Managing Dysphagia
in an evidence-seeking world

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**AGENDA**

- Review EBP
- Levels of Evidence
- NMES
- Tongue Strengthening
- Dysphagia Screening Approaches
- Use of thickened liquids
- Questions/Answers

As a profession, we must be critical thinkers and reviewers of methods and materials that are on the market. We must seek **efficacy data** that has been published and is peer-reviewed. Incorporation into clinical practice should only occur after the underlying hypothesis has shown some positive results in controlled trials.

**FOOD FOR THOUGHT...**

Logemann, 2002, outlines six main areas that clinicians and researchers should address in the decision-making process when considering adoption of a controversial practice:

- Knowing the source of the controversy (rationale, outcome data, risks/benefits, perceived effectiveness)
- Appreciating how the controversial technique fits into the realm of accepted methods
- Establishing formal informed consent procedures
- Providing patient-specific criteria for implementation
- Seeking out specialized training in the use of the practice
- Keeping careful documentation and having a non-biased professional evaluate effectiveness
What is Evidence-Based Practice?

“judicious use of current best evidence in making decisions about the care of individual patients... [by] integrating individual clinical expertise with the best available external clinical evidence from systematic research”  
Sackett, et al, 1996

What is Evidence-Based Practice?

EBP allows us to systematically retrieve and synthesize data; make the data available to clinicians; and incorporate the information into clinical practice.

EBP originates from:

- Ongoing concerns about quality
- Variations in diagnosis, hospitalization rates, therapeutic interventions and outcomes

What is Evidence-Based Practice?

The EBP paradigm emphasizes that practice is driven by scientifically based models of clinical practice that are tested or testable in clinical research.

Currently, in rehabilitation medicine, we have great difficulty developing quality indicators that are evidence-based.
What are Levels of Evidence?

- Efficacy
  - The level of benefit expected when interventions are applied under “ideal” conditions of use.

What is the Level of Evidence?

- Effectiveness
  - The level of benefit expected when interventions are rendered under ordinary circumstances by average practitioners for typical patients/clients.
What is the Level of Evidence?

- **Operations**
  - The procedures established/developed to achieve the best outcomes.

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Levels of Evidence

- Randomized clinical trials
- Cohort studies *(with adjustments)*
- Case series
- Case reports
- Consensus expert opinion
Levels of Evidence for treatment studies

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
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<tbody>
<tr>
<td>Ia</td>
<td>Meta-analysis of ≥1 randomized controlled trial</td>
</tr>
<tr>
<td>Ib</td>
<td>Well-designed randomized controlled study</td>
</tr>
<tr>
<td>IIa</td>
<td>Well-designed controlled study without randomization</td>
</tr>
<tr>
<td>IIb</td>
<td>Well-designed quasi-experimental study</td>
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<tr>
<td>III</td>
<td>Well-designed non-experimental studies (i.e., correlational and case studies)</td>
</tr>
<tr>
<td>IV</td>
<td>Expert committee report, consensus conference, clinical experience of respected authorities</td>
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Factors to enhance integration of Research into Clinical Practice

- Level of evidence
- Meaningful outcomes
- No magic bullet or single intervention
- Cost-effective interventions and/or overwhelming social value

3 oz Water Swallow Challenge
3 oz Water Swallow Challenge


- What is it?
- Why controversial?
- Issues to consider

NMES: Electrical Stimulation

- What is it?
- Why controversial?
- Issues to consider
ELECTRICAL STIMULATION

WHAT IS IT?

- Surface electrical stimulation: electrodes placed submentally.
- Claim: e-stim results in + effect for muscle strength, endurance and coordination.
- FDA: cleared VitalStim as a device specifically manufactured to treat the swallowing musculature with electrical stimulation (2001).

