Best Practices in Deficit-Based Dysphagia Management
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Iowa Speech-Language-Hearing Association Fall Convention
Thursday, October 16, 2019

ABSTRACT
Effective dysphagia management requires accurate diagnosis and deficit-specific intervention. We discussed best practices and collaboration for videofluoroscopic swallowing evaluation, and relationships between clinical manifestations of dysphagia and their underlying physiology.

LEARNING OBJECTIVES
After participating in this seminar, learners will be able to:
• Explain principles of deficit-based management.
• Describe symptoms and deficits in sensory- and motor-based dysphagia.
• Summarize perspectives, best practices, and collaborative strategies for VFSS administration and interpretation across relevant disciplines.

INTRODUCTION
• Dysphagia management has some unique challenges compared to other types of rehab services
  o Risks, timeline, impact of deficits

DEFICIT-DRIVEN DYSPHAGIA ASSESSMENT
• Symptoms vs signs vs impairments vs deficits; different but related to each other in somewhat predictable ways
• A range of assessment tools to address these different levels
  o Symptom: client-reported limitation
    ▪ Eating Assessment Tool (EAT-10), M.D. Anderson Dysphagia Inventory (MDADI), SWAL-QOL and SWAL-CARE, Dysphagia Handicap Index (DHI)
  o Sign: clinician-observed limitation
    ▪ Massey Bedside Swallow Screen, Mann Assessment of Swallowing Ability (MASA)
  o Impairment: functional effect
    ▪ Penetration-Aspiration Scale (PAS), Functional Oral Intake Scale (FOIS), ASHA National Outcome Measurement System (NOMS), Dysphagia Outcome Severity Scale (DOSS)
  o Deficit: anatomical/physiological abnormality
    ▪ Modified Barium Swallow Impairment Profile (MBSImP™), Test of Mastication and Swallowing Solids (TOMASS), Computational Analysis of Swallowing Mechanics (CASM)
• Indications of sensory, motor, and sensorimotor deficits
  - **Sensory**: somewhat stimulus-specific; over-responsivity, under-responsivity, stimulus-seeking
  - **Motor**: fairly consistent across circumstances; weakness, abnormal tone
  - **Sensorimotor**: breakdown in sensory processing/integration and/or formulating appropriate motor response to stimulus; incoordination re: timing and amplitude of movements

• The nature of the deficit determines the management approach
  - Need to consider additional factors such as developmental vs. acquired, acute vs. chronic, single-incident vs. degenerative, sensory vs. motor vs. sensorimotor vs. other
  - Accurate identification of impairments and deficits is critical for treatment selection and success

**ASSESSMENT BEST PRACTICES**

• Some oral deficits may be identified via clinical assessment tools, but pharyngeal deficits require **visualization** of the relevant anatomy and physiology (FEES or VFSS)
• FEES requires specific additional training and mentorship for the clinician plus endoscopy equipment and means to disinfect the equipment.
• VFSS requires specific training/mentorship, videofluoroscopic equipment, and **collaboration** with another discipline.
  - Neither Radiologists nor SLPs are solely responsible for interpretation of VFSS
    - Radiologist and SLP present throughout image acquisition
    - Both create a report but may prioritize different information depending on professional **guidelines** and **perspective**, leading to potential false dichotomy
  - **Teambuilding strategies**
    - Start from shared GOALS to avoid us/them mentality:
      1. accurate diagnosis of swallowing anatomy and physiology
      2. best possible patient-centered care
      3. **balance between obtaining adequate images for assessment and minimizing radiation dose**
    - Establish mutual respect for what each team member brings re: expertise by all disciplines reviewing each other’s practice guidelines and relevant literature
      1. SLP: ASHA Guidelines for VFSS, Knowledge and Skills for VFSS
      2. Radiology: American College of Radiology and the American Association of Physicists in Medicine
    - Clarify specific approaches, outcome measures, and common language/terms such as “frame rate” versus “pulse rate” and desired field of view
    - Establish routine interactions, both formal and informal, between disciplines outside the VFSS suite: in-services, luncheons, happy hours, emails to share literature
Consider joint, formalized QA program with specified outcomes to guide revision of strategies as needed

DEFICIT-DRIVEN DYSPHAGIA MANAGEMENT STRATEGIES

- Evidence-based dysphagia management
  - Strive to balance scientific evidence (quantitative research studies), clinical experience (professional consensus statements, practice groups, evidence-based continuing education) and patient circumstances (QoL, treatment burden, satisfaction surveys)
  - We are not limited to the evidence in SLP journals! (More about that later today)

