

Treatment of Dysphagia Following Stroke: A Review and Update on Evidence

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Outline

- Compensation versus rehabilitation
- Evidence of rehabilitative exercises
- Specific swallowing impairment
- New/controversial treatments

Swallowing Treatment

- Goals of Treatment
 - Rehabilitation of dysfunction
 - Prevention of dehydration, malnutrition, and pneumonia
 - Return to least restricted diet possible

Swallowing Treatment

- Swallowing treatment should be based on results of the instrumental examination
- The effect of compensatory strategies must be observed in the instrumental examination before implemented

Swallowing Treatment

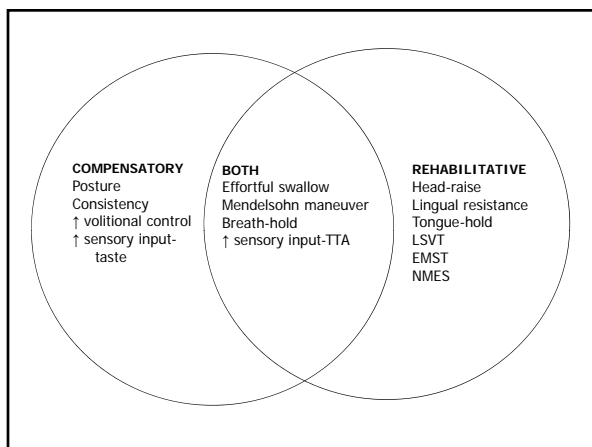
- SLP must understand a stroke patients:
 - Language
 - Attention
 - Awareness
 - Memory
 - Visuospatial functioning
 - Executive function

Swallowing Treatment

- Compensatory
 - Attempted during the instrumental exam
 - Primarily manipulated by the clinician
 - Most require limited cognition-BUT....
 - Benefits are immediate, not permanent
- Rehabilitative
 - Alter swallowing physiology
 - Require good cognition-BUT...
 - Benefits are permanent

Swallowing Treatment

- **Compensatory Strategy**
 - Benefits are immediate, not permanent
 - Aimed to secure safe and adequate oral intake
- **Rehabilitative Treatment**
 - Alter swallowing physiology
 - Permanent improvement
- **Not always a clear distinction between the two**



Neuroplasticity and Treatment

Plasticity-the capacity for being altered

- We can change behavior-measured by decreased airway invasion, improved temporal or spatial measures
- Behavior can change neural pathways and synapses of the CNS

Neuroplasticity and Treatment

Principles of Neuroplasticity (Kleim & Jones, 2008)

- Use it and lose it: Failure to drive specific brain functions can lead to functional degradation
- Use it and improve it: Training that drives a specific brain function can lead to an enhancement of that function
- Specificity: The nature of the training experience dictates the nature of the plasticity
 - Repetition: Induction of plasticity requires sufficient repetition
 - Intensity: Induction of plasticity requires sufficient training intensity
 - Time: Different forms of plasticity occur at different times during training
 - Sallence: The training experience must be sufficiently salient to induce plasticity
- Age: Training-induced plasticity occurs more readily in younger brains
- Transference: Plasticity in response to one training experience can enhance the acquisition of similar behaviors
- Interference: Plasticity in response to one experience can interfere with the acquisition of other behaviors

Swallowing Treatment- Rehabilitative

- All patients should receive at least an attempt at rehabilitative treatment, unless:
 - Obtunded
 - Unable to attend and/or follow directions
- Frail or cognitive impaired:
 - Gradually build-up endurance
 - Work on attention and comprehension
 - SLPs not just swallowing therapists

Swallowing Treatment- Rehabilitative

- ↑ Sensory Threshold
 - Thermal-Tactile Stimulation (Logemann 1983, Lazzara et al., 1986; Rosenbek et al., 1991, 1996, 1998)
 - Suggested to facilitate elicitation of the pharyngeal swallow
 - Thought with some is that it has long term effects- thus rehabilitative in nature; however, not proven
 - Immediate but temporary ↑ in swallowing evocation
 - Suggestion of 4-5, 10-15 minute sessions daily, but need further research to confirm

