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Short communication

## Oral health and dysphagia in the older population: Report of the 2nd EICA-ESSD-EUGMS train the trainers course



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### 1. Introduction

The purpose of the manuscript is to summarize the key points of the European Society for Swallowing Disorders (ESSD) course, “Effective care of older patients with swallowing difficulties” organized by the European Interdisciplinary Council of Ageing (EICA) and by the European Union Geriatric Medicine Society (EUGMS).

According to a review by Wirth et al., oropharyngeal dysphagia (OD), a swallowing disorder implicating impairment in forming or moving the bolus, is a highly prevalent, growing condition in the older population affecting up to 1% of the total population over 65 years and 51% of institutionalized older persons [1]. Common Risk factors for OD are: decline in dental status, loss of muscle mass or function, reduced saliva production and tissue elasticity [1]. It is commonly held that oral hygiene is linked to swallowing disorders; older persons suffering from OD present poor oral health and hygiene and a high prevalence of edentulism, periodontal disease, and caries [2]. Tooth loss, in fact, together

with poor oral hygiene is associated to chewing problems. Poor oral health characterized by missing teeth or ill-fitting dentures can lead to food selectivity and limit an already unbalanced diet which can have a negative impact on nutritional and health status and lead to malnutrition [1]. Older patients suffering from OD are at high risk of developing aspiration pneumonia which is defined as pneumonia contracted following aspiration of colonized oropharyngeal material [2]. Contaminated food or salivary bacteria could be responsible for a high oral bacterial load of pathogens in OD patients that can enter the airways and lead to pneumonia [3]. Age-related physiological changes and other factors such as polypharmacy or sarcopenia can also be linked to swallowing disorders.

The following sections outline the role of oral health and hygiene in swallowing disorders and examine the risk of malnutrition and of aspiration pneumonia in elderly patients.

### 2. Oral hygiene and swallowing disorders

With an estimated prevalence ranging from 18.7 (in healthy individuals) to 46.3% (in community-dwelling individuals), chewing problems are quite common in older persons [4]. Several factors such as ulcerations, bleeding gums, inflammatory diseases and dry mouth have been implicated in the development of chewing problems. Oral care is important for oral health and for

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chewing problems, and poor nutritional status and dental hygiene can lead to tooth decay and tool loss [5].

Chewing ability is strictly dependent on the number of teeth an individual possesses [5]. Just as in individuals of other age groups, the most common factors leading to tooth loss in elderly persons are caries and periodontitis [6]. Tooth loss indirectly alters the coordinated execution of pre-swallowing and swallowing movements, particularly during the oral stage of deglutition. Tooth loss decreases chewing ability and causes difficulties in forming the bolus. Some investigators have reported that the size of the bolus tends to increase as the number of missing teeth rises, and larger boluses potentially interfere with optimal swallowing leading to consequences such as aspiration pneumonia [6]. A poorly formed bolus is, in fact, more difficult to smoothly and efficiently transport into the pharynx, thus leading to additional swallowing disorders in the preparatory oral stage [6].

Another important, frequent problem linked to poor oral hygiene and swallowing problems in elderly adults is reduced saliva production, which affects between 20 to 60% of the elderly population [7]. A reduction in saliva secretion can also impair bolus formation and oropharyngeal bolus transport; it is also associated with tooth loss creating a vicious circle amplifying swallowing problems and poor oral health [7].

Findings outlined during the course indicate that appropriate oral care identifying and treating caries and periodontal disease and properly fitting dentures can prevent tooth loss and promote saliva production. Safe swallowing training can likewise have positive effects on swallowing function and thus on systemic health as well. Lifelong oral hygiene and care are thus important factors in maintaining and improving oral as well as systemic health.

