

# Dysphagia

## Major determinant of quality of life



Dysphagia is a major determinant of the quality of life. People with swallowing disorders can face difficulties with self-esteem, social behaviour and depression (Ekberg et al., 2002). They are also at greater risk for underfeeding and dehydration.

### OLDER ADULTS ARE MORE AT RISK

People over 75 years old staying in hospital are twice as likely to develop dysphagia (Altman et al., 2010). These patients on average stay in hospital 40% longer.

### DIET MODIFICATIONS INSTEAD OF TREATMENT

Despite the negative impacts of dysphagia, swallowing disorders are often not treated by the speech therapist. Only 32% of adults over 55 years with swallowing disorders get professional treatment (Ekberg et al., 2002). Instead of treatment, diet modifications are usually suggested. One of the reasons why therapists often avoid treatment is that swallowing exercises are difficult to explain to the patient.

### DYSPHAGIA TREATMENT

If swallowing exercises are prescribed, the speech therapist will give oral instructions to their patients in order to let them perform the exercises correctly. For patients it can sometimes be very difficult to fully understand the requirements and properly perform the exercises. Visual feedback using a surface electromyogram (sEMG) is being used more and more to complement the oral instructions.

### VISUALISING MUSCLE CONTRACTIONS DURING SWALLOWING

sEMG-assisted biofeedback is a method to help patients perform swallowing exercises that are already common in clinical practice (Daniels & Huckabee, 2008). The method uses electrodes placed on the surface of the skin. The electrodes record muscle activity during swallowing, which are then shown on an electromyogram. sEMG can be used to visualize and facilitate swallowing exercises and swallowing manoeuvres. This way, the speech therapist has an assistive

### SILVERFIT: ENJOY EXERCISING

SilverFit, a Dutch company launched in 2008, develops game-based training systems for geriatric rehabilitation. We offer accessible exercises to people with (temporary or chronic) physical or cognitive impairments. Our systems support game-based therapeutic exercises adapted to the level of each individual. They are currently in use worldwide in over 3900 care facilities: assisted living residences, nursing homes, (geriatric) rehabilitation centres, hospitals, mental disability care and day care.

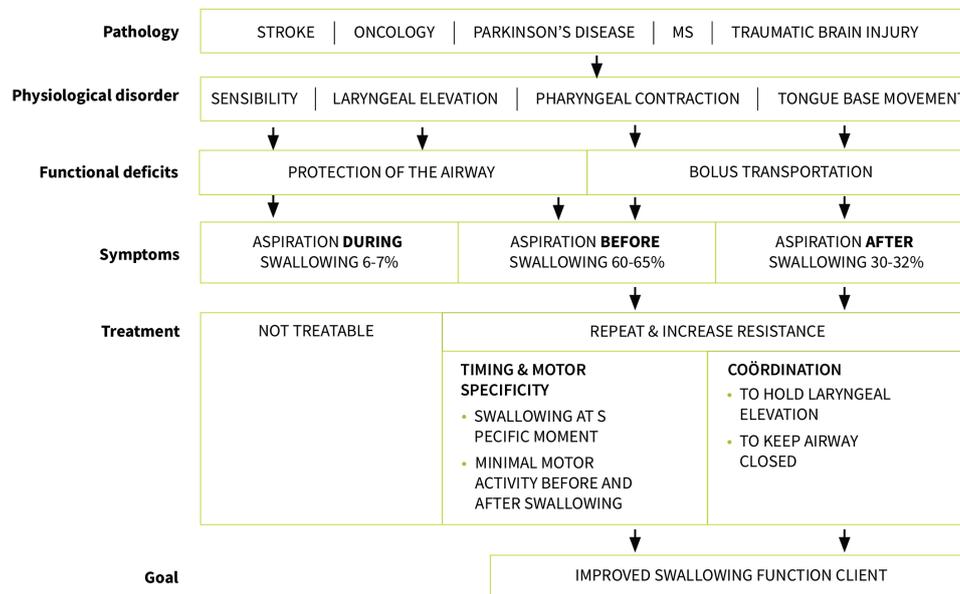
tool. The patients can see what happens when they swallow, meaning that the exercise can be performed effectively. It is important to note that the sEMG signal is not a diagnostic tool. sEMG biofeedback is only a method to support and enable the patient to do swallowing exercises. Studies that investigated the additional value of sEMG during swallowing exercises reported positive results (Crary et al., 2004).

