Review

Oropharyngeal Dysphagia in Otolaryngology: An Interdisciplinary Narrative Review

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ABSTRACT Oropharyngeal dysphagia (OD) is a common and complex disorder that can compromise nutrition, respiratory health, and quality of life. Its evaluation and management require an understanding of the underlying disease, swallowing physiology, and the patient's broader clinical context. This narrative review presents a contemporary interdisciplinary perspective on adult OD for otolaryngologists. Clinical assessment establishes the nature and context of the swallowing problem, while instrumental methods help define the mechanisms underlying impaired swallowing safety and efficiency. Management may combine treatment of modifiable structural or medical factors with compensation, rehabilitation, and nutritional support. Aspiration-related pulmonary risk is best understood within a multifactorial framework that considers swallowing impairment alongside airway clearance, oral health, and overall health. Otolaryngologists and speech-language pathologists contribute complementary structural, functional, and rehabilitative perspectives, supported by other disciplines as needed. Treatment decisions should balance clinically important risks with feasibility, treatment burden, and the patient's priorities. Emerging approaches, including neurostimulation, artificial intelligence-assisted analysis, wearable sensing, and remote care, may support more objective and individualized management. Integrating these perspectives provides a practical framework for safer swallowing and better living with dysphagia.

KEYWORDS
oropharyngeal dysphagia, swallowing rehabilitation, patient-centered care, otolaryngology, speech-language pathology, flexible endoscopic evaluation of swallowing

1 Introduction

Dysphagia is a swallowing disorder that affects the transport of food and liquid from the oral cavity to the stomach. Oropharyngeal dysphagia (OD) is the form most frequently encountered in otolaryngology practice. It commonly occurs in association with neurological disease, head and neck cancer and its treatment, aging, and critical illness[1–7]. Structural or iatrogenic abnormalities of the upper aerodigestive tract may also contribute[8,9]. Esophageal dysphagia generally follows a different diagnostic pathway[10], although oropharyngeal and esophageal disorders can coexist[11].

OD is common and clinically important. It affects approximately 15%–30% of community-dwelling older adults[2,12] and 40%–50% of individuals after stroke[13,14], with an even greater burden in hospitals and long-term care settings[15]. Its consequences extend beyond aspiration. Patients may experience impaired nutrition and hydration, prolonged hospitalization, and loss of eating-related quality of life[16–18]. Effective care should therefore address both swallowing safety and the ability to maintain efficient and meaningful oral intake.

Management of OD often draws on several disciplines, with otolaryngology and speech-language pathology providing closely related perspectives. Otolaryngologists contribute expertise in upper aerodigestive tract disease, laryngeal and airway function, and selected medical or surgical treatment. Speech-language pathologists (SLPs) characterize swallowing function and guide compens-

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ation, rehabilitation, and longitudinal care. Additional expertise may be required according to the underlying disease and its nutritional or respiratory consequences.

This narrative review presents a contemporary interdisciplinary perspective on OD for otolaryngologists. It focuses on adults and uses neurological, oncological, structural, age-related, and critical-care conditions as representative clinical contexts commonly encountered in otolaryngology and multidisciplinary swallowing practice. The article aims to connect swallowing physiology and functional assessment with multidisciplinary management, with particular attention to rehabilitation, aspiration-related pulmonary risk, and patient-centered care. Emerging research is considered for its potential to support more objective and individualized care.

2 Literature Search and Review Approach

A literature search was conducted in PubMed for English-language publications on adult oropharyngeal dysphagia published through October 10, 2026. Search terms combined concepts related to oropharyngeal dysphagia with swallowing physiology, clinical and instrumental assessment, rehabilitation, medical and surgical management, aspiration-related pulmonary risk, patient-centered care, neurostimulation, artificial intelligence (AI), wearable sensing, and telehealth. Priority was given to clinical guidelines, consensus statements, systematic reviews, meta-analyses, and representative studies directly relevant to adult OD and otolaryngology practice. Seminal physiological studies were retained where they remained foundational to contemporary understanding. Evidence was selected to support a broad narrative synthesis rather than a systematic review or formal evidence grading.

3 Pathophysiology of Oropharyngeal Dysphagia

3.1 Swallowing physiology

Normal swallowing requires coordinated movement of the bolus through the oral cavity and pharynx into the esophagus. This process is conventionally divided into the oral preparatory, oral, pharyngeal, and esophageal phases, although these phases overlap as part of a continuous sensorimotor sequence[6].

During the pharyngeal phase, contraction of the tongue base and pharyngeal walls generates the pressure needed to propel the bolus toward the upper esophageal sphincter (UES)[19]. Passage into the esophagus is supported by relaxation of the cricopharyngeus, opening of the UES, pharyngeal shortening, and forward and upward movement of the hyolaryngeal complex[20]. Efficient swallowing therefore depends on both adequate bolus propulsion and a sufficiently open passage into the esophagus.