ELECTRICAL STIMULATION

VitalStim Study:

- (e-stim) to thermal-tactile stimulation (TS) in patients with dysphagia.
- Results (submitted to FDA):
  - 98.4% of patients improved swallow function score
  - 97.5% of patients w/ severe dysphagia regained swallow function past point of PEG dependency
  - 38.3% of patients w/ severe dysphagia regained full normal swallow function
  - At 3 year f/u, over 76% had retained swallow function; and only 3% reported aspiration

Ludlow Study (2004):

- Participants: 8 patients w/ chronic phx dysphagia.
- Methods (in brief):
  - Each participant given 3 swallow trials of 3ml liquid barium before and after e-stimulation.
  - To investigate: Will e-stim move the hyoid/larynx when applied at rest? and, did e-stim change the freq of aspiration.
- Results:
  - Little change in hyoid elevation
  - Frequency of aspiration and attempts to clear decreased
  - Penetration stayed the same or increased
- Conclusions:
  - Surface e-stim did not induce hyolaryngeal elevation at rest.
  - Suggestion of the sensory aspects of e-stim to the skin may affect aspiration in patients w/ chronic dysphagia
**ELECTRICAL STIMULATION**

**Ludlow Study (2007):**
- **Method** (in brief):
  - Bipolar electrodes; current applied at rest.
  - To investigate: eStim and VFSS. Current min and max.
- **Results:**
  - Significant: hyoid depression during stim at rest.
  - Aspiration & pooling reduced only min electrical levels.
- **Conclusions:**
  - "Patients who had reduced aspiration and penetration during swallowing with stimulation, had greater hyoid depression during stimulation at rest. Stimulation may have acted to resist patient's hyoid elevation during swallowing."

**ELECTRICAL STIMULATION**

Additional published data:
- **FINDINGS:** Because surface electrical stimulation reduced hyolaryngeal elevation during swallowing in normal volunteers, our findings suggest that surface electrical stimulation will reduce elevation during swallowing therapy for dysphagia.

Present thinking:
- Thoughts on motor learning applicability from limb research to swallowing research.

**ELECTRICAL STIMULATION**

Anecdotal data on Vital Stim:

*The positives...*
- Mr. A, dx: ALS, on honey thick liquids/puree meals underwent 20 treatments in 4 weeks. Results: he now eats burgers, fries and BBQ sandwiches. As per MBS, he no longer aspirates. Mr. A is now more intelligible.
- Mr. D, dx: MS, on PEG feeds/NPO, underwent 32 treatments in 6 weeks. Results: can now eat all foods w/ thickened liquids. PEG removed.
ELECTRICAL STIMULATION

Anecdotal data on Vital Stim:

The not-so-positives…

- “I have invested time and money into training SLP staff and have been using VitalStim for several months at our hospital facility. We are not seeing those wonderful success stories.” Example:
- Patient s/p brainstem CVA. After two weeks of daily sessions, MBS shows minimal improvement: some swallow initiation only when electrodes are in place.

EMST:

Expiratory Muscle Strength Training

- Potential use for dysphagia: train expiratory, suprhyoid (submental) and other muscle groups as a modality for improving respiration, swallowing and its integration
- Focus: resp coord, hyolx elevation, VP closure, apneic phase
- More info: Respiratory Muscle Strength Training - Christine Sapienza, PhD, CCC-SLP

www.aspireproducts.org
Tongue strength

Skeletal Muscle composition:
- Type I - slow twitch, fatigue resistant
- Type II - fast twitch, fatigable
  - IIA: adaptable, more efficient Type II fiber
  - IIB: best force generation, but inefficient
- Tongue muscles contain blend of fibers, with a predominance of ONE type
- Orophx: Type II is predominant; unique architecture

Tongue strengthening

THE TONGUE
- Multiple fibers
- Intrinsic muscles of the tongue
- Extrinsic muscles of the tongue
- Multiple directions
  - Fibers that run longitudinally, transversely, vertically; arise from extrinsic structures
  - Lingual movements: forward-back; upward-downward; convex-concave; laterally; tip differentiation; BOT elevation/depression
- All working in synchrony!
TONGUE STRENGTHENING

LINGUAL EXERCISES

• Tongue is major pressure-generating organ in the context of deglutition
• Commonly used for Tx oropharyngeal dysphagia:
  • Reduced tongue stripping
  • Increased oral stasis
  • Lingual pumping
  • Reduced bolus parcellation
  • Reduced bolus cohesion
  • Stasis at pharyngeal recesses (BOT)
  • Other…

TONGUE STRENGTHENING

RESEARCH

• Several studies have looked at tongue strength in the context of swallowing
• Few studies have looked at tongue strength alone
• Look out for:
    • Head/neck cancer population
  • Healthy young adults (20-29yo)
    • Healthy elders

