Nijmegen in a few appendices. The scientific evaluation of these questionnaires is underway. A short overview of the areas in which evidence was lacking has been included in Appendix 12.

1.11 Dissemination and implementation

The guideline will be able to be ordered from the NVLF or downloaded from the NVLF website (www.nvlf.nl). The NVLF will see to publication of the guideline among its members, external contacts and the general public.

A summary of the guideline and an article about its development will be published by the project group in the September 2008 issue of *Logopedie en Foniatrie*. The project group will also publish articles in medical journals and international journals about the importance of the guideline for referrers. The guideline has also been definitively included in the training course material for ParkinsonNet speech-language pathologists.

Further implementation is not included in the process of guideline development.

1.12 Legal significance

Guidelines are not statutory regulations, but rather insights and recommendations based on as much evidence as possible, that health professionals need to follow in order to provide high quality care (15). Since the recommendations are based on symptoms seen in the average PwP, health professionals can deviate from the guideline according to their professional autonomy. This depends on the weight of the particular recommendation. Deviating from guidelines may even be necessary if the patient's situation calls for it.

1.13 Procedure for revising the guideline

According to the method for guideline development and implementation, guidelines should be revised within three to five years following publication. This means that in 2013 by the latest, the NVLF, in collaboration with the working group members, will determine whether the guideline is still up-to-date. If necessary, a new working group will be assembled to evaluate the guideline and update it according to the best evidence available at the time. The validity of the guideline will lapse if new developments lead to the initiation of a revision process.

1.14 External financial support

The development of the guideline was made possible in part by financial support from the Nuts/Ohra foundation and the Dutch Parkinson Association. The potential interests of these organizations did not influence the contents of the guideline.

1.15 Word of thanks

The project group would like to thank all members of the secondary working group and the panel of patients and caregivers for their valuable and indispensable contribution to the development of this guideline. We would also like to thank Charlotte Haaxma, neurologist in training at UMC St Radboud, for her contribution to Chapter 2 and Viola van der Voorden, master's student in speech-language pathology at the Radboud University Nijmegen, for her contribution to the evidence tables in Chapter 3.

A special word of thanks goes to the Dutch Parkinson Association and the Nuts/Ohra foundation for their financial support in the development of this guideline.

1.16 Structure and summary

After this introductory chapter, Chapter 2 provides background information about Parkinson's disease and the medical and allied health treatment options. (This chapter largely corresponds with Chapter 2 of the occupational therapy guideline).

Chapters 3, 4 and 5 comprise the body of the guideline and describe the assessment and treatment of speech and language disorders, oropharyngeal dysphagia and drooling. Measuring tools and evidence tables are listed in the appendices.

2. Parkinson's disease

This chapter describes the most important features of Parkinson's disease and is important as background information for the speech-language pathologist.

2.1 Pathogenesis

Parkinson's disease is a chronically progressive cerebral disorder with the primary feature being the loss of dopamine-producing cells in the substantia nigra (situated high in the brainstem; part of the basal ganglia) (22). This results in a lack of dopamine, which reduces the stimulating function of the basal ganglia on the motor cortex. Cells and functions of various other non-dopaminergic neural circuits can also be affected, which leads to non-motor impairments. The cells which remain contain distinctive pink-colored inclusion bodies, the so-called Lewy bodies (22). The cause of Parkinson's disease is unknown. Recent findings point to the influence of a combination of environmental and genetic factors (22). The familiar physical symptoms of Parkinson's disease appear when the dopaminergic neurons have been reduced to approximately 20% of their original number (22).

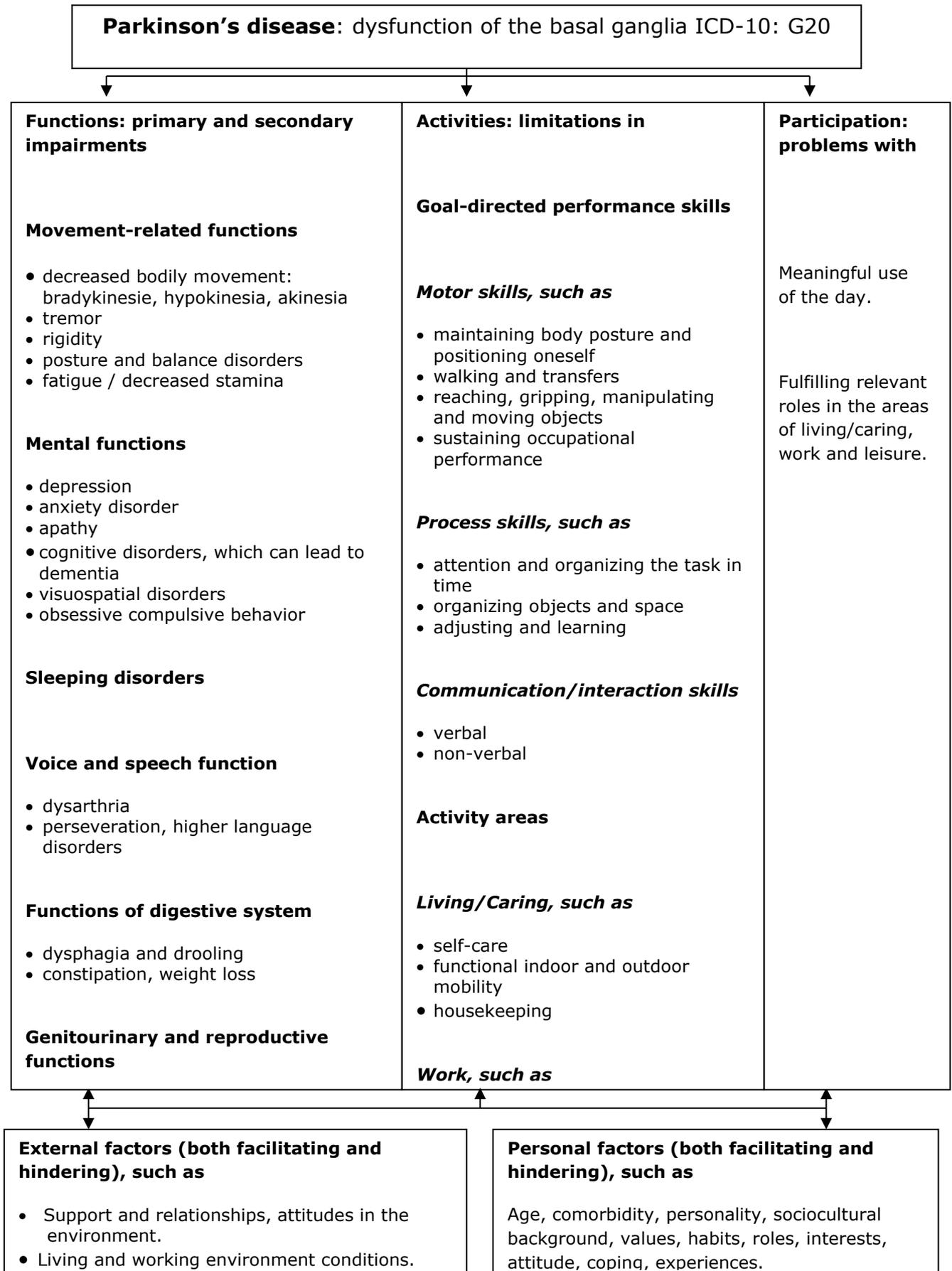
2.2 Epidemiology

After Alzheimer's disease, Parkinson's disease is the most common neurodegenerative disorder. It has a prevalence of approximately 0.3% in the overall population and approximately 1% in the population over the age of 60 (22). The incidence increases with age. The average age at which the disease emerges is 60-65, though in 5-10% of the patients the first symptoms appear prior to the age of 50 (22). As the population of the Netherlands continues to age, it is expected that the number of patients with Parkinson's disease will rise significantly and double over the next 20 years. In the Netherlands, the total number of individuals with Parkinson's disease is estimated to be 50,000.

2.3 Consequences of Parkinson's disease

Based on the World Health Organization's *International Classification of Functioning* (ICF) model, Figure 2.1 provides an overview of the health problems which are related to Parkinson's disease and the factors which can influence these problems. The impairments have been classified according to the terminology of the ICF. Impairments in functions can occur as a result of Parkinson's disease itself, but also as a result of taking medicine, or inactivity. Whether an individual experiences problems in activities and participation does not only depend on the presence and severity of the disorders in functions; it also depends on personal and external factors (see ICF model).

Figure 2.1



2.3.1 Impairments in functions

The following is an explanation of some of the impairments, which can appear in Parkinson's disease. This includes impairments in movement-related functions, mental functions and impairments in speech and swallowing.

Movement-related impairments

Characteristic motor symptoms of PD are bradykinesia, hypokinesia, rigidity, tremor and disturbed posture reflexes (23).

The term *bradykinesia* is used when movements occur more slowly and with a smaller range of motion. With repetitive movements, the range of motion becomes increasingly smaller ("extinction"). Bradykinesia is particularly noticeable in quick, repetitive movements, such as shaking, knocking and brushing. There is also a disturbance in the timing of various movement components in a composite movement, such as a reach-to-grasp movement (24;25).

Hypokinesia means that the patient makes fewer *automatic* movements. Characteristic examples of this are a decreased arm swing while walking and decreased facial expression or hypomimia (which results in a "mask facies").

Akinesia is when movements can suddenly no longer be initiated or continued – so-called "freezing." This symptom occurs mainly in conjunction with a series of successive automatic movements, such as walking, talking and writing.

With *rigidity*, there is an increase in muscle tone caused by a disorder of the extrapyramidal system (in contrast to spasticity, in which there is increased muscular tension resulting from a pyramidal tract disorder). Rigidity can be observed in the passive movement of an arm, leg or the head. The increased muscle tone may then feel like the so-called "lead pipe" phenomenon, in which the entire range of motion is rigid. *Dystonia* is a sustained muscle contraction in which the joint assumes an abnormal position. In Parkinson's disease, it appears primarily in the hands and feet (26).

The *tremor* associated with Parkinson's disease is generally a distal resting tremor (4-6 Herz) involving the thumb (and is thus called the "pill-rolling" or "money-counting" tremor) which disappears or diminishes when a movement is initiated. The tremor can return when the individual assumes a fixed position (e.g. keeping an arm extended). Sometimes, a tremor is observed – particularly among younger PwPs – which occurs over the entire track of a voluntary movement. This is known of as an "action" tremor.

PwPs eventually encounter problems related to *posture* and *balance*. Posture and balance disorders, which can appear at a relatively early stage, include a stooped posture, a decreased arm swing and decreased rotation in the trunk. Postural instability and falling are later phenomena (26).

The disease is also often accompanied by *reduced stamina* as well as mental and physical *fatigue*, both of which can appear separately (27-30). The cause of fatigue is not yet well understood, but it is likely that a role is played by multiple factors, such as physical

components, depression, dyspnea and sleeping disorders. However, research has shown that the fatigue experienced is relatively unrelated to the degree of motor problems and that the complaint of fatigue also appears in patients not suffering from depression (31). Fatigue can vary during the day and often increases as the day progresses. In addition, it is partly dependent on the effect of the medicine (see response fluctuations in Section 2.5.3).

Impairments in mental functions

Cognitive deterioration is a known problem in PD, which manifests itself particularly during the later stages of the disease. In the early stages of the disease, a neuropsychological exam can already detect disturbances in memory, concentration and executive functions (32).

A commonly occurring problem in PD is decreased flexibility in changing the focus of attention (problems with alternating and divided attention) (33). It is also more difficult for patients to filter non-relevant auditive and visual stimuli (selective attention) and their ability to concentrate can fluctuate (sustained attention) (34). The processing of information can also begin to slow down (bradyphrenia) and memory functions can change. There is not so much a disturbance in the holding of information, but rather a disturbance in the spontaneous retrieval of that information from memory (35;36). Executive functions can worsen, causing problems related to organization, planning and problem-solving ability (37). Patients with PD have an increased risk of developing dementia (38).

In addition to problems in well-being and mood during the process of accepting the disease (i.e. adjustment problem), a large group of patients develop depression (39;40). Fear and apathy are also frequent.

Disturbances in visuospatial functions can also occur. For example, PD can have a negative effect on estimating spatial relationships and the ability to see contrasts properly (41,42).

Sleeping disorders, such as REM sleep-related disorder, problems with falling and staying asleep, nightmares and excessive daytime sleepiness (EDS), can also appear related to Parkinson's disease and have a big impact on the quality of sleep and thus on mood and degree of fatigue during the day. Serious sleeping problems are often also a reason for sleeping apart from one's partner.

Impairments in speech and language

Many patients with PD develop speech problems. 70-80% have complaints with respect to intelligibility or have been diagnosed with dysarthria by specialists (43,44). In general, dysarthria is not an early symptom in the progression of the disease. A small retrospective study with confirmed post-mortem diagnoses showed that the idiopathic form of dysarthria only manifests itself after an average of seven years, compared to an average of two years for patients with PSP or MSA (45).

Fitting with the pattern of motor impairments (see above), the dysarthria of PwPs is hypokinetic in nature. Hypokinesia with rigidity and bradykinesia manifests itself in all aspects of speech (46), namely:

- breathing: reduced respiratory movement
- vocalization: hoarse, soft or high voice, ranging to aphonia
- articulation: little articulation movements (mumbling)
- resonance: reduced capacity (hyponasality or hypernasality is not a symptom of hypokinetic dysarthria)
- prosody monotonic and monodynamic, but also impairments in speech rate, such as talking too fast, accelerating or having difficulty initiating phonation.

In a study involving 200 PwPs (44), 66% of the patients had impaired voice production, 39% had impaired articulation and 29% had an impaired speech rate. Though the voice complaints are the most prominent, the dysphonia is sometimes incorrectly diagnosed by physicians and SLP as an isolated voice impairment, while it is actually part of the dysarthria. Dysarthrophonia is perhaps a better term.

The stuttering speech exhibited by some PwPs can often be traced to a problem in initiating speech, similar to the festination in walking ("freezing of gait"). This problem is called "freezing of speech" or "oral festination"(47). In certain cases, stuttering may also be the recurrence of pre-existing stuttering caused by the diminishing function of the basal ganglia (48).

An important aspect that has an impact on the quality of speech is the fact that PwPs, in comparison with healthy test subjects, do not automatically adjust their speech volume to the distance from the listener or the surrounding noise (49). They are, however, able to adjust their volume upon request. They also overestimate their speech volume and intelligibility, but not when they listen to a recording of themselves (50). This explains the remark often made by PwPs that their conversational partners need a hearing aid. The treatment must therefore devote explicit attention to compensate for this (see Section 3.2).

Quite a number of PwPs experience word-finding problems. These problems can be attributed to the aforementioned cognitive deterioration, which leads to, among other things, memory and concentration problems. Lexico-semantic impairments, both in language production and language comprehension, have also been described. These impairments improve with an increase in dopamine (51-53).

Dysphagia and drooling

Hypokinesia and rigidity in the mouth area can lead to oropharyngeal dysphagia. Dysphagia in PD can be attributed partly to dopamine shortage and partly to a non-dopaminergic defect in the brainstem, where the "central pattern generator" for primarily the pharyngeal phase is located (61,62). When a PwP has a swallowing impairment, chewing and swallowing occurs more slowly and food stays longer in the mouth before the patient begins to swallow; residue-free swallowing of solid food is more difficult (60). In general, swallowing complaints are not an early symptom in PD. According to Müller et al. (45), symptoms only manifest themselves after ten years in patients with PD compared to three to six years in patients with PSP and MSA. This difference can be explained by the fact that the muscular weakness or spasticity in the oropharyngeal muscles can quickly worsen the efficiency of swallowing in atypical parkinsonisms. The frequency of dysphagia in PwPs is estimated at approximately 50%, depending of the definition and the disease severity (54,55).

In contrast to dysarthria, in which the impairment is audible as soon as the patient begins to speak, a swallowing impairment is not always visible. Thus, this will be underreported in the case history (56, 57). When doubtful the patient must be screened to determine whether dysphagia is present (58, 59) which potentially needs treatment. Dysphagia can only be partly influenced by the administration of anti-parkinson medication.

Aspiration pneumonia is a notorious complication resulting from choking and is one of the most important causes of death in the final phase of the disease (63).

Drooling is a typical complaint, which primarily appears in patients in the advanced phases of the disease. The frequency varies between 30 and 78% (64). In general, drooling is seldom if ever visible during a therapy session and cannot be tested, so drooling can only be determined by interview. The complaints can begin with the feeling of excess saliva, meaning that the saliva is building up in the mouth, probably due to a decrease in the swallowing frequency. Drooling then occurs when the patient also does not sufficiently close his mouth (65-67). It is now assumed that the cause is not attributable to a hypersecretion of saliva (68), but to insufficient swallowing frequency combined with an open mouth, and stooped posture while double tasking.

2.3.2 Severity and progression of symptoms

Parkinson's disease is progressive, but the exact progression of its symptoms varies per individual (69,70). The classic motor symptoms are often preceded by a number of non-motor symptoms, such as smell disorders, constipation, depression and sleeping disorders. The first motor disorders usually begin unilaterally (22). Though the contralateral side also becomes affected at a later stage, the initial side usually remains the most affected during the entire progression of the disease.

The Hoehn and Yahr scale provides a rough classification of the severity of the disease (71).

Table 2.2 Classification according to the modified Hoehn and Yahr scale (72).

Stage	Severity
1.0	Unilateral involvement only
1.5	Unilateral and axial involvement
2.0	Bilateral involvement without impairment of balance
2.5	Mild bilateral disease with recovery on pull test
3.0	Mild to moderate bilateral disease; some postural instability; physically independent
4.0	Severe disability; still able to walk or stand unassisted
5.0	Wheelchair bound or bedridden unless aided

Not everyone progresses through these stages as described in this scale. Less than 5% of PwPs ultimately end up in a wheelchair or bedridden (73). With today's medication, overall life expectancy is almost average.

The process is more favorable (e.g. slower progression, less frequent and later occurring postural instability and cognitive deterioration) for patients whose first predominant motor symptom is a resting tremor than for those patients who suffer mostly from bradykinesia and rigidity (74-76). A higher age of onset and cognitive deterioration are associated with a faster progression of the disease (77-79).

2.3.4 Limitations in skills and activities

Motor skills

Walking and transfers

The abnormal gait (characterized by a reduction in stride length, stride height and speed) is usually exacerbated during double tasks, such as when objects have to be moved or when the individual is thinking about something or talking to someone while walking (80). If the patient suffers from freezing, this occurs mainly when starting to walk, passing through close spaces, making turns and performing double tasks (81). Problems can therefore specifically arise when transporting objects. Propulsion occurs when the patient begins to actually walk faster and faster and often has difficulty stopping.

The performance of transfers is often limited. PwPs have difficulty implementing the *transfer* with sufficient speed, they look down too much and usually do not bring their trunk forward enough (82,83). Sitting at a table can be difficult due to problems with moving the chair while half standing at the same time.

The rate of occupational performance is slow and, due to the impairment of motor and cognitive function, the performance of activities is more difficult and energy-consuming. In addition, mental and physical fatigue and reduced stamina make it difficult to sustain activities.

Eating and drinking

PwPs can have difficulty eating and drinking due to slow arm/hand motor skills or tremors in one of the hands. Accordingly, the handling of utensils is problematic, eating and drinking requires a lot of time or the patient has to experiment with solid food or drinking from a cup (84).

This dysphagia can also lead to longer mealtimes as well as the forced modification of food consistencies (85). Hard food requires too much effort or gets more easily stuck in the throat and pills have to be swallowed with supervision (86-88). In other cases, eating and drinking without choking is only possible when the patient is not distracted or has taught himself not to talk during a meal or while drinking coffee (5).

Process skills and learning ability

The many limitations resulting from the disease compel the patient to change and perform actions more consciously. "These days I have to pay full attention to everything I do." is a frequently heard and understandable remark. As it is, however, many patients suffer from altered information processing, attention and memory functions (89-93). While PwPs are able to take in and process new information and learn other skills, this requires additional time and a quiet environment. It can be confusing if they are given too much information at the same time. An important aspect with respect to learning is that patients have difficulty with implicit learning. They must be given information in an explicit manner and repetition is important. Generalizing a learned skill to a new situation is difficult.

Communication skills

The writing skills of a PwP usually change quite early in the disease. Writing becomes smaller (micrography) and is thus less legible. The writing speed and fluency also decrease (94,95). Handwriting worsens with double tasks, such as taking minutes during a meeting or making notes during a telephone conversation.

The voice and speech impairments result in reduced intelligibility, which has an influence on the patient's communicative coping ability. In addition, verbal communication is less supported with non-verbal expression (hypomimia and a decrease of gestures).

Reduced speech skills are a major consequence of PD. The difficulty with following and understanding conversations may also result in patients being less involved in conversations and this can lead to social isolation. While voice problems are often the first complaint of PwPs with dysarthria, a qualitative study by Miller et al. (3) showed that PwPs already begin to experience communicative limitations even without a noticeable decrease in intelligibility. Almost a third of PwPs find that their speech problem is one of the most important consequences of Parkinson's disease (96).

2.3.5 Participation problems

Participating in different life domains and continuing to spend one's days in a meaningful way can become more difficult and can no longer be taken for granted. The aforementioned disorders and limitations play a role in this, as do personal factors and physical and social environmental factors (see ICF model in Figure 2.1).

A patient's communicative coping ability or the degree of assistance provided in conversation and goal-oriented interviews are factors, which determine the extent to which the PwPS can perform in various roles. A mild dysarthria can already have a large impact on performance in paid and unpaid work. In this case, early speech-language intervention can have a strong positive influence.

Difficulty with eating and drinking and easily choking on food can lead to participation problems, such as only being able to eat together with trusted individuals or preferring to no longer attend receptions or parties (86). Severe drooling can make a PwP feel ashamed and want to avoid social contacts (97).

2.3.6 Quality of life and the patients' perspective

Parkinson's disease has a major negative impact on the quality of life of Parkinson's patients. Studies have found a close correlation between the presence of depression and a lower quality of life (98-100). The quality of life also decreases with growing limitations, symptom fluctuations (101-103) and fatigue (104,105).

When asked to state the worst aspects of PD, patients mention their limitations in activities more often than the impairments (106).

In qualitative studies on the perception of and experiences with PD, patients state that accepting the disease is difficult (107,108). Many patients experience a loss of control of their body, thoughts, situations and the future. They can no longer take their occupational performance for granted. This contributes to a feeling of insecurity and a lack of confidence in their body and themselves (109).

2.3.7 Quality of life and the caregivers' perspective

Caregivers — especially those who are partners of a PwP -- experience a heavy physical and psychosocial burden which has a negative impact on their own health and well-being (110-112). The most important factors which affect the caregiver burden are depression, hallucinations, confusion, falling and personal factors, such as social support and coping style of both the patient and caregiver (113-115). There is a close connection between the patient's quality of life and that of the caregiver (116). From the standpoint of the well-being and performance of both the patient and the caregiver, it is important to consider the caregiver's perspective and occupational issues. A number of small studies have shown that caregivers need emotional support as well as information and advice on how to deal with specific disease-related problems.

2.4 Medical diagnosis

The diagnosis of PD can only be made post-mortem by demonstrating the presence of Lewy bodies, which can develop both in the substantia nigra and the cortex. Clinically, a presumptive diagnosis can only be made based on various characteristics (117,118):

1. The presence of an asymmetrical hypokinetic rigid syndrome. At least two of the following disorders must be present, including either bradykinesia or resting tremor:
 - bradykinesia
 - resting tremor
 - rigidity
 - postural instability
2. A good, sustained reaction to levodopa.
3. The absence of specific exclusion criteria (the so-called “red flags”) (22,119). Examples of these are: pyramidal tract disorder, cerebellar abnormalities, prematurely manifested cognitive disorders, prominent postural instability or falling in the first three years, quick or step-by-step progression, symmetrical onset, CT and MRI abnormalities.

