Andrea Parker B.S. and Abbie Olszewski, Ph.D., CCC-SLP
University of Nevada, Reno

Surface EMG Biofeedback During Swallow Therapy

Introduction

- Swallowing is a complicated event that incorporates activity from multiple muscle groups in the upper aerodigestive tract (Crary, Carnaby, & Groher, 2006).
- The inability to swallow safely presents an increased risk of pneumonia, dehydration, and even death. Painful swallowing, or odynophagia, can cause malnutrition and reduced quality of life (Stepp, Britton, Chang, Merati, Matsuoka, 2011).
- It is important to visualize the coordinated work of the muscular movements during the pharyngeal phase of the swallow to evaluate the functional abilities of a patient and determine whether there is adequate amplitude to ensure proper timing for safe swallowing (Crary, Carnaby, & Groher, 2006).

Methods

- During the pharyngeal phase of swallowing, a study of surface electromyographic (sEMG) signals can be obtained, which displays amplitude and duration of the swallow. Other instrumentation used to detect amplitude is videofluoroscopy, which is a video and yields amplitude and duration measures (Crary, Carnaby, & Groher, 2006).

Case Scenario

Andrea is a speech pathologist working in private practice. Her client, Claire, is a young woman interested in starting a family and needs to address her swallowing problem before becoming pregnant. Her family physician has referred her here.

After an extensive interview with Claire, Andrea performed a flexible fiber optic endoscopic examination of swallowing (FEES) on Claire. Andrea’s clinical evaluation of Claire found no organic cause for her dysphagia.

The clinic has recently acquired equipment capable of performing surface electromyography. Andrea was wondering what effect the biofeedback would have on Claire’s condition. She thought it might help Claire to visualize her swallow. She wondered if Claire could learn the therapeutic maneuvers more efficiently if sEMG biofeedback was added to her therapy.

Purpose

- Does traditional therapy with adjunctive sEMG biofeedback for patients with dysphagia increase treatment efficiency, as measured by lower total cost, greater functional oral intake, and higher swallow amplitude, compared to traditional therapy?

External Evidence: Research has shown that adding sEMG to traditional therapy techniques is a safe and effective way to improve patient outcomes. The biomechanical events represented in the trace recordings are highly correlated to the gold standard of videofluoroscopy but without the cost and health hazards associated with x-ray exposure. It is safe enough to use multiple times a day with minimal discomfort.

Evidence Internal to Clinical Practice: The clinic that employs Andrea is providing training for their new equipment. She feels that adding the sEMG biofeedback will improve many of her patient’s outcomes.

Final Decision: Integrating external evidence found in research studies, internal evidence to the clinical practice, and the client’s expressed needs, I feel comfortable using sEMG with Claire adjacent to traditional swallow therapy techniques to resolve my clients health concerns.

Discussion

- Swallow rate
- Premotor duration
- Pressswallow time

Results

- Swallow rate for liquids: Posttest significantly quicker than pretest, p = .034
- sEMG scores for premotor time: Posttest significantly faster than pretest, p = .003
- sEMG scores for pressswallow time: Posttest significantly faster than pretest, p = .001
- SWAL-QOL scores: Significantly higher than pretest, p = .018

Strong positive significant correlations between VFSS and sEMG for each time and each outcome:
- Hyoid elevation:
  - onset: r = .9998, p < .05
  - peak: r = .9999, p < .05
  - offset: r = .9997, p < .05
- Pharyngeal constriction:
  - onset: r = .9997, p < .05
  - peak: r = .9999, p < .05
  - offset: r = .9997, p < .05

Amplitude:
- There was significantly higher muscle recruitment with swallow to command compared to volitional swallow, p = 0.001

- Average total cost per unit on the FOIS scale
- Cost per unit on FOIS: Although patients with dysphagia following stroke required more therapy sessions, their functional change was greater; they achieved more change on the FOIS, i.e., Stroke = $321.00, Cancer = $453.00.

References


