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The swallowing process in the perspective of physiological

Proces połykania w perspektywie następstw fizjologicznego starzenia się

Sandecka Karolina^{1,2(B,E,F)}, Śliwiński Zbigniew^{3(E,F)}

¹Stationary Rehabilitation Center for Musculoskeletal Diseases for Adults and Children WS-SPZOZ in Zgorzelec, Poland /

Stacjonarny Ośrodek Rehabilitacji Chorób Narządu Ruchu dla Dorosłych i Dzieci WS-SPZOZ w Zgorzelcu

²Psychological and Pedagogical Counseling Center in Luban, Poland / Poradnia Psychologiczno-Pedagogiczna w Lubaniu

³Collegium Medicum, UJK Kielce, Faculty of Health Sciences, Department of Physiotherapy, Kielce, Poland /

Collegium Medicum, UJK Kielce, Wydział Nauk o Zdrowiu, Zakład Fizjoterapii, Kielce

Abstract

In an aging society, recognizing the needs of seniors is extremely important. As a result of the physiological aging process progressing with age, we observe increasing limitations in the daily functioning of individuals. For caregivers of the elderly, it is important to be aware of these changes. Disturbances in the swallowing process also intensify with age. Choosing appropriate swallowing therapy methods for the elderly and providing proper instructions for feeding food and drinks can limit the risk of negative health consequences and improve the comfort of life for seniors.

Key words:

swallowing, presbyphagia, senior

Streszczenie

W starzejącym się społeczeństwie niezwykle istotne jest dostrzeganie potrzeb seniorów. W następstwie postępującego wraz z wiekiem fizjologicznego procesu starzenia się organizmu obserwujemy narastające ograniczenia w codziennym funkcjonowaniu człowieka. Dla opiekunów osób starszych ważna jest świadomość tych zmian. W procesie połykania również obserwuje się zaburzenia nasilające się wraz z wiekiem. Dobór odpowiednich metod terapii połykania do stanu seniora oraz instruktaż prawidłowego podawania pokarmów i napojów dla opiekunów ograniczają ryzyko negatywnych konsekwencji dla zdrowia i poprawy komfortu życia seniora.

Słowa kluczowe:

połykanie, presbyfagia, senior

Introduction

The aging of the organism is a progressive and inevitable process. Naturally occurring degenerative changes in systems and a tendency to suffer from chronic diseases (average 3-4 diseases in people after 65 years of age) mean that seniors often require treatment, rehabilitation, speech therapy, psychological care, and daily supervision. In the perspective of an aging society, where 75 million people aged 65 and older were recorded in the European Union population in 2018, it is worthwhile to pay special attention to the needs of patients in this age group [1].

The aim of this work is to show the essence of changes related to the natural aging process of the organism, their impact on swallowing function, and the therapy of presbyphagia and care for the elderly. Based on a literature review, difficulties associated with consuming food and fluids by people in the autumn of life are discussed.

Swallowing

The swallowing process plays an important role in daily functioning. It is a complex act involving the oral cavity, pharynx, and esophagus. It occurs in three phases:

1. Oral phase: preliminary and proper (volitional), lasting about 31 seconds – during which food is crushed and mixed with saliva to form a bolus. The bolus is transported to the pharyngeal isthmus, where irritation of receptors initiates the swallowing reflex [2, 3].
2. The pharyngeal phase (involuntary) occurs within 1–3 seconds. Following the triggering of the swallowing reflex, it involves: closure of the velopharyngeal and protection of the laryngeal inlet, lowering the tension of the upper esophageal sphincter muscle complex; elevation of the hyolaryngeal complex and moving it forward with simultaneous retraction of the tongue base [2, 3]. The critical aspect of this phase is the pressure gradient between the oral part and the space of the upper esophageal sphincter. In the mechanism of pressure creation, the movement of the tongue is crucial, acting as a piston in the throat space limited by the soft palate, which secures the nasal part of the pharynx, and the closed laryngeal inlet. The negative pressure results from lowering the tension in the upper esophageal sphincter and the movement of the hyolaryngeal complex [4].
3. Esophageal phase (involuntary), in which the food bolus is transported to the stomach by a peristaltic wave, lasts 8–20 seconds [3].