At the same time, the larynx closes to protect the airway. This involves closure of the true and false vocal folds, narrowing of the laryngeal vestibule, and epiglottic inversion supported by hyolaryngeal excursion and tongue-base retraction[21,22]. Failure of these mechanisms may result in penetration, in which material enters the laryngeal vestibule but remains above the vocal folds, or aspiration, in which material passes below the vocal folds. Aspiration may trigger a cough response but can occur silently[23,24], particularly when laryngopharyngeal sensation or cough responsiveness is impaired.

3.2 Sensory and respiratory coordination

Swallowing requires precise coordination with breathing because the pharynx serves as a shared pathway for air and the bolus. In healthy adults, swallowing occurs with a brief pause during expiration and is followed by continued expiration, helping to direct any remaining material away from the airway[25]. This pattern may be disrupted in OD and may represent a target for intervention in selected patients[26,27].

Sensory input also shapes the swallowing response. Information about bolus properties, such as volume and texture, allows the nervous system to adjust the timing and amplitude of swallowing movements[28–30]. After the swallow, sensation in the pharynx and larynx detects residue or airway invasion. This may trigger an additional swallow or cough to clear the material[31,32]. Reduced sensation can therefore allow residue or aspiration to occur without an obvious response.

These movements are coordinated through a distributed neural network involving the brainstem, cranial nerves, cerebellum, and higher cortical and subcortical regions[33,34]. This network integrates sensory information with the motor activity required for bolus transport, airway closure, and respiratory coordination.

3.3 How oropharyngeal dysphagia develops

OD develops when one or more of these functions becomes impaired. Reduced oral or pharyngeal propulsion can leave residue and prolong bolus transit. Restricted UES opening can obstruct passage into the esophagus. Incomplete or poorly timed laryngeal closure can allow material to enter the airway. Sensory impairment may delay the swallow or reduce the response to residue and aspiration. In many patients, several of these abnormalities occur together.

Head and neck cancer and its treatment can affect swallowing through changes in anatomy, sensation, and structural movement. Surgery may alter structures needed for bolus preparation, propulsion, or airway protection[3]. Radiotherapy can produce both early effects, such as

edema and mucosal injury, and late effects, including fibrosis, stenosis, and cranial neuropathy[3]. These changes may impair pharyngeal clearance and airway protection and can continue to evolve long after treatment[3].

Other structural disorders may obstruct bolus flow or alter pharyngeal and UES mechanics. Examples include cervical esophageal diverticula, anterior cervical osteophytes, and postoperative or radiation-related stenosis[3,8,35]. Following total laryngectomy, separation of the respiratory and digestive pathways prevents conventional laryngeal aspiration, but dysphagia may persist because of stricture, impaired propulsion, or pharyngoesophageal dysfunction[3].

Neurological disease can disrupt the timing, coordination, strength, or sensory control of swallowing[4]. Central disorders such as stroke and Parkinson disease may affect several stages of swallowing[4,36], whereas peripheral vagal injury may impair vocal fold movement, laryngeal sensation, pharyngeal contraction, or cough[37]. In patients with vocal fold paralysis, glottic insufficiency is therefore only one possible contributor to dysphagia[38].

Respiratory illness and critical illness can further reduce swallow safety by disrupting breath-swallow coordination and limiting the patient's ability to clear aspirated material. Post-extubation status, tracheostomy, reduced alertness, and physical deconditioning are common examples[39]. In older or medically complex patients, these factors often coexist with frailty and loss of muscle reserve, producing a multifactorial pattern of OD[7,40].

Taken together, OD can be understood as a failure of bolus transport, airway protection, sensory control, and/or respiratory coordination. Identifying which functions are impaired, and how they interact in an individual patient, provides the basis for selecting appropriate swallowing assessments and interventions.

4 Referral Pathways and Interdisciplinary Care

Because OD may arise from structural, neurological, respiratory, or treatment-related disorders, patients enter the healthcare system through different referral pathways. Otolaryngology is often the first specialist service involved when dysphagia accompanies head and neck cancer, vocal fold paralysis, tracheostomy, or other upper aerodigestive tract disorders. In these cases, otolaryngology evaluation is commonly combined with SLP assessment of swallowing function. Dental or prosthodontic input may also be needed when oral surgery has resulted in structural deficits that affect bolus preparation or transfer.

Other patients are referred to otolaryngology from specialties such as neurology, gastroenterology, oncology, or respiratory medicine. In the outpatient setting, primary care referrals may provide little more than a general complaint of dysphagia. Symptoms such as difficulty initiating a swallow, coughing during meals, or nasal regurgitation may suggest an oropharyngeal disorder, whereas a sensation of food sticking lower in the chest may suggest an esophageal cause[10]. These patterns help guide initial investigation, but symptom location is not always reliable, and oropharyngeal and esophageal dysphagia may coexist[10,11].

