- If you are viewing this course as a recorded course after the live webinar, you can use the scroll bar at the bottom of the player window to pause and navigate the course.
- This handout is for reference only. It may not include content identical to the PowerPoint. Any links included in the handout are current at the time of the live webinar, but are subject to change and may not be current at a later date

PRINCIPLES AND EVIDENCE: TREATMENT OF PHARYNGEAL DYSPHAGIA

NANCY B. SWIGERT, M.A.,CCC-SLP, BCS-S (RETIRED)
SWIGERT & ASSOCIATES, INC.
NANCYSWIGERT1066@GMAIL.COM

Disclosures

Financial:
- Received an honorarium for this presentation
- Royalties from The Source for Dysphagia (ProEd/Linguisystems)

Non-financial:
- Presented previously on this topic
- Serve on Medical Advisory Board for National Foundation on Swallowing Disorders

Goals for this session

Describe the relationship between impaired physiology and signs and symptoms of dysphagia.

Describe the differences between postural, compensatory and rehabilitative techniques for pharyngeal dysphagia.

Explain how to determine appropriate strategies for various pharyngeal deficits.

Describe the evidence for specific techniques for pharyngeal dysphagia.

Why understand related principles?

Swallowing involves series of highly coordinated, volitional and reflexive sensorimotor movements in mouth, larynx, and pharynx

- Coordination between respiratory and swallowing functions in upper aerodigestive tract

To manage some a complex disorder, the SLP must understand underlying physiology and related principles

Without the understanding, how does the SLP answer:

Can the impaired physiology actually be changed?

Is it possible an exercise could cause more harm than good?

How frequently should an exercise be practiced?

How many repetitions of the exercise are needed to obtain a benefit?

Should the practice be spaced out or massed together?

At what point in recovery will dysphagia intervention be most beneficial?

Categorizing treatment strategies

Compensatory
- Postural
- Diet/bolus modifications

Rehabilitative

Sensory overlaps compensatory, diet and rehabilitative

Compensatory

Compensate for lost or impaired function

Not intended to improve impaired anatomy or physiology

Achieve a more functional, safe or efficient swallow

Physical therapy example: Brace to prevent foot drop

Examples: External pressure to the cheek or placing bolus on strong side

Postural

Used to re-direct bolus flow in oral, but mostly pharyngeal phases

Physical therapy example: after a back injury, person has pain with sitting. Using a roll behind lower back may eliminate pain

E.g. head turn, head tilt

Bolus modifications

Texture changes

Temperature changes

Viscosity changes

Sensory changes (e.g. sour, carbonation)

Size of bolus

Rehabilitative

Designed to alter (and in some cases have been demonstrated to) the physiology of the swallow

- i.e. result in long-lasting behavioral changes (and maybe changes in neural pathways)

Should target the underlying impaired physiology identified during assessment

Require individual to actively participate and in most cases to follow complex directions

Rehabilitative

Physical therapy example:

- They use the term restorative
- Activity-based therapeutic exercise to re-educate and strengthen damaged muscle
- Thermotherapy to promote healing

Rehabilitative + Compensatory

Some strategies thought to be rehabilitative (i.e. result in lasting change in physiology) can also be used in a compensatory way (e.g. used to improve safety or efficiency of each swallow during a meal)

- Mendelsohn maneuver

Combining type of strategies

Which strategy at what point in continuum of care?

How well will individual be able to utilize different types of strategies?

Are certain types of strategies more effective in certain settings (e.g. available caregivers to implement?)

Physical therapy example: Using crutches to get around while attending physical therapy for treatment of muscular injury)

Case example - combining strategies

75 year old male with acute CVA

Oral and pharyngeal dysphagia

Difficulty following commands

Postural: head rotation

Compensatory: support to lips

Bolus modifications: pureed, nectar thick

No rehabilitative strategies at this time

CVA case example

As patient recovers, and repeat instrumental studies are completed:

- Remove postural and compensatory strategies
- Adjust bolus modifications
- Add in specific rehabilitative strategies

Case example – combining strategies

87 year old SNF resident with early to mid stage dementia

Difficulty chewing solids

No pharyngeal deficits

Compensatory: reminder sign for second swallow and sip of liquid

No postural, bolus modifications or rehabilitative

Dementia – case example

As dementia progresses..

Individual no longer able to respond to cues for the compensations

Managed only with bolus modifications

Let's move to treatment

Framework

Techniques

Efficacy (when we have it ☺)

Application

Without knowledge of underlying physiology

You might select the wrong treatment techniques for the problem

A sign/symptom may have more than one possible physiologic cause

You might select a treatment technique or method which doesn't even make sense for the problem (e.g. treating a delay when the problem is reduced laryngeal elevation)

Attending to physiology helps determine what to treat

Sign/symptom	Functional short term goal	Different physiologic causes	Reworded functional short term goal
Patient has residue in the pyriforms after the swallow	Patient will reduce the amount of residue in the pyriform sinuses to reduce the risk of food falling into the airway	Reduced laryngeal elevation	Patient will **increase laryngeal elevation** to reduce the amount of food remaining in the pyriforms which could fall into the airway
		Reduced anterior movement of hyolaryngeal complex	Patient will **increase anterior movement of hyolaryngeal complex** to reduce the amount of food remaining in the pyriforms which could fall into the airway

How would you reword goals if no rehabilitative techniques are selected (i.e. no improvement is expected)?

