



Components of Swallow, Impairments, Causes, Observations, and Therapy

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Introduction

This chapter will summarize in a tabular form the chief components of the swallow, the impairments, the causes and conditions of such swallowing dysfunction, the observations and findings on evaluation, and the suggested therapy strategies. The components of the swallow which are relevant in the dysphagia associated with head

and neck cancers and its management, are lip closure, lingual control, mastication, tongue base retraction, velopharyngeal closure, hyolaryngeal excursion, laryngeal closure, pharyngeal contraction, and pharyngoesophageal segment (PES) opening (Fig. 31.1).

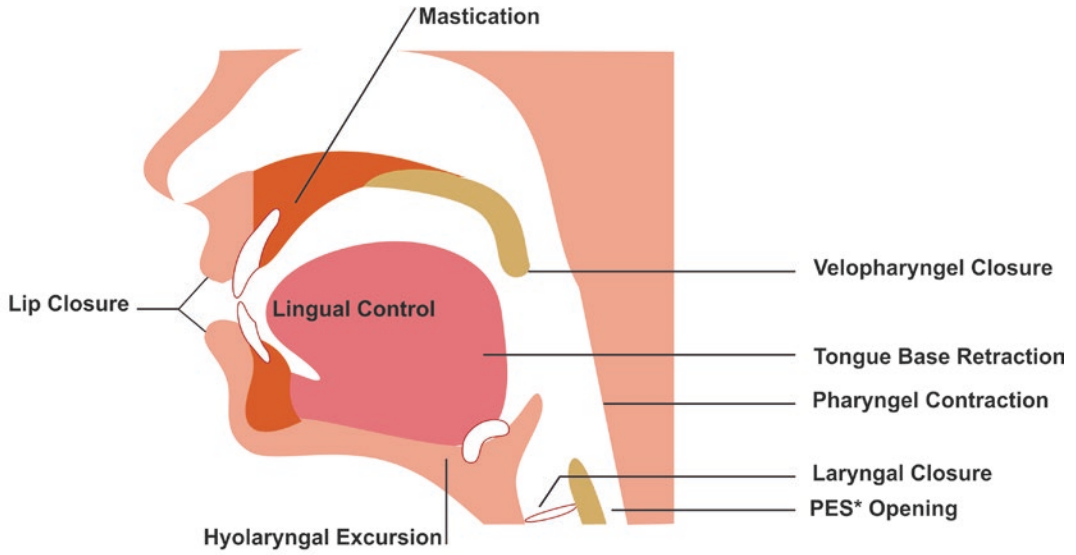
Videos 31.1 and 31.2 (slow motion) and Fig. 31.2a–d show normal swallow on a lateral view VFS.

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* PES - Pharyngo-Esophageal Sphincter