### 3. The relationship between poor oral hygiene and malnutrition

Malnutrition (and in particular undernutrition) [8,9] is a significant, pressing public health problem in Europe [10]. Every third nursing home inhabitant, 1–35% of community-living seniors, and 4–43% of elderly inpatients suffer from malnutrition, and in particular undernutrition [11–15]. The high variability in malnutrition prevalence rates mirrors the high population heterogeneity, differences in the physical and functional status of the older population and the very criteria defining malnutrition [16]. According to the European Society for Clinical Nutrition and Metabolism (ESPEN) guidelines, the Mini Nutritional Assessment (MNA) is a validated nutritional screening instrument to identify risk of malnutrition and undernutrition at an early stage [17,18]. An important “take-home message” of the course was, in fact, that the MNA is an efficacious instrument available to general practitioners to evaluate patients' nutritional status.

The main psychological and physical risk factors linked to malnutrition and undernutrition in older adults are age-related physiological changes, poor dental status, chewing difficulties, swallowing problems (especially oropharyngeal dysphagia), social isolation, mourning, difficulty in acquiring and preparing food, low income, alcohol abuse, poor functional status, cognitive and psychiatric disorders, multimorbidity, some medications such as digoxin, nonsteroidal anti-inflammatory drugs, diuretics, antibiotics and antidepressants (e.g. fluoxetine, bupropion) [13,16,19].

Another “take-home message” presented at the course was that the first or oral stage (the chewing, bolus formation and propulsion process) depends on good oral status. Studies have shown that poor oral hygiene, edentulism and ill-fitting prostheses are important risk factors for malnutrition in elderly subjects. With regard to dentures, despite the fact that wearing dentures during

the night is associated to more tongue and denture plaque and gum inflammation and exposure to bacterial agents present in saliva, 41% of older persons continue to wear dentures over night. It is well established that poor oral health status is one of the most frequent causes of malnutrition due to its effect on mastication and swallowing and can lead to severe nutritional deficiencies [20,21]. Oral health assessment should thus be considered an integral part of a comprehensive geriatric assessment [20,21]. According to a literature review, there is an interdependent relationship between nutrition and oral tissue health: just as malnutrition affects oral health, poor oral health can lead to malnutrition in old, frail adults [22,23].

Another of the course's “take-home messages” was: poor oral condition (tooth loss, loose or shifting teeth, poorly fitted prostheses, periodontitis) can cause pain and discomfort. As eating takes longer when the oral/dental status is poor, older people risk not finishing their meals because they simply get tired. Older people also tend to develop different food preferences as they grow older: they prefer smaller meals and smooth, soft textures. This too can lead to a lower food intake which can in turn cause protein-energy or micronutrient malnutrition [24]. It is also known that the well-being of the oral tissues, the quantity and quality of saliva, the dimension of taste all depend on the intake of micronutrients. Mucin provides an effective barrier against desiccation, penetration, physical and chemical irritants, and bacteria. Retinol deficiency can reduce mucin production, leading to compromised salivary flow and weakened tooth integrity. Recurrent aphthous may be caused by nutritional deficiencies linked to inadequate iron, vitamin B12 and folate intakes.

An association between calcium intake and periodontal diseases has been reported. The relationship between vitamin C and periodontal disease may be due to the former's role in maintaining and repairing healthy connective tissue along with its antioxidant properties. Fluoride ions are integrated into the chemical structure of tooth enamel. In addition, fluoride may inhibit oral microbial metabolism. A potassium deficiency can cause a burning mouth or tongue sensation when eating or drinking [23].

A strong relationship between malnutrition, immunity, and infectious diseases has been noted: malnutrition elicits dysfunctions in the immune system, immunodeficiency leads to a greater susceptibility to infectious diseases and infections. Immune hormones (cytokines) in the meantime promote inflammatory-induced disease-related malnutrition [23,25]. Cytokines also inhibit chemokines and other cells involved in attracting inflammatory cells at inflammation sites which ultimately impact the tissue healing process [25].

The relationship between poor oral hygiene and malnutrition is schematically outlined in Fig. 1 (based on information gathered during the course).

### 4. The relationship between poor oral hygiene and pneumonia

Many of the lectures presented during the San Servolo course were dedicated to one of the most serious medical problems in acute geriatric medicine and one of the major complications of dysphagia: pneumonia. OD, which is associated with malnutrition and dehydration, may lead to retention and aspiration during deglutition and, consequently, result in the development of lower respiratory tract inflammation [26]. The process of swallowing engages 28 muscles and requires 0.5 mL of saliva. The average adult swallows approximately 750 mL of saliva per day in about 600 swallows. Sarcopenia and frailty can cause weakness of muscles including the pharynx and increase the risk of dysphagia and aspiration.