Patient will *compensate for* decreased laryngeal elevation to reduce the amount of food remaining in the pyriform sinuses that falls into the airway after the swallow.

Patient will *compensate for* decreased closure at the entrance to the airway to keep food from entering the top of the larynx and falling into the airway after the swallow.

Oral phase treatment – that's another seminar!

For More information about:	Refer to:
Strength Training Exercise Principles	Burkhead, L.M., Sapienza, C.M., & Rosenbek, J.C. (2007). Strength-training exercise in dysphagia rehabilitation: Principles, procedures, and directions for future research. *Dysphagia, 22,* 251-265.
Neuromuscular Treatment Exercise Principles	Clark, H.M. (2003, November). Neuromuscular treatments for speech and swallowing: A tutorial. *American Journal of Speech-Language Pathology, 12,* 400-415.

The tongue as the transition between oral and pharyngeal

Need more than subjective measure of strength

Inexperienced and experienced raters judge tongue strength differently

Correlations to specific functional aspects of the oral swallow differed between the rater groups

- Clark et al 2003

Devices to measure strength

Swallow Strong

IOPI

Lingual exercises in stroke

(Robbins, et al 2007)

8-week isometric lingual exercise program with IOPI

10 stroke patients (acute and chronic)

http://www.iopi.info/index.php?option=com_content&view=article&id=64&Itemid=71

Lingual exercise

All subjects significantly increased isometric and swallowing pressures

Airway invasion reduced for liquids

Two subjects increased lingual volume

So is there an effect on swallowing?

Resistance Exercise: Swallowing

Robbins et al (2007) started to take the next step

- Pen-Asp Scale (Rosenbek et al, 1996)
  - Mean reportedly improved across groups
- Attempted to measure vallecular & pyriform residue
  - Lower pressures → increased oropharyngeal residue & more likely to aspirate
  - Challenges:
    - difficulties with consistency of measures
    - not all spaces are created equally

The Next Steps: Swallowing Physiology?

- Other possibilities:
  - Oral control
  - Pharyngeal residue
    - 2' weak tongue propulsion of bolus
  - Hyoid per VFS (Molfenter, et al 2010)
    - Closely timed with tongue pressure events
    - Anterior max pressures → elevation
    - Posterior max pressures → excursion
  - Others?
- Base of tongue: role in initiation of the pharyngeal response?

Categorizing strategies for pharyngeal phase

AIRWAY CLOSURE

- Delay
- Mistiming of initiation
- Movement impairments
  - Poor back of tongue control
  - Reduced closure at folds
  - Reduced closure at entrance to airway
  - Reduced hyolaryngeal excursion

Categorizing strategies for pharyngeal phase

BOLUS CLEARANCE

- Reduced hyolaryngeal excursion
- Reduced tongue base
- Reduced pharyngeal wall movement

Focus on pharyngeal

What is the sign?

What is the physiologic cause?

What treatment techniques are indicated?

What evidence do we have for the technique?

- Some listed as “rehabilitative” may only have evidence to support a compensatory effect

A strategy may address more than one impairment in physiology

Super-supraglottic
- Airway closure
- Timing of closure
- Movement

Effortful swallow
- Movement
- Timing
- Duration
- Bolus flow
- Pressures

Selecting treatment objectives

Sign	Physiology	Treatment Techniques (R?)
Aspiration **before** the swallow	Decreased back of tongue	k,g
		Pressure on tongue blade
	Delayed swallow	Thermal stim
		Sour, carbonation
		Prep: 3-second
		Neurosensory stim
		Supra and super-supra, Mendelsohn

Efficacy of Mechanical, Cold, Gustatory and Combined Stimulation

Study broke the components down

Normal healthy adults

Only when all three components were presented was there statistically quicker average activity compared to no stimulation

Used a different methodology: slowly introduced liquid bolus until patient felt capable of swallowing

Support explanation of temporary facilitative effect of this stimulus combination on swallow-specific activity

Raised more questions than it answered
- Sciortino, et al 2003

Efficacy: Gustatory (Sour)(Pelletier, 2003)

11 SNF residents

10 aspirated water (1 penetrator)

Citric acid (2.7%) improved swallowing safety compared to water

Eliminated aspiration in 8/10

Efficacy: Gustatory (Sour) (Pelletier, 2003)

Taste stimuli increased the # of spontaneous swallows observed within 1 minute after initial swallow compared to water

Gustatory stimuli might facilitate swallowing in some patients with neurogenic dysphagia

Best response in patients without dementia

Lemon glycerin swabs Trenter-Roth 1986

When used for oral hygiene, considered ineffective

- Lemon reduces oral pH to 2-4 (below the normal 6-7)
- Acid conditions can irritate the mouth, cause pain and decalcify teeth and increase risk of dental caries
- Glycerin dehydrates the oral tissues

Trenter-Roth & Creason 1986

Coleman 2002

Effects of sour on tongue movements

16 healthy adults

Tongue movement data for tongue body and dorsum

Water, high intensity sour (2.7% citric acid), moderate intensity sour, moderate sweet, sweet-sour