The evaluation is refined by combining structural examination with observation of swallowing function. Otolaryngologic assessment may identify mucosal or structural disease, vocal fold dysfunction, airway abnormalities, and impaired secretion management. SLP assessment shows how the patient prepares, transfers, and clears a bolus, how effectively the airway is protected, and whether performance changes with bolus modification or compensatory strategies. Together, these findings help distinguish a focal, potentially modifiable abnormality from a broader sensorimotor disorder.

Related findings may also redirect the diagnostic pathway. Changes in voice, motor speech, or cognition may suggest an underlying neurological disorder, while evidence of esophageal involvement may prompt gastroenterologic evaluation. Nutritional, respiratory, dental, and rehabilitative needs may require additional specialist input.

Interdisciplinary care therefore integrates the underlying disease, upper aerodigestive tract findings, and functional swallowing performance. This combined perspective helps direct further investigation and management while reducing fragmented or duplicative care (Figure 1).

5 Evaluation Methods

Evaluation of OD begins by identifying the likely nature of the swallowing problem and its clinical context. The initial assessment establishes a working hypothesis, while instrumental testing provides a more detailed view of swallowing physiology. Together, these approaches help determine which functions are impaired and how they may be managed.

5.1 Non-instrumental assessments

The SLP assessment begins with a review of the patient's medical history, swallowing symptoms, and current feeding status[41]. The medical and symptom history may suggest whether the disorder is acute, chronic, progressive, or potentially reversible. Previous treatment, respiratory health, nutritional status, alertness, and relevant neurological or structural findings provide further context.