In this whitepaper, we will give an overview of the scientific substantiation of swallowing exercises with and without sEMG for treatment of dysphagia. Afterwards, we will explain the SilverFit RePhagia, a system that offers swallowing exercises with games and sEMG. We will also share information on research that has been performed using the SilverFit RePhagia.



# Efficiency of swallowing exercises

First, we discuss the efficiency of some pharyngeal swallowing exercises (effortful swallowing, functional swallowing, and the Mendelsohn Maneuver) and oral swallowing exercises. Treatment of a patient always begins with functional swallowing. The rest of the treatment depends on the patient’s swallowing function.



Source: Clinical pathways developed by SilverFit i.c.w. E. Scholten (2014).

## EFFORTFUL SWALLOWING

Patients with dysphagia can have reduced oropharyngeal muscle power. This may result in aspiration and/or penetration. During effortful swallowing training (EST) the patient is instructed to swallow and simultaneously push hard with the tongue against the hard palate. By using this method, the tongue and muscles in the oral and pharyngeal area are activated.

### Without sEMG

Studies that look at the effectivity of EST have mostly been conducted with healthy older adults. Park et al. (2019) performed a randomised controlled trial looking at the effect of EST on tongue strength and swallowing function among stroke patients with dysphagia. This study shows that resistance training by EST is an effective method to improve tongue muscle power (assessed using the Iowa Oral Performance Instrument (IOPI)) and oropharyngeal swallowing function (assessed using the Videofluoroscopic Dysphagia Scale (VDS)). Park et al. (2019) believe that the improvement in oropharyngeal swallowing function is the result of increased tongue muscle power.

### With sEMG

sEMG biofeedback is often used during effortful swallowing to help teach patients how to do the swallowing exercises (Huckabee & Macrae, 2014).

## FUNCTIONAL SWALLOWING

During functional swallowing, the patient is stimulated to repeatedly swallow a bolus. This allows the patient to improve the swallowing frequency.

### Without sEMG

The patients in the control group of the study of Park et al. (2019) performed functional swallowing training without exerting extra force with the tongue. The control group also showed a significant improvement in oropharyngeal swallowing function, although this improvement was significantly lower than the improvement in oropharyngeal swallowing function in the experiment group who performed effortful swallowing training.

**With sEMG**

Huimin et al. (2015) heeft gekeken naar het effect van functionele sliktraining. In dit geval met behulp van sEMG. Cliënten in de experimentgroep voerden functionele sliktraining uit met behulp van sEMG en cliënten in de controlegroep voerden functionele sliktraining uit zonder sEMG. Na 4 weken intensief trainen toonden zowel de experimentgroep als de controlegroep een significante verbetering in slikfysiologie en maximale verplaatsing van het hyoid. De experimentgroep liet echter een significant grotere verbetering zien in vergelijken met de controlegroep.

**MENDELSONN MANEUVER**

The Mendelsohn Maneuver is a widely used swallowing technique to prolong the hyolaryngeal elevation during swallowing and thus prolong closure of the airway and opening of the oesophagus..

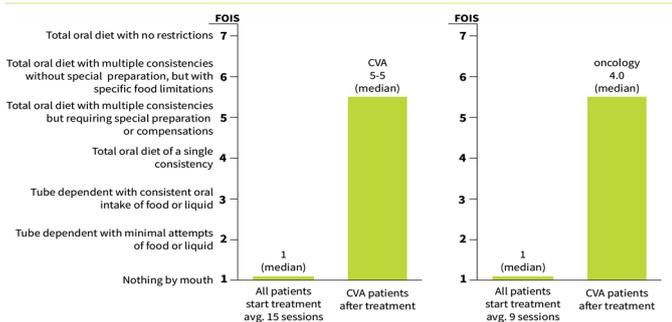
**Without sEMG**

In 2015 Langmore and Pisegna made an overview of published studies about dysphagia exercises. According to them, there is evidence for the use of the Mendelsohn Maneuver in swallowing exercises (McCullough et al., 2012). Reductions in hyoid movement have been reported in stroke patients with dysphagia. McCullough et al. (2012) studied the effect of the Mendelsohn Maneuver on the extent of hyoid movement. It was found that practicing with the Mendelsohn Maneuver leads to gains in the extent of hyoid movement. Aside from using the Mendelsohn Maneuver to induce physiological changes, it can also be used as a compensation strategy.