Fig. 31.1 Components of normal swallow. Schematic representation

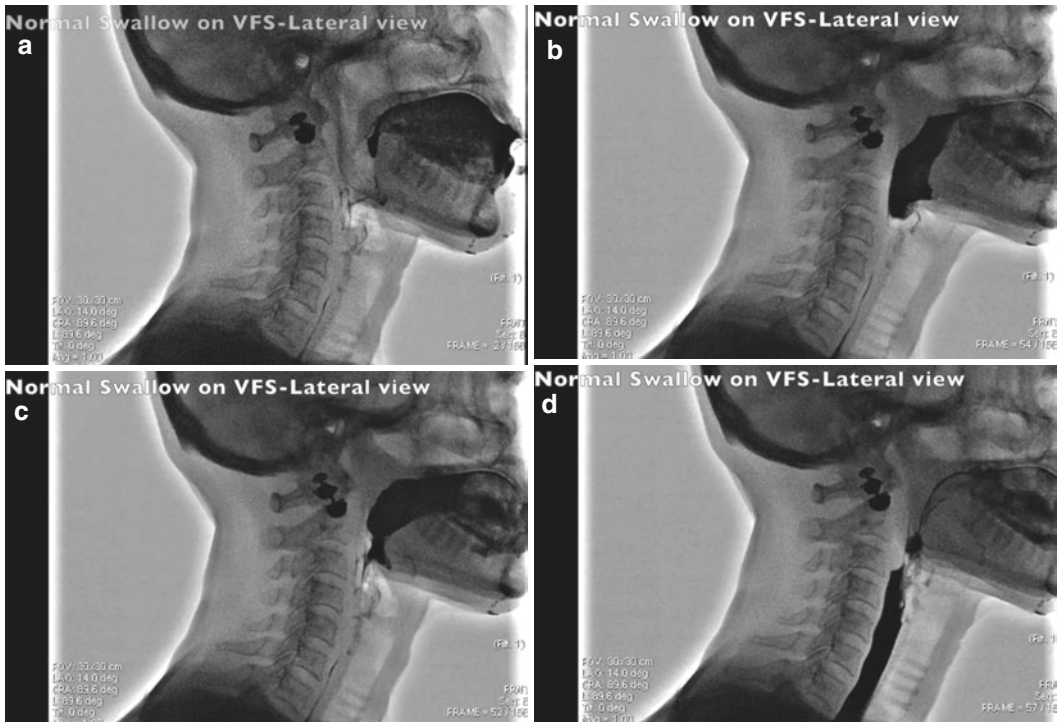


Fig. 31.2 (a-d) Steps of normal swallow

Lip Closure (Table 31.1)

This component is essential for the oral bolus containment and the generation of intraoral pressure to transport the bolus. The orbicularis oris seals the lips.

Video 31.3 and Fig. 31.3 show poor lip seal.

Table 31.1 Lip closure

Impairments	Decreased labial strength Decreased labial range of motion Incompetent oral commissure
Causes/conditions	Lip resections Facial nerve palsies
Observations/findings	Anterior spillage of bolus Difficulty in managing secretions
Compensatory strategies	Straw drinking Labial press Manual support Texture and bolus size modification
Rehabilitative strategies	Labial range of motion Button and thread exercise

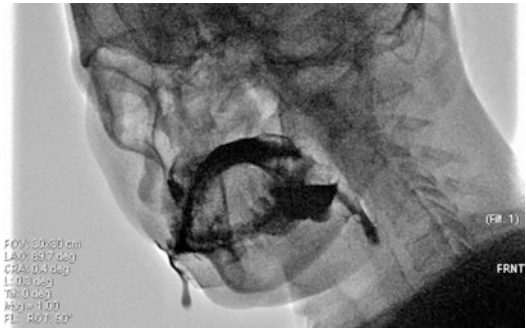


Fig. 31.3 Poor lip seal

Lingual Control (Table 31.2)

This component is essential for shaping, holding, and manipulation of the bolus in the oral cavity. This is also essential for the anteroposterior bolus

propulsion. The muscles of the tongue, both intrinsic and extrinsic, help in this function.

Video 31.4 and Fig. 31.4 show poor lingual control in a total glossectomy.

Table 31.2 Lingual control

Impairments	Lingual atrophy Decreased lingual range of motion Decreased lingual strength
Causes/conditions	Glossectomy Floor of mouth resections Mandibulectomy Hypoglossal nerve palsy
Observations/findings	Impaired bolus control Impaired bolus formation Impaired bolus propulsion Oral residue Impaired oral containment Aspiration before swallow Penetration before swallow
Compensatory strategies	Head back/chin up Texture and bolus size modification Head tilt Multiple swallows Liquid wash Oral sweep
Rehabilitative strategies	Effortful swallow Masako maneuver Lingual range of motion Lingual resistance exercise Back of tongue exercises



Fig. 31.4 Poor lingual control in total glossectomy

Mastication (Table 31.3)

This component is essential for the preparation and manipulation of the bolus in the mouth so that it can be propelled back through the pharynx and esophagus. The masticator muscles, the tem-

poralis, the masseter, and the medial pterygoids, help in elevating the mandible. The lateral pterygoids assist in the movement of the mandible side to side and a rotary pattern.

Video 31.5 and Fig. 31.5 show poor mastication in a segmental mandibulectomy.