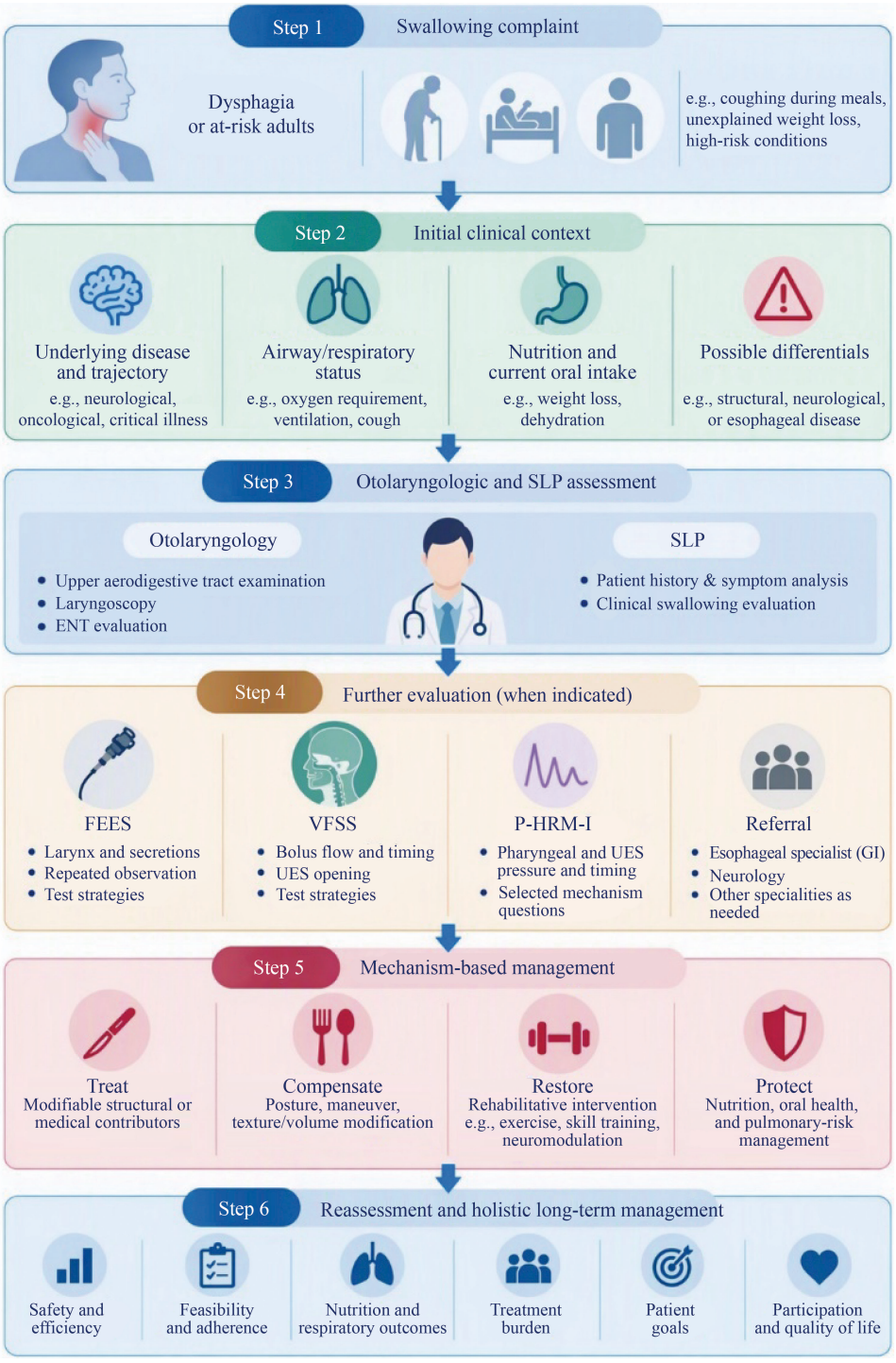


Fig. 1 Practical interdisciplinary framework for the evaluation and management of suspected oropharyngeal dysphagia. The framework proceeds from the presenting swallowing complaint through consideration of the clinical context, complementary otolaryngologic and speech-language pathology assessments, targeted further evaluation, mechanism-based management, and longitudinal reassessment. Long-term care is guided by patient-centered decision-making. ENT, ear, nose, and throat; FEES, flexible endoscopic evaluation of swallowing; GI, gastroenterology; P-HRM-I, pharyngeal high-resolution manometry with impedance; SLP, speech-language pathologist; UES, upper esophageal sphincter; VFSS, videofluoroscopic swallowing study.

The bedside evaluation commonly includes assessment of communication, oral motor function, and swallowing performance[41]. Speech, voice, and cognition are considered because abnormalities in these areas may affect feeding or provide clues to an underlying neurological disorder. The oromotor examination evaluates the movement and function of structures involved in swallowing, such as the lips, tongue, jaw, and

palate. Dentition, oral hygiene, secretion management, and cough are also relevant to bolus preparation and airway protection.

When appropriate, the patient is observed swallowing selected food and liquid consistencies[41]. The SLP assesses bolus control, signs of airway difficulty, oral and pharyngeal clearance, and the patient's endurance and respiratory tolerance. Changes in bolus consistency, volume, posture, or pacing may be introduced to identify potentially helpful strategies.

These findings inform immediate recommendations and help determine whether instrumental assessment is needed. Bedside evaluation alone cannot reliably detect silent aspiration or define the underlying pharyngeal physiology[41]. Its main role is to identify the clinical problem, generate a working hypothesis, and guide the next stage of assessment[42].

5.2 Instrumental assessments

Instrumental assessment allows swallowing to be examined in greater physiological detail. Flexible endoscopic evaluation of swallowing (FEES) and videofluoroscopic swallowing study (VFSS) are the principal methods used to visualize swallowing, while pharyngeal high-resolution manometry (P-HRM) provides complementary information about pharyngeal propulsive pressure and UES function[43]. The most appropriate tests depend on the question being asked (Table 1).

5.2.1 Flexible endoscopic evaluation of swallowing

FEES uses a transnasal endoscope to examine the pharynx and larynx. It provides information about laryngeal anatomy and function, secretion management, pharyngeal residue, and airway invasion[44]. Because it is portable and does not involve radiation, FEES can be performed at the bedside and repeated when necessary.

During food and liquid trials, FEES can show whether material enters the pharynx before the swallow, remains as residue afterward, or enters the airway. It also allows assessment of the patient's sensory and cough responses and the effects of bolus modification or compensatory strategies[44].

FEES does not directly visualize oral bolus preparation or esophageal transit. The pharynx is also briefly obscured during the swallow by the "white-out" period, so events occurring at that moment are inferred from findings immediately before and after it[44].

5.2.2 Videofluoroscopic swallowing study

VFSS, also known as the modified barium swallow study, uses radiographic imaging to follow barium-containing food and liquid through the oral cavity and pharynx[45]. It shows the movement of the bolus in relation to coordinated movement of the swallowing structures.

VFSS is particularly useful for examining oral propulsion, the timing and coordination of the swallow, airway protection, pharyngeal clearance, and opening of the UES[46]. Different consistencies and compensatory strategies can be tested during the study. A limited view of the esophagus may identify findings that require further investigation, but it does not replace a dedicated esophageal study[11].

VFSS captures only a short sample of swallowing and involves exposure to ionizing radiation. It may also be less accessible for patients who cannot be transported or positioned adequately[47].

5.2.3 Pharyngeal high-resolution manometry

P-HRM measures pressure, coordination, and timing along the pharynx and UES using a transnasal catheter. More recently, incorporating impedance measurement (P-HRM-I) allows time synchronization of pressure measurements with bolus transit in the absence of direct bolus visualization[48]. It plays a role in explaining

Table 1 Comparison of common clinical instrumental tools for swallowing evaluation.

