SJSU SAN JOSÉ STATE UNIVERSITY

EVIDENCE-BASED PRACTICE IN DYSPHAGIA: A SCOPING REVIEW

OTAC 2024 Annual Conference – Session 69
November 9, 2024 3 hour session

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Both from San Jose State University

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Objectives

- 1. Examine the anatomy and physiology of the oral and pharyngeal phases of the swallow
- 2. Identify common issues during each phase that result in swallowing disorders (dysphagia)
- 3. Describe evidence-based interventions that can be used in clinical practice to specifically address these two phases of the swallow
- 4. Apply the specific interventions to case presentations using professional reasoning to consider the client context(s)

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Advanced Practice Requirements

- "Swallowing" as used in Code section 2570.3 is the passage of food, liquid, or medication through the pharyngeal and esophageal phases of the swallowing process.
- "Instrumental evaluation" is the assessment of any aspect of swallowing using imaging studies that include, but are not limited to, endoscopy and videofluoroscopy.
- Swallowing assessment, evaluation or intervention may be performed only when an occupational therapist has demonstrated to the Board that he or she has met the post professional education and training requirements established by this section as follows:

3

Advanced Practice Requirements

- Education: Completion of 45 contact hours in the following subjects:
  - (A) Anatomy, physiology and neurophysiology of the head and neck with focus on the structure and function of the aerodigestive tract;
  - (B) The effect of pathology on the structures and functions of the aerodigestive tract including medical interventions and nutritional intake methods used with patients with swallowing problems;
  - (C) Interventions used to improve pharyngeal swallowing function.
- Completion of 240 hours of supervised on-the-job training

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Anatomical Structures

Extra-oral structures involved in the swallow process

- Head/neck positions influence the swallowing process
  - 1. Normal alignment of head/neck in upright allows for pressure gradients for swallow to occur with least effort
  - 2. Reduces the risk of aspiration
- Trunk position influences the swallowing process
  - 1. Neutral pelvic alignment as the supporting surface facilitates respiratory capacity
  - 2. Alignment of head and trunk fosters improved control and organization of oral preparatory and oral phase
- Basic Clinical Assessment
  - Assume symmetrical position
  - Sustain position throughout the meal

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Anatomical Structures

Intra-oral structures involved in the swallow process

- Structures of the oral cavity
  - Teeth
  - Lips
  - Tongue (oral cavity portion)
  - Hard Palate
  - Mandible

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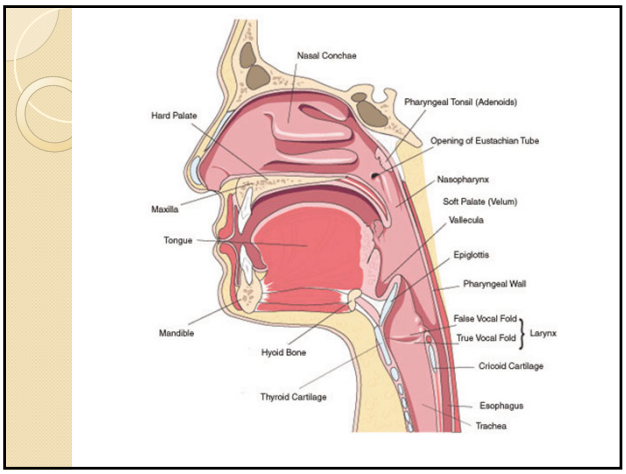
Nasal Conchae
Pharyngeal Tonsil (Adenoids)
Hard Palate
Opening of Eustachian Tube
Nasopharynx
Soft Palate (Velum)
Maxilla
Vallecula
Tongue
Epiglottis
Pharyngeal Wall
False Vocal Fold
True Vocal Fold
Larynx
Mandible
Hyoid Bone
Cricoid Cartilage
Thyroid Cartilage
Esophagus
Trachea

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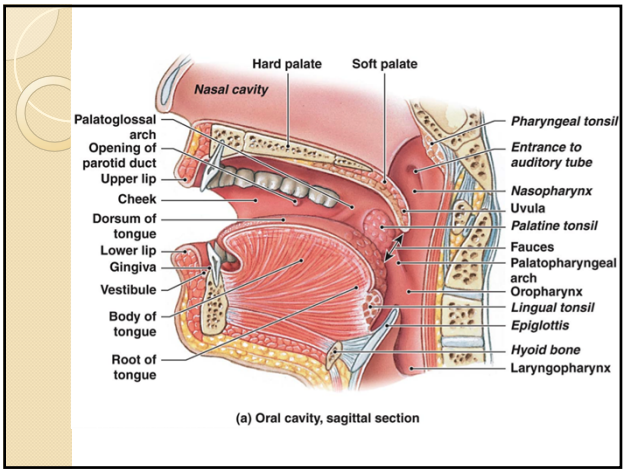
Hard palate
Soft palate
Nasal cavity
Palatoglossal arch
Opening of parotid duct
Upper lip
Cheek
Dorsum of tongue
Lower lip
Gingiva
Vestibule
Body of tongue
Root of tongue
Pharyngeal tonsil
Entrance to auditory tube
Nasopharynx
Uvula
Palatine tonsil
Fauces
Palatopharyngeal arch
Oropharynx
Lingual tonsil
Epiglottis
Hyoid bone
Laryngopharynx
(a) Oral cavity, sagittal section

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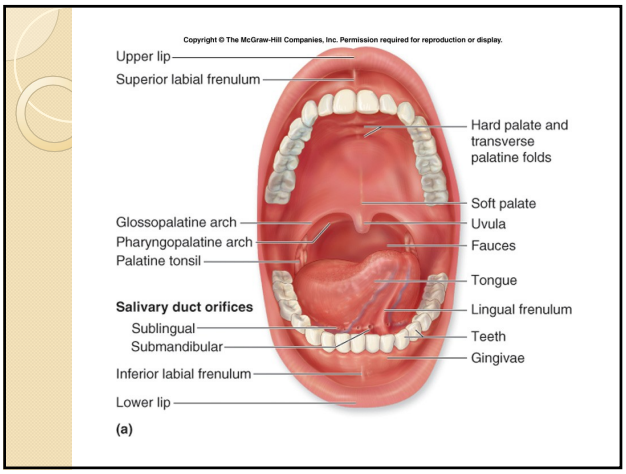
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Upper lip
Superior labial frenulum
Hard palate and transverse palatine folds
Soft palate
Glossopalatine arch
Uvula
Pharyngopalatine arch
Fauces
Palatine tonsil
Tongue
Salivary duct orifices
Lingual frenulum
Sublingual
Teeth
Submandibular
Gingivae
Inferior labial frenulum
Lower lip
(a)

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Anatomical Structures

- Muscles of the Face, Tongue, and Jaw
- Facial Muscles
  - Orbicularis oris
  - Buccinator
  - Levator anguli oris/risorius
- Mastication
  - Temporalis
  - Masseter
  - Lateral and medial pterygoids
- Tongue
  - Intrinsic tongue muscles
  - Extrinsic tongue muscles