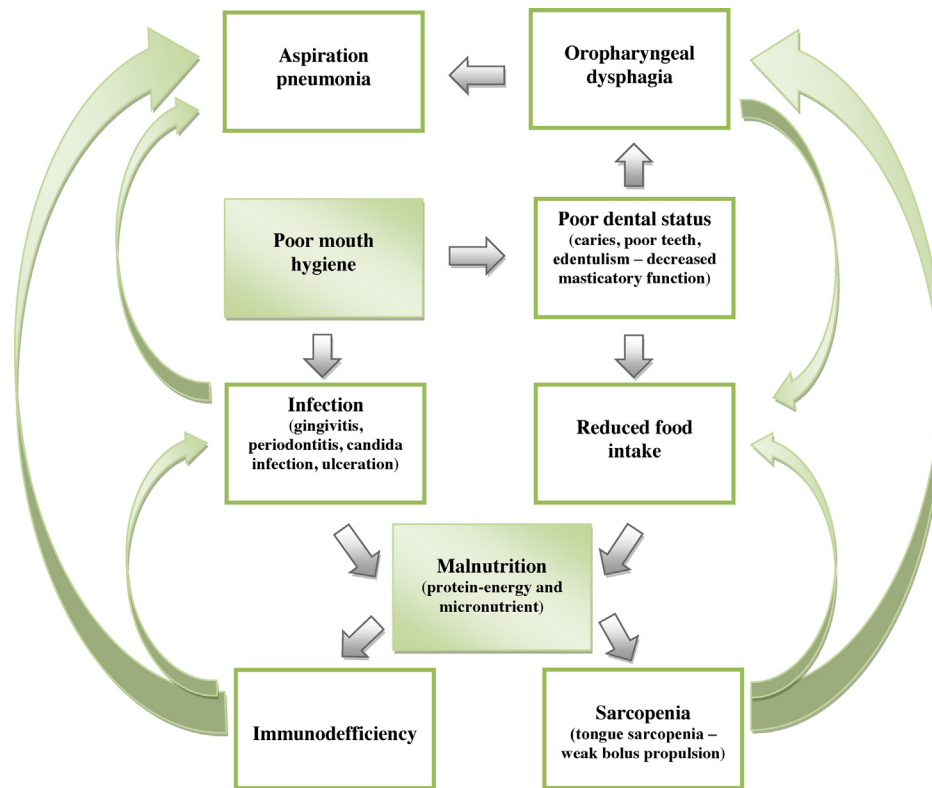


Fig. 1. Pathways in the poor oral hygiene-malnutrition relationship.

Since aspiration pneumonia is defined in various ways, its real prevalence is difficult to assess and, according to the literature, ranges between 6 and 53% of all cases of pneumonia [1]; it may constitute approximately 15% of community-acquired pneumonias [27]. With respect to other types of lung infections, gram-negative bacteria is frequently the cause of aspiration pneumonia [27]. It is not only the consequence of aspirated food and chemical inflammation of the airways, but also of a bacterial colonization of the oral cavity.

Older people and in particular those with frailty syndrome have poor oral health status which is associated to multiple risk factors: impaired functional ability, multi-comorbidity and polypharmacy leading to hypo-salivation, high saliva acidity, an unbalanced diet, high sugar consumption and poor oral hygiene. All of these variables lead to caries, peri-dontal disease and peri-implantitis and high levels of respiratory pathogens in the mouth [28]. According to course lectures, bacterial colonization is significantly higher in patients with oropharyngeal dysphagia and may reach approximately 90%, compared to 67% in a control group [3]. The main types of pathogens are respiratory bacteria: *Streptococcus pneumoniae*, *Staphylococcus aureus*, but also gram-negative ones (*Haemophilus influenzae*, *Pseudomonas aeruginosa* and *Escherichia coli*). These can contaminate the food and saliva that can be aspirated into the airways when deglutition is impaired and cause pneumonia. As was explained during the lectures, these mechanisms should be taken into consideration when antibiotic therapy is being considered.

