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## Dysphagia in Parkinson's disease

### SUMMARY

This article discusses the issue of dysphagia linked to Parkinson's disease, debates over the swallowing disorders which may appear during its oropharyngeal stage, ways of their formation and methods of interactions in terms of SLP, which allow to secure the whole process, limit the symptoms and adapt the patient to the rising difficulties.

**Keywords:** Parkinson's disease, dysphagia, swallowing treatment.

### INTRODUCTION

It is estimated that dysphagia, i.e. disorder of ingestion and passage of the digesta from the oral cavity to the pharynx and esophagus into the stomach, as well as the accompanying discomfort (Pruszewicz, Wiskirski-Woźnica 2002), afflicts from 45% to 90% of patients suffering from Parkinson's disease, and in many cases significantly affects the quality and length of life. Even slight difficulties in swallowing may negatively affect the social and emotional functioning of a patient, and any increase in their severity worsens the prognosis carrying the risk of aspiration pneumonia, malnutrition, weight loss, dehydration, and thus – cachexia (Tjaden 2008). At the same time, dysphagia may hinder taking appropriate doses of medications and adversely affect the therapy. Early diagnosis, as well as providing a patient with a comprehensive care from an interdisciplinary team consisting of a physician, speech therapist, nutritionist, or even a psychologist, are therefore a necessity and should become a standard in terms of therapeutic procedure.

## PARKINSON'S DISEASE – ESSENTIAL INFORMATION, SYMPTOMS

Parkinson's disease is one of the most common neurodegenerative disorders. It usually afflicts older people (within the population over 55 years of age, the incidence is 1%, over 75 years of age – 3%), although there are cases of early-onset Parkinsonism (before 40 years of age), and even of onset during adolescence. At the origin of PD's symptoms lies damage to dopaminergic neurons of the substantia nigra, resulting in reduction of concentration of dopamine in the striatum<sup>1</sup>. A reduction of 60-80% (the damage affects around 60-80% of neurons in the substantia nigra) induces first motor dysfunctions: slowness (bradykinesia), muscle rigidity and resting tremor (Krygowska-Wajs 2006). The clinical picture also displays nonmotor symptoms which can come even several years before the typical motor disorders. They include, among others, speech disorders (dysarthria), swallowing, smelling and peristalsis disorders, as well as depressive states (Friedman 2005).

### SWALLOWING DISORDERS DURING OROPHARYNGEAL PHASE

Swallowing is a complex semi-automatic process involving the following stages.

1. Initial decisive (preoral) phase.
2. Oral preparatory phase.
3. Oral phase.
4. Pharyngeal phase.
5. Oesophageal phase.

The preoral phase consists of noticing the food/liquid and of its preparation for intake; this stage requires smooth functioning of the senses, motor abilities, preserved eye-hand coordination and correct conduct of cognitive-behavioral functions (among others – memory, attention, executive functions).

The oral preparatory phase includes the intake of food/liquid, its crushing, chewing, mixing with saliva and forming a bite (bolus). During the proper oral phase (also called oral transport stage), the bolus is transported through the oral cavity towards the back of the mouth – this phase ends with the passage of the food/liquid into the pharyngeal cavity with elevation and retraction of the soft palate. This is the last voluntary phase of swallowing. Both oral phases – preparatory

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<sup>1</sup> I.e. caudate nucleus and putamen, which together with globus pallidus, control the automated movements and muscle tension; muscular stiffness and impaired coordination appear in the case of damage to the above-mentioned structures (Gołąb 2004).

and proper one – require full operational skills of lips, cheeks, tongue and velum, as well as correct coordination of their functioning.

The pharyngeal phase<sup>2</sup> is involuntary – after the soft palate closes the entrance to the nasal cavity, the larynx is lifted up and moved forward, vocal folds contract together with vestibular folds and epiglottis, cricopharyngeus muscle loosens (followed by the opening of the upper esophageal sphincter) – owing to the peristaltic wave, the bolus moves through the pharyngeal cavity in the direction of the esophagus.

Following the opening of the upper esophageal sphincter, the bite goes into the stomach (esophageal stage) and enters it after the lower esophageal sphincter opens (Marks, Rainbow 2011).

In PD, each phase of swallowing may be impaired<sup>3</sup>, at any stage of the disease, including the very early one. The increase of dysphagia's severity is not always proportional to the severity of other disorders. What is characteristic, patients often are not aware of the deficit in this area, so it is important to observe them and monitor their weight.