High intensity sour stimulus elicited significantly larger amplitude and higher peak velocity forward and backward tongue body movements than other stimuli

Suggests Trigeminal irritation may be required to influence bolus transmit times during swallowing

Steele & Pelletier 2007

Carbonation

Carbonated thickened liquids decreased penetration and aspiration on 5 ml boluses during instrumental exam

- Sdravou et al 2012

Better PenAsp scores with carbonated compared to non-carbonated barium on VFSS

- Turkington 2017

Prepping the system

Three second prep

Suck-swallow with added sensory input ((Neurosensory stim)

Three-step swallow (Langmore)

Added benefits on timing

Supraglottic and super-supraglottic originally intended to improve closure

Found to have impact on timing in healthy adults:

- Earlier and longer laryngeal closure
- Higher position of hyoid bone at swallow onset
- Longer PES opening
- Longer duration of hyolaryngeal complex movement
  - (Logemann et al 1997)

Added benefits on timing

Mendelsohn found to have impact on timing in a single subject

- Lazarus et al 1993

Selecting treatment techniques

Sign	Physiology	Treatment Techniques (c,d)
Aspiration **before** the swallow	Decreased back of tongue	Chin down (c) Control bolus size (c) Thickened liquids (d)*
	Delayed swallow	

Thickening – lessons from Protocol 201

Honey thick liquids most effective in immediately eliminating aspiration

- Patients didn't like it

Patients who aspirated on all, and were randomized to honey, got more pneumonia

- More patients assigned to thickened liquids (than chin down) had dehydration, UTI and fever

A word on thickening and carbonation

Thickening carbonated liquids decreased effect of both starch and gum-based thickening agents

Rendered thickened carbonated liquid thinner than a non-thickened carbonated liquid

- Bulow et al 2003

Selecting treatment techniques

Sign	Physiology	Treatment technique (R)
Aspiration **during** the swallow	Decreased closure of larynx	Supraglottic
		Super-supraglottic
		Breath hold (Valsalva)
		Vowel initiate words
	Mistiming of laryngeal elevation/closure Shortened duration of closure	Supraglottic
		Mendelsohn Effortful swallow

Efficacy studies - particular approach

Laryngeal closure: Valsalva, Supraglottic and Supersupraglottic

- Some subjects close glottis during breath hold, and others did not
- Arytenoid approximation and true vocal fold closure were produced consistently by the majority of subjects on all breath hold maneuvers, but false vocal fold approximation and anterior arytenoid tilting accomplished by majority of subjects only during effortful breath-hold conditions
  - (Mendlesohn & Martin, et al 1993)

Efficacy studies - particular approach

Laryngeal closure: Valsalva, Supraglottic and Supersupraglottic

- Normal subjects produced earlier cricopharyngeal opening, prolonged pharyngeal swallow, some degree of laryngeal valving before swallow, and change in extent of vertical laryngeal position before the swallow
- Changes more successful and maintained longer with SSG than SG
- Breath-holding maneuvers alter not only airway conditions before swallow but also temporal relationships and biomechanical events during (Ohmae, et al 1996)

Efficacy studies: Breath-hold

(Brady, 2002)

Effortful breath hold instruction most effective method to obtain TVC closure

Inhale/easy breath hold least effective

Easy breath hold better than inhale/easy

Instructions for supraglottic to take a deep breath and then hold may be counter-productive

Caution: Supraglottic and super-supraglottic

Prolonged voluntary closure of glottis may create Valsalva maneuver, which has been associated with sudden cardiac death and cardiac arrhythmias

Subjects: recent stroke, dysphagia and/or CAD

86% demonstrated abnormal cardiac findings(supraventricular tachycardia, premature atrial and ventricular contractions)

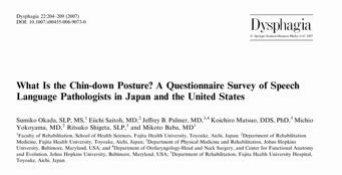
SG and SSG contraindicated for patients with history of stroke or CAD

- (Chaudhuri et al 2002)

Selecting treatment techniques

Sign	Physiology	Treatment Technique (c,d)
Aspiration **during** the swallow	Decreased closure	Head rotation(C) Chin down (C) Thick liquids (d) Bolus size (d)
	Mistiming of laryngeal elevation/closure	

Chin down – do we all agree on what that is?


Dysphagia 22:204–209 (2007)
DOI: 10.1007/s00455-006-9073-0

Dysphagia

What Is the Chin-down Posture? A Questionnaire Survey of Speech Language Pathologists in Japan and the United States

Sumiko Okada, SLP, MS,[1] Eiichi Saitoh, MD,[2] Jeffrey B. Palmer, MD,[3,4] Koichiro Matsuo, DDS, PhD,[5] Michio Yokoyama, MD,[2] Ritsuko Shigeta, SLP,[2] and Mikoto Baba, MD[2]

[1]Faculty of Rehabilitation, School of Health Sciences, Fujita Health University, Toyoake, Aichi, Japan. [2]Department of Rehabilitation Medicine, Fujita Health University, Toyoake, Aichi, Japan; [3]Department of Physical Medicine and Rehabilitation, Johns Hopkins University, Baltimore, Maryland, USA; and [4]Department of Otolaryngology-Head and Neck Surgery, and Center for Functional Anatomy and Evolution, Johns Hopkins University, Baltimore, Maryland, USA. [5]Department of Rehabilitation, Fujita Health University Hospital, Toyoake, Aichi, Japan.