TONGUE STRENGTHENING

RESEARCH

• Terminology:
  • Kinetics: pressure/forces
  • Kinematics: temporospatial
  • Swallowing = series of pressure changes
  • Isometric:
    • Pmax = strength
    • 50% of Pmax = endurance
  • Sarcopenia: muscle atrophy in old age
  • Functional reserve: ability to adapt to stress. Decreases with age.
TONGUE STRENGTHENING

RESEARCH

• Methodology:
  • Most studies have used
    - IOPI-Iowa Oral Pressure Instrument
    - A bulb pressure sensor. Has been used to
      study changes in lingual pressure in
      healthy aging (one sensor/bulb)
    - Kay Elemetrics Swallow Workstation - this
      system allows clinician to use 1-3 sensors
      placed orally.
  • Measurement: “Press against the bulb as
    hard as you can”

TONGUE STRENGTHENING:

IOPI - www.iopi.com

TONGUE STRENGTHENING:

KayPentax DSW - Tongue Bulb Array

www.kaypentax.com
TONGUE STRENGTHENING

RESEARCH

Findings:

- **Head/Neck cancer population** (Lazarus, 2000)
  - Study looked at tongue strength over time
  - Hypothesis: Reduced lingual strength = Reduced oral stripping
  - Results: Tongue strength initially worse, then better with time. Probable increase in mucousitis secondary to radiochemotherapy.

Findings:

- **Healthy YOUNG adults** (Lazarus, 2003)
  - Methods: Young adults (ages 20-29) were to perform lingual strengthening exercises over a 1-month period.
  - Results: No change in lingual strength, as measured with the IOPI, over the 1-month period.
TONGUE STRENGTHENING

Healthy OLDER adults
What we know:
- Increased oral and phx transit times
- Increased total swallowing duration
- Increased duration of hyoid movement
- Increased phx residue/stasis
- Higher incidence of multiple hyoid gestures
- Increased delay from bolus entry to phx to the beginning of hyoid ascent

QUESTIONS:
(1) Changes in lingual strength?
(2) Changes in swallow pressures?

TONGUE STRENGTHENING

RESEARCH
Terminology - Part 2:
Swallowing = series of pressure changes
Max. Isometric Pressure (IP_{max}): “press tongue against bulb as hard as you can.”
Max. Swallow Pressure (SP_{max}): “swallow with tongue bulb in place.”
Functional Reserve: relation between IP_{max} and SP_{max} (ability to adapt to stress).

WE KNOW:
P_{swallow} remain similar across lifespan
Swallow Reserve declines with age (reduction in lingual isometric pressures)

(Robbins, 1995; Nicosia, 2000)

TONGUE STRENGTHENING

RESEARCH
Findings:
Healthy OLDER Adults (Robbins, 2005)
Hypothesis: (1) Increase in lingual isometric strength after 8-week progressive lingual exercise program; (2) increased lingual isometric strength will carry-over into swallow function as per increased lingual strength/pressure during swallowing; (3) lingual muscle volume will increase; (4) functional swallow outcomes will improve.
Protocol:
- 8-week exercise program: “Press the tongue against the bulb as hard as possible.”
- 10 repetitions, 3 sets per day, 3 X week
- Week 1: goal = 60% of baseline P_{max}
- Weeks 2-7: goal = 80% of P_{max}
TONGUE STRENGTHENING
RESEARCH
• Findings:
  • Healthy OLDER Adults (Robbins, 2004 @ DRS)
• Results:
  • Max. isometric pressures increased in at least one lingual location in all participants after 8 weeks of exercise;
  • Average swallowing pressures increased at all 3 lingual locations (most at anterior bulb) for all bolus conditions;
  • Tongue volume increased with exercise in all participants who underwent MRI (N=4);
  • Increase in functional reserve.

Dysphagia Screening

How did this get started?

•
•
• emphasis on patients with acute stroke
http://www.asha.org/uploadedFiles/FAQs-on-Swallowing-Screening.pdf#search=%22FAQ%22
What is a screen vs an evaluation?

- not assessing.
- Screen should be:
  - Non-invasive
  - Non-technical
  - Administered by a non-expert
  - Results should be quickly interpretable

Several screening tools...

