Facing the Challenge of Dysphagia

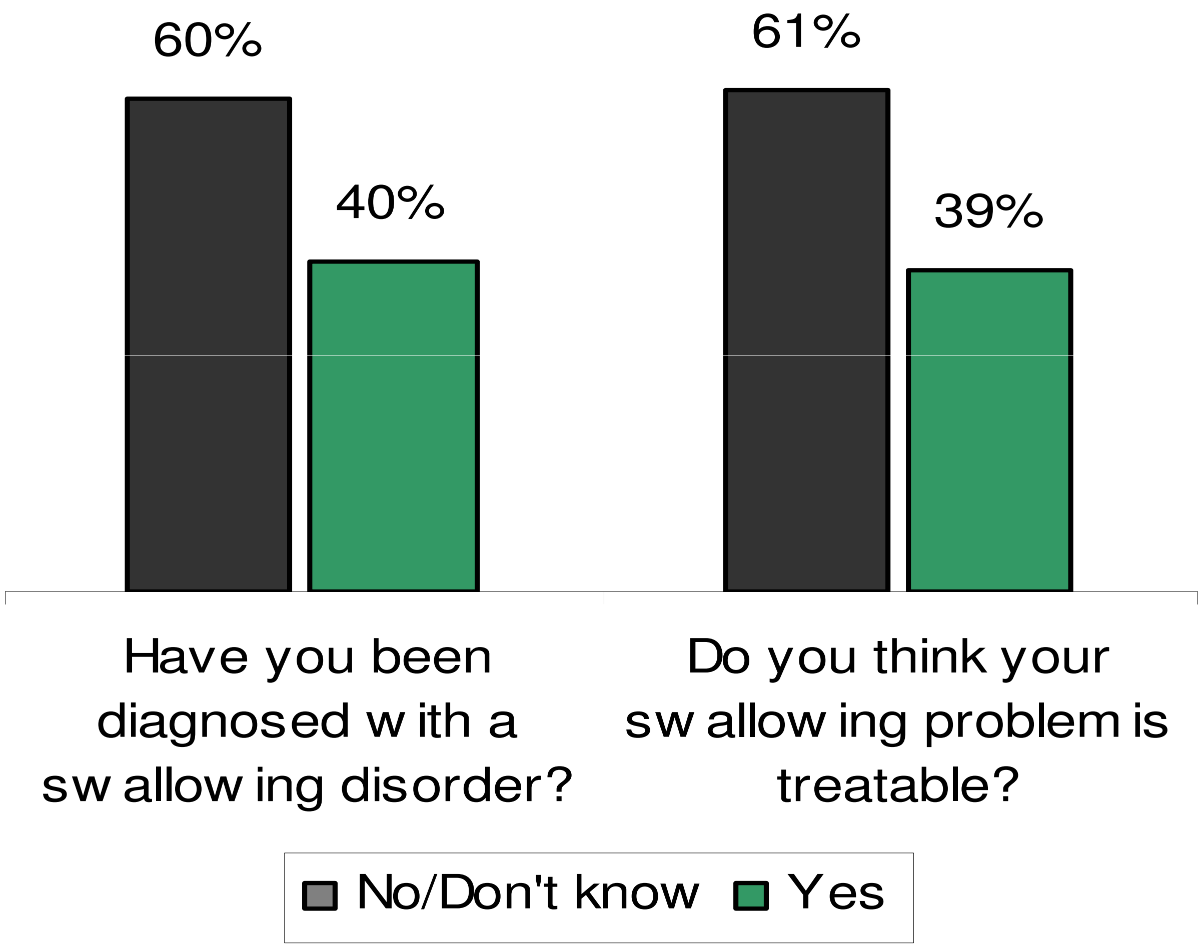
Dysphagia

- Estimated 15 million adult patients in USA
- Frequently occurring condition in many disease states
- CVA is most frequent diagnosis

Undiagnosed and untreated

Survey on patients consulting physicians for general complaints unrelated to swallowing.

100% = 360 patients with known complaints of dysphagia



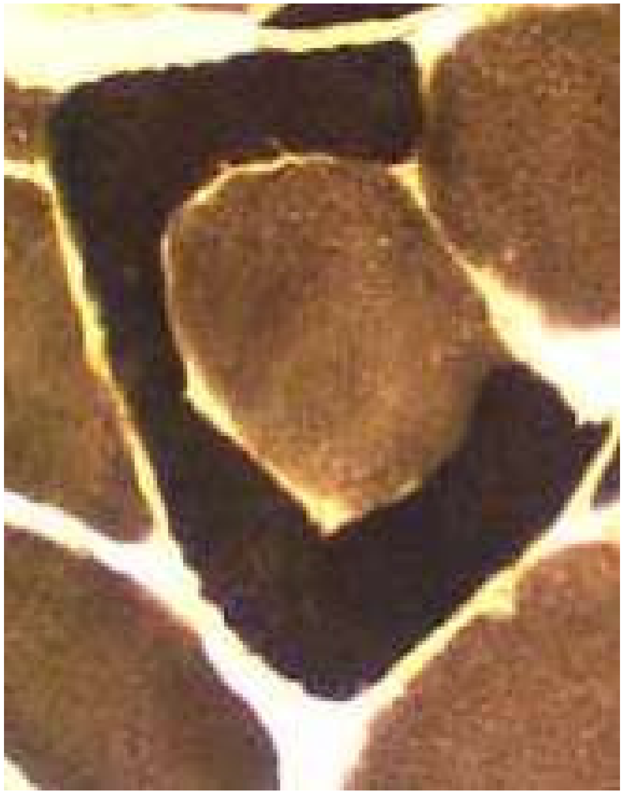
Ekberg O. et al. Dysphagia, 2002; 17:139-46

Dysphagia due to stroke

- Majority of dysphagic patients are cortical or brainstem stroke patients
- Dysphagia generally resolves in majority of cortical stroke patients within 6 months
- Brainstem stroke causes more severe and permanent dysphagia due to damage to cranial nerve nuclei
- Medical priority in treating dysphagia:
  - Prevent dehydration and malnutrition

Swallow dysfunctions in CVA

- Swallow system is impaired as a result of multiple contributing factors:
  - Decreased neural drive to swallowing musculature
  - Insufficient sensory feedback for efficient motor control
  - Muscle atrophy as a



