Swallowing 101

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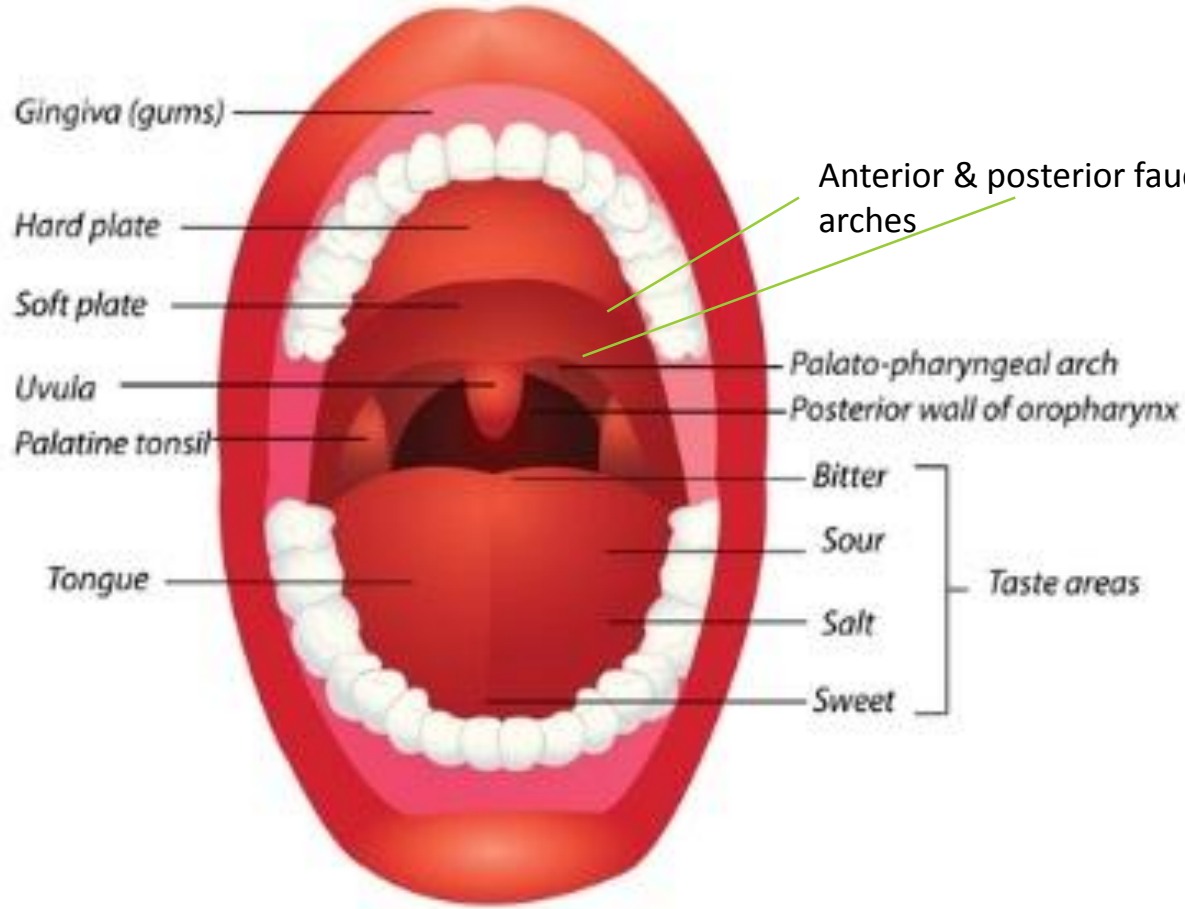
From the beginning….

From the first trimester in utero and throughout our lives each of us seeks oral stimulation-for comfort, nutrition and from boredom.

The fetus begins swallowing in utero as early as 12 weeks gestation.

Basic Swallowing Anatomy

Basic Anatomy of the Mouth



Basic Anatomy of the Mouth

Lips

- For seal for suck and prevention of spillage
- To allow creation of oral sling for transit

Cheeks

- Tension assists with bolus manipulation & control
- Assists in oral pressure and sling for a-p transit

Basic Anatomy of the Mouth

Hard Palate (maxilla)

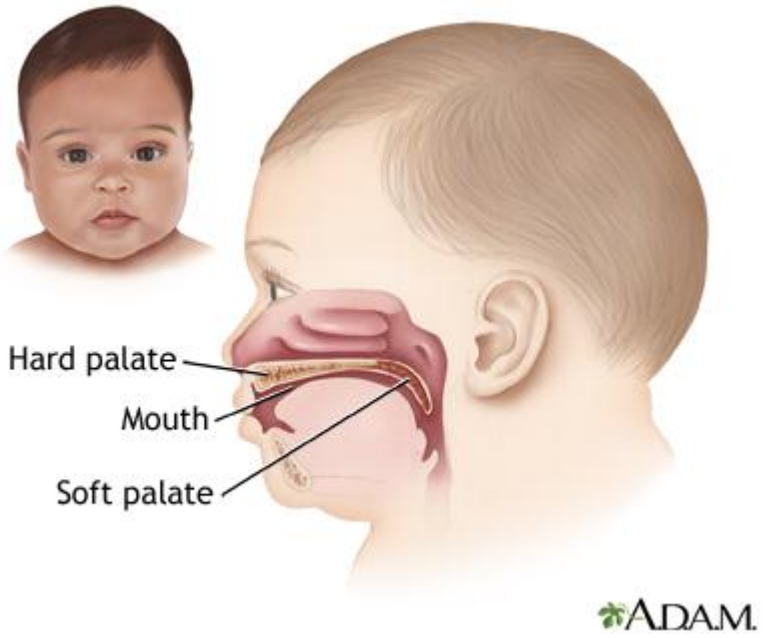
- Forms the roof of the mouth
- Contour and shape can impact swallow function

Soft Palate (velum) & uvula

- Forms the roof of the mouth
- Retracts to contribute to velopharyngeal closure-prevents nasal regurgitation
- Gag reflex