Survey with five pictures with variety of head and neck positions

23% of Japanese and 58% of US SLPs made a distinction between chin down and chin tuck

This may explain varying results of published studies on effects of chin down

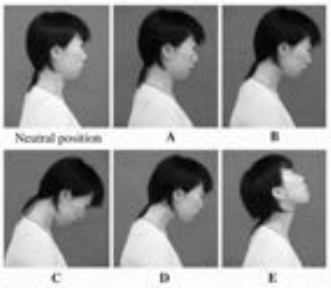


Fig. 1. The figure sheet used for the questionnaire. Functional-anatomical terms are (A) head flexion on the neck position; (B) neck flexion position; (C) combined head and neck flexion position; (D) head extension neck flexion position; (E) combined head and neck extension position. The photos were presented without functional-anatomical captions.

Chin down – the good & bad

Posterior shift of AP structures

Narrowed laryngeal entrance

Narrowed distance from epiglottis to pharyngeal wall and entrance

Widened angle of epiglottis
- Welch et al 1993

Dementia w or w/o Parkinson's

77% reduction in vallecular area

76% of those with reduction aspirated
- Kunduk et al

Chin down

8 healthy volunteers

Reduced laryngohyoid distance

Reduced hyoid-mandibular distance

Weaker pharyngeal contractions
- Bulow et al 1999

Efficacy: chin down (Lewin et al 2001)

However… in 21 esophagectomy patients
- Associated with potential trauma to recurrent laryngeal nerve

Who had impaired elevation and anterior movement of hyolaryngeal complex with aspiration during swallow in 100% cases……..

Aspiration was eliminated in 81% of aspirators with the chin tuck maneuver

Head rotation (and other postural changes)

Head rotation was one of the postural changes studied in 32 patients s/p head and neck CA surgery

Each posture eliminated aspiration in at least 50% of patients

- Logemann et al 1994

Head rotation

Head rotation to the damaged side twists the pharynx and closes the damaged side so that food flows down the more normal side

- Logemann, Kahrilas, Kobara & Vakil, 1989

Used when there is a unilateral pharyngeal wall impairment or unilateral vocal fold weakness

Head rotation

320 detector row CT revealed increased volume, length and cross-sectional area of the pyriform sinuses in healthy volunteers

- Nakayama et al DRS 2010

Thick liquids and timing

Healthy Young

Increased velocities and higher peak velocities with nectar thick compared to thin

- *Hyoid moved faster and further*

Perhaps this is why thickened liquids contribute to improved airway protection

- Facilitating more timely laryngeal vestibule closure

Selecting treatment techniques

Sign	Physiology	Treatment techniques (R)
Aspiration **after from pyriform sinus residue**	Decreased laryngeal elevation	Mendelsohn
		With SEMG
		Falsetto/Effortful pitch glide
	Decreased anterior movement of hyolaryngeal complex	Head lift/CTAR
		Mendelsohn

Efficacy- particular treatment method

Mendelsohn maneuver

- Use of maneuver increased the duration of the anterior-superior excursion of the larynx and hyoid and delayed sphincter closure by maintaining traction on anterior sphincter wall
  - (Kahrilas, et al 1991)
- Improved extent of UES and bolus head velocity
  - (Logemann & Kahrilas, 1990)

Efficacy of specific method

Mendelsohn with SEMG

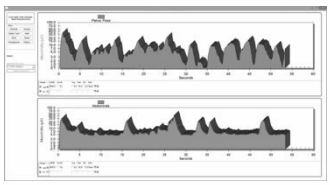
- Changes in swallow physiology
- Improved coordination, longer duration, and increased effort
- Sustained oral and pharyngeal postures inhibited some of the transient movements noted as part of incomplete swallow (e.g. lingual pumping, repetitive pharyngeal contraction) (Crary, 1995)

Efficacy of specific treatment techniques

SEMG biofeedback

- Chronic dysphagia secondary to brainstem stroke
- Physiologic change in swallowing as measured by severity ratings on VFSS
- 8 of 10 able to return to full oral intake with elimination of G-tube
- Average of 5.3 months

- Huckabee & Cannito, 1999
- Bryant, 1991
- Crary, 1995



Efficacy of specific treatment techniques

SEMG biofeedback

- Stroke and Head/Neck Cancer patients
- Reduced hyolaryngeal elevation, reduced pharyngoesophageal segment opening & residue
- Daily 50 minute sessions and portable biofeedback to practice at home
  - Average # sessions 12/stroke and 9/head & neck
- 87% of patients increased functional oral intake by at least one scale score on FOIS
  - Stroke had more functional gains
    - Crary, et al 2004

A poor woman's biofeedback

Thanks to Maggie Lee Huckabee for the idea

EMST

The EMST device is a calibrated instrument consisting of a mouthpiece with a one-way spring-loaded valve (Baker et al., 2005), and it is referred to as an expiratory pressure threshold trainer.