**Swallowing Treatment-
Rehabilitative**

■ **Lingual Strengthening**

- Lingual resistance (Lazarus et al., 2003)
 - 3 groups-healthy adults:
 - No treatment
 - Resistance against tongue-blade
 - Compressing, an air filled bulb (IOPI) between tongue and hard palate
 - ↑ tongue strength with any treatment

**Swallowing Treatment-
Rehabilitative**

■ **Lingual Strengthening**

- Lingual resistance (Robbins et al., 2005, 2007)
 - Compressing IOPI between tongue and hard palate
 - Identify one repetition maximum value
 - Press your tongue as hard as you can against the IOPI bulb
 - Complete 2 sets of 3 reps

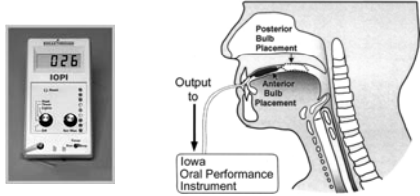
**Swallowing Treatment-
Rehabilitative**

■ **Lingual Strengthening**

- Lingual resistance (Robbins et al., 2005, 2007)
 - Work at 60% maximum first week and 80% maximum remainder of time
 - Readjust 80% maximum every 2 weeks
 - Regime: 30 reps, 3X/day, 3days/week for 8-weeks
 - Anterior tongue
 - Posterior tongue

Swallowing Treatment-Rehabilitative

- Lingual Strengthening



Robbins et al., 2007

Swallowing Treatment-Rehabilitative

- Lingual Strengthening
 - Lingual resistance (Robbins et al., 2005, 2007)
 - Results:
 - ↑ tongue volume
 - ↑ isometric and swallowing pressures
 - ↓ OTT
 - ↓ P-A Scale score

Swallowing Treatment-Rehabilitative

- Lingual Strengthening
 - Madison Oral Strengthening Therapeutic (MOST®) Device
 - Sensors at 5 locations embedded into a custom molded mouthpiece
 - Improve swallow function, lingual muscle stamina
 - Madison Oral-Lever Resistance Exercise (MORE®) Device
 - Maintain gains made with MOST

Swallowing Treatment- Rehabilitative

- Tongue-Hold Exercise (Masako Maneuver)
 - Initially documented in patients S/P BOT resection
 - ↑ anterior movement of PPW
 - Developed exercise to mimic this motion (Fujiu et al., 1995)
 - Protrude tongue maximally but comfortably, holding between central incisors while swallowing
 - Individual swallows saliva, not bolus-Not a compensatory strategy as ↑ vallecular residue due to immobilizing tongue

Swallowing Treatment- Rehabilitative

- Tongue-Hold Exercise (Masako Maneuver)
 - Results in healthy adults (Fujiu et al., 1996)
 - ↑ anterior bulging of PPW
 - Inhibits tongue movement- ↑ vallecular residue
 - Results in patients with BOT resection (Lazarus et al., 2002)
 - ↑ pharyngeal pressure
 - Use with patients with vallecular residue due to ↓ BOT retraction

Swallowing Treatment- Rehabilitative

- Gargling
 - 20 dysphagic adults with postswallow vallecular residue due to ↓ BOT retraction (Veis et al., 2000)
 - Greatest BOT retraction during movement for gargle as compared to tongue pull-back or yawn
 - Requires study to determine if improvement in swallowing following exercise program of gargling

**Swallowing Treatment-
Rehabilitative**

- **Effortful Swallow**
 - Individual swallows "with effort" or "hard"
 - Initially thought to be compensatory but research showing rehabilitative properties
 - Positive results of effortful swallow (Hind et al., 2001; Huckabee et al., 2005; Kahrilas et al., 1991; Olsson et al., 1996):
 - ↑ oral and pharyngeal pressure, particularly distal pharynx
 - ↑ tongue to palate contact

