

Effects of Neuromuscular Electrical Stimulation on Swallowing - Real or Placebo? One Case Study

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Abstract. Neuromuscular electrical stimulation (NMES) of laryngeal muscles is a popular treatment strategy for adults with dysphagia (swallowing difficulty). However, the evidence base for the theoretical premise of this strategy is limited. Advocates of the approach state that notable improvements in swallowing ability can be observed after 12 consecutive days of treatment. The adult in this case study was a 42 year-old woman with a history of drug abuse and related physical and nutritional problems. She suffered a series of strokes and was admitted to the Veterans Administration system for care. Her difficulties were documented through a Modified Barium Swallow (MBS) videofluoroscopic examination as she swallowed thin and nectar-thick liquids. The transit of each liquid was measured at five specific landmarks and showed that her swallow was significantly delayed with evident aspiration of liquid into her airway. She underwent 10 consecutive days of NMES treatment and a repeat MBS examination. Post-NMES liquid transit measures continued to document a delayed swallow and aspiration. However, the participant felt strongly that NMES was effective. Results raise important considerations about the placebo effect in treatment and its influence in decision-making.

1. Introduction

Anecdotal data from clinicians suggests that Neuromuscular Electrical Stimulation (NMES or VitalStim) is a popular treatment strategy for adults with dysphagia (swallowing difficulties). NMES involves the administration of an electrical current to the muscles of the neck, through surface electrodes, to initiate and coordinate muscle contractions, as well as strengthen muscles necessary for swallowing. [1] Advocates of the approach report that NMES treatment for 12 consecutive days, 60 minutes per day, can restore normal swallow function in 35% of individuals who have severe dysphagia, and in 45% of all individuals who have mild to moderately severe dysphagia. [1, 2] Using NMES with the protocol advocated by Freed et al. [1], adults with dysphagia provide the clinician with feedback and in turn the clinician adjusts the intensity of the electrical current while the participant performs a deliberate effortful swallow as food and liquid are consumed. Other investigators argue for more rigorous research into the intensity and placement of electrical stimulation used in the treatment of adults with dysphagia. [3, 4] These investigators are particularly concerned that electrical stimulation of the neck muscles may place adults with dysphagia at greater risk for aspirating food and/or liquid into the airway and developing aspiration pneumonia. The following case presents objective data pre- and post-intervention with NMES and the patient's reactions to the intervention.

2. Experiment

The participant was a 42-year-old woman with a history of drug abuse and related physical and nutritional problems. She suffered a series of strokes that severely affected her ability to direct food and liquid effectively into the esophagus for swallowing. As a result, she was fitted with a percutaneous enteral gastric (PEG) tube directly into the stomach through which she received her primary nourishment. Her ability to coordinate breathing and swallowing also was weak, which put her at further risk for aspiration. She expressed severe apprehension while eating.

Procedure and Results. A Modified Barium Swallow (MBS) or videofluoroscopic examination was performed as a baseline measure to document her ability to swallow thin and thickened liquids. The transit of each liquid was measured at five specific landmarks, along with elevation of the larynx (movement of the hyoid bone) and areas where liquid pooled. [5, 6] The duration of a typical swallow for 44-year-old women is approximately 1.3 seconds. [7] Compared to normative data, [5, 7] the participant's swallow was significantly delayed with pooling of liquid in the valleculae and pyriform sinuses, and evident aspiration of liquid into the airway (Table 1). She underwent 10 days of consecutive NMES treatment (the VitalStim approach) [1] and then a repeat MBS examination. Post-NMES

liquid transit measures again documented a delayed and unsafe swallow, with continued pooling of liquid in the pyriform sinuses and aspiration. However, the participant felt her swallow had improved noticeably and stated she was no longer apprehensive about taking liquids orally. Her speech-language pathologist removed her NPO (nothing by mouth) status and introduced nectar-thickened liquids and pureed foods as the participant was weaned from her feeding tube.

Table 1: Mean bolus transit measurements (in seconds) for 20 cc nectar-like and thin liquid pre and post-NMES treatment.

Liquid Transit Measures	Pre-Treatment MBS		Post-Treatment MBS	Normative Data
	Nectar	Thin	Nectar	
Hyoid bone movement to initiate a swallow (H1)	32.18 (±8.97)	52.01	28.89	
Liquid past nasal spine (B1)	30.35 (±7.60)	50.44	-	
Liquid past tongue base (B2)	31.59 (±8.27)	50.72	-	
Liquid at valleculae (B3)	31.68 (±8.21)	50.79	-	
Liquid beyond valleculae (B4)	31.87 (±8.05)	50.82	28.91	
Liquid enters Upper Esophageal Sphincter (B5)	32.68 (±8.61)	52.09	29.01	
Mean time difference between H1 and liquid transit measures				
H1-B1	1.82 (±1.36)		-	0.25
H1-B2	0.58 (±0.70)		-	0.15
H1-B3	0.49 (±0.76)		-	-0.04
H1-B4	0.31 (±0.90)		-0.02	-0.06
H1-B5	-0.50 (±0.35)		-0.12	-0.11

Note. In the baseline measures, two trials of nectar liquid were run; one trial of thin liquid. Measurements for thin liquids post-treatment were not obtained by the radiologist due to the participant’s aspiration on nectar liquid. Equipment error prevented B1, B2, and B3 measures post-treatment.

3. Discussion and Significance. Objective measures showed some improvement in timing but continued delayed swallowing following the NMES treatment. However, the apparent positive psychological effects of the patient-directed NMES treatment appear worthy of consideration and may parallel a “placebo effect” – real psychobiological changes that can be attributed to the therapeutic environment, particularly the expectation of a patient that the treatment will have some impact. [8] This participant’s past experiences, beliefs, and level of motivation all may have increased her positive reaction to the NMES treatment, which could account for her impression that her swallowing ability had improved to a notable degree. Further, treatment, whether it is sham or active, requires a high degree of trust, communication, and empowerment between clinician and patient and this relationship can significantly enhance health outcomes. [8, 9] Quite possibly, this patient’s swallowing did feel better to her although such improvement was not yet measured as clinically significant. Findings support the importance of obtaining continuous input from patients regarding their perceptions of the effectiveness of the therapeutic environment and strategies to manage their dysphagia.

4. References

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