The valve blocks airflow produced by the user until a sufficient "threshold" pressure is produced to overcome the force.

EMST

www.aspireproducts.org

SEMG of submental muscles with EMST

Patterns of activation in the submental muscles while training on EMST had longer duration of activation with higher amplitude compared to swallowing

- Increases motor unit recruitment

EMST compared to other techniques

Wheeler-Hegland, et al 2008

25 healthy male subjects

Compared normal swallow, effortful swallow, Mendelsohn and EMST

- Videofluorographic measurements and SEMG

The target threshold was defined as 75% of each participant's MEP.

EMST

Compared to normal swallow, Mendelsohn and Effortful swallow, there was less hyoid displacement with EMST

- Speaks to specificity of the task

EMST achieved higher maximum and average submental sEMG activity versus normal swallowing.

EMST

With the Mendelsohn maneuver and effortful swallow, the load imposed was volitional.

- That is, the submental muscle activity found to increase on sEMG resulted from the intention of the participant to "squeeze" those muscles, or to "swallow hard."

Conversely, the load imposed by EMST results from an externally imposed threshold that must be overcome in order to break the spring-loaded valve and allow air to flow through the device.

EMST

EMST has potential to induce strength gains in the submental muscles secondary to the externally imposed load.

Expiratory muscle strength training (EMST) increases motor unit recruitment of the submental muscle complex.

- Wheeler, K. M., Chiara, T., & Sapienza, C. M. (2007).

Efficacy of specific treatment technique

Head Lift

- Health elderly: Increase in:
- magnitude of anterior excursion of the larynx
- maximum A-P diameter
- cross-sectional area of UES
- decrease in hypopharyngeal intrabolus pressure (decrease in pharyngeal outflow resistance)
- Strengthens suprahyoid muscles
  - Shaker et al 1997

Efficacy: head lift

14 healthy elderly and 14 healthy young

AP deglutitive UES opening and hyoid bone and thyroid cartilage anterior excursion are reduced in the elderly

Associated with higher intra-bolus pressure

Suggests higher pharyngeal resistance

- Kern et al 1999

Efficacy: Head lift (Shaker et al 2002)

27 patients (hemispheric CVA, brainstem CVA, pharyngeal radiation)

Six weeks of exercise vs. sham

Improvement in:

- UES opening
- Anterior laryngeal excursion
- Post-deglutitive aspiration resolved
- Returned to PO

Efficacy: Head lift (patients)

In addition to strengthening suprahyoid muscles…

Augments thyrohyoid muscle shortening

11 patients with UES dysfunction

Compared traditional therapy to Shaker

- Mepani et al 2009

Shaker compared to traditional

Pre and post MBS

Traditional: Super-supraglottic; Mendelsohn; Tongue base; yawning; gargle; tongue pull back

Shaker vs. traditional

Shaker: reduced post swallow aspiration to greater degree than traditional

Traditional: superior hyoid and laryngeal better (uses greater muscle effort than Shaker)

Both: significant increase in width of UES opening on paste

Aspiration after: Shaker

Reduced range of movement in structures of pharynx: traditional therapy

Chin tuck against resistance

CTAR using ball

CTAR

Increase in submental muscle activity with use of CTAR in healthy adults

- Yoon et al 2014

S-CTAR

Swallow CTAR

36 healthy adults

Higher mean and and maximum sEMG values with S-CTAR compared to:

- Normal swallow
- CTAR

Yoon et al DRS Poster 2017

Falsetto/Effortful Pitch Glide

Falsetto- hypothesis that elevation for falsetto will facilitate elevation for swallow

Effortful Pitch Glide (Miloro et al 2014) – Healthy Adults

Saw similarity in movements with EPG and swallow

- Anterior hyoid
- Hyolaryngeal approximation
- Laryngeal elevatin
- Lateral pharyngeal wall medialization

Only superior hyoid movement was greater during swallowing

Selecting treatment techniques

Sign	Physiology	Treatment Technique (c,d)
Aspiration **after from pyriform sinus residue**	Decreased laryngeal elevation	Liquid wash (c) Multiple swallows (c) Bolus size (c) Head rotation (c) Avoid sticky (d) Thickened liquids (d)
	Decreased anterior movement of hyolaryngeal complex	

Selecting treatment techniques

Sign	Physiology	Treatment Techniques (R)
Aspiration **after from penetration** into laryngeal vestibule	Decreased laryngeal elevation	Mendelsohn
		Falsetto/EPG
	Decreased arytenoid tipping	Super-supraglottic
	Slow or mistimed closure of larynx	Mendelsohn
		Supraglottic

Selecting treatment techniques

Sign	Physiology	Treatment Techniques (c,d)
Aspiration **after from penetration** into laryngeal vestibule	Decreased laryngeal elevation	Bolus size (c) Chin down (c) Thickened liquids (d)
	Decreased arytenoid tipping	
	Slow or mistimed closure of larynx	

