Verb Network Strengthening Treatment Combined with tDCS in Non- fluent Chronic Aphasia
Olga Buivolova1 (obuivolova@hse.ru), Ekaterina Ivanova1, Ekaterina Iskra1,3, Olga Soloukhina1, Olga Pakholiuk4, Anastasia Shlyakhova1, Maria Ivanova5, Svetlana Malyutina1,2
1 Center for Language and Brain, National Research University Higher School of Economics, Moscow, Russia
2 Federal Center for Brain and Neurotechnologies, Moscow, Russia
3 Center for Speech Pathology and Neurorehabilitation, Moscow, Russia
4 University of Amsterdam, Amsterdam, the Netherlands
5 University of California, Berkeley, CA

Introduction

- Verb Network Strengthening Treatment (VNeST):
  - Aphasia therapy aimed at improving word and sentence production.
  - Works by strengthening the semantic and syntactic networks of verbs because they are the core elements of the language structure.
  - Effectiveness shown in English and Korean (Edmonds, Nadeau & Kiran, 2009; Edmonds, 2016).
- Transcranial direct current stimulation (tDCS):
  - Safe, non-invasive brain stimulation method.
  - Can potentially enhance the effect of language therapy (Galletta et al., 2016).
- Is there an added benefit of combining VNeST with tDCS in chronic post-stroke aphasia?

Methods

VNeST

- 20 frequent Russian 2-argument action verbs (e.g., to close, to catch, to drink, to count, to kiss, etc.) practiced in live SLT sessions in the following tasks:
  - Step 1. Generation of agents and patients for verbs (Fig. 2).
  - Step 2. Reading generated sentences aloud.
  - Step 3. Expanding sentences (prompted by questions).
  - Step 5. Verb production without cues.
  - Step 6. Sentence production without cues.

- Duration: 10 days, 2 sessions per day, 60 min each.
- Intensity: 6-7 verbs a day, all 20 trained verbs used 3-4 times during the therapy course.

tDCS

- Every day at the beginning of the 1st therapy session.
- Stimulation: 57 electrodes, 1.5 mA, 20 min.
- Would it be superior to (1) due to lateralizing language processing to LH and inhibiting maladaptive RH activation? (see TMS; Martin et al., 2009; Weiduschat et al., 2011)
- (3) Sham: Intact perisylvian cortex, informed by MRI.

Outcome measures

- Russian Aphasia Test (RAT; Ivanova et al., 2019)
  - Comprehensive test battery for assessment of linguistic function in aphasia.
  - Consists of 13 subsets covering language comprehension, production, and repetition.

Custom tests

- Verbs and Sentences: two tests: verb naming and sentence production.
  - Each contains 20 trained verbs and 20 untrained verbs, balanced for psycholinguistic parameters to test generalization.

Accuracy on trained and untrained verbs in the custom test

Discussion and Conclusions

- A combination of VNeST with tDCS in Russian-speaking people with chronic severe non-fluent aphasia showed promising results.
  - The added benefit of stimulation can hardly be determined at this stage. Data collection is ongoing.
  - All participants significantly improved on sentence production. These findings are consistent with the aim of the VNeST therapy and crucial for people with non-fluent aphasia.
  - Immediate testing, significant improvement was detected only in trained items. However, participants SYaV, who performed delayed testing after three months, improved significantly on untrained items in sentence production and reported an overall improvement in daily communication. In the future, we will perform delayed testing for all participants.

Accuracy on trained and untrained verbs in the custom test

Discussion and Conclusions (continued)

- Questions to be answered:
  - Does tDCS in general enhance the effect of language therapy?
  - Is 'lateralizing' stimulation (Group 2) superior to anodal LH stimulation?
  - Question beyond the scope of the study:
  - Within intact perisylvian cortex, how close to the lesion should the stimulation be targeted?