Faucial Arches & Tonsil

- Sensation for trigger of pharyngeal swallow

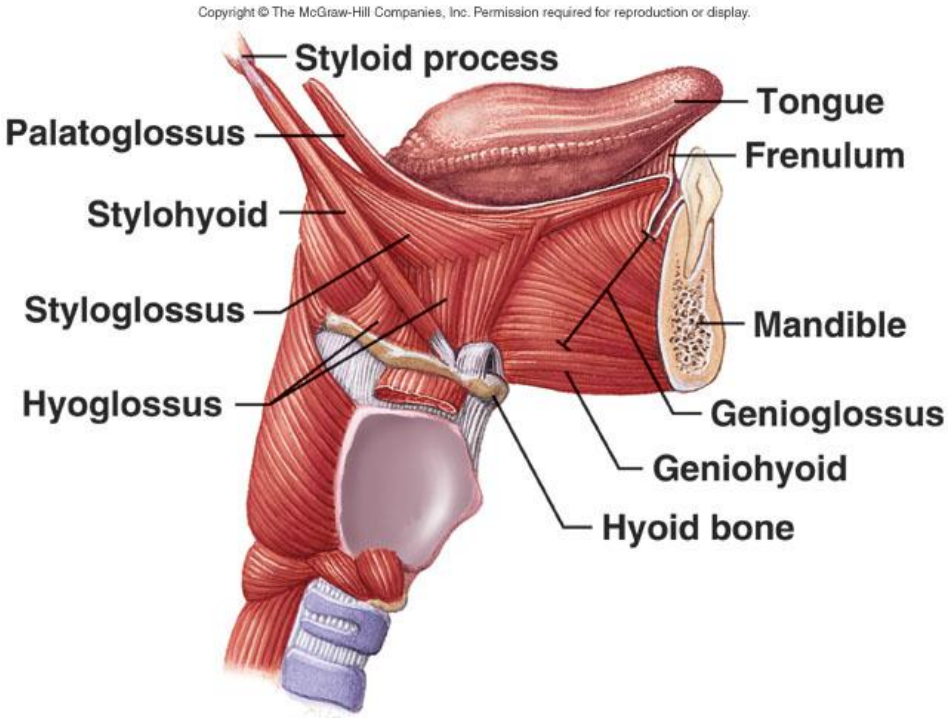


Basic Anatomy of the Mouth

Tongue

- Extrinsic- attach outside the body of the tongue
  - Gross motor
  - Elevation, depression, extension, retraction

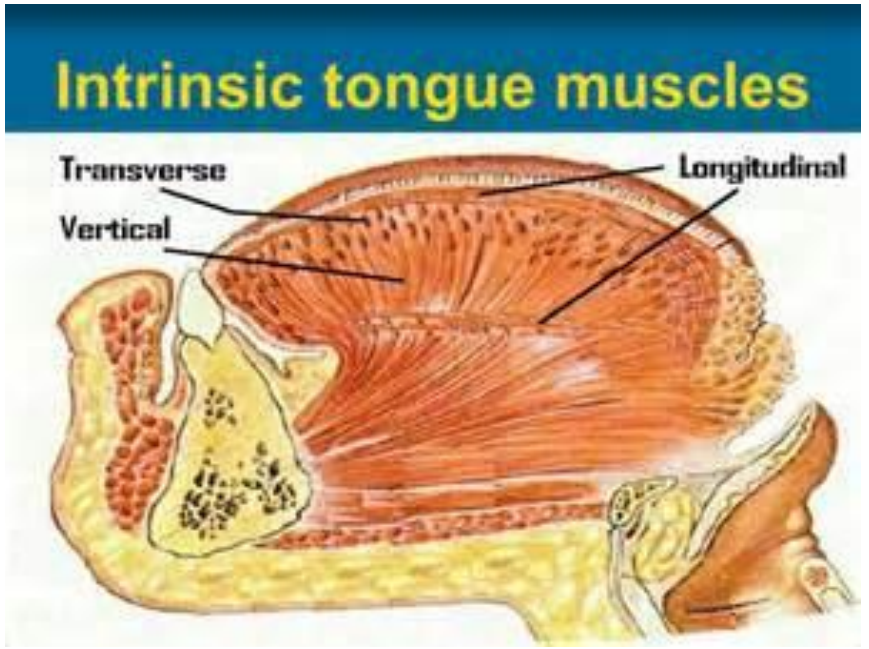
Extrinsic tongue muscles



Basic Anatomy of the Mouth

Tongue

- Intrinsic
  - Fine motor movement
  - Assist with change in contour and contact points within the mouth
  - Help to thin and cup the tongue
  - Lateral, midblade elevation, tongue tip elevation and everything in between