Disuse atrophy

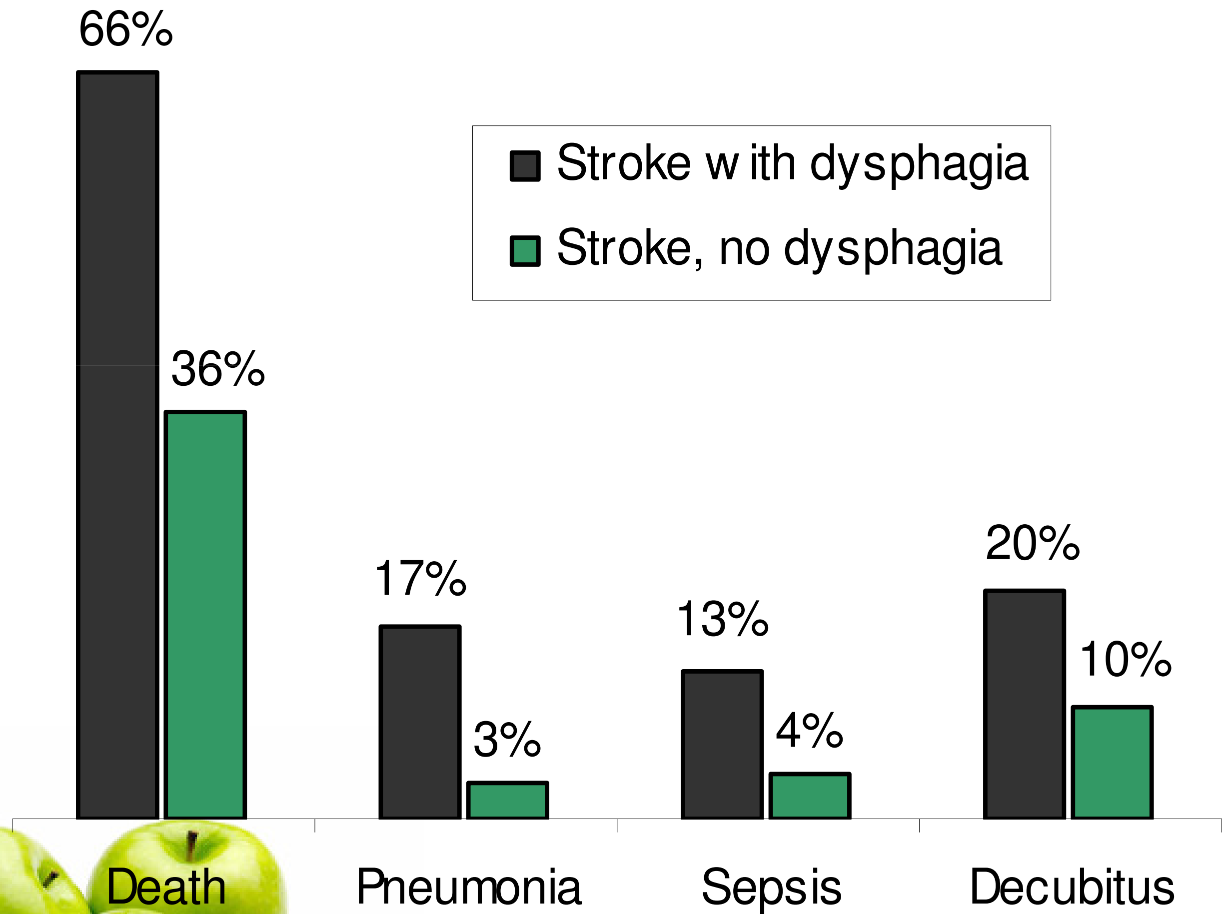
- Dysphagia is associated with disuse atrophy, especially of fast-twitch, type II muscle fibers
  - Patients elicit spontaneous swallows with less frequency than non-dysphagic counterparts
  - Individuals with compromised health and those of advanced age are most susceptible to disuse atrophy
- Significant atrophy is evident as soon as 72 hours post-stroke

Burkhead et al. *Dysphagia.* Jul 2007;22(3):251-265. Urso et al. *European Journal of Applied Physiology.* 2006;96:564-571. Nicosia et al. *J Gerontol A Biol Sci Med Sci.* Nov 2000;55(11):M634-640.

Swallow dysfunctions in CVA

- Management strategies often reinforce underlying impairments
  - Patients are often taught compensatory swallowing techniques (e.g., turning head or tucking chin when swallowing) to improve swallow safety but at the expense of normal swallow dynamics
  - Diets are often modified to a consistency requiring slower contractions
  - Diets are often limited to a quantity and consistency that limits aspiration but decreases oral intake

Burden of illness



Occurrence of complications 1 year post stroke in patients with severe dysphagia and a PEG compared to patients without dysphagia. (CMS data file analysis)

Covance. VitalStim Therapy economic model. 2005

Limited treatment options

Compensation (mainstay of current management)

- Head turn
- Chin tuck
- Modified diet
- Supraglottic swallow

Medical

Therapy

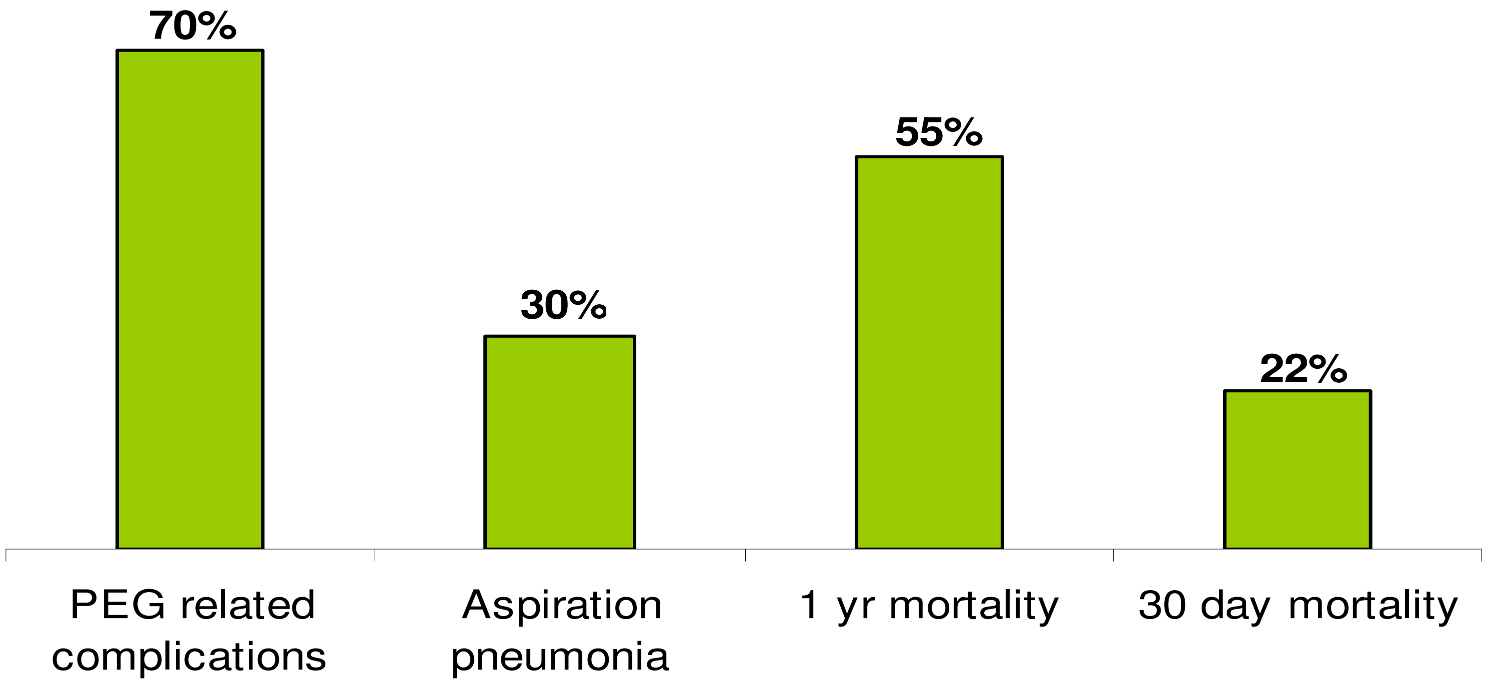
- Biofeedback (sEMG, pressure)
- Effortful swallow
- Oromotor exercise
- Thermotactile stim
- Mendelsohn, Masako, Shaker
- Electrotherapy (recent addition = VitalStim)

Conventional therapies

- Conventional treatment and management strategies have little supporting evidence
- Data demonstrate that:
  - Management strategies are effective at limiting aspiration but not at improving swallowing
  - Feeding tubes do not reduce aspiration nor occurrence of aspiration pneumonia
  - Feeding strategies (tubes, diet modifications, etc.) do not improve

