Improving Aphasia Outcomes through tDCS-Mediated Attention Management

Clinical Trial Number: NCT04963803

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Overview

This protocol describes procedures for a study examining transcranial direct current stimulation (tDCS) combined with language treatment for individuals with aphasia following stroke.

PHASE 1: ELIGIBILITY TESTING

Session Preparation

- Prepare testing materials and record forms
- Start video/audio recording (label: Participant ID_Eligibility Testing_Date)
- Review test administration notes for any modifications

Participant Intake

- Collect or administer Participant Intake Form via data collection system
- Collect Emergency Contact Information

Consent Procedures

1. Review and obtain signed Informed Consent
2. Review and obtain signed HIPAA authorization
3. Provide participant with copies of signed forms
4. Collect payment information form

Screening Assessments

Frenchay Aphasia Screening Test

- Administer all subtests per manual instructions
- Record: date, examiner, raw score, participant age

Near Vision Screening

- Ask participant to wear corrective lenses if needed
- Use Tumbling E chart
- Have participant identify direction of "E" on line 8 (or line 7 if needed)
- Pass criteria: Able to identify direction on line 8 or 7
- Record: whether participant wears glasses, pass/fail status

Hearing Screening

- Ask participant to wear hearing aids if needed

- Position participant facing away from audiometer
- Test frequencies: 1000, 2000, 4000, 500 Hz at 25dB and 35dB as needed
- Test order: Right ear (1000, 2000, 4000), Left ear (4000, 2000, 1000, 500), Right ear (500)
- Fail criteria: Cannot hear any tone at 35dB in either ear OR cannot hear any two tones at 25dB in same ear
- If participant fails, conduct informal speech discrimination screening
- Record: whether participant wears hearing aids, pass/fail for each ear

Language and Cognitive Assessments

WAB-R (Western Aphasia Battery-Revised)

Administer subtests:

- Conversational Questions
- Picture Description
- Auditory Verbal Comprehension (Yes/No Questions, Auditory Word Recognition, Sequential Commands)
- Repetition
- Object Naming
- Word Fluency
- Sentence Completion
- Responsive Speech

Record: date, examiner, subscale scores, aphasia quotient, aphasia type

CLQT+ (Cognitive Linguistic Quick Test Plus)

Administer subtests:

- Personal Facts
- Symbol Cancellation
- Confrontation Naming
- Story Retelling
- Symbol Trails
- Generative Naming
- Design Memory
- Mazes
- Design Generation
- Auditory Comprehension
- Clock Drawing

Record: date, examiner, severity ratings for non-linguistic cognition, linguistic/aphasia indices, clock drawing

tDCS Head Measurement

- Measure head circumference (1 inch above eyebrows and ears, on occipital bump)
- Take measurement twice for reliability
- Determine head strap size: Small (52-55 cm), Medium (55-58 cm), Large (58-62 cm)

PHASE 2: PRE/POST-TESTING

Session Setup

- Start recording (label: Participant ID_Pre/Post Testing_Date)
- Prepare testing materials

Assessments

Sentence Comprehension Task

- Create copy of stimulus spreadsheet for this session
- Read each sentence aloud to participant
- Ask associated comprehension question
- Allow one repetition per sentence if requested
- Score: correct (1) or incorrect (0)
- Record repetition requests
- Calculate percent correct for each sentence type and overall
- Sentence types tested: anaphora, nominal grounding, clausal grounding, windowing, topicalization

Revised Token Test

- Administer Subtests 1-5 only (not pretest)
- Set up tokens according to specified arrangements for each subtest
- Before Subtest 3, provide explicit instruction and practice items with feedback
- Practice items: "Touch the blue circle and the red square," "Touch the black circle and the green circle," "Touch the red square and the blue circle"
- Record scores for each subtest and overall score

Scenario Test

- Administer using laminated stimulus cards
- Record: scores (0-3 scale), total score, percentile, communication modalities used, flexibility, partner assistance needs

Continuous Performance Task (CPT)

- Administer on computer using experimental software
- Calculate: raw accuracy, average accuracy, average reaction time for non-target responses
- Export and save results data

Attention Network Test (ANT)

- Set up response box with correct configuration
- Run practice trials until participant demonstrates understanding
- Administer full test
- Record: alerting effect RT, orienting effect RT, conflict effect RT
- Export and save raw and summary data

PHASE 3: tDCS ADMINISTRATION

Device Setup

1. Select appropriate tDCS device (pre-coded for participant)
2. Insert fully charged batteries (3 required)
3. Select correct head strap size based on eligibility measurements
4. Prepare two saline sponges

