

# Bio-electro stimulation therapy for the treatment of the non-motor symptoms of Parkinson's disease: a pilot study

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## Background

- Parkinson's disease (PD) is a progressive neurodegenerative disorder driven by loss of dopaminergic neurons in the substantia nigra<sup>1</sup>.
- Although loss of function is typically associated with motor impairments, individuals with PD also experience non-motor symptoms<sup>2,3</sup>.
- Although pharmacologic interventions focuses on increasing intracerebral dopamine, alternative treatment methods include yoga, acupuncture, and dance<sup>4</sup>.
- Anecdotal evidence suggests micro-current stimulation, a form of transcutaneous electrical nerve stimulation, may help improve non-motor symptoms.

### Goal:

We utilized an exploratory approach to determine if the micro-current stimulation provided by the e-tapper TT-R1 improved the non-motor symptoms in patients diagnosed with PD.

## Methods: Participants and Device Information

**Table 1: Participant Demographics**

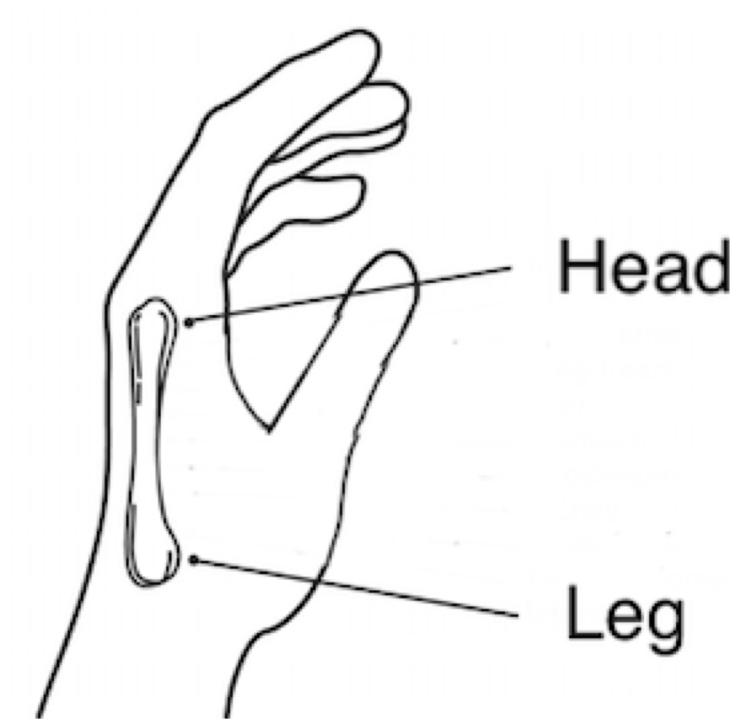
Results are presented as mean (SD). Independent samples t-tests revealed no significant differences for age ( $p = .809$ ), education ( $p = .642$ ), and baseline Hoehn and Yahr Stage ( $p = .635$ ) between HP and LP groups which are explained below.

	Men	Women
N <sub>HP</sub>	7	2
N <sub>LP</sub>	3	3
Age (years)	63.10 (6.59)	59.80 (5.17)
Education (years)	16.80 (2.57)	16.80 (2.17)
Hoehn & Yahr Stage	1.50 (0.71)	1.20 (0.45)

HP, head point; LP, leg point; see below for details.



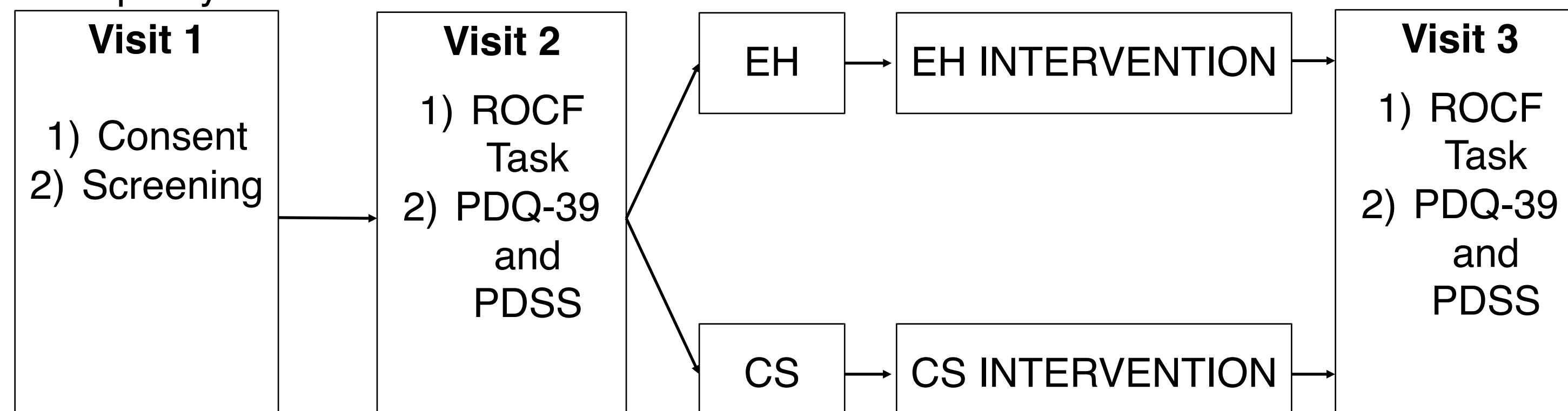
**Figure 1: The E-Tapper TT-R1.** This is a non-invasive handheld device that applies micro-current stimulation via wires to different points on the hand that are thought to represent different body parts.