The presence of red flags can indicate forms of atypical parkinsonisms, such as: progressive supranuclear palsy (PSP), multiple system atrophy (MSA), corticobasal degeneration (CBDG), essential tremor (ET), vascular parkinsonism, drug-induced parkinsonism and dementia with Lewy bodies (DLB) (120). The differential diagnosis is important because the therapeutic options and prognosis for these forms of parkinsonisms are different than those for the idiopathic Parkinson's disease (26).

Table 2.3 Most important differential diagnoses (*Parkinson Handboek 2007* abridged version) (26).

Clinical syndrome	Clinical features	Progression
Drug-induced parkinsonism	<ul style="list-style-type: none"> • frequently occurring; • symptoms often symmetrical; • rapid tremor; • action tremor more often than resting tremor; • sometimes accompanied by tardive dyskinesias; • dopamine receptor-blocking medication (e.g. neuroleptics). 	<ul style="list-style-type: none"> • dependent on recognition of syndrome and proper therapy; • usually resolved within three months following discontinuation of iatrogenic medication; can take up to twelve months before complaints fully disappear.
Multiple system atrophy (MSA)	<ul style="list-style-type: none"> • parkinsonism, often symmetrical; • ataxia; • spasticity or weakness, leading to other dysarthric features and more severe dysphagia; • autonomous disorders; • cognition largely unimpaired. 	<ul style="list-style-type: none"> • quick progression; • median survival: 9 years.
Progressive supranuclear palsy (PSP)	<ul style="list-style-type: none"> • parkinsonism, often symmetrical and axial; • vertical gaze palsy; • spasticity, leading to other dysarthric features and more severe dysphagia; • significantly impaired balance marked by frequent backward falls; • cognitive deterioration (particularly in the frontal lobes). 	<ul style="list-style-type: none"> • quick progression; • median survival: 16 years.
Corticobasal degeneration (CBDG)	<ul style="list-style-type: none"> • asymmetrical parkinsonism; • apraxia and cognitive disorders; • alien limb syndrome. 	<ul style="list-style-type: none"> • quick progression; • median survival: 8 years.
Vascular parkinsonism	<ul style="list-style-type: none"> • parkinsonism affecting the lower limbs more than the upper limbs ('lower body parkinsonism'); • gradual progression is suggestive, but not necessary; • balance impairment; • cardiovascular risk factors; • background of TIA/CVA, thus potentially pre-existing dysphasia, dysarthria and dysphagia. 	<ul style="list-style-type: none"> • varies, usually quick progression; • cognitive deterioration often also possible in later stages.
Dementia with Lewy bodies (DLB)	<ul style="list-style-type: none"> • cognitive deterioration with fluctuations in attention and alertness; 	<ul style="list-style-type: none"> • quick progression in which cognitive deterioration is most evident.

Clinical syndrome	Clinical features	Progression
Dementia with Lewy bodies (DLB) (continued)	<ul style="list-style-type: none"> • hallucinations; • autonomous disorders; • excessive sensitivity to neuroleptics with an increase in symptoms. 	
Essential tremor (ET)	<ul style="list-style-type: none"> • symmetrical action tremor; • often a positive family anamnesis; • not a parkinsonism; • “no-no” head movement; • improvement of tremor with alcohol (50%). 	<ul style="list-style-type: none"> • very slow progression of action tremors without parkinsonism.

2.5 Treatment

The general aim of treatment for PwPs is to optimize daily performance and social and societal participation. In order to achieve this, various medical and allied health treatments are possible. Multidisciplinary collaboration with PwPs, which involves the coordination of information and treatment aims, is still developing.

2.5.1 Multidisciplinary approach

Particularly in the case of complex issues, the use of a multidisciplinary treatment team is desirable in order to optimally advise and supervise a PwP. Professionals who can participate in this multidisciplinary treatment team include – in no particular order – neurologists, geriatricians, general practitioners, specialists in rehabilitation medicine, specialist physicians in nursing homes, psychiatrists, neuropsychologists, PD nurses, physical therapists, speech-language pathologists, occupational therapists, sexologists, dietitians and social workers. Good coordination between the various practitioners is required.

A multidisciplinary Dutch national guideline for Parkinson's disease was completed in 2009 (6). Among other things, this guideline will make recommendations regarding the coordination and organization of optimal continuity of care for Parkinson's patients.

Given the chronic and degenerative nature of Parkinson's disease, patients become increasingly dependent on assistance from others. Caregivers, such as partners, children and neighbors, play an important role in supporting the patient from both a psychosocial and practical perspective. For this reason, attention should be devoted to the social system surrounding them and, where necessary, interventions carried out by the multidisciplinary team should also focus on the caregivers and family.

2.5.2 Medical treatment

Medication

Medication aimed at reducing parkinsonian symptoms can begin when functional limitations and/or impairing symptoms (e.g. severe tremor) appear, but not merely for cosmetic reasons.

The basic principles for pharmacological treatment in PD are (23,121,122):

- replacement of dopamine (levodopa, dopamine-agonists);
- diminishing the breakdown of dopamine;
- blocking the relative excess of acetylcholine.

Appendix 11 shows the most common medications for PD, including their effects and side effects. As is true for nearly all medication, abrupt discontinuation can result in dangerous situations (withdrawal symptoms).

Depending on the accompanying problems, patients may also have to be treated with antidepressants, antipsychotics, laxatives, or sleep medication.

Side effects of medication

After using dopaminergic medication for an average of two to seven years, patients with PD begin to suffer fluctuations in the effect of the medication (response fluctuations) (26). This exhibits itself in predictable and/or unpredictable fluctuations in the severity of the symptoms over the course of a day. Motor fluctuations express themselves in an increase of parkinsonian symptoms during an *off* phase, when dopamine levels are too low, and in pathologically excessive movement (dyskinesias) during an *on* phase, when dopamine levels are too high.

Dopaminergic medication – particularly dopamine agonists – can lead to obsessive behavior problems. This can involve “punding” (stereotyped, purposeless, wholly disruptive behavior) or becoming addicted to medication, sex, gambling, shopping, the internet, eating and stealing (123). Young patients, especially, or patients who already had minor addictive or compulsive tendencies prior to starting the medication run a greater risk of such reactions.

Medical treatment of drooling

The medical treatment of drooling focuses on decreasing saliva production. Anticholinergic medication blocks the production of saliva, but its effect is limited and a drawback is that it can have side effects, such as constipation or vision impairments (66). The injection of botulinum-neurotoxin into the salivary glands has now become a common treatment. Both the parotid gland and the submandibular salivary glands can be treated, preferably with the use of ultrasound (64-66,124). Radiotherapy on the salivary glands has now also become a real treatment option for PwPs who suffer from severe drooling (125).

Neurosurgical treatment

When patients have been treated with dopaminergic medication for a long period and the disease is at an advanced stage, a point may be reached at which the medication options for allowing the patient to maintain a reasonable quality of life are exhausted. The patient is then suffering from severe response fluctuations, and deep brain stimulation (DBS) can be

considered. In most cases, the subthalamic nucleus (STN) is electrically stimulated by means of implanted electrodes. The advantage of this operations lies, on the one hand, in the possibility of reducing the medication so that fewer side effects occur. On the other hand, the operation also directly counteracts tremors or dyskinesias (23,126). Unfortunately, not every PwP can undergo this operation; due to the risks involved, strict inclusion and exclusion criteria apply (127).

At the same time, there are indications that DBS has a negative impact of the speech quality of some patients (128-130).

2.5.3 Allied health treatment

For the rehabilitation of PwPs, Morris & Iansek (1) have described a theoretical model which has been met with positive experiences in large Parkinson's centers abroad. This model consists of the following five basic principles:

1. "Normal movement is possible in Parkinson's disease; what is required is appropriate activation. The skilled therapist is able to determine the most effective methods to activate normal movement.
2. Complex movements need to be broken down into smaller components. This is to avoid motor instability and to take advantage of increased amplitude at the beginning of movement sequences.
3. Each component of a task needs to be performed at a conscious level. Conscious attention appears to bypass the basal ganglia and restore movement towards normal.
4. External cues may be used to initiate and maintain movement and cognitive processes. Visual, auditory or proprioceptive cues may be used. Cues indicate the appropriate movement size and appear to activate attentional motor control mechanisms.
5. Simultaneous motor or cognitive tasks are to be avoided. This is because the more automatic task is not executed properly and only the task demanding attention is satisfactorily completed."

The allied health treatment techniques for PwPs are based on these principles.

Occupational therapy

The occupational therapy guideline was developed at the same time as the speech-language guideline (20).

The importance of the occupational therapist's contribution is endorsed by patients, caregivers and specialists in PD rehabilitation, but the effectiveness of occupational therapy for patients with Parkinson's disease has not yet been demonstrated (131,132). For this reason, the guideline has incorporated many insights into the effectiveness of occupational therapy in other diseases.

Occupational therapy in PD is focused on maintaining or optimizing the meaningful occupational performance of the patient within his living and working environment. This means that occupational therapists can make a positive contribution to a wide range of problems and limitations experienced by the PwP and the caregiver(s) in their daily life. Some of the occupational therapy intervention techniques, which are recommended, have been taken from other areas, while others are specific for PD:

- encouraging self-management
- optimizing daily structure and activities
- reducing stress and time pressure
- maintaining arm/hand motor skills
- performing with focused attention
- reducing dual tasks
- using cues
- optimizing the physical environment
- advising and supervising caregivers (for themselves)

The interventions can focus on four different starting points or a combination thereof: the patient himself, the activity concerned, the environment in which the activity takes place and the caregiver(s).

Physical therapy

The Royal Dutch Society for Physical Therapy (KNGF) published a guideline on Parkinson's disease in 2004 (19). This guideline was developed in cooperation with the Professional Association for Remedial Therapy (VVOCM), in light of the fact that there is no difference in the treatment options of both professional groups with respect to patients with PD.

The goal of physical therapy and remedial therapy (Cesar and Mensendieck) for Parkinson's disease is to improve the quality of life by improving or maintaining the self-reliance, safety and well-being of the patient through and during movement. This is achieved by preventing inactivity, preventing falls, maintaining and improving performance and reducing limitations in activities and participation problems. Six domains are distinguished in this regard:

1. transfers (e.g. standing up from a chair and rolling out of bed)
2. body posture
3. reaching and gripping
4. balance
5. walking
6. physical capacity (i.e. muscular strength, joint mobility, general condition)

The disease progression is divided into three phases: early (Hoehn & Yahr 1-2.5), middle (Hoehn & Yahr 2-4) and late (Hoehn & Yahr 5). In the early phase, the goal is to prevent inactivity, fear of moving and fear of falling and to maintain and/or improve the condition. The goal in the middle phase is to maintain or encourage activities in the aforementioned domains. The treatment goal in the late phase is to maintain vital functions and prevent complications, such as decubitus and contracture. Close cooperation with the nursing staff (caregivers) is essential in this.

Recommendations for interventions which are based on evidence of two or more controlled studies are: 1) the use of cueing strategies to improve walking; 2) cognitive movement strategies to improve the performance of transfers; 3) specific exercises to improve balance; 4) training joint mobility and strength to improve physical capacity.

Speech-language pathology

The speech-language treatment of PwPs usually focuses on improving intelligibility and communicative skills or reducing swallowing complaints or drooling or a combination of these.

It is clear that treatment can only be optimal when the speech-language pathologist, just as the other allied health practitioners, possesses enough knowledge of the disease and its impact on the patient's motor and cognitive performance.

For a detailed description of the speech-language interventions in the form of recommendations, please refer to Chapters 3, 4 and 5.

3. Dysarthria and communication

This chapter describes the evaluation of the speech and communication skills (3.1) and the treatment of dysarthria and communication problems (3.2) in people with Parkinson's disease (PwP).

3.1 Evaluation of speech and communication

This section provides answers to the following key questions:

3. In reviewing a PwP's history with respect to speech problems, what must at least be addressed?
4. What is the best way to quantify the severity of the speech problems?
5. What is specific to the dysarthria evaluation in PwPs?
6. What is the best way to evaluate spontaneous speech in a PwP?
7. What is the best way to quantify the severity of hypokinetic dysarthria?
8. What is the best way to evaluate the stimulability of speech in a PwP?
9. Which audiovisual registrations are important for PwPs with speech problems?
10. When should the speech-language pathologist recommend an examination by an otolaryngologist for a PwP with speech problems?
11. What is the best way to evaluate language impairments and/or communication problems among PwPs?

Question 3

In reviewing a PwP's history with respect to speech problems, what must at least be addressed?

In reviewing the patient's history, the speech-language pathologist (SLP) inquires about the extent to which the patient experiences difficulty with speech and what consequences this has for daily activities and social participation. The outcome gives direction to the wishes and expectations of both the patient and caregivers with respect to the treatment. At the same time, the SLP can observe the patient's quality of speech.

Literature review

No validated questionnaires specific for PD have been found which assess the nature and severity of the speech complaints of PwPs. Based on the complaints and problems described in the literature, the SLP should pay attention to the following aspects, among others, when reviewing the patient's history.

In the first place, it is important to inquire about both function impairments (e.g. soft and hoarse voice) and the functional consequences of reduced intelligibility, such as problems with talking on the telephone, making oneself understood in conversation or difficulty with speech during work. Secondly, both speech motor impairments and cognitive impairments can play a role in these problems (3). The SLP should check the influence of both aspects. Thirdly, PwPs can have difficulty evaluating their own speech and attribute their reduced intelligibility to, for example, the poor hearing of their conversational partners (50). For this reason, the SLP should be watchful for a discrepancy between the patient's judgment, on

the one hand, and that of his conversational partner and/or caregiver(s), on the other, with respect to both intelligibility and communicative participation. See the sample questions in **Appendix 2**.

A standardized questionnaire is being developed (133). A preliminary analysis shows that the questions have a high internal consistency ($\alpha > 0.90$) and correlate well ($r > 0.70$) with dysarthria severity, disease severity and disease duration. **See Appendix 3**.

Conclusion

Level 4	<p>According to experts, while reviewing the history of a PwP's speech complaints, a speech-language pathologist should inquire about a wide range of complaints: from motor and cognitive problems to the complaints of both the patient and the caregivers / conversational partners.</p> <p>D Miller, 2006</p>
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Other considerations

Prior to the first consultation, the patient can fill out a standardized questionnaire to serve as a basis for determining the occupational issues.

Recommendation 3a

While reviewing a patient's history of speech problems, the speech-language pathologist should:

- d. inquire about problems at the function level, activity level and participation level
- e. inquire about problems both with respect to speech (voice, intelligibility) and communication skills (e.g. finding words, starting a conversation)
- f. inquire about the problems and experiences of the patient as well as the experiences of the conversational partner and/or caregivers.

Recommendation 3b

The SLP should consider having a PwP complete a standardized questionnaire before the first session.

Question 4

What is the best way to quantify the severity of the speech problems?

The SLP can express the patient's communication limitations due to difficulty with speech on a rating scale. In the United Kingdom and Australia, SLPs use the intelligibility scale of Enderby & John (134,135), one of the 6-point scales of the Therapy Outcomes Measures (TOM). Unpublished research shows that the Dutch version of the scale with a weighted kappa of 0.70 has an acceptable inter-rater reliability (136). **See Appendix 4**.

Conclusion

Level 3	<p>There are indications that the Dutch version of the Intelligibility subscale of the Therapy Outcomes Measures (TOM) is a sufficiently reliable scale for expressing the degree of intelligibility resulting from dysarthria.</p> <p>C Enderby, 1999, Knuijt, 2007</p>
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Other considerations

While the Dutch version of the Intelligibility subscale is not specifically designed for PwPs, the working group takes the view that it can be used for PwPs. Accordingly, the reduction in communication effectiveness due to cognitive impairments will be factored in implicitly.

Recommendation 4

The SLP should consider rating the severity of the effects of the dysarthria on the intelligibility and communicative effectiveness according to the Dutch version of the intelligibility subscale of the Therapy Outcomes Measures (TOM).

Question 5

What is specific to the dysarthria evaluation in PwPs?

While a lot is known about hypokinetic dysarthria, it is unclear which clinical observations and measurements are relevant.

Literature review

Numerous measurements, such as those described by Kent et al. (137), are available for the assessment of dysarthric features. Various publications for assessing the voice and speech impairments of PwPs are also available. However, many assessment techniques are intended for scientific research and not for clinical assessment. For PwPs who, to a certain extent, have normal voice and articulation that has to be activated (2), the degree of stimulability of the speech intensity – and thus the intelligibility – is of primary relevance to the clinical assessment.

No specific clinical measurements or observations are known for assessing the quality of speech of PwPs. For this reason, the working group has formulated the following proposals based on theory, experience and consensus:

For a minimal evaluation of a patient with PD and voice and/or intelligibility complaints, the SLP can limit himself to (138):

- evaluating spontaneous or *unstimulated speech*, i.e. a subjective evaluation of the speech quality during spontaneous speech;
- evaluating *stimulated speech* during a maximum performance test, such as “automatic” speech tasks (counting etc.), maximum phonation time and maximum pitch range.

Conclusion

Level 4	<p>While various observations and measurements of voice and speech are possible, it is sufficient to observe the unstimulated speech and then to determine the stimulability of the intensity and intelligibility with a few maximum performance tests for the evaluation of dysarthria.</p> <p>D Opinion of the working group</p>
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Other considerations

In order to work efficiently, the assessment could remain limited to the relevant observations and measurements. The time available to both the SLP and the patient should be spent mainly on the intervention.

Recommendation 5

<p>It is recommended to limit the clinical dysarthria evaluation of patients with Parkinson's disease to:</p> <p>c. an evaluation of spontaneous or unstimulated speech and</p> <p>d. an evaluation of the stimulability of the various speech features by using maximum performance tests.</p>

Question 6

What is the best way to evaluate spontaneous speech in a PwP?

Literature review

The best way to evaluate the unstimulated speech of a PwP is during spontaneous speech, such as when interviewing the patient. The internationally described features of dysarthria (46,139-141) can be used for evaluating unstimulated speech. These features are: respiration, voice (quality, loudness and pitch), articulation, resonance and prosody (intonation and speech rate). For the registration method, we refer to **Appendix 5**.

Conclusion

Level 4	<p>The spontaneous speech of a PwP can be evaluated based on the speech features used for all dysarthrias: respiration, voice, articulation, resonance and prosody.</p> <p>D Darley, 1975, Lambert, 2003</p>
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Other considerations

The quality of the respiration, phonation, articulation, resonance and prosody can be subjectively evaluated by the SLP on a 4-point scale, such as is used in other subjective observations (142,143):

- 0 = very severely impaired;

- 1 = clearly impaired;
- 2 = slightly impaired or uncertain;
- 3 = normal.

In doing so, the SLP focuses on PD-specific features, especially manifestations of hypokinesia and rigidity. In interpreting the results, the SLP should take into account the effect of age, gender, fatigue and stress on speech. For PwPs with response fluctuations, the effect of medication should also be kept in mind. In other words, has the patient been observed during an *on* period (better performance) or during an *off* period (worse performance)? See **Appendix 5** for the descriptions and the rating form.

Based on the identified features, the SLP can formulate a diagnosis and indication for intervention. A clear hypokinetic dysarthria is characteristic of PD, but the SLP must continue to watch for aspects, which point to other forms of dysarthria, which potentially require another treatment technique.

Though this guideline pertains to Parkinson's disease, it is useful here to briefly mention the dysarthric features of atypical parkinsonisms. Dysarthric features that are *not* characteristic of a hypokinetic dysarthria are muscular weakness (paresis), spasticity or ataxia (coordination impairments). When in doubt, the following evaluations are particularly helpful:

- evaluation of oral motor function, which can detect muscular weakness, spasticity and asymmetry (143);
- diadochokinetic rates and word repetition to reveal spasticity or coordination impairments (142).

A description of all possible aspects of other forms of dysarthria falls outside the scope of this guideline on PD. Adequate assessment requires sufficient neurological knowledge and experience in the field of speech-language pathology. Here, the working group refers to reference books, such as Lambert et al. (140) or Dharmaperwira-Prins (141).¹

Recommendation 6

It is recommended to evaluate the spontaneous speech of a PwP by assessing common speech features, such as breathing, phonation, articulation, resonance and prosody. In the interpretation, it is important to know whether the patient has been observed during an *on* period or an *off* period.

Question 7

What is the best way to quantify the severity of a hypokinetic dysarthria?

Literature review

There are various comprehensive intelligibility tests for dysarthria patients, but the only subjective speech-language pathology rating scale is the Therapy Outcomes Measures (TOM), the dysarthria subscale of Enderby & John (134,146). The lowest score is 0 (very severe dysarthria or anarthria) and the best score is 5 (no dysarthria). Unpublished research shows that the Dutch version of the scale with a weighted kappa of 0.70 (and 0.90 for

¹ In English e.g. Duffy (144) or Yorkston et al. (145).

speech-language pathologists with over 10 years of experience) has an acceptable inter-rater reliability (136). **See Appendix 3.**

Conclusion

Level 3	<p>There are indications that the Dutch version of the TOM dysarthria subscale is also a sufficiently reliable scale to express the severity of a hypokinetic dysarthria.</p> <p>C Knuijt, 2007</p>
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Other considerations

Among other things, PwPs samples were used to evaluate the Dutch version of the TOM dysarthria subscale. In the opinion of the working group, the scale is therefore also suitable for evaluating the severity of hypokinetic dysarthrias.

Recommendation 7

The SLP can consider rating the severity of the dysarthria with the Dutch version of the dysarthria subscale of the Therapy Outcomes Measures (TOM).

Question 8

What is the best way to evaluate the stimulability of speech in a PwP?

In order to evaluate to what extent intelligibility can be improved by practicing (see Section 3.2), the stimulability of the speech must be evaluated by means of maximum performance tests. In addition, if the SLP is familiar with the range of dysarthrias and neurological diseases, the stimulability can indicate whether it is a typical hypokinetic dysarthria or a combination of dysarthrias, characteristic for atypical parkinsonisms (see Chapter 2). In interpreting the results, the SLP should take into account – just as with the evaluation of unstimulated speech – the effect of age, gender, fatigue and stress on speech. The effect of *on* period versus *off* period and the severity of the disease should also be taken into consideration here, because the voice intensity and intelligibility of patients with very severe hypokinetic dysarthria are very difficult to improve.

Literature review

According to the working group, the following maximum performance tests are relevant to PD. One or more of these tasks can be used to evaluate the stimulability.

Automatic speech tasks

In order to evaluate whether the voice and the intelligibility can be improved, the PwP must be cued to speak louder (147,148). The easiest tasks for this are over-learned or automatic speech tasks, such as counting and saying the days of the week or the months of the year. The patient does not have to think about what he is going to say and only has to focus on speaking more clearly, i.e. louder. To keep the pitch from increasing along with the volume, the patient must often be asked to do the same but in a lower voice (“loud and low”).

It is vital to demonstrate this properly to the patient, to provide constant *feedback* and to specifically instruct the patient. The improvements that may be expected are (149):

- improved respiration
- a louder voice (without a rise in pitch)
- better voice quality
- larger articulation movements
- a lower speech rate

and, consequently, improved intelligibility immediately.

Maximum phonation time

The most used voice measurement in the world is the maximum phonation time (MFT), which allows the evaluation of breath control and voice quality (150). To measure the MFT, the patient is asked to sustain an /a:/ as long as possible while being timed with a stopwatch. Proper instruction and demonstration are important, as is having the patient perform the task at least three times in order to record the best performance (137; 151). The MFT has a high degree of variability and also depends on the quality and loudness of phonation. It is typically a task in which learning and fatigue play a major role. These are deliberately used to evaluate the stimulability in PwPs. When repeating the task, the patient is asked to phonate louder and, if necessary, in a lower voice to evaluate to what extent the loudness, clarity and pitch can be improved and cued.