Before starting to take in food, a pre-oral phase can also be distinguished. In response to the stimulus of appearing food, saliva production increases, and the individual tends to adopt a body posture suitable for consuming a meal [5].

For proper swallowing, functioning of 26 muscle groups and three pairs of cervical nerves (C₁-C₃) and five pairs of cranial nerves (V, VII, IX, X, XII) is crucial [2, 6]. In the nervous system, the whole process is controlled and coordinated by cortical areas - the precentral gyrus, postcentral gyrus, lower and inner part of the frontal operculum; supplementary motor cortex, anterior part of the insula; anterior gyrus of the cingulate cortex, premotor cortex, as well as pyramidal tracts, subcortical nuclei, and the cerebellum [6, 7].

For an effective swallowing process, the efficient functioning of all structures responsible for it is necessary.

Aging processes of the organism

According to data from the Central Statistical Office, based on studies on the situation of the elderly in Poland in 2021, the number of people aged sixty and older in society has significantly increased. Over 15 years, the number of seniors increased by 8.4%, from 17.2% in 2005 to 25.6% in 2020 [8]. According to forecasts, the number of people aged 80+ will be 12.3% by 2060. For comparison, in 2013, 3.8% was recorded [9]. The increase in the number of sixty-year-olds and older requires society's attention to their special needs resulting from the natural aging process of the organism.

Some authors claim that the slow aging process of the organism starts already at the age of 25–30 and affects every

system. It is difficult to find a unanimous cause of this process in the literature. One of the often-repeated hypotheses is about programmed aging, which is based on Hayflick's discovery of a limited number of possible cell divisions, the so-called Hayflick limit. This is due to the shortening of telomeres as a result of their incomplete copying during cell divisions. Another theory suggests somatic mutation as a result of the influence of harmful factors [10, 11, 12].

Many factors, including genetic factors, somatic diseases, lifestyle, personality traits, experiences, socioeconomic situation, environmental factors, gender, and culture, influence the course of the aging process. The pursuit of maintaining homeostasis by the organism in the course of progressing physiological changes, lowering of organ reserves, and disturbances of adaptation and defense mechanisms is difficult. Even small changes such as dehydration or infection can disrupt it [11, 12].

In old age, the functioning of the entire organism deteriorates, and the accompanying symptoms include, among others:

- decrease in the sensitivity of the bronchial epithelium, resulting in reduced mucous sensitivity and weakening of the cough reflex;
- atrophy of pulmonary parenchyma and proliferation of connective tissue, which may result in the formation of emphysema and atelectasis foci;
- decreased arterial elasticity, changes in coronary vessels, resulting in insufficient supply to the heart and associated with fibrosis of the myocardium;
- with age, the filtering capacity of the glomeruli in the kidneys decreases and the effective excretion of toxins weakens, weakening of the contractile force of the bladder muscles and urine retention [11];
- sarcopenia, understood as a reduction in muscle mass and the accompanying loss of muscle strength. This process results from the gradual degeneration of the nervous system that supplies muscles. The atrophy of motor units occurs due to a lack of an adequate number of supplying α -motoneurons. In the aging processes, demyelination of axons progresses, resulting in their smaller number and diameter innervating muscle fibers. This is associated with limitations in the possibilities of movement and senior's activity [13];
- xerostomia (feeling of dryness in the mouth) that may occur as a result of reduced estrogen secretion in women during the peri- and postmenopausal period, as well as changes in the salivary glands occurring in older people. Reduced saliva secretion makes it difficult to form a bolus, initial digestion phases, and tasting [14, 15];
- anatomical, structural, and neurochemical changes increase the risk of mental disorders. The deterioration of cognitive functions often translates into a limited ability to function independently [11].