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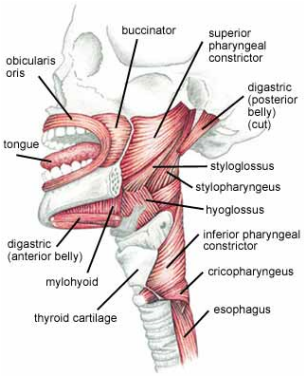
Facial Muscles



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Muscles of mastication

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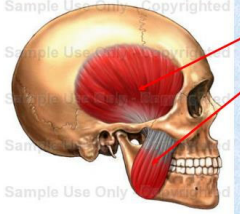
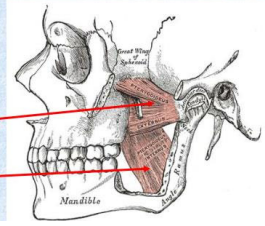


Temporalis

Masseter



Lateral pterygoid

Medial pterygoid

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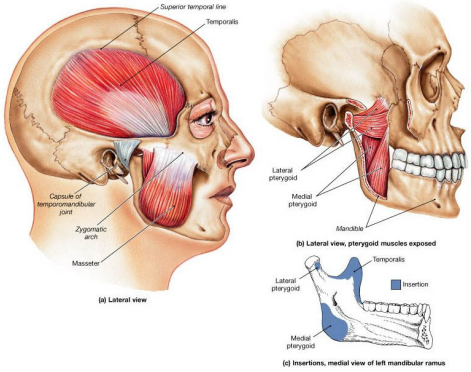
Muscles of Mastication



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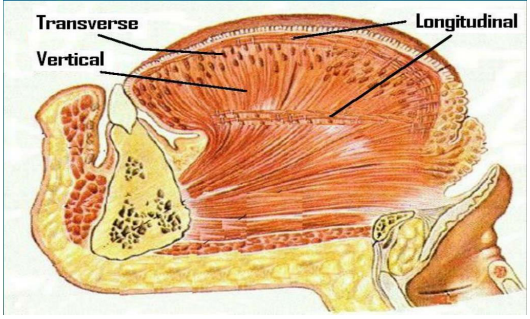
Intrinsic tongue muscles



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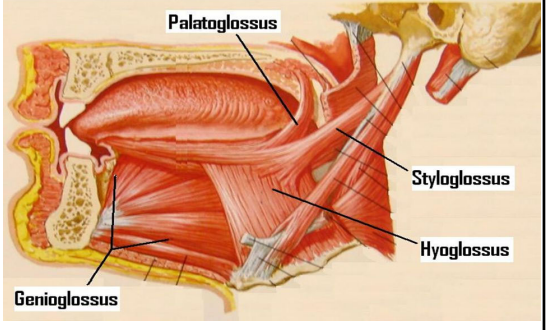
Extrinsic tongue muscles



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Role of tongue muscles

- Both intrinsic and extrinsic tongue muscles are critical for the normal sallow to occur
- Given the structure of the tongue muscles being striated tissue these muscles can be strengthened, and coordination can be improved with practice
- The tongue performs significant functions in the oral preparatory, oral transit, and pharyngeal phase of swallowing, including major contributions to bolus manipulation and transport
  - Youmans et al, 2009

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Anatomical Structures

- Structures of the Pharynx
- Pharyngeal arches (faucial arches, faucial pillars)
- Tongue (pharyngeal portion)
- Pharyngeal wall
- Valleculae
- Epiglottis
- Anterior to pharynx is the larynx and trachea
- Musculature of throat
  - Suprahyoids
  - Infrahyoids

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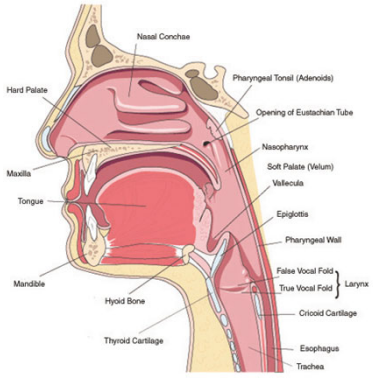
Structures of the Pharynx



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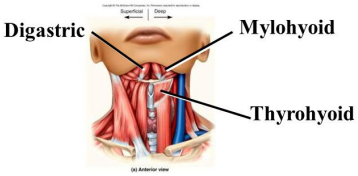
Suprahyoid Muscles and Swallowing

- Digastric and Mylohyoid = open mouth
- Geniohyoid = widens pharynx during swallowing
- Stylohyoid = elevates hyoid
- Thyrohyoid = elevates larynx, closing glottis



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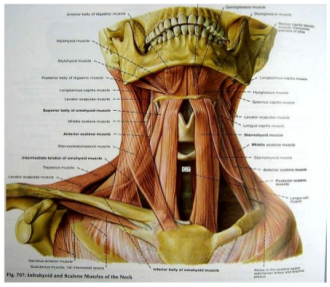
The Accessory Muscles of Mastication

Other muscles that are active in mastication include the suprahyoid and infrahyoid muscles of the anterior area of the neck. Both groups of muscles are active in helping depress the mandible



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Anatomical Structures

- Structures of the Esophagus
- Cricopharyngeal sphincter (upper esophageal sphincter)
- Lower esophageal sphincter

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Four Phases of the Swallow

- Oral Preparatory Phase
- Oral Phase – focus of this presentation
- Pharyngeal Phase – focus of this presentation
- Esophageal Phase

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Review of Normal Anatomy and Physiology of the Swallow

- Oral preparatory phase
  - This phase is under voluntary control and requires task recognition, head and neck control, intact tongue, jaw and lip control.
  - The length of time for the oral preparatory phase varies depending on the consistency of the food
  - These actions are sometimes included as part of the oral phase
  - The duration of the oral preparatory phase varies depending on the resistive quality of the food and strength of chewing needed

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Review of Normal Anatomy and Physiology of the Swallow

- Oral phase
  - During this phase the bolus of food or liquid is propelled to the pharynx by the tongue
  - The tongue creates a trough to control the bolus with the intrinsic tongue muscles
  - The tongue then elevates and flattens against the hard palate using a front to back motion to propel the bolus posteriorly

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Review of Normal Anatomy and Physiology of the Swallow

- Oral phase
  - Requires: Intact labial musculature, intact lingual movement, intact buccal musculature, normal palatal musculature, and the ability to breathe comfortably through the nose
  - Typically respiration stops as the food moves posteriorly
  - The soft palate begins to flare and elevate
  - This phase is under voluntary control and typically lasts approximately 1 second

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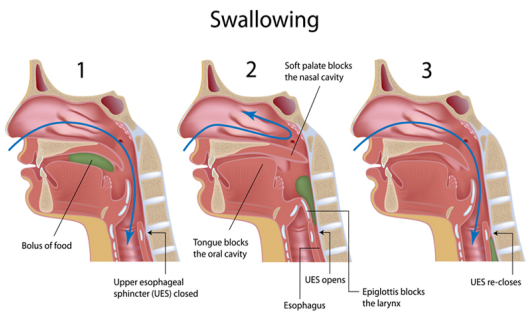
Swallowing process – All phases