Pitch range and loud calling.

Maximum vocal range and control can be evaluated by asking the patient (after demonstrating) to make vowel glides between his lowest and highest pitch. For PwPs, this mainly involves evaluating the rigidity and the extent to which the variation in pitch can be stimulated. Loud calling can also be used for evaluating the stimulability of loudness and pitch. Table 3.1 displays the dysarthric features and evaluation tasks.

Table 3.1. Speech features and the tasks used to evaluate them.

	Unstimulated speech	Stimulated speech (maximum performance tests)		
	Spontaneous speech	Automatic speech tasks	Maximum phonation time	Pitch range and calling.
1. Respiration	X	X	X	X
2. Voice				
– quality	X	X	X	X
– loudness	X	X	X	X
– pitch	X	X	X	X
3. Articulation	X	X		
4. Resonance	X	X		
5. Prosody				
- intonation	X	X		
– speech rate	X	X		

Conclusion

Level 4	<p>Various tasks are suitable for evaluating the stimulability of speech in PwPs. These include, in particular, automatic speech tasks, maximum phonation time (MPT), maximum pitch range and loud calling.</p> <p>D Kent, 1987, de Swart, 2003</p>
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Other considerations

The SLP is free to choose the order of tasks. The focus is not achieving a normal performance, but to determine to what extent the quality of speech can be stimulated and the patient can be cued. In order to render results, the working group proposes the following four-point scale:

- 0 = not possible to cue
- 1 = difficult to cue
- 2 = easy to cue
- 3 = the patient is able to cue himself (after receiving instructions)

See the rating form in **Appendix 4**.

Recommendation 8

It is strongly recommended to use one or more of the following maximum performance tests to evaluate the stimulability of the intensity and quality of the speech of a PwP:

- automatic speech tasks
- maximum phonation time
- pitch range and calling

In the interpretation, it is important to know whether the patient has been observed during an *on* period or an *off* period.

Question 9

Which audiovisual registrations are important for PwPs with speech problems?

It is customary to make an audio or video recording during speech-language pathology evaluation.

Literature review

In an experiment, Ho et al. (49, 50) found that PwPs, in comparison with healthy test subjects, do not automatically adjust their speech volume to the distance from the listener or the surrounding noise. They were, however, able to adjust their volume upon request. They also overestimate their speech volume and intelligibility, but not when they listen to a recording of themselves.

Conclusion

Level 3	<p>There are indications that PwPs overestimate their speech volume and intelligibility.</p> <p>C Ho, 1999, 2000</p>
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Other considerations

It is also useful to make an audio or video recording of spontaneous speech to help the PwPs form a realistic idea of the quality of their speech.

Because the emphasis of the intervention lies on increasing the loudness (see Section 3.2), it can also be useful to objectively determine a zero measurement for the speech intensity during spontaneous speech using a basic dB meter. It is vital to always conduct the measurement in the same way.

Recommendation 9a

It is recommended to make an audio or video recording of the spontaneous speech for each PwP in order to record the initial situation and to give the patient feedback regarding his intelligibility.

Recommendation 9b

It is recommended to record the intensity of the spontaneous speech with a dB meter during the first session.

Question 10

When is it important for PwPs with voice complaints to be examined by an otolaryngologist?

In the Netherlands, anyone with persistent speech complaints can be examined by an otolaryngologist. The question is in which cases it is desirable and practicable to also do this for PwPs with voice complaints.

Literature review

Video laryngostroboscopy is the most important assessment tool for determining the etiology of a voice impairment (150). Ramig (152) recommends that PwPs first be seen by an otolaryngologist prior to voice treatment in order to rule out contraindications and comorbidity (such as vocal fold nodules or laryngeal cancer).

Conclusion

Level 4	<p>According to experts, it is prudent to first have PwPs with voice complaints examined by an otolaryngologist prior to the speech-language interventions in order to visualize the larynx and to rule out any contraindications and comorbidity.</p> <p>D Dejonckere, 2001, Ramig, 2004</p>
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Other considerations

Video laryngostroboscopy can only be performed in a hospital. When in doubt, the SLP should advise an examination by an otolaryngologist, but according to the working group this is not a necessary condition for treatment, because the SLP will only intensively treat a PwP if it is possible to stimulate the improvement of the voice quality and loudness. This is simply not possible for other laryngeal pathologies.

Recommendation 10

It is recommended that the SLP should propose a video laryngostroboscopy by an otolaryngologist for a PwP with a hypokinetic dysarthria only when vocal fold pathology is suspected which is unrelated to PD.

Question 11

What is the best way to evaluate language impairments and/or communicative problems among PwPs?

The cognitive impairments in PwPs can also affect language production, language comprehension and communication skills, expressed in reduced word-finding, and easily losing track of a conversation (3).

Literature review

It is unknown whether it is useful to also test the language impairments in PwPs with existing language tests for adult neurological patients. It is, however, useful to ask the PwP about word-finding complaints (the tip-of-the-tongue phenomenon), fluent formulation, being to the point, initiating and maintaining a conversation, and the influence this has on social participation, as described in Section 3.1. These aspects can also be observed while interviewing the patient.

Conclusion

Level 4	<p>According to experts, it is sensible to determine from patients' histories whether they have difficulty finding words and initiating and maintaining a conversation.</p> <p>D Miller, 2006</p>
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Other considerations

Given that little is known about the treatment of language and communication impairments in Parkinson's patients (see Section 3.2), the working group takes the view that it is sufficient to include this aspect while reviewing the patient's history and observing his spontaneous speech.

Recommendation 11

to the SLP should explicitly ask PwPs about difficulty in finding words and participating in conversation. As yet, it is not recommended to administer a formal language test.

3.2 Treatment of dysarthria and communication problems

This section contains the recommendations regarding the treatment of hypokinetic dysarthria in patients with PD. The extent to which these recommendations also apply to patients with an atypical parkinsonism depends on the diagnostic judgment of the SLP (see also Section 3.1).

This section provides answers to the following key questions:

12. What are the results of treatment with LSVT and PLVT?
13. What is the optimal treatment intensity for PLVT/LSVT?
14. When is treatment with PLVT/LSVT indicated for a PwP?
15. What is the best treatment when PLVT/LSVT is not indicated for a PwP?
16. What is the value of other speech-language treatments of hypokinetic dysarthria?
17. What can be expected from speech-language treatment of hypomimia?
18. What is the value of group treatment?
19. In what way should the SLP take the influence of medication into account?
20. What is the value of instrumental aids in positively influencing the intelligibility of PwPs?
21. What are the treatment options for communication problems resulting from language impairments in PwPs?
22. What place do communication aids have as a replacement for speech in PD?
23. What is the role of the caregiver(s) in the treatment of dysarthria and communication problems?
24. What are the best tools for determining the treatment results?

Question 12

What are the results of treatment with LSVT and PLVT?

The Lee Silverman Voice Treatment (LSVT-LOUD), developed by Ramig and colleagues in the early 1990s, is the most well-known speech-language intervention for improving the intelligibility of PwPs. It is used worldwide and also has a following in the Netherlands. LSVT is a specific voice treatment in which the patient is trained to speak louder ("*think loud, think shout*"). Since respiration, voice volume and intelligibility are one connected system, speaking louder is enough to strongly activate respiration, voice quality, mouth opening and articulation. LSVT employs the principle that a PwP has "normal" motor skills which have to

be activated and which only require a single cue (loud) to induce this activation each time (1). Lastly, intensive practice is necessary so that, on the one hand, the patient can get accustomed to greater speech intensity which he would not sustain spontaneously and, on the other hand, to incorporate the new technique into his spontaneous speech (153). This American approach focuses on the vocal function and has primarily been evaluated with phoniatric studies.

This treatment technique is based on the following principles:

- the treatment focuses on one task, i.e. speaking louder;
- this entails maximum phonation being stimulated by a great deal of repetition and consistent and precise feedback;
- the patient must become accustomed to the increased loudness and strength (calibration);
- this is only possible by means of intensive treatment;
- loudness and strength are quantified by means of decibel measurements.

The aim is for the patient to sustain greater intensity and better intelligibility and be able to easily cue himself to improve intelligibility. This approach is thus specific to patients with hypokinetic dysarthria. A dB meter is usually used as visual feedback during exercises in order to allow the patient to get accustomed to the greater intensity that is necessary to improve intelligibility.

In the beginning of the 1980s, De Swart independently developed a similar intervention specific for Parkinson's disease based on a neurological perspective - in other words, the voice and intelligibility problem as part of the hypokinetic dysarthria and the neurological clinical picture. He also focused on preventing hyperfunction due to the high intensity of vocalization by having the patient simultaneously learn to produce more loudness at an equal or lower pitch. To differentiate it from LSVT, he eventually called the technique Pitch Limiting Voice Treatment (PLVT) (154). The conversational partner is also given a large role in this approach – something that, until recently, was not part of the treatment in LSVT. LSVT now also puts more emphasis on preventing hyperfunction (www.lsvt.org).

Literature review

The effect of LSVT has been intensively studied. Over the course of four weeks, Ramig and colleagues treated 45 PwPs fifty minutes a day, four days a week (148, 149, 155). They compared the effects of LSVT on 26 patients with 19 patients receiving only respiration therapy and found that LSVT produced significant positive changes in loudness, phonation time and vocal fold closure. Follow-up studies found that the effects were also still measurable six, twelve and 24 months later (156, 157). It is unclear what effect LSVT has on intelligibility in the normal daily and social activities of PwPs. It is unknown what effect LSVT has on PwPs with a very severe dysarthria or one combined with other dysarthric impairments, such as in an atypical parkinsonism.

De Swart et al. (147) compared the voice quality of 32 PwPs after being given LSVT instructions and after being given PLVT instructions. The application of PLVT results in a significantly lower voice and a more relaxed and natural voice quality in comparison with LSVT. Moreover, after receiving PLVT instructions, the patients found that their voices sounded more natural and the effort required was less tiring. However, it has not been

studied whether a complete treatment with PLVT produces the same or better results than LSVT.

Conclusion(s)

Level 1	It has been shown that intensive treatment of hypokinetic dysarthria in patients with Parkinson's disease by means of practicing to speak louder is more effective than only breathing exercises. A Ramig, 1995, 1996, 2001a
Level 1	It has been shown that treatment with LSVT can still have positive effects on the loudness and quality of the voice at least six months later. A Ramig, 1996, 2001a, B Ramig, 2001b
Level 3	It is reasonable to assume that PLVT, compared with LSVT at the same loudness, prevents a rise in pitch and results in a better and more natural voice quality. B de Swart, 2003

Other considerations

According to Ramig (152), a contraindication for LSVT is another voice pathology, such as voice fold nodules, laryngeal cancer or laryngeal irritation due to reflux.

The cue to speak louder is a technique specific to Parkinson's disease to improve intelligibility. Given that PLVT largely corresponds to LSVT, the techniques seem comparable and it is thus assumed that the effectiveness is also comparable.

In the Netherlands, LSVT or PLVT is not offered in initial education, but in post-graduate courses. Until 2002, the LSVT course had been given a few times in the Netherlands thanks to financial support from the Dutch Parkinson's Disease Association. Since then, de Swart has provided at least two PLVT courses each year. Moreover, this approach is a key element in the training of SLPs since 2007, who want to participate in a Parkinson's network (see www.parkinsonnet.nl).

Recommendation 12

It is strongly recommended to administer PLVT or LSVT to PwPs with a hypokinetic dysarthria who satisfy the indications for intensive treatment.

Question 13

What is the optimal treatment intensity for PLVT/LSVT²?

Literature review

The studies in which LSVT has been evaluated are based on a treatment intensity of four 50-minute sessions per week for four weeks (148;152). No dose-response studies are known which compare different treatment intensities.

Conclusion

Level 3	It is reasonable to assume that the intensity of the treatment (four times a week for four weeks) is one of the explanations for the effectiveness of LSVT. B Ramig, 1995, 2005
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Other considerations

In the Netherlands, PLVT/LSVT can be administered in treatment sessions of thirty minutes (according to the current reimbursement for a speech-language treatment session) and many PwPs are also tired after a half hour of intensive practicing. Since patients must be intensively stimulated and cued and are in need a lot of feedback, treatment and independent practicing is insufficient when delivered only once per week. In the experience of the working group members, the minimal intensity should be a half hour of intensive treatment, three times a week, for at least four weeks.

This also means that the patient and the SLP have to plan the intensive period well, so that it does not conflict with other intensive therapy sessions, vacations, etc.

Recommendation 13a

It is recommended to administer PLVT/LSVT to patients indicated for it with a treatment frequency of at least three times a week for thirty minutes over at least four weeks. A lower treatment frequency is discouraged.

Recommendation 13b

It is also recommended to plan PLVT/LSVT in such a way that it is feasible for both the patient and the SLP to practice for at least four consecutive weeks and that this preferably does not coincide with other allied health interventions, which also demand a lot of time and energy.

Question 14

When is treatment with PLVT/LSVT indicated for a PwP ?

Not all PwPs with hypokinetic dysarthria are indicated for intensive treatment.

Literature review

² Note: In this guideline 'PLVT/LSVT' is used because currently in the Netherlands there are more SLPs trained to apply PLVT than SLPs trained to apply LSVT.

Two studies on the effectiveness of LSVT were conducted with patients in Hoehn & Yahr stages 1, 2 or 3, and as such did not involve (very) severely affected patients. And while it has never been studied with respect to speech-language pathology treatment, it can be inferred from various publications (22;162) that fatigue and cognitive disorders in PwPs play a major role in daily activities and thus also in participating in allied health treatments, which make demands on physical condition and learning ability.

Conclusion

Level 4	<p>Since PLVT/LSVT is an intensive treatment, sufficient energy and learning ability are a prerequisite for carrying out the treatment successfully.</p> <p>C Rascol 2002</p>
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Other considerations

PLVT/ LSVT is commonly only advisable when the diagnostic assessment has demonstrated that the patient has hypokinetic dysarthria, in which case the voice intensity (loudness, clarity and pitch) can be sufficiently cued.

According to the experience of the working group, it is also important that the patient has sufficient intrinsic motivation to practice intensively. This motivation depends, on the one hand, on the severity of the patient's complaint and, on the other hand, on the demands the patient puts on his or her own communicative functioning. This means that, in the opinion of the working group, PwPs with the following complaints are not indicated for PLVT/LSVT:

- minor dysarthria, where the patient can easily and independently compensate for this by speaking with more intensity; a one-time consultation with recommendations is usually sufficient;
- clear apathy, which has greatly decreased the patient's need to speak (or communicate in general); in this case, counseling aiming at acceptance is possibly the most important intervention.

Other contraindications include limited learning ability and easy fatigability (see also Question 13).

If, after the diagnostic assessment, there is doubt with respect to the patient's learning ability and ability to tolerate treatment, it can be advisable in the experience of the working group to arrange a trial treatment. This could, for example, take the shape of a week of intensive practice, followed by a discussion with the patient (and caregivers) to weigh the results against the efforts. Based on this, it can be decided whether it is worthwhile to complete the full treatment or to look for a less intensive approach.

According to the experience of the working group, the assistance of a co-therapist is also essential for many patients to be able to practice adequately at home. A co-therapist is a caregiver who regularly accompanies the patient during speech-language treatment sessions in order to be able to help the patient to practice at home.

While research has shown that the treatment results can last up to 24 months (9,163), the working group believes that an examination or follow-up can be advisable after 6 or 12

months in order to briefly refresh skills or ascertain whether any new problems have arisen as a result of the progression of the disease.

Recommendation 14a

Treatment with PLVT/LSVT is advised to be given to PwPs with hypokinetic dysarthria if:

- the voice quality – loudness, clarity and pitch – can be sufficiently stimulated;
- the patient has enough intrinsic motivation to practice intensively, based on the severity of the problem and the expectations of the communicative performance;
- the patient is (cognitively) able enough to learn a new technique;
- the patient has enough energy to practice intensively.

Recommendation 14b

In case of doubt regarding the indication for PLVT/LSVT, it can be worthwhile to first conduct a trial treatment of, for example, a week.

Recommendation 14c

It can also be worthwhile to have the patient practice with the assistance of a caregiver as co-therapist during the treatment period.

Recommendation 14d

It is recommended to schedule a follow-up 6 to 12 months after initial treatment with PLVT/LSVT.

Question 15

What is the best treatment for a PwP when PLVT/LSVT is not indicated?

Literature review

There are no studies that have evaluated variations of PLVT/LSVT or the possibility of application for PwPs who have more reduced capacities or patients with a mixed dysarthria, such as in atypical parkinsonisms. The basic principles for treating PwPs, which are internationally endorsed (see also Chapter 2), make it reasonable to assume that the use of training and cueing strategies can also be useful for patients with reduced capacities. This also depends on the experience and inventiveness of the speech-language pathologist. Because patients can often be cued to improve their speech, but are unable to do so or sustain this independently, the conversational partners and caregivers are given an important role in cueing the patient.

Conclusion

Level 4	PLVT/LSVT techniques can also be used to cue intelligibility in Parkinson's patients with reduced capacities. As part of this, the conversational partner is given a larger role.
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	D Morris & Iansek 1997
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Other considerations

For PwPs who do not satisfy the set criteria, the working group believes that the following treatment could be useful. The SLP attempts to stimulate the patient as best as possible and tries to find out the most effective cue for the patient in getting him to speak as intelligible as possible. The SLP then teaches this cue to the main conversational partners.

Recommendation 15

For PwPs who are not indicated for intensive treatment, it is recommended to still treat them with PLVT/LSVT techniques but with less intensity. At the same time, the SLP trains the caregivers to take over cueing when necessary.

Question 16

What is the value of other speech-language treatments of hypokinetic dysarthria?

Literature review

In the Netherlands, the treatment of dysarthria in general is described only to a limited extent. The available sources describe classic speech-language treatment techniques, such as exercises for oral motor function and articulation (141).

There is no evidence for the treatment of dysarthria in PwPs with other techniques than LSVT or PLVT, though it has also not been shown that these techniques are not effective. In the experience of the working group members, however, classic speech-language treatment techniques, which are not specific to PD (isolated exercises for respiration, voice, oral motor function or articulation), only produce temporary improvement during the treatment but no consistent improvement in intelligibility.

Level 4	In general, classic speech-language techniques do not appear to have any added value in the treatment of hypokinetic dysarthria. D Opinion of the working group
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Other considerations

If a speech-language pathologist does not have any experience with techniques specific for PD, such as LSVT or PLVT, the long-term provision of classic exercises also leads to unnecessary costs.

Recommendation 16

In the treatment of PwPs with clear hypokinetic dysarthria there is perhaps no room for general exercises for oral motor skills or articulation.

Question 17

What can be expected from treatment of hypomimia?

Facial expression is a non-verbal and valuable aspect of communication. As such, the reduced facial expression of Parkinson's patients can restrict communication (158).

Literature review

Spielman et al. (159) studied the effect of LSVT on facial expression and the degree of involvement evaluated by others based on the video recordings of 26 Parkinson's patients who had been treated with LSVT compared with 19 Parkinson's patients who had received breathing training. In roughly half of the treatment group, the facial expression and involvement in conversation were evaluated as improved in comparison with the control group. The difference was only significant for involvement, but not facial expression.

Level 3	<p>There are indications that LSVT can have a favorable effect on the non-verbal conversational involvement of PwPs, but not on facial expression.</p> <p>B Spielman, 2003</p>
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Other considerations

Just as it does not seem worthwhile to have PwPs perform isolated oral motor exercises, presumably, it is not meaningful either to have them perform isolated facial expression exercises. It seems clear that conversational involvement and perhaps also facial expression improve when the patient can speak louder and more actively.

Patients who complain about facial rigidity may sometimes benefit from facial massage or exercises temporarily, but this is unlikely to improve facial expression.

Recommendation 17

<p>In considering the use of PLVT/LSVT, it can also be taken into account that this treatment can have a favorable effect on non-verbal communication.</p> <p>Facial massage or the isolated practicing of facial expression in PwPs can be considered to temporarily reduce the rigidity of the facial muscles, but it does not seem worthwhile for improving facial expression.</p>

Question 18

What is the value of group treatment?

Treatment in groups is possible in many treatment centers. One of the goals can be improving intelligibility in new communication situations.

Literature review

The intensive training of intelligibility is an individual process, but the consistent application of it in new situations is important for stabilizing the newly learned behavior. While there is no known study on this, a treatment group with fellow PwPs, such as also used in the

treatment of patients with aphasia (160), can be one of the opportunities to practice speech intensity and communication skills.

Level 4	Group treatment can be a valuable supplement to using and maintaining good intelligibility. D Opinion of the working group
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Other considerations

Group treatment is only possible in places where several PwPs with roughly similar skills and interests meet with a therapeutic goal. This often occurs in combination with another intervention, such as psychosocial supervision. Speech-language group treatment takes place mainly in rehabilitation centers and nursing homes.

Recommendation 18

If circumstances permit it, group treatment can be considered for PwPs with dysarthria and communication problems.

Question 19

In what way should the SLP take the influence of medication into account?

Literature review

Though it is generally assumed that the effect of levodopa speech intelligibility is small, there are also studies that show that levodopa can have a favorable effect on the hypokinesia and rigidity of the vocal folds and, accordingly, the voice quality.

Conclusion

Level 2	It is likely that levodopa can have a favorable (but limited) effect on voice function. B Sanabria, 2001, Goberman, 2005
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Other considerations

The experience of the working group is that PwPs who do not use the proper or optimum dosage of anti-parkinson medication perform better after this is corrected. Especially when the speech-language treatment does not need to start immediately, it is worth to wait for the medication to take effect.

The SLP also has to deal with patients who have response fluctuations. This means that it can be important, on the one hand, to plan practice sessions mainly during *on* periods and, on the other hand, to teach patients how they can best handle the *off* periods.

Recommendation 19a

It can be worthwhile to start the speech-language treatment only after the medication has been well regulated.

Recommendation 19b

It is recommended to take the patient's *on* and *off* periods into account during treatment.

Question 20

What is the value of instrumental aids in influencing the intelligibility of PwPs?

Communication aids can be useful in speech-language treatment.

Literature review

Some SLPs use a pacing board or metronome to help a PwP to divide his message in short parts or to reduce accelerated speech. This technique was already described in 1983 (161), but was not subjected to scientific evaluation.

A portable amplification system is intended to amplify intelligible but soft speech to a conversational volume. There are only two descriptive articles (from 1968 and 1972) regarding the use of portable amplification systems. Referring to the previous article (162), Green et al. (7) report that a portable amplification system can be helpful for PwP as well, when the only problem is lack of volume. Of course, intelligibility would not be improved if mumbling were to be amplified.

Conclusion

Level 4	The use of a pacing board or metronome can be helpful for counteracting accelerated speech. D Lang, 1983, lansek, 1997
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Level 4	The use of a portable amplification system can be helpful for amplifying a soft voice to an intelligible level when the articulation is adequate. D Greene, 1968, 1972
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Other considerations

The speech rate automatically decreases through treatment with PLVT/LSVT since loudness does not accompany a high speech rate. If the speech rate cannot be influenced by PLVT/LSVT, a pacing board or metronome, among other things, can be used as a cueing strategy. However, it is unlikely that this cue will also be applicable in a normal conversation outside the home.

Forty years ago, when speech-language treatment for PwPs was still seen as ineffective and pointless (7, 162), speech amplification was considered an obvious option when the articulation was adequate. It has since become clear that the intelligibility of PwPs can be

improved with PLVT/LSVT, precisely by teaching the patient to speak louder. When the hypokinetic dysarthria is very severe and can no longer be cued, this usually pertains to all speech components, that is, voice quality, volume, articulation and prosody. It is therefore only in exceptional cases that when volume can no longer be improved articulation is still acceptable.