**Swallowing Treatment-
Rehabilitative**

- **Effortful Swallow**
 - Negative results of effortful swallow (Bulow et al., 1999, 2001, 2002)
 - ↓ anterior hyoid movement
 - No change in airway invasion
 - No change in pharyngeal pressure

**Swallowing Treatment-
Rehabilitative**

- **Effortful Swallow**
 - Which patients? Based on research results:
 - Vallecular residue due to ↓ BOT to PPW contact-YES
 - Vallecular or pyriform sinus residue due to ↓ anterior hyoid movement -? Need to ensure no negative effect on anterior hyoid movement

**Swallowing Treatment-
Rehabilitative**

- **Effortful Swallow-Instructions**
 - Swallow normally, but squeeze very hard with your tongue and throat muscles throughout the swallow
 - Excess effort should be clearly visible in the patient's neck during the swallow

**Swallowing Treatment-
Rehabilitative**

- **Mendelsohn Maneuver**
 - Also, initially designed as a compensatory strategy to facilitate bolus flow through the UES (Logemann & Kahrilas, 1990)
 - Individual initiates swallow and at peak of hyolaryngeal excursion, maintain suprahyoid contraction before relaxing and completing the swallow
 - Notion is that prolonging suprahyoid contraction prolongs UES opening

**Swallowing Treatment-
Rehabilitative**

- **Mendelsohn Maneuver**
 - Immediate effects studied in healthy adults
 - ↑ duration of anterior and superior hyolaryngeal movement (Kahrilas et al., 1991)
 - Prolonged contraction of lateral pharyngeal wall movement (Miller & Watkin, 1997)
 - ↑ pharyngeal muscle contraction (Boden et al., 2006)

**Swallowing Treatment-
Rehabilitative**

- Mendelsohn Maneuver
 - The rehabilitative thought is that repetitive performance ↑ UES compliance and bolus flow
 - No specific rehabilitation study but case reports using sEMG
 - Which patient?:
 - Piriform sinus residual due to ↓ anterior hyoid movement and/or ↓ UES compliance

**Swallowing Treatment-
Rehabilitative**

- Mendelsohn Maneuver –Instructions
 - Swallow normally. Feel your Adam's Apple lift during the swallow. Swallow again. During this swallow hold the voice box up with your neck muscles for several seconds during the swallow and after if possible, then allow your voice box to return to rest.

**Swallowing Treatment-
Rehabilitative**

- Mendelsohn Maneuver
 - Difficult to master
 - Visual feedback (sEMG) to facilitate mastery of technique

**Swallowing Treatment-
Rehabilitative**

- **Head-Lift Exercise**
 - Designed to increase UES opening by targeting anterior hyoid movement
 - Use with patients with pyriform sinus postswallow residual due to UES opening caused by ↓ anterior hyoid movement (Shaker et al., 1997)

**Swallowing Treatment-
Rehabilitative**

- **Head-Lift Exercise**
 - Completed with individual in supine position
 - Isotonic
 - Individual lifts head "high enough to observe toes"
 - Maintains for maximum of 1 minute
 - Completes 3X
 - Isokinetic
 - 30 repetitions raising and lowering head

**Swallowing Treatment-
Rehabilitative**

- **Head-Lift Exercise**
 - Series should be completed 3X/day for 6 weeks
 - May need to build-up duration and reps
 - Do not lift shoulders
 - Use strap muscles not abdominals to raise head
 - Continually breath through exercise
 - Maintain smooth, steady rate for isokinetic portion

**Swallowing Treatment-
Rehabilitative**

- **Head-Lift Exercise**
 - Evaluated in heterogeneous group with chronic dysphagia and tube feeding-all had postswallow hypopharyngeal residual with aspiration (Shaker et al., 2002)
 - ↑ anterior laryngeal movement
 - ↑ UES opening
 - ↓ postswallow aspiration
 - All individuals resumed oral intake
 - Compared with traditional therapy, also resulted in thyrohyoid shortening in patients with chronic dysphagia (Mepani et al., 2009)