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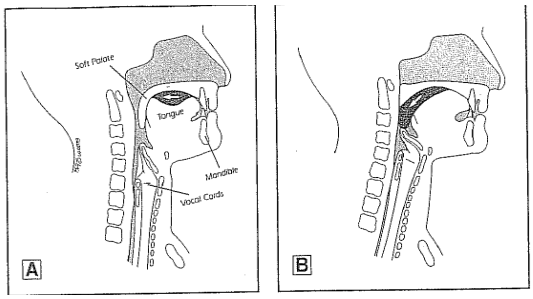
Oral Phase of Swallow



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Review of Normal Anatomy and Physiology of the Swallow

- Pharyngeal phase
  - Swallow response occurs when bolus passes through faucial arches and the middle of the tongue base.
  - Respiration does not occur during this phase
  - Physiological activities:
    - Velopharyngeal closure (nasopharynx) to avoid nasal regurgitation
    - Elevation and closure of the larynx to avoid aspiration
    - Progressive top to bottom peristaltic action of the pharyngeal wall
    - Relaxation of the cricopharyngeal sphincter

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Review of Normal Anatomy and Physiology of the Swallow

- Pharyngeal phase
  - This is the phase where the "reflexive swallow" is initiated; this is considered the involuntary phase of the swallow
  - Ramping of the base of the tongue followed by tongue base retraction
  - This phase lasts approximately 1 second

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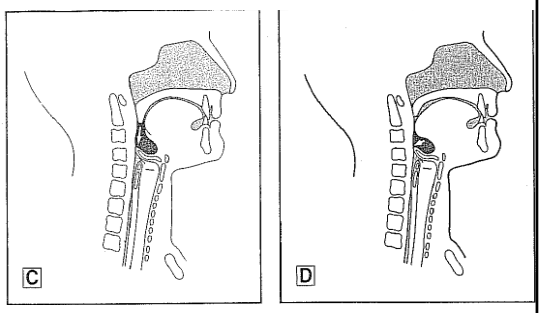
Pharyngeal Phase of Swallow



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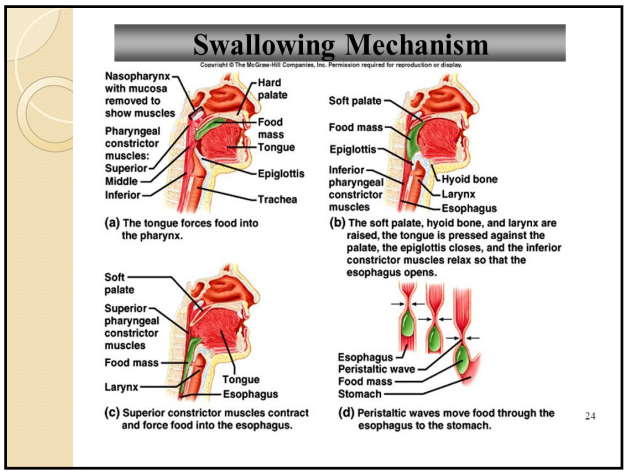

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Review of Normal Anatomy and Physiology of the Swallow

- Esophageal phase
  - This phase is also involuntary during the process of swallowing
  - Peristaltic action propels the food through the esophagus to the stomach
  - At the onset of this phase the upper esophageal sphincter relaxes to allow food to pass into the esophagus
  - At the end of this phase the lower esophageal sphincter opens to allow food to pass into the stomach
  - The length of time varies depending on the viscosity of the food but typically is completed within 20 seconds

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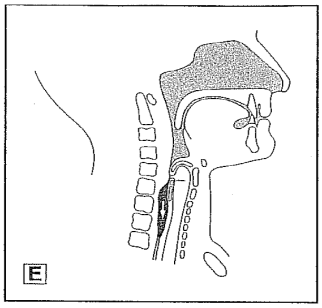
Esophageal Phase of Swallow



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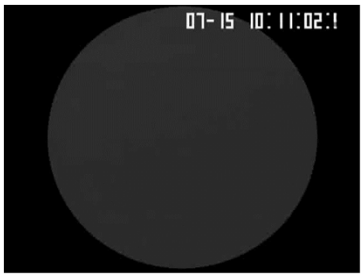
Video of normal swallow

- Speed of oral phase
  - After bolus is prepared the transit time is 1 second
- Speed of pharyngeal phase
  - Transit time is 1 second



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Common physiological problems during Oral Preparatory and Oral phase

- Oral Preparatory Phase
  - Poor oral motor control of bolus in oral cavity
  - Poor postural control to sustain safe eating
  - Problems with cognitive/perceptual function
- Oral Phase
  - Poor tongue control of bolus; limited intrinsic tongue muscle control
  - Extended oral transit time

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Common physiological problems during Pharyngeal and Esophageal phase

- Pharyngeal Phase
  - Absent/delayed swallow reflex
  - Problems with laryngeal closure/elevation
  - Reduced pharyngeal peristaltic action
- Esophageal Phase
  - GERD along with sphincter dysfunction
  - Reduced esophageal peristaltic action

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Videoflouroscopy – Abnormal Swallow

- 7 year old with history of pneumonia 2 - 3 times per year
- Look at transit during oral phase
- Look at transit during pharyngeal phase
- Pharyngeal residue after swallow

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Videoflouroscopy – Abnormal Swallow

- Adult client
  - Assess oral transit
  - Assess oral residue
  - Assess pharyngeal transit
  - Assess pharyngeal residue

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Incidence of Dysphagia

Bhattacharyya, 2014; Lawlor & Choi, 2020; Sato et al, 2013

- Incidence may be as high as 22% in those over 50 years of age
- Approximately 10 million Americans are evaluated each year with swallowing difficulties
- Swallowing difficulties negatively impact quality of life functioning
- Impaired swallowing can cause significant morbidity and mortality
- Parents report close to 50% of children experience episodes of dysphagia; most common for premature infants and children with neuromuscular disorders

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Dysphagia and normal aging

- Transit time increases with normal aging
- The retrusion (retraction of the tongue) does not appear to change in skill but diminished strength has been noted
  - Becker, et al, 2015
- Protrusion of tongue diminish with aging
- Pharyngeal transit time is increased
- Less laryngeal excursion with older adults
- Traveling esophageal velocity pressure is decreased with aging marking it more difficult to propel the bolus to the LES
  - Nishikubo et al, 2015
- Oral frailty is defined as the age-related functional decline of orofacial structures
  - Parisius et al, 2022

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Sarcopenia and older adults

- Past publications addressing dysphagia in older adults focused on those residing in residential facilities
- More contemporary research has focused on dysphagia with community dwelling older adults
  - Christmas et al, 2019; Sakar et al, 2022; Yang et al, 2022
- Sarcopenia is documented with older adults and plays an important role in dysphagia during both the oral preparatory, oral and pharyngeal phases
  - de Sire et al, 2022; Sakar et al, 2022