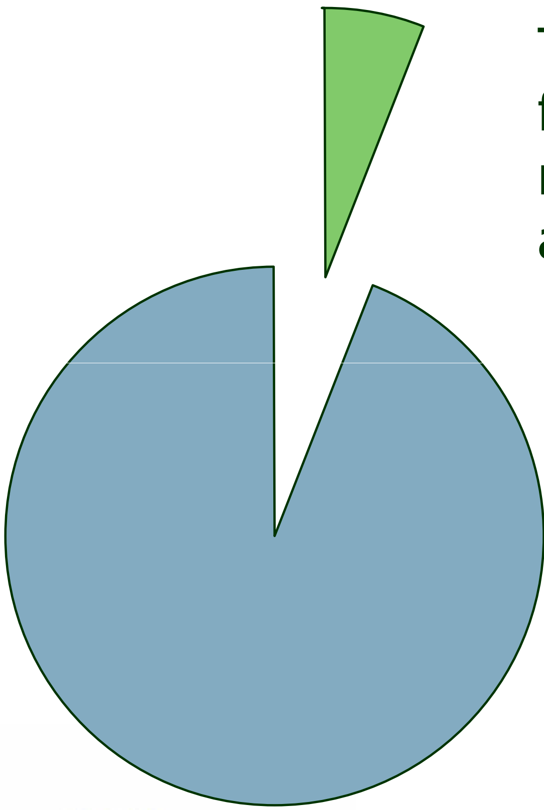
Langmore et al. *Dysphagia* 13 (2): 69-81, 1998. Martin et al. *Dysphagia* 9 (1): 1-6, 1994

Complications of PEG tubes



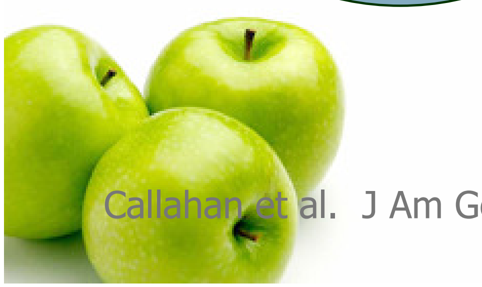
American Gastroenterological Association Technical Review on Tube Feeding for Enteral Nutrition. Gastroenterol. 1995; 108: 1282-1301

Cost of enteral tube feeding



Total annual cost to Medicare for enteral feeding supplies was more than $670 million (6% of annual DME budget).

Estimated cost of providing 1 year of feeding via PEG is $31,832. Main components of this cost include the initial PEG procedure, enteral formula and hospital charges for major complications.



Callahan et al. J Am Geriatr Soc 2001; 49(11):1525-1529

Dysphagia

ASSESSING the issues

Dysphagia

Effective Assessment

Results in

Effective Treatment

What is required in an effective assessment of our patient?

I. Understand the normal anatomy and physiology of the swallow system

II. Gather the Facts

-ALL info necessary to treat the

CAUSE of the problem

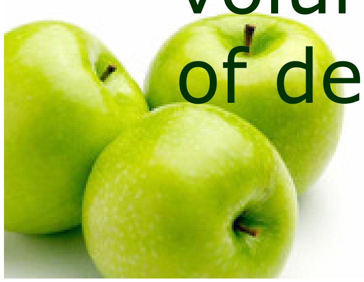
III. Establish a plan for solving the problem

The Facts

Term	**Definition**	**Example**
Pathology	*What is the disease? What is the diagnosis?*	Status post CVA
Dysfunctio n	*What basic function or activity is limited?*	Decreased hyolaryngeal excursion, UES dysfunction
Impairmen t	*What system failure or anatomical failure is responsible?*	Weakness suprahyoid musculature, stiffness cricopharyngeus
Symptoms	*What is the patient reporting?*	Coughing during meal, feeling of a lump in the throat
Signs	*What is the therapist observing?*	Penetration, aspiration

Pathology

- Investigate the pathophysiology of the diagnosis
- It is not enough to know the name of the diagnosis
- Must know how it effects the system…what is the impairment.
- EX: PD= decrease in dopamine production=poor control/coordination of voluntary muscle movements= impairment of decreased coordination and weakness



Dysfunction vs Impairment

Dysfunction

- Related **ONLY** to muscles and their function
- Can be seen on an eval= sign
- CAUSE of the dysphagia symptoms

Impairment

- Related to the Pathology directly
- Reason for the dysfunction
- CAUSE of the dysfunction

Dysfunction vs Impairment

Dysfunction Examples-

- Decreased tongue base retraction
- Poor labial seal
- Limited/No hyolaryngeal protraction
- Decreased pharyngeal constriction

Impairment Examples-

- Weakness
- Spacticity
- Stiffness
- Decreased sensation
- Poor coordination

Best Clinical Practice

- The 4 W's – a clinical decision making paradigm
- The therapist should ask the following questions in this order:
  - **W**hat is happening?
  - **W**hy is it happening?
  - **W**hich muscles/nerves are involved?
  - **W**here should I start? What therapy to employ? What modalities will I use?

WHAT is happening?

- Evaluate your patient thoroughly
- View the MBS and note all signs and symptoms
  - Signs: what the therapist can see (e.g., pooling, residuals)
  - Symptoms: what the patient tells you (e.g., coughing episodes, feeling of tightness in throat)

WHY is it happening?

- Interpret the signs and symptoms to identify impairment(s)
- Pathology = the etiology or diagnosis
- Dysfunction = what functional movement is affected?
  - Decreased hyolaryngeal excursion
  - Poor pharyngeal constriction
  - Decreased tongue base retraction
- Impairment = how and why the function is affected
  - Muscle weakness?
  - Lack of coordination?

WHICH muscles need therapy?

- Determine which muscles or muscle groups would benefit from therapy
- Identify the location of these muscle groups

WHERE do I start?

- What therapy to use?
- What compensation strategies, if any?
  - Bolus viscosity for variability and/or resistance…
- What modalities will I use based on my impairment?
  - E-stim for strengthening…
  - sEMG for endurance therapy…
  - sEMG triggered stim to build power…

Treatment

ADDRESSING the issues

Who is a candidate for therapy?

- Patients on a modified diet
  - Goal: increase diet
- Patients at risk for aspiration
  - Goal: increase function so as to decrease risk
- Patients who are demonstrating aspiration and/or penetration
  - Goal: increase functions in muscles so as to protect the system

What does therapy look like?

Treatment

- Electrotherapy
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- Oromotor exercise
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Compensation

- Head turn
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- Etc.

Therapeutic Intervention- how do we make a difference?

- Dr. Giselle Carnaby-Mann

"Behavioral Intervention for dysphagia in acute stroke." (14)

  - RCT
  - 306 total patients enrolled; pts randomly assigned to 3 groups
  - Usual Care= "pt management by the attending physicians as per usual practice. Treatment if offered consisted mainly of supervision for feeding and precautions for safe swallowing."
  - Standard low intensity swallowing therapy= "composed of swallowing compensation strategies, mainly environmental modifications; safe swallow advice; and appropriate dietary modification, under direction of a SLP."
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- The primary standard of measure was survival free of an abnormal diet at 6 months.
- So- effect and long term impact

- Results:
  - Usual Care pts: **56%** free of abnormal diet 6 months after strove; time to return to normal diet was significantly shorter when compared to standard care; **32%** achieved pre-stroke swallowing functions at 6 months; **63%** experienced a swallowing-related medical complication within the first 6 months after stroke
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  - Standard High Intensity Swallowing tx: **70%** free of abnormal diet 6 months after stroke; **48%** achieved pre-stroke swallowing function at 6 months

- So….