Recommendation 20a

When PLVT/LSVT does not sufficiently help to counteract accelerated speech, the use of a pacing board or metronome can be considered.

Recommendation 20b

Only when treatment techniques such as PLVT/LSVT are insufficient in helping to regain an acceptable voice volume *and* when the quality of the articulation permits it, the use of a portable amplification system can be considered.

Question 21

What are the treatment options for communication problems resulting from language impairments in PwPs?

Cognitive impairments in Parkinson's disease can also influence speech and communicative skills, such as word-finding problems, no longer being able to make long sentences, no longer being able to respond fluently, taking a long time to answer a question and having difficulty following a conversation.

Literature review

There is no evidence that the treatment of cognitive impairments has an effect on the communication skills of PwPs. The working group members take the view that it can be helpful to learn compensation strategies for initiating and sustaining a conversation. This depends on the competence and experience of the speech-language pathologist (2). Apathy can be a dominant feature in some PwPs with dementia, resulting in a decrease in the patient's need to communicate. In the experience of the working group members, explanation and acceptance are more useful in these cases than compensation strategies.

Level 4	<p>The working group believes that it is useful for the SLP to attempt to find compensation strategies for the communication problems of a PwP (which are due to cognitive impairments, not to poor intelligibility).</p> <p>D Opinion of the working group</p>
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Other considerations

Finding compensation strategies depends in part on the type and extent of the patient's social contacts and his learning ability.

Examples of compensation strategies for the conversational partner / caregiver are to:

- initiate the conversation when the patient has problems doing so;
- repeat questions;
- repeat the topic of conversation;
- actively steer the topic of conversation to the interests of the patient;
- allow more time for a response.

The chance of success is probably largest when the dysarthria is not severe or when the patient has first learned to improve his intelligibility.

Recommendation 21

The SLP has a task in understanding and identifying compensation strategies for language impairments and communication problems that are not caused by poor intelligibility.

Question 22

What place do communication aids have as a replacement for speech in Parkinson's disease?

When intelligibility speech is almost no longer possible, speech can be replaced by pointing to a communication board or alphabet board or by using a communication aid, with or without artificial speech (augmentative and alternative communication; AAC). A condition is that the patient knows what he wants to say, is able to recall words in their written form and has one consistently usable motor function to correctly point out or key in letters or symbols.

Literature review

The use of AAC is a familiar intervention in speech-language pathology (163). Research shows that communication aids increase the communicative effectiveness (164). However, there are no known studies, which address the added value of communication aids for PwPs.

Conclusion

Level 4	Properly adapted communication aids can support or replace speech. D Van Balkom 1994, Hustad 2005
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Other considerations

In the experience of the working group members, PwPs who are in no way capable to produce intelligible speech are usually in the final phase of the disease and their cognition and motor function is thus also limited.

For patients with an atypical parkinsonism, when the dysarthria may worsen faster than the hand-arm motor function, a communication aid can still provide important support.

Recommendation 22

For PwPs with very severe dysarthrias, but with a useful hand-arm function, it is recommended that the SLP advises and supports the use AAC.

Question 23

What is the role of the caregiver(s) in the treatment of dysarthria and communication problems?

Literature review

There are no studies, which have assessed and evaluated the task of the caregivers of PwPs with speech problems.

As the disease progresses, the PwP also becomes more dependent of his conversational partners with respect to verbal communication. The working group members believe that the caregivers should be well acquainted with the cues and best strategies which are necessary for supporting the PwP in being optimally intelligible in daily communication. This varies from helping the patient, as an instructed co-therapist, to exercises at home during the intensive treatment period (see Recommendation 12a) and using cues to facilitate louder speech (see Recommendation 13), to repeating questions and maintaining a conversation (see Recommendation 19).

Level 4	Caregivers have an important role in generalizing and maintaining intelligible speech of the PwP in daily communication. D Opinion of the working group
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Other considerations

If the partner cannot fulfill the role of co-therapist or instructed conversational partner, the SLP would do well to inform and instruct other caregivers as well as health professionals (e.g. nurses).

Recommendation 23

It deserves recommendation for the SLP to actively involve the caregivers in the treatment of the dysarthria and communicative slowness. The caregiver can perform three tasks (roles):

4. co-therapist during intensive PLVT/LSVT;
5. trained conversational partner in intelligibility problems: using cues to facilitate the learned technique for producing more intelligible speech;
6. trained conversational partner in communicative (cognitive) problems: assisting during conversations by, for example, repeating questions.

Question 24

What are the best tools for determining the treatment results?

Literature review

The following measurements can be used both at the start and evaluation of the treatment (see also Key Questions 1 and 2). The TOM “intelligibility” and “dysarthria” subscales are sufficiently reliable for individual use (136). Though the responsiveness has not yet been determined, the standardized questionnaire (see Appendix 2) can also be used as an evaluation after the treatment in order to get an impression of the patient’s opinion (133). An important aspect of administering the PLVT/LSVT is measuring the speech intensity with a dB meter (138,148). The intensity of the spontaneous speech must then be measured at the end of the treatment in exactly the same way as during the first session.

Conclusion

Level 3	<p>It is reasonable to assume that dB meter measurements and TOM scales can be used for quantifying the treatment result.</p> <p>C Ramig 1995, Knuijt 2007</p>
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Other considerations

The qualitative evaluation of the treatment consists of discussing with the patient to what extent the treatment goals – which are usually formulated at the start of the treatment – have been achieved.

Recommendation 24

<p>It is recommended that the treatment results be determined by:</p> <ul style="list-style-type: none"> – objectively evaluating the intensity of the spontaneous speech with a dB meter or video recording – subjectively evaluating the dysarthria and intelligibility during spontaneous speech with the TOM scales – discussing with the patient and caregivers the extent to which the initial treatment goals have been achieved
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Summary of Chapter 3

Possible outcomes of the speech-language evaluation and considerations in making a therapeutic decision (see also the summary card in Part I).

Possible conclusions	Treatment
The patient has little to no hypokinetic dysarthria and can easily cue himself, if necessary, to speak louder:	It is sufficient to give advices on speaking with more intensity during a one-time consultation.
The patient has clear hypokinetic dysarthria in which loudness and pitch can be easily stimulated:	Indication for short, intensive treatment with PLVT/LSVT, preferably with a co-therapist.
The patient has clear hypokinetic dysarthria which can be improved to a certain extent (or which is combined with another form of dysarthria):	Attempt intensive treatment, but also supervise and instruct conversational partners.
The patient has very severe hypokinetic dysarthria in which little to no improvement is possible:	Focus on supervising and instructing conversational partners or – when the patient has sufficient indicating ability and cognitive skills – on teaching the use of a communication aid.
The patient suffers primarily from reduced word-finding and communicative problems:	Suggest and discuss compensations, together with the caregiver(s).
The patient has severe apathy, meaning that he can speak intelligibly but hardly speaks anymore and prefers to remain silent:	Explain and help with acceptance.

4. Dysphagia

This chapter describes the assessment of swallowing (4.1) and the treatment of dysphagia (4.2) in people with Parkinson's disease.

4.1 Evaluation of chewing and swallowing

This section provides answers to the following questions:

25. In reviewing the PwP's history with respect to chewing and swallowing problems, what must at least be addressed?
26. Which swallowing assessment is relevant to PwPs?
27. When should the SLP recommend instrumental assessment for a PwP with swallowing problems?

Question 25

In reviewing the PwP's history with respect to chewing and swallowing problems, what must at least be addressed?

With respect to dysphagia, reviewing the patient's history is an important part of the assessment. By carefully inquiring about the complaints, it is possible to acquire a good picture of the nature and severity of the swallowing problems. Asking more in-depth questions is also important because of possible underreporting (see also Question 26).

Literature review

There are no validated questionnaires specific for PD about the specific complaints and subjective severity of dysphagia and its consequences.

General history questions regarding problems with chewing and swallowing can be founded in the speech-language pathology manuals (87, 165). A qualitative study by Miller et al. (5) has shown that dysphagia in PwPs does not have to be severe in order to have a significant influence on meals and social participation. Specific questions regarding dysphagia in PD can be found in **Appendix 6**.

A standardized questionnaire is being developed (133). A preliminary analysis shows that the questions have a high internal consistency ($\alpha > 0.90$) and correlate reasonably well with swallowing speed ($r > 0.60$), swallowing frequency ($r = 0.62$) and disease severity ($r = 0.63$) (166). **See Appendix 7**.

Conclusion

Level 4	In reviewing the history of dysphagia in PD, experts believe that questions should be asked about not only dysphagia, but also its consequences with respect to food consistencies, speed and eating with others. D Miller 2006
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Other considerations

Prior to the first consultation, the patient can complete a standardized questionnaire to serve as a basis for further interviews.

Recommendation 25a

It is recommended that, when reviewing the patient's history of oropharyngeal dysphagia, the SLP inquires about the specific problems and their progression at the function level (swallowing, slow eating), activity level (avoiding difficult food consistencies) and participation level (eating with others).

Recommendation 25b

The SLP should consider having a PwP complete a standardized questionnaire before the first session.

Question 26

Which swallowing assessment is relevant to PwPs?

In diagnosing dysphagia based on a patient's history, underreporting is possible. In other words, the PwP may have mild dysphagia but does not complain about it. (56,57). Not every patient experiences the gradual adjustments to less easy swallowing, such as eating slower and taking smaller sips, as a disorder. Conversely, occasionally choking on substances or more frequent coughing is not necessarily caused by a genuine swallowing disorder. Quantitative swallowing tests (maximum performance tests) are easy measurements for determining whether dysphagia is likely or unlikely (167). But just as in speech, the working group believes that these tests should primarily be used to evaluate the stimulability of PwPs.

Literature review

Swallowing speed is defined as the volume of water divided by the time required drinking the water, expressed in milliliters per second. Normal values for this test are listed according to age group (167,168). Nathadwarawala et al. (169) found a positive predictive value of 64% and a negative predictive value of 93% for the cut-off value of 10 ml/s. Clarke et al. (170) compared 64 PwP with 80 healthy control subjects and found that PwP had significantly lower swallowing speeds than the control group as well as significantly lower swallowing speeds during the *off* phase than during the *on* phase.

In another measurement, the patient is asked to swallow a volume of water in one swallow. Ertekin et al. (171,172) determined that many patients with dysphagia have difficulty swallowing 20 ml in one swallow. To swallow a food bolus in smaller pieces i.e. "piecemeal swallowing" (87) is a normal adjustment to reduced swallowing capacity. Potulska et al. (56) compared 18 PwPs with healthy volunteers and found that all PwPs, but not the controls, had a swallowing volume of less than 20 ml. Only five of the 18 PwPs had also reported swallowing complaints and their swallowing volumes were significantly lower than those of the patients without swallowing complaints.

Conclusions

Level 2	<p>It is likely that, in more than two-thirds of the cases, measuring the swallowing speed with a cut-off point of 10 ml/s correctly identifies the presence or absence of an oropharyngeal dysphagia.</p> <p>B Nathadwarawala 1994, Clarke 1998</p>
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Level 2	<p>It is likely that the inability to swallow more than 20 ml of water in one swallow is an indication of dysphagia, also in PwP.</p> <p>B Ertekin 1998, Potulska 2003</p>
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Other considerations

The swallowing speed test is easy to use, but less suitable for PwPs who easily choke or who have difficulty maintaining sustained drinking due to limitations in posture and arm/hand motor function. It is perhaps easier to measure the maximum swallowing volume when the volume of water gradually increases (167). According to the working group these tests should be used to evaluate the stimulability of PwPs. In the experience of the working group members, this makes many patients perform better than they would spontaneously. In this way, it can be analyzed why swallowing goes wrong in the domestic setting and which adjustments and cues can be useful.

When the patient confirms or suggests having difficulty with swallowing, the working group proposes the following order of assessment:

1. observing spontaneous drinking (water, coffee, tea)
2. evaluating the stimulability of drinking using a maximum performance test (maximum swallowing volume and/or swallowing speed)
3. observing the patient during a meal in cases where the patient has complaints regarding solid food and observing the influence of instructions and cues.

It is also important to determine whether complaints regarding slow eating and spilling of food are caused by dysphagia or problems with arm/hand motor function, or both. An occupational therapist can be helpful when the complaints regarding eating and drinking involve problems with mobility of the arm or hand.

Recommendation 26a

<p>For PwPs with swallowing problems, it is recommended that the SLP:</p> <ol style="list-style-type: none"> c. observes spontaneous drinking d. evaluates the stimulability of drinking by using a maximum performance test (maximum swallowing volume and/or swallowing speed)
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Recommendation 26b

With respect to problems related to regular feeding, it is recommended that the SLP observes a meal and evaluates the influence of instructions and cues.

Question 27

When should the SLP recommend instrumental assessment for a PwP with swallowing problems?

Literature review

For evaluating the oropharyngeal swallowing function, the videofluoroscopy (VFS) and the flexible endoscopic evaluation of swallowing (FEES) are regarded internationally as the “gold standard” (87,173). They include both recording the various aspects of the dysphagia and evaluating the result of an intervention (174).

Since the VFS and FEES themselves are reference tests, the assessment precision and validity cannot be evaluated against a gold standard. The use of videofluoroscopy on PwPs has been shown to be scientifically valuable for describing and analyzing the pathophysiology of dysphagia. Countless studies have used a radiologic swallowing evaluation to identify the typical features of dysphagia in PwPs, including bradykinesia and silent aspiration (175-178).

Conclusion

Level 3	<p>There are indications that using videofluoroscopy with PwPs is valuable in demonstrating and explaining pharyngeal dysphagia and aspiration of food.</p> <p>C Robbins 1986, Leopold 1996, 1997, Nagaya 1998</p>
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Other considerations

Radiologic and endoscopic swallowing evaluation are complementary (87,173). A well-made VFS captures all swallowing phases up to and including the esophageal passage, but a disadvantage is that the patient is subjected to radiation. FEES is easier to perform, but it cannot record all swallowing phases. Both evaluation techniques can only be performed in a hospital. Moreover, experts find that these techniques only are valuable if they are performed or interpreted by an experienced radiologist and SLP or an otolaryngologist in collaboration with an SLP. In general, instrumental swallowing assessment is only indicated when pharyngeal and esophageal dysphagia are suspected, such as in the case of severe choking, silent aspiration, difficult pharyngeal passage, cricopharyngeal hypertrophy or Zenker's diverticulum (174). Impairments in chewing or in the oral transport phase can be sufficiently determined by non-instrumental swallowing assessment. Though instrumental assessment is greatly valuable for analyzing and describing the pathophysiology of dysphagia, it is usually only useful for the clinic if the outcome has an impact on therapeutic

decisions. Clarke et al. (170) believe that dysphagia in patients with PD is usually not severe enough to justify a VFS or FEES.

Recommendation 27

For PwPs with dysphagia whose characteristic and severity is unclear, the SLP can consider advising a supplementary assessment using VFS or FEES.

4.2 Treatment of oropharyngeal dysphagia

This section provides answers to the following questions:

28. What are important elements of instruction and education?
29. What are useful techniques for reducing choking on fluids?
30. What are useful techniques for improving lengthy chewing and slow initiation of swallowing?
31. What are useful techniques for reducing pharyngeal residue?
32. What is the value of LSVT in hypokinetic dysphagia?
33. What are useful techniques for facilitating the swallowing of pills?
34. What is the value of multidisciplinary collaboration on dysphagia?
35. What is the role of the caregiver(s) in the treatment of dysphagia?

In the treatment of dysphagia, a distinction is generally made between compensations and rehabilitation or exercise techniques. The result of a compensation is directly visible, but temporary in that it lasts as long as the compensation is used. Exercise techniques are intended to achieve long-lasting improvement (179,180). The basic principles for treating dysphagia can be found in several handbooks (87,179,181). It is also important in the treatment of PwPs with oropharyngeal dysphagia to focus attention in all cases on optimal posture, dental health, alertness and learning ability, appetite, and physical energy.

Question 28

What are important elements of instruction and education?

Chewing and swallowing are largely conscious but automatic motor functions and only the laryngeal elevation can be seen from the outside during swallowing itself. Nearly all patients with a dysphagia that are seen by an SLP are unaware of the characteristics of normal and abnormal swallowing.

Literature review

There are no scientific studies which show that providing the patient with information about normal and abnormal swallowing has added value in the treatment. However, the international consensus is that it is useful during the assessment or at the start of the treatment to explain to the patient and caregivers what normal swallowing is, what happens when choking occurs, how food can get stuck in the throat, etc. Understanding the disorder makes it easier to appreciate the goals and necessity of interventions (87). Various visual aids are available for this purpose, such as images from instrumental evaluation (VFS,

FEES), sketches or animations of the swallowing process on video or DVD or a realistic model of a cross-section of the oral cavity, pharynx and larynx.

Level 4	<p>Experts believe that providing information about the swallowing process by means of visual material can be a useful part of the treatment.</p> <p>D Logemann 2000</p>
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Other considerations

In the experience of the working group members, PwPs also benefit from having their dysphagia explained by means of visual material.

Recommendation 28

<p>To increase understanding and motivation, it is recommended to explain the normal process of chewing and swallowing to the patient and caregivers and to point out what is his case is going wrong.</p>
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Question 29

What are useful techniques for reducing choking on fluids?

SLPs use three generally accepted compensations to prevent choking on fluids: safer head position, smaller bolus size and thicker consistencies (87,88,179). An additional compensation for PwPs can be to avoid double tasking.

Avoiding double tasking

In the experience of the working group members, some PwPs who have a history of problems with choking (on fluids and/or saliva) show only few problems during a swallowing evaluation and hardly choke during swallowing tests. Since eating and drinking usually takes place in the company of others, choking can be the result of reduced attention, as in double tasks. In this case, it is presumable that the patient only has a minimal or mild dysphagia and it should be sufficient to instruct him to "first swallow everything completely, before starting to talk."

Conclusion

Level 4	<p>Experts believe that PwPs with a history of choking, but who do not choke during a swallowing evaluation and provocation tests, should be told how choking can result from double tasking.</p> <p>D Morris & Iansek 1997; opinion of the working group members</p>
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Other considerations

Teaching the PwP to practice taking larger gulps, drinking quickly and checking when everything has been swallowed can be helpful in making the patient aware of the normal swallowing capacity. The application of the usual compensations for choking (see below)

which have to be followed consistently, such as the chin tuck or thickened fluids, is too drastic in such cases and unnecessary in the opinion of the working group.

Recommendation 29a

For PwPs who have a history of choking but who do not choke during a swallowing evaluation and provocation test, it is recommended:

3. to explain choking as a result of double tasking, and
4. by means of practicing, make them aware of safe swallowing with attention.

The SLP should only consider other interventions after this has not resulted in enough improvement.

Adjusting head position

Swallowing with the chin down (chin tuck) is a widely applied compensation designed to prevent choking (182).

Literature review

Welch et al. (183) conducted a radiologic study on the effect of chin tuck on the pharynx in 30 patients with swallowing complaints and found that chin tuck pushes the base of the tongue and the epiglottis somewhat backwards, thereby narrowing the pharyngeal and laryngeal entrance and thus protecting against aspiration. Shanahan et al. (184) compared 15 neurological patients with dysphagia and aspiration who benefited from chin tuck with 15 patients with the same complaints who did not benefit from chin tuck. The latter group primarily had residue in the piriform sinus – in other words, a much more severe dysphagia. Logemann et al. (2008) used videofluoroscopy to evaluate chin tuck as a compensation in 228 PwPs who choked on fluids. In 41% of the patients, aspiration was immediately resolved upon applying chin tuck.

Conclusion

Level 3	<p>There are indications that swallowing with a chin tuck can prevent choking on fluids.</p> <p>B Logemann 2008 C Welch 1993, Shanahan 1993</p>
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Other considerations

According to experts, swallowing in a upright seated posture with the neck extended and the chin down may be sufficient to prevent choking. For patients who have difficulty closing their lips, the SLP should check whether chin tuck enhances the loss of liquid from the mouth. The right degree of chin tuck should be determined on a patient-by-patient basis. In addition, the compensation is only useful if the patient is capable of consistently maintaining it, either independently or cued by someone else.

Recommendation 29b

For a PwP who easily chokes on fluid, it is recommended that the SLP evaluates whether a chin tuck is an adequate compensation and can be maintained.

Modifying volume and consistency

Reducing the bolus volume or thickening the consistency are frequently used compensations in treating oropharyngeal dysphagia (87,88,179,185).

Literature review

After swallowing has been initiated, a large volume of food requires a quicker reaction from the pharynx than a small volume (186). As such, taking smaller volumes is a logical compensation for preventing choking. Physiological research has shown that the bolus transport time increases as the viscosity of a fluid increases (187). This can compensate for a delayed pharyngeal swallow, because the fluid reaches the pharynx later. Then the pharyngeal transport phase is in time to receive the fluid and safely transport it into the esophagus. In other words, the chance of choking is smaller with a viscous fluid than with a thin fluid.

Logemann et al. (2008) used videofluoroscopy to evaluate thickened fluids as a compensation in 228 PwPs who choked on fluids. Aspiration was immediately resolved in 46% and 56% of the patients when they drank fluids with the consistency of nectar and honey, respectively.

In a follow-up study, it could not be demonstrated whether the application of chin tuck and/or the use of thickened fluids could further reduce the chance of aspiration pneumonia in PwPs (188).

Conclusion

Level 3	<p>There are indications that choking on fluids can be prevented with thicker consistencies.</p> <p>B Logemann 2008</p>
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Other considerations

The disadvantage of small volumes is making it difficult to initiate a swallow when a PwP needs a strong tactile cue to begin swallowing.

The disadvantage of advising the use of viscous fluids (or a thickening agent for normal fluids) is that it must be consistently applied to everything the patient wants to drink. The SLP must determine the right degree of thickness for each patient.

Recommendation 29c

For a PwP who easily chokes on fluids, it is recommended that the SLP tries out whether smaller volumes and/or thicker consistencies are sufficient for preventing choking on fluids.

Question 30

What are useful techniques for improving lengthy chewing and slow initiation of swallowing?

A characteristic dysphagic symptom in PD is the difficulty to stop chewing food and to initiate a swallow. In order to swallow, the patient has to briefly stop chewing. The rigidity of the tongue also plays a part in this complaint.

Literature review

In a small study, Nagaya et al. (189) had 10 PwPs and 12 healthy volunteers perform motor exercises once for twenty minutes. This training included practicing oral motor skills, moving the head and shoulders, sustaining a tone as long as possible and attempting a Mendelsohn maneuver. Before and after the training, the "premotor time" (PMT) was measured. This is the time between a visual command to begin swallowing and the actual initiation of swallowing. While the PMT of the PwP was significantly longer than that of the control group prior to the training, this was no longer the case after the training. This experiment shows that the delayed swallowing onset of PwPs can be temporarily corrected with simple activation exercises, as also assumed by the basic principles for treatment in Morris & Iansek (190) (see Part I). It is unknown what kind of influence practicing has after a few hours or an even longer period.

Another approach described by Morris & Iansek (190), but not scientifically evaluated, involves dividing the automatic process of chewing and swallowing into steps, i.e. a cognitive movement strategy. They propose making the patient conscious of these steps: putting food in the mouth and closing the lips, chewing, collecting the food on the tongue, pushing the tongue backwards and swallowing. The patient learns to consciously eat and drink according to these steps, if necessary with the aid of an instruction card or verbal cues from a health professional or caregiver.

