

Home-based non-invasive brain stimulation in combination with speech therapy in Parkinson's disease – Preliminary analysis of neural correlates

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Introduction

Up to 90% of patients with **Parkinson's disease (PD)** have **hypokinetic dysarthria (HD)** during the disease's progression. HD is characterized by **reduced variability of pitch and loudness, imprecise articulation, and impaired speech prosody**. The objective of this ongoing study is to investigate the long-term effects of repeated sessions of **home-based transcranial direct current stimulation (tDCS)** as an add-on to the well-established remote **Lee-Silverman Voice Treatment (LSVT)**, compared to LSVT alone (coupled with sham stimulation) in patients with PD.

Study design

Using a **double-blinded, randomized design**, PD patients are divided into two groups, receiving either real or sham anodal **tDCS (2 mA, 20 min)** of the **right superior temporal gyrus (rSTG – auditory-feedback area)** over 20 sessions in four weeks. Concurrently, both groups undergo remote LSVT. All participants will undergo clinical assessments, including MRI scans, EEG measurements, recording of speech tasks, and evaluations by speech therapists at baseline (V0), after treatment (V1), and 8 weeks after baseline (V2).

Preliminary results

Analysis of the 12 subjects (6 sham, 6 real stimulation) revealed **significant improvements** for all participants in the **Dysarthric profile scale Total score** (median relative change = 5.87, $p = 0.005$) and **Phonetics score** (median relative change = 4.0, $p = 0.038$). Changes in Phonetics score **correlated with changes in left supplementary motor area (ISMA) activations** ($R = 0.678$, $p = 0.045$). Interestingly, changes in resting state connectivity between rSTG and ISMA were higher after real stimulation (median = 63.8) than after sham (median = -100.4), though not statistically significant ($p = 0.114$). Additional **acoustic analysis** (16 subjects) showed **significant improvement of articulation** 8 weeks after baseline (V2) **only for real stimulation** (median relative change = 17.7, $p = 0.043$).

Conclusions

Preliminary data suggest that the remote LSVT is beneficial for PD patients and combination with home-based stimulation is feasible. We also observed neural correlates of induced speech improvements.

Acknowledgement

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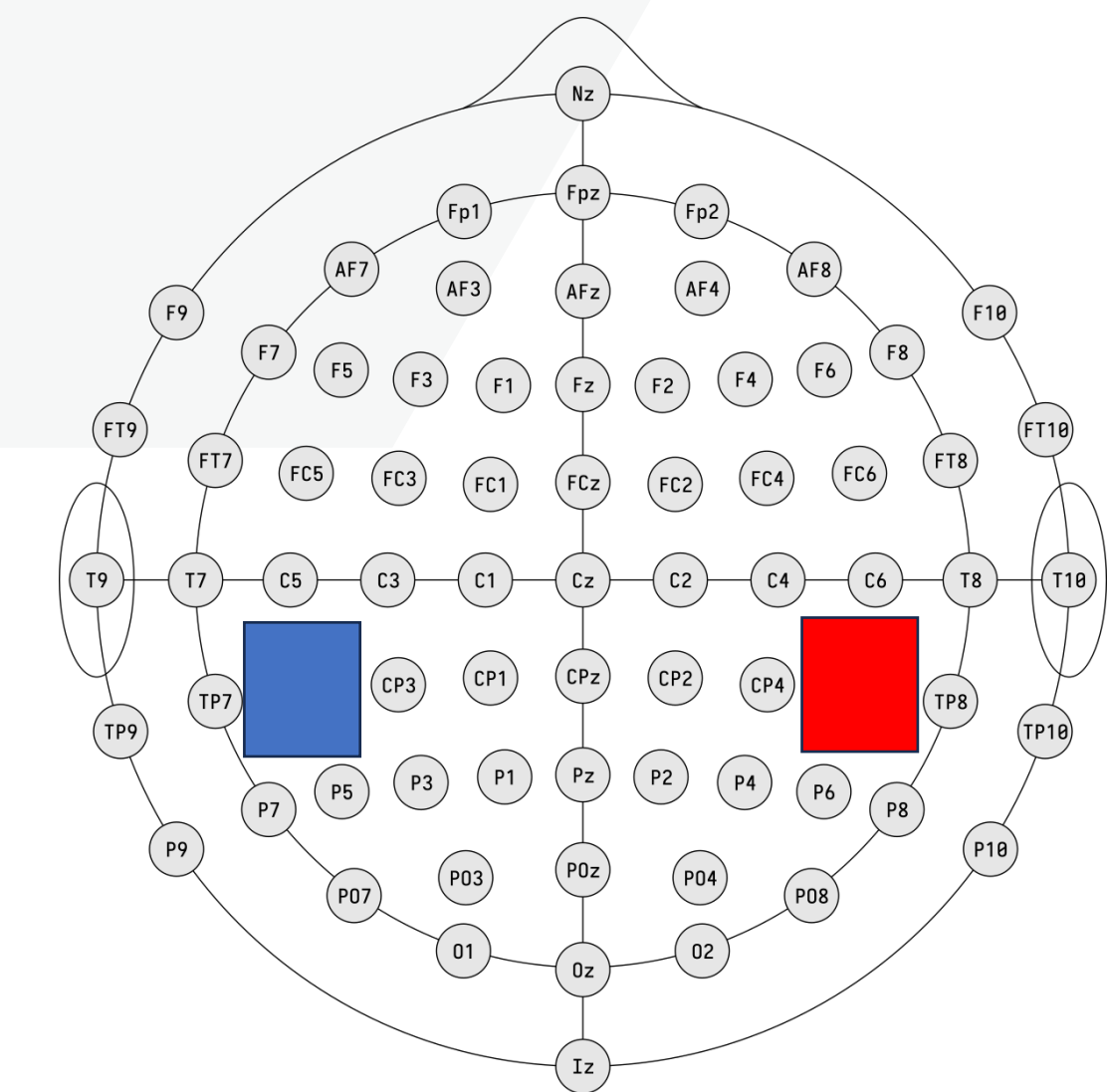