- Yale Swallow Protocol (S. Leder)
- TOR-BSST (R. Martino)
  - Toronto Bedside Swallowing Screening Tool
- MMASA (G. Carnaby)
  - Mini Mann Assessment of Swallowing Abilities

Thickened Liquids
• **What is a THICK liquid?**
  - Variability by facility/setting
    (Cichero, et al, 2000)
  - Poor correlation between viscosity of thickened liquids used during VFS and the viscosity of liquids thickened for patients during mealtime.
  - Poor correlation between viscosity, density and yield stress of thickened liquids between facilities. [Study = 10 hospitals in Australia]

RHEOLOGY of liquids
  (Steele, et al, 2003)
  - **Viscosity** = interval friction of a fluid, or it’s tendency to resist flow.  
    ADA recommendations (2000) for standard consistency class nomenclature, with class boundaries defined viscometrically at shear rate of 50 s⁻¹

<table>
<thead>
<tr>
<th>Consistency class</th>
<th>Min. (cP)</th>
<th>Max. (cP)</th>
</tr>
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<tbody>
<tr>
<td>Thin</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>Nectar-like</td>
<td>51</td>
<td>350</td>
</tr>
<tr>
<td>Honey-like</td>
<td>351</td>
<td>1750</td>
</tr>
<tr>
<td>Spoon-thick</td>
<td>1751</td>
<td></td>
</tr>
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</table>

RHEOLOGY of liquids
  - **Yield stress** begins to occur, but below which flow does not occur.
  - **Density** = mass per unit volume, most closely related to weight of fluid.
THICKENED LIQUIDS

- Xantham Gum
- Powder
- Gel
- Pre-mixed: recently discontinued

Viscosity Comparison: Varibar to Other Liquids

<table>
<thead>
<tr>
<th>Consistency Class</th>
<th>Average (target)</th>
<th>Other Liquids</th>
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</thead>
<tbody>
<tr>
<td>Thin liquid</td>
<td>4</td>
<td>1 - 50</td>
</tr>
<tr>
<td>Nectar thick</td>
<td>300</td>
<td>51 - 350</td>
</tr>
<tr>
<td>Thin Honey</td>
<td>1500</td>
<td>351 - 1750</td>
</tr>
<tr>
<td>Honey</td>
<td>3000</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Prevalence/Usage

- 30 – 90% of resident population have some type of Dysphagia
- On average 8.3% of SNF residents receiving thickened liquids (increased in the facilities providing rehab services to CVA and TBI patients)
  - 60% - receiving nectar thick liquids
  - 6% - receiving pudding/spoon thick liquids
  - 9% of facilities in the study provided thin water between meals

Taste perception

- Pelletier, 1997; Pelletier & Lawless, 2003
  - No one commercial thickener consistently produces a desired consistency or consistently superior regarding taste
  - Thick & Easy is superior with the syrup and honey consistency
  - Thick It and Thicken Right are superior with the pudding consistency
  - For juice, Thick It or Thicken Right are superior across several thicknesses, but not across all combinations of thickness and time period
  - The only liquid showing taste difference: juice

Compliance issues

- Colodny, 2005
  - N = 63 independent feeders w/ dysphagia
  - Reasons for non-compliance categorized:
    - Denial of a swallowing problem
    - Dissatisfaction with the preparation
    - Assuming a calculated risk
    - Rationalizing non-compliance in face of contradictory evidence
    - Minimizing severity of the problem
    - Verbal accommodation, while non-compliant
    - Projection of blame towards the SLP
    - Deflection of non-compliance by referring to an external authority

- About 67% of SLPs report some use of pre-thickened products in their practice
- Limited information about the viscosity of prethickened products or their ability to produce a repeatable level of thickness across beverage type.
- Distinct differences in the thickening properties of some starch- and gum-based products, particularly when the setting time of a thickened liquid was extended to 10 or 30-minutes at its serving temp.
- Ability to produce a similar level of nectar- or honey-like thickness for serving temperature across beverages (water, juice, coffee, etc)
- Thickened liquids were tested at serving temperature

Considerations and Implications

- Thickening agents vary in their thickening properties and additional variability is created by the base liquid, especially when mixed with starch products.
- Although the viscosity of gum-based product remained fairly stable across beverages and thickening times, nectar and honey-like samples were typically less viscous, which may contribute to different concerns about swallowing safety.

General Notes on THICK LIQUIDS

Ethical considerations for when pt refuses SLP recommendations:

- Professional opinion
- Documentation
- Counseling
  - Meeting with staff and caretakers
Select References: Thick Liquids


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