According to a study that analyzed of the relationship between pneumonia incidence and the hygiene in denture wearers, it was found that wearing dentures overnight doubles the risk of pneumonia in geriatric patients [29]. These data confirm the importance of opportune oral hygiene including using an antibacterial mouthwash before bedtime, especially in patients with swallowing difficulties.

Aspiration pneumonia, accompanied by malnutrition and dehydration, leads to more complications, extended hospital stay, and higher mortality [30]. In addition, dehydration can be responsible for less pronounced symptoms at lung auscultation/radiological signs of pneumonia. Malnutrition can explain impaired immune responses, lack of fever and an increase in inflammatory parameters that hinder and delay diagnosis. Muscle weakness may result in the absence of cough and of the so-called silent aspiration and silent pneumonia in elderly adults. Instrumental diagnostic tests such as fiberoptic endoscopic evaluation of swallowing (FEES) and videofluoroscopy (VFS) are important in this context because clinical monitoring and even clinical tests such as the volume-viscosity swallow test may not detect symptoms of dysphagia.

Studies examining aspiration pneumonia as a common complication of dysphagia were presented during the workshops. Over 55% of geriatric patients hospitalized for pneumonia and in particular the older patients suffering from functional or cognitive impairment, malnourishment, and multimorbidity showed symptoms of oropharyngeal dysphagia [30]. According to another study that assessed patients using videofluoroscopy, the number reached 92% [31].

Depending on the assessment method, the incidence of dysphagia after stroke ranges from 37% (in screening tests) to approximately 78% if instrumental methods are used. Stroke patients with dysphagia have a 3.17 higher risk of pneumonia, and those with evidence of aspiration as high as 115 higher. The probability of mortality in patients with swallowing difficulties after a neurologic incident is, moreover 5 times higher [32].

These statistics led to questions about measures to prevent the complication and to improve patients' survival: these include early diagnosis of dysphagia/aspiration and detection of risk factors for pneumonia and frailty. An algorithm that can be helpful in daily practice is the Minimal Massive Intervention (MMI), based on a 2-step approach:

- assessing the 3 main risk factors: dysphagia, low nutritional status and oral cavity hygiene;
- implementing a treatment strategy with regard to fluids and diet.

The preliminary results of the study carried out in Spain, showed a reduction in the number of hospital readmissions and of respiratory tract infections and an improvement in survival rate [27]. The strategy seemed effective and further research is warranted.

## 5. Causes of swallowing disorders

It is well established that dysphagia, which could be considered an expression of frailty, is an increasingly common problem in the elderly population [33]. But despite a greater understanding of swallowing physiology and advances in evaluating dysphagia, swallowing and feeding disorders remain underappreciated by the general public and physicians. Formal diagnosis of dysphagia is not a simple endeavor given its many causes and risk factors pertaining to numerous areas of medical specialization. Depression, cognitive dysfunction, and behavioral changes may further delay the recognition of dysphagia. In addition, swallowing disorders are often insidious in their onset and may present few signs or symptoms for years or even decades. Self-learned compensatory strategies can in the meantime mask normal physiological changes that weaken the integrity of deglutition during aging. Although these changes have been described as “presbypharynges” and considered a natural part of senescence, the ability to adapt gradually to eating and swallowing changes renders the diagnosis of dysphagia difficult at any age.

Swallowing has two main functions: an alimentary one to transport nutrients and water and a protective one to prevent aspiration.