Compensatory Strategies
- Immediate effects regarding bolus flow and/or airway protection, a bolus is present
- Some consideration of how strategies fit impairments, but not necessarily deficits
- Test (instrumentally) to determine whether they successfully reduce risks associated with impairments

Oral/lingual control & propulsion
- Head tilt – no peer-reviewed published evidence but consistent with what we know of physics and physiology (Logemann, 1983).
- Effortful swallow – strong support via multiple reports of improvements in linguopalatal pressures in younger (Clark & Shelton, 2014, Fukuoka et al., 2013, and Steele et al., 2010) and older (Yeates et al. 2010) healthy adults. Noted improvements in linguopalatal and pharyngeal-tongue base pressures in HNC pts after XRT (Lenius et al., 2015).
- Altered diet texture – meta-analysis of 22 papers found reduction in aspiration risk seen on VFSS but not on clinical aspiration/pneumonia rates (Painter et al., 2017), another systematic review and meta-analysis of thin vs. thick liquid intake identified no difference in aspiration rates for those who aspirated on thin (Kaneoka et al., 2017). IDDSI offers standardization and testing (Cichero et al., 2017).
- Chin down/chin tuck – solid evidence that this position facilitates tongue-to-palate contact pressures for oral containment (Hori et al., 2011). Additionally, duration of tongue base/pharyngeal wall contact pressure in healthy persons (Balou et al., 2014), as well as pharyngeal constriction ratio and pyriform residue in patients status-post esophagectomy (Kumai et al., 2017).
- Chin up/neck extension – improved oral clearance times and completeness with chin up positioning during VFSS status-post glossectomy (Furia et al., 2000; Halczy-Kowalik et al., 2015), but only considered for patients with adequate laryngeal closure or who can simultaneously utilize supraglottic swallow because associated with earlier LVC closure and later HLE in healthy people (Calvo et al., 2017).
- Respiratory-swallow training – strong preliminary evidence of immediate improvement in tongue base retraction per MBSimP rating (Martin-Harris et al., 2015).

Temporal aspects (onset of pharyngeal response, pharyngeal transit time, etc.)
- Tactile-thermal stimulation (TTS) – very specific cold stimulation to anterior faucial arches has had mixed results at best; little evidence regarding carryover to nutritive non-stimulated swallows within same person (Miyaoka et al., 2006; Regan et al., 2010; Rosenbek et al., 1998; Scioritino et al., 2003).
Deficit-Based Dysphagia Management

Altered liquid consistencies – multiple RCTs (Logemann et al., 2008; Robbins et al., 2008) and a systematic review and meta-analysis (Kaneoka et al., 2017) conclude that thickened liquids are relatively successful at immediately eliminating aspiration on VFSS (without regard to nature of dysphagia), but rates of aspiration-related complications such as pneumonia in known aspirators was no different for thin vs thick liquids.

Tongue base to posterior-pharyngeal wall contact

- **Head turn** – convincing evidence of increased duration of UES opening, decreased residual UES resistance/pressure (Balou et al., 2014), and (when combined with chin tuck) reduced vallecular residue (Nagy et al, 2016).

- **Effortful swallow** – strong evidence of improved pharyngeal pressures and faster UES opening in healthy participants (Doeltgen et al., 2017), more complete pharyngeal constriction in healthy people (Fritz et al., 2014), and pharyngeal-tongue base pressures in patients post-XRT (Lenius et al., 2015).

- **Masako (tongue-hold) exercise** – immediate effects on a range of outcome measures in healthy people (Fujiu-Kurachi et al., 2014; Hammer, Jones, Mielens, Kim, & McCulloch, 2014; Langmore & Pisegna, 2015; Slovarp et al., 2016).

Hyolaryngeal excursion

- **Mendelsohn maneuver** – overwhelming evidence of immediate improvements in HLE with Mendelsohn as measured with sEMG (Ding et al., 2002; Wheeler et al., 2008), manometry (Hoffman et al., 2012), and VFSS kinematics (McCullough & Kim, 2013) compared to control conditions in a range of healthy and dysphagic persons.

- **Effortful swallow** – fair support but depends on instruction and outcome measures as per two systematic reviews (Ashford et al., 2009; Langmore & Pisegna, 2015).

- **Effortful pitch glide** – one study to date, preliminary evidence that low to high glide yields immediate improvement in hyoid elevation and pharyngeal movements in healthy persons (Miloro et al., 2014).