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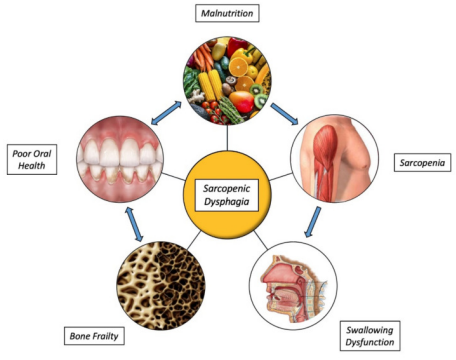
Sarcopenia dysphagia de Sire et al, 2022



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Sarcopenia dysphagia de Sire et al, 2022

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Incidence of Dysphagia - Settings

- Dysphagia in different health care settings:
  - 61% of adults admitted to acute trauma centers
  - 41% of individuals admitted to rehab settings
  - 30%-75% of patients in nursing homes
  - 25%-30% of patients admitted to hospitals

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Anatomical Structures

- Anatomical problems and the impact on swallowing – Adult
- Decreased tongue mobility
- Surgical resections

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Anatomical Structures

- Anatomical problems and the impact on swallowing – Pediatric
  - Anatomical disorders of the oral cavity
    - Size of the tongue relative to the oral cavity
    - Cleft palate, submucosal cleft
  - Anatomical disorders of the jaw
    - Small jaw that compromises mastication
    - Mal-alignment that compromises mastication
  - Anatomical disorders of the esophagus
    - Obstructions to the esophageal tube
    - Esophageal fistulas and atresia

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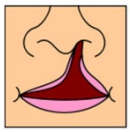
Cleft Lip and Palate

Unilateral Cleft Lip - incomplete

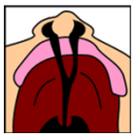


Unilateral Cleft Lip - Complete

Bilateral Cleft of the lip

Isolated Cleft of the palate

Unilateral Cleft lip & palate



Bilateral cleft lip & Palate

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Esophageal fistulas and atresia

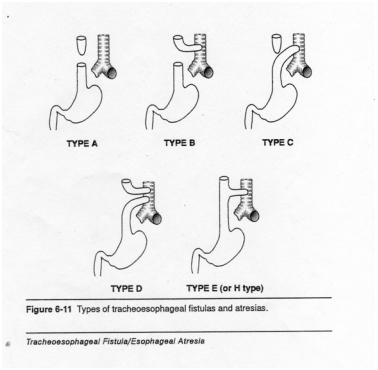

Figure 8-11 Types of tracheoesophageal fistulas and atresias.

Tracheoesophageal Fistula/Esophageal Atresia

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Etiology of Dysphagia – Physiological Cranial Nerves

- Motor
  - CN V Trigeminal
  - CN VII Facial
  - CN IX Glossopharyngeal
  - CN X & XI Vagus & Accessory
  - CN X Vagus
  - CN XII Hypoglossal
- Sensory
  - CN VII Facial
  - CN IX Glossopharyngeal
  - CN X Vagus
- Reflexive
  - CN IX Glossopharyngeal
  - CN X Vagus

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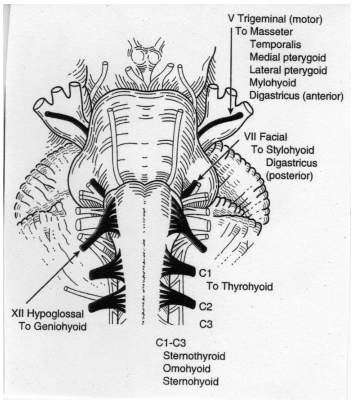
Brainstem and location of cranial nerves



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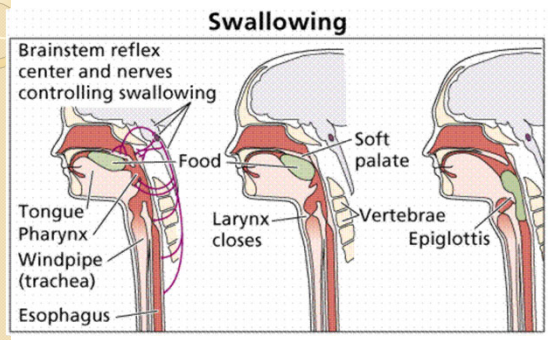
Cranial Nerves and Swallowing



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Central Pattern Generators

- Central pattern generators (CPG) are a neural network designed to produce a motor action without higher level CNS input
- Differentiated from reflexes that produce a specific response following specific sensory input; the CPG can occur without preliminary sensory input
- CPGs support the function of swallowing
- The CPG for respiration and swallowing interact

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Case Presentation

- Child born 3 months premature
  - Gastroschisis: incomplete closure of the abdominal wall with protrusion of intestines & stomach through the hole
  - Mobius syndrome: cranial nerve involvement with bilateral facial paralysis
  - Arthrogryposis: congenital deformity of muscles and joints
- Lives with both parents and older brother (3 years old)

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Case Illustration

- Hospitalized for first 2 months of life.
- Surgery to correct gastroschisis but fed through G-tube on continuous drip pump.
- Discharged to home with pump at 2 months CA (still 1 month prior to due date). Family lived in a small 2 bedroom apartment in a subsidized housing complex. Crib had to be placed in parents bedroom to accommodate electrical needs of the pump.
- Although other relatives were concerned about daughter, they did not offer active support for this family.

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Small Group Discussion

- Neonatologist and gastroenterologist want this child transitioned to oral feeds ASAP!
- What phase of the swallow would be the start for your intervention and why?
- What strategies would you use?
- What evidence do you have for starting at this point of the swallowing process?

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Dysphagia – Mr. J

- Mr. J is a 68 year old gentleman with moderately advanced Parkinson's Disease.
- He lives at home with his daughter and is ambulatory but with increasing motor impairment. He reports that he is more sedentary than in the past due to his concern with his unsteady balance.
- Mr. J has moderately impaired oral motor skills (strength and coordination) and impaired pharyngeal and esophageal function related to his progressing Parkinson's disease.
- Recently he has been experiencing greater difficulty eating (his current diet is pureed and mashed foods). He reports excessive time is required for oral transit of food and often he cannot swallow it or "get it down".

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Case Illustration of Mr. J – Small Group Discussion

- What do you feel is contributing to his recent decline in swallow function?
- What phase/s of the swallow would you anticipate to be most compromised given this man's history and current complaints?
- What problems would you suspect most impact his ability to safely swallow?
- What areas might you target for intervention?
- What is your predicted outcome?
- What evidence would support this anticipated outcome?