1. Therapy helps to return pts to function
2. High intensity, aggressive therapy; not diet monitoring alone returns pts to function
3. There are fewer complications when the impaired system is addressed

Carnaby, G.,Hankey, GJ., Pizzi, J. Behavioral intervention for dysphagia in acute stroke: a randomized control trial. Lancet Neurology. 2006; 5:31-37.

Why is this important?

- ***Why should I take a close, hard look at what I am doing with my patients?***

1. 'Dysphagia is clinically present in about 42-67% of patients within the first 3 days of stroke onset.' (1, 2)

2. 'About 50% of patients with dysphagia experience aspiration.' (3)

3. 'Along with oral bacteria, gastric contents are likely the second most common substance aspirated.' (4)

4. ‘When episodes of aspiration are small, the resulting pulmonary response if often non-specific and cannot be recognized easily as secondary to aspiration.’ (5)

5. ‘Even when aspiration is “massive” and pneumonia results, unless the aspiration was observed, it is difficult to be sure of the cause of the pulmonary disease.’ (5)

6. ‘The ratio for developing pnemonia was 5.6 times greater for those who aspirated thickened liquids or more solid consistencies when compared to those who did not aspirate at all, or who aspirated thin consistencies.’ (6)

7. ‘The ratio for death was 9.2 times greater for those aspirating thickened liquids or more solids, when compared to those aspirating thin liquids, or not aspirating at all.’ (6, 7)

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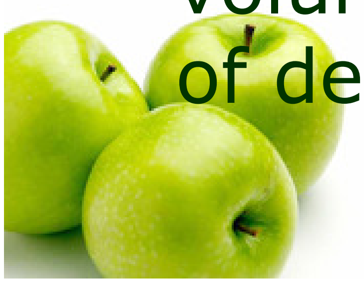

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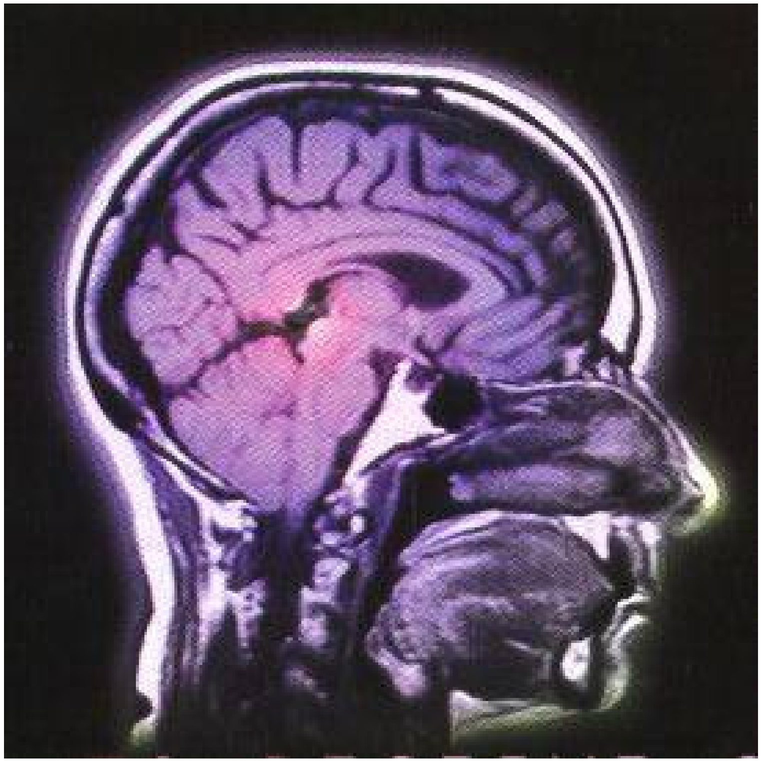
Cortical reorganization

- Much recent research about plasticity of the brain
- Brain is capable of reorganizing itself to much larger extent than previously thought



Cortical reorganization

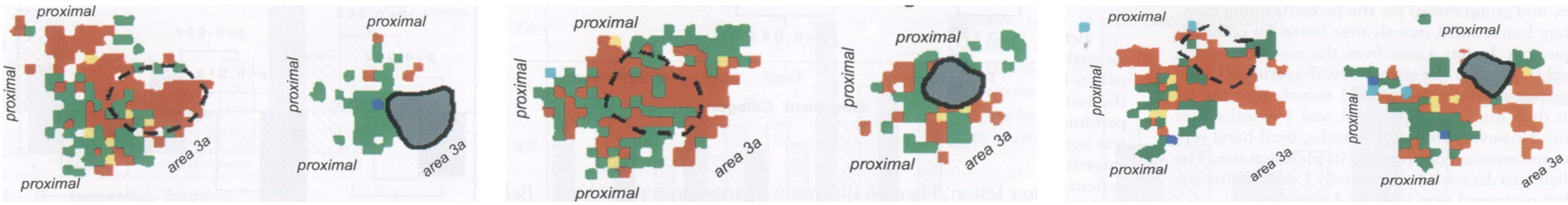
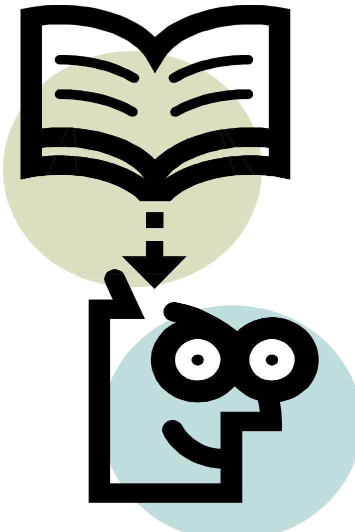


Illustration: Jorge Hernandez

Literature: Cortical plasticity



- Hamdy, 1998:
  - Propensity for recovery of swallow after stroke is likely relates to cortical organization and reorganization
  - Swallowing has a bilateral but asymmetric inter-hemisphere representation within motor and premotor cortex
  - Because there is additional substrate for swallowing in the undamaged hemisphere, the capacity for compensatory reorganization in the contralateral

Hamdy S, Rothwell JC. Gut feelings about recovery after stroke: the organization and reorganization of human swallowing motor cortex. Trends Neurosci, 1998; 21:278-82

Cortical reorganization – variables

- Repetition
  - Volume of exercise/intervention seems to enhance therapeutic benefit
  - Variety of exercise/intervention enhances recovery
  - ‘Trial and error’ exercise stimulates recovery, as long as success is norm rather than exception

Cortical reorganization – variables

- Repetition
- Sensory stimulation
  - Sensory stimulation in the same dermatome and myotome facilitates motor return
  - Volume of sensory input appears to be important

Cortical reorganization – variables

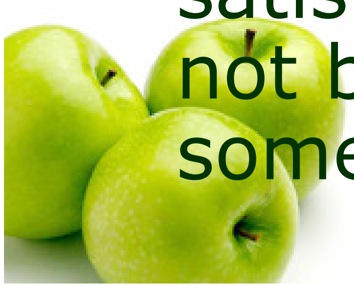
- Repetition
- Sensory stimulation
- Movement specific feedback about the quantity and quality of the attempted movement stimulates motor return
  - Sensory feedback
  - Visual feedback
  - Proprioceptive feedback