Table 31.3 Mastication

Impairments	Decreased buccal tension Decreased oral sensation Impaired mastication Reduced mouth opening
Causes/conditions	Buccal resections Mandibulectomy Maxillectomy Alveolar resections Facial nerve palsy
Observations/ findings	Oral residue especially vestibular residue
Compensatory strategies	Food placement of stronger side External pressure to cheek Texture and bolus size modification Sensory stimulation techniques Suck and swallow Multiple swallows Liquid wash Oral sweep
Rehabilitative strategies	Jaw range of motion (ROM) exercises Jaw opening against resistance Mouth opening exercises with devices



Fig. 31.5 Poor mastication, segmental mandibulectomy

Tongue Base Retraction (Table 31.4)

This component primarily generates the positive pressure against the bolus and helps in the pharyngeal clearance and airway protection. The

extrinsic muscles of the tongue help in the retraction of the tongue to get the tongue in contact with the posterior pharyngeal wall.

Video 31.6 and Fig. 31.6 show poor tongue base retraction and total glossectomy.

Table 31.4 Tongue base retraction

Impairments	Delayed initiation of swallowing Decreased tongue base retraction Decreased base of tongue to pharyngeal wall approximation Increased retrolingual space
Causes/conditions	Base of tongue resections Pharyngeal resection Post radiotherapy Supraglottic laryngectomy Hypoglossal nerve palsy
Observations/findings	Impaired bolus propulsion Oral residue Vallecular residue Aspiration before swallowing Penetration before swallowing
Compensatory strategies	Suck and swallow Sensory stimulation techniques Texture and bolus size modification Modification Chin tuck In case of residue Head tilt Multiple swallows Liquid wash Oral sweep
Rehabilitative strategies	Back of tongue exercises Masako maneuver Effortful swallow Supraglottic swallow Super-supraglottic swallow



Fig. 31.6 Poor tongue base retraction, total glossectomy

Velopharyngeal Closure (Table 31.5)

This component is essential for the flow of the bolus retrograde into the nasopharynx. It is also needed for the generation of the pressure to drive the bolus downward. The levator veli palatini

assisted by the tensor veli palatini and the musculus uvulae tenses, elevates, and retracts the soft palate against the posterior pharyngeal wall. This will separate the oral and nasal cavities.

Video 31.7 and Fig. 31.7 show poor velopharyngeal closure with nasal regurgitation.

Table 31.5 Velopharyngeal closure

Impairments	Decreased intraoral pressure Impaired closure of the velopharynx
Causes/ conditions	Soft palate resection Maxillary resections Post radiotherapy
Observations/ findings	Nasal regurgitation of the bolus
Compensatory strategies	Nose pinch Chin tuck Texture and bolus size modification
Rehabilitative strategies	Blowing against resistance (balloon, wind musical instruments like conch)
Other strategies	Intraoral prosthetics



Fig. 31.7 Poor velopharyngeal closure, nasal regurgitation

Hyolaryngeal Excursion (Table 31.6)

Hyolaryngeal excursion is necessary for the protection of the airway by facilitating epiglottic inversion over the laryngeal vestibule. It also helps in the upper esophageal sphincter opening that allows the bolus to enter the next stage. The

suprahyoid musculature moves the hyoid anteriorly when the longitudinal pharyngeal muscles shorten and widen the pharynx. The thyrohyoid elevates the larynx to displace the epiglottis to a horizontal position.

Video 31.8 and Fig. 31.8 show infrequent hyolaryngeal excursion.

Table 31.6 Hyolaryngeal excursion

Impairments	Impaired hyolaryngeal excursion
Causes/conditions	Partial laryngectomy Post radiotherapy Hyomandibular complex disruption <ol style="list-style-type: none"> 1. Symphysis menti resection 2. Floor of the mouth resection 3. Tongue base resection 4. Supracricoid laryngectomies
Observations/findings	Aspiration after the swallow Penetration after the swallow Vallecular residue Pyriform sinus residue
Compensatory strategies	Chin tuck Side lying In case of residue Head tilt Multiple swallows Liquid wash
Rehabilitative strategies	Effortful swallow Super-supraglottic swallow Mendelsohn maneuver Jaw opening against resistance Chin tuck against resistance Shaker exercise Pitch glide Expiratory muscle strength training
Other strategies	Neuromuscular electrical stimulation (NMES)



Fig. 31.8 Reduced hyolaryngeal excursion and poor opening of upper esophageal sphincter

Laryngeal Closure (Table 31.7)

Laryngeal closure happens at three levels (aryepiglottic, ventricular fold, and true cord). This closure is critical for the protection of the airway, respiration regulation, effective cough reflex, and voice production. The thyroarytenoid, the lateral

cricoarytenoid, and the interarytenoid muscles approximate the arytenoid cartilages to close the true cords and approximate the ventricular folds. The styloglossus and the palatoglossus retract the base of the tongue to protect the vestibule.