Laryngeal vestibular closure

- **Chin tuck** – chin tuck posture significantly reduces AP diameter of the laryngeal inlet in healthy people (Leigh et al, 2015) and increases the duration of LVC closure (Macrae et al., 2014).

- **Supraglottic swallow maneuver (and variations)** – research is old but consistently indicated tighter TVC closure with supraglottic, plus arytenoid-epiglottis approximation with super-supraglottic (Martin et al., 1993; Ohmae et al., 1996).

Sensory deficits - Exploratory work is building a body of literature examining:

- coincidence of sensory deficits and dysphagia

- immediate effects of sensory stimulation on swallow function
  - carbonation may possibly help?? (Turkington et al., 2017)
  - for cold boluses, inconsistent evidence of more rapid swallow overall (Cola et al., 2010 vs. Michou et al., 2012); more consistent evidence of increase esophageal contractions (Choi et al., 2014; Elvevi et al., 2014).
  - good evidence of sour taste stimuli altering swallowing timing/mechanics (Lee et al., 2012; Logemann et al., 1995; Pauloski et al., 2013; Pelletier & Lawless, 2003); exploratory work for more palatable options (Dietsch et al., 2016).
Rehabilitation Strategies

- Longer-term effects on swallowing physiology even when technique not being performed, often performed when bolus is not present.
- Principles of exercise – specificity, intensity, load/resistance
- Several recent reviews of the dysphagia exercise literature (Ashford et al., 2009; Langmore & Pisegna, 2015; McKenna et al., 2017; Rogus-Pulia & Connor, 2016; Waito et al., 2017).

Oral/lingual control & propulsion

- **Expiratory muscle strength training (EMST)** - improved buccinator strength documented in one RCT (Park JS et al., 2016).
- **Tongue-to-palate strength training** – most studies use one of two commercial systems to measure/train pressures, mixed results at best re: functional bolus control effects despite consistent evidence of increased tongue-to-palate pressures (Lazarus et al., 2014; Namasivayam-MacDonald et al., 2017; Oh, 2015; Park JS et al., 2015; Robbins et al., 2005; Rogus-Pulia et al., 2016; Yeates et al., 2008).
- **Deep pharyngeal nerve stimulation (DPNS)** - no peer-reviewed published evidence
- **Effortful swallow** – moderate evidence of long-term benefits to tongue strength and oral manipulation in patient groups after 4-6 weeks of exercise (Clark & Shelton, 2014; Kraaijenga et al., 2017). Others noted higher tongue-to-palate pressures in healthy persons after several weeks of training (Oh, 2015; Park T & Kim, 2016).

Temporal aspects (onset of pharyngeal response, pharyngeal transit time, etc.)

- **Tactile-thermal stimulation (TTS)** – no evidence of sustained effects
- **McNeill Dysphagia Therapy Program (MDTP)** – improved functional outcomes reported in limited trials but several issues with controls and outcome measures (Carnaby-Mann & Crary, 2010; Crary, Carnaby, LaGorio, & Carvajal, 2012; Lan et al., 2012).
- **Neuromuscular electrical stimulation (NMES)** – Several commercial systems; most studies found little benefit in comparison to “traditional therapy” in a range of patient groups; sensory level of stimulation generally more favorable than contraction-eliciting level (Baijens et al., 2008; Byeon & Koh, 2016; Christiaanse et al., 2011; Gallas et al., 2010; Heijnenet al., 2012; Lim et al., 2009; Xia et al., 2011; Zhang et al., 2016).

Tongue base to posterior-pharyngeal wall contact

- **Tongue-to-palate strength and accuracy training** – Solid RCT evidence supports reduced vallecular residue in post stroke population (Steele et al., 2016) but not BI (Steele et al., 2013).
- **Effortful swallow** - Mixed evidence for increased pharyngeal pressures, pharyngeal constriction ratios (summarized in Langmore & Pisegna, 2015); improved PCR shown when combined with NMES but no control condition (Kim et al., 2017).
- **DPNS** – no peer-reviewed published evidence
- **Masako (tongue-hold) exercise** – limited evidence of long-term benefit (Langmore & Pisena, 2015); one study compared Masako to NMES after stroke and found equal benefit after 5/wk x 4wks (Byeon, 2016b).
- **Respiratory-swallow training** – improved tongue base retraction sustained 1 month after treatment (Martin-Harris et al., 2015).
Hyolaryngeal excursion

- **Shaker/Chin tuck against resistance (CTAR)** – Early Shaker literature strongly supports improvements maintained over time; more recent papers focus on CTAR vs Shaker with generally comparable results for the two exercises (Easterling et al., 2005; Gao & Zhang, 2016; Logemann et al., 2009; Mishra et al., 2015; Sze et al., 2016; Yoon et al., 2014).