Modality	Best suited to assess	Main strengths	Main limitations
FEES	• Larynx • Soft palate function • Secretions • Movement symmetry	• Bedside • No radiation • Prolonged or repeated assessment • Direct observation of secretions, residue, airway invasion, and behavioral responses • Sensory testing is possible with specialized protocols	• White-out • Oral and esophageal phases not directly visualized
VFSS	• Oral and pharyngeal bolus flow • Timing and coordination • Airway protection • UES opening • Limited esophageal screening	• Visualizes bolus flow in relation to swallowing movements • Captures events occurring during the swallow • Non-invasive	• Radiation • Brief sample • Transport and positioning requirements • Contrast allergy • Not a full esophageal motility workup
P-HRM-I	• Pharyngeal propulsion • Timing and coordination • UES relaxation and opening	• Quantitative pressure and timing measurements to complement and explain FEES/VFSS findings	• No direct visualization • Does not assess aspiration • Specialized availability • Interpretation generally requires correlation with clinical or imaging findings

Note: FEES, flexible endoscopic evaluation of swallowing; VFSS, videofluoroscopic swallowing study; P-HRM-I, pharyngeal high-resolution manometry with impedance; UES, upper esophageal sphincter.

whether impaired bolus passage is related to weak pharyngeal propulsion, abnormal coordination, or inadequate UES relaxation and opening[49].

Unlike FEES and VFSS, P-HRM-I does not directly visualize the bolus or swallowing structures, nor aspiration. It is therefore usually interpreted alongside clinical or imaging findings. Its use is more specialized, and availability and analytic methods vary among centers[50].

5.2.4 Integrating the findings

FEES, VFSS, and P-HRM-I provide different views of the same swallowing process. FEES offers detailed assessment of the larynx, secretions, residue, and airway responses. VFSS shows bolus movement through the oral and pharyngeal phases, including events that occur during the swallow, and may provide limited screening of esophageal transit. P-HRM-I adds objective information about pressure and coordination.

The purpose of instrumental assessment is broader than determining whether aspiration occurs. A useful evaluation explains why swallowing is unsafe or inefficient, under which conditions the problem occurs, and whether a particular strategy improves function. This mechanism-based interpretation provides the link between assessment and individualized management.

6 Intervention Approaches

Once the main swallowing impairment has been identified, management can be directed toward the underlying cause, its functional consequences, or both. Treatment may include medical or surgical intervention, compensatory strategies, rehabilitation, and management of nutritional and pulmonary risk. The appropriate combination depends on the swallowing mechanism, severity and expected trajectory of the disorder, and the patient's overall condition and goals.

6.1 Medical and selected surgical approaches

Medical and surgical approaches are most relevant when assessment identifies a modifiable structural, secretory, laryngeal, or pharyngoesophageal contributor. These interventions usually address one component of a broader swallowing disorder and are often combined with SLP-led assessment and rehabilitation. Evidence varies across conditions, and much of the surgical literature is based on selected patient groups and observational studies. The following section therefore provides an overview of established approaches rather than procedural recommendations (Table 2).

6.1.1 Secretion and salivary management

Difficulty managing saliva may result from excessive production or, more commonly, from reduced oral control and impaired clearance[51]. Initial management includes oral care, positioning, hydration, and treatment of reversible medical or medication-related factors[52]. Suction or caregiver support may also be required.

Anticholinergic medication and botulinum toxin injection to the salivary glands are used in selected patients, particularly those with neurological disease[51–53]. Surgical salivary procedures are less commonly considered. Treatment should balance reduced secretion burden against adverse effects such as dry mouth, thickened secretions, dental complications, and difficulty preparing a food bolus[51,52].

6.1.2 Glottic insufficiency

Injection laryngoplasty and framework surgery improve glottic closure in selected patients with unilateral vocal fold paralysis or vocal fold atrophy[38,54]. In addition to improving voice, these procedures may strengthen cough and support airway protection during swallowing[55].

The effect on dysphagia depends on the underlying

Table 2 Overview of medical and selected surgical approaches to oropharyngeal dysphagia.

Clinical target	Representative approaches	Key considerations
Salivary or secretion burden	Supportive care; anticholinergic medication; salivary gland botulinum toxin; selected salivary procedures	Determine whether the primary problem is excessive production or impaired clearance. Consider dry mouth, thickened secretions, oral health, and bolus preparation.
Glottic insufficiency	Injection laryngoplasty; framework surgery	May improve glottic closure and cough. Swallowing outcomes also depend on laryngeal sensation, pharyngeal function, and the underlying neural injury.
Structural obstruction	Dilation; endoscopic treatment; reconstruction or resection	Treatment depends on the lesion, tissue characteristics, and associated swallowing dysfunction.
Cricopharyngeal or UES dysfunction	Dilation; botulinum toxin injection; cricopharyngeal myotomy	Restricted UES opening may reflect impaired relaxation, reduced compliance, weak propulsion, or limited hyolaryngeal excursion.
Severe persistent dysphagia	Selected laryngeal elevation, pharyngeal, infrahyoid, or cricopharyngeal procedures	Careful physiological and patient selection is required; evidence is mainly observational and rehabilitation remains important.
Intractable aspiration	Laryngeal closure or separation procedures	Reserved for highly selected patients because of major effects on voice and normal airway function.
Tracheostomy-related dysfunction	Cuff management; one-way speaking valve; airway procedures; decannulation planning	Effects depend on the underlying disease, airway patency, secretion clearance, cough, and respiratory reserve.