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Evidence to support intervention

- Bolus size can impact energy expenditure and the total number of chews to prepare the bolus
- For healthy women, as the size of the bolus increased there was increased energy to prepare the bolus
- Consider bolus size to conserve energy and alter food resistive properties
  - Goto et al, 2015
- Reduction in pressure of the upper esophageal sphincter was seen in older healthy adults
- Longer pharyngeal transit time noted in older adults
- Provide sips of water to support pharyngeal phase
  - Nishikubo et al, 2015

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International Dysphagia Diet Standardization Initiative (IDDSI)

THE IDDSI FRAMEWORK

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IDDSI Framework

- Level O:
  - Characteristics:
    - Flows like water
    - Fast Flow
    - Can drink through any type of nipple, straw, spout as appropriate for age and skills
  - Functionality: Able to manage liquids of all types
  - Testing: Test liquid flows through a 10 ml slip tip syringe completely within 10 seconds with no residue

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IDDSI Framework

- Level 1: Slightly thick
  - Characteristics:
    - Thicker than water
    - Requires more effort to drink compared to water
    - Flows through straw, syringe, teat/nipple
    - Similar thickness to commercially available anti-regurgitation infant formulas
  - Functionality: Predominantly sued in pediatric population
- Testing: Test liquid flows through a 10 ml slip tip syringe leaving 1-4 ml in syringe after 10 seconds

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IDDSI Framework

- Level 2: Mildly Thick
  - Characteristics:
    - Flows off spoon
    - Sippable, but slower than thin drinks
    - Effort required to drink this from a standard straw
  - Functionality: control of flow for safety issues if delays noted with oral and/or pharyngeal phase
  - Testing: Test liquid flows through a 10 ml slip tip syringe leaving 4-8 ml in syringe after 10 seconds

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IDDSI Framework

- Level 3: Liquidized/Moderately Thick
  - Characteristics:
    - Drink using a cup
    - Effort required when using standard or large bore straw
    - Cannot be eaten with a fork
    - Can be eaten with a spoon
    - No oral preparation (chewing) needed and can be swallowed directly
  - Functionality: If tongue control cannot manage Level 2 liquid, move to Level 3; allows increased time for oral prep phase; does require tongue propulsion effort
  - Testing: Test liquid flows through a 10 ml slip tip syringe leaving >8 ml in syringe after 10 seconds; runny rice cereal, runny pureed fruit, sauces

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IDDSI Framework

- Level 4: Pureed, Extremely Thick
  - Characteristics:
    - Eaten with a spoon but possible to use a fork
    - Cannot be sucked through a straw; Does not require chewing
    - Falls off the spoon in a single shape; holds shape on plate
    - No lumps, not sticky
    - Liquid MUST not separate from solid
  - Functionality: Poor tongue control; no need for biting or chewing; can be used with missing teeth or poorly fitting dentures
  - Testing: Fork test – press a fork into the substance and the time marks remain, no lumps; spoon tilt test – food should slide off a spoon, in a cohesive unit, when the spoon is tilted with no stickiness and very little residue on the spoon

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IDDSI Framework

- Level 5: Minced & Moist
  - Characteristics:
    - Eaten with fork or spoon or chopsticks
    - Can be scooped and shaped; soft & moist with no separate thin liquid
    - Small lumps visible
  - Functionality: Biting not required but slight chewing needed, tongue force alone can break this texture into smaller sections
  - Testing: Fork test – press a fork into substance and substance easily comes through the tines; easily mashed; cohesive on a spoon; spoon test – must slide off the spoon with very little residue on the spoon, not sticky; mashed or minced meats/fish, mashed fruit, thick cereal with small lumps, soaked bread (NOT regular bread)

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IDDSI Framework

- Level 6: Soft & Bite-sized (appropriate for oral cavity)
  - Characteristics:
    - Eaten with fork, spoon or chopsticks
    - Can be mashed with utensils
    - Chewing required before swallowing, but no biting required; soft and tender but no separate liquid
  - Functionality: tongue force and control required during oral prep and oral phase to move the bolus
  - Testing: Pressure from fork/spoon to "cut" food; when pressing utensil into food with thumb, thumb nail blanches due to resistance from food; tender cooked meat/fish, casserole/stew/, mashed fruit, steamed vegetables

66

IDDSI Framework

- Level: Transitional foods
  - Characteristics:
    - Foods that start as one texture and change into another texture with moisture or temperature
  - Functionality: biting not required and minimal chewing needed; tongue can break apart food
  - Testing: after moisture or temperature is applied, food cannot be reformed; ice cream, sorbet, waffle cone, gelatin, Pringles, Veggie Sticks, baby "puffs"

67

IDDSI Framework

- Level 7: Regular Diet
  - Characteristics:
    - Normal everyday foods of various textures
    - Includes dual consistency foods (mixed consistency)
  - Functionality: Need to bite and chew foods without tiring, need to form foods into cohesive bolus to be swallowed; ability to sort foods in mouth (bone shard from meat; extremely fibrous vegetable from soft – artichoke)
  - Testing: Any foods – no test required

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Evidence to support intervention

- Use of carbonated thin liquids was compared to non-carbonated thin liquids for adults with neurogenic dysphagia
  - Use of carbonated thin liquids significantly decreased the penetration and aspiration upon videofluoroscopy
  - No significant change in oral transit or pharyngeal transit
    - Sdravou et al, 2012
- Adults with dysphagia due to deconditioning responded best to carbonated thin liquids
    - Shapira-Galitz et al, 2021

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Use of carbonated liquids

- Investigation of length of swallowing following use of carbonated liquids for older adults without dysphagia
- Carbonated water stimulates the oral and pharyngeal mucosa and is a sensory stimulus.
- The pharyngeal phase was shortened resulting in less time for the bolus to remain in the pharyngeal region
  - Morishita et al, 2023
- Thickened carbonated liquids significantly reduced the penetration and aspiration for older adults with dysphagia
  - The subjective experience of clients was the thickened carbonated liquid was significantly easier to swallow compared to thin, thick and thin carbonated liquids
  - Morishita et al, 2022

70

Incidence of Dysphagia – Older Adult

(Bhattacharyya, 2014; Miller, 2013; Sura et al, 2012)

- Approximately 7%-10% of adults older than 50 years have dysphagia, although this number may be artificially low because many patients with this problem may never seek medical care. Of those over age 60, approximately 14% of individuals are affected by dysphagia

71

Incidence of Dysphagia – CVA

(Daniels et al, 2012; Kang et al, 2012; Kim et al, 2020; Takizawa et al., 2016)

- Studies on the prevalence of dysphagia range from 30%-70% in clients who have experienced stroke. Estimates vary because of the method of assessing swallowing function, the timing of swallowing assessment after stroke, and the number of and type of clients studied
- Although dysphagia improves in most clients post-stroke, many have persistent swallowing difficulties, with 10%-30% of individuals continuing to have dysphagia with aspiration
- Dysphagia has a significant impact on the quality of life for those who sustained a stroke (Kim et al, 2020)
- Bedside exercises improve swallowing function (Kang et al, 2012)

72

Incidence of dysphagia – Alzheimer's Disease

(Affoo et al, 2013; Espinosa-Val et al, 2020; Mira et al, 2022; Sato et al, 2014)

