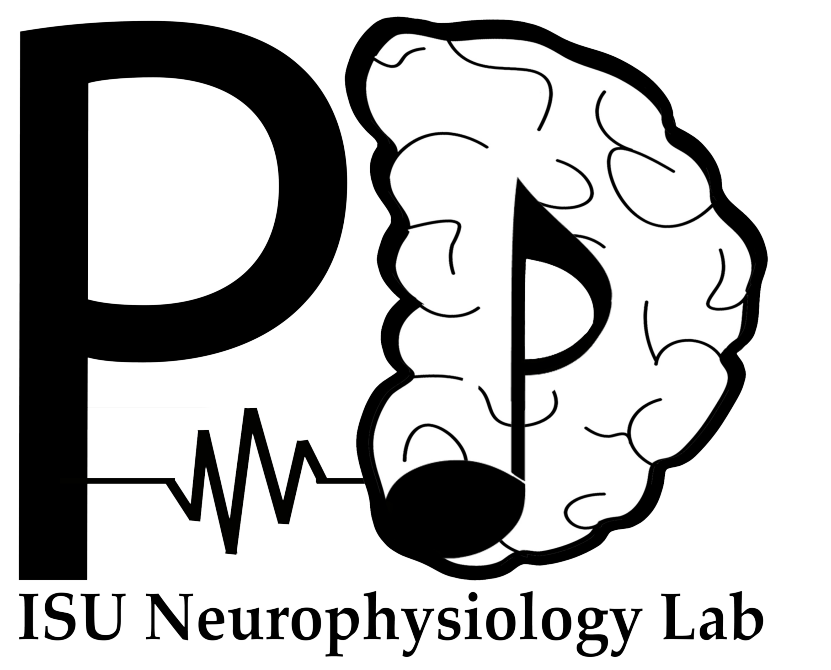




The effects of a weighted pen on handwriting in people with Parkinson's disease

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INTRODUCTION

- Parkinson's disease (PD) is a common neurodegenerative disease.
- Micrographia, or small handwriting, is a common symptom of PD.
- People with PD find handwriting to be a stressful task.
- Weighted pens (Figure 1) are often used and recommended for improving handwriting in people with PD.
- There is a lack of evidence demonstrating the effectiveness of weighted pens.



Figure 1.
Weighted pen

PURPOSE

- The **aim** of this project was to determine how a weighted pen affects handwriting in people with Parkinson's disease.
- We **hypothesized** that the use of a weighted pen would reduce micrographia by increasing letter height and improving muscle activity.

PARTICIPANT DEMOGRAPHICS

N	8
Age (mean \pm SD)	72.4 \pm 6.8
Caucasian (%)	100
Female (%)	62.5
Right-handed (%)	100

Table 1.
Participant demographics

METHODS

Experimental Setup

- Participants used a standard ballpoint pen or a weighted pen with an electromagnetic sensor attached to the tip.
- Electromyography (EMG) sensors were adhered to the extensor digitorum communis (EDC) and first dorsal interosseous (FDI) muscles of the right arm (Figure 2).