Selecting treatment techniques

Sign	Physiology	Treatment techniques (R)
Aspiration **after from vallecular residue/ pharygeal wall**	Decreased tongue base movement	Tongue retraction Effort, yawn, gargle
	Decreased pharyngeal wall movement	Yawn Gargle /i/ Tongue hold
	Decreased laryngeal elevation	Mendelsohn Falsetto

Efficacy: Three techniques on Maximum Posterior Movement of Tongue Base (Veis, et al 2000)

Pull-back (tongue retraction): "Pull the back of your tongue to the back of your mouth and hold for a second"

Yawn: "Pull your tongue back during a yawn and hold for a second"

Gargle: "Pull your tongue back during a gargle and hold for a second"
- (Subjects were consecutively referred patients)

Efficacy: Three techniques on Maximum Posterior Movement of Tongue Base (Veis, et al 2000)

Gargle task most successful in eliciting more tongue base retraction for the group of subjects (although not in every subject)

Number of repeat swallows on each bolus correlated significantly with approximate % of residue in valleculae

Efficacy: Tongue hold (Masako)

CA patients with tongue resection

Noted increased anterior bulging of PPW 3 months after surgery

More bulging with greater tongue resection

Suggested PPW could compensate

- Fujiu et al 1995

Efficacy: Tongue hold (Masako)

10 normal adults

Increased PPW bulging at mid and inferior levels of second cervical vertebra

- Fujiu & Logemann, 1996

Tongue hold (Masako)

Do NOT use with food

- The move impairs some of the natural movements of swallowing (inhibits tongue base retraction)

Three negative findings:

- Increased pharyngeal residue, particularly in valleculae
- Shortened duration of airway closure
- Increased pharyngeal delay time in triggering the pharyngeal swallow

More evidence that tongue hold is rehabilitative only Doeltgen et al 2007

20 healthy participants

Tongue hold swallows created significantly lower pressures in upper pharynx than non-effortful saliva swallows

The increased anterior bulge cannot compensate for decreased pressure generation at level of upper pharynx

- This might impede bolus flow through the pharynx

Effortful swallow: unintended consequences

Patient changed mechanics of swallow

Interfered with typical bolus flow

Used abnormal tongue base seal with bolus still in oral cavity

Resulted in nasal backflow

Authors stressed importance of carefully monitoring behaviors taught

They observed this on MBS, and could not tell clinically

Garcia, Hakel, Lazarus

Effortful swallow and esophagus

Healthy adults

Effortful swallowing resulted in increased peristaltic amplitudes within the distal smooth muscle region of esophagus

Selecting treatment techniques

Sign	Physiology	Treatment techniques (c,d)
Aspiration **after from vallecular residue/ pharyngeal wall**	Decreased tongue base movement	Bolus size (c) Stay seated up (c) Multiple swallow (c) Liquid wash (c) Head rotation (c) Avoid sticky (d)
	Decreased pharyngeal wall movement	
	Decreased laryngeal elevation	

Patient resources

Videos of exercises

Tri-fold brochures

References

Baker, S., Davenport, P., & Sapienza, C. (2005). Examination of strength training and detraining effects in expiratory muscles. *Journal of Speech, Language, and Hearing Research*, *48*(6), 1325-1333.
Bryant, M. (1991). "Biofeedback in the Treatment of a Selected Dysphagic Patient." *Dysphagia*, Vol. 6, pp. 140-144.

Burkhead, L.M., Sapienza, C.M., & Rosenbek, J.C. (2007). Strength-training exercise in dysphagia rehabilitation: Principles, procedures, and directions for future research. Dysphagia, 22, 251-265.

Bülow, M., Olsson, R., & Ekberg, O. (2003). Videoradiographic analysis of how carbonated thin liquids and thickened liquids affect the physiology of swallowing in subjects with aspiration on thin liquids. *Acta Radiologica*, *44*(4), 366-372.

Bülow, M., Olsson, R., & Ekberg, O. (1999). Videomanometric analysis of supraglottic swallow, effortful swallow, and chin tuck in healthy volunteers. *Dysphagia*, *14*(2), 67-72.

Chaudhuri, G., Hildner, C.D., Brady, S., Hutchins, B., Aliga, N., Abadilla, E. (2002). "Cardiovascular Effects of the Supraglottic and Super-supraglottic Swallowing Maneuvers in Stroke Patients with Dysphagia." *Dysphagia*, Vol. 17, pp. 19-23.

Clark, H.M. (2003, November). Neuromuscular treatments for speech and swallowing: A tutorial. American Journal of Speech-Language Pathology, 12, 400-415.

Coleman, P. Improving Oral Health Car for the Frail Elderly: A Review of Widespread Problems and Best Practices; Geriatric Nursing 2002; Vol. 23 No. 4

Crary, M.A. (1995). "A Direct Intervention Program for Chronic Neurongenic Dysphagia Secondary to Brainstem Stroke." Dysphagia, Vol. 10, pp. 6-18

Crary, M.A., Carnaby, G.D., Groher, M.E., Helseth, E., Functional Benefits of Dysphagia Therapy Using Adjunctive sEMG Biofeedback

Doeltgen S Huckabee ML Witte U Gumbley F Pharyngeal Pressure Generation During tongue hold maneuver Presented to DRS March 2007 Vancouver Dysphagia 19: 160-164 (2004)

Fijiu-Kurachi, M., Fujiwara, S, Tamine, K., Kondo, J., Minagi, Y., Maeda, Y., Hori, K., Ono, T. Tongue Pressure Generation During Tongue-Hold Swallows in Young Healthy Adults Measured with Different Tongue Positions Dysphagia (2014) 29: 17-24

Fujiu, M., & Logemann, J. A. (1996). Effect of a tongue-holding maneuver on posterior pharyngeal wall movement duringdeglutition. *American Journal of Speech-Language Pathology*, *5*(1), 23-30.