Conclusions

<p>Level 3</p>	<p>There are indications that activation exercises of the head-neck region can temporarily normalize the initiation of swallowing in PwPs.</p> <p>B Nagaya 2000 D Morris & Iansek 1997</p>
<p>Level 4</p>	<p>Experts believe that it is helpful to teach PwPs who chew their food for a very long time and have difficulty initiating a swallow, to perform the process consciously in steps, if necessary with the aid of visual or verbal cues.</p> <p>D Morris & Iansek 1997</p>

Other considerations

The question is whether, and for whom, it is useful to perform random exercises for twenty minutes prior to each meal, as the study by Nagaya et al. (189) suggests. In the analysis of the problem, it is very important to determine where the starting or stopping problem is in the

process and how the patient can best be cued. This requires careful observation and inventiveness from the SLP. Other possible helpful cues can be taking a sip between bites when eating bread or hot food to cue swallowing as well as to add moisture if the food bolus becomes too dry to swallow. Modifying the food consistency (soft food, puree) is also an obvious compensation, but only if all other instructions and compensation do not prove to be sufficiently helpful. In many cases, the caregivers will then also begin to play an important role.

Recommendation 30a

The SLP can consider evaluating the result on the initiation of swallowing when activation exercises are performed prior to each meal.

Recommendation 30b

For PwPs who chew too long (hypokinesia) and/or keep food in their mouth without swallowing it (akinesia), it can be useful to see whether the patient can learn to perform the process in conscious steps and by using specific cues.

Recommendation 30c

When it proves difficult to improve lengthy chewing and the initiation of swallowing from a behavioral perspective, it is recommended to advise easier food consistencies.

Question 31

What are useful techniques for reducing pharyngeal residue?

Rigidity and hypokinesia of tongue retraction, pharynx constriction and hyolaryngeal elevation can make it difficult for food to pass through the pharynx. As a result, the food bolus is not swallowed entirely. After swallowing, the patient then feels that part of the food is stuck in his throat. It can also lead to choking on solid food, either while swallowing and due to the aspiration of residue that remains after swallowing (87).

Literature review

Conscious "effortful swallowing" is a compensation which is recommended in the handbooks to correct a weak pharyngeal transport phase and thereby pharyngeal residue (87,88,179). Various physiological studies (191-193) have shown that effortful or hard swallowing instruction i.e. "As you swallow, squeeze hard with all your muscles," (Logemann, 2000, p. 238) makes the passage of food through the pharynx more effective and can prevent residue. However, there are no controlled trials available involving large groups of patients. A compensation spontaneously used by patients and also frequently advised by SLPs with respect to reduced pharyngeal passage is the adaptation of food consistencies (87,179,194). Among other things, this entails replacing hard and tough food by eating soft food using more fluids. There are no scientific studies on this subject, probably because these modifications are so self-evident.

Conclusions

Level 3	<p>There are indications that conscious effortful swallowing can be a useful compensation for improving the pharyngeal passage and reducing pharyngeal residue after swallowing.</p> <p>C Hind 2001, Bülow 2001</p>
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Level 4	<p>Experts believe that replacing hard and tough food by softer food is an obvious compensation for pharyngeal passage problems.</p> <p>D Huckabee 1999, Logemann 2000</p>
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Other considerations

Though it has not been studied in PwPs, the instruction to “swallow hard” can be sufficient for a PwP to overcome the hypokinesia and consciously make better use of his motor functions, according to the basic principles outlined by Morris & Iansek (1).

Another simple adjustment is taking an extra sip of fluid to ensure that the residue is swallowed. However, if there is clear pharyngeal weakness (but then it is more likely a atypical parkinsonism), this will have no added value.

Recommendation 31a

It is recommended for the SLP to teach PwPs with reduced pharyngeal transport to swallow harder in a conscious and consistent manner.

Recommendation 31b

When it proves difficult to improve reduced pharyngeal transport from a behavioral perspective, it is recommended to advise easier food consistencies.

Recommendation 31c

When the SLP advises the patient to modify food consistencies, it is recommended to ask a dietitian to advise the patient on the best way to maintain a wholesome diet.

Question 32

What is the value of LSVT in hypokinetic dysphagia?

Literature review

In a pilot study, El Sharkawi et al. (195) studied the effect of the Lee Silverman Voice Treatment (LSVT) on the swallowing function of Parkinson's patients. The team treated eight

patients suffering from idiopathic Parkinson's disease with LSVT over the course of four weeks and used VFS to compare seventeen abnormalities in the oral and pharyngeal transport phases before and after the treatment. This resulted in various improvements, such as short transport times and less food residue, but the differences were not always significant.

Conclusion

Level 3	<p>There are indications that LSVT could have a favorable influence on swallowing in PwPs.</p> <p>C El Sharkawi 2002</p>
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Other considerations

Although these results are based on just a small number of patients and do not contain data on how long the results lasted, these findings correspond with the experiences of SLPs with the side-effects of intensive voice treatment using LSVT or PLVT (see Chapter 3). The improvement of speech motor function also appears to activate the primary oral functions to a certain extent. It is illogical to administer LSVT or PLVT only to improve swallowing. However, if the patient also has a treatable hypokinetic dysarthria, it is an obvious step to use this technique and to reevaluate which swallowing complaints remain after an intensive treatment of the speech.

Recommendation 32

For PwPs with dysphagia and hypokinetic dysarthria, the SLP can consider to give only the necessary advice and to reevaluate the chewing and swallowing after treatment with PLVT/LSVT.

Question 33

What are useful techniques for facilitating the swallowing of pills?

Some PwPs develop difficulty swallowing their medication as the disease progresses, while it is of utmost importance to their functioning that they take it on time and completely.

Literature review

There are a few studies on the added value of orally disintegrating tablets (ODT) for PwPs, but this type of anti-parkinson medication is not available in the Netherlands.

Other considerations

In many cases, the same recommendations and instructions probably apply to the swallowing of pills as to the swallowing of food, depending on the nature and cause of the problem. If taking the medication with water is a problem due to choking, taking the medication with food can be helpful. It is important to note here that levodopa preparations should not be taken with protein-rich products (e.g. pudding, yogurt) and not during or right before a meal because this reduces their effectiveness (see also **Appendix 11**).

Other causes of the complaint can include taking all pills at the same time or not drinking enough water along with the pills so that they remain in the mouth or throat. The SLP must be capable of analyzing this, based on the patient's history and observing the pill swallowing, choosing the simplest modification and teaching it to the patient. Examples of modifications include taking the medication with a large amount of water instead of small sips or taking the medication with a spoonful of applesauce (instead of pudding) if it is no longer possible with water.

Recommendation 31

Given the various causes of difficulty with swallowing pills, it is recommended that the SLP comes up with and evaluates appropriate advice, based on individual observation of the patient swallowing pills and on the existing treatment techniques for swallowing disorders.

Question 34

What is the value of multidisciplinary collaboration on dysphagia?

In treating PwPs with dysphagia, the SLP may have to deal with various disciplines.

Literature review

The SLP has to deal with a dietitian when the consequences of modified food consistencies, impaired oral food intake or undesirable weight loss related to the dysphagia are involved. For PwPs who are dependent on nursing home care, it is essential that there is coordination between the SLP and the nurse regarding assistance with eating and drinking and oral care (86,196).

Eating and drinking are part of the activities of daily living (ADL) and can be a problem as a result of impaired arm/hand function. For instance, Lorefält et al. (85) showed that some PwPs also avoid solid food because they have difficulty handling utensils. An occupational therapist is the appropriate person for analyzing and treating this. Lastly, a physical therapist can help the SLP if it is difficult to achieve the body posture necessary for safe eating and drinking.

Internationally, it is also recognized that the treatment of PwPs requires multidisciplinary collaboration (190).

Conclusion

Level 4	Experts believe that multidisciplinary treatment and collaboration is useful in the care of PwPs with oropharyngeal dysphagia. D Morris & Iansek 1997, Huckabee 1999, Kalf 2008
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Other considerations

The form of cooperation in a team depends on the setting. In most institutions, care is usually coordinated during a multidisciplinary consultation. In primary care, this depends on whether regional agreements have been made.

Recommendation 34

In the treatment of dysphagia, it can be useful for the SLP to collaborate with a dietitian, nurse, occupational therapist or physical therapist.

Question 35

What is the role of the caregiver(s) in the treatment of dysphagia?

Literature review

There are no studies that have assessed and evaluated caregivers' tasks related to PwPs with dysphagia. As the disease progresses, the PwP becomes more and more dependent on his caregivers for safe and sufficient eating and drinking. The working group members believe that especially the caregivers of PwPs who are dependent on external cues for chewing and swallowing should be properly informed and instructed by the SLP.

Level 4	<p>The caregivers have an important role in applying cues to facilitate swallowing and to prevent choking or very slow swallowing.</p> <p>D Opinion of the working group</p>
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Other considerations

If the partner cannot fulfill the role of the instructed caregivers, the SLP would do well to inform and instruct other caregivers as well as health professionals (e.g. nurses).

Recommendation 35

The SLP is advised to actively involve the caregivers in the treatment of dysphagia, especially when the PwP is dependent on external cues.

Summary of Chapter 4

Possible outcomes of the dysphagia assessment and considerations in making a therapeutic decision (see also the summary card in Part I).

Possible conclusions	Treatment
The patient has a minor dysphagia, effected by double tasking or inadequate head position:	Teach compensation strategies (e.g. posture, volume) and cues to limit or prevent choking and difficulty with swallowing pills, etc.
Moderate to severe dysphagia, including slow eating and/or aspiration risk.	Modify food consistencies or provide more assistance or cues to maintain an acceptable speed and limit fatigue, if necessary, in consultation with a dietitian and occupational therapist.

5. Drooling

This chapter describes the evaluation of drooling (5.1) and the treatment of drooling (5.2) in patients with Parkinson's disease (PwP).

5.1 Evaluation of saliva control

This section provides answers to the following questions:

36. In reviewing a PwP's history with respect to drooling, what must at least be addressed?
37. What is the best way to quantify the severity of drooling?
38. Which contributing factors to drooling can be examined in PwPs?

Question 36

In reviewing a PwP's history with respect to drooling, what must at least be addressed?

It is often not possible to observe light to moderate and even severe drooling during an introductory interview or assessment because the PwP is doing his best to avoid this. Drooling is thus usually diagnosed based on an interview.

Inquiring about the occurrence of drooling in PwPs and what kind of problems they have with drooling can provide a good idea of the severity of the problem. It may be that the both the patient and partner (or caregiver) provide this information, who may give different answers.

Literature review

When interviewing the patient about drooling, it is important not only to ask about the occurrence of drooling but also its impact on personal activities and social contacts (97). Specific history questions regarding drooling in Parkinson's disease can be found in **Appendix 8**.

A validated questionnaire on drooling in Parkinson's disease (197), consisting of seven questions on a 4-point scale, can be used to assess the severity of drooling and the problems related to it. The internal consistency is good ($\alpha = 0.78$), while the scale has a moderate correlation to saliva volume ($r = 0.41$) and a reasonable correlation to disease severity ($r = 0.70$). The questionnaire does not have a translated and validated Dutch version.

A Dutch questionnaire is being developed. A preliminary analysis shows that the questions have a high internal consistency ($\alpha > 0.90$) and a reasonable correlation with disease severity ($r = 0.50$) and disease duration ($r = 0.44$) (198), see **Appendix 10**.

Another Dutch instrument is the *Observatie-instrument Speekselverlies* (199), which is a translation and adaptation of *A Practical Approach to the Management of Saliva* (200). The instrument consists of four unvalidated evaluation forms (a combination of patient history, observation and speech-language evaluation) and is intended for all age groups. In the opinion of the working group, however, the instrument is too detailed and not specific enough for use with PwPs.

Conclusions

Level 3	<p>There are indications that, while reviewing the patient's history, the SLP should also inquire about the impact of drooling on personal activities and social contacts.</p> <p>C Perez Lloret 2007</p>
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Other considerations

In the experience of the working group members, it is also useful for the SLP to know *when* the drooling usually occurs. For example: it usually occurs during activities in which the patient is bent over and concentrating on something, but sometimes precisely when the patient is relaxing, such as when watching television.

Recommendation 36a

In reviewing the patient's history with respect to drooling, it is recommended for the SLP to inquire about complaints at the function level, activity level and participation level. Understanding when drooling exactly occurs can also provide a basis for the treatment.

Recommendation 36b

The SLP should consider having a PwP complete a standardized questionnaire for the first consultation.

Question 37

What is the best way to quantify the severity of drooling?

Literature review

Thomas-Stonell & Greenberg (201) described the Drooling Severity and Frequency Scale (DSFS), a not validated scale which was developed to quantify drooling in children with cerebral palsy, but is also frequently used in evaluation studies on the medical treatment of drooling in PD. With the addition of the "feeling of too much saliva" option, the scale is probably more suitable for PwPs. Preliminary results of the validation evaluation show that the scale is valid ($r = 0.96$) when correlated with the "saliva" subscale of the Unified Parkinson's Disease Rating Scale (UPDRS) (198). See **Appendix 9**.

Conclusion

Level 3	<p>There are indications that the Drooling Severity and Frequency Scale modified for Parkinson's disease (DSFS-P) is a valid scale for quantifying the severity of drooling.</p> <p>C Thomas-Stonell 1988, Kalf 2007</p>
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Other considerations

The scale can either be completed by the patient in advance or during the interview. The objective measurement or treatment of the saliva secretion is not relevant to speech-language assessment, because it cannot be influenced by behavioral treatment and it is also probably not the main cause in PD.

Recommendation 37

The use of the DSFS-P to quantify the severity of the drooling can be considered.

Question 38

Which contributing factors to drooling can be examined in PwPs?

Literature review

There are currently no publications available on the aspects of drooling which can be influenced behaviorally, but there are suggestions that drooling in PwPs may be caused by reduced swallowing frequency, swallowing inefficient, not closing the mouth adequately and/or a stooped posture (202).

In the experience of the working group members, it is useful to analyze the potential causes of the drooling and whether these causes can be influenced by therapy. The following aspects are involved:

- Mouth closure: does the patient leave his mouth open without noticing it? If so, can this be corrected verbally and is the patient able to keep his mouth closed?
- Attentiveness in swallowing: can the patient adequately swallow his saliva and can he swallow fast enough if he is reminded to do so?
- Body posture and head position: does the patient have a stooped posture or laterocollis? If so, can he compensate for this when needed to prevent drooling?
- Is the patient capable of learning a movement strategy for certain activities (see below)?

Conclusion

Level 4	In the experience of the working group, it is useful to attempt to influence the potential causes of drooling from a behavioral perspective.
	D Opinion of the working group

Other considerations

If the patient requires a lot of instruction and assistance, the SLP must realize that caregivers have to be able to carry on this assistance when the patient is at home.

Recommendation 38

It is recommended to analyze what the treatable causes of the drooling are, such as closing the mouth, adequate swallowing, head and body posture and the extent to which the patient

can be instructed and is able to put this instruction into practice and maintain it (if necessary with the help of a caregiver).

5.2 Treatment of drooling

This section provides answers to the following key questions:

- 39. What is the value of speech-language treatment of drooling?
- 40. What is the role of the caregiver(s) in the treatment of drooling?

Question 39

What is the value of speech-language treatment of drooling?

The treatment of the oral motor causes of drooling has hardly been described or evaluated.

Literature review

Various studies and reviews are available on the medical treatment of saliva secretion (see Chapter 2), but these fall outside the scope of this guideline.

Currently, only one publication by Marks et al. (2003) has appeared on the speech-language treatment of drooling. They studied the effect of having a patient practice swallowing saliva for 30 minutes each day over four weeks, using a metronome in the form of a brooch. It is not mentioned how frequent the metronome gave the signal to swallow. The intervention group consisted of six PwPs who scored a 1 on the severity scale (0 to 15) designed for this purpose and who were also able to swallow on command. The control group consisted of patients for whom only a baseline score was determined and a small group of patients who received an injection of botulinum-toxin as a reference treatment. Data on the place of injection or dosage is lacking. In the treatment group, the average score improved from 10 to 5.5, but data on the statistical significance is lacking. Over 60% of the patients reported experiencing improvement.

Conclusion

Level 3	<p>There are indications that the treatment of drooling by means of a self-use swallow reminder can be effective in reducing the loss of saliva.</p> <p>B Marks 2001</p>
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Other considerations

A special metronome for cueing the swallowing frequency is not yet available in the Netherlands.

In the experience of the working group members, explaining the cause of drooling and employing simple modifications can already lead to a clear improvement in some patients. As soon as the patient understands that it is normal to swallow saliva as soon as it is felt in the mouth, some change might already be possible.

Teaching the patient cognitive movement strategies can also be helpful, for example:

- before starting to speak, first collect and swallow your saliva;
- before standing up, close the mouth and collect and swallow saliva (if necessary, integrate this with other movement strategies in consultation with the physical therapist).

The result depends on the severity of the drooling and the instructability and cognition of the patient. If necessary, the caregiver will be given a role in instructing and cueing the patient. After a few sessions, it should be clear whether the approach produces results. If not, it is probably not worthwhile to practice for a longer period.

If behavioral interventions do not produce enough results, the SLP should refer the PwP back to the physician, with a detailed report of the findings, for possible medical treatment (e.g. injections with botulinum-neurotoxin).

Recommendation 39a

For PwPs with drooling complaints, it is recommended that the SLP explains the causes of drooling and attempts to positively influence these by providing instructions about swallowing and movement strategies.

Recommendation 39b

Because data are lacking regarding the added value of specific treatment techniques, terminating treatment can be considered when there has been no clear improvement after two or three sessions.

Recommendation 39c

If behavioral treatment produces insufficient results, it is recommended that the SLP refers the PWP back with a report, for possible medical treatment.

Question 40

What is the role of the caregiver(s) in the treatment of drooling?

Literature review

There are no studies that have assessed and evaluated the task of the caregivers of PwPs who have problems with drooling. As the disease progresses, the risk of drooling increases. The working group members believe that especially the caregivers of PwPs who are dependent on external cues for preventing drooling, should be properly informed and instructed by the SLP.

Level 4	The caregivers can play an important role in using cues to prevent drooling. D Opinion of the working group
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Other considerations

If the partner cannot fulfill the role of the instructed caregivers, the SLP would do well to inform and instruct other caregivers as well as health professionals (e.g. nurses).

Recommendation 40

The SLPs advised to actively involve the caregivers in preventing drooling, especially when the PwP is dependent on external cues and movement strategies.

Summary of Chapter 5

Possible outcomes of the speech-language pathology evaluation and considerations in making a therapeutic decision (see also the summary card in Part I).

Possible conclusions	Treatment
The patient only has a feeling of having accumulation of saliva:	Explain the importance of swallowing in time.
The patient has a history of drooling or the drooling is visible:	Try out modifications and cues, such as a cue for closing the mouth, swallowing before standing up and so on. When results are insufficient, refer back to the neurologist.

Appendices

1. Contributors to the guideline
2. Sample questions for taking patient's history of speech and language impairments in Parkinson's disease
3. Questionnaire on dysarthria in Parkinson's disease (ROMP-speech)
4. Nijmegen Dysarthria Scale (NDS)
5. Rating form for dysarthria and language production
6. Sample questions for taking patient's history of oropharyngeal dysphagia in Parkinson's disease
7. Questionnaire on dysphagia in Parkinson's disease (ROMP-swallowing)
8. Sample questions for taking patient's history of drooling in Parkinson's disease
9. Drooling Severity and Frequency Scale, modified for Parkinson's patients (DSFS-P)
10. Questionnaire on drooling in Parkinson's disease (ROMP-saliva)
11. Medication for Parkinson's disease
12. Overview of desired evidence
13. Evidence tables

Appendix 1. Contributors to the guideline

Commissioning party

Dutch Association for Logopedics and Phoniatics (NVLF)

Project group

- Prof. B.R. (Bas) Bloem, neurologist and medical director of Parkinson Centrum Nijmegen, UMC St Radboud Nijmegen.
- Dr. M. (Marten) Munneke, senior researcher and scientific director of Parkinson Centrum Nijmegen, UMC St Radboud Nijmegen.
- J.G. (Hanneke) Kalf, MSc speech-language pathologist and researcher of the department of Rehabilitation and Parkinson Centrum Nijmegen, UMC St Radboud Nijmegen.
- Dr. B.J.M. (Bert) de Swart, speech-language pathologist and head of the department of Rehabilitation, UMC St Radboud, Nijmegen and assistant professor of Neurorehabilitation at the HAN University of Applied Sciences.

Supervisor

- J.G. (Hanneke) Kalf, speech-language pathologist and researcher, Rehabilitation ward and Parkinson Centrum Nijmegen, UMC St Radboud Nijmegen.

Steering committee

- P. (Peter) Hoogendoorn, former chairman of the Dutch Parkinson's Disease Association (*Parkinson Patiënten Vereniging*).
- C. (Cora) Kok, succeeded by C. (Cindy) Koolhaas, policy officer in the advancement of quality and expertise at the Dutch Association for Logopedics and Phoniatics (NVLF).
- M. (Mirjam) Top, lecturer in speech-language pathology, HAN University of Applied Sciences.
- S.J.H. (Samyra) Keus, physical therapist/researcher, Leiden University Medical Center (LUMC), 1st author of physical therapy guidelines (KNGF) and Cesar & Mensendieck exercise therapy (VvOCM) in Parkinson's disease.

Primary working group

- M.W.J. (Marianne) Bonnier, freelance speech-language pathologist in Uden and Ravenstein.
- J.H.M. (Jolanda) Kanters, speech-language pathologist, Breda rehabilitation center.
- M.F.C. (Marga) Hofman, speech-language pathologist at De Zeven Bronnen nursing clinic in Maastricht and lecturer in speech-language pathology at Zuyd University in Heerlen.
- J.E.M. (Judith) Kocken, speech-language pathologist at Rijnstate hospital in Arnhem and freelance speech-language pathologist in Arnhem.
- M. (Marije) Miltenburg, speech-language pathologist at Canisius Wilhelmina hospital in Nijmegen.

Secondary working group of speech-language pathologists

- H. Zegwaard-Vos, Zegwaard-Vos speech-language pathology clinic in The Hague.
- M. Kwak, Bronovo hospital in The Hague.

- H. Kos-Jonker, Naarden-Bussum clinic for speech-language pathology.
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- D. van der Kaaden, Friesland rehabilitatin center in Beesterzwaag.

Secondary multidisciplinary working group

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- A. De Groot, specialist nursing home physician/instructor VU Medical Center-GERION in Amsterdam.
- Dr. R. Meijer, specialist in rehabilitation medicine, Groot Klimmendaal in Arnhem.
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- S.H.J.Keus, MSc physical therapist/research, Leiden University Medical Center in Leiden.
- Dr.H.M. Smeding, neuropsychologist, Academic Medical Center (AMC) in Amsterdam.
- M. Smits-Schaffels, general practitioner in Soest.
- H.E.A. ten Wolde, social worker, Maartenshof nursing home in Groningen.

Patients and caregivers

A panel of four Parkinson's patients and two caregivers from the working group of the Dutch Parkinson's Disease Association.

Test groups

- 55 speech-language pathologists from ParkinsonNet in the regions Alkmaar, Apeldoorn, Arnhem-Zevenaar, Ede-Wageningen, Delft, The Hague, Deventer, Doetinchem, Eindhoven, Haarlem, Gooi, Gouda, Nijmegen-Boxmeer, Oss-Uden-Veghel, Venlo, 's-Hertogenbosch, Zoetermeer and Zutphen.
- 59 speech-language pathologists from ParkinsonNet in the regions Bergen op Zoom, Breda, Heerlen-Kerkrade, Helmond-Geldrop, Hoorn, Maastricht, Roermond, Roosendaal Sittard-Geleen, Tilburg-Waalwijk, Weert, Zeeland-Noord, Zeeuws-Vlaanderen (Terneuzen).

Others

- Dr. J.J.A. (Hans) de Beer, Dutch Institute for Healthcare Improvement (CBO) Utrecht, guideline development program.
- Mr. R. (Ruud) Aalbersberg, chairman of the Parkinson's advisory council on care of the Dutch Parkinson's Association.