Traditionally, deglutition has been divided into three neuroanatomical phases: oral, pharyngeal and esophageal. Anatomic or physiologic swallowing disorders can occur in any of these stages [8]:

- in the oral preparatory phase swallowing disorders can be linked to (a) incomplete lip closure, (b) reduction in tension in cheek musculature, (c) reduction in motion of lower jaw, (d) reduction in range or coordination of tongue movement and (e) few or no teeth [7];
- pharyngeal-phase abnormalities are of greater clinical significance because they reduce the swallowing reserve, a measure of strength and coordination in excess of that needed to prevent aspiration [21]. These abnormalities are the least common, and aspiration is usually secondary to other conditions present. Manometric studies have demonstrated that the amplitude and duration of pharyngeal pressures, and the rate of propagation are preserved in older patients. Despite the preservation of muscular activity, pharyngeal swallowing is delayed in healthy elderly subjects with respect to younger persons, and the former frequently need to swallow multiple times to effectively clear a bolus from the pharynx. These subjects are three times more likely to inspire rather than expire after swallowing and have more laryngeal penetration as evidenced by coughing and polyphasic laryngeal movements. Coupled with deficits in pharyngo-laryngeal sensory discrimination that occur with age, this reduction in pharyngeal reserve may lead to silent aspiration in an otherwise healthy subject. A delayed or absent triggering of the swallow reflex, a reduction in velopharyngeal closure, damage to pharyngeal peristalsis or to the hyoid traction could cause dysphagia;

- closure of the upper esophageal sphincter (UES) is due to passive forces as well as active muscle contraction, and its relaxation requires inhibition of the crico-pharyngeus and contraction of suprahyoid muscles. UES relaxation and opening are related although not synonymous events. Impaired opening of the UES can result from crico-pharyngeal fibrosis, disordered neurally-mediated opening (Parkinson), suboptimal pharyngeal driving force, or a combination of these factors.

Cerebro-vascular ischemia, sarcopenia, slower nerve conduction and timing are the most frequent causes of this affection, but some hidden etiologies such as diabetes, heavy metal exposure and vitamin deficiency should be suspected in some cases.

Environmental factors (smoking, alcohol, medication, ambient temperature) may contribute to the deterioration of this disease.

To summarize, the swallowing response is a pattern-elicited complex response (it is not strictly a reflex, as it can be partly modulated by central and peripheral information). Alterations in several characteristics (timing, strength, extent) of this response can impair the safety and efficacy of swallowing in patients with oropharyngeal dysphagia.

## 6. ESSD-EUGMS White paper

Whether OD can be considered a geriatric syndrome was discussed during the course, and the “Oropharyngeal Dysphagia as a Geriatric Syndrome” White Paper, which was developed by the Dysphagia Working Group, a committee made up of ESSD and EUGMS members and invited experts, was presented [28]. Based on the definition proposed by Inouye et al. [34], the geriatric syndrome was defined as clinical conditions that do not fit into disease categories but that are highly prevalent in older persons with multiple underlying causes and associated to multiple comorbidities and often poor outcomes that require a multidimensional treatment approach [35].

OD corresponds to the definition of a geriatric syndrome as it is highly prevalent in older persons presenting with multiple symptoms such as aspiration, coughing, choking, hoarse voice etc. [36–38]. It is also associated with multimorbidity, multiple geriatric syndromes and impaired functional capacity as well as poor outcomes such as higher short and long-term mortalities [33]. OD should thus be considered a true geriatric syndrome.

## 7. Conclusion

As amply demonstrated during the course, OD evaluation should be included in standard screening protocols of elderly patients. The MMI, which appears to be an effective instrument in evaluating frail geriatric patients, could be utilized in clinical practice. The MMI assesses, among other health aspects, dysphagia by means of FEES or VFS which is crucial in detecting silent aspiration. An assessment of oral health should be considered an important part of an overall geriatric health evaluation to analyze oral bacterial load and the risk of aspiration in patients with OD. Bacterial colonization can be reduced by appropriate treatment and oral hygiene. Appropriate oral hygiene and regular dental care and use of properly fitting dentures can optimize chewing ability and bolus formation. Edentulism and improperly fitting prosthesis are associated to risk factors contributing to malnutrition which is linked to changes in food preferences.

## Ethical statement

Being a review of previously published studies, the authors did not require any approval by the IRBs.

## Authorship

All authors have made substantial contributions to all of the following: (1) the conception and design of the study, or acquisition of data, or analysis and interpretation of data, (2) drafting the article or revising it critically for important intellectual content, (3) final approval of the version to be submitted.

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## Disclosure of interest

The authors declare that they have no competing interest.

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