Figure 1: Electrode montages for home-based stimulation

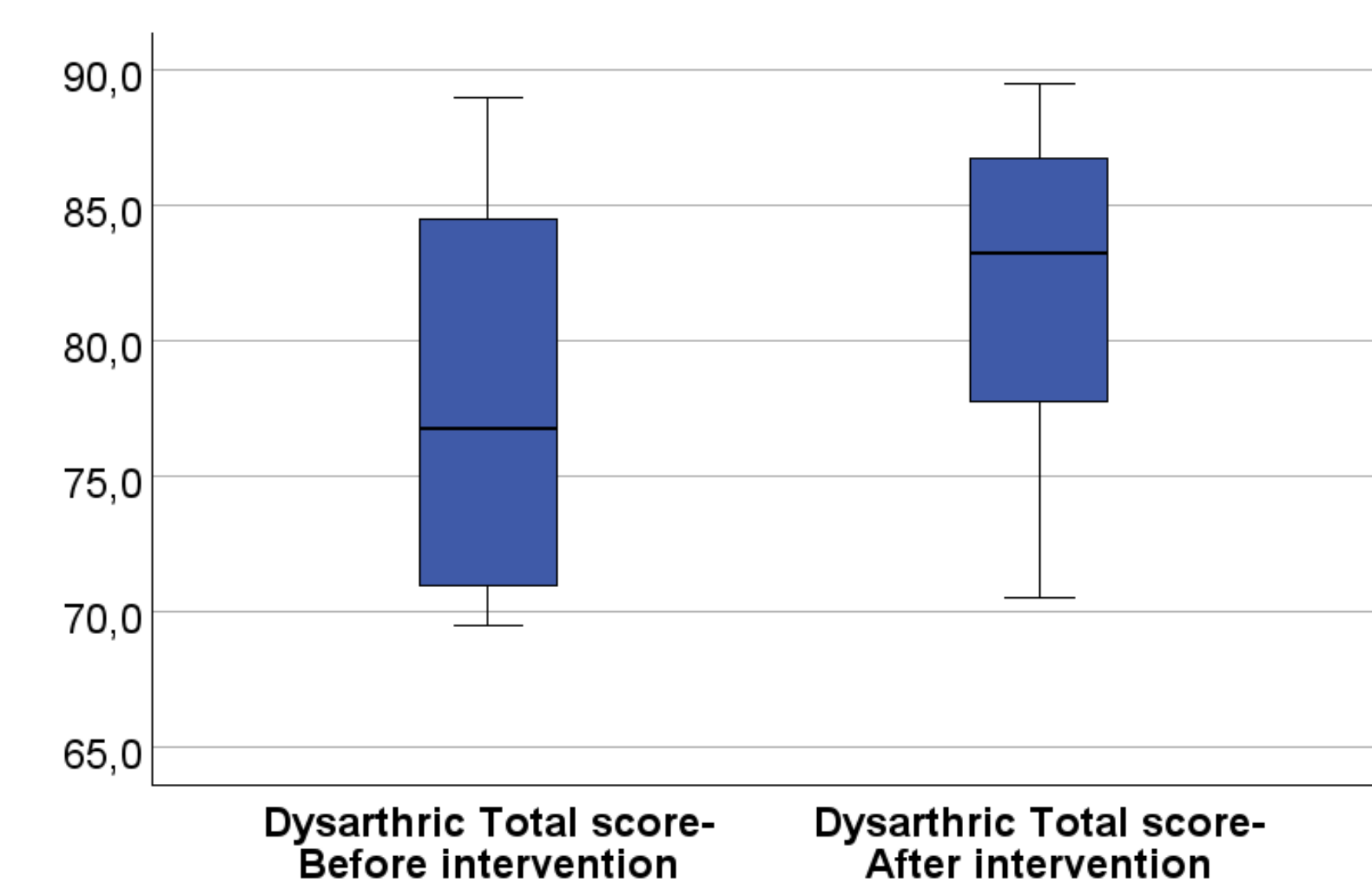


Figure 2: Speech assessment before and after