Cortical reorganization – variables

- Repetition
- Sensory stimulation
- Movement specific feedback
- Successful outcome
  - Repeated success: positive feedback loop is engaged and functional movement is facilitated
  - Repeated failure: negative feedback loop is engaged and functional movement is inhibited

Swallow: The ideal system

- Very repetitive (> 2,000 swallows per day)
- Much sensory stimulation occurs during all phases of the swallow (consistency of food, smell, taste, movement)
- Immediate feedback is received from the attempted movement (one moment the food is in the mouth, the next it is swallowed)
- Successful swallows are tremendously satisfying, especially to someone who has not been able to swallow successfully for some time



Nature of the swallow

- Explosive event (type IIa)
- Frequent (2,000 + times per day)
- Reflexive and voluntary

Note:

- When the explosive contractions of the fast twitch groups occur (TB, HLE, PC) the slow twitch group (UES) relaxes
- The slow twitch group is pulled open by the fast twitch groups
- Deficits in the one group will affect normal function of the other – they are interdependent – in a typical agonist-antagonist relationship

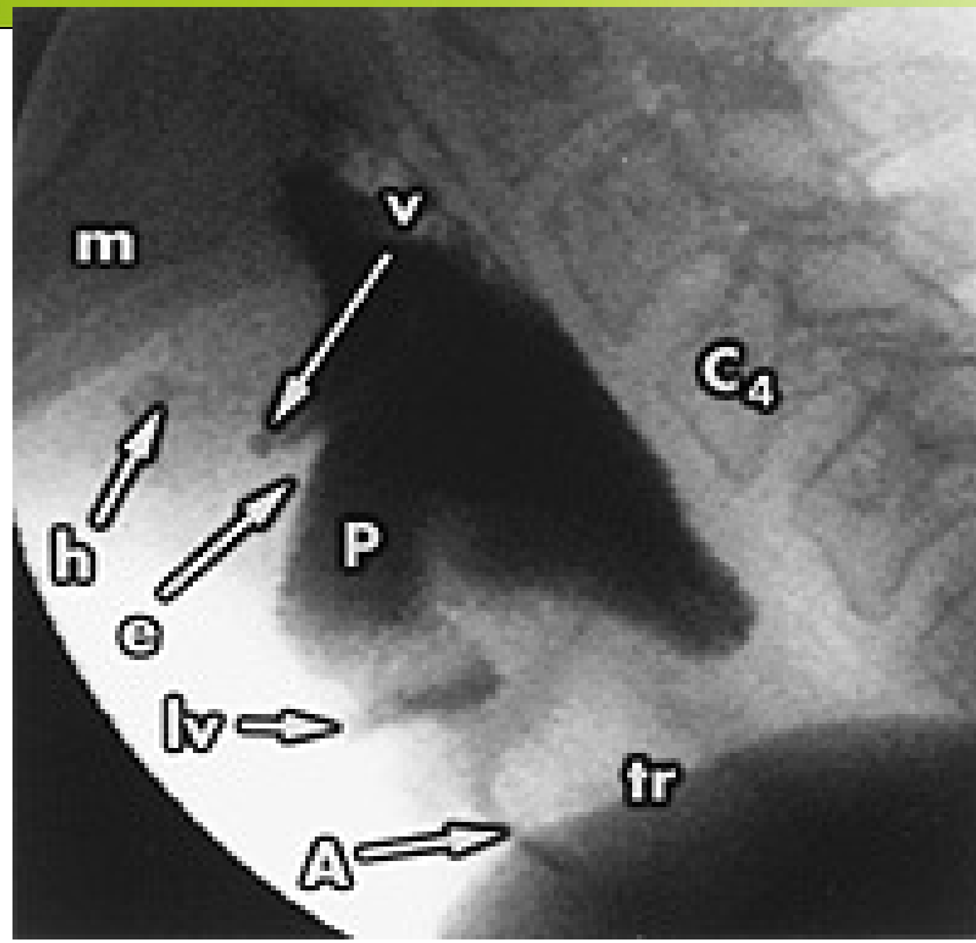
What should swallow training look like?

- Exercise intensity: intense enough to be challenging to the patient
  - Push your patient!
- Exercise frequency: frequent enough to facilitate motor learning
  - 3-5 x per week
- Exercise specificity: specific enough to obtain functional carry-over
  - Best exercise for the swallow is the swallow
- Exercise variability: variable enough to train entire swallow spectrum
  - Train with multiple consistencies and quantities as tolerated by patient
- Strength vs endurance training: focus on type IIa function
  - Swallow hard and fast
  - Do it again! And again! And again!
  - What about bolus size and consistency?

But what about safety?

- The dysphagia dilemma: effective exercise therapy targeting fast twitch fibers is difficult to execute because of safety concerns

- So what is a therapist to do?



Purpose of modalities

- Trigger neurophysiological responses to:
  - Accelerate healing (soft tissue and bone)
  - Decrease pain
  - Modulate inflammation
  - **Increase/Accelerate strengthening process**
  - **Facilitate neural reorganization**

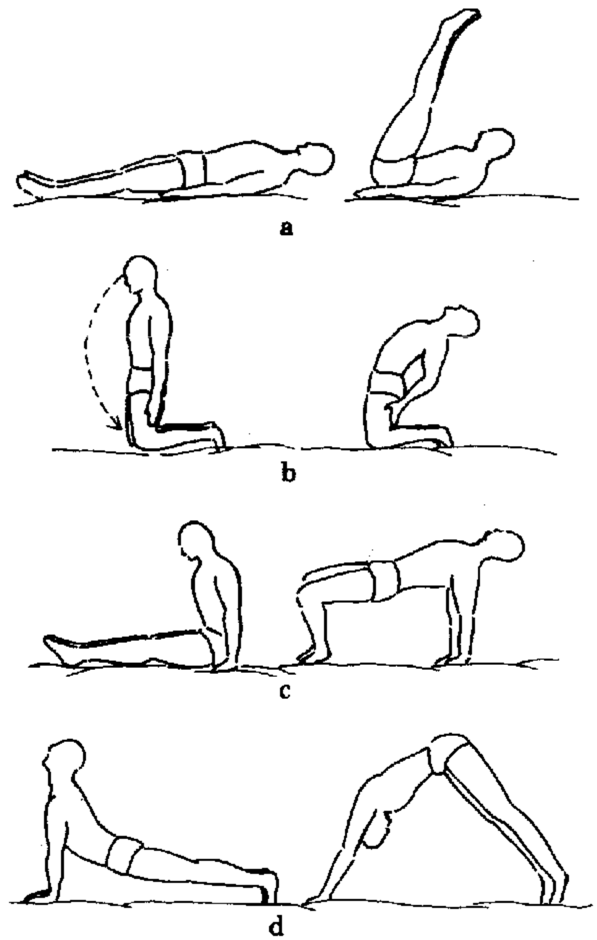
Primary use in dysphagia therapy

- Use is usually adjunctive to other therapeutic interventions such as exercise or mobilization

- Often modalities enable the therapist to do exercise therapy that would have been hard or impossible to do without them (safety concerns, weight bearing restrictions, etc.)