**With sEMG**

The Mendelsohn Maneuver is a difficult exercise to perform, therefore arduous to explain to patients. Cognitive problems can be an additional obstacle. The use of sEMG can facilitate learning of the Mendelsohn Maneuver (De Bodt et al., 2015). Crary et al. (2004) also looked at the Mendelsohn Maneuver in combination with sEMG. The results show that patients' oral nutritional intake increased significantly after treatment with sEMG.

THE EFFECT OF SEMG ON ORAL FOOD INTAKE



FOIS; Functional Oral Intake Scale

Source: Crary et al. (2004)

**ORAL SWALLOWING EXERCISES**

Oral swallowing exercises focus on isolated movements of the tongue, jaws and lips. Scientific consensus regarding the efficiency of oral exercises to train swallowing is yet to be established.

We can conclude that pharyngeal swallowing exercises are effective and that sEMG has additional value.

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# Effectivity SilverFit Rephagia

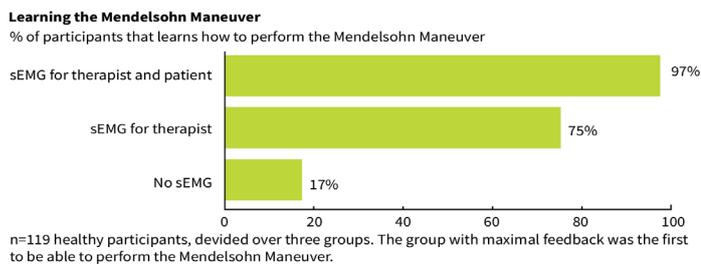
The SilverFit Rephagia is a system that combines existing evidence-based swallowing exercises for the treatment of dysphagia, with sEMG biofeedback and a visual representation of swallowing movement, swallowing power, and swallowing timing. The SilverFit Rephagia consists of a laptop with installed software and supports the speech therapy. The system offers the exercises through games or a graph. The SilverFit Rephagia is not a diagnostic tool.

The benefits of the SilverFit Rephagia compared to treatment without visual representation:

- The speech therapist has a supportive tool that ensures the patient properly understands the exercise and can perform it effectively.
- The speech therapist and the patient both receive valuable insights of the patient's progress..
- The patient is motivated to practice, thanks to the interactive games.

## MENDELSONH MANEUVER

Galek et al. (2018) show that the use of sEMG in the US version of the SilverFit Rephagia strongly improves the correct execution of the exercise. Both the Mendelsohn Maneuver and the effortful swallowing were more often correctly performed when sEMG was used.



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0348 769 110

Source: Galek et al. (2018)

## HUNTINGTON'S DISEASE

The aim of the study of Kerkdijk et al. (2018) was to find out whether the SilverFit Rephagia is a suitable treatment method for people with Huntington's disease (HD). The study shows that therapy with the SilverFit Rephagia is feasible within the treatment time and that sEMG electrodes remain in place. In addition, the interviews show that visual support was experienced as an important additional value. The patients were enthusiastic and indicated that the program motivated them to practice. It was concluded that the SilverFit Rephagia is a suitable treatment method for HD patients.

## PARKINSON'S DISEASE

Snoek (2019) investigated user experience of the SilverFit Rephagia. Speech therapists using the SilverFit Rephagia for treatment of patients with Parkinson's Disease were included. The therapists indicated that a positive feature of the SilverFit Rephagia was the interactivity between patients and the screen, and the fact that the swallowing training was instantly shown through nice games or graphics. The therapist mentioned this as a motivation for patients, resulting in a faster progress in rehabilitation. In addition, the visualizations ensure that the patient understands the exercise and allow tracking of the patient's progress. It was concluded that swallowing therapy with biofeedback is mainly useful for patients who are not yet in an advanced stage of the disease.

## MENTAL HEALTHCARE

Helmhout (2018) studied the use of SilverFit Rephagia with people with mental disabilities. The study shows that even people with severely limited cognitive capacities can do swallowing exercises thanks to the game-based exercises.

**Based on these studies we can conclude that the SilverFit Rephagia can support swallowing exercises. It motivates patients to train and ensures that they understand the exercises. Because of this, patients can perform the swallowing exercises effectively.**