- Alzheimer's Disease
  - With deterioration to the autonomic nervous system the coordination is often compromised during the oral preparatory, oral and pharyngeal stages of the swallow
  - A systematic review of the literature revealed that dysphagia occurs in the early stages of AD
  - Dysphagia increases in severity as AD progresses
  - Thickened liquids eliminate thin-liquid aspiration in individuals with AD
  - Appropriate head and neck posture improves oral phase
  - Pneumonia accounts for 70% of causes of death
  - Cerebrocortical atrophy negatively impacts initiation and modification of swallow force in response to bolus size and viscosity

73

Incidence of Dysphagia – Parkinson's Disease

(Suttrup & Warnecke, 2016; Takizawa et al., 2016; Wang et al. 2021)

- Clients with Parkinson's disease not only experience dysfunction of the various phases of swallowing, but they also have great difficulty in their ability to feed themselves
- Dysphagia is reported by 20%-40% of clients with idiopathic Parkinson's disease
- A longitudinal investigation noted that men with PD and cognitive impairments had greater risk of developing dysphagia; dysphagia was also associated with greater levels of anxiety
  - Wang et al, 2021
- Oral motor exercises improve swallowing function for clients with Parkinson's disease
- Thermal-tactile stimulation reduces the delay in initiation of the pharyngeal phase of the swallow

74

Incidence of Dysphagia – Huntington's Disease

(Heemskerk et al, 2011; Pizzorni et al, 2020)

- Dysphagia is a common symptom that may be associated with fatal complications
- Dysphagia hinders nutritional intake and places the patient at risk for aspiration
- Dysphagia is related to diminished control during the oral phase in almost all clients with HD as the diseases progresses
  - Faster than typical oral transit phase
  - Impulsive behaviors
  - Poor postural control during oral preparatory and oral phase
- Dysphagia is also noted in the pharyngeal stage for many clients as the HD progresses
  - Poor epiglottis closure
  - Prolonged elevation of the larynx
  - Residue after initiation of pharyngeal phase

75

Incidence of Dysphagia – MS

(Ansari et al, 2020; Printza et al, 2020; Takakoli et al, 2023)

- Clients with multiple sclerosis (particularly those with brainstem involvement) are reported to have swallowing difficulties.
- Dysphagia may develop early or late in the disease's process and significantly impacts the quality of life for those with MS
- Over 30% of individuals with multiple sclerosis experience swallowing problems
- Problems most often seen in oral and pharyngeal phases, but problems noted during all phases of the swallow
  - Poor tongue control during oral transit
  - Poor coordination of musculature during pharyngeal phase
- Coordination of the suprahyoid muscles was compromised on electrophysiological studies as was the duration of pause for the cricopharyngeal muscles – extended time compromised the transition from the pharyngeal phase to esophageal phase
- Intervention that combines oral motor and pharyngeal exercises improved swallowing function; when NMES was added to conventional exercises additional gains were noted but use of NMES alone did not produce significant improvement

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Incidence of Dysphagia – TBI

(Prum et al, 2022; Takizawa et al., 2016; Yan et al, 2021)

- Incidence of dysphagia in individuals with traumatic brain injury vary greatly depending on whether the population studied is comprised of clients with severe TBI, consecutive brain injury admissions, clients with acute TBI, or clients in the rehabilitation phase of recovery
- Most clients with a TBI have dysphagia during the first two weeks following injury and typically dysphagia resolves within five months of the injury
- To hasten the appropriate excursion of the hyoid bone and larynx during the swallowing process neuromuscular electrical stimulation (NMES), used on the suprahyoid muscles, was successful in fostering more appropriate swallowing process. This was combined with thermal-tactile stimulation to faucial arches to achieve results.
- A RCT was conducted and demonstrated that the use of oral motor exercises decreased episodes of aspiration for clients with TBI
- Sensory stimulation was used with clients with severe TBI and increased swallowing was noted with decreased aspiration

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Incidence of Dysphagia – CP

(Acar et al 2022; Crary et al, 2022; Garcia Ron et al, 2023; Gonzalez-Rozo et al, 2022; Morgan et al, 2012)

- Feeding problems are seen in 38% - 57% of children diagnosed with cerebral palsy (CP) during the first year of life
- Children with more severe forms of CP have a much higher rate of dysphagia with swallowing problems seen in over 90% of clients
- Dysphagia identified in all phases of swallowing process – oral preparatory, oral, pharyngeal, and esophageal
- Dysphagia continues in many of these children throughout their lifetime and presents as a persistent compromise to nutritional status
- Even children with mild CP can display dysphagia and the severity of gross motor problems is associated with increased rate of dysphagia and drooling
- Use of NDT to foster better trunk control and posture improved feeding and swallowing skills in an RCT

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Incidence of Dysphagia – Pre-term Infants

(Celik et al, 2023; Fucile et al, 2012; Hwang et al, 2010; Lawlor et al, 2020; Li et al, 2022; Morgan et al, 2012)

- Premature infants are typically dependent upon the use of G or NG tube feedings for nutritional support and have not developed the suck-swallow-breath coordination of a full-term infant
- Preterm infants: typical suck-swallow-breathe pattern is not developed until 37 weeks GA
- Bottle/breast feeding may be seen at 34-36 weeks gestational age, but swallow is poorly coordinated
- Dysphagia often persists beyond the time when the infant has reached full-term
- Diminished development of hunger-satiety with tube feedings since continuous feeds are most common
- An RCT used KT around the upper orbicularis oris and to support elevation of the hyoid bone with pre-term infants, improved oral reflexes and swallowing noted compared to control group

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Incidence of dysphagia – Developmental Delay

(Hashimoto et al, 2014; Jackson et al, 2016; Morgan et al, 2012; Nordstrom et al, 2020; O'Neill & Richter, 2013)

- Oral preparatory deficits are frequent in children who have Down syndrome and the ability to effectively grind foods is compromised
- Oral phase deficits are very common and due to poor tongue control of bolus and poor oral transit time
- Poor tongue pressure noted during the oral phase to propel food posteriorly and due to poor tongue control and short, narrow palate
- Over 50% of children diagnosed with Down syndrome display pharyngeal dysphagia

80

Interventions: Positioning

- Positioning - 75% of eating intervention is positioning
  - Chin tuck - a forward head position compromises the suprahyoid activity and places a person at risk for dysphagia (Tamai et al, 2022)
  - Head turn – unilateral problems (CVA) and turn head towards more involved side
  - Head tilt – unilateral problems (CVA) and tilt head away from more involved side
  - Pelvic position – neutral alignment, even weight bearing
  - Body positioning – symmetrical sitting position with head in neutral alignment

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Modification to Volume, Rate and Placement of Food

- Variations in sensory
  - Offering ice chips or cold fluids between solids
- Pacing
  - Speed of presentation
  - Hunger/satiety paradigm
- Placement
  - Position of food within oral cavity
  - Food on the back of the bowl of the spoon
  - Food on a NUK toothbrush or on an infadent
- Flipped spoon
  - Placing spoon in mouth and then flipping over to deposit food on tongue

