Project summary

Project Title: Restoring visual function in CVI pediatric population using non-invasive visual stimulation

Following stroke or traumatic brain injury, many patients exhibit cortical visual impairment (CVI), usually in the form of a large blind spot in the visual field contralateral to the insult. CVI results specifically from damage to the primary visual cortex, and it is usually permanent. However, these patients do have access to visual input, via another brain pathway that bypasses the primary visual cortex. Animal studies have shown that this pathway is functionally intact following brain damage, but it appears that CVI patients are unable to use them.

An exciting but controversial idea is that training can strengthen this residual pathway. Indeed, some studies have shown that CVI patients can be trained to react to visual stimuli presented in their blind fields. However, other studies have not detected any benefit of training.

To overcome their blindness, CVI patients typically make saccades to explore space with their seeing fields. This is classical compensatory behavior, but it leads to an even greater bias to rely on information from the intact, ipsilesional hemisphere. The classical treatment in patients suffering from a stroke in motor areas is to require the patient to use a weakened limb, such as a hand, by restricting movement of the good hand. This approach is thought to engage plasticity in cortical areas outside the damaged primary structure. We will use a similar strategy here, forcing the patients to make use of spared extrastriate regions to make decisions about specific stimuli presented in their blind fields, while giving feedback about the accuracy of each decision.

We will measure brain signals using an electroencephalography (EEG) system obtained specifically for this project. Previous work has identified neurophysiological correlates of perceptual learning in the event-related potentials from posterior brain areas. Specifically, the N1 component of these responses has been shown to arise from high-level extrastriate cortex, the LOC in particular. We will therefore record EEG signals from patients, before and after training, to track changes in the shape selectivity of the N1 response associated with stimuli presented in the blind field. We will also attempt to recover similar changes in selectivity for motion stimuli.

Position 1: Clinical Research Fellow (1)

Duration: Two and half year (Fellowship+consultant)

Job description:

The ideal candidate would have to first learn the necessary background of vision neuroscience and visual psychophysics. In order to do that, he/she will spend 4 months at McGill University where he/she will take a course on visual perception and gain research experience at a vision research lab there.

After initial training, the researcher will collect behavioral data from CVI pediatric population during daily training and pre- and post-training tests. The researcher will be responsible to setup the training rig, organize data gathering protocols using existing programs and matlab code and analyze the collected data. He/she will be conducting research with supervision from Principal Investigator and Co- Investigators at TilgangaInstitute of Ophthalmology and MIT. In addition, he/she will have to accomplish the task as per the need of the project and TIO.

The duration of fellowship will be of one year following which candidate needs to continue the work in the same project for a period of one and half year as research consultant.

Qualification:

- Master in Ophthalmology in from recognized university.

Required Skills:

- Experience as an ophthalmologist with special interest in pediatric Ophthalmology and neuroscience
- Strong mathematical background
- Comfortable communicating in English (to be able to learn well at McGill University) and Nepali (to communicate with patients and guardians in Nepal)
- Able and eager to learn about the field of vision science

Position 2: Research Trainee (1)

Duration: 2.5 years

Job description:

The ideal candidate would have to first learn the necessary background of vision neuroscience and visual psychophysics. In order to do that, he/she will spend 4 months at McGill University

where he/she will take a course on visual perception and gain research experience at a vision research lab there.

After initial training, the researcher will collect behavioral data from CVI pediatric population during daily training and pre- and post-training tests. The researcher will be responsible to setup the EEG rig, organize data gathering protocols using existing programs and matlab code and analyze the collected data. He/she will be conducting research in the capacity of a graduate student with supervision from Principal Investigator and Co- Investigators at Tilganga Institute of Ophthalmology and MIT. In addition, he/she will have to accomplish the task as per the need of the project and TIO.

Qualification:

- Bachelor's in engineering or physics or similar quantitative field

Required Skills:

- Electrical or biomedical engineering degree is a valuable asset
- Matlab programming
- Strong mathematical background
- Comfortable communicating in English (to be able to learn well at McGill University) and Nepali (to communicate with patients and guardians in Nepal)
- Able and eager to learn about the field of vision science

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