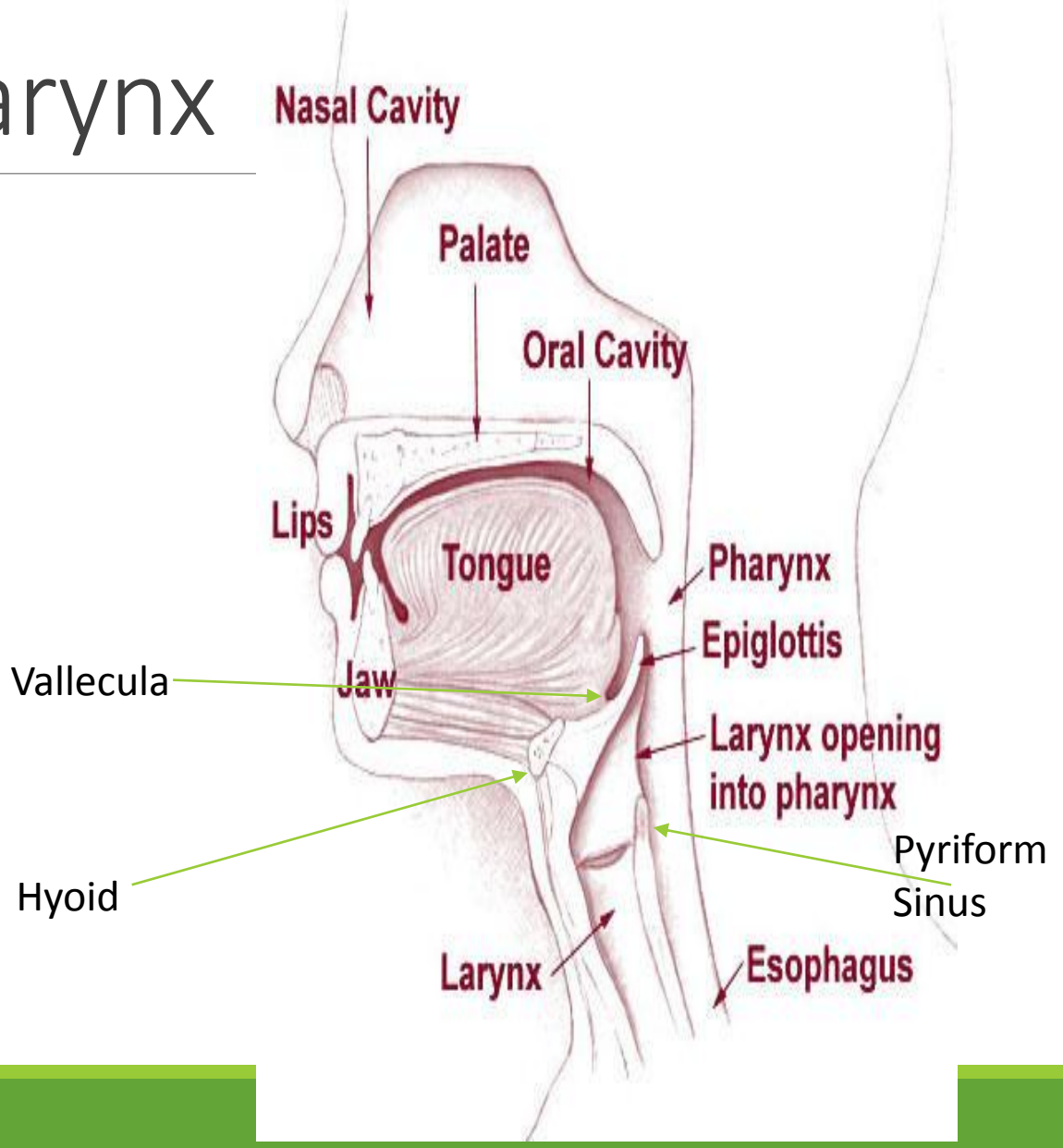
Basic Anatomy of the Pharynx

Hyoid
- Several muscles attached to the hyoid which creates an up and forward pull during the swallow.

Epiglottis
- With the movement of the muscles attached to the hyoid, the epiglottis is inverted to protect the airway and allow movement of boluses through the pharynx.

Vallecula
- Pocket at the base of the tongue and above the epiglottis.

Pyriform Sinus
- Pocket at the base of the pharynx, above the esophagus.



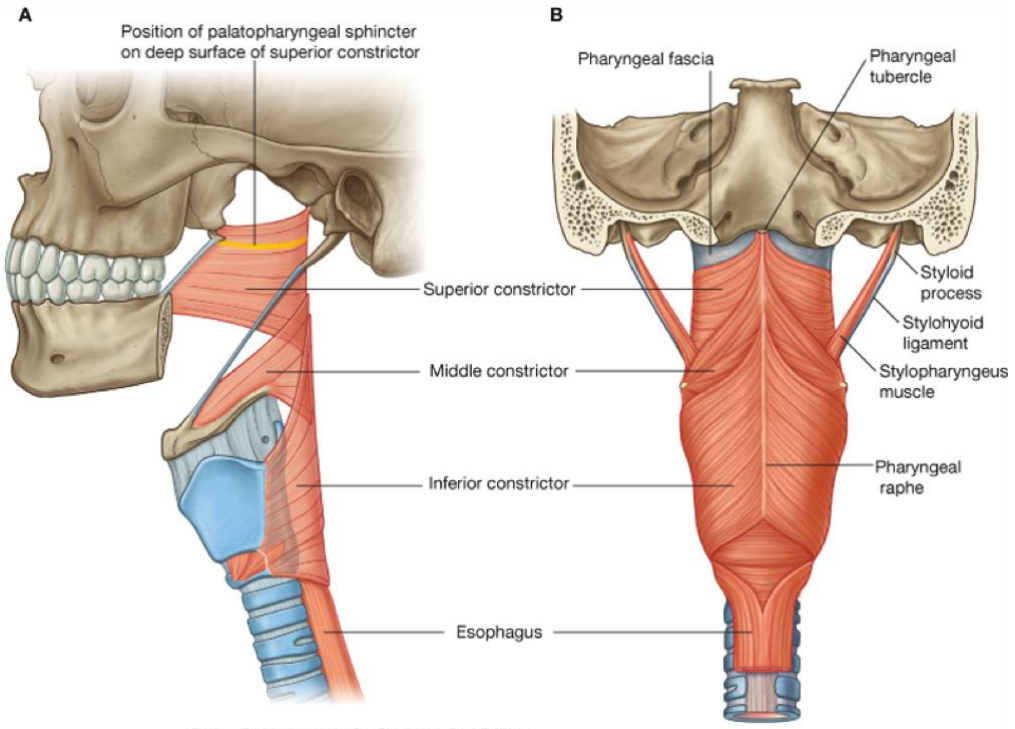
Basic Anatomy of the Pharynx

Pharyngeal Constrictors

- Work as a group to move boluses through the pharynx by contracting.
  - Inferior
  - Middle
  - Superior
  - Stylopharyngeous