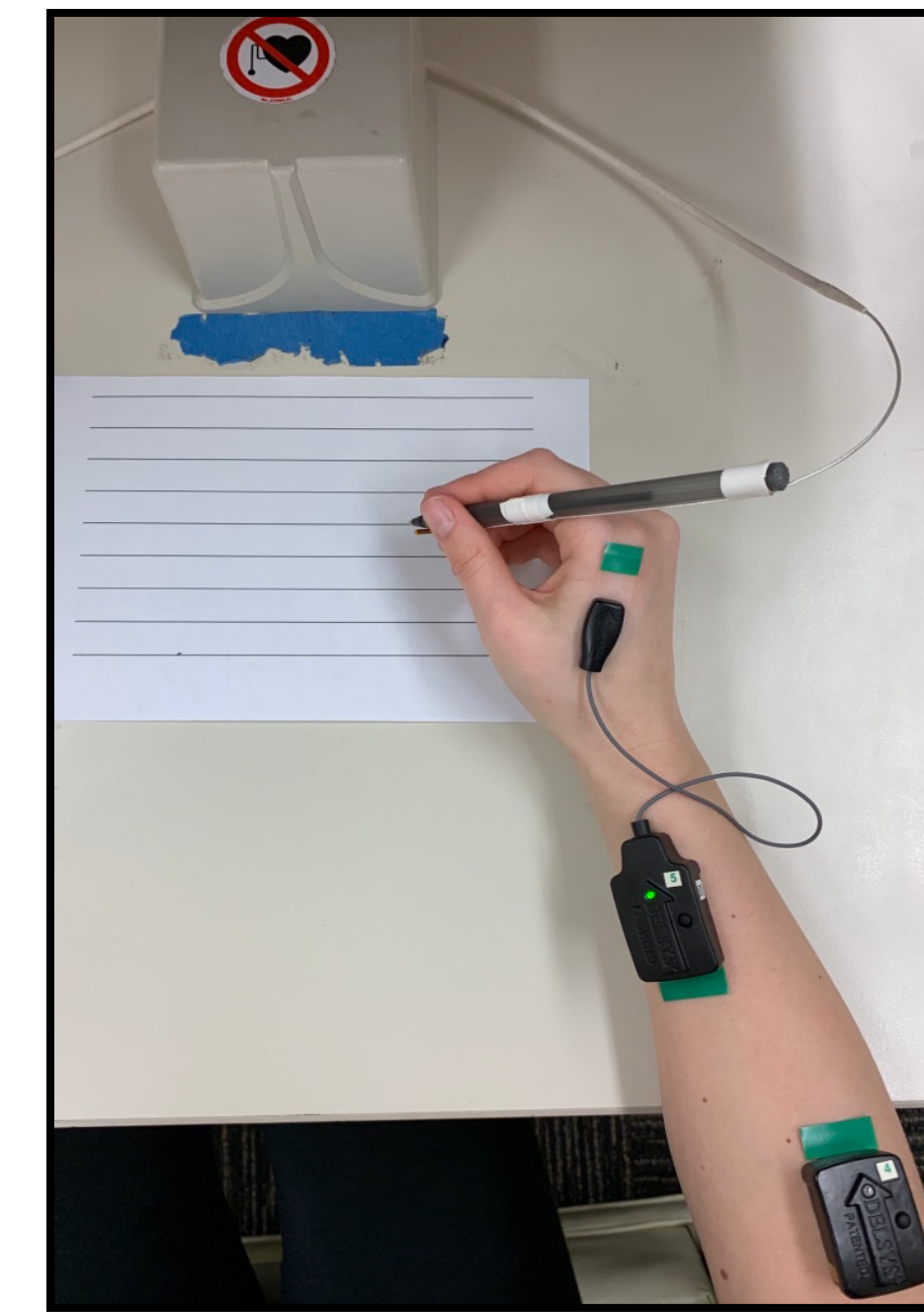


Figure 2.
Experimental setup

Data Collection

- Participants were asked to write continuous, lowercase cursive "L's" on a 1.5 cm lined paper (Figure 3).
- Participants were given an optional practice trial.
- 8 participants with PD completed three 10-second trials with each pen.
- Participants were randomly assigned to start with the standard pen or the weighted pen.

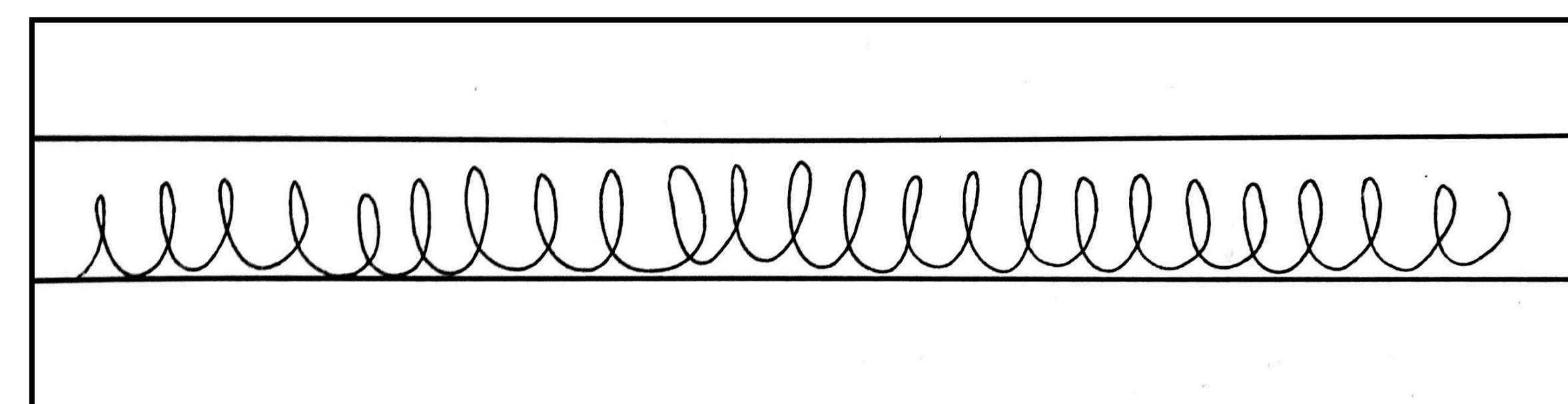


Figure 3.
Example of participant handwriting

Outcome Measures

- Average letter height
- Average peak acceleration of pen
- Average area under EMG curve for EDC muscle
- Average area under EMG curve for FDI muscle

Data Analysis

- Kinematic data from the tip of the pen was measured and analyzed using MotionMonitor.
- EMG curves were marked corresponding to each "L" that was written.
- Paired t-tests were used to compare outcome measures between the standard and weighted pens.
- Significance was set at $\alpha = 0.05$.