Application Procedure

1. Seat participant comfortably
2. Clean scalp at electrode sites with alcohol wipes
3. Attach saline sponges to head strap electrodes using snaps
4. Position head strap on participant:
    - Black electrode (labeled "front") on forehead
    - Red electrode (labeled "top") on top of head
5. Ensure sponges are flush against scalp
6. Connect head strap to device (red to red, black to black)

Device Operation

1. Power on device
2. Navigate menu: Select "Stimulation"
3. Check contact quality (aim for "good")
4. Enter session code
5. Device will begin automatically

During Stimulation

- Monitor device for connection quality alerts
- Session duration: 20 minutes
- Device will beep when complete
- If participant needs to stop: Press zero to abort and ramp down current
- **Never remove head strap until current fully ramped down**

Post-Session

- Remove head strap after current ramps down
- Remove batteries and recharge
- Dispose of sponges
- Clean head strap with alcohol wipes

PHASE 4: BEHAVIORAL TREATMENT SESSIONS

Session Preparation

- Access training stimulus materials
- Determine appropriate stimulus group for each sentence type based on previous performance
- Organize laminated stimulus cards in correct order
- Start recording (label: Participant #_Training Session #)

Pre-Treatment Assessment

- Administer Visual Analog Fatigue scale

Treatment Overview

Introduce task: "I am going to read you some sentences and ask you some questions about them. Some sentences are challenging, and you may not get them correct on your first try. If you answer incorrectly, I will give you a cue and read you the sentence again. If you still get it wrong after the cue, I will give you the answer and we will move on."

Treatment Structure

Session cycle order:

1. Anaphora
2. Nominal Grounding
3. Clausal Grounding
4. Topicalization
5. Windowing

Repeat cycle if time remains after completing all five types.

General Procedure for All Sentence Types

For each sentence:

1. Keep stimulus card hidden initially
2. Read sentence at steady pace
3. Wait 3 seconds
4. Ask comprehension question
5. If participant requests repetition: Repeat sentence without showing card, mark repetition
6. If incorrect: Provide one of three auditory cues while showing printed sentence
7. Remove card before re-asking question
8. If still incorrect after cue: Provide answer and move on

Auditory Cue Options:

- **Self-monitoring:** "The next time I read the sentence, watch me, and make sure you are paying attention to what I am saying."
- **Rehearsal:** "I am going to repeat the sentence again. After I say it, I want you to repeat it either out loud or in your head before I ask the question."
- **Listening and anticipating:** "Think of the question I just asked you while I read the sentence again."

Scoring:

- 1 point: Correct after initial question OR correct after repetition (no cues)
- 0 points: Incorrect or required any cues

Sentence Type Specifications

Anaphora (Groups 1-3)

- Single question per sentence
- **Advancement criterion:** 16+ correct responses over two consecutive trials

Nominal Grounding (Groups 1-3)

- Instruct: "Please respond with Yes or No"
- Single question per sentence
- **Advancement criterion:** 16+ correct responses over two consecutive trials

Clausal Grounding (Groups 1-2)

- Instruct: "Please respond with Yes or No"

- Single question per sentence
- **Advancement criterion:** 12+ correct responses over two consecutive trials

Topicalization (Group 1)

- Two questions per sentence (Question A, then Question B)
- Read sentence before each question
- Follow standard cueing procedure for each question
- Score each question separately

Windowing (Groups 1-3)

- **Group 1:** Three questions per sentence
- **Group 2:** Two questions per sentence
- **Group 3:** One question per sentence
- Read sentence before each question
- Participant does not need exact wording to be correct; use clinical judgment
- **Advancement criteria:**
    - Group 1→2: 48+ correct over two consecutive trials
    - Group 2→3: 32+ correct over two consecutive trials
    - Group 3: 16+ correct over two consecutive trials

Advancement Rules

- If participant meets advancement criteria mid-session AND ≥30 minutes remain: Advance to next group
- If <30 minutes remain: Continue with current groups

Post-Treatment Assessment

- Administer Visual Analog Fatigue scale

Session Closing

1. Ask safety questions
2. Schedule next session if needed
3. Save session data
4. Enter data into system including:
    - Number correct and administered per category
    - Additional supports provided
    - Plan for next session

Data Management

Recording Requirements

- All sessions must be video or audio recorded
- Label recordings with: Participant ID, Session Type, Date

Data Entry

- Enter all assessment scores into data management system
- Upload relevant files (Excel sheets, results files)
- Mark forms as complete after data entry

Test Administration Notes

Frenchay Aphasia Screening Test:

- Use larger pictures in examiner's manual
- Comprehension item #4: Score correct if participant points to left from picture's perspective
- Comprehension item #3: Say "rectangle" instead of "oblong"

WAB-R:

- Yes/No Questions item #13: Use "Is this the Aphasia Lab?" (or appropriate location)
- Auditory Word Recognition: Substitute "painting" for "window" (item #37), "table" for "desk/bed" (item #39)
- Object Naming: Accept "cup" or "mug" as correct (item #4)
- Word Fluency: 1-minute time limit, start timer after giving directions

Note: Animal generation task appears in Frenchay, WAB, and CLQT. May use same data across tests.

