University of Rochester School of Medicine and Dentistry

The Neuroscience Graduate Program

Presents:

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In a PhD Thesis Defense

Advisor: Krystel R. Huxlin, PhD

Blind-field visual abilities after occipital stroke: incidence, dynamics, substrates and consequences for visual rehabilitation

Cortically induced blindness (CB), which most often results from stroke damage to the primary visual cortex (V1) or its afferents, leads to binocular loss of conscious visual perception. While motor stroke rehabilitation is well-researched, the visual deficits faced by CB patients lack effective treatment, with only compensatory therapies like saccadic training and prism lenses prescribed clinically. CB is considered permanent, offering little hope for visual recovery. However, recent research from the Huxlin lab and others has challenged this notion, demonstrating the potential for recovering direction discrimination abilities - among others - within the blind field. In addition, building on the pioneering work of Riddoch and Weiskrantz, Saionz and colleagues (2020) reported that about 1/3 of naïve, early post-occipital stroke patients retain a range of preserved conscious simple and complex motion abilities. More rarely, some even retained the ability to discriminate orientation of static targets within their perimetrically-defined blind fields. Whether with different perimetric tests or psychophysical tasks, evidence is mounting supporting the heterogeneity of perception inside CB fields. A next step is to identify and understand the natural history of these abilities, what anatomical structures enable them, and what their presence means for rehabilitation.

The first step in this endeavor is to define the deficit. Humphrey automated perimetry (HAP) is the most common type of clinical perimetry used in CB. It measures light detection using a small, static stimulus, presented randomly in a grid-like pattern across the central visual field. However, it does not control fixation during testing as rigorously as the Macular Integrity Assessment (MAIA) perimeter. We contrasted these two perimeters' ability to identify visual impairment and assess changes both spontaneously and following restorative interventions. We concluded that on the sum, HAP performed according to strict test quality criteria is the most optimal way to quickly but coarsely define the extent and severity of the deficit in CB. Based on HAP-defined blind-field boundaries, we then proceeded to map motion discrimination in the blind-field. Our standard method for identifying preservation of such abilities involved repeatedly and densely testing a few, adjacent blind field locations using random dot stimuli. Although precise, this approach is time-consuming, and oversamples a very small region of visual space rather than canvassing the entire deficit. This limitation makes it impractical for clinical use, leaving most patients uninformed about the truly heterogenous nature of their "blind" field.

This thesis addresses this gap, developing an automated, direction discrimination perimetric tool (ADDaPT) able to rapidly and accurately detect preserved motion discrimination abilities across the HAP-defined blind-field of CB patients. Then, using the new ADDaPT definition of preservation in concert with computerized, home-based training, we compare the efficacy of training in preserved and non-preserved CB patients. In addition, we correlated performance outcomes with the progression of retrograde degeneration affecting the ganglion cell and inner plexiform layers of the retina, measured using optical coherence tomography at baseline and 12-months post-stroke.

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EIOH Farash Auditorium
ZOOM Link **https://urmc.zoom.us/j/95585151087**
Meeting ID: 955 8515 1087