Note: UES, upper esophageal sphincter.

mechanism[56]. Patients with vagal or recurrent laryngeal nerve injury may also have reduced laryngeal sensation or pharyngeal weakness, which will not necessarily improve after vocal fold medialization[38]. Functional swallowing assessment can help determine the contribution of glottic insufficiency and evaluate whether improved closure leads to better swallowing outcomes[55].

6.1.3 Structural and pharyngoesophageal interventions

Structural obstruction may be treated with dilation, endoscopic procedures, reconstruction, or resection, depending on the underlying abnormality[57]. Common examples include treatment-related stenosis, cervical esophageal diverticula, and other lesions that restrict bolus passage.

For selected patients with cricopharyngeal or UES dysfunction, treatment options include dilation, botulinum toxin injection, and cricopharyngeal myotomy[58,59]. Reduced UES opening, however, can arise from several mechanisms. These include impaired cricopharyngeal relaxation, reduced tissue compliance, weak pharyngeal propulsion, and limited hyolaryngeal excursion. Treatment is therefore most likely to help when the proposed procedure matches the physiological impairment identified during assessment[50,58].

6.1.4 Swallowing-improvement and aspiration-prevention surgery

In selected patients with severe and persistent dysphagia, surgery may be considered to improve bolus passage or airway protection. Reported procedures include laryngeal elevation and selected combinations of pharyngeal, infrahyoid, or cricopharyngeal procedures[60]. These operations are generally performed in specialist centers after conservative treatment has provided insufficient benefit. Outcomes depend on the underlying disease, residual swallowing capacity, cognition, and ability to participate in rehabilitation[60,61].

Aspiration-prevention surgery represents a separate and more definitive approach for otherwise intractable aspiration. Procedures that close or separate the laryngeal airway can substantially alter voice and normal airway function. They are therefore reserved for carefully selected patients after detailed discussion of expected benefits, functional trade-offs, and goals of care[62].

6.1.5 Head and neck cancer and tracheostomy-related considerations

After head and neck cancer treatment, medical and surgical management may address recurrence, stenosis, xerostomia, dental disease, or reconstructive problems[3,63]. Swallowing rehabilitation remains important because correction of a structural problem may not fully restore movement, sensation, or coordination[3,63].

In patients with tracheostomy, swallowing is influenced by the underlying disease, airway patency, secretion management, cough, and respiratory reserve. Cuff deflation, when clinically appropriate, permits upper-airway airflow, while a one-way speaking valve redirects expiration through the larynx and may improve subglottic pressure, secretion management, and swallowing function in selected patients[26,64]. Their effects vary, however, and they do not independently eliminate aspiration risk. Decisions concerning airway procedures, decannulation, and oral intake therefore require coordinated airway and swallowing assessment.

6.2 Behavioral and rehabilitative management

Behavioral management addresses the functional swallowing impairment identified during assessment. It may aim to make swallowing immediately safer or more efficient, improve swallowing safety and efficiency over time, or support nutrition when oral intake remains inadequate. Compensatory strategies are intended to improve swallowing safety or efficiency during the task without necessarily changing the underlying swallowing capacity, whereas restorative rehabilitation seeks sustained improvements in swallowing physiology or performance through targeted practice.

The intensity and goals of treatment depend on the severity and expected course of OD. Mild impairment may require education or a limited compensatory strategy. More severe dysphagia may require substantial modification of oral intake or enteral feeding, either temporarily or over the longer term. Enteral feeding can support nutrition and reduce aspiration risk associated with swallowing food and liquid, but it does not prevent aspiration of saliva or refluxed material[65]. Feeding recommendations must therefore consider the underlying disease, potential for recovery, and the patient's goals.

6.2.1 Compensatory management

Compensatory strategies alter the way food or liquid is delivered or swallowed to produce an immediate functional benefit. Changes in food texture, liquid thickness, bolus volume, posture, or pacing may slow bolus flow, redirect it through the pharynx, or improve clearance and airway protection[66–68]. Although texture and viscosity modifications have demonstrable physiological effects, their clinical benefits and burdens vary across patients and outcomes. These strategies are therefore best individualized rather than applied routinely. Feeding assistance and environmental modification may also support patients with reduced attention, endurance, or motor control[69].

The effect of each strategy depends on the individual swallowing impairment and is best evaluated during clinical or instrumental assessment. Thickening liquids, for example, may improve bolus control in some patients but increase residue or reduce fluid intake in others[67]. Standardized terminology such as the International Dysphagia Diet Standardization Initiative (IDDSI) provides a common language for describing modified foods and liquids across disciplines and care settings[70].