Garcia, J.M., Hakel, M., Lazarus, C. Unexpected Consequence of Effortful Swallowing: Case Study Report. Journal of Medical Speech-Language Pathology Vol. 12, No. 2, pp. 59-66

Hewitt, A., Hind, J., Kays, S., Nicosia, M., Doyle, J., Tompkins, W., ... & Robbins, J. (2008). Standardized instrument for lingual pressure measurement. Dysphagia, 23(1), 16-25.

Huckabee, M.L., Cannito, M.P. (1999). "Outcomes of Swallowing Rehabilitation in Chronic Brainstem Dysphagia: A Retrospective Evaluation." Dysphagia, Vol. 14, pp. 93-109.

Kahrilas, P.J., Logemann, J.A., Krugler, C., Flanagan, E. (1991). "Volitional Augmentation of Upper Esophageal Sphincter Opening During Swallow." American Physiological Society, Vol. 91, pp. G450 – G456.

Lazarus, C., Logemann, J. A., & Gibbons, P. (1993). Effects of maneuvers on swallowing function in a dysphagic oral cancer patient. Head & neck, 15(5), 419-424.
Lever, R.E., Cox, K.T., Holbert, D., Shahrier, M., Hough, M., Kelley-Salamon, K. 2007 Dysphagia 22: 312-325

Lewin, J.S., Hebert, T.M., Putnam, J.B. & Dubrow, R.A. (2001). "Experience with the Chin Tuck Maneuver in Postesophagectomy." Dysphagia, Vol. 16, pp. 216-219.

Logemann, J. A., Pauloski, B. R., Rademaker, A. W., & Colangelo, L. A. (1997). Super-supraglottic swallow in irradiated head and neck cancer patients. Head & neck, 19(6), 535-540.

Logemann, J.A., Gensler, G., Robbins, J.A., Lindglad, A.S., Brandt, D., Hind, J.A., Kosek, S., Dikeman, K., Kazandjian, M., Gramigna, G.D., Lundy, D., McGarvey-Toler, S., Gardner, P.J.M., (2008) A Randomized Study of Three Interventions for Aspiration of Thin Liquids in Patients with Dementia or Parkinson's Disease JSLHR Vol 51 173-183

Logemann, J., Kahrilas, P., Cobara, M. Vakil, N. (1989). "The Benefit of Head Rotation on Pharyngoesophageal Dysphagia." *Archives of Physical Medicine and Rehabilitation,* Vol. 70, pp. 767-771.

Logemann, J.A., Rademaker, A., Pauloski, B.R., Kelly, A., Stangl-McBreen, C., Antinoja, J., Grande, F., Farquharson, J., Kern, M., Easterling, C., Shaker, R. 2009 Dysphagia 24: 403-411
Miloro, K. V., Pearson, W. G., & Langmore, S. E. (2014). Effortful pitch glide: a potential new exercise evaluated by dynamic MRI. *Journal of Speech, Language, and Hearing Research*, *57*(4), 1243-1250.

Mendelsohn, M. S., & Martin, R. E. (1993). Airway protection during breath-holding. *Annals of Otology, Rhinology & Laryngology*, *102*(12), 941-944.

Mepani, R., Antonik, S., Massey, B., Kern,M., Logemann, J., Pauloski, B., Rademaker, A. Easterling, C., Shaker, R., (2009) Augmentation of Deglutitive Thyrohyoid Muscle Shortening by the Shaker Exercise Dysphagia 24: 26-31

Molfenter, S. M., & Steele, C. M. (2011). Physiological variability in the deglutition literature: hyoid and laryngeal kinematics. *Dysphagia*, *26*(1), 67-74.

Nagy,A., Molfenter, S.M., Peladeau-Pigeon, M., Stokely, S., Steele, C.M. *The Effect of Bolus Consistency on Hyoid Velocity in Healthy Swallowing* Dysphagia 2015 30: 445-451

Northwest, I. O. P. I. (2005). Iowa oral performance instrument: user's manual. *Carnation, WA: IOPI Northwest*.

Ohmae, Y., Logemann, J. A., Hanson, D. G., Kaiser, P., & Kahrilas, P. J. (1996). Effects of two breath-holding maneuvers on oropharyngeal swallow. Annals of Otology, Rhinology & Laryngology, 105(2), 123-131.

Okada, S., Saitoh, E., Palmer, J. B., Matsuo, K., Yokoyama, M., Shigeta, R., & Baba, M. (2007). What is the chin-down posture? A questionnaire survey of speech language pathologists in Japan and the United States. Dysphagia, 22(3), 204-209.

