Improving Vision in Adults With Macular Degeneration, Study 1: the Effect of Brain Stimulation

Study Protocol Outline

Date Approved by Researchers: September 19, 2019

Inclusion Criteria

- Diagnosis of AMD (age 60+) or JMD (current age 18+).
- Central vision loss and use of a PRL (confirmed by a microperimeter).
- Visual acuity (VA); between 0.5 and 1.0 logMAR inclusive (6/18-6/60) in the better eye.
- Best-corrected near visual acuity of 4.0M at 40 cm or better in the better eye
- Stable vision for the previous 3 months (by patient report).

Exclusion Criteria

- Diagnosed dementia.
- Not fluent in reading English (Waterloo) or Chinese characters (Hong Kong).
- any ocular surgery (including anti-vegF injections) within the duration of the study.
- Ocular pathology other than JMD or AMD that can reduce central vision.
- Severe hearing impairment.

Contraindications for tDCs:

- Suffer from epilepsy, have had an epileptic seizure, or family history of epilepsy.
- Any metal implant (excluding tooth fillings).
- Implanted medication pump or implanted electronic device, including pacemaker or defibrillator
- Heat disease, neurological condition, or have had neurological or cardiac surgery.
- Recurring headaches
- Skull fracture or head injury
- Head or Brain surgery
- Pregnancy
- Skin Condition
- Taking any medication on the list on Form A
- Excessive alcohol (>2 standard drinks) or slept dramatically less the usual in the last 24 hours.

Protocol Outline

Day 0: Pre-Screening

1. Potential participants are recruited
    - Done by clinician for privacy and also to make an initial assessment about eligibility.
        - Diagnosis of AMD or JMD with VA in the inclusion range
        - Age >= 18
        - No diagnosis of dementia
        - No other eye disease or condition affecting vision
        - No indication of being not fluent reader in tested language
2. Call potential participants to recruit.

Day 1: Screening and RSVP baseline selection

1. Consent form and signature
2. Refraction
3. Distance ETDRS acuity.
4. Near VA (MNREAD with stopwatch) and with +4D in trial frame).
5. Decide on eye to be used (eye with better near reading vision)
6. Ocular health check (of the eye to be used)
7. PRL measure with microperimetry
8. If better eye has another ocular disease or not a stable PRL, check the poorer eye for eligibility and use that for all further testing

If patient qualifies for main study:

10. Full RSVP test [45+ minutes]
    - 5 print sizes by 5 reading speeds, selected based on the MNREAD test results.

11. Select single print size and word speed combination that is predicted to elicit 55% with the following procedure:
    - Fit a two-line function and a simple linear regression to the data

        i. If two-line fit is better (a CPS/ "elbow" was found):
            The CPS defines the print size and word speed to be used

        ii. If simple linear regression is better (no reliable "elbow" found):
            Use print size of 1.5 deg x-height and corresponding reading speed

12. Blind-selection of stimulation codes to determine active/sham schedule for participant
    - Active/sham stratified by:
        i. VA – [0.5, 0.8) and [0.8, 1.0] logMAR groups, to be balanced as far as stimulation schedule

        NOTE: JMD participants will not be stratified by VA, but active/sham schedules will be balanced for JMD participants.

Treatment Days: *(treatment days must be separated by 2 – 14 days, otherwise redo baseline measures.)*

- Order of crowded and uncrowded tests is randomized on a per-subject basis but maintained throughout testing for each patient.
- Setup consists of two computers. One computer 3 meters away for the crowded and uncrowded Landolt C test, and one computer on an independently rolling cart. The RSVP task will be done on the rolling computer, and then will be moved out of the way for the participant to do the Landolt C tests. This allows older patients to not be required to move continuously for these tests.

1. Primary outcomes pre-test.
    a. specifically-selected RSVP condition tested.
2. Secondary outcomes pre-test. Computer is fixed 3 meters away.
    a. Crowded Landolt C
    b. Uncrowded Landolt C
    c. Manually calculate measure of crowding strength:
3. Stimulation (either active or sham) for 20 minutes.
    a. During stimulation: specifically-selected RSVP condition tested
    b. During stimulation: Crowded and Uncrowded Landolt C
4. Five minutes after stimulation end:
    a. Specifically-selected RSVP condition tested
    b. Crowded and Uncrowded Landolt C tested
5. Thirty minutes after stimulation end:
    a. Specifically-selected RSVP condition tested
    b. Crowded and Uncrowded Landolt C tested

6. Participant fills out a brain stimulation adverse-effects questionnaire.
7. ONE THE FINAL TREATMENT DAY: administer blind MoCA cognitive test for use in sensitivity analysis/as a covariate
8. After sending patient home, use custom-written program to process all patient data collected for that day for the individual subject.