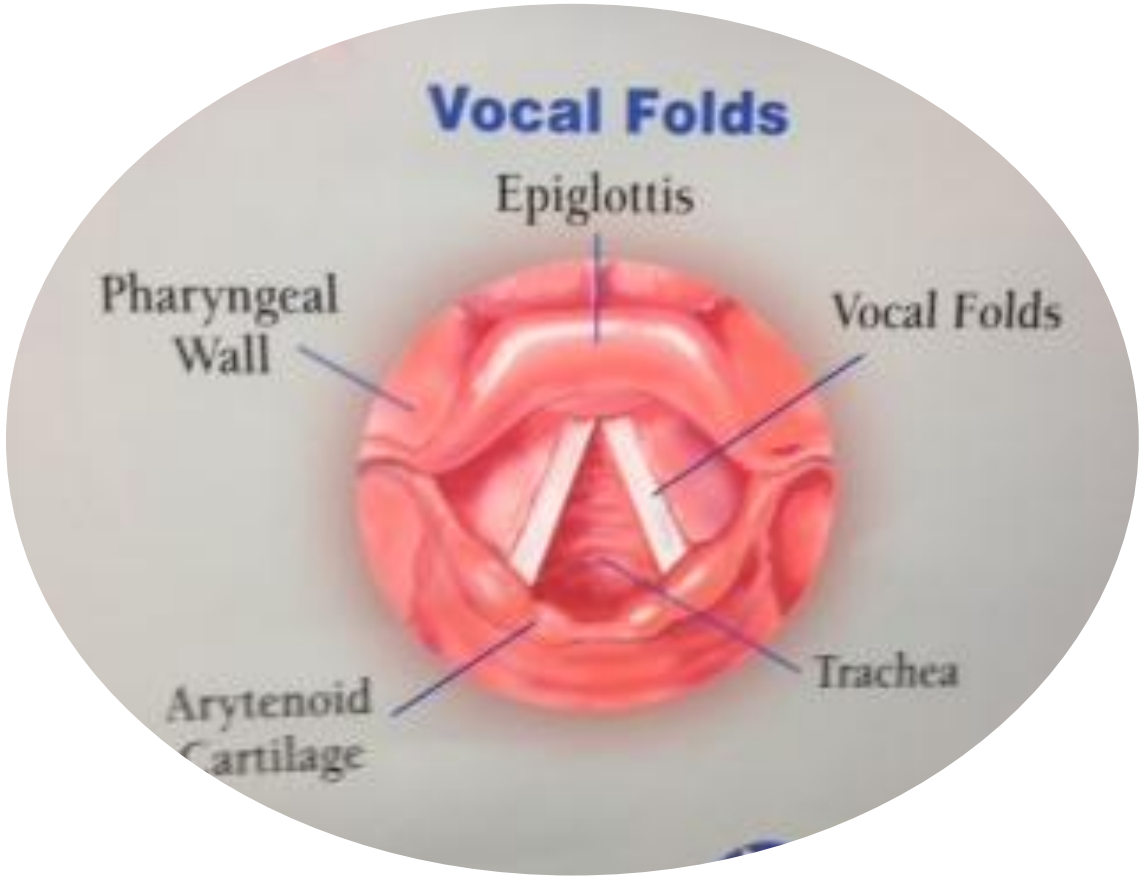
Pharyngeal Elevators

- Work as a group to shorten and elevate the pharynx
  - Stylopharyngeus
  - Salpingopharyngeus
  - Palatopharyngeus



Basic Anatomy of the Larynx

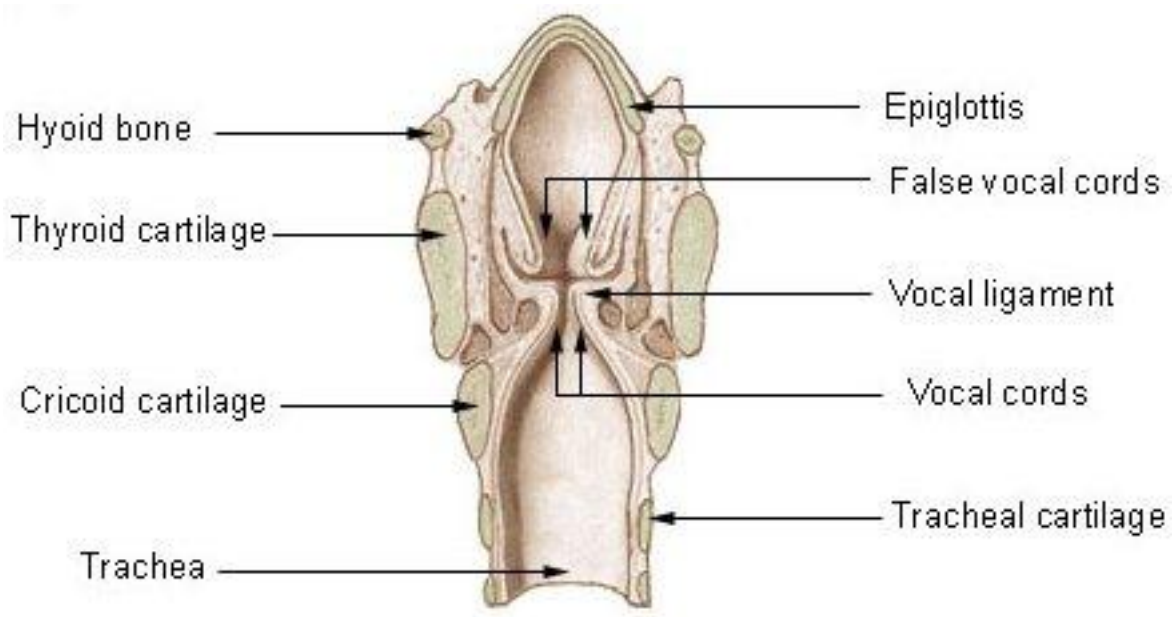
- True & false vocal folds
  - Airway protection during the swallow
  - Cough reflex/throat clear
  - Stays patent during breathing for air exchange, closes for coughing, throat clearing, breath holding and swallowing.