RESULTS

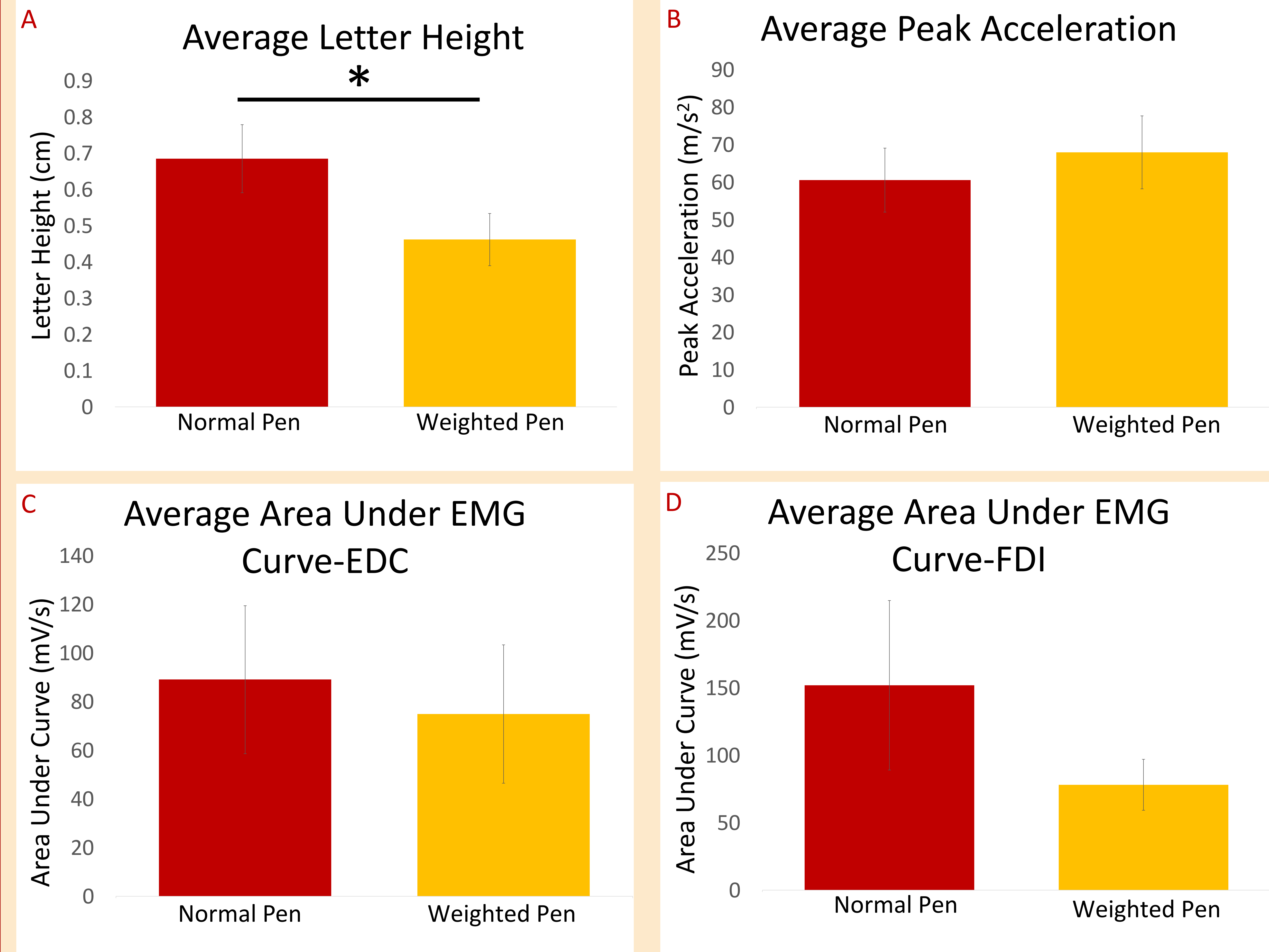


Figure 4.

A) Letter height was significantly reduced with the weighted pen ($p = 0.041$). **B)** Peak acceleration was slightly increased with the weighted pen ($p = 0.151$). **C)** EDC muscle activity was slightly decreased with the weighted pen ($p = 0.208$). **D)** FDI muscle activity was slightly decreased with the weighted pen ($p = 0.178$). * $p < 0.05$ Errors bars = SE

DISCUSSION

- Letter height was significantly reduced with the weighted pen, suggesting that weighted pens worsen micrographia in people with PD.
- No significant changes were seen in acceleration or muscle activity, suggesting that a weighted pen did not improve handwriting.
- Qualitative interviews will be collected in the future to assess the perceptions of handwriting interventions in people with PD.
- Further studies could be conducted to compare this population with healthy older adults.