Safety Considerations

tDCS Safety

- Never remove electrodes while current is active
- Monitor participant throughout stimulation
- Follow abort procedure if participant experiences discomfort
- Document any adverse events

General Safety

- Ensure participant comfort throughout all procedures

- Offer breaks between assessment batteries
- Monitor for signs of fatigue
- Maintain appropriate infection control procedures

Statistical Analysis

An intent-to-treat analytical approach will be used to examine differences in grammar scores between the two RCT arms. General and generalized linear mixed effect models (McCulloch & Neuhaus, 2001) for continuous and the dichotomized grammar measures, respectively, will be used to describe the pattern of change in each RCT arm and examine whether the pattern of change differs between RCT arms (i.e., significance of the treatment x time interaction). To account for potential heterogeneity between patients, each patient will be modeled as a random effect nested within treatment group. Time will be modeled as both a continuous and categorical variable defined by specific time points (baseline, post-training, follow-up). We will examine both within-patient changes (fixed time effect – to describe pattern of changes within each RCT arm) and between patient changes (fixed effect: time x treatment arm interaction – to examine whether pattern of change differs between RCT arms). Final models will be adjusted for (1) multiple comparisons using appropriate correction methods to adjust for inflation in the type I error rate and (2) missing data (possibly due to loss of follow-up) under the assumption that data are missing-at-random using a full information maximum-likelihood based approach (Collins et al., 2001).

References

Collins LM, Schafer JL, Kam C. A comparison of inclusive and restrictive strategies in modern missing data procedures. *Psychol Methods*. 2001;6(4):330. doi:10.1037//1082-989X.6.4.330. PMID: 11778676

McCulloch CE, Neuhaus JM. *Generalized Linear Mixed Models*. Wiley Online Library; 2001.

SYRACUSE UNIVERSITY

Department of Communication Sciences and Disorders

Protocol Title: Improving Aphasia Outcomes through tDCS-Mediated Attention Management

Principal Investigator/Key Research Personnel: The Principal Investigator for this study is Dr. Ellyn Riley. Dr. Riley is a professor at Syracuse University and the Principal Investigator for the Aphasia Laboratory. If you should need to contact Dr. Riley, you can reach her by phone at 315-443-9621 or by email at earil100@syr.edu.

Introduction:

The purpose of this form is to provide you with information about participation in a research study and offer you the opportunity to decide whether you wish to participate. You can take as much time as you wish to decide and can ask any questions you may have now, during or after the research is complete. Your participation is voluntary.

What is the purpose for the research study?

- **Aphasia is a language disorder that occurs frequently following a stroke. Therapy for aphasia requires long and active participation to see significant improvement, but it can be difficult for people to get enough therapy. In our lab, we are interested in learning more about ways to improve language recovery in order to make therapy more effective and help people recover their language in a shorter period of time.**
- **The purpose of this study is to determine if a new brain stimulation technology can help make language recovery faster. The new technology is called Transcranial Direct Current Stimulation, or tDCS. You are being asked to participate in this study because you are an adult with aphasia who has expressed interest in helping us learn more about the effects of brain stimulation on attention and language recovery.**
- **Transcranial Direct Current Stimulation (tDCS) is a minimally invasive technique (i.e., it does not involve any surgical procedures, additional medication or sedation, or needles). It is a relatively new technology; however, it has been applied to many previous research participants without any serious problems. It uses a small amount of electrical current that is passed through the hair, skin, and skull to temporarily stimulate specific areas of the brain.**

What will I be asked to do?