**Swallowing Treatment-
Rehabilitative**

- **Head-Lift Exercise**
 - Designed to be performed independently, but compliance issues-have patients return for follow-ups to check on progress (Easterling et al., 2005)

New/Controversial Treatments

- **Deep Pharyngeal Neuromuscular Stimulation (DPNS)**
- **McNeil Dysphagia Therapy Program (MDTP)**
- **Neuromuscular Electrical Stimulation (NMES)**
- **Expiratory Muscle Strength Training (EMST)**

New/Controversial Treatments

■ Deep Pharyngeal Neuromuscular Stimulation

- No Evidence
- Practice-based evidence????

New/Controversial Treatments

■ McNeil Dysphagia Therapy Program-MDTP (Carnaby-Mann & Crary, 2008, 2010)

- "Systematic exercise-based approach"
- Not a specific technique, but a "framework" to provide individualized therapy

New/Controversial Treatments

■ McNeil Dysphagia Therapy Program-MDTP (Carnaby-Mann & Crary, 2008, 2010)

- Treatment:
 - Place bolus in mouth and close mouth
 - Breath through nose
 - Swallow hard and fast in a single attempt
 - Keep mouth closed and, if needed, inhale gently through nose and clear throat
 - Repeat this sequence until bolus is swallowed or expectorated

New/Controversial Treatments

■ McNeil Dysphagia Therapy Program-

MDTP (Carnaby-Mann & Crary, 2008, 2010)

- Food hierarchy:
 - Ice chips (low end) to patient's preferred food (high end)
 - Start with highest level of food that does not cause expectoration or aspiration on VFSS
 - Progress through hierarchy based on no expectorations and clinical impression of no aspiration (cough, throat clear, change in respiratory rate)
 - Volume is initially increased followed by consistency

New/Controversial Treatments

■ McNeil Dysphagia Therapy Program-

MDTP (Carnaby-Mann & Crary, 2008, 2010)

- Food hierarchy:
 - Based on patient's performance progress upward or downward along food hierarchy
 - Successful swallow 8 of 10 trials, advance
 - Clinical indication of aspiration 3 of 5 swallows, regress
- May be used with NMES or sEMG

New/Controversial Treatments

■ McNeil Dysphagia Therapy Program-

MDTP (Carnaby-Mann & Crary, 2010)

- Retrospective study
- MDTP: N = 8
 - Chronic dysphagia receiving MDTP from 2006-2008
 - FOIS < 5 (oral diet of single consistency or tube feeding)
- Controls: N = 16
 - Chronic dysphagia receiving traditional therapy (Mendelsohn or effortful swallow) with sEMG from 1994-1999
 - Limited oral intake

New/Controversial Treatments

■ McNeil Dysphagia Therapy Program-

MDTP (Carnaby-Mann & Crary, 2010)

- MDTP
 - 1 hour TX, 5 days/week for max of 3 weeks
 - Daily home practice
- Controls
 - 1 hour TX, 5 days/week (duration not specified)
 - Home practice not mandatory

New/Controversial Treatments

■ McNeil Dysphagia Therapy Program-

MDTP (Carnaby-Mann & Crary, 2010)

- Results
 - Significant ↑ in MASA and FOIS for MDTP group
 - ↑ hyolaryngeal movement and BOT retraction, ↓ pharyngeal residue and airway invasion
- Of note
 - AVG # of sessions; swallows per session
 - MDTP = 20 sessions; 91 swallows/session
 - Traditional = 12 sessions; 32 swallows/session

New/Controversial Treatments

■ Neuromuscular Electrical Stimulation

- Intramuscular
- Transcutaneous (VitalStim)
- Peripheral stimulation of the faucial arches
- Peripheral stimulation of the pharynx

