**Statistical Design Consulting**

**SEMESTER REPORT**

**Spring 2024**

**Client:** Macy Griffis  **File Number:** 24-023

**Department:** Speech, Language, and Hearing Sciences **Major Prof:** Dr. Georgia Malandraki

**Consultant:** Sumeeth Guda **Initial Meeting Date:** 03/19/24

**Meeting Attendees:** Macy Griffis, Sumeeth Guda, Dr. Georgia Malandraki, Dr. Chong Gu

**Statement of Problem:** To identify neuromuscular amplitude and timing characteristics of typical swallows and compare to rehabilitative swallowing maneuvers in idiopathic Parkinson's disease patients.

**Goal of This Project:** M.S Thesis

**Background:**

The client’s research is about studying swallowing techniques among people with Parkinsons disease. Primarily, the two most common techniques for swallowing and dysphagia rehabilitation are the Mendelsohn maneuver and effortful swallow techniques. One of the major issues in patients affected with diseases that affect the head and neck is that they have difficulty swallowing. What the client is trying to determine is which exercises and maneuvers are most effective to rehabbing the swallowing among patients with Parkinson’s disease.

The client will collect data from a group of patients with idiopathic Parkinson’s disease and dysphagia (n=15). The patients will wear a sEMG (surface electromyography) sensor system developed by the I-EaT lab (i-Phagia system) to collect submental muscle activity. Participants will perform two trials each of the following five tasks:

1. Typical swallow, 5ml thin liquid
2. Typical swallow - 5cc pudding
3. Swallows using a swallow maneuver (Mendelson maneuver)
4. Swallows using maximum effort (effortful swallow)
5. Maximum isometric tongue press.

Submental muscle activity will be measured during these five tasks.

The experimental factors include the patient population (idiopathic Parkinson’s), as well as the labeling of the swallowing tasks (effortful swallow, Mendelsohn maneuver, tongue resistance, and typical swallow 1 and 2) Surface EMG will be used to quantify muscle activity in the study. The client will measure three outcome variables of each trial in the study: normalized mean sEMG amplitude, time to peak, and burst duration.

* The normalized mean sEMG amplitude is measured in % of maximum effort and indicates the level of muscle contraction and force.
* Time to peak is the duration from the onset of contraction to the time of peak amplitude (measured in seconds). This indicates how quickly a muscle reaches its maximal activation from the onset of the muscle activity.
* The burst duration is the total duration of the muscle contraction during an event (measured in seconds) detected on the EMG device.

**Progress During Current Semester:**

The client’s project is a textbook example of a randomized complete blocking design. The main thing the consultant did was analyze the dataset in R and provide the code and explanations to the client.

What the consultant did was verify the left and right-side measurements to validate that the measurements from the 3 signals (Burst Duration, Time to peak, Maximum Amplitude) were the same. Additionally, the consultant fitted a glm model to the data and they investigated if ordering matters within each of the swallowing tasks. While doing this, the client also validated that the left side and right-side model residuals were approximately the same.

The consultant created an R markdown file containing all of the analysis and interpretations of the results and shared the findings with the client. The consultant explained the ways to analyze and interpret the results with the client.

**Current Status:** Continuing.