82

Infadent for oral stimulation and exercises

Oral and gum cleaner that can also be used for oral stimulation and exercises

83

Interventions – flipped spoon

- Flipped spoon technique was found to be effective in a pre-test/post-test design for children with developmental delays and oral preparatory/oral phases of the swallow
- Often used for children who pack foods in the cheeks and lack the tongue control to maneuver the bolus
- Collect the bolus onto the spoon
- Insert the spoon into the child's mouth
- Flip the spoon over, open bowl side on the tongue and deposit the food on the tongue while applying slight downward pressure on the middle of the tongue
- Maintain pressure on the tongue as you pull the spoon out of the mouth
  - Rivas et al, 2011; Volkert et al, 2011

84

Interventions – Side Placement of Food

(Ibanez et al, 2021; Rubio et al 2015; Taylor, 2020)

- The "flipped spoon" intervention has been used to diminish food refusals and packing of food in the lateral sulci by children
- Side placement of food on the lateral surface of the tongue and molars using a Nuk toothbrush or the back of the spoon was more effective to decrease food expulsions and refusals compared to the "flipped spoon" method
- Many children with feeding refusals also have oral motor difficulties in controlling the bolus during the oral and pharyngeal phases

85

Interventions

- Use of Cheek and Jaw support
  - Support provided by placing fingers on either side of the infant's cheeks
  - Provide slight pressure inward and towards the corners of the lips
  - Bottle/nipple presented in midline
  - Technique improved oral intake for pre-term infants
- Hwang et al, 2010

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Interventions

87

Pre-term infants (Fucile et al, 2012)

- Transition to oral feeds can be enhanced through oral and sensory interventions
- 75 pre-term infants (ave. 29 weeks GA)
- Randomly assigned to 3 intervention groups and 1 control
- Intervention groups:
  - Oral sensory input to the oral region
  - Tactile/kinesthetic stimulation to trunk and limbs
  - Combined use of both of the above interventions
- Outcomes:
  - Oral sensory group showed more advanced sucking skills with greater suction and amplitude than controls
  - All 3 interventions improved the respiratory support for the swallow-respiration sequence

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Pre-term infants (Fucile et al, 2012)

- Outcomes:
  - All 3 intervention groups transitioned to oral feeds faster than control by 9-10 days,
  - Oral and non-oral sensorimotor interventions (i.e. oral and tactile/kinesthetic) accelerated the transition from introduction of oral feeding to independent oral feeding and enhanced oral feeding skills.
  - Sensorimotor interventions (tactile/kinesthetic) had beneficial effects beyond the specific targeted system.
  - Combined (oral+tactile/kinesthetic) sensorimotor intervention had an additive/synergistic effect on oral feeding performance over single sensorimotor interventions

89

Extra-oral facilitation

- Vibration to suprahyoids
  - Provide stimulation to the muscles to elevate the larynx during the swallowing process
  - Uses the same musculature involved with VitalStim but uses finger tips instead of electrical stimulation
- Vitalstim
  - Electrical stimulation to the musculature to elevate the hyoid and larynx
  - Uses specialized electrodes
  - Gains noted in small studies, most often single subject design
- Oral motor exercises of lips, tongue & jaw (Kang et al, 2012)
  - 50 clients 6 mo post-CVA with dysphagia enrolled in an investigation
  - 25 in conventional tx of thermal-tactile stimulation, 25 in conventional tx plus specific daily exercises to lips, tongue and jaw
  - Each group seen daily for 2 mo (in Korea)
  - The group receiving thermal-tactile stim coupled with the oral motor exercises had significantly improved oral transit time but there was no difference between groups for the pharyngeal phase

90

Shaker technique

- The Shaker technique, also called the Head Lift, is indicated for clients who exhibit reduced superior and anterior movement of the hyolaryngeal complex. This results in residue in the pyriform sinuses, placing the client at risk to aspirate this material.
- RCT where one group had Shaker exercise and the other group had traditional pharyngeal exercises of elevating the larynx and tongue exercises (Logemann et al, 2009)
  - Only 9 clients in control and 5 in Shaker group completed both pre-test/post-test measures
  - Clients who used the Shaker method and had fewer episodes of post swallow aspiration than the group who used traditional exercises
  - Both groups improved in the UES opening

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Shaker exercise

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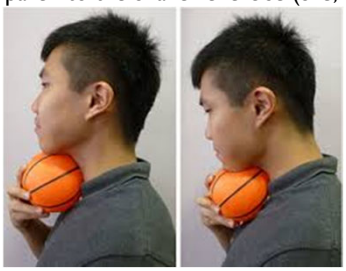
Chin Tuck Against Resistance (CTAR)

- Exercise to strengthen the suprahyoids
- CTAR found to more specifically target the suprahyoid muscles and foster laryngeal elevation compared to the Shaker exercise (Sze, et al. 2016)



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Chin Tuck Against Resistance (CTAR)

- This exercise was introduced as an alternative to the Shaker exercise
- The systematic review completed by Liu et al, 2023 comparing results of studies using the Shaker exercise versus CTAR
- They concluded that the CTAR exercise is superior to Shaker exercise in improving swallowing safety for clients with dysphagia following a CVA

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Effortful Swallow and Double Swallow Techniques

- Effortful Swallow Technique (EST): the client is asked to swallow with a hard force (extra effort by the client) as if gulping by pushing the tongue against the hard palate while squeezing the neck muscles (Park & Kim, 2016)
  - Double blind RCT had clients with dysphagia due to a stroke perform EST 10 times, 3x/day for 4 weeks (Park et al, 2019)
  - Tongue strength improved significantly as did both the oral and pharyngeal phases of the swallow using the Videofluoroscopic Dysphagia Scale (VDS)
- Double Swallow: the client swallows twice in rapid succession

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Mendelsohn Maneuver

- This exercise is done to improve swallowing. It helps to raise the larynx and open the esophagus when swallowing.
- Most often, these exercises should not be done with food in your mouth.
- Swallow your saliva several times and pay attention to your neck as you swallow.
- Feel your voice box, also called your Adam's apple, lift and lower as you swallow.
- Now, swallow and feel your voice box lift but do not let it drop. Hold it with your muscles for 2 seconds. Release and then repeat 5 times.