These are just a few of the difficulties that a senior may face every day. It is important that doctors, nurses, and therapists are able to explain to the family how to support an older person in the gradual deterioration of efficiency, loss of independence, and motivate them to activity adjusted to their health status and capabilities.

Swallowing disorders in old age

Presbyphagia refers to swallowing disorders that intensify with age. Such problems are faced by 8% of people over the age of 50 and as many as 16% of the elderly. Other sources report that 30-40% of patients after the age of 65 and 60% of nursing home residents have difficulty swallowing [16, 17, 18].

As a result of the aging processes, several factors affecting the ability to consume food and effectively swallow it are observed, including:

1. Sarcopenia, slowing of movements, limitation of the ability to move.
2. Deterioration of sensation related to nervous conduction disorders.
3. Weakening of appetite, related to the atrophy of olfactory fibers, and consequently weakening of the senses of smell and taste.
4. Changes in the central nervous system in the centers of hunger and satiety, which are associated with appetite disorders.
5. Reduced elasticity of tissues, affecting the slower elevation of the larynx and delayed opening of the upper esophageal sphincter.
6. Changes in the gastrointestinal system: lack of dentition and deterioration of occlusal conditions, disturbed saliva secretion, slowing of gastrointestinal motility, weakening of bolus transport from the throat to the esophagus as a result of lower resting tension of the upper esophageal sphincter, and increased pressure during maximum contraction [4, 16].

Cognitive and emotional processes also influence the process of meal consumption in old age, such as disturbances in consciousness, attention, memory, and self-control; agnosia related to difficulty in recognizing food; apraxia concerning improper motor planning; executive function disorders, excessive arousal, depression [16].

Among the methods of therapy for swallowing disorders, one can distinguish:

1. Restorative methods based on functional training and activation of brain neuroplasticity mechanisms. Their task is to rebuild the disturbed swallowing function.
2. Compensatory methods – their goal is to improve the efficiency of swallowing and the safety of consuming meals and drinks. These methods involve changing body position and swallowing techniques, such as tilting the chin to the chest during swallowing.



Fig. 1. A chair that provides a stable position for a senior when consuming meals (foto: own source)

3. Adaptive methods are based on eliminating from the patient's diet foods of a consistency that may cause aspiration of food content, selection of appropriate feeding equipment, and ways of delivering food adapted to the capabilities and condition of the senior [18, 19].



Fig. 2. Cutlery with bending tips that facilitate picking up and delivering food to the mouth. Plates with a high edge (shovel plate) with a non-slip base. Facilitate seniors picking up food on cutlery, minimize the risk of spilling beyond the plate. A cup with a spout filled with thickened drink facilitates the control of the amount of liquid taken and swallowing (foto: own source)

In the case of progressive swallowing disorders, adaptive and compensatory methods are usually introduced [16]. In therapy, it is crucial to minimize the risk of aspiration of food content into the respiratory tract and to avoid aspiration pneumonia. For maintaining the health of seniors, it is important to avoid dehydration and malnutrition.

Conclusion

The aging process is progressive and inevitable. A decrease in the functional capacity of seniors negatively affects their social, intellectual, and mental efficiency. The lesser ability to move and communicate affects interpersonal relationships and leads to social isolation. Disorders in the sphere of food intake, in addition to the threat of malnutrition, dehydration, and aspiration of food content into the respiratory tract, also affect family and social relations. Spilling, leaking of food from the mouth, choking, coughing can cause the older person's reluctance to participate in shared meals. The family and caregivers of seniors may have difficulty

noticing and accepting the declining efficiency of a close person. It is important that in the process of treatment, professional care, and therapy, caregivers are sensitized to the needs of the older person and helped in overcoming everyday difficulties.

Adres do korespondencji / Corresponding author

Karolina Sandecka

e-mail: sandecka@onet.eu

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