Client 24-023

Meeting time: 09/18, Wednesday, 9:30 AM

Current stage: Analysis

Supported by a grant or contract: Yes. Partially funded: Center for Aging and the Life Course Grant and Greulich Gift Fund (Awarded to Advisor)

Background:

The client is a master’s student in the SLHS department, they want to identify and describe neuromuscular amplitude and timing components of typical swallows in patients with idiopathic Parkinson’s disease. Specifically, by comparing neuromuscular amplitude and timing components of rehabilitative swallowing maneuvers (Mendelsohn maneuver, effortful swallow, isometric tongue contraction) with typical swallows in patients with idiopathic Parkinson’s disease.

The client will collect data from a group of patients with idiopathic Parkinson’s disease and dysphagia (n=15). The response of submental muscle activity will be measured using a wearable sEMG (surface electromyography) sensor system developed by the I-EaT lab (i-Phagia system).

The current set up of the experiment has the participants performing two trials of five tasks:

a) typical swallows (two consistencies, 5ml thin liquid, and 5cc pudding)

b) swallows using a swallow maneuver (Mendelson maneuver),

c) swallows using maximum effort (effortful swallow)

d) maximum isometric tongue press.

Submental muscle activity will be measured during these four tasks.

The experimental factors are the patient population (idiopathic Parkinson’s), in addition to the 4 different Swallowing tasks (effortful swallow, Mendelsohn maneuver, tongue resistance, and typical swallows).

The Surface EMG will be used to quantify muscle activity in the study and will measure three outcome variables in the study: Normalized mean sEMG amplitude, time to peak sEMG amplitude, and burst duration.

1. The normalized mean sEMG amplitude is measured in % of maximum effort and indicates the level of muscle contraction and force.
2. Time to peak sEMG amplitude is the duration from the onset of contraction to the time the peak amplitude value is reached (measured in seconds) which indicates how quickly a muscle reaches the maximal activation from the onset of the muscle activity. It is calculated by the duration between the onset of muscle activity and the peak amplitude value for each swallowing task.
3. The burst duration is the total duration of the muscle contraction during an event (measured in seconds) detected on the EMG device.

Progress so far:

In Spring 2024, the client and consultant worked together to create a R statistical report identifying the differences between the patients, validating that the right and left side (Amplitude, Time to peak, burst duration) residuals were approximately the same, and verifying the RCBD assumptions.

In Summer 2024, the client put a pause with the SCS help and they only reached out to make sure their understanding of the results was sound. They published and successfully proposed their thesis to the committee, and beginning in the Fall 2024 semester would begin their official analysis phase of the project.

Research questions from client:

The client wants to compare the data from three measured outcome variables to see:

1. What are the timing and amplitude components of normal swallows for PD patients’ (just descriptive data).
2. Is there any difference in timing and amplitude components of the swallowing maneuvers compared to the typical swallows.

**For Fall 2024:**

How to compare neuromuscular amplitude and timing components of rehabilitative swallowing maneuvers (effortful swallow, Mendelsohn maneuver) with typical swallows (5mL thin liquid and 5cc pudding) in patients with idiopathic PD.

Statistical issues

* The client would like to discuss what statistical methods should be used to answer their research questions.
* The client would like to determine how to compare and contrast the standard swallowing maneuvers (5ml water, 5cc pudding) against the rehab techniques (effortful swallow, Mendelsohn). Based on the signal data (TTP, BD, Max Amplitude)

Discussion points:

1. Is the fifth task a control group?
2. What programming language do they want the work to be completed in.
3. The new wearable sEMG patch provides measurements at three different muscle locations on both the left and right side. Do we average these effects?

1. How does she want to compare the swallowing techniques?
   1. Does she want to aggregate the groups together (standard group, rehab group)?
   2. Does she want to analyze each group separately?
   3. Significant difference using the Tukey test?

Dr. Craig’s notes:

Sumeeth:

                This analysis will be similar to some other Malandraki projects so you might ask Tadd about those.  Usually one does a check of whether left and right side readings can be combined.   I think the three muscles/locations are not combined.  The five tasks are tongue press, maximal effort, Mendelsen, 5cc pudding and 5ml liquid.  Fifteen subject from population perform each of these tasks twice (30 values per outcome per patient – 10 at each location).  Repeated measures study so need to consider correlations.

BC