- **If you agree to be in this study, the following will happen:**
  - **You will be administered a brief phone/in-person screening to ensure you meet the basic inclusionary and exclusionary criteria. If you are a woman of childbearing age and you are pregnant, you cannot be in this study.**
  - **If you are determined to be eligible following the screening, you will be administered language and cognitive tests to confirm that you will be able to participate in the tDCS speech and language treatment sessions. During this initial testing session, you will also be administered a brief hearing and vision test. Initial eligibility testing will require approximately 1.5 hours.**

- **If you continue to be eligible based on this testing, you will be scheduled to come in for one pre-testing session. This session will last about 1.5 hours. During this pre-testing session, you will complete a variety of tasks that will involve doing things like listening, talking, and pressing buttons while viewing letters or shapes on a computer screen.**
- **Before you start speech and language treatment, you will be randomly assigned to one of two groups: "active" stimulation or "sham" stimulation.**
  - **Active stimulation means that the tDCS device will be delivering electrical current to your scalp through the electrodes during your treatment sessions.**
  - **Sham stimulation means that the tDCS device will be attached to your scalp, but the electrical current will be switched off during your treatment sessions.**
  - **This is a double-blinded study, which means that neither you nor your clinician will know which stimulation group to which you are assigned.**
  - **Regardless of whether you receive "active" or "sham" stimulation, you will receive the same behavioral speech and language treatment during these sessions.**
- **You will be scheduled to come in for 10 treatment sessions, each lasting about 1 hour and 15 minutes. During these sessions, a clinician will work with you on speech and language therapy and you will do different kinds of language tasks like listening to sentences and talking. During these sessions, you will also receive tDCS, which will consist of the device being connected to your scalp via small electrodes, and salt-water pads. You will receive either "active" or "sham" stimulation, but neither you nor your clinician will know which one you are receiving. At the end of each treatment session, you will be asked which type of stimulation you think you received during the session, but the clinician will not be able to tell you if you are correct about your guess.**
- **Once you have completed these sessions, you will be scheduled to come into the lab for 2 post-testing sessions, each lasting about 1.5 hours. One session will be scheduled soon after you finish treatment, and the other session will be scheduled about one month after you have finished treatment. These two sessions will be very similar to your pre-testing session. You will complete a variety of tasks that will involve doing things like listening, talking, and pressing buttons while viewing letters or shapes on a computer screen.**

- **All testing and treatment sessions will be conducted by a clinician or research assistant on the research team who has been well-trained to administer tDCS and the speech and language therapy.**
- **Participation in this study requires that you come to the lab up to 14 times. One session will be for initial eligibility testing, three sessions will be for pre- and post-testing, and ten sessions will be for tDCS + speech and language treatment. All testing sessions will last about 1.5 hours and treatment sessions will last about 1.25 hours.**

What are the possible risks of participation in this research study?

- **Risks of Language/Cognitive Testing, Speech and Language Treatment: There are no known risks of the language/cognitive tests or speech and language treatment we will administer in this study. You may become tired or frustrated but you will be allowed to take breaks as needed. If you feel tired or fatigued after completing any of the sessions, you can rest in the lab until you have recovered.**
- **Potential Risks of tDCS: tDCS has been found to be safe in humans with mild side-effects such as itching under the electrodes (experienced by 70% of tDCS stroke patients), tingling sensations (30%), skin redness (10%), mild burning sensation (40%), sleepiness (20%), mild fatigue (10%), dizziness (10%), and headache (40%).**
    - **Some mild skin irritation can occur after tDCS treatment. Mild skin burns have been reported in a few rare cases. However, these problems have only been seen when the electrode sponges are soaked in certain types of liquid, none of which will be used in this study. These rare instances of burns reported in the research literature have all been reported to heal without scarring within 1 to 3 weeks following the end of tDCS treatment. Because we are using liquids that have not been associated with skin irritation, the risk of mild burns is very minimal. Further, if the investigators detect any evidence that you are developing more than a mild skin irritation in response to the treatment, the treatment will be discontinued.**
    - **tDCS is thought to be safe, with no potential for brain damage. There have been no reports of long-term changes in cognitive function (memory, attention, etc.) in tDCS studies. However, tDCS is an experimental procedure and may have unknown side effects. The researchers will let you know if they learn anything that might make you change your mind about participating in the study. The doses applied in this study have been used in many other published research studies and long-term changes have not been reported.**
- **Risks Regarding Confidentiality: Despite efforts to maintain participants' confidentiality, there is always some minimal risk of people other than the study investigators gaining access to your information. Every effort will be made to ensure that your information will be collected and stored in a manner that ensures the highest level of protection of confidentiality. It should be noted, however, that confidentiality cannot be guaranteed in a laboratory setting if persons outside the research team are present (e.g., other students who volunteer in the lab).**

What are the possible benefits of participation in this research study?

- **It is possible that you may experience some improvements in your language ability or your ability to focus on a task as a result of the things we ask you to do during this experiment. However, because this is a research study, it is important that you do not have unrealistic expectations. Some participants may improve, but others may not. It is hoped that the information gained from the study will help researchers to understand the possible utility of tDCS in improving language recovery. It is also hoped that this technology will eventually help individuals with aphasia receive more effective and sufficient language therapy.**

How will my privacy be protected?