Applied modality use

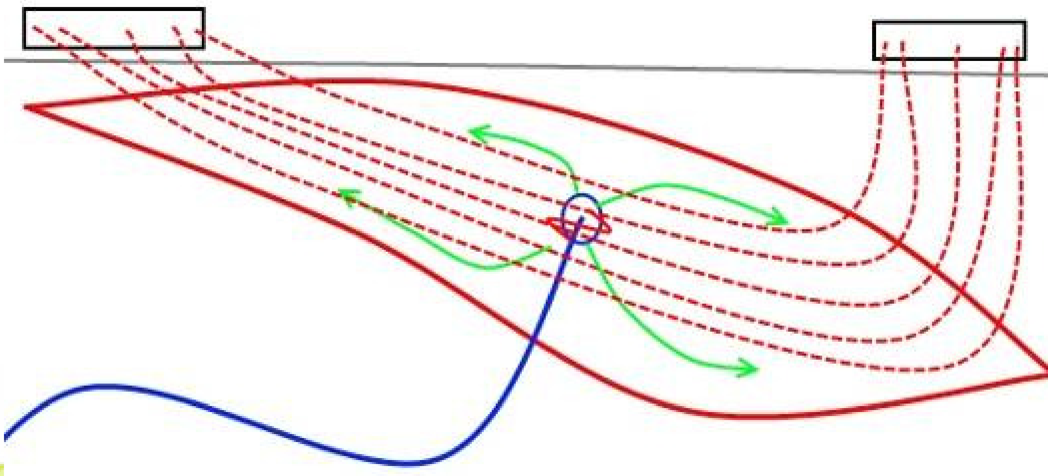
- Remember: therapeutic intervention should ideally facilitate the following:
  - Exercise intensity
  - Exercise frequency
  - Exercise specificity
  - Exercise variability
  - Strength training
  - Endurance training

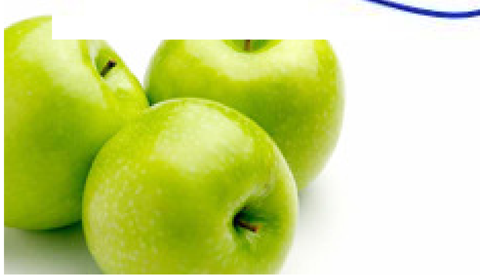


- Lets look at:
  - NMES
  - Thermotactile stimulatior
  - sEMG biofeedback
  - Pressure biofeedback
  - DPNS

NMES

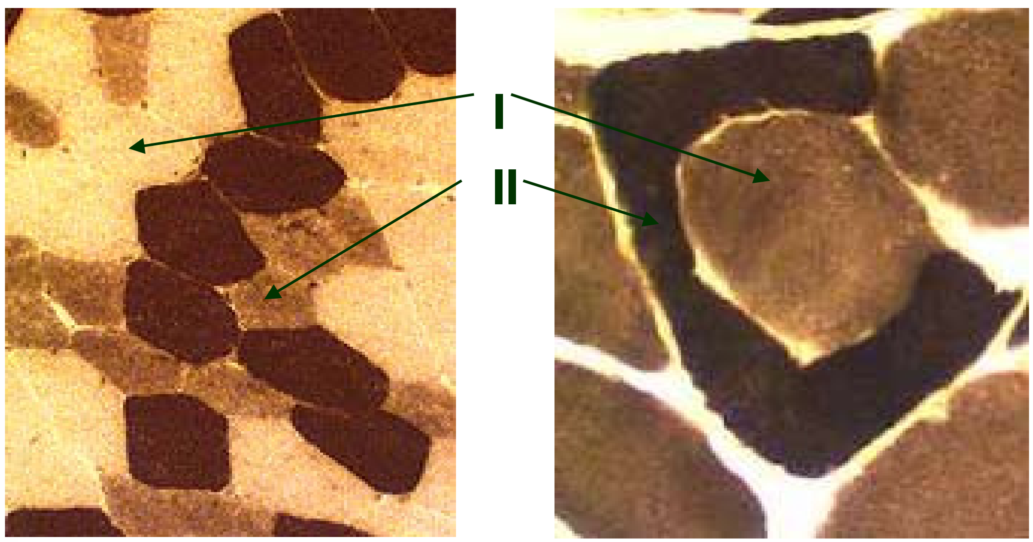
- Electrodes are placed on the skin
- Current flows between the electrodes eliciting a depolarization of the motor neurons and thereby a contraction in