6.2.2 Rehabilitation

Rehabilitation aims to improve swallowing function through repeated and targeted practice. Approaches can be broadly grouped into exercise-based, skill-based, sensory, and respiratory interventions[71].

Exercise-based treatment targets strength, endurance, or range of movement in structures involved in swallowing[72]. Skill-based treatment focuses on the timing and coordination of swallowing movements[73]. Sensory and afferent-modulation approaches, including selected pharmacological and peripheral stimulation methods, aim to influence the swallowing response[74,75], while respiratory interventions may target cough or breath-swallow coordination[27]. Evidence for these approaches varies by intervention, dosage, underlying disease, and outcome measure, and the available evidence base remains heterogeneous, with limited consensus regarding uniform clinical recommendations.

Treatment is most clinically meaningful when the selected exercise or task addresses an impairment demonstrated during assessment. Intervention selection should also consider cognition, respiratory reserve, ability to participate, caregiver support, disease trajectory, and the patient's goals. Treatment response is influenced by factors such as treatment dose, adherence, cognition, fatigue, and disease progression. Rehabilitation goals may also change over time. Restoration may be realistic during recovery from an acute disorder, whereas maintenance, compensation, and caregiver support may become more important in progressive disease.

6.2.3 Managing aspiration pneumonia risk

One important goal of OD management is to reduce pulmonary complications. Aspiration increases the risk of pneumonia at the population level[14], but the relationship is not direct in every patient. Pneumonia develops through the interaction of the material entering the airway, oral microbial burden, pulmonary clearance, and the patient's general health[76,77].

This multifactorial model explains why patients with similar aspiration findings may have different clinical outcomes. A patient with effective cough, good oral health, and adequate pulmonary reserve may tolerate occasional aspiration differently from a frail patient with poor secretion clearance and chronic respiratory disease[76,77]. Instrumental evidence of aspiration should therefore be interpreted within the broader clinical context.

Risk reduction may involve swallowing intervention, but it also extends beyond the swallow itself. Risk management therefore addresses not only aspiration exposure but also other factors that influence pulmonary outcomes, such as airway clearance, oral health, and overall medical status. Relevant measures include oral and dental care, support with feeding and positioning, optimization of nutrition and hydration, and management of secretions, cough, mobility, and respiratory disease[76–79]. Decisions about texture modification, oral intake, or enteral feeding should consider these factors together rather than relying on aspiration status alone[76].

A clinically useful assessment therefore asks not only whether aspiration occurs, but also under what conditions it occurs and whether the patient can respond effectively. It should also identify modifiable factors that increase the likelihood of pulmonary complications. This broader approach supports individualized management and prepares the ground for shared decisions about treatment burden, oral intake, and quality of life.

7 Patient-centered Care and Living Well with Dysphagia

Reducing clinical risk is an important goal of OD management, but the most appropriate plan also depends on what is acceptable and meaningful to the patient. Decisions about diet modification, continued oral intake, and tube feeding should therefore consider the underlying disease, expected trajectory, and the patient's values and goals of care[80–82].

The balance between safety and quality of life differs among individuals[82]. Some patients may prioritize maximal reduction of aspiration risk, while others may place greater value on preserving oral intake, independence, or participation in family and social activities involving eating and drinking. The feasibility of a plan also depends on factors such as alertness, endurance, caregiver support, and the patient's willingness to follow the recommended modifications.

Shared decision-making is particularly important when OD is severe, progressive, or unlikely to resolve[83]. Early counseling gives patients and caregivers time to understand the available options and the practical implications of long-term tube feeding or modified oral intake. Clear and consistent communication across the multidisciplinary team can help patients make informed choices and reduce conflicting recommendations[82,83].

Living well with dysphagia also requires attention to how recommendations are implemented outside the clinic. Patients and caregivers need practical guidance,

access to suitable foods and fluids, and continuity between hospital and community care. Standardized terminology such as IDDSI supports communication across settings[70], while education helps translate recommendations into everyday meals[82,84]. For patients receiving long-term enteral feeding, participation in community and social life remains an important outcome of care[85].

Patient-centered dysphagia care therefore extends beyond selecting the safest feeding method. It aims to develop a plan that is clinically appropriate, realistically sustainable, and consistent with the individual's priorities.

8 Clinical Research and Future Directions

Recent research aims to make dysphagia assessment and management more objective, individualized, and accessible. Three areas are particularly relevant: neurostimulation, AI-assisted analysis and precision management, and technologies that extend swallowing care beyond the clinic.

8.1 Neurostimulation and sensorimotor modulation

Neurostimulation aims to enhance swallowing activity or promote recovery within the sensorimotor swallowing network. Approaches include peripheral stimulation, such as neuromuscular and pharyngeal electrical stimulation, and non-invasive brain stimulation using repetitive transcranial magnetic stimulation or transcranial direct-current stimulation[75,86–89].

