VitalStim in Swallowing Rehabilitation

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Disclosures

- No financial or non-financial disclosures

Control of the swallow

- Both voluntary and involuntary
  - Pattern elicited response
  - Cortex, brainstem, peripheral nerves
- Sensory and motor
  - Feedback is important
What is VitalStim?

- Neuromuscular electrical stimulation (NMES), wherein a device sends an electrical impulse through the skin to selected muscles
- Specifically meant for treatment of dysphagia
  - FDA approved
- Used to support gains in muscle strength development, reduce atrophy, and enhance muscle reeducation
- Supports cortical reorganization through repetition, sensory input, movement feedback, and successful outcome of movement

How does it work?

- Electrodes are placed in different positions to stimulate muscles involved in swallowing, based on impairments
- Electrical stimulation passes between the electrodes to create a biphasic pulse to the motor point
- Increased intensity leads to current passing deeper and depolarizing more neurons
  - Sensory > sensory and motor
- Increased content of muscle contractile proteins, amount of enzymes used in aerobic pathways, mitochondrial size, and capillary density
  - Keep it functional

Normal swallow compared to a stimulated swallow

**Normal Contraction**
- Muscle fibers do not all contract at the same time, but relay to each other
- Smaller motor units innervated by slow-twitch fibers depolarize first
  - Fast-twitch fibers with increased effort

**Evoked Contraction**
- Muscle fibers within the path of the current contract at the same time
- Larger motor units innervated by fast-twitch fibers are depolarized first
  - Slow-twitch fibers with greater intensity
- Increased intensity, fatigue more quickly
- Repeated fatigue changes the muscle
- Increases capacity to meet the demands
- VitalStim fatigues muscles more quickly due to the increased intensity
- BUT... need to continue to use the muscles
- Keep it functional

How to decide if someone is appropriate for VitalStim
- History
- Bedside Swallow Evaluation
- Instrumental Evaluation
  - Not necessary, but helpful to objectively determine what needs to be targeted
- Treatment plan
Who is not appropriate for VitalStim?

- Patients with active neoplasm or infection at electrode location
- Patients with significant lower motor neuron damage
- Patients with significantly impaired cognition
- Open wounds at site
- Patients with seizure disorders, significant reflux, experiencing drug toxicity, tracheostomy patients, or those who have implanted electrical devices can participate, but proceed with caution

What do you need to use VitalStim?

Is VitalStim effective?

- Outcome measures vary depending on the study
  - Clark et al, 2009
    - Variable physiological changes
    - Positive changes for functional swallowing outcomes for most
  - Design flaws throughout VitalStim research
  - Issues noted by Burns and Miller, 2011, indicating insufficient evidence to determine effectiveness, overall, and for diagnoses and severities
  - Shaw et al, 2007: helpful for mild to moderate, less likely to make gains in severe
  - Bulk of research done on patients following strokes
Efficacy with brain injured population

- Terre and Heath, 2015
  - Randomized, controlled, blinded to patients and assessors analyzing data, subjective and objective measures evaluated over 3 month period
  - Functional Oral intake score (FOIS), Likert scale
  - Oral transit time, palatal closure, and penetration/swallowing (oral); Pharyngeal residuum after the swallow, laryngeal elevation, cricopharyngeal dysfunction, pharyngeal delay time, pharyngeal transit time, and penetration/aspiration (Pharyngeal)
  - Pharyngeal transmural to address VLS elevation, pharyngo-oesophageal coordination, and pharyngeal contracture

- Results
  - Larger gains in FOIS in VitalStim group after 1 mo (P=0.005)
  - No significant difference between groups at 3 mo
  - Higher level of perceived improvement with VitalStim after 1 mo (P=0.001)
    - No significant difference between groups at 3 mo
    - Improvements in ability to handle thinner consistencies at 1 mo with VitalStim (P=0.015)
    - No significant difference between groups at 3 mo
    - No significant change in post-treatment analyses between groups for temporal measures, but greater change in VitalStim group
      - Oral transit time within the normal range for the VitalStim group
      - Improved, but still abnormal pharyngeal delay (PDT) and pharyngeal transit time (PTT) with VitalStim
      - No change at 3 mo, more VitalStim subjects rated to have normal PDT and PTT in persistent abnormal in control subjects
    - Pharyngeal-oesophageal manometry showed significant increase in pharyngeal contraction pressure at 1 mo after VitalStim with no significant change in sham group (P=0.04)
      - No change for other group at 1 mo

- Safety Issues regarding the use of VitalStim Therapy
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- Sources