- **EMST** – strong evidence of improved hyoid displacement and/or improved respiratory support/coordination; results maintained in multiple patient populations; appropriate level of resistance is key (Byeon, 2016a; Hegland et al., 2016; JS Park JS et al., 2017; JS Park et al., 2016; Plowman et al., 2016; Reyes et al., 2015; Troche et al., 2010; Troche et al., 2014).

- **Tongue-to-palate strength training** – One study identified greater anterior and superior hyoid movements and UES opening in elderly patients with dysphagia symptoms after 2x/day tongue press exercises over a month (Namiki et al., 2019)

- **DPNS** – no peer-reviewed published evidence

- **MDTP** – improvements reported in one uncontrolled study (Sia et al, 2015); no other published reports

- **Mendelsohn maneuver** – strong evidence of extended benefit in multiple well-controlled studies including multiple populations and outcome measures (Ding et al., 2002; Hoffman et al., 2012; Langmore & Pisegna, 2015; McCullough & Kim, 2013).

- **Effortful swallow** – positive evidence of long-term benefit in some studies but differences in dosing and exercise regime confound interpretation of studies (Ashford et al., 2009; Kraaijenga et al., 2015; Langmore & Pisegna, 2015; JW Park et al, 2012); one study of patients with head/neck CA found no significant changes in HLE (Kraaijenga et al., 2017).

- **NMES** – some poorly controlled studies show limited benefit in comparison to or in combination with “traditional therapy” (Beom et al., 2015; Tang et al., 2017); others found no benefit in well-controlled studies (Christiaanse et al., 2011; Heijnen et al., 2012; Langmore et al., 2016; Ryu et al., 2009; Zhang et al., 2016) and even reductions in HLE and swallowing safety depending on electrode placements (Humbert et al., 2006).

Laryngeal vestibular closure

- **Respiratory-swallow training** – improved laryngeal vestibular sustained 1 month after treatment (Martin-Harris et al., 2015).

Prophylaxis in head-neck cancer

- Several programs of exercise being evaluated (Cnossen et al., 2017; Govender et al., 2017; Kraaijenga et al., 2015; Mortensen et al., 2015; Ohba et al., 2016; Wallet al., 2016); key is compliance, recent systematic review summarizes results of several key studies (Govender et al., 2017).

Neuroplasticity – several types of exploratory work

- **Transcranial magnetic stimulation** – better recovery compared to sham maintained 3 months post-treatment, stimulate unaffected hemisphere, settings matter (Du et al., 2016; Kumar et al., 2011; Pisegna et al., 2016; Yang et al., 2015).

- **TTS** – increased neural activation in swallows with vs. without TTS (Teismann et al., 2009).

- **Other tactile stimulation** – Punctate saltatory facial stimulation (Rosner & Barlow 2016) led to long-term changes in oromotor neural cortex; vibration over the larynx (Mulheren & Ludlow, 2017) increased bloodflow to swallowing-relevant regions.
• **Taste stimulation** – several labs have shown increased cortical bloodflow to relevant regions with taste stimuli (Babaei et al., 2010; Humbert & Joel, 2012; Mulheren & Ludlow, 2017; Wahab et al., 2010); preliminary work in Dietsch lab is exploring the longer-term neuroplastic changes and recovery of swallowing motor patterns associated with specific taste stimuli.

**Computer modeling** – general and individualized computer models of human swallowing may enable better surgical and treatment planning.

**Summary**

- Quantity and quality of evidence ranges widely
- Concerning trend toward most costly trainings/equipment having least extensive evidence base (DPNS, MDTP, NMES)
- Focus expanding to include multiple systems (respiratory, neural bases) as well as functional outcomes of interventions
- Building solid foundation of evidence is slow, requires collaboration between clinicians and researchers to be relevant and reliable

**REFERENCES** – these some key references that cover main principles of this presentation. For access to entire list of references, please visit https://sisc.unl.edu/isha2019

** designates review or meta-analyses papers


International Atomic Energy Agency, Radiation protection of patients: fluoroscopy. Downloaded from rpop.iaea.org.


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<th>Patient-Reported Symptom or Clinician-observed sign</th>
<th>Functional Impairment</th>
<th>Physiological Deficit</th>
<th>Sensory, Motor, Both, Other</th>
<th>Possible Rehab Strategy</th>
<th>Evidence Base for Deficit-Strategy Match?</th>
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