therapy (both groups together)

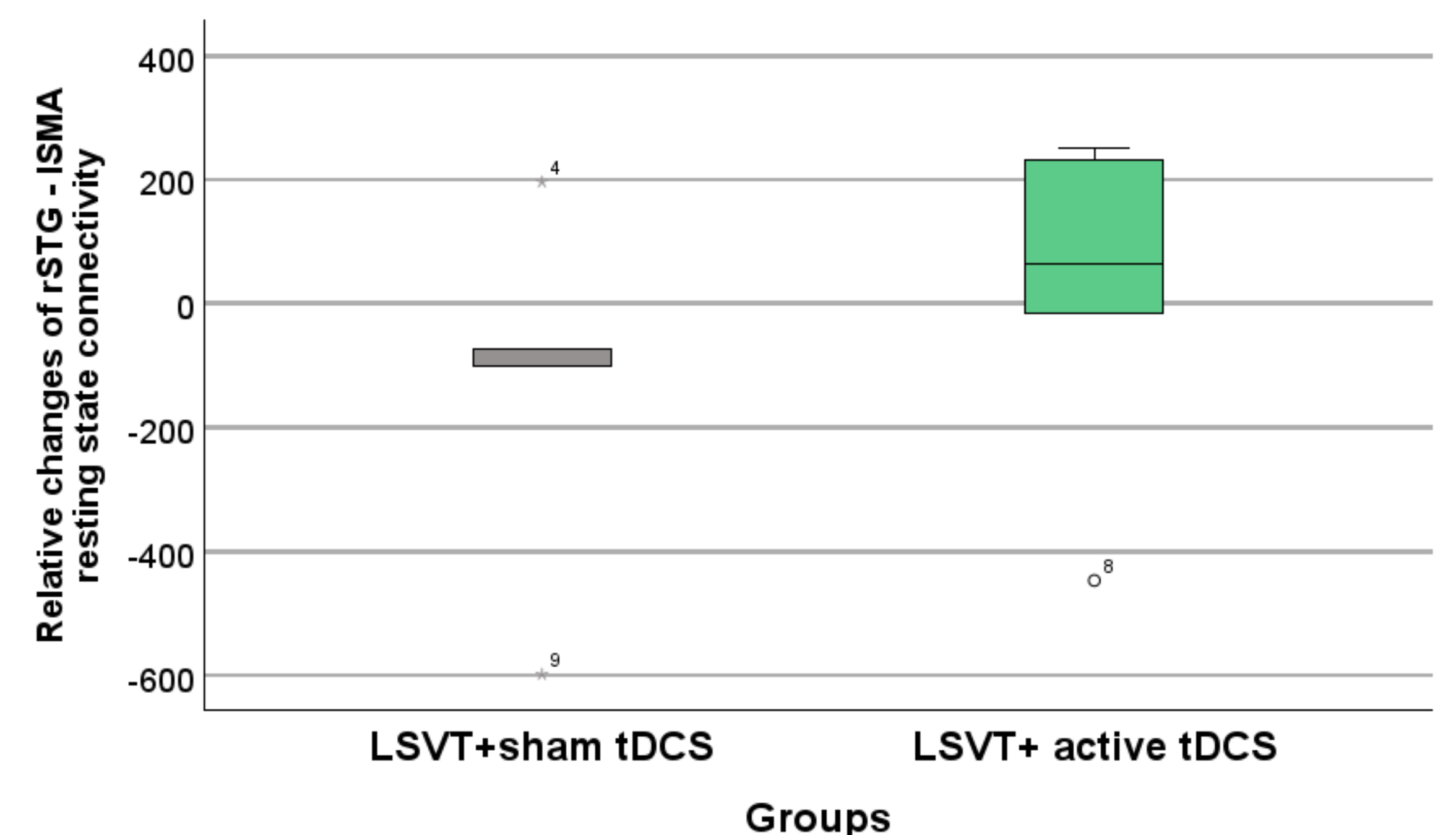


Figure 3: Relative changes of resting state connectivity (V1-V0)