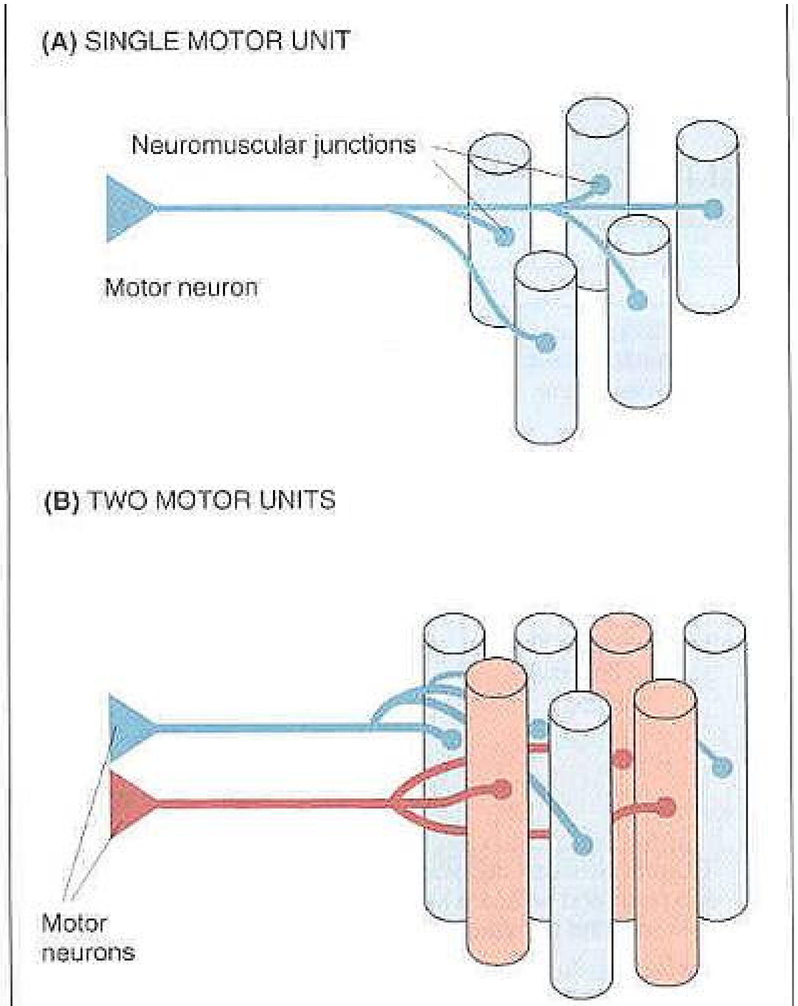


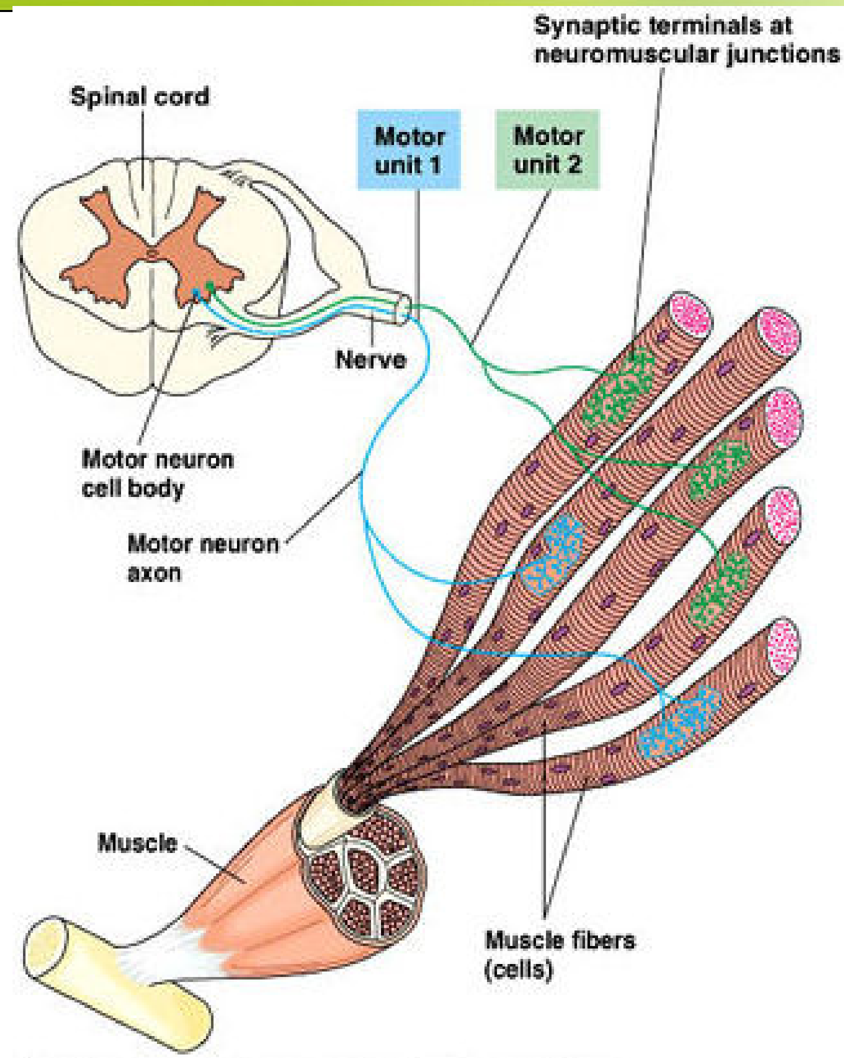
Recruitment during NMES

- Recruitment patterns during electrical stimulation are reversed:
  - Type II fibers are the first to contract
  - Type I fibers contract only later when the pulse width and intensity are raised above a certain threshold
  - Result: training effect that preferentially trains the type II fibers



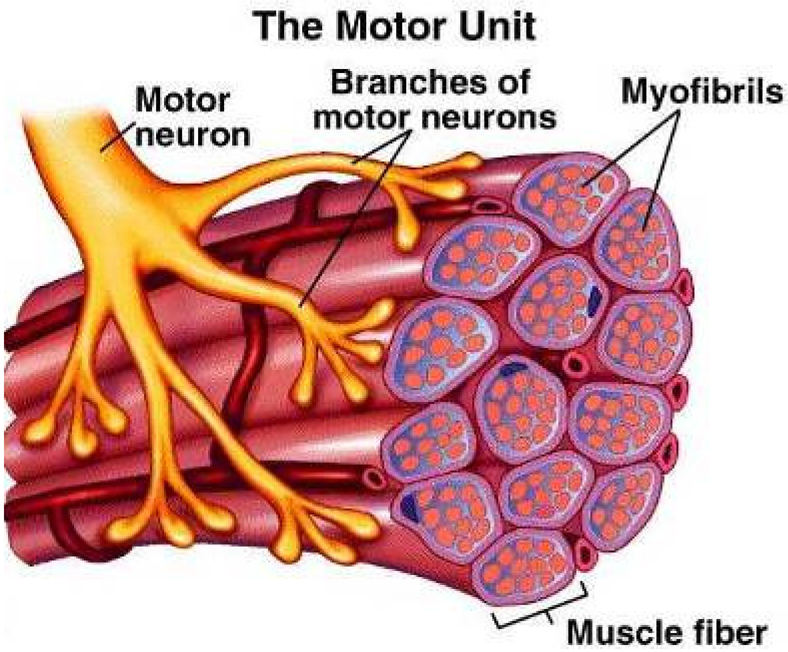
Preferential recruitment type II





Firing pattern during NMES

- Muscle fibers within the path of the current will contract (synchronous contraction)
  - Muscle fibers are not permitted to relax
  - Exercise intensity is therefore greater than it is during normal contractions



NMES (VitalStim)

Description

- Stimulus/Tool: Surface electrodes deliver electrical stimulation to subcutaneous muscles to increase muscular effort during swallow.
- Goal of modality: Increase muscular effort to increase exercise intensity and frequency.
- Outcome: Strong facilitation of muscular effort and facilitation of cortical reorganization.
- Comment: Neurophysiological rationale is sound: increased effort accelerates strengthening and promotes motor learning. Benefit: can be used during the swallow.

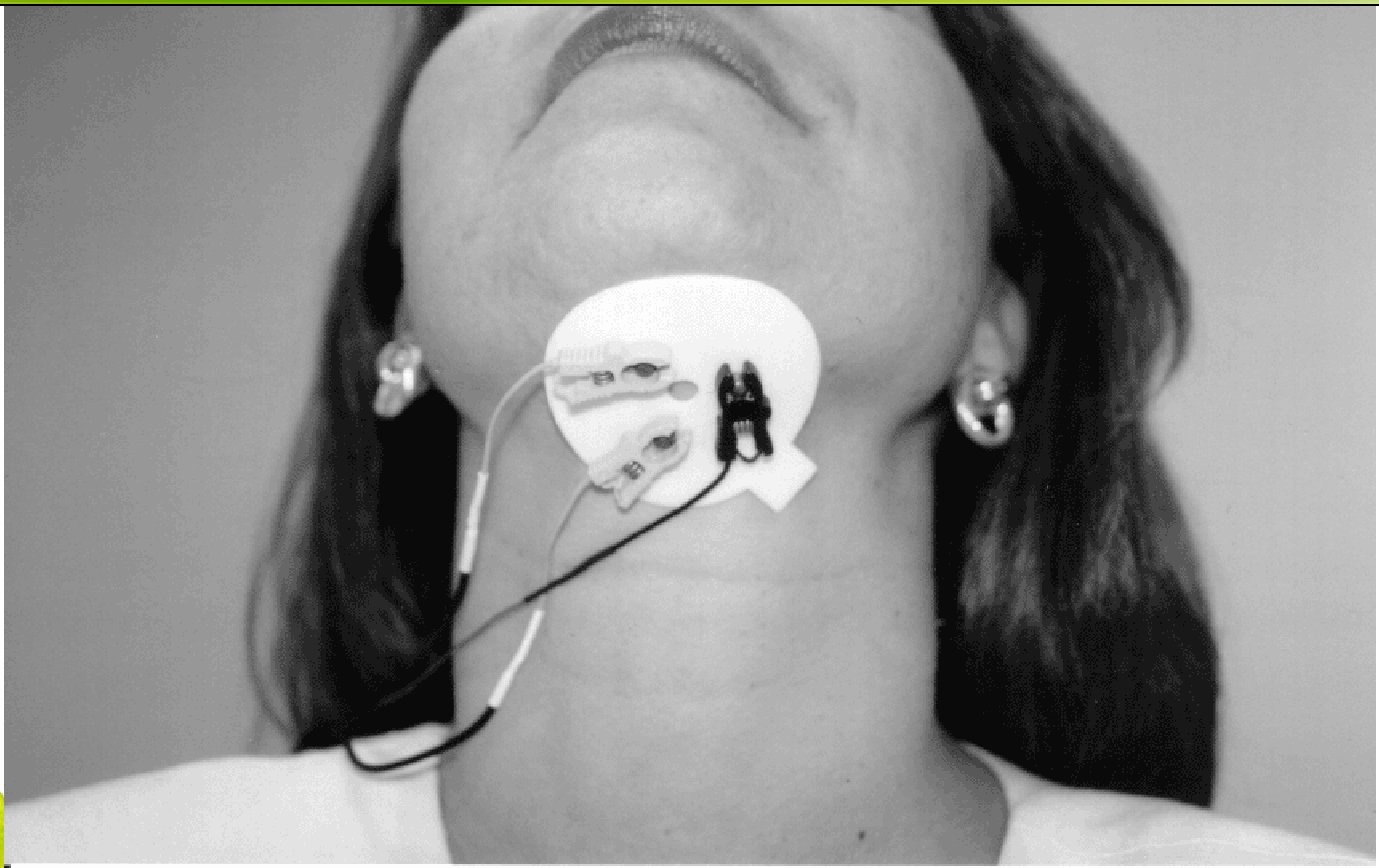
Characteristics

- Increases intensity: Yes
- Increases frequency: Yes
- Promotes specificity: Yes
- Enhances variability: Yes