Video 31.9 and Fig. 31.9 show penetration.

Video 31.10 and Fig. 31.10 show aspiration.

Table 31.7 Laryngeal closure

Impairments	Impaired cough reflex Impaired protection of the airway Impaired vocal fold closure Impaired sensation
Causes/conditions	Partial laryngectomy Supraglottic laryngectomy Vocal cord palsy Post-thyroidectomy Any causes of vagal N palsy: skull base resections and neck surgeries
Observations/findings	Aspiration during swallow Penetration during swallow
Compensatory strategies	Chin tuck Head tilt Side lying Head turn Valsalva Therapeutic texture modification Therapeutic bolus size modification
Rehabilitative strategies	Expiratory muscle training Vocal fold adduction exercise Falsetto Supraglottic swallow Super-supraglottic swallow Effortful swallow
Other strategies (surgeries)	Medialization thyroplasty Injection laryngoplasty Arytenoid rotation



Fig. 31.9 Penetration

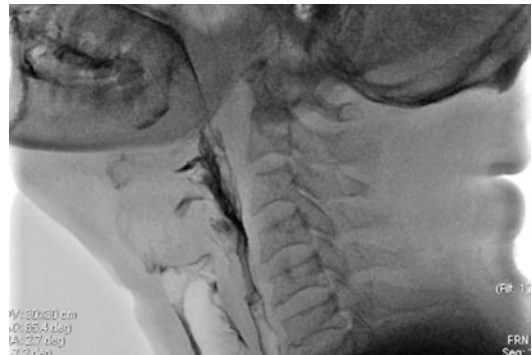


Fig. 31.10 Aspiration

Pharyngeal Contraction (Table 31.8)

This is required for pushing the bolus down through the pharyngeal cavity, into the esophagus. This occurs by squeezing the walls of the pharynx along with a stripping wave effect. The superior, middle, and inferior constrictors contract sequentially and cranio-caudally to create a positive pressure on the bolus.

Table 31.8 Pharyngeal contraction

Impairments	Impaired pharyngeal contraction
Causes/ conditions	Pharyngeal resections Post radiotherapy Pharyngeal paralysis
Observations/ findings	Aspiration after the swallow Penetration after the swallow Pyramidal sinus residue Vallecular residue
Compensatory strategies	Head tilt Head turn Chin tuck In case of residue Multiple swallows Liquid wash
Rehabilitative strategies	Effortful swallow Super-supraglottic swallow Mendelsohn maneuver Chin tuck against resistance Shaker exercise
Other strategies	Neuromuscular electrical stimulation (NMES) Hypopharyngoplasty (obliteration of the affected pyriform fossa)

Pharyngoesophageal Segment (PES) Opening (Table 31.9)

PES is also the upper esophageal sphincter (UES). It relaxes at the end of the pharyngeal phase of the swallow and allows the bolus to enter the esophagus. It then closes, preventing the reflux of the contents back into the pharynx and airway. The cricopharyngeus relaxes aided by the inferior pharyngeal constrictor. The suprahyoid and infrahyoid muscles and the longitudinal pharyngeal muscles elevate the hyolaryngeal complex to produce a traction.

Table 31.9 Pharyngoesophageal segment (PES) opening

Impairments	Impaired relaxation of the PES
Causes/conditions	Post radiotherapy Post laryngectomy Primary causes: Laryngectomy Partial pharyngectomy Nerve palsies Secondary causes: Hyomandibular complex disruption 1. Symphysis menti resection 2. Floor of the mouth resection 3. Tongue base resection 4. Supracricoid laryngectomies
Observations/findings	Aspiration after the swallow Penetration after the swallow Pyriform sinus residue
Compensatory strategies	Head tilt Head turn Side lying Texture and bolus size modification Sour bolus, warm bolus In case of residue Multiple swallows Liquid wash
Rehabilitative strategies	Effortful swallow Mendelsohn maneuver Jaw opening against resistance Chin tuck against resistance Shaker exercise
Other strategies	Dilatation Botulinum toxin injection in case of spasm Cricopharyngeal myotomy/myectomy