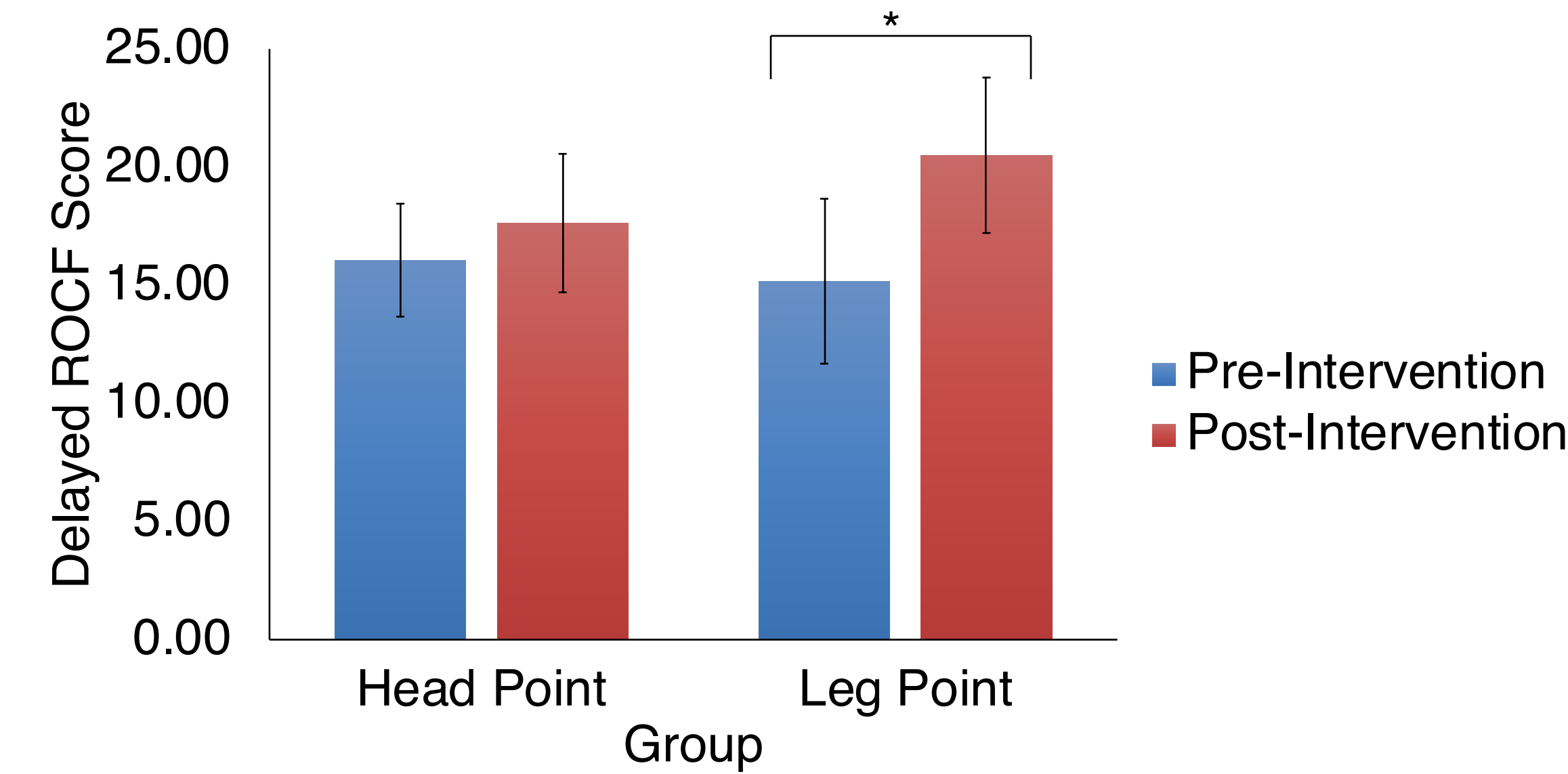
**Figure 2:** Modified image from E-Tapper TT-R1 tutorial demonstrating head point (HP) and leg point (LP) electrode placement utilized by participants.