Basic Anatomy of the Larynx

Skeleton

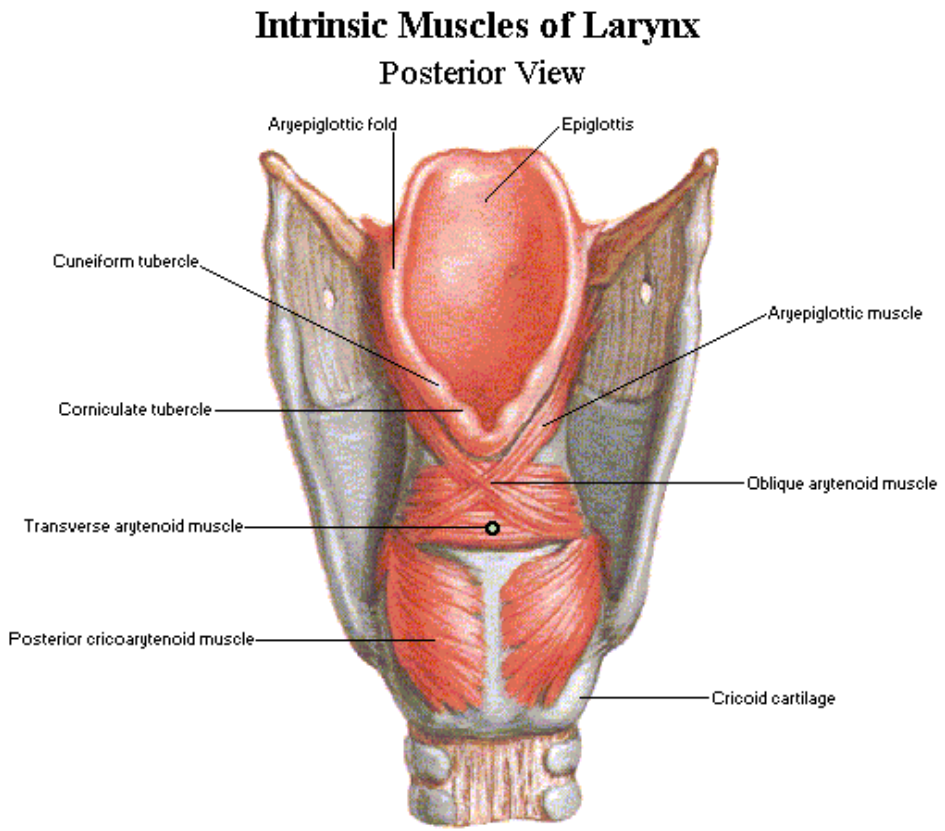
- Hyoid bone
- Thyroid cartilage
- Cricoid cartilage
- Arytenoids



Basic Anatomy of the Larynx

Muscles of the larynx

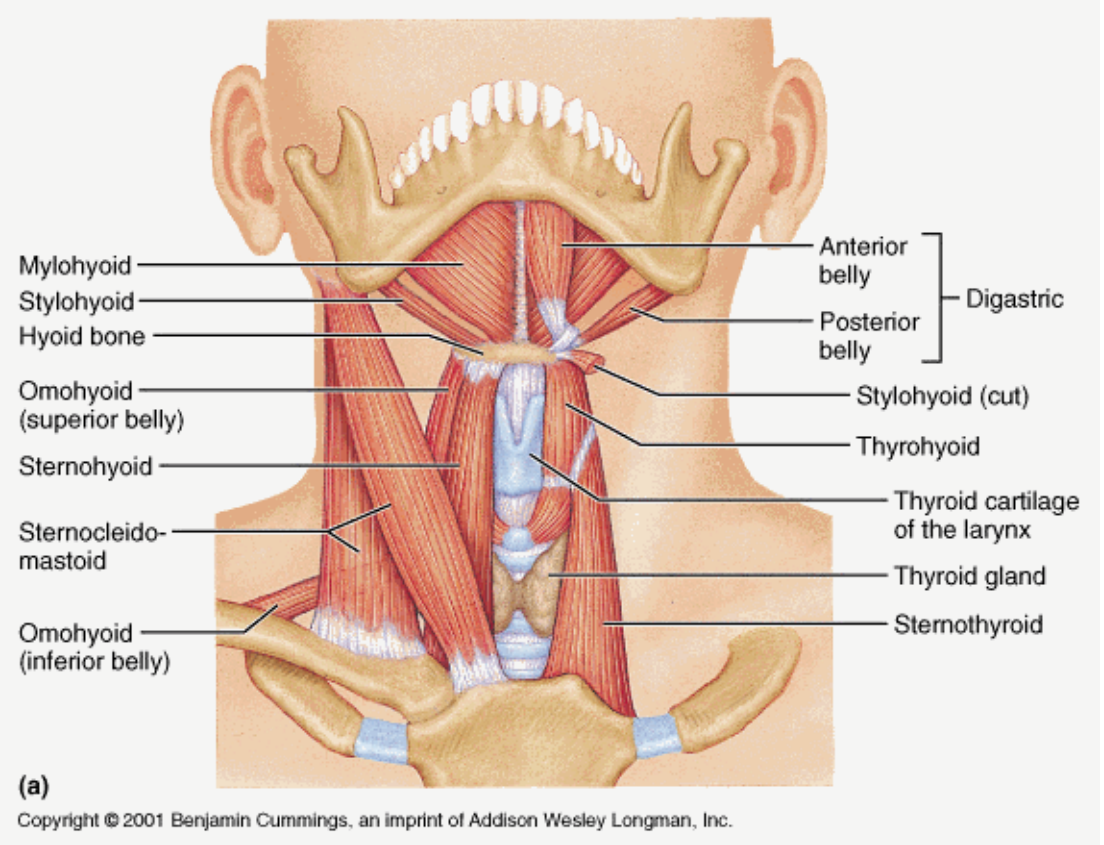
- Intrinsic-for vocal abduction and adduction
  - Cricothyroid
  - Posterior and lateral cricoarytenoid
  - Interarytenoid: transverse and oblique arytenoid
  - Thyroarytenoid
  - Aryepiglotticus



Basic Anatomy of the Larynx

Muscles of the larynx

- Extrinsic-for hyoid and laryngeal excursion
  - Digastrics, anterior and posterior belly
  - Stylohyoid
  - Mylohyoid
  - Geniohyoid
  - Sternohyoid
  - Sternothyroid
  - Omohyoid
  - Thyrohyoid



Changes with Age

The normal anatomy of the upper airway in a young child differs from that of the adult.