Systematic reviews of randomized trials have reported promising results, particularly in neurogenic dysphagia, but findings vary across patient populations and stimulation protocols[75,86–89]. Evidence for head and neck cancer and other causes of OD remains more limited. The role of neurostimulation continues to evolve, with current applications generally positioned alongside mechanism-based assessment and behavioral rehabilitation, and its use as a stand-alone treatment remains uncertain. Future studies should identify which patients are most likely to respond, determine how stimulation can be combined with behavioral rehabilitation, and establish whether physiological improvement leads to sustained gains in oral intake and quality of life.

8.2 AI-assisted quantitative analysis and precision management

FEES and VFSS contain detailed information about bolus flow, structural movement, airway protection, and swallowing timing. AI-assisted methods are being developed to extract these features more efficiently and consistently. Current applications include detection of swallowing events, tracking of the bolus and anatomical structures, and identification of penetration, aspiration, and residue[90].

These measurements may support more detailed phenotyping of OD and provide objective markers of disease severity or treatment response. However, most available models have been developed using relatively small or single-center datasets. Differences in imaging protocols, patient populations, and reference labels remain important barriers to generalizability[90].

AI and other predictive methods may also combine swallowing features with broader clinical information to estimate outcomes such as pneumonia, loss of oral intake, or response to treatment. This approach could help explain why patients with similar instrumental findings follow different clinical courses and may eventually support more individualized management. However, these tools remain investigational and are not yet sufficiently established to guide clinical decision-making independently. For clinical use, these models will require prospective multicenter validation and evidence that they add value beyond expert assessment.

8.3 Wearable sensing and remote care

FEES and VFSS provide detailed information but capture swallowing only during a brief clinical examination. Wearable sensors may extend observation into daily life by recording signals related to swallowing, cough, muscle activity, or respiratory coordination. Early studies suggest that swallowing events can be detected using signals such as acoustics, accelerometry, and surface electromyography, although performance varies across devices and testing conditions[91].

The potential value of wearable sensing lies in monitoring change over time rather than replacing instrumental assessment. Possible applications include identifying fatigue during meals, monitoring swallowing frequency, tracking adherence to rehabilitation, and detecting deterioration between clinic visits[92]. However, wearable-derived measures have not yet been sufficiently standardized to support routine clinical interpretation. Further research is needed to establish whether these measurements are reliable in everyday settings and whether they lead to useful clinical action.

Telehealth provides a related means of extending specialist support beyond the clinic. Selected applications appear feasible, although their clinical implementation depends on patient and service-related factors and may still require in-person examination. It can facilitate education, caregiver training, supervised rehabilitation, and follow-up where access to swallowing services is limited[93]. Hybrid models that combine in-person assessment with remote rehabilitation and monitoring may be more practical than fully remote care for many patients.

8.4 Considerations for translation

Across these areas, new technologies should be evaluated by their ability to improve meaningful outcomes rather than technical performance alone. Future studies will require standardized data collection, representative multicenter cohorts, external validation, and evaluation within feasible clinical workflows. Outcomes should extend beyond physiological measures to include oral intake, respiratory health, participation, treatment burden, and quality of life. The most useful innovations will complement clinical expertise, support interdisciplinary decision-making, and strengthen patient-centered care without adding unnecessary complexity.

9 Conclusion

OD is a complex disorder in which the underlying disease, swallowing physiology, and the patient's overall health interact. Effective evaluation therefore extends beyond identifying aspiration and seeks to explain why swallowing is unsafe or inefficient and how the impairment affects nutrition, respiratory health, and daily life. Otolaryngology and speech-language pathology provide complementary perspectives. Otolaryngologists identify structural disease and potentially modifiable medical or surgical factors, while SLPs characterize swallowing function and guide compensation, rehabilitation, and longitudinal care. Instrumental assessments add value when they clarify the mechanism of impairment and inform meaningful management decisions.

The goal of care is to develop a plan that reduces clinically important risks while remaining feasible, sustainable, and consistent with the patient's priorities. This requires a broader understanding of aspiration-related pulmonary risk, careful consideration of treatment burden, and shared decision-making throughout the disease course. Emerging approaches, including neurostimulation, AI-assisted analysis, wearable sensing, and remote care, may make swallowing assessment and care more objective and individualized. Their value will ultimately depend on whether they improve outcomes that matter to patients. By integrating anatomical, functional, rehabilitative, and patient-centered perspectives, otolaryngologists and speech-language pathologists can advance a more complete approach to OD, one that supports not only safer swallowing, but also better living with dysphagia.

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Ethical statement

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Conflicts of interest

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AI statement

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Author contributions

Seng Mun Wong: Conceptualization, Methodology, Investigation, Validation, Writing–original draft, Writing–review & editing; Yike Li: Conceptualization, Methodology, Investigation, Validation, Writing–original draft, Writing–review & editing, Visualization, Project administration. Both authors reviewed, edited, and approved the final version of the manuscript and agree to its publication.

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