New/Controversial Treatments

- Neuromuscular Electrical Stimulation
 - NMES is designed to augment the motor pattern
 - It should be used for specific swallowing pathophysiology, not applied randomly

New/Controversial Treatments

- Neuromuscular Electrical Stimulation (Ludlow, 2010)
 - With intramuscular stimulation, can target specific muscles
 - With transcutaneous electrode, stimulate superficial muscles, difficult to target specific deep muscles

New/Controversial Treatments

- Transcutaneous NMES: VitalStim
 - Review of research 2006 and prior (Huckabee & Doeltgen, 2007)
 - "Studies using non-blinded subjective outcome measures based on non-validated rating scales reported potential success of VitalStim treatment."
 - "If blinded and more objective measures were used, no positive effect was reported."
 - Review of research to 2009 (Ludlow, 2010)

New/Controversial Treatments

- Neuromuscular Electrical Stimulation-
VitalStim (Ludlow, 2010)
 - Submental placement-strength of stimulation
 - Platysma
 - Anterior belly of the Digastric
 - Elevates hyoid, Opens mandible with fixed hyoid
 - Mylohyoid
 - Elevates hyoid
 - Geniohyoid
 - Pulls hyoid anteriorly

New/Controversial Treatments

- Neuromuscular Electrical Stimulation-
VitalStim (Ludlow, 2010)
 - Throat placement-strength of stimulation
 - Platysma
 - Sternohyoid
 - Depresses hyoid
 - Omohyoid
 - Depresses hyoid
 - Thyrohyoid
 - Elevates larynx

New/Controversial Treatments

- Transcutaneous NMES (VitalStim)
 - Exercise suprahyoids (Freed et al., 2001; Leelamanit et al., 2002)
 - Surface electrodes
 - Numerous uncontrolled methodological variables

New/Controversial Treatments

- Transcutaneous NMES (VitalStim)
 - Stimulation of submental and throat regions (Ludlow et al., 2007)
 - Adults w/ chronic neurogenic dysphagia (N=11)
 - 5 ml VFSS swallows w/o NMES, low NMES, max NMES
 - Significant hyoid descent at rest
 - ↓ in aspiration w/ low NMES in patients who could overcome depression by volitional elevation

New/Controversial Treatments

- Transcutaneous NMES (VitalStim)
 - Testing patient's response to VitalStim in the fluoroscopy suite to identify the affect of VitalStim on the hyoid and determine if patient can overcome depression (Ludlow, DRS 2008)
 - If so, it may be appropriate to address ↓ anterior superior hyoid movement
 - If not, DO NOT USE

New/Controversial Treatments

- Transcutaneous NMES: VitalStim
 - Meta-analysis or previous research (Carnaby-Mann & Crary, 2008)
 - 7 studies analyzed
 - Small but significant effect size for VitalStim
 - Of note:
 - Use of excessively lax inclusion criteria
 - Results weak and not able to generalize

New/Controversial Treatments

- Transcutaneous NMES: VitalStim
 - Stimulation of throat regions with vertical alignment of electrodes (Carnaby-Mann & Crary, 2008)
 - Individuals with chronic dysphagia (n=6)- multiple medical DX
 - Exclusion criteria
 - No swallowing therapy w/in 3 months of participation
 - VFSS evidence of ↓ hyolaryngeal elevation, ↓ pharyngeal constriction, and/or ↓ UES opening

New/Controversial Treatments

- Transcutaneous NMES: VitalStim
 - Carnaby-Mann & Crary, 2008 (cont.)
 - Subjects completed:
 - 15 1-hour sessions (5 days/week for 3 weeks)
 - VitalStim paired with swallow hard and fast-MDTP protocol
 - Results:
 - Mean number of swallows per session-45.06±27.5
 - Significant ↑ in clinical swallowing ability (MASA)*, functional oral intake (FOIS), body weight, and patient perception