The anatomic relationship between the structures of the oral cavity and the pharynx is different.

In an infant, the tongue fills the oral cavity, the fat pads in the cheeks narrow the oral cavity laterally.

The hyoid bone and the larynx are much higher than in adults which contributes to more natural protection of the airway.

The velum hangs lower, with the uvula often resting inside the epiglottis which forms a pocket in the valleculae.

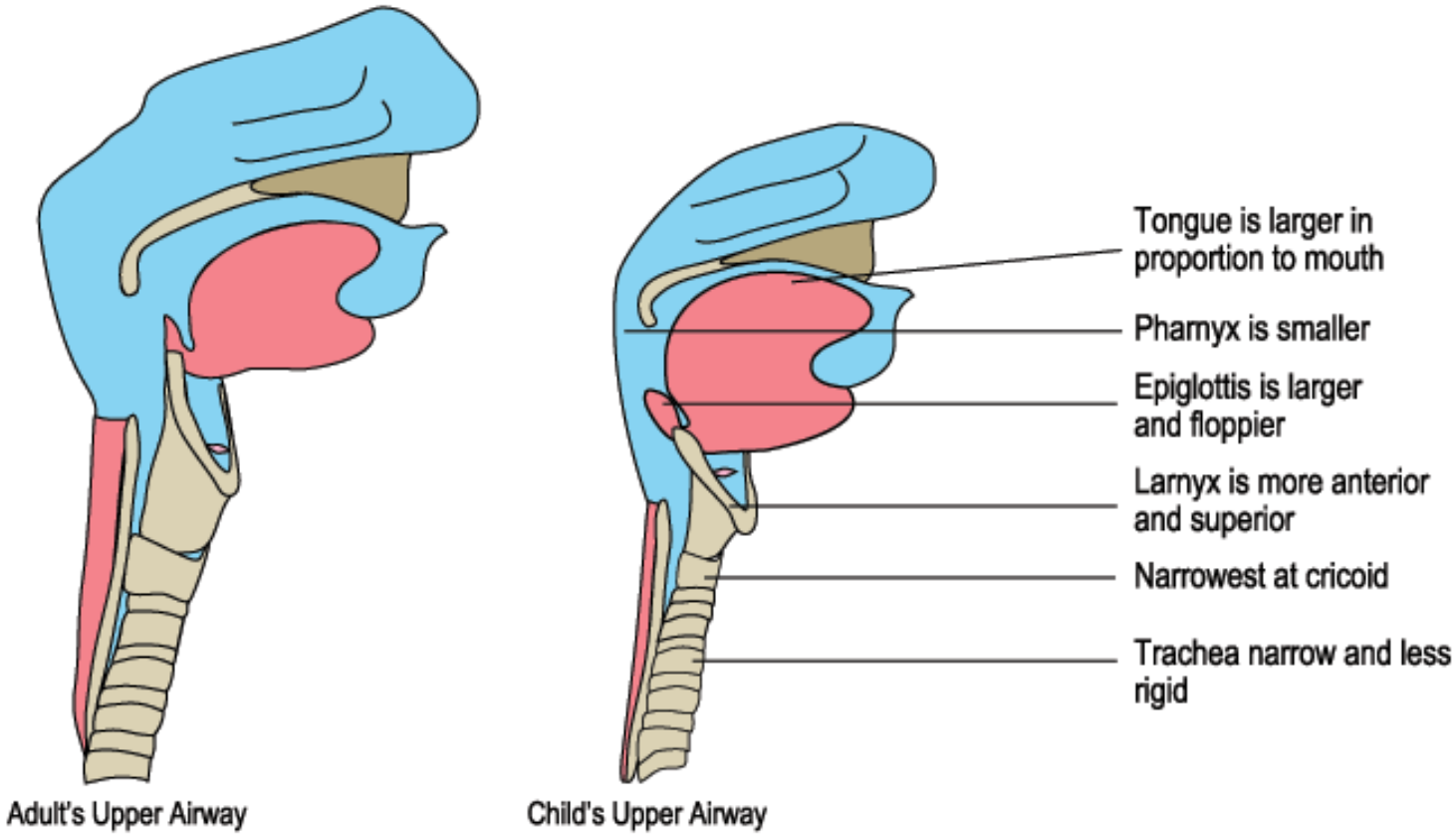
Changes with Age

During the first 21 years of life the face continues to grow.

The jaw grows down and forward, carrying the tongue down and enlarging the space between the tongue and the palate, which develops the oral cavity space.

The larynx and hyoid bone lower which elongates and enlarges the pharynx (puberty).

Changes with Age



Stages of the swallow

Oral Preparatory Phase

Sensory recognition of food approaching the mouth and being placed in the mouth is critical before any movements can be initiated.

Movements vary dependent on the viscosity of the material.

Lips, tongue, and cheeks work together to manipulate and control the bolus in preparation to swallow the bolus.

This stage involves acceptance, sucking, mastication, manipulation, breathing with pharynx/larynx at rest.

Oral Phase

When the tongue begins posterior movement of the bolus.