Benefit to swallow

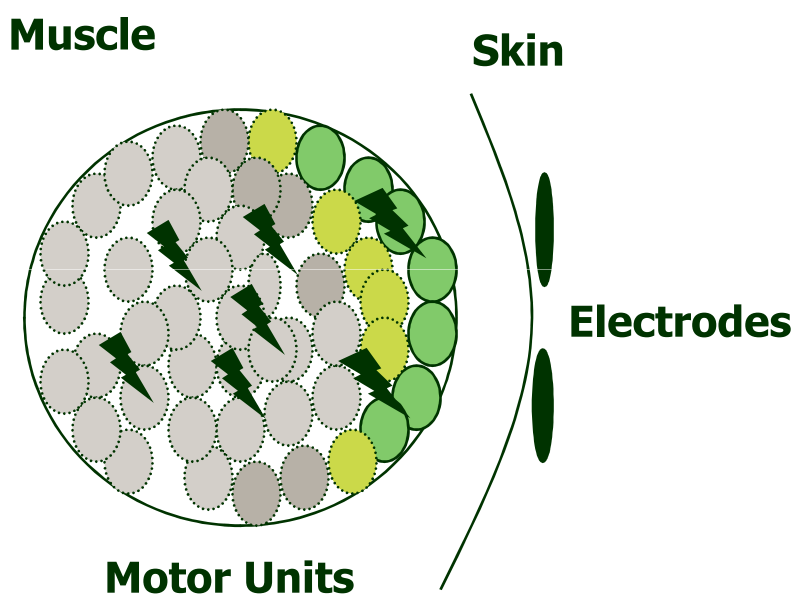
- Cross-over to swallow: Yes
- Promotes strength: Yes
- Promotes endurance: ?

sEMG biofeedback



sEMG biofeedback

- Surface electrodes pick up electrical activity in underlying muscle fibers
- Fibers closest to the skin contribute most to the sEMG signal



sEMG biofeedback

Description

- Stimulus/Tool: Surface electrodes measure electrical activity to provide visual and/or auditory feedback about muscular effort.
- Goal of modality: Increase voluntary motor recruitment effort to increase exercise intensity and facilitate swallow effort
- Outcome: Strong facilitation of muscular effort
- Comment: Neurophysiological rationale is sound: increased feedback of effort facilitates effort and promotes motor learning. Benefit: can be used during the swallow.

Characteristics

- Increases intensity: Yes
- Increases frequency: Yes
- Promotes specificity: Yes
- Enhances variability: Yes

Benefit to swallow

- Cross-over to swallow: Yes
- Promotes strength: Yes
- Promotes endurance: ?

Pressure biofeedback

Pressure biofeedback

Description

- Stimulus/Tool: Intraoral pressure sensor provides visual and/or auditory feedback about tongue effort (pressure against palate).
- Goal of modality: Increase voluntary motor recruitment effort to increase exercise intensity and facilitate swallow effort
- Outcome: Strong facilitation of muscular effort
- Comment: Neurophysiological rationale is sound: increased feedback of effort facilitates effort and promotes motor learning. Benefit: can be used during the swallow.

Characteristics

- Increases intensity: Yes
- Increases frequency: Yes
- Promotes specificity: Yes
- Enhances variability: Yes

Benefit to swallow

- Cross-over to swallow: Yes
- Promotes strength: Yes
- Promotes endurance: ?

Thermotactile stimulation

Description

- Stimulus/Tool: Thermal/tactile stimulation applied intraorally with subsequent swallowing activities
- Goal of modality: Reflexive facilitation of motor oropharyngeal response during subsequent swallow effort
- Outcome: Brief facilitation of swallow effort
- Comment: Neurophysiological rationale is plausible: sensory input through CN V. Shortcoming: swallow effort can not occur simultaneously.

Characteristics

- Increases intensity: No
- Increases frequency: Maybe
- Promotes specificity: Maybe
- Enhances variability: Maybe

Benefit to swallow

- Cross-over to swallow: ?
- Promotes strength: ?
- Promotes endurance: ?

DPNS

DPNS

Description

- Stimulus/Tool: Intense, repetitive gustatory/thermal/tactile stimulation applied intraorally and intrapharyngeally
- Goal of modality: facilitate/elicit a pharyngeal muscle contraction
- Outcome: reflexive contractions (gag reflex) elicited in pharyngeal muscles
- Comment: Intensive training (when done right) but possibly training of wrong movement patterns. Shortcoming: swallow effort can not occur simultaneously.

Characteristics

- Increases intensity: Maybe
- Increases frequency: Maybe
- Promotes specificity: No
- Enhances variability: ?

Benefit to swallow

- Cross-over to swallow: ??
- Promotes strength: Yes
- Promotes endurance: Yes

Frequently asked questions

- What about fatigue?
- What about progressive neuromuscular diseases?

Fatigue in NMD

- Central fatigue is common symptom in more than 60% of neuromuscular disease patients (Zwarts, 2008), such as:
  - ALS
  - MS
  - MD
  - Parkinson’s disease
  - SNP
  - MG
- Exercise therapy is commonly thought to be contraindicated in progressive neuromuscular diseases for concern of:
  - Exacerbating disease progression
  - Precipitously depleting functional capacity

Exercise in NMD

- Worsening of motor neuron degeneration (excitotoxicity, oxidative stress or increased calcium loads) as a result of moderate exercise is unlikely (Liebetanz, 2004)
- Moderate exercise benefits patient in terms of fatigue resistance and functional performance in ALS, MS, MD, (McCrate, 2008; Cup, 2007)
- Therapeutic electrical stimulation decreases central fatigue during exercise and may thus increase benefits of functional exercise
- Close monitoring of functional performance indices during and after exercise therapy should guide exercise intensity

Recommended course work

- As SLP's get into modalities more, you have a unique opportunity to do it right: evidence based and firmly anchored in rehab approach
- Responsibility of the clinician: get educated
- Eventually it will be mandatory (see OT curriculum)
- Recommended courses:
  - VitalStim Therapy certification course
  - McNeil Dysphagia Therapy Program
  - Myofascial Release/Manual Therapy

Summarize…

- Modalities are intended to be an adjunct to primary rehab intervention, especially exercise therapy
- As such, their use should contribute to achieving rehab goals, i.e. recovery of motion
- Exercise therapy is not the same as compensation; likewise, just using a modality is not really "therapy"
- Modality use can not be separated from exercise therapy
- Modalities that currently best enhance exercise therapy are electrotherapy (NMES) and sEMG biofeedback

Questions?

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