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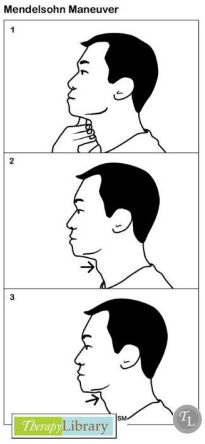
Mendelsohn Maneuver



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EBP – Mendelson Maneuver

- Prospective cross-over study of 18 post CVA clients showed gains in extent of hyoid movement and UES opening and improvements in coordination of structural movements (McCullough & Kim, 2013)
- Results from other studies show increased hyoid movement and UES opening (McCollough et al., 2012)

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Intervention – Masaka technique

Protrude your tongue from your mouth (stick out your tongue), hold your tongue between your teeth and then swallow
Exercise to improve laryngeal elevation during swallow

99

Tactile Stimulation to the Tongue

- 45 children with various congenital anomalies and gastroenterologic dysfunctions
- All received artificial feedings
- All children had significant difficulties with configuration of the tongue to support the oral phase of the swallow
- All children were able to transition to oral feeds following 5-7 days of treatment
  - Lamm et al, 2005

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Facilitation of masseter and pterygoids

- Gloved hand
- Index and middle finger
- Squeeze fingers laterally together
- Provide slight shaking as you withdraw finders from the side of the cheek

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Clinical Assessment and Intervention during Phases of Swallow

- Thermal-tactile Stimulation
- *Purpose*: to increase the sensory awareness in the oral cavity prior to the
- swallow and to decrease the delay between the oral and pharyngeal swallow.
- *Technique*: 00 laryngeal mirror is used to stimulate the faucial arches 4 or more times in rapid succession followed by the command "swallow".

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Thermal-tactile Stimulation

Laryngeal Mirror

103

Intra-oral Facilitation

- Faucial arches
- Thermal-tactile stimulation (TTS)
  - (Park et al, 2010)
- Provide sensory stimulation to the anterior faucial arches to more rapidly trigger the pharyngeal phase of the swallow
- A long stainless steel device is dipped in ice water for at least 30 sec and then applied to the anterior faucial arches within 6 sec of removal from the ice water to retain the cold, process repeated 5 times
- Results for clients with CVA and PD demonstrated reduction in pharyngeal transit time
- The TTS did not reduce the oral transit time
- Focused on triggering the action controlled by the glossopharyngeal nerve
- Effortful swallow

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Aspiration	Intervention Approaches
Aspiration before the swallow	Posture & positioning techniques Tactile – thermal stimulation Dietary alterations Carbonated liquids
Aspiration during the swallow - reduced protection of the airway	Chin tuck Chin tuck against resistance Mendelsohn Maneuver Dietary alterations & carbonated liquids Mealtime routines with clearing sips of water interspersed with solids Posture & positioning techniques
Aspiration after the swallow – residue in pharyngeal	Effortful swallow Double swallow Mendelsohn Maneuver Masako Maneuver

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Clinical Assessment and Intervention Phases of Swallow – Small Group

- Identify a client (dx) who would have problems with the oral phase of the swallow
- Identify intervention methods that could be used to foster improved oral skills
- Interventions for Oral Phase
  - Sensory issues to detect the position of the bolus
  - Motor control of the tongue to propel the bolus
  - Physiological issues related to respiration support

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Clinical Assessment and Intervention during Phases of Swallow

- Intervention strategies for the oral phase
  - Food consistencies
  - Rate of food presentation
  - Positioning
  - Motor facilitation for tongue
  - Oral motor exercises
  - Thermal stimulation to facilitate a swallow
  - Vibration to suprahyoids

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Clinical Assessment and Intervention Phases of Swallow – Small Group

- Identify a client (dx) who would have problems with the pharyngeal phase of the swallow
- Identify intervention methods that could be used to foster improved pharyngeal skills
- Pharyngeal phase
  - Physiological issues of closure of larynx by epiglottis
  - Poor force of peristaltic action of pharyngeal wall
  - Poor coordination of swallow and breathing

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Intervention during Phases of Swallow

- Intervention strategies for the pharyngeal phase
  - Positioning
  - Thermal stimulation to facilitate initiation of swallow
  - Vibration to suprahyoids
  - Effortful swallow
  - To clear residual food, use alternating temperatures (ice chips contrasted with foods)
    - (Leder et al. 2013; Nakayama et al. 2013; Park et al. 2012)

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Intervention during Phases of Swallow

- *Oral motor Exercises*
- *Purpose*: to increase ROM, strength, coordination
- *Technique*: Use of quick stretch, 3 repetitions, to orbicularis oris, tongue, suprahyoids, masseter; also use of chewy foods or items to increase strength and control for muscles of mastication; ROM exercises; chewing on plastic straws

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Intervention – tongue strengthening

Have client protrude tongue and push against tongue blade
Ask client to push as the client or therapist counts 10 seconds
Repeat 3 times twice a day
A toothbrush head can be substituted for the tongue blade if asking the client to perform this exercise at home

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Intervention

- Tongue exercises
  - Use of an ice straw to foster lateralization
  - Ice straw to foster trough in tongue
- Repeated exercises can produce changes in corticomotor regions
  - Komoda et al, 2015
- Tongue exercises can improve oral phase of the swallow
  - Carnaby-Mann & Crary, 2010

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Intervention during Phases of Swallow

Effortful Swallow

- *Purpose*: To improve tongue base retraction and reduce residue in the valleculae after the swallow.
- *Technique*: Ask the patient to "swallow normally" but to squeeze hard with the tongue and throat muscles throughout the swallow.

Combining this maneuver with the chin-down posture will aide in pushing the tongue base posteriorly and improving pharyngeal pressure and peristaltic strength.

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Intervention during Phases of Swallow

- Neuromuscular electrical stimulation (NMES) with traditional swallowing therapy
- NMES with traditional swallowing therapy is significantly better than use of tradition swallowing therapy alone to improve coordination of swallowing for patients with acute/subacute stroke – RCT with over 25 clients in each group
  - NMES on suprahyoids
  - Traditional swallowing therapy included:
    - Thermal-tactile stim, tongue exercises, effortful swallow, Mendelsohn and Masako maneuver and Shaker exercises
    - Kim et al, 2014

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Clinical Assessment and Intervention during Phases of Swallow

- Neuromuscular electrical stimulation (NMES) with traditional swallowing therapy
- RCT with over 25 in each group
  - NMES (VitalStim) on infrahyoids with effortful swallow
  - Control group had electrodes placed with insufficient stimulus to produce muscular action
  - All had oral motor exercises
  - Outcome measure – excursion of the hyoid bone during swallow as a measure of control and power
  - Park et al, 2016

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Intervention during Phases of Swallow

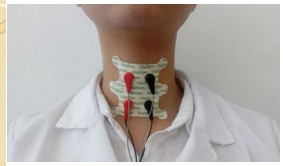

Fig. 2. Application of electrodes in the infrahyoid area targeting the sternohyoid muscles.

Electrodes were placed on both experimental and control group participants, the NMES was insufficient to produce muscular contraction for control group (placebo)
All participants had oral motor exercises using the effortful swallow exercise
Significant improvement in hyoid excursion noted in the experimental group

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Intervention during Phases of Swallow

- *Vibration to suprahyoids*
- *Purpose*: to increase the motor control of suprahyoids to propel the bolus posterior and decrease the delay between the oral and pharyngeal swallow.
- *Technique*: place fingers on the suprahyoids and quickly vibrate for 1-2 seconds

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Questions??

Thank you!

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OTAC 2024 Session 69 Evidence-Based Practice for Dysphagia
November 9, 2024, 3-hour session, Schultz-Krohn & Smith

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