Stripping action

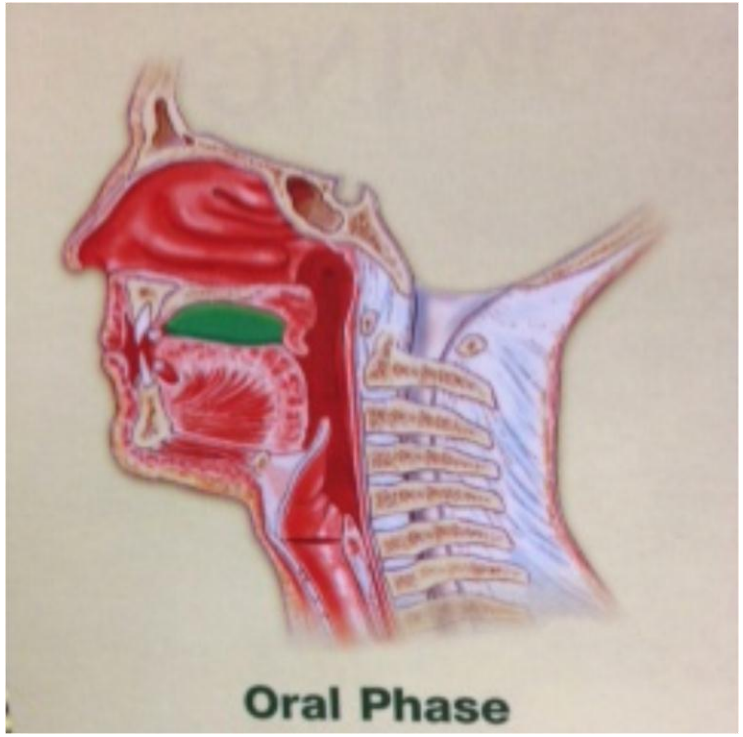
Propels bolus towards the pharynx

Requires intact labial musculature

Intact lingual movement to propel posteriorly

Intact buccal musculature

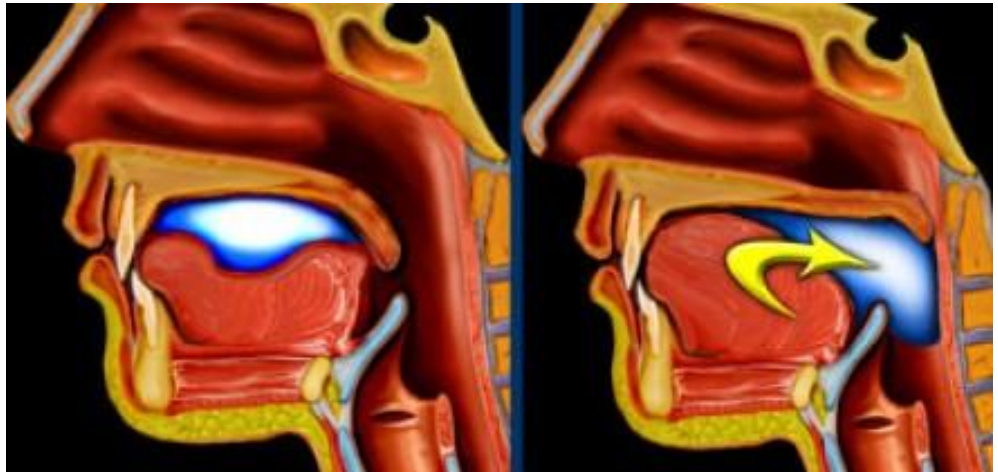
Normal palatal musculature



Triggering of the Pharyngeal Swallow

As tongue movement propels the bolus posteriorly, sensory receptors in the oropharynx and tongue are stimulated, which sends sensory information to the cortex and the brainstem.

When the bolus head passes any point between the anterior faucial pillars and the point where the tongue base crosses the lower rim of the mandible the pharyngeal swallow should be triggered.



Pharyngeal Swallow

Elevation and retraction of the velum and complete closure of the velopharyngeal port.

Elevation and anterior movement of the hyoid and larynx.