Explanation of the measuring instruments

The measuring instruments which appear in the appendices can be administered as follows:

The standardized questionnaires (*Appendices 3, 7 and 10*) are rated by the patient (if necessary, together with the caregiver) in order to provide an idea of the severity of the complaints. Since these are standardized questions, they can be completed by the patient in the waiting room or sent to the patient prior to the first consultation. This saves time and gives the patient the opportunity to think about the questions or discuss them with the caregiver. (At this point, the sum score does not have significance for the assessment).³

The sample questions (*Appendices 2, 6 and 8*) are intended to be an aid so that nothing is missed while taking the patient's history. The history questions can be incorporated into an evaluation form or used as a checklist during the history taking.

The severity scales (*Appendices 4 and 9*) are intended to enable the documentation of the severity of the problem in a standardized manner.

The dysarthria rating form (*Appendix 5*) is intended for the purpose of noting an overview of the outcomes of the dysarthria evaluation, as described in Section 3.1. The rating form can be included in your own speech-language evaluation form.

³ Meanwhile, the validation of the ROMP has been published as: Kalf et al. Archives of Physical Medicine and Rehabilitation 2011; 92(7):1152-1158.)

Appendix 2. Sample questions for taking a patient's history of speech and language impairments in Parkinson's disease

At the impairment level:

- Is your voice too soft or too hoarse?
- Has your voice gone up in pitch?
- Do you frequently have to cough as though there's something in your throat?
- Do you get out of breath while speaking?
- Does speaking make you tired?
- Is there less melody in your voice? Do you find that your speech is monotone?
- Do you have problems with reduced facial expression?
- Do you sometimes have trouble finding the right words?

At the activity level:

- Are you often asked to repeat what you say? If so, when and how frequently?
- Do you still use the telephone?
- Do you find it difficult to formulate your thoughts?
- Do you have difficulty making yourself understood during conversation?

At the participation level:

- Does your reduced intelligibility have an impact on your work or other activities?
- Do you allow others to do more and more of the speaking?
- Do you feel excluded from conversations?
- Are you ashamed of the way you speak?

Appendix 3. Questionnaire on speech complaints in Parkinson's disease Radboud Oral Motor inventory for Parkinson's disease (ROMP-speech)

Circle the best description of each statement.

ROMP-speech

I. My voice is nowadays:

1. My voice sounds normal.
2. My voice sounds a bit softer or more hoarse than it used to be.
3. My voice is clearly softer or more hoarse.
4. My voice is very soft or hoarse.
5. My voice can hardly be heard.

II. My ability to speak to familiar people:

1. Familiar people find me intelligible as normal; I do not have to repeat.
2. For familiar people, I am sometime less intelligible when I am tired or do not pay attention.
3. For familiar people, I am frequently less intelligible; I have to repeat multiple times.
4. For familiar people, I am very often unintelligible, especially when I am tired.
5. For familiar people, I am usually unintelligible, also when I repeat.

III. My ability to speak to strange people:

1. Strange people find me intelligible as normal; I do not have to repeat.
2. For strange people, I am sometime less intelligible when I am tired or do not pay attention.
3. For strange people, I am frequently less intelligible; I have to repeat multiple times.
4. For strange people, I am very often unintelligible, especially when I am tired.
5. For strange people I am usually unintelligible, also when I repeat.

IV. The use of my telephone:

1. Using the telephone is no problem for me at all.
2. I use my telephone as I used to do, but I need to pay more attention than I used to do.
3. I have to repeat regularly when I am on the phone.
4. I am reluctant to use the phone, because people do not understand me.
5. Using the phone is impossible for me, because my speech is inadequate.

V. When I start to talk:

1. I can say what I want to say, as easy as I used to say.
2. I sometimes have to think a bit longer than I used to.
3. I need more time or easily forget what I wanted to say.
4. I need help to formulate my thoughts.
5. I usually do not know what to say and prefer to stay silent.

VI. Having a conversation in a group:

1. I can take part in conversations as always.
2. I can take part in a conversation, but I need to pay more attention.
3. I can only take part in a conversation when others take into account that I need more time.
4. I can only take part in a conversation when familiar people assist me.
5. I feel left out, because I cannot take part in a conversation.

VII. How bothered are you as a result of your difficulty with speaking?

1. I have no difficulty with speaking.
2. My difficulty with speaking bothers me a little.
3. I am bothered by my difficulty with speaking, but it is not my priority concern.
4. My difficulty with speaking bothers me a lot, because it is very limiting.
5. Difficulty with speaking is the worst aspect of my disease.

Appendix 4. Nijmegen Dysarthria Scales (NDS) Therapy Outcomes Measures (Enderby & John, 1997).

(This is the original English text, instead of a translation of the Dutch version.)

Dysarthria severity

- 0 Severe dysarthria:** severe persistent articulatory/prosodic impairment. Inability to produce any distinguishable speech sounds. No oral motor control. No respiratory support for speech.
*(PD: no audible speech)**
- 1 Severe/moderate dysarthria** with consistent articulatory/prosodic impairment. Mostly open vowels with some consonant approximations/severe festination of speech. Extremely effortful or slow speech, only one or two words per breath. Severely limited motor control.
*(PD: hardly audible speech)**
- 2 Moderate dysarthria** with frequent episodes of articulatory/prosodic impairment. Most consonants attempted but poorly represented acoustically/moderate festination. Very slow speech, manages up to four words per breath. Moderate limitation oral motor control.
*(PD: patient can correct with some effort and for a short while)**
- 3 Moderate/mild dysarthria:** consistent omission/articulation of consonants. Variability of speed. Mild limitation of oral motor control or prosodic impairment.
*(PD: patient can easily correct hypokinetic speech)**
- 4 Mild dysarthria:** slight or occasional omission/mispronunciation of consonants. Slight or occasional difficulty with oral motor control/prosody or respiratory support.
*(PD: speech slightly differs acoustically from non-PD speech)**
- 5 No impairment.**

* PD specific comment added for this guideline.

Level of communicative effectiveness

- 0 Unable to communicate in any way. **No effective communication.** No interaction.
- 1 Occasionally able to make **basic needs known with familiar persons** or trained listeners in familiar contexts. Minimal communication with maximal assistance.
- 2 Limited functional communication. Consistently able to make basic needs/conversation understood but heavily dependent on cues and context. Communicates better with trained listener or family members or in familiar settings. **Frequent repetition required.** Maintains meaningful interaction related to here and now.
- 3 Consistently able to make needs known but can sometimes convey more information than this. Some inconsistency in unfamiliar settings. Less dependent for intelligibility on cues and context. **Occasional repetition required.** Communicates beyond here/now with familiar persons, needs some cues and prompting.

- 4 Can be **understood most of the time by any listener** despite communication irregularities. Holds conversation, requires some special consideration, particularly with a wider range of people.
- 5 Communication **effectively in all situations**.

Appendix 5. Rating form for evaluation of dysarthria and language production

Spontaneous speech		Stimulated speech			
ON / OFF	0 = very severely impaired 1 = clearly impaired 2 = slightly impaired or uncertain 3 = normal	0 = not able to be cued 1 = somewhat able to be cued 2 = easy to cue 3 = the patient is able to cue himself			
		'automatic' speech tasks	Maximum phonation time	pitch range	
Respiration	<input type="checkbox"/> little respiratory movement	↓			
.....					
Voice					
quality	<input type="checkbox"/> hoarse (hypofunctional) <input type="checkbox"/> strained (hyperfunctional) <input type="checkbox"/> constantly wet voice				
loudness	<input type="checkbox"/> soft (hypofunctional) <input type="checkbox"/> soft (hyperfunctional)				
pitch	<input type="checkbox"/> pitch				
.....					
Articulation	<input type="checkbox"/> poor articulation movement (mumbling)				
.....					
Resonance	<input type="checkbox"/> little capacity				
.....					
Prosody					
intonation	<input type="checkbox"/> monotone <input type="checkbox"/> monodynamic				
speech rate	<input type="checkbox"/> fast <input type="checkbox"/> slow <input type="checkbox"/> acceleration <input type="checkbox"/> initiating problems, stopping problems				
.....					

Language production

word-finding	<input type="checkbox"/> slow		
communication	<input type="checkbox"/> little initiative <input type="checkbox"/> limited content		
.....			

When in doubt, perform an additional assessment by means of, for example, oral motor evaluation and diadochokinetic rates.

Symptoms of other forms of dysarthria:

No Yes, namely: weakness spasticity ataxia

in

.....

Conclusion: indication for PLVT trial treatment with PLVT other, namely

.....

Explanation of the rating form

Respiration

In Parkinson's disease, the breathing capacity may have decreased due to rigidity in the respiratory muscles (204). It should be observed what the breathing pattern is and whether the respiratory capacity is sufficient for speech.

Voice quality

The voice quality can vary from hoarse to aphonic (hypofunctional). The voice quality can vary under the influence of dyskinesias and rigidity. A strained voice indicates hyperfunctionality and can also lead to aphonia. The voice can also feature a constantly wet sound, which indicates residue from sputum or saliva on the vocal folds, which the patient does not spontaneously cough away.

Pitch

Due to the rigidity of the vocal folds, PwPs with voice complaints are more likely to have high pitch than low pitch. The pitch of healthy women averages 212 Hz (95% BI 167 – 258) and that of healthy men averages 122 Hz (95% BI 78 – 166) (205), but the pitch cannot be measured in Hertz without equipment. The fundamental frequency is five semitones above the lowest producible tone (Hirano 1981). In PwPs, a subjective assessment of the pitch is enough and factors such as fatigability and learning ability partly determine what an optimum voice pitch is.

Loudness

PwPs with intelligibility complaints usually speak too soft due to rigidity and hypokinesia (hypofunctional). An audible phonation results in an average intensity or sound pressure level (SPL) of at least 50 dB (137; 205). According to the working group, it is not necessary to measure the maximum intensity of speech in PwPs and it is sufficient to subjectively assess the loudness. However, since the emphasis of the therapy is on increasing the loudness (see Section 3.2), it can be useful to objectively determine a zero measurement for the speech intensity during spontaneous speech using a dB meter.

Articulation

Mumbling as a result of making small articulation movements, as a symptom of hypokinesia is the most striking feature in the articulation of PwPs. The quality of the articulation is subjectively evaluated. The PwP can also suffer from dyskinesias (e.g. of the tongue) or a tremor in the jaw or lips.

Resonance

Clear hyponasality or hypernasality is not a feature of parkinsonian speech.

Intonation

Monotony and monodynamics in speech are striking features of a hypokinetic dysarthria and are subjectively evaluated.

Speech rate

Though most dysarthria patients speak slower than healthy peers, the speech rate in PwPs is normal or even faster. Sometimes, the rate increases even more while speaking (acceleration). A normal speech rate averages roughly 150 syllables per minute (206) and is easy to calculate. According to the working group, however, it is not necessary to calculate this for PwPs; a subjective assessment is sufficient.

Appendix 6. Sample questions for taking patient's history of oropharyngeal dysphagia in Parkinson's disease.

At the impairment level:

- Do you choke on substances more than you used to? In other words, do you cough while eating and drinking or choke on saliva for no apparent reason? If yes, how frequently and what do you choke on?
- Do you make a mess while eating and drinking? If yes, do you have difficulty bringing food to your mouth or keeping it in your mouth?
- Do you chew on your food for a very long time or keep it in your mouth for a long time before swallowing?
- Does food get stuck in your throat? If yes, with what food does this happen and how do you usually resolve the problem?
- Do you have difficulty swallowing your medication? If yes, how do you usually solve the problem?
- Do you have problems with food that will not go down after you tried to swallow it? If yes, with what food does this happen and how do you usually solve the problem?
- Does your food get regurgitated from the stomach, do you have problems with heartburn? If yes, with what food does this happen and how do you usually solve the problem?

At the activity level:

- Can you eat and drink everything just like in the past or does your food have to be modified? If yes, how do you modify your food? (e.g. avoiding hard and tough food, eating pureed or soft food)
- Does it take you a lot longer to complete a meal? If yes, is that because your hands and arms move slower or because it takes you more time to chew and swallow your food?
- Do you eat and drink enough or have you recently unintentionally lost weight ?

At the participation level:

- Is your chewing and swallowing an obstacle with respect to eating and being with others?
- Are you worried about whether your swallowing can have an impact on your health?

Appendix 7. Questionnaire on swallowing complaints in Parkinson's disease Radboud Oral Motor inventory for Parkinson's disease (ROMP-swallowing)

Circle the best answer to each question.

ROMP-swallowing

I. How many times do you choke when eating or drinking?

1. I do not choke at all or not more than I used to do.
2. I choke about once a week.
3. I choke almost daily.
4. I choke about than 3 times a day or during every meal.
5. I choke more than 3 times a day or multiple times during meals.

II. Are you limited during drinking?

1. I can drink liquids as easy as I used to do.
2. I can easily drink liquids, but I choke a little easier than I used to do.
3. I can only drink safely when I concentrate on it.
4. In order to drink safely, I need to use a special cup or technique.
5. I can only drink safely when I take thickened liquids.

III. Are you limited during eating?

1. I can eat as easy as I used to do.
2. I can eat everything, but it takes me longer time than earlier.
3. I have to avoid tough or hard solid foods (meat, peanuts etc.).
4. I can only eat soft or easy chewable food.
5. I have to use supplemental or non-oral feeding.

IV. Do you have difficulty swallowing pills?

1. I take my pills just like I used to do.
2. I have a little more difficulty to swallow my pills than I used to do.
3. I can only take my pills with apple sauce or a specific technique.
4. Swallowing my pills is quite a struggle nowadays.
5. I cannot swallow pills anymore and need another way of taking medication.

V. Does your swallowing difficulty limit your dining with others?

1. Eating with others is no problem for me at all.
2. I dine and drink with others, but I have to take my swallowing difficulty into account.
3. I prefer eating in the presence of familiar people in familiar places.
4. I only eat at home and in the presence of familiar people.
5. I can only eat at home and with the assistance of a skillful caregiver.

VI. Are you concerned about your difficulty with swallowing?

1. I do not experience any difficulties.
2. I have some difficulty with swallowing, but I am not concerned about it.
3. I am a little concerned about my difficulty with swallowing.

4. I am becoming more concerned about my difficulty with swallowing.
5. I am very much concerned about my difficulty with swallowing.

VII. How bothered are you as a result of your difficulty with swallowing?

1. I have no difficulty with swallowing.
2. My difficulty with swallowing bothers me a little.
3. I am bothered by my difficulty with swallowing, but it is not my priority concern.
4. My difficulty with swallowing bothers me a lot, because it is very limiting.
5. My difficulty with swallowing is the worst aspect of my disease.

Appendix 8. Sample questions for taking patient's history of drooling in Parkinson's disease

At the impairment level:

- In which specific situations do you primarily experience loss of saliva?
- Do you sometimes choke on your saliva?
- Do you experience saliva in your throat or do you have to cough frequently?

At the activity level:

- What do you do to remove saliva that runs out of your mouth? Do you use a handkerchief and, if so, how often per day?
- Does your loss of saliva limit you with respect to your activities?

At the participation level:

- Does your loss of saliva limit you with respect to your social contacts? If so, in which?
- How severe is your drooling compared to other complaints?

Appendix 9. Drooling Severity and Frequency Scale, Modified for Parkinson's patients (DSFS-P)

Severity:

I. Do you experience loss of saliva during the day?

1. I do not lose saliva during the day, neither do I feel accumulation of saliva in my mouth.
2. I do not lose saliva, but I feel accumulation of saliva in my mouth.
3. I lose some saliva in the corners of my mouth or on my chin.
4. I lose saliva on my clothes.
5. I lose saliva on my clothes, but also on books or on the floor.

Frequency:

II. How often do you experience increased amounts or loss of saliva?

1. Less than once a day.
2. Occasionally: on average once or twice a day.
3. Frequently: 2 to 5 times a day.
4. Very often: 6 to 10 times a day
5. Almost constantly

**Appendix 10. Questionnaire on drooling in Parkinson's disease
Radboud Oral Motor inventory for Parkinson's disease (ROMP-saliva)**

Circle the best answer to each question.

(For the severity of drooling during the day, see DSFS-P)

When do you have the most problems with saliva and/or drooling?

(e.g. while reading, watching TV, driving a car, bending over)

.....

.....

.....

.....

I. Do you experience loss of saliva during the night?

1. I do not experience loss of saliva during the night at all.
2. My pillow sometimes gets wet during the night.
3. My pillow regularly gets wet during the night.
4. My pillow always gets wet during the night.
5. Every night my pillow and other bedclothes get wet.

II. Does your (loss of) saliva impair your eating and drinking?

1. No, my (loss of) saliva does not impair my eating or drinking.
2. Yes, my (loss of) saliva occasionally impairs my eating or drinking.
3. Yes, my (loss of) saliva frequently impairs my eating or drinking.
4. Yes, my (loss of) saliva very often impairs my eating or drinking.
5. Yes, my (loss of) saliva always impairs my eating or drinking.

III. Does your (loss of) saliva impair your speech?

1. No, my (loss of) saliva does not impair my speech.
2. Yes, my (loss of) saliva occasionally impairs my speech.
3. Yes, my (loss of) saliva frequently impairs my speech.
4. Yes, my (loss of) saliva very often impairs my speech.
5. Yes, my (loss of) saliva always impairs my speech.

IV. What do you have to do to remove saliva?

1. I do not have to remove saliva.
2. I always carry a handkerchief to remove possible saliva.
3. I use one or two handkerchiefs daily to remove some saliva
4. I need more than two handkerchiefs daily to remove saliva
5. I need to remove saliva so frequently, that I always keep tissues near me or use a towel to protect my clothes.

V. Does the loss of saliva limit you in contacts with others?

1. My loss of saliva does not limit me in contacts with others.
2. I have to pay attention, but that does not bother me.
3. I have to pay more attention, because I know that others could see me losing saliva.
4. I try to avoid contact when I know that I will lose saliva.
5. I notice that others avoid having contact with me because I lose saliva.

VI. Does your loss of saliva limit you in doing activities inside or outside your home (work, hobbies)?

1. My (loss of) saliva does not limit me in activities.
2. I have to pay attention when I am busy, but that does not bother me.
3. I have to pay more attention, which is rather effortful.
4. My loss of saliva limits me in being active.
5. Due to my loss of saliva, important activities are no longer possible for me.

VII. How bothered are you as a result of your (loss of) saliva?

1. I hardly notice loss of saliva.
2. Feeling more saliva or losing it bothers me a little.
3. I am bothered by my loss of saliva, but it is not my priority concern.
4. My loss of saliva bothers me a lot, because it is very limiting.
5. Losing saliva is the worst aspect of my disease.

Appendix 11. Medication for Parkinson's Disease

Group	Effect	Substance name	Preparation name
1. Levodopa	<ul style="list-style-type: none"> – combination of levodopa and decarboxylase inhibitor – reduces hypokinesia, rigidity and, to a lesser extent, tremor – strongest medicine 	levodopa/ benserazide	Madopar®
		levodopa/ carbidopa	Sinemet®
		levodopa/ carbidopa/ entacapone	Stalevo®
2. Dopamine agonists	<ul style="list-style-type: none"> – dopamine receptor agonist: stimulates the dopamine receptors 	bromocriptine	Parlodel®
		pergolide	Permax®
		ropinirole	Requip®
		pramipexole	Sifrol®
		apomorphine (subcutaneous injection)	APO-go®
3. COMT inhibitors	<ul style="list-style-type: none"> – in combination with levodopa to reduce <i>end-of-dose</i> phenomenon 	entacapone	Comtan®
4. MAO-B inhibitors	<ul style="list-style-type: none"> – inhibits the breakdown of dopamine in the brain – extends and enhances the effect of levodopa when taken simultaneously 	selegiline	Eldepryl®
		rasagiline	Azilect®
5. Anticholinergics	<ul style="list-style-type: none"> – reduces almost exclusively tremors – occupies only a small space, particularly for young people, in the treatment of Parkinson's disease 	trihexyphenidyl	Artane®
		biperiden	Akineton®
6. Amantadine	<ul style="list-style-type: none"> – reduces rigidity, hypokinesia, and, to a lesser extent, tremor – less efficacious than levodopa – fairly good effect on dyskinesias at later stage of disease 	amantadine	Symmetrel®

Side effects

The primary side effects may be:

- confusion, hallucinations, delusions
- sleeping disorders
- response fluctuations (*peak-dose* dyskinesia and *end-of dose* akinesia)
- nausea, dry mouth, orthostasis

Directions

All medication should be taken with water or during a meal, except for levodopa, which must be taken a half hour prior to a meal or an hour after a meal, but not with protein-rich food (i.e. dairy products). COMT inhibitors and MAO-B inhibitors should always be taken together with the levodopa.

Appendix 12. Desired Scientific Evidence for the Added Value of Speech-language Pathology in Parkinson's Disease

This is a short and thus incomplete overview of questions, which currently cannot be answered with scientific evidence. Perhaps they will be addressed and answered as part of the revision of the guideline.

Treatment of speech

1. What is the effectiveness (also cost effectiveness) of PLVT on the intelligibility and quality of life of Parkinson's patients?
2. What is the influence of intensity of treatment with PLVT?
 - a. What are the characteristics of PwPs, who have to be treated at least three times a week?
 - b. Are there PwPs for whom treatment once to twice a week is sufficient and, if so, what are their characteristics (in terms of disease severity, dysarthria severity, cognitive skills, etc.)?
3. What is the effect of computer-based systems, which enable the patient to practice independently on the result, the treatment duration and the effect duration?
4. What is the best treatment for stuttering in PwPs?

Treatment of swallowing

5. What is the effect of simple specific compensations and cues on the frequency of choking and the severity of swallowing complaints experienced by PwPs?
6. What is the effect of specific intensive swallowing exercises on severe swallowing complaints experienced by PwPs?

Treatment of drooling

7. What is the effect of simple specific compensations and cues on the frequency and severity of drooling experienced by PwPs?
8. What is the effect of specific intensive exercises on drooling experienced by PwPs?

Appendix 13 . Evidence tables: Treatment of Hypokinetic Dysarthria in Parkinson's Disease

Author	Year	Level of study	Study design	Patients	Characteristics	Intervention	Control	Follow-up	Results
Ramig	1995	A2	RCT	45 (26 vs. 19)	PD mean 64 y, mean H&Y stage 2.5	LSVT 16 x 50 min. (4 wk)	RET 16 x 50 min. (4 wk)	(in following studies)	Many outcomes. With LSVT mean increase of SPL in men with 13.96 dB and in women with 9.89 dB. With RET increase of SPL in men of 3.13 dB and in women of 1.99 dB. Reading: with LSVT mean increase in men 9.13 dB and in women 3.39 dB; with RET increase in men 1.92 dB and in 3.45 dB.
Smith	1995	B	cohort study	22 (from Ramig, 1995)	PD (see Ramig 1995)	LSVT 16 x in 4 weeks	RET 16 x in 4 weeks	No	Significant improved laryngeal function after LSVT, without increase of supraglottic hyperfunction.
Ramig	1996	A2	RCT	35 (22 vs. 13)	PD LSVT-group: 63 y, H&Y 2.6 RET-group: 65 y, H&Y 2.3	LSVT 16 x in 4 weeks	RET 16 x in 4 weeks	After 6 and 12 months	After LSVT, but not after RET, significant increase of loudness directly post treatment and after 6 months and 12 months. Reading: significant increase directly after treatment, but only for LSVT group also after 6 and 12 months. Monologue: after LSVT significant increase directly post treatment, but not after 6 and 12 months. No changes in control group.
Ramig a	2001	A2	RCT	31	PD 14 PD intervention 15 PD control 14 healthy controls	LSVT 16 x in 4 weeks	None	After 6 months	Significant difference of 8 dB in LSVT-group between baseline and post treatment and of 6 dB between baseline and after 6 months. Significant difference between LSVT-group and control group for maximum phonation time and reading, but not for monologue.
Ramig b	2001	B	cohort study	33 21 vs. 12 (from Ramig 1995)	PD (see Ramig 1995)	LSVT 16 x in 4 weeks	RET 16 x in 4 weeks	Follow-up of Ramig 1995 cohort, after 2 years	LSVT: significant increase in loudness for three tasks after 24 months. RET: only increase directly post treatment.
Spielman	2003	B	RCT	44 (see Ramig 1995)	PD (see Ramig 1995)	LSVT 16 x in 4 weeks	RET 16 x in 4 weeks	No	Comparison of facial expression from video recording before and after LSVT-treatment: significant difference (group mean) for involvement, but not for facial expression.
de Swart	2003	B	Cohort study	32	PD	PLVT (loud and low)	LSVT (loud only)	No	Increase of SPL with both techniques. With LSVT also increased pitch but not with PLVT.