## Methods: Study Procedure

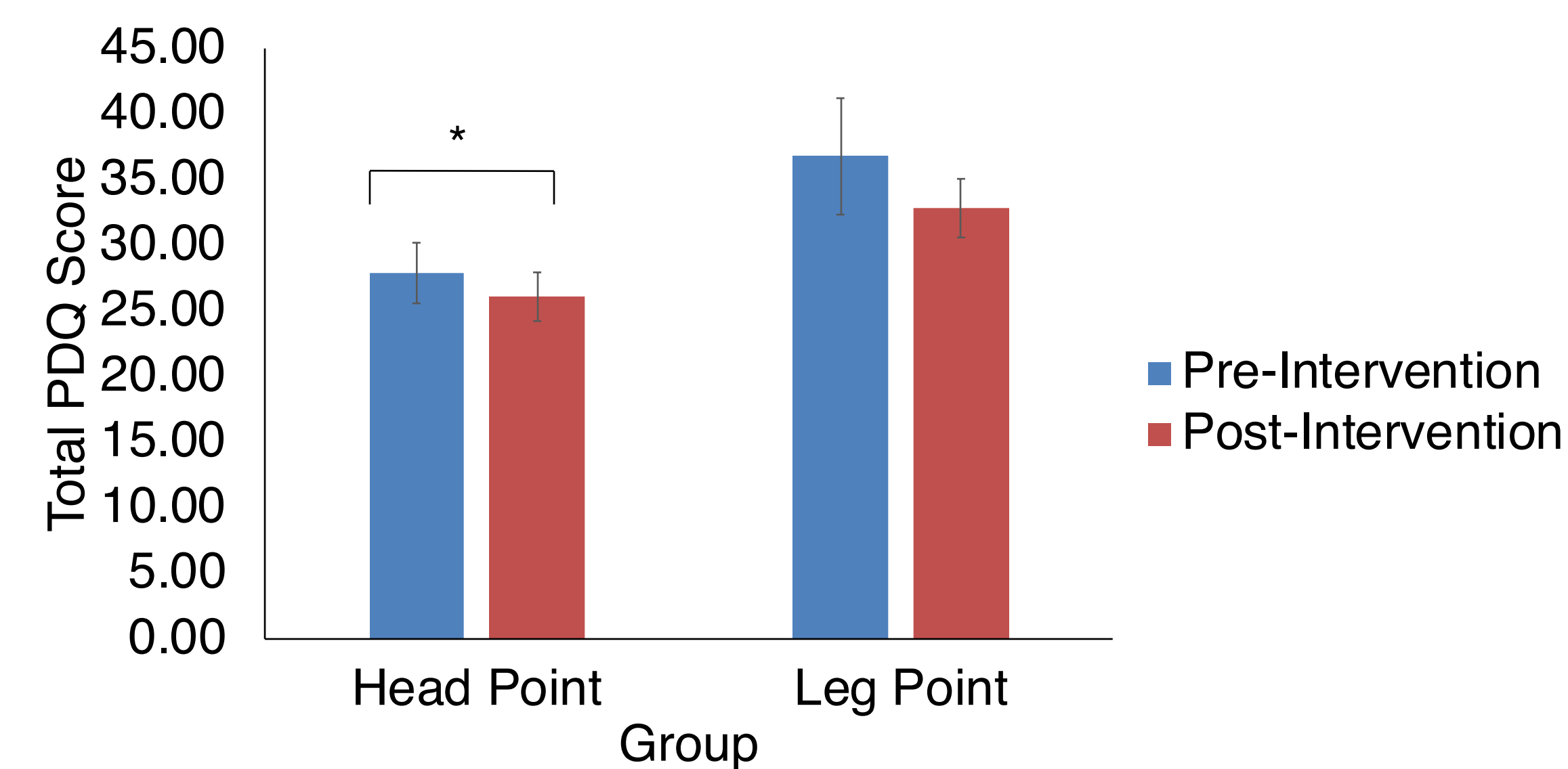
**Figure 3: Overview of Study Procedures.** If eligible after visit 1, visit 2 included a battery of cognitive tests that assessed executive function, verbal learning, and visuospatial memory using the Rey-Osterrieth Complex Figure (ROCF) task. Visit 2 also included quality of life measures such as the Parkinson's disease Quality of Life Scale (PDQ-39) and Parkinson's Disease Sleep Scale (PDSS). Participants were then randomized to one of two groups: 1) electrical stimulation of the head point of the hand (EH), or 2) electrical stimulation of the leg point of the hand (control stimulation; CS). The intervention lasted 6 weeks followed by an identical post assessment of cognition and quality of life measures.