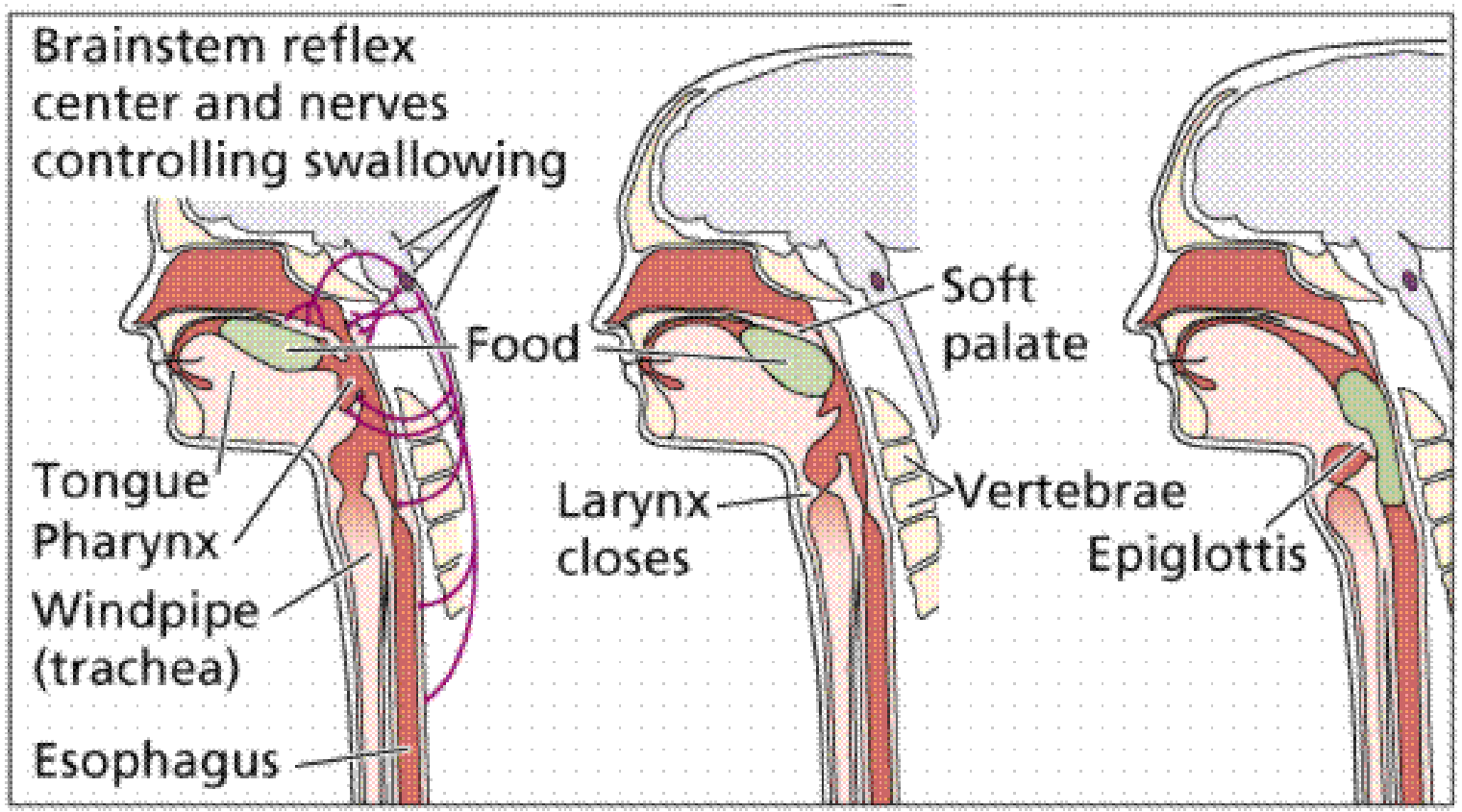
Closure of the larynx

Opening of the cricopharyngeal sphincter

Tongue base retraction and bulging of the posterior pharyngeal wall

Top to bottom contraction in the pharyngeal constrictors

Pharyngeal Swallow

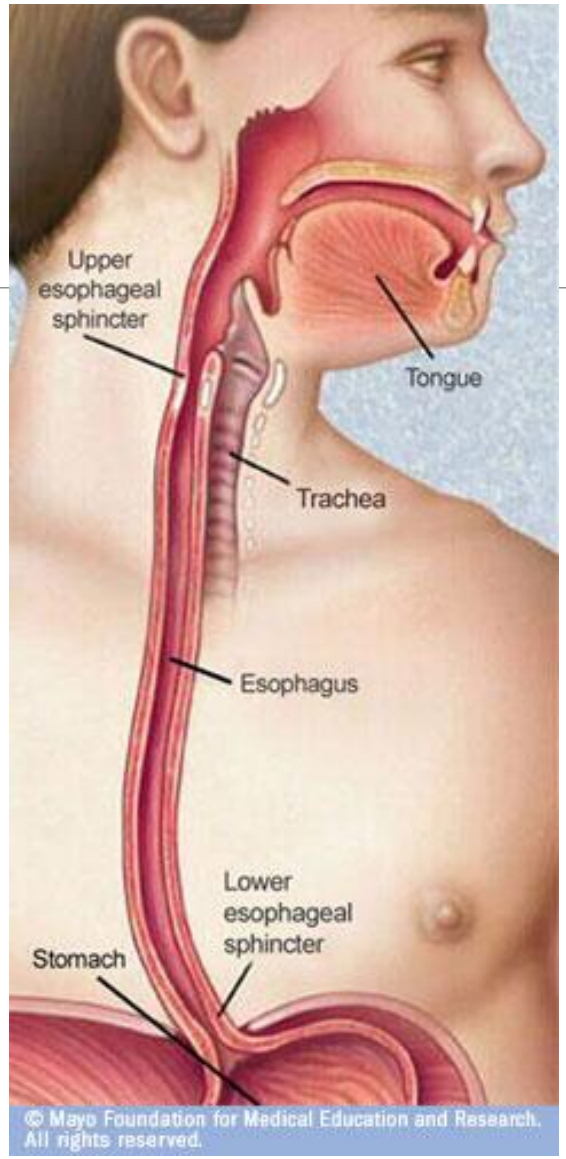


Animated Video of Swallow

Esophageal Stage

This stage begins when the upper esophageal sphincter opens and foods passes into the esophagus.

Peristaltic muscle contractions move the bolus through the esophagus, through the lower esophageal sphincter, and into the stomach.



Swallow Evaluation

Clinical Bedside swallow evaluation

- Cervical auscultation
- Palpation

Modified Barium Swallow

- Barium contrast swallowed during video fluoroscopy

FEES

- Fibro endoscopic evaluation of swallowing
- Scope through nasal passage to view swallow

Pharyngeal Swallow Assessments

Normal Infant MBS

Normal Adult MBS

FEES swallow study

Modified Barium Swallow Studies

Normal 7 wk old, term delivery, birth weight 7 lbs (Case 8)

- Typically 2 sucks per swallow, WNL
- No aspiration or laryngeal penetration

Intrauterine heroin exposure 6 months old, global developmental delays (Case 1)

- 2-4 sucks per swallow
- Delayed swallow initiation with silent aspiration

Term delivery, 16 months, probable autosomal dominant microphthalmial-anophthalmia syndrome, developmental delay, visual deficits (Case 9)

- Slow to initiate tongue action, inefficient suck to extract from spout, 2-3 swallows to clear oral cavity at times, mild delay in swallow initiation, no penetration aspiration.

5 year old with 49XXXXY syndrome (Case 3)

- Oral deficits with mastication and reduced a-p transit, mild swallow delay with transient penetration.

In conclusion...

Swallowing is an incredibly complex process that involves both voluntary and involuntary processes controlled by cranial nerves which impact multiple muscles and structures.

Given that swallowing is such a complex process with so many intricate components, proper evaluation and treatment for a disordered swallow are critical to development.

Swallowing precautions and recommendations for feeding are extremely important to follow in order to improve efficiency and safety of feedings.

Thank you!!! Questions???

References

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