- **We will protect your privacy by limiting the number of individuals on the research team who will have access to personally identifying information that you provide to us (e.g., name, address, phone number). This information will be kept in a secure location in the SU Aphasia Lab and only the clinicians and research assistants who work directly on this study will have access to it.**
- **When you come in for testing and treatment sessions, we will protect your privacy by completing these sessions in a private data collection room in the SU Aphasia Lab. We will also limit the number of individuals who will interact with you when you come in for these sessions to members of the research team.**

How will my data be maintained to ensure confidentiality?

- **All information will be kept confidential. I will assign a number to the data we collect from you, and only my research team in the SU Aphasia Lab and I will have the key to indicate which number belongs to which participant.**
- **Only my research team and I will have access to the data obtained from this research study that would contain any identifying information. Research team members who we collaborate with from other institutions (e.g., statistician) will not have access to any of your personal information and all data they access will be only labeled with the number code assigned to you and not your name or any other information that would identify you.**
- **After identifying information has been removed, data from in this study could be used for future research studies or distributed to another investigator for future research studies without additional consent from the participant or legally authorized representative.**

Will photographs, audio, video, or film recording be used?

- **We will audio-record all study sessions. These recordings will be used for research and data analysis purposes and are required to complete the study. By signing this consent, you agree to allow us to collect audio recordings of your speech during the study.**
- **With your permission, we will also video-record study sessions. These recordings will include images of you, which may include your face. These recordings will be used for research and data analysis purposes, but are optional and *not* required to complete the study.**
- **Audio and video recordings will be stored by ID number on a password protected computer. Only members of the research team in the SU Aphasia Lab will have access to these recordings. Recordings will be destroyed after 6 years following publication of the data unless you provide us with permission to retain the files for instructional/presentation purposes. You may request to have the recordings destroyed by contacting Dr. Riley.**

Will I receive compensation for participation?

- **In return for your time, effort, and travel expenses, you will be paid up to a total of $150 for participation in this study. You will not receive any money for the brief screening, but you will receive up to $10 for each data collection and treatment session (maximum of 14 sessions: 1 eligibility testing, 1 pre-testing, 10 language training, 2 post-testing sessions). Once you have completed your last post-testing**

visit, you will receive an additional $10 study completion bonus. If the clinician determines that additional sessions are needed and you agree to participate in these extra sessions, you will be paid an additional $10 for each additional session (maximum of $30).

- **If you withdraw from participation during any of these sessions (before data collection is finished), you will be compensated $5 for the session in which you withdrew. For example, if you complete session 1 but withdraw in the middle of session 2, you would have received $10 at the end of the session 1 and $5 for session 2. If you withdraw from the study, you will not be able to rejoin.**

What are my rights as a research participant?

- **Your participation is voluntary.**
- **You may skip and/or refuse to answer any question for any reason.**
- **You are free to withdraw from this research study at any time without penalty.**
- **The investigators may stop your participation in this study at any time if they decide it is in your best interest. They may also do this if you do not follow the investigator's instructions.**

Whom may I contact with questions?

- **For questions, concerns or more information regarding this research you may contact Dr. Ellyn Riley at 315-443-9621 or earil100@syr.edu.**
- **If you have questions or concerns about your rights as a research participant, you may contact the Syracuse University Institutional Review Board at (315) 443-3013.**

Audio and Video Recording Permission (please check one of the following options)

____ I agree to be video AND audio recorded during study sessions

____ I agree to be audio recorded ONLY

Permission to use recordings for Instruction/Presentations

It is very helpful to have examples of our research procedures available to train students or speech-language clinicians. It is often helpful to have recordings to support these presentations. These recordings would consist of only audio recordings or video with accompanying audio, depending on which option you check below. If you allow this, no names will be used when these recordings are shown. If you choose not to allow recordings to be used for instructional purposes, you may still participate in this study.

____ I agree to allow VIDEO and AUDIO recordings to be used for instructional purposes.

____ I agree to allow ONLY AUDIO recordings to be used for instructional purposes.

____ I do NOT agree to allow recordings to be used for instructional purposes.

Permission to contact about future studies

I agree to be contacted about future research studies. ____ Yes ____ No

All of my questions have been answered, I am 18 years of age or older, and by signing this consent form, I agree to participate in this research study. I have received a copy of this form for my personal records.

---------- **Date: _____**
Printed Name of the Participant

_____
Signature of the Participant

---------- **Date: _____**
Printed Name of the Researcher

_____
Signature of the Researcher