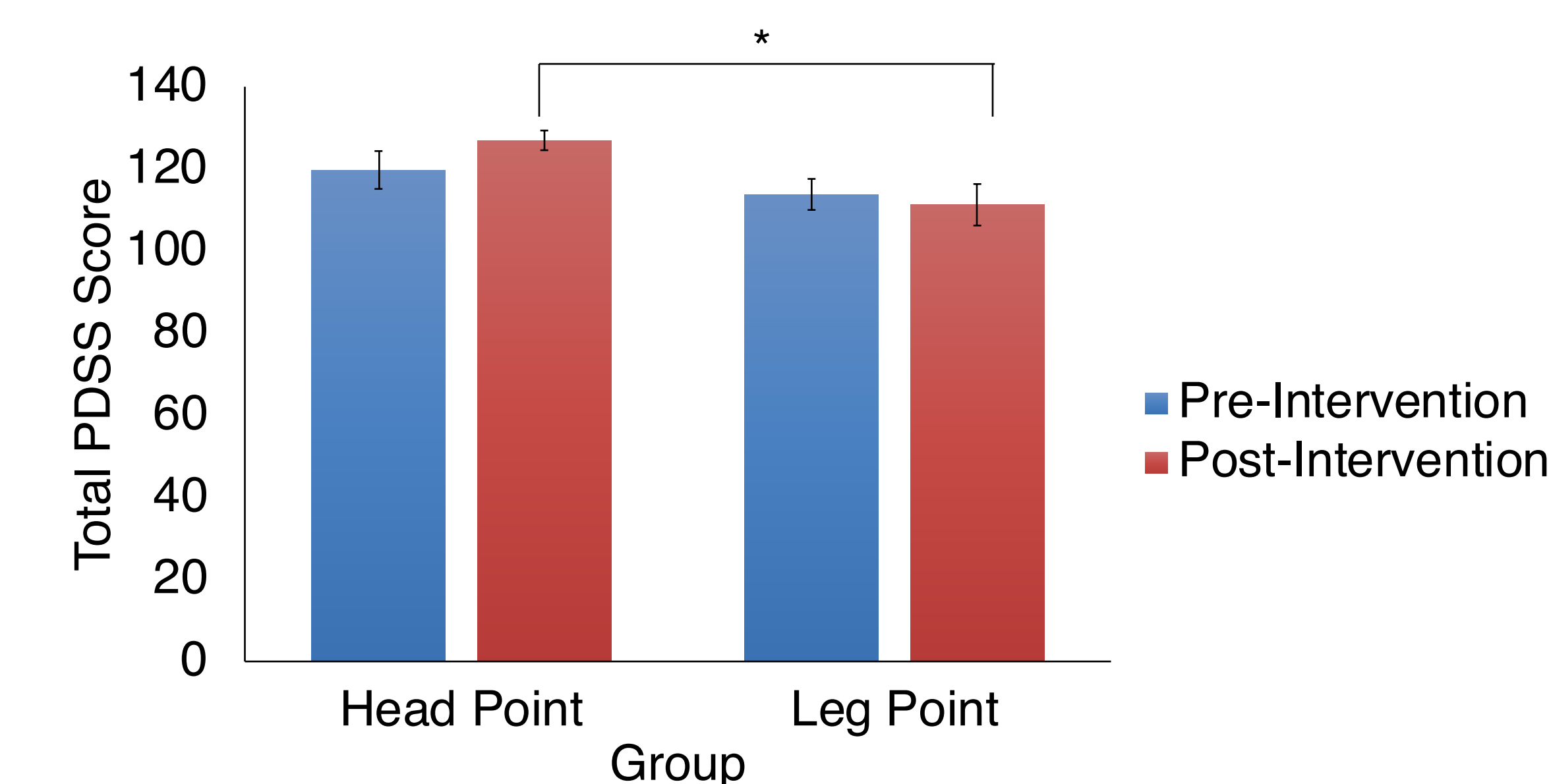
## Results



**Figure 4: Delayed ROCF Score for HP and LP group at pre vs. post intervention.** The ROCF delay task assesses visuospatial memory. Higher score indicates better performance. \*Paired samples t-test revealed significant difference between pre-intervention ( $M = 15.17$ ) and post-intervention ( $M = 20.50$ ) ROCF delay score for LP group only,  $t(5) = 2.769$ ,  $p = .039$ .