Treatment of Dysphagia in Parkinson's Disease

Author	Year	Level of study	Study design	Patients	Characteristics	Intervention	Control	Follow-up	Results
Welch	1993	C	observational	30	30-94 year, referred for VFS	Chin tuck	Neutral head posture	N/A	Chin tuck versus neutral head posture pushes tongue base and epiglottis in dorsal direction and narrows the pharynx and entrance of the larynx, protecting against aspiration.
Shanahan	1993	C	observational	30	30-84 year:15 chin tuck effective, 15 chin tuck not effective	Chin tuck	None	N/A	Patients with no effect from chin tuck showed residue in the piriform sinuses, probably resulting from pharyngeal dysfunction, meaning a more severe dysphagia.
Nagaya	2000	B	cohort study	10 PD en 12 healthy controls	PD, 53-80 jaar, H&Y 3 or 4.	1x 20 minutes: exercises for tongue, neck, shoulders, phonation and swallowing	None	None	After 1x 20 minutes training, significant shorter PMT, meaning improved swallowing onset in PD patients, not in healthy controls.
Hind	2001	C	observational	64	Healthy volunteers 45-93 year	Effortful swallowing	Normal swallowing	N/A	With effortful swallowing significantly more tongue pressure and hyolaryngeal elevation.
Bülow	2001	C	observational	8	4 men and 4 women mean 70 year	Effortful swallowing	Normal swallowing	N/A	With effortful swallowing some improvement in 4 out of 8 patients.
El Sharkawi	2002	B	cohort study	8	PD with dysphagia	LSVT, 4 weeks	None	None	50% reduction of oral and pharyngeal dysfunctions. Only improved swallowing efficiency with cup drinking.
Logemann	2008	B	cohort study	711	228 PD, 351 dementia, 132 PD + dementia: aspiration of liquids during VFS	3 interventions in random order: chin tuck, nectar consistency, honey consistency	None	None	No aspiration in 68% using chin tuck (PD 59%), 63% using nectar (PD 54%) and 53% using honey thickness (44%).

Treatment of drooling in Parkinson's disease

Author	Year	Level of study	Study design	Patients	Characteristics	Intervention	Control	Follow-up	Results
Marks	2001	C	case series	21 (6 vs.15)	PD, able to swallow on demand	Metronome broche (frequency unknown): patient has to swallow with every beep for 4 weeks, one half hour daily	No treatment or botulinum toxin injections.	3 months	Improvement on 0-15 scale from 10 to 5.5 (significance?); 60% subjective improvement. Geen clear comparison with controls. No outcomes reported at follow-up after 3 months.

Evidence table: assessment

Assessment of dysphasia in Parkinson's disease

Author	Year	Level of study	Study design	Patientz	Characteristics	Index test	Reference test	Outcome	Resultaten
Nathadwarawala	1994	B	validation study	90	Out patients depart. neurology	Swallowing speed test (150 ml) and cut-off 10 ml/s	Oropharyngeal assessment and swallowing questionnaire	Predictive values	Positive predictive value 64%, negative predictive value 93%
Ertekin	1998	C	cohort study	252	75 healthy volunteers, 149 with chronic neurologic dysphagia and 28 neurologic patients without dysphagia	"dysphagia limit" = 20 ml water swallow	"overt" dysphagia (enteral feeding or "suspected" dysphagia (difficulty with swallowing))	"dysphagia limit" in ml	positive predictive value 97%, negative predictive value 89%
Potulska	2004	C	observational	18 PD, 22 controls	PD and healthy controls	"dysphagia limit", meaning +/- 20 ml water in one swallow	Swallowing complaints	objective dysphagia (dysphagia limit) versus swallowing complaints	positive predictive value 72%, negative predictive value 100%

Note: Because there is no classification for clinimetric studies on reliability and validity of severity scales and questionnaires, these studies are not included and reviewed in tables of evidence.

References

- (1) Morris MS, Iansek RN. Parkinson's disease: a team approach. Melbourne, Australia: Buscombe Vicprint; 1997.
- (2) Marigliani C, Gates S, Jacks D. Speech Pathology and Parkinson's Disease. In: Morris MS, Iansek RN, editors. Parkinson's disease: a team approach. Melbourne, Australia: Buscombe Vicprint; 1997.
- (3) Miller N, Noble E, Jones D, Burn D. Life with communication changes in Parkinson's disease. *Age Ageing* 2006 May;35(3):235-9.
- (4) Trail M, Fox C, Ramig LO, Sapir S, Howard J, Lai EC. Speech treatment for Parkinson's disease. *NeuroRehabilitation* 2005;20(3):205-21.
- (5) Miller N, Noble E, Jones D, Burn D. Hard to swallow: dysphagia in Parkinson's disease. *Age Ageing* 2006 Nov;35(6):614-8.
- (6) Kwaliteitsinstituut voor de gezondheidszorg CBO. Multidisciplinaire richtlijn voor diagnostiek en behandeling van de ziekte van Parkinson (in ontwikkeling). Utrecht: CBO; 2008.
- (7) Greene MC, Watson BW, Gay P, Townsend DB. A therapeutic speech amplifier and its use in speech therapy. *Journal of Laryngology and Otology* 1972;86(6):595-605.
- (8) Schulz GM, Grant MK. Effects of speech therapy and pharmacologic and surgical treatments on voice and speech in Parkinson's disease: a review of the literature. *J Commun Disord* 2000 Jan;33(1):59-88.
- (9) Pinto S, Ozsancak C, Tripoliti E, Thobois S, Limousin-Dowsey P, Auzou P. Treatments for dysarthria in Parkinson's disease. *Lancet Neurol* 2004 Sep;3(9):547-56.
- (10) Deane KH, Ellis-Hill C, Jones D, Whurr R, Ben Shlomo Y, Playford ED, et al. Systematic review of paramedical therapies for Parkinson's disease. *Mov Disord* 2002 Sep;17(5):984-91.
- (11) Suchowersky O, Gronseth G, Perlmutter J, Reich S, Zesiewicz T, Weiner WJ. Practice Parameter: neuroprotective strategies and alternative therapies for Parkinson disease (an evidence-based review): report of the Quality Standards Subcommittee of the American Academy of Neurology. *Neurology* 2006 Apr 11;66(7):976-82.
- (12) Nijkrake M, Bloem BR, Mulleners W, Oostendorp R, Munneke M. Referral to non-pharmacological interventions in Parkinson's disease. *Parkinsonism Relat Disord* 2005;11(Supplement 2):S249.
- (13) Kalf H, Munneke M. Logopedie bij de ziekte van Parkinson. *Logopedie en Foniatrie* 2008;80(2):36-40.
- (14) Kwaliteitsinstituut voor de gezondheidszorg CBO. Evidence-based Richtlijnontwikkeling. Handleiding voor werkgroepleden. Utrecht: Kwaliteitsinstituut voor de Gezondheidszorg CBO: www.cbo.nl; 2007.
- (15) Everdingen J van, Burgers JS, Assendelft WJJ van, Swinkels JA, Barneveld TA van, Klundert JLM van de. Evidence-based richtlijnontwikkeling. Een leidraad voor de praktijk. Houten: Bohn Stafleu Van Loghum; 2004.
- (16) Deane KH, Whurr R, Playford ED, Ben-Shlomo Y, Clarke CE. A comparison of speech and language therapy techniques for dysarthria in Parkinson's disease. *Cochrane Database Syst Rev* 2001;(2):CD002814.

- (17) Deane KH, Whurr R, Playford ED, Ben-Shlomo Y, Clarke CE. Speech and language therapy for dysarthria in Parkinson's disease. *Cochrane Database Syst Rev* 2001;(2):CD002812.
- (18) Deane KH, Whurr R, Clarke CE, Playford ED, Ben Shlomo Y. Non-pharmacological therapies for dysphagia in Parkinson's disease. *Cochrane Database Syst Rev* 2001;(1):CD002816.
- (19) Keus SHJ, Hendriks HJM, Bloem BR, Bredero-Cohen AB, Goede CJT de, Haaren M van, et al. KNGF-richtlijn Ziekte van Parkinson. Amersfoort: Koninklijk Nederlands Genootschap voor Fysiotherapie; 2004.
- (20) Sturkenboom IHWM, Thijssen MCE, Gons-van Elsacker JJ, Jansen IJH, Maasdam A, Schulten M, et al. Ergotherapie-richtlijn ziekte van Parkinson. Utrecht: Ergotherapie Nederland; 2008.
- (21) The AGREE Collaboration. Appraisal of Guidelines for Research & Evaluation (AGREE) Instrument. 2001.
- (22) Samii A, Nutt JG, Ransom BR. Parkinson's disease. *Lancet* 2004 May 29;363(9423):1783-93.
- (23) Wolters EC, van Laar T. *Bewegingsstoornissen*. Amsterdam: VU Uitgeverij; 2002.
- (24) Maitra KK, Dasgupta AK. Incoordination of a sequential motor task in Parkinson's disease. *Occup Ther Int* 2005;12(4):218-33.
- (25) Gentilucci M, Negrotti A. Planning and executing an action in Parkinson's disease. *Mov Disord* 1999 Jan;14(1):69-79.
- (26) Sanders Er. *Parkinson handboek, een beknopte leidraad voor de praktijk*. 2nd ed. Utrecht: Academic Pharmaceutical Productions BV; 2007.
- (27) Garber CE, Friedman JH. Effects of fatigue on physical activity and function in patients with Parkinson's disease. *Neurology* 2003 Apr 8;60(7):1119-24.
- (28) Friedman JH, Brown RG, Comella C, Garber CE, Krupp LB, Lou JS, et al. Fatigue in Parkinson's disease: a review. *Mov Disord* 2007 Feb 15;22(3):297-308.
- (29) Herlofson K, Larsen JP. The influence of fatigue on health-related quality of life in patients with Parkinson's disease. *Acta Neurol Scand* 2003 Jan;107(1):1-6.
- (30) Ziv I, Avraham M, Michaelov Y, Djaldetti R, Dressler R, Zoldan J, et al. Enhanced fatigue during motor performance in patients with Parkinson's disease. *Neurology* 1998 Dec;51(6):1583-6.
- (31) Friedman JH, Brown RG, Comella C, Garber CE, Krupp LB, Lou JS, et al. Fatigue in Parkinson's disease: a review. *Mov Disord* 2007 Feb 15;22(3):297-308.
- (32) Muslimovic D, Post B, Speelman JD, Schmand B. Cognitive profile of patients with newly diagnosed Parkinson disease. *Neurology* 2005 Oct 25;65(8):1239-45.
- (33) Cools R, Barker RA, Sahakian BJ, Robbins TW. Mechanisms of cognitive set flexibility in Parkinson's disease. *Brain* 2001 Dec;124(Pt 12):2503-12.
- (34) Bronnick K, Ehrt U, Emre M, De Deyn PP, Wesnes K, Tekin S, et al. Attentional deficits affect activities of daily living in dementia-associated with Parkinson's disease. *J Neurol Neurosurg Psychiatry* 2006 Oct;77(10):1136-42.
- (35) Zgaljardic DJ, Borod JC, Foldi NS, Mattis P. A review of the cognitive and behavioral sequelae of Parkinson's disease: relationship to frontostriatal circuitry. *Cogn Behav Neurol* 2003 Dec;16(4):193-210.
- (36) Spaendonck KP van, Berger HJ, Horstink MW, Borm GF, Cools AR. Memory performance under varying cueing conditions in patients with Parkinson's disease. *Neuropsychologia* 1996 Dec;34(12):1159-64.

- (37) Zgaljardic DJ, Borod JC, Foldi NS, Mattis P. A review of the cognitive and behavioral sequelae of Parkinson's disease: relationship to frontostriatal circuitry. *Cogn Behav Neurol* 2003 Dec;16(4):193-210.
- (38) Aarsland D, Bronnick K, Ehrt U, De Deyn PP, Tekin S, Emre M, et al. Neuropsychiatric symptoms in patients with Parkinson's disease and dementia: frequency, profile and associated care giver stress. *J Neurol Neurosurg Psychiatry* 2007 Jan;78(1):36-42.
- (39) Weintraub D, Moberg PJ, Duda JE, Katz IR, Stern MB. Effect of psychiatric and other nonmotor symptoms on disability in Parkinson's disease. *J Am Geriatr Soc* 2004 May;52(5):784-8.
- (40) Adler CH. Nonmotor complications in Parkinson's disease. *Mov Disord* 2005;20 Suppl 11:S23-S29.
- (41) Davidsdottir S, Cronin-Golomb A, Lee A. Visual and spatial symptoms in Parkinson's disease. *Vision Res* 2005 May;45(10):1285-96.
- (42) Uc EY, Rizzo M, Anderson SW, Qian S, Rodnitzky RL, Dawson JD. Visual dysfunction in Parkinson disease without dementia. *Neurology* 2005 Dec 27;65(12):1907-13.
- (43) Hartelius L, Svensson P. [Parkinson disease and multiple sclerosis often cause speech and swallowing disorders]. *Lakartidningen* 1992 Feb 26;89(9):654, 659-4, 660.
- (44) Ho AK, Iansek R, Marigliani C, Bradshaw JL, Gates S. Speech impairment in a large sample of patients with Parkinson's disease. *Behav Neurol* 1998;11(3):131-7.
- (45) Muller J, Wenning GK, Verny M, McKee A, Chaudhuri KR, Jellinger K, et al. Progression of dysarthria and dysphagia in postmortem-confirmed parkinsonian disorders. *Arch Neurol* 2001 Feb;58(2):259-64.
- (46) Darley FL, Aronson AE, Brown JR. *Motor speech disorders*. Philadelphia: Saunders Company; 1975.
- (47) Moreau C, Ozsancak C, Blatt JL, Derambure P, Destee A, Defebvre L. Oral festination in Parkinson's disease: biomechanical analysis and correlation with festination and freezing of gait. *Mov Disord* 2007 Jul 30;22(10):1503-6.
- (48) Alm PA. Stuttering and the basal ganglia circuits: a critical review of possible relations. *J Commun Disord* 2004 Jul;37(4):325-69.
- (49) Ho AK, Bradshaw JL, Iansek T. Volume perception in parkinsonian speech. *Mov Disord* 2000 Nov;15(6):1125-31.
- (50) Ho AK, Iansek R, Bradshaw JL. Regulation of parkinsonian speech volume: the effect of interlocuter distance. *J Neurol Neurosurg Psychiatry* 1999 Aug;67(2):199-202.
- (51) Grossman M, Glosser G, Kalmanson J, Morris J, Stern MB, Hurtig HI. Dopamine supports sentence comprehension in Parkinson's Disease. *J Neurol Sci* 2001 Mar 1;184(2):123-30.
- (52) Angwin AJ, Chenery HJ, Copland DA, Murdoch BE, Silburn PA. The speed of lexical activation is altered in Parkinson's disease. *J Clin Exp Neuropsychol* 2007 Jan;29(1):73-85.
- (53) Boulenger V, Mechtouff L, Thobois S, Broussolle E, Jeannerod M, Nazir TA. Word processing in Parkinson's disease is impaired for action verbs but not for concrete nouns. *Neuropsychologia* 2008 Jan 31;46(2):743-56.
- (54) Johnston BT, Li Q, Castell JA, Castell DO. Swallowing and esophageal function in Parkinson's disease. *Am J Gastroenterol* 1995 Oct;90(10):1741-6.

- (55) Kalf JG, de Swart BJM, Zwarts MJ, Munneke M, Bloem BR. Frequency of oral motor impairments in Parkinson's disease and implications for referral to speech therapists. *Movement Disorders* 2008;23(Supplement 1):S328.
- (56) Potulska A, Friedman A, Krolicki L, Spychala A. Swallowing disorders in Parkinson's disease. *Parkinsonism Relat Disord* 2003 Aug;9(6):349-53.
- (57) Volonte MA, Porta M, Comi G. Clinical assessment of dysphagia in early phases of Parkinson's disease. *Neurol Sci* 2002 Sep;23 Suppl 2:S121-S122.
- (58) Manor Y, Giladi N, Cohen A, Fliss DM, Cohen JT. Validation of a swallowing disturbance questionnaire for detecting dysphagia in patients with Parkinson's disease. *Mov Disord* 2007 Oct 15;22(13):1917-21.
- (59) Lam K, Lam FK, Lau KK, Chan YK, Kan EY, Woo J, et al. Simple clinical tests may predict severe oropharyngeal dysphagia in Parkinson's disease. *Mov Disord* 2007 Apr 15;22(5):640-4.
- (60) Monte FS, da Silva-Junior FP, Braga-Neto P, Nobre e Souza MA, Sales dB, V. Swallowing abnormalities and dyskinesia in Parkinson's disease. *Mov Disord* 2005 Apr;20(4):457-62.
- (61) Hunter PC, Crameri J, Austin S, Woodward MC, Hughes AJ. Response of parkinsonian swallowing dysfunction to dopaminergic stimulation. *J Neurol Neurosurg Psychiatry* 1997 Nov;63(5):579-83.
- (62) Ertekin C, Tarlaci S, Aydogdu I, Kiylioglu N, Yuceyar N, Turman AB, et al. Electrophysiological evaluation of pharyngeal phase of swallowing in patients with Parkinson's disease. *Mov Disord* 2002 Sep;17(5):942-9.
- (63) Fernandez HH, Lapane KL. Predictors of mortality among nursing home residents with a diagnosis of Parkinson's disease. *Med Sci Monit* 2002 Apr;8(4):CR241-CR246.
- (64) Chou KL, Evatt M, Hinson V, Kompolti K. Sialorrhea in Parkinson's disease: a review. *Mov Disord* 2007 Dec;22(16):2306-13.
- (65) Tan EK. Botulinum toxin treatment of sialorrhea: comparing different therapeutic preparations. *Eur J Neurol* 2006 Feb;13 Suppl 1:60-4.
- (66) Potulska A, Friedman A. Controlling sialorrhoea: a review of available treatment options. *Expert Opin Pharmacother* 2005 Aug;6(9):1551-4.
- (67) Kalf JG, Bloem BR, Zwarts MJ, de Swart BJM, Munneke M. Causes of drooling in Parkinson's disease. *Movement Disorders* 2008;23(Supplement 1):S328.
- (68) Tumilasci OR, Cersosimo MG, Belforte JE, Micheli FE, Benarroch EE, Pazo JH. Quantitative study of salivary secretion in Parkinson's disease. *Mov Disord* 2006 May;21(5):660-7.
- (69) Poewe WH, Wenning GK. The natural history of Parkinson's disease. *Ann Neurol* 1998 Sep;44(3 Suppl 1):S1-S9.
- (70) Jankovic J, Kapadia AS. Functional decline in Parkinson disease. *Arch Neurol* 2001 Oct;58(10):1611-5.
- (71) Hoehn MM, Yahr MD. Parkinsonism: onset, progression, and mortality. 1967. *Neurology* 1998 Feb;50(2):318.
- (72) Goetz CG, Poewe W, Rascol O, Sampaio C, Stebbins GT, Counsell C, et al. Movement Disorder Society Task Force report on the Hoehn and Yahr staging scale: status and recommendations. *Mov Disord* 2004 Sep;19(9):1020-8.
- (73) Global Parkinson's disease Survey Steering Committee. Factors impacting on quality of life in Parkinson's disease: results from an international survey. *Mov Disord* 2002 Jan;17(1):60-7.

- (74) Poewe WH, Wenning GK. The natural history of Parkinson's disease. *Ann Neurol* 1998 Sep;44(3 Suppl 1):S1-S9.
- (75) Jankovic J, Kapadia AS. Functional decline in Parkinson disease. *Arch Neurol* 2001 Oct;58(10):1611-5.
- (76) Marras C, Rochon P, Lang AE. Predicting motor decline and disability in Parkinson disease: a systematic review. *Arch Neurol* 2002 Nov;59(11):1724-8.
- (77) Poewe WH, Wenning GK. The natural history of Parkinson's disease. *Ann Neurol* 1998 Sep;44(3 Suppl 1):S1-S9.
- (78) Alves G, Wentzel-Larsen T, Aarsland D, Larsen JP. Progression of motor impairment and disability in Parkinson disease: a population-based study. *Neurology* 2005 Nov 8;65(9):1436-41.
- (79) Marras C, Rochon P, Lang AE. Predicting motor decline and disability in Parkinson disease: a systematic review. *Arch Neurol* 2002 Nov;59(11):1724-8.
- (80) O'Shea S, Morris ME, Iansek R. Dual task interference during gait in people with Parkinson disease: effects of motor versus cognitive secondary tasks. *Phys Ther* 2002 Sep;82(9):888-97.
- (81) Fahn S. The freezing phenomenon in parkinsonism. *Adv Neurol* 1995;67:53-63.
- (82) Kamsma YPT. Implications of motor and cognitive impairments for ADL and motor treatment of patients with Parkinson's disease [Dutch]. *Ned Tijdschr Fysioth* 2004;114(3):59-62.
- (83) Morris ME. Movement disorders in people with Parkinson disease: a model for physical therapy. *Phys Ther* 2000 Jun;80(6):578-97.
- (84) Fellows SJ, Noth J. Grip force abnormalities in de novo Parkinson's disease. *Mov Disord* 2004 May;19(5):560-5.
- (85) Lorefalt B, Granerus AK, Unosson M. Avoidance of solid food in weight losing older patients with Parkinson's disease. *J Clin Nurs* 2006 Nov;15(11):1404-12.
- (86) Huckabee ML, Pelletier CA. *Management of Adult Neurogenic Dysphagia*. New York: Thomson Delmar Learning; 2003.
- (87) Logemann JA. *Slikstoornissen. Onderzoek en behandeling*. Lisse: Swets & Zeitlinger; 2000.
- (88) Perlman AL, Schulze-Delrieu KS. *Deglutition and its Disorders*. San Diego: Singular Publishing Group; 1997.
- (89) Zgaljardic DJ, Borod JC, Foldi NS, Mattis P. A review of the cognitive and behavioral sequelae of Parkinson's disease: relationship to frontostriatal circuitry. *Cogn Behav Neurol* 2003 Dec;16(4):193-210.
- (90) Spaendonck KP van, Berger HJ, Horstink MW, Buytenhuijs EL, Cools AR. Executive functions and disease characteristics in Parkinson's disease. *Neuropsychologia* 1996 Jul;34(7):617-26.
- (91) Spaendonck KP van, Berger HJ, Horstink MW, Cools AR. [Cognitive deficits in Parkinson's disease]. *Tijdschr Gerontol Geriatr* 1998 Aug;29(4):189-95.
- (92) Cools AR, van den Bercken JH, Horstink MW, van Spaendonck KP, Berger HJ. Cognitive and motor shifting aptitude disorder in Parkinson's disease. *J Neurol Neurosurg Psychiatry* 1984 May;47(5):443-53.
- (93) Bronnick K, Ehrt U, Emre M, De Deyn PP, Wesnes K, Tekin S, et al. Attentional deficits affect activities of daily living in dementia-associated with Parkinson's disease. *J Neurol Neurosurg Psychiatry* 2006 Oct;77(10):1136-42.
- (94) Gemmert AW van, Teulings HL, Stelmach GE. Parkinsonian patients reduce their stroke size with increased processing demands. *Brain Cogn* 2001 Dec;47(3):504-12.