New/Controversial Treatments

- Transcutaneous NMES: VitalStim
 - Carnaby-Mann & Crary, 2008 (cont.)
 - Results:
 - ↓ in hyoid and laryngeal elevation post-TX for 5 ml thin liquid but ↑ elevation for 10 ml nectar thick liquid
 - Must consider this in light of Ludlow's 2007 findings

New/Controversial Treatments

- Transcutaneous NMES: VitalStim
 - Stimulation of throat regions w/ 2 sets of electrodes on each side of the throat 3B (Bulow, et al., 2008)
 - Stroke patients > 3 months post-infarct (n=25)
 - Exclusion criteria included inability to evoke a pharyngeal swallow

New/Controversial Treatments

- Transcutaneous NMES: VitalStim
 - Bulow et al., 2008 (cont.)
 - Randomly assigned to VitalStim or traditional TX
 - 15 1-hour sessions (5 days/week for 3 weeks)
 - VitalStim paired with swallow hard and fast
 - Traditional therapy determined by SLP

New/Controversial Treatments

- Transcutaneous NMES: VitalStim
 - Bulow et al., 2008 (cont.)
 - Results
 - Patient satisfaction and nutritional intake significantly improved following both TX, no group differences
 - No pre-and post-VFSS differences
 - Poor correlation between outcome measurements
 - 2 patients reported positive results from TX even though no objective VFSS improvements, patients advanced their own diet which resulted in aspiration pneumonia

New/Controversial Treatments

- Transcutaneous NMES: VitalStim
 - Was it the VitalStim, mass practice or combination of the two that produced results?
 - Are results maintained?
 - Long-term effects?

New/Controversial Treatments

- Cross-Systems Effects
 - Expiratory Muscle Strength Training
 - EMST-increase forced output of the expiratory muscles
 - Utilizes principles of overload
 - 75% of MEP
 - Initially used to ↑ voice and speech but findings showing positive effects on swallowing

New/Controversial Treatments



EMST 150-Aspire Products

New/Controversial Treatments

- Cross-systems Effects
 - Expiratory Muscle Strength Training
 - N=29 healthy adults (Wheeler et al., 2007)
 - 1-session study
 - ↑ amplitude and duration of submental muscle activation
 - With overload of submental muscles, can impact swallowing

New/Controversial Treatments

- Expiratory Muscle Strength Training
 - Wheeler et al. 2008
 - N = 25 healthy adults
 - Compared immediate effects of EMST, Mendelsohn maneuver, and effortful swallow to normal swallow on measures of EMG activation and hyolaryngeal displacement
 - ↑ amplitude and duration of submental muscle activation with all three tasks
 - EMST appears to impact vertical hyoid movement

New/Controversial Treatments

- Expiratory Muscle Strength Training
 - Pitts et al. 2009
 - N = 10 mid-stage PD patients w/ VFSS evidence of airway invasion during sequential swallowing
 - Completed 4 weeks of EMST at home
 - 5 days per week
 - 5 sets of 5 breaths completed sequentially
 - Trainer set at 75% of the individual's MEP
 - Improved effectiveness of volitional cough
 - Significant ↓ in airway invasion

New/Controversial Treatments

- Expiratory Muscle Strength Training
 - Troche et al. 2010
 - N = 60 mid-stage PD patients w/ C/O dysphagia
 - Randomized to EMST or sham
 - Completed 4 weeks of EMST or sham at home
 - 5 days per week
 - 5 sets of 5 breaths completed sequentially
 - Trainer set weekly at 75% of the individual's MEP

New/Controversial Treatments

- Expiratory Muscle Strength Training
 - Troche et al. 2010 (cont.)
 - Significant ↓ PAS score following treatment in EMST group
 - Significant ↑ in hyoid displacement during UES opening

Dysphagia TX in Stroke: Summary

- Identify specific swallowing impairment not just dysphagia symptom
- Target TX for specific swallowing impairment
- Most if not all individuals deserve a chance at rehabilitation

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