**Figure 5: Total PDQ Score for HP and LP group at pre vs. post intervention.** The PDQ is a 39-item self-report questionnaire that assesses the impact of PD severity on eight different domains of life over the course of the last month<sup>5</sup>. Scores are averaged to give total PDQ and lower scores indicate higher well-being. \*Paired samples t-test revealed a significant difference between pre-intervention ( $M = 27.89$ ) and post-intervention ( $M = 26.08$ ) total PDQ score for the HP group only,  $t(8) = -2.509$ ,  $p = .036$ .



**Figure 6: Total PDSS Score for HP and LP group at pre vs. post intervention.** The PDSS is a self-report 15-question survey on a 1-10 point scale that assesses sleep quality over the last week. Higher scores indicate better sleep quality. Paired samples t-tests revealed no significant within-group differences. \*Independent samples t-test revealed significant difference at post-intervention between LP participants ( $M = 111.25$ ) and HP participants ( $M = 126.94$ ),  $t(7.282) = 2.805$ ,  $p = .025$ .

## Results Continued

**Table 2: Non-Motor Activities of Daily Living from Unified Parkinson's Disease Rating Scale at Post-Intervention**

Results reported as Mean (SD). Higher numbers indicate worse measures. Independent samples t-tests revealed marginally significant differences between groups following the intervention, \* $p < .10$ . Pre-post differences assessed via paired samples t-tests, ^  $p < .05$ , ^^,  $p < .10$ .

Measure	Head Point	Leg Point
Cognitive Impairment	0.56 (1.01)	0.67 (0.82)
Hallucinations and Psychosis	0.11 (0.33)	0.17 (0.41)
Depressed Mood	0.00 (0.00)	0.33 (0.52)^^
Anxious Mood	0.56 (0.73)	1.17 (1.17)
Apathy	0.11 (0.33)	0.67 (0.82)*
Features of Dopamine Dysregulation Syndrome	0.00 (0.00)	0.33 (0.82)
Sleep Problems	1.00 (1.12)	1.67 (1.63)
Daytime Sleepiness	0.78 (0.83)	1.33 (1.03)
Pain and Other Sensations	0.56 (0.53)	1.50 (0.84)
Urinary Problems	0.56 (0.73)	1.33 (1.03)
Constipation Problems	0.56 (0.73)	0.67 (0.82)
Lightheadedness on Standing	0.22 (0.44)	0.33 (0.52)
Fatigue	0.56 (0.74)^	0.83 (0.75)

## 15-Second Summary

**Question:** Does bio-electro stimulation therapy improve the non-motor symptoms of individuals with PD?

**Method:** Participants were randomized into either HP or LP groups, and self-administered micro-current stimulation via the e-Tapper TT-R1 twice daily for 30 minutes over a period of six weeks.

**Results:** Delayed visuospatial memory was improved following LP intervention, but there was no change in any of the other cognitive domains tested. Additionally, total quality of life was improved following the HP intervention and overall sleep quality was improved following the HP intervention when compared to LP intervention.

**Discussion:** These results are preliminary and suggest that further exploration of bio-electro stimulation therapy on non-motor symptoms is warranted.

## Discussion/Summary

- One goal of this pilot study was to determine if bio-electro stimulation therapy provided relief for the non-motor symptoms of patients with PD.
- Limitations of this work include the small sample size, use of exploratory analyses, and lack of objective measures.
- Given the number of comparisons, it is possible that significant findings were solely due to chance.
- Results indicate that further exploration of alternate treatment modalities such as bio-electro stimulation therapy for PD is warranted.
- Replication of this work is also needed.

## References

- 1) NINDS Parkinson's Disease Information Page. <https://www.ninds.nih.gov/Disorders/All-Disorders/Parkinsons-Disease-Information-Page>
- 2) The Michael J. Fox Foundation for Parkinson's Research. <https://www.michaeljfox.org/symptoms>
- 3) Poewe, W. (2008). Non-Motor symptoms in Parkinson's disease. *European Journal of Neurology*, 15(s1), 14-20.
- 4) Dong, J. et al. (2016). Current Pharmaceutical Treatments and Alternative Therapies of Parkinson's Disease. *Current Neuropharmacology*, 14(4), 339-355.
- 5) Parkinson's disease Quality of Life Scale. <https://www.sralab.org/rehabilitation-measures/parkinsons-disease-questionnaire-39>

## Acknowledgements

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