

DRK Progress Report Year 1 (2017)

Grant Title: Photoneuromodulations: A Novel Therapy for Mild Cognitive Impairment

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A. Significance

This is a mechanism-driven translational research project to test the efficacy of a new intervention, photoneuromodulation through non-invasive transcranial infrared laser stimulation, to enhance brain function in older adults with Mild Cognitive Impairment (MCI). MCI is widely regarded as a transitional phase between normal cognitive aging and dementia with MCI patients converting to dementia at rates much higher than the general population (10-15% per year vs. 1-2% per year) (Petersen et al., 2001). Among patients with MCI, adults with impairments in multiple domains (e.g., memory + attention, executive, or psychomotor deficits) appear to be most vulnerable to further cognitive decline (Belleville et al., 2007; Broster et al., 2013; Mitchell et al., 2009). Considering the current lack of dementia cures, and the fact that cognition is the most important determinant of quality of life and functional ability in older age (Gaugler et al., 2009), it is critical to seek new treatments to prevent or delay severe cognitive impairment in this particularly vulnerable population.

B. Specific Aims

Aim 1: To determine if non-invasive transcranial infrared laser stimulation to the forehead can boost neurocognitive function in older adults with multi-domain MCI.

Aim 2: To test if the cognitive benefits of transcranial infrared laser stimulation in adults with multi-domain MCI are mediated by treatment-related changes in cerebrovascular response to a cognitive challenge.

These aims have not been modified from the original application.

C. Studies and Results

Status: The project is ongoing.

Preliminary Findings: All aims are progressing at the same rate and at the same time. We have not yet attempted to test the specific aims proposed for this 3-year project; however, preliminary analyses of the pilot data revealed improved neurocognitive performance in older adults following a single transcranial laser treatment as well as repeated treatments. These changes were accompanied by reduced cerebrovascular response during a working memory task in the frontal lobe, possibly indicating increased oxygen extraction. Our preliminary findings were presented during a symposium highlighting Neuromodulation of Cognition, Emotion and Behavior at the annual meeting of the *American Psychosomatic Society*. They were included in a manuscript published in the journal of *Lasers in Medical Science*.

The support of the DRK for this project was acknowledged in each presentation/publication.

Publications:

1. Vargas, E., Barrett, D., Saucedo, C., Huang, Li-Da, Abraham, J.A., Tanaka, H., **Haley, A.P.**, Gonzalez-Lima, F. (2017). Beneficial neurocognitive effects of transcranial laser in older adults. *Lasers in Medical Science*, [Epub ahead of print].

Oral Presentations:

1. **Haley, A.P.**, Barrett, D., Vargas, E., Pasha, E., Tanaka, H., Gonzalez-Lima, F. (2017). *Neuromodulation of Cognition through Transcranial Laser Stimulation*. American Psychosomatic Society (APS), 75th Annual Meeting, Seville, Spain.