Table 1. Swallowing disorders in Parkinson's disease

Oral phase	Pharyngeal phase
<ul style="list-style-type: none"> <li>– split of liquid, food falling out from the oral cavity</li> <li>– retention of food debris in the oral cavity</li> <li>– tongue pumping</li> <li>– drooling</li> <li>– uncontrolled entry of food or its debris into the pharyngeal cavity</li> <li>– difficulties in initiating the movements of the tongue</li> <li>– long time for bolus transport</li> </ul>	<ul style="list-style-type: none"> <li>– disorder in initiating swallowing reflex (delay)</li> <li>– retention of food in the pharyngeal cavity</li> <li>– lower force of pharyngeal constrictor muscles</li> <li>– weakened pulling up of the pharynx</li> <li>– weakened adduction of vocal folds</li> <li>– penetration</li> <li>– aspiration</li> </ul>

Most often, the first symptoms of swallowing disorders occur during the oral stage.

Reduction of performance within the oral motor apparatus, including, among others, lips, tongue and cheeks, is observed in connection with muscular rigidity

<sup>2</sup> As well as oesophageal phase.

<sup>3</sup> Due to the impossibility of impacting the swallowing trough speech therapy's methods during the oesophageal phase, it has been excluded from the hereby study.

and resting tremor. This leads to slowing of the chewing, extension of time necessary to form the bolus, as well as difficulties in manipulating it.

One of the symptoms considered as pathognomonic is tongue pumping, i.e. backward and forward rocking, non-propulsive and inefficient motion of the tongue which prevents the smooth passage of the bolus into the pharyngeal cavity – the back and forth motion may be repeated before the back of the tongue lowers, allowing further passage (Tjaden 2008). In order to limit this phenomenon, the patient may try to consciously hold the bite on the palate, and then to initiate swallowing with a firm movement of the tongue's root towards the throat (Logemann 1998).

Moreover, difficulties in keeping the food or (more frequently) the liquid in the oral cavity, as well as accumulation of food debris on the inner surface of the cheeks and palate (which during inspiration may lead to uncontrolled penetration, i.e. food getting into the larynx, over the vocal cords) may also occur.

Drooling proves to be also a quite troublesome symptom of dysphagia; however, it is generally provoked not so much by the overproduction of mucus, but by ineffective performance of the tongue, too rare swallowing, distinctive, bent posture, as well as rigidity and tremor, which do not allow of a full closure of the lips. A conscientious intensification of the swallowing frequency, control of the respiratory pattern and maintaining the labial seal may help with weaker drooling. With a stronger one – it is sometimes necessary to apply pharmacotherapy limiting the amount of liquid produced or botulinum injections into the salivary glands<sup>4</sup> (Tjaden 2008).

Approximately half of the patients suffer from significant dryness in the mouth, called xerostomia. Its severity can be correlated with high doses of levodopa and anticholinergics (Ahlskog 2009). Xerostomia augments the difficulty in swallowing (lack of saliva prevents the formation of bolus and its effective manipulation), brings discomfort and increases the risk of gum and tooth diseases. If aspiration, i.e. passage of food below the vocal folds, occurs – the bacteria proliferating in the oral cavity cause a threat to the respiratory system and may contribute to the development of pneumonia (Marks, Rainbow 2011).

In the case of severe dryness, it can be helpful to take frequent sips of water, to suck sour candies or tablets moisturizing the throat, and to use the so-called artificial saliva (in the form of tablets, aerosol or gel), which is available to be bought in pharmacies. A special diligence in oral hygiene is also necessary.

Initiation of swallowing reflex can be (usually slightly) delayed in the case of patients suffering from Parkinson's disease, but even a small delay will favor the passage of food into the respiratory tract.

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<sup>4</sup> The intake of liquids by the patient should not be restricted even in the case of excessive drooling.

The performance of pharyngeal constrictor muscles and retraction of tongue root are also weakened. This leads to retention of food in epiglottic valleculae in the mesopharynx or in pyriform sinuses of the hypopharynx and increases the risk of aspiration after swallowing, when the respiratory tract is opened.

The correct lift of the larynx (moved up and forward), adduction of the true vocal folds at the time of swallowing, as well as weakened/suppressed cough reflex, indicating penetration of a foreign body into the larynx in the case of healthy people<sup>5</sup> can also be problematic.

Impaired cognitive functioning and intensifying symptoms of dementia exacerbate the image of dysphagia and hinder its therapy in severe cases of the disease. Another problem is also the binge eating disorder (Tjaden 2008).

### TREATMENT OF DYSPHAGIA

In the treatment of dysphagia, there are two types of interaction – compensatory and therapeutic strategies (Logemann 1998).

Table 2. Summary of interaction methods

Compensatory strategies	Therapeutic strategies
Postural changes	Oral motor exercises
Modification of food intake rate	Falsetto exercise
Modified bite size	Effortful swallow
Modified consistency diet	Mendelsohn maneuver
Coordination of meals and medication taking	Supraglottic swallow
Sensory stimulation	LSVT
Double swallow with expectoration	EMST

Compensatory strategies allow to extend control over swallowing – they reduce the risk of food residues in the oropharyngeal cavity and of the aspiration. They also minimize the symptoms without altering the physiology of the entire process.