Pelletier, C. A., & Lawless, H. T. (2003). Effect of citric acid and citric acid–sucrose mixtures on swallowing in neurogenic oropharyngeal dysphagia. Dysphagia, 18(4), 231-241.

Robbins, J., Kays, S. A., Gangnon, R. E., Hind, J. A., Hewitt, A. L., Gentry, L. R., & Taylor, A. J. (2007). The effects of lingual exercise in stroke patients with dysphagia. Archives of physical medicine and rehabilitation, 88(2), 150-158.

Robbins, J.A., Gensler, G., Hind, J., logemann, J.A., Lindblad, A.S., Brandt, D., Baum, H., Lilenfeld, D., Kosek, S., Lundy, D., Kideman, K., Kazandjian, M., Gramigna, G.D., McGarvey-Roler, S., Miller, P.J.M, 2008 Annals of Internal Medicine 148: 509-518

Okada, S., Saitoh, E., Palmer, J. B., Matsuo, K., Yokoyama, M., Shigeta, R., & Baba, M. (2007). What is the chin-down posture? A questionnaire survey of speech language pathologists in Japan and the United States. Dysphagia, 22(3), 204-209.

Pelletier, C. A., & Lawless, H. T. (2003). Effect of citric acid and citric acid–sucrose mixtures on swallowing in neurogenic oropharyngeal dysphagia. Dysphagia, 18(4), 231-241.

Robbins, J., Kays, S. A., Gangnon, R. E., Hind, J. A., Hewitt, A. L., Gentry, L. R., & Taylor, A. J. (2007). The effects of lingual exercise in stroke patients with dysphagia. Archives of physical medicine and rehabilitation, 88(2), 150-158.

Robbins, J.A., Gensler, G., Hind, J., logemann, J.A., Lindblad, A.S., Brandt, D., Baum, H., Lilenfeld, D., Kosek, S., Lundy, D., Kideman, K., Kazandjian, M., Gramigna, G.D., McGarvey-Roler, S., Miller, P.J.M, 2008 Annals of Internal Medicine 148: 509-518

Rosenbek, J. C., Robbins, J. A., Roecker, E. B., Coyle, J. L., & Wood, J. L. (1996). A penetration-aspiration scale. *Dysphagia*, *11*(2), 93-98.

Sciortino, K.S., Liss, J.M., Chase, J.L., Gerritsen, K.G.M., Katz, R.C. – Dysphagia Volume 18, 16-26, 2003

Shaker, R., Kern, M., Bardan, E., Stewart, E.T., Hoffmann, R. (1997). "Augmentation of Deglutitive Upper Esophageal Sphincter Opening in the Elderly by Exercise." *The American Journal of Psychology*, Vol. 272, pp. G1518 – 22.

Shaker, R., Easterling, C., Kern, M., Nitschke, T., Massey, V. Daniels, S., Grande, B., Kazandjian, M., Dikeman, K. (2002). "Rehabilitation of Swallowing by Exercise in Tube-Fed Patients With Pharyngeal Dysphagia Secondary to Abnormal UES Opening." *American Gastroenterological Association*, Vol. 122, pp. 1314-132

Shaker, R., Bardan, E., Gu, C., Kern, M., Torrico, L., & Toohill, R. (2003). Intrapharyngeal distribution of gastric acid refluxate. *The Laryngoscope*, *113*(7), 1182-1191.

Steele, CM Pelletier CA van Lieshout PHHM Variationgs in Swallowing-Related Tongue movements across 5 different tastant stimuli. Presented to DRS March 2007 Vancouver BC CA

Sdravou, K., Walshe, M., & Dagdilelis, L. (2012). Effects of carbonated liquids on oropharyngeal swallowing measures in people with neurogenic dysphagia. *Dysphagia*, *27*(2), 240-250.

Trenter-Roth, P. Creason, N. Nurse-administered oral hygiene: is there a scientific basis? J Adv Nurs 1986: 11: 323-331 cited in:

Welch, M.V., Logemann, J.A., Rademaker, A.W., Kahrilas, P.J. (1993). "Changes in Pharyngeal Dimensions Effected by Chin Tuck." *American Academy of Physical Medicine and Rehabilitation,* Vol. 74, pp. 178-181.

Wheeler, K.M., Chiara, T., Sapienza, C.M. 2007 Surface Electromyographic Activity of the Submental Muscles During Swallow and Expiratory Pressure Threshold Training Tasks Dysphagia 22: 108-116

Wheeler-Hegland, K. M., Rosenbek, J. C., & Sapienza, C. M. (2008). Submental sEMG and hyoid movement during Mendelsohn maneuver, effortful swallow, and expiratory muscle strength training. *Journal of Speech, Language, and Hearing Research*, *51*(5), 1072-1087.

Wheeler, K. M., Chiara, T., & Sapienza, C. M. (2007). Surface electromyographic activity of the submental muscles during swallow and expiratory pressure threshold training tasks. *Dysphagia*, *22*(2), 108-116.

Yoon, W. L., Khoo, J. K. P., & Liow, S. J. R. (2014). Chin Tuck Against Resistance (CTAR): New Method for Enhancing Suprahyoid Muscle Activity Using a Shaker-type Exercise. *Dysphagia*, *29*(2), 243-248.