Management of Swallowing Disorders

- Key elements of rehabilitation will likely involve ➔
  - effectively altering the underlying pathway and/or
  - enhancing the remaining intact pathway after neurologic damage has occurred.
- Treating dysphagia could involve stimulating the sensory system more often through the two primary nerves involved with swallowing, **the glossopharyngeal** and **superior laryngeal nerves**, as well as by enhancing the **trigeminal sensory input**[i].
- Enhancement of the motor system can occur by using muscles in special exercises or by electrically stimulating the target muscles directly[ii].
- **Examples of sensory stimuli** could include a blunt probe, a drop of water, an air puff, a sour solution, an ice cube applied with stroking, or a thermo-regulated probe applied to cool or warm a region of oropharyngeal mucosa[iii].
- Stimulating specific glossopharyngeal nerve (CN IX) branches along with stimulation of the internal branch of the superior laryngeal nerve (iSLN) will evoke more swallowing in either an anesthetized animal or in an unanesthetized experimental animal with a decerebration that removes the cortex and subcortical regions. This finding suggests that stimulation of the sensory nerve fibers that synapse in the primary brain stem swallowing center can modify the threshold of this site, even in the absence of a cortex[iv].
- Several studies have evaluated the effect of altering sensory input on the cortical swallowing pathway (Power et al., 2004). We can increase the use of sensory input from CN IX or iSLN , **increase the intensity of the sensory stimulus**, or possibly enhance the stimulation of sensory systems which do not directly synapse on the central swallowing pathway, particularly in the brain stem around the nucleus and tractus solitarius (NTS).
- Shinghai (1977) found that moving such a stimulus across multiple oropharyngeal and hypopharyngeal receptive fields of sensory neurons is effective in evoking swallowing.
- **We could enhance the stimulus by combining several modalities** to, it is hoped, lower the central threshold to elicit swallowing
- To enhance the excitability of the brain stem central pattern generator for pharyngeal swallowing, for example, **we may wish to utilize the trigeminal (CN V) nervous system.**
- Important sensory information (e.g., pain, temperature, tactile sensation) from the tongue, palate, pharynx, and larynx comes through the trigeminal sensory fibers and synapses in several regions within the NTS.
- These sensory inputs do not appear to directly trigger the pharyngeal phase of swallowing, but could be effective for **modulating the threshold to evoke swallowing.**
- **Increased frequency of use of a skeletal** or striated muscle enhances the fatigue resistance of the muscle and causes muscle fibers to transform and become more oxidative. As a result, they contain slower contractile proteins and increased capillary beds to support the increased mitochondria present in the muscle cells. **Increasing the load against which muscle fibers respond** will also cause the fibers to transform and increase the number of contractile proteins and myoplasm. This, in turn, increases the diameter of the muscle fibers and improves the potential to develop more force or tension.
- **Electrical stimulation applied directly to a striated muscle,** particularly intramuscularly, has also been shown to strengthen the muscle in an animal model.
- One effective stimulation paradigm has used a high frequency of 100Hz (most motoneurons and their motor units discharge at much lower levels of 12-18Hz), with a short number of electrical pulses (20-30), at 90% of the maximum isometric titanic tension, inducing 200 muscle contractions in 24 hours.
- Electrical stimulation has also been directly applied as a sensory stimulus, and has been tried with the faucial pillars to evoke swallowing.

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- There are discrete sites of the cortex that evoke pharyngeal swallowing with electrical stimulation, but most cortical sites induce swallowing intermixed with rhythmic jaw movements.
- The following three questions need to be answered after evaluation of the patient with an oropharyngeal swallowing problem:

1) What type of nutritional management is necessary?
2) Should therapy be initiated and what type (compensatory, facilitating, or and diet modification)?
3) What specific therapy strategies should be used?
4) Does the patient require a maintenance program to maintain the gains in therapy or slow deterioration?

The goals of dysphagia therapy are:[v]

- The patient is able to tolerate chewing, drinking, and swallowing food and liquids safely with out signs and symptoms of aspiration
- To assure that the nutritional needs are met

Treatment Techniques:

1) Diet Modification Techniques:
2) Compensatory Treatment Techniques:
3) Rehabilitative therapy Techniques:

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[i] Miller, A.J., 2008. Neuroscience of Swallowing: Strategies in Rehabilitation. *Perspectives on swallowing and swallowing disorders*, 17 (4), pp. 121-127.

[ii] Miller, A.J., 2008. Neuroscience of Swallowing: Strategies in Rehabilitation. *Perspectives on swallowing and swallowing disorders*, 17 (4), pp. 121-127.

[iii] Miller, A.J., 2008. Neuroscience of Swallowing: Strategies in Rehabilitation. *Perspectives on swallowing and swallowing disorders*, 17 (4), pp. 121-127

[iv] Miller, A.J., 2008. Neuroscience of Swallowing: Strategies in Rehabilitation. *Perspectives on swallowing and swallowing disorders*, 17 (4), pp. 121-127

[v] Palmer, J.B., Drennan, J.C. & Baba, M. (2000). Evaluation and Treatment of Swallowing Impairments [Electronic version]. *American Family Physician Journal*, 61, 8