The following procedures (among others) are recommended to patients suffering from Parkinson's disease:

<sup>5</sup> Lack of cough (as well as choking during/after swallowing) does not exclude aspiration.

- adoption of the so-called “safe posture” during the meal (sitting position, head in the axis of the body, chin-down posture);
- sensory stimulation through the introduction of cold and sour food, as well as carbonated beverages into the diet (which allows better “feeling” of the bite and easier initiation of swallowing);
- reduction of bite intake rate – fast rate may be conducive to retention of food in the oropharyngeal cavity, and thus – aspiration;
- modification of bite volume (bigger<sup>6</sup>, more noticeable bite exerts sufficient pressure on the palatal arches and the tongue, and thus makes it easier to trigger the swallowing reflex);
- double swallow with expectoration;
- modified consistency diet.

The modified consistency diet, including food and liquids, should always be taken into consideration only after trying other compensatory strategies, or when due to limited motor abilities/progressive process of dementia their introduction is impossible; elimination of certain products from the diet, as well as the need to consume semi-fluid (blended) consistencies can be a difficult experience for the patient.

Both thick and sticky, as well as thin food/liquids may be difficult to swallow. “Dangerous” products also include crumbling ones (wafers, crackers, whole wheat bread), loose ones (rice, groats), with a heterogeneous structure (soups, fruits such as oranges, grapes), as well as medications, which, if their properties do not exclude it, should be preferably administered in a yoghurt/cream cheese or dissolved and condensed. In order to condense the liquids, one can use a thickening agent in powder, usually used for infant formula milk and available to buy in pharmacies.

The safest products include semi-liquid ones, of homogenous consistency (drinking yoghurt, cream cheese, cream soup, mashed vegetables), but it should be noted that the degree of food or liquid modification always depends on the type and severity of dysfunction.

As far as the Parkinson’s disease is concerned, it is most preferable to adjust the time of meal to the point when the effects of medications maximally increase the efficiency of the human body (“on” mode) – in the case of levodopa, about 30 minutes after taking the tablet<sup>7</sup>.

The aim of therapeutic strategies is to modify the physiology of swallowing.

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<sup>6</sup> The bite cannot be too large – larger amount of food may be retained in the oral cavity;

<sup>7</sup> Taking levodopa may require limitation in consuming high-protein food, thus, in order to avoid losing weight, the patient’s diet should be consulted with both the doctor in charge of the case and a nutritionist; levodopa may also exacerbate dyskinesia, which has an impact on the swallowing process, aggravating the symptoms of dysphagia.

Patients with moderate difficulties can perform exercises which improve the performance of lips, cheeks and involve lifting the larynx (e.g. falsetto exercise – the patient produces a vowel, going from a low sound to the highest one and holds the maximum pitch for several seconds).

Patients are also advised to:

- practice effortful swallow (with reduced backward movements of tongue root) (Tjaden 2008),
- perform Mendelsohn maneuver, expanding the opening of the cricopharyngeus muscle; it consists in consciously extending the lift of the larynx during swallowing (Logemann 1998,
- supraglottic swallow (strengthens the protective function of the larynx) – takes place according to the scheme: inspiration – strong air retention (vocal folds adduct) – swallow – expectoration – exhalation.

It is sometimes helpful to apply the expiratory muscle strength training (EMST) conducted by using the spirometer with adjustable resistance and working on the basis of LSVT (Lee Silverman Voice Treatment) – they are aimed at shortening the time of bolus transport and at increasing the control over it, at minimizing the risk of food retention in the oropharyngeal cavity, improving the tongue performance, and thus – at strengthening the safety and efficiency of swallowing (cf. Tab. 2).

In the case of patients suffering from severe dysphagia, it may be necessary to apply the enteral nutrition (e.g. through PEG), which does not necessarily exclude taking a portion of food/liquid via the oral cavity. However, to a large extent, it allows to avoid malnutrition, dehydration and aspiration pneumonia [Tjaden 2008].

Implementation of speech therapy-based swallowing therapy must be preceded by a thorough observation of the patient, by collecting a detailed history of the patient and his family, as well as SLP examination. The choice of working methods depends not only on the type and severity of dysfunction, but also on the overall functioning of the patient – motor, as well as cognitive. Due to the progressive nature of the Parkinson's disease, both intensification of dysphagia's symptoms in time (which forces systematic monitoring of the patient's state and modification of interactions), as well as limitations in the therapy's effectiveness should be expected. Personality changes, depression, rising motor difficulties and deepening dementia may gradually exclude the patient from active participation in the therapy.

However, it is important not to ignore the problem. Early diagnosis and implementation of appropriate strategies give a chance to increase the safety of patients and improve their quality of life.

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