- (95) Gemmert AW van, Adler CH, Stelmach GE. Parkinson's disease patients undershoot target size in handwriting and similar tasks. *J Neurol Neurosurg Psychiatry* 2003 Nov;74(11):1502-8.
- (96) Hartelius L, Svensson P. Speech and swallowing symptoms associated with Parkinson's disease and multiple sclerosis: a survey. *Folia Phoniatr Logop* 1994;46(1):9-17.
- (97) Kalf JG, Smit AM, Bloem BR, Zwarts MJ, Munneke M. Impact of drooling in Parkinson's Disease. *Journal of Neurology* 2007;254:1227-32.
- (98) Global Parkinson's disease Survey Steering Committee. Factors impacting on quality of life in Parkinson's disease: results from an international survey. *Mov Disord* 2002 Jan;17(1):60-7.
- (99) Gage H, Hendricks A, Zhang S, Kazis L. The relative health related quality of life of veterans with Parkinson's disease. *J Neurol Neurosurg Psychiatry* 2003 Feb;74(2):163-9.
- (100) Slawek J, Derejko M, Lass P. Factors affecting the quality of life of patients with idiopathic Parkinson's disease--a cross-sectional study in an outpatient clinic attendees. *Parkinsonism Relat Disord* 2005 Nov;11(7):465-8.
- (101) Gage H, Hendricks A, Zhang S, Kazis L. The relative health related quality of life of veterans with Parkinson's disease. *J Neurol Neurosurg Psychiatry* 2003 Feb;74(2):163-9.
- (102) Slawek J, Derejko M, Lass P. Factors affecting the quality of life of patients with idiopathic Parkinson's disease--a cross-sectional study in an outpatient clinic attendees. *Parkinsonism Relat Disord* 2005 Nov;11(7):465-8.
- (103) Koplas PA, Gans HB, Wisely MP, Kuchibhatla M, Cutson TM, Gold DT, et al. Quality of life and Parkinson's disease. *J Gerontol A Biol Sci Med Sci* 1999 Apr; 54(4):M197-M202.
- (104) Herlofson K, Larsen JP. The influence of fatigue on health-related quality of life in patients with Parkinson's disease. *Acta Neurol Scand* 2003 Jan;107(1):1-6.
- (105) Brown RG, Dittner A, Findley L, Wessely SC. The Parkinson fatigue scale. *Parkinsonism Relat Disord* 2005 Jan;11(1):49-55.
- (106) Schenkman M, Wei ZC, Cutson TM, Whetten-Goldstein K. Longitudinal evaluation of economic and physical impact of Parkinson's disease. *Parkinsonism Relat Disord* 2001 Sep;8(1):41-50.
- (107) Benharoch J, Wiseman T. Participation in occupations: some experiences of patients with Parkinson's disease. *British Journal of Occupational Therapy (Br J Occup Ther)* 2004;67(9):380-7.
- (108) Marr JA. The experience of living with Parkinson's disease. *J Neurosci Nurs* 1991 Oct;23(5):325-9.
- (109) Nijhof G. Uncertainty and lack of trust with Parkinson's disease. *European journal of public health (Eur J Pub Health)* 1996;6(1):58-63.
- (110) Martinez-Martin P, Ito-Leon J, Alonso F, Catalan MJ, Pondal M, Zamarbide I, et al. Quality of life of caregivers in Parkinson's disease. *Qual Life Res* 2005 Mar;14(2):463-72.
- (111) Schrag A, Hovris A, Morley D, Quinn N, Jahanshahi M. Caregiver-burden in parkinson's disease is closely associated with psychiatric symptoms, falls, and disability. *Parkinsonism Relat Disord* 2006 Jan;12(1):35-41.

- (112) Carter JH, Stewart BJ, Archbold PG, Inoue I, Jaglin J, Lannon M, et al. Living with a person who has Parkinson's disease: the spouse's perspective by stage of disease. Parkinson's Study Group. *Mov Disord* 1998 Jan;13(1):20-8.
- (113) Aarsland D, Larsen JP, Karlsen K, Lim NG, Tandberg E. Mental symptoms in Parkinson's disease are important contributors to caregiver distress. *Int J Geriatr Psychiatry* 1999 Oct;14(10):866-74.
- (114) Fernandez HH, Tabamo RE, David RR, Friedman JH. Predictors of depressive symptoms among spouse caregivers in Parkinson's disease. *Mov Disord* 2001 Nov;16(6):1123-5.
- (115) Edwards NE, Scheetz PS. Predictors of burden for caregivers of patients with Parkinson's disease. *J Neurosci Nurs* 2002 Aug;34(4):184-90.
- (116) Martinez-Martin P, Forjaz MJ, Frades-Payo B, Rusinol AB, Fernandez-Garcia JM, Ito-Leon J, et al. Caregiver burden in Parkinson's disease. *Mov Disord* 2007 May 15;22(7):924-31.
- (117) Calne DB, Snow BJ, Lee C. Criteria for diagnosing Parkinson's disease. *Ann Neurol* 1992;32 Suppl:S125-S127.
- (118) Gelb DJ, Oliver E, Gilman S. Diagnostic criteria for Parkinson disease. *Arch Neurol* 1999 Jan;56(1):33-9.
- (119) Hughes AJ, Daniel SE, Kilford L, Lees AJ. Accuracy of clinical diagnosis of idiopathic Parkinson's disease: a clinico-pathological study of 100 cases. *J Neurol Neurosurg Psychiatry* 1992 Mar;55(3):181-4.
- (120) Tolosa E, Wenning G, Poewe W. The diagnosis of Parkinson's disease. *Lancet Neurol* 2006 Jan;5(1):75-86.
- (121) Ziekenfondsraad. *Farmacotherapeutisch Kompas* 2007. Amstelveen: Ziekenfondsraad; 2007.
- (122) Horstink M, Tolosa E, Bonuccelli U, Deuschl G, Friedman A, Kanovsky P, et al. Review of the therapeutic management of Parkinson's disease. Report of a joint task force of the European Federation of Neurological Societies and the Movement Disorder Society-European Section. Part I: early (uncomplicated) Parkinson's disease. *Eur J Neurol* 2006 Nov;13(11):1170-85.
- (123) Voon V, Potenza MN, Thomsen T. Medication-related impulse control and repetitive behaviors in Parkinson's disease. *Curr Opin Neurol* 2007 Aug;20(4):484-92.
- (124) Meningaud JP, Pitak-Arnop P, Chikhani L, Bertrand JC. Drooling of saliva: a review of the etiology and management options. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2006 Jan;101(1):48-57.
- (125) Postma AG, Heesters M, van LT. Radiotherapy to the salivary glands as treatment of sialorrhea in patients with parkinsonism. *Mov Disord* 2007 Dec;22(16):2430-5.
- (126) Martinez-Martin P, Deuschl G. Effect of medical and surgical interventions on health-related quality of life in Parkinson's disease. *Mov Disord* 2007 Apr 30;22(6):757-65.
- (127) Moro E, Lang AE. Criteria for deep-brain stimulation in Parkinson's disease: review and analysis. *Expert Rev Neurother* 2006 Nov;6(11):1695-705.
- (128) Pinto S, Thobois S, Costes N, Le BD, Benabid AL, Broussolle E, et al. Subthalamic nucleus stimulation and dysarthria in Parkinson's disease: a PET study. *Brain* 2004 Mar;127(Pt 3):602-15.
- (129) Tornqvist AL, Schalen L, Rehncrona S. Effects of different electrical parameter settings on the intelligibility of speech in patients with Parkinson's disease treated with subthalamic deep brain stimulation. *Mov Disord* 2005 Apr;20(4):416-23.

- (130) Klostermann F, Ehlen F, Vesper J, Nubel K, Gross M, Marzinzik F, et al. Effects of subthalamic deep brain stimulation on dysarthrophonia in Parkinson's disease. *J Neurol Neurosurg Psychiatry* 2008 May;79(5):522-9.
- (131) Deane KH, Ellis-Hill C, Jones D, Whurr R, Ben-Shlomo Y, Playford ED, et al. Systematic review of paramedical therapies for Parkinson's disease. *Mov Disord* 2002 Sep;17(5):984-91.
- (132) Dixon L, Duncan D, Johnson P, Kirkby L, O'Connell H, Taylor H, et al. Occupational therapy for patients with Parkinson's disease. *Cochrane Database Syst Rev* 2007;(3):CD002813.pub2.
- (133) Kalf JG, Swart BJM de, Bloem BR, Munneke M. Development and evaluation of a dysarthria severity questionnaire for Parkinson's disease (ROMP-speech). *Parkinsonism Relat Disord* 2007;13(Supplement 2):S48.
- (134) Enderby P, John A. *Therapy Outcomes Measures Speech Language Pathology*. San Diego/London: Singular Publishing Group; 1997.
- (135) Perry A, Morris M, Unsworth C, Duckett S, Skeat J, Dodd K, et al. Therapy outcome measures for allied health practitioners in Australia: the AusTOMs. *Int J Qual Health Care* 2004 Aug;16(4):285-91.
- (136) Knuijt S, Kalf H. Dysartrieonderzoek. Drie nieuwe instrumenten beschikbaar. *Logopedie en Foniatrie* 2007;79(12):412-7.
- (137) Kent RD, Kent JF, Rosenbek JC. Maximum performance tests of speech production. *J Speech Hear Disord* 1987 Nov;52(4):367-87.
- (138) Swart BJM de. Reader 'Pitch Limiting Voice Treatment'. Nijmegen: UMC St Radboud/Hogeschool van Arnhem en Nijmegen; 2006.
- (139) Lambert J, Rutten Ch. *Frenchay Dysartrie Onderzoek*. Lisse: Swets & Zeitlinger; 1996.
- (140) Lambert J, van den Engel-Hoek L, van Gerven M, van Hulst K, Keyser A, de Swart B. Dysartrie. In: Peters H, Bastiaanse R, van Borsel J., Dejonckere PHO, Jansonius-Schultheiss K, van der Meulen Sj, et al., editors. *Handboek Stem-, Spraak-Taalpathologie*. Houten: Bohn Stafleu Van Loghum; 2002.
- (141) Dharmaperwira-Prins R. *Dysartrie en verbale apraxie*. Lisse: Swets & Zeitlinger; 1996.
- (142) Knuijt S, de Swart B. *Handleiding Dysartrieonderzoek bij volwassenen*. Nijmegen: UMC St Radboud (downloadbaar via www.umcn.nl/logopedie); 2007.
- (143) Kalf H, de Swart B. *Handleiding oraal onderzoek bij volwassenen met een dysartrie en/of dysfagie*. Nijmegen: UMC St Radboud (downloadbaar via www.umcn.nl/logopedie); 2007.
- (144) Duffy JR. *Motor Speech Disorders. Substrates, differential diagnosis and management*. St Louis: Elsevier Mosby; 2005.
- (145) Yorkston KM, Beukelman DR, Strand EA, Hakel M. *Management of motor speech disorders*. Austin, Texas: Pro-Ed; 2010.
- (146) Perry A, Morris M, Unsworth C, Duckett S, Skeat J, Dodd K, et al. Therapy outcome measures for allied health practitioners in Australia: the AusTOMs. *Int J Qual Health Care* 2004 Aug;16(4):285-91.
- (147) Swart BJ de, Willems SC, Maassen BA, Horstink MW. Improvement of voicing in patients with Parkinson's disease by speech therapy. *Neurology* 2003 Feb 11;60(3):498-500.

- (148) Ramig LO, Countryman S, Thompson LL, Horii Y. Comparison of two forms of intensive speech treatment for Parkinson disease. *J Speech Hear Res* 1995 Dec;38(6):1232-51.
- (149) Ramig LO, Dromey C. Aerodynamic mechanisms underlying treatment-related changes in vocal intensity in patients with Parkinson disease. *J Speech Hear Res* 1996 Aug;39(4):798-807.
- (150) Dejonckere PH, Bradley P, Clemente P, Cornut G, Crevier-Buchman L, Friedrich G, et al. A basic protocol for functional assessment of voice pathology, especially for investigating the efficacy of (phonosurgical) treatments and evaluating new assessment techniques. Guideline elaborated by the Committee on Phoniatics of the European Laryngological Society (ELS). *Eur Arch Otorhinolaryngol* 2001 Feb;258(2):77-82.
- (151) Hirano M. *Clinical examination of voice*. New York: Springer; 1981.
- (152) Ramig LO, Fox C, Sapir S. Parkinson's disease: speech and voice disorders and their treatment with the Lee Silverman Voice Treatment. *Seminars in Speech and Language* 2004;25(2):169-80.
- (153) Ramig LO, Countryman S, O'Brien C, Hoehn M, Thompson L. Intensive speech treatment for patients with Parkinson's disease: short-and long-term comparison of two techniques. *Neurology* 1996 Dec;47(6):1496-504.
- (154) Swart B de. De "Pitch Limiting Voice Treatment". *Keypoint* 2004;1:11-3.
- (155) Smith ME, Ramig LO, Dromey C, Perez KS, Samandari R. Intensive voice treatment in Parkinson disease: laryngostroboscopic findings. *J Voice* 1995 Dec;9(4):453-9.
- (156) Ramig LO, Sapir S, Countryman S, Pawlas AA, O'Brien C, Hoehn M, et al. Intensive voice treatment (LSVT) for patients with Parkinson's disease: a 2 year follow up. *J Neurol Neurosurg Psychiatry* 2001 Oct;71(4):493-8.
- (157) Ramig LO, Sapir S, Fox C, Countryman S. Changes in vocal loudness following intensive voice treatment (LSVT) in individuals with Parkinson's disease: a comparison with untreated patients and normal age-matched controls. *Mov Disord* 2001 Jan;16(1):79-83.
- (158) Pinto S, Ozsancak C, Tripoliti E, Thobois S, Limousin-Dowsey P, Auzou P. Treatments for dysarthria in Parkinson's disease. *Lancet Neurol* 2004 Sep;3(9):547-56.
- (159) Spielman JL, Borod JC, Ramig LO. The effects of intensive voice treatment on facial expressiveness in Parkinson disease: preliminary data. *Cogn Behav Neurol* 2003 Sep;16(3):177-88.
- (160) Elman RJ, Bernstein-Ellis E. The efficacy of group communication treatment in adults with chronic aphasia. *J Speech Lang Hear Res* 1999 Apr;42(2):411-9.
- (161) Lang AE, Fishbein V. The "pacing board" in selected speech disorders of Parkinson's disease. *J Neurol Neurosurg Psychiatry* 1983 Aug;46(8):789.
- (162) Greene MC, Watson BW. The value of speech amplification in Parkinson's disease. *Folia Phoniatica et Logopaedica* 1968;20(4):250-7.
- (163) Balkom van H., Welle Donker M. *Kiezen voor communicatie*. Nijkerk: Intro; 1994.
- (164) Hustad KC, Garcia JM. Aided and unaided speech supplementation strategies: effect of alphabet cues and iconic hand gestures on dysarthric speech. *J Speech Lang Hear Res* 2005 Oct;48(5):996-1012.
- (165) Kalf JG. Logopedisch onderzoek. A.6.2.2. In: Peters HFM, Dejonckere P, Jansonius K, Mondelaers B, editors. *Handboek Stem-, Spraak- en Taalpathologie*. Houten: Bohn Stafleu Van Loghum; 2005.

- (166) Kalf JG, de Swart BJM, Bloem BR, Munneke M. Development and evaluation of a swallowing severity questionnaire for Parkinson's disease (ROMP-swallowing). *Parkinsonism Relat Disord* 2007;13(Supplement 2):S48.
- (167) Kalf JG. Twee kwantitatieve sliktests. *Logopedie en Foniatrie* 2004;7/8:640-6.
- (168) Hughes TA, Wiles CM. Clinical measurement of swallowing in health and in neurogenic dysphagia. *QJM* 1996 Feb;89(2):109-16.
- (169) Nathadwarawala KM, Nicklin J, Wiles CM. A timed test of swallowing capacity for neurological patients. *J Neurol Neurosurg Psychiatry* 1992 Sep;55(9):822-5.
- (170) Clarke CE, Gullaksen E, Macdonald S, Lowe F. Referral criteria for speech and language therapy assessment of dysphagia caused by idiopathic Parkinson's disease. *Acta Neurol Scand* 1998 Jan; 97(1):27-35.
- (171) Ertekin C, Aydogdu I, Yuceyar N. Piecemeal deglutition and dysphagia limit in normal subjects and in patients with swallowing disorders. *J Neurol Neurosurg Psychiatry* 1996 Nov;61(5):491-6.
- (172) Ertekin C, Aydogdu I, Yuceyar N, Tarlaci S, Kiylioglu N, Pehlivan M, et al. Electrodiagnostic methods for neurogenic dysphagia. *Electroencephalogr Clin Neurophysiol* 1998 Aug;109(4):331-40.
- (173) Langmore SE. *Endoscopic Evaluation and Treatment of Swallowing Disorders*. New York: Thieme; 2001.
- (174) Logemann JA. *Manual for the videofluorographic study of swallowing*. Austin/Texas: Pro-Ed; 1993.
- (175) Robbins JA, Logemann JA, Kirshner HS. Swallowing and speech production in Parkinson's disease. *Ann Neurol* 1986 Mar;19(3):283-7.
- (176) Leopold NA, Kagel MC. Prepharyngeal dysphagia in Parkinson's disease. *Dysphagia* 1996;11(1):14-22.
- (177) Leopold NA, Kagel MC. Laryngeal deglutition movement in Parkinson's disease. *Neurology* 1997 Feb;48(2):373-6.
- (178) Nagaya M, Kachi T, Yamada T, Igata A. Videofluorographic study of swallowing in Parkinson's disease. *Dysphagia* 1998;13(2):95-100.
- (179) Huckabee ML, Pelletier CA. *Management of Adult Neurogenic Dysphagia*. San Diego: Singular Publishing Group; 1999.
- (180) Kalf JG. Functionele behandeling van orofaryngeale slikstoornissen. In: Peters H, Dejonckere P, Mondelaers B, editors. *Handboek Stem-, Spraak- en Taalpathologie*. Houten: Bohn Stafleu Van Loghum; 2006.
- (181) Groher ME. *Dysphagia. Diagnosis and Management*. Boston: Butterworth-Heinemann; 1997.
- (182) Logemann JA. *Evaluation and treatment of swallowing disorders*. Austin, Texas: Pro-Ed; 1983.
- (183) Welch MV, Logemann JA, Rademaker AW, Kahrilas PJ. Changes in pharyngeal dimensions effected by chin tuck. *Arch Phys Med Rehabil* 1993 Feb;74(2):178-81.
- (184) Shanahan TK, Logemann JA, Rademaker AW, Pauloski BR, Kahrilas PJ. Chin-down posture effect on aspiration in dysphagic patients. *Arch Phys Med Rehabil* 1993 Jul;74(7):736-9.
- (185) Groher ME. *Dysphagia. Diagnosis and Management*. Boston: Butterworth-Heinemann; 1997.
- (186) Kahrilas PJ, Lin S, Logemann JA, Ergun GA, Facchini F. Deglutitive tongue action: volume accommodation and bolus propulsion. *Gastroenterology* 1993 Jan;104(1):152-62.

- (187) Raut VV, McKee GJ, Johnston BT. Effect of bolus consistency on swallowing--does altering consistency help? *Eur Arch Otorhinolaryngol* 2001 Jan;258(1):49-53.
- (188) Robbins J, Gensler G, Hind J, Logemann JA, Lindblad AS, Brandt D, et al. Comparison of 2 interventions for liquid aspiration on pneumonia incidence: a randomized trial. *Ann Intern Med* 2008 Apr 1;148(7):509-18.
- (189) Nagaya M, Kachi T, Yamada T. Effect of swallowing training on swallowing disorders in Parkinson's disease. *Scand J Rehabil Med* 2000 Mar;32(1):11-5.
- (190) Morris MS, Iansek RN. *Parkinson's disease: a team approach*. Melbourne, Australia: Buscombe Vicprint; 1997.
- (191) Bulow M, Olsson R, Ekberg O. Videomanometric analysis of supraglottic swallow, effortful swallow, and chin tuck in healthy volunteers. *Dysphagia* 1999;14(2):67-72.
- (192) Bulow M, Olsson R, Ekberg O. Videomanometric analysis of supraglottic swallow, effortful swallow, and chin tuck in patients with pharyngeal dysfunction. *Dysphagia* 2001;16(3):190-5.
- (193) Hind JA, Nicosia MA, Roecker EB, Carnes ML, Robbins J. Comparison of effortful and noneffortful swallows in healthy middle-aged and older adults. *Arch Phys Med Rehabil* 2001 Dec;82(12):1661-5.
- (194) Groher ME. *Dysphagia. Diagnosis and Management*. Boston: Butterworth-Heinemann; 1997.
- (195) El Sharkawi A, Ramig L, Logemann JA, Pauloski BR, Rademaker AW, Smith CH, et al. Swallowing and voice effects of Lee Silverman Voice Treatment (LSVT): a pilot study. *J Neurol Neurosurg Psychiatry* 2002 Jan;72(1):31-6.
- (196) Kalf H, van Keeken P., Dicke H, Rood B. *Slikstoornissen bij volwassenen*. Houten: Bohn Stafleu Van Loghum; 2008.
- (197) Perez Lloret S., Piran Arce G., Rossi M., Caivano Nemet M.L., Salsamendi P, Merello M. Validation of a New Scale for the Evaluation of Sialorrhea in Patients with Parkinson's Disease. *Mov Disord* 2007;22(1):107-11.
- (198) Kalf JG, Swart BJM de, Bloem BR, Munneke M. Development and evaluation of a severity scale (DSFS-P) and questionnaire for drooling in Parkinson's disease (ROMP-saliva). *Parkinsonism Relat Disord* 2007;13(Supplement 2):S47.
- (199) Hofman M, da Costa SP. *Observatie-instrument Speekselverlies*. Amsterdam: Harcourt Test Publishers; 2006.
- (200) Scott A, Johnson H. *A Practical Approach to the Management of Saliva*. Austin, Texas: Pro-Ed; 2004.
- (201) Thomas-Stonell N, Greenberg J. Three treatment approaches and clinical factors in the reduction of drooling. *Dysphagia* 1988;3(2):73-8.
- (202) Molloy L. Treatment of sialorrhoea in patients with Parkinson's disease: best current evidence. *Curr Opin Neurol* 2007 Aug;20(4):493-8.
- (203) Marks L, Turner K, O'Sullivan J, Deighton B, Lees A. Drooling in Parkinson's disease: a novel speech and language therapy intervention. *Int J Lang Commun Disord* 2001;36 Suppl:282-7.
- (204) Polatli M, Akyol A, Cildag O, Bayulkem K. Pulmonary function tests in Parkinson's disease. *Eur J Neurol* 2001 Jul;8(4):341-5.
- (205) Bodt M de. *Een onderzoeksmodel voor stemevaluatie. De relatie tussen subjectieve en objectieve parameters in de beoordeling van de normale en pathologische stemfunctie*. Doctoraal proefschrift. Antwerpen: Universiteit Antwerpen; 1997.
- (206) Nishio M, Niimi S. Speaking rate and its components in dysarthric speakers. *Clinical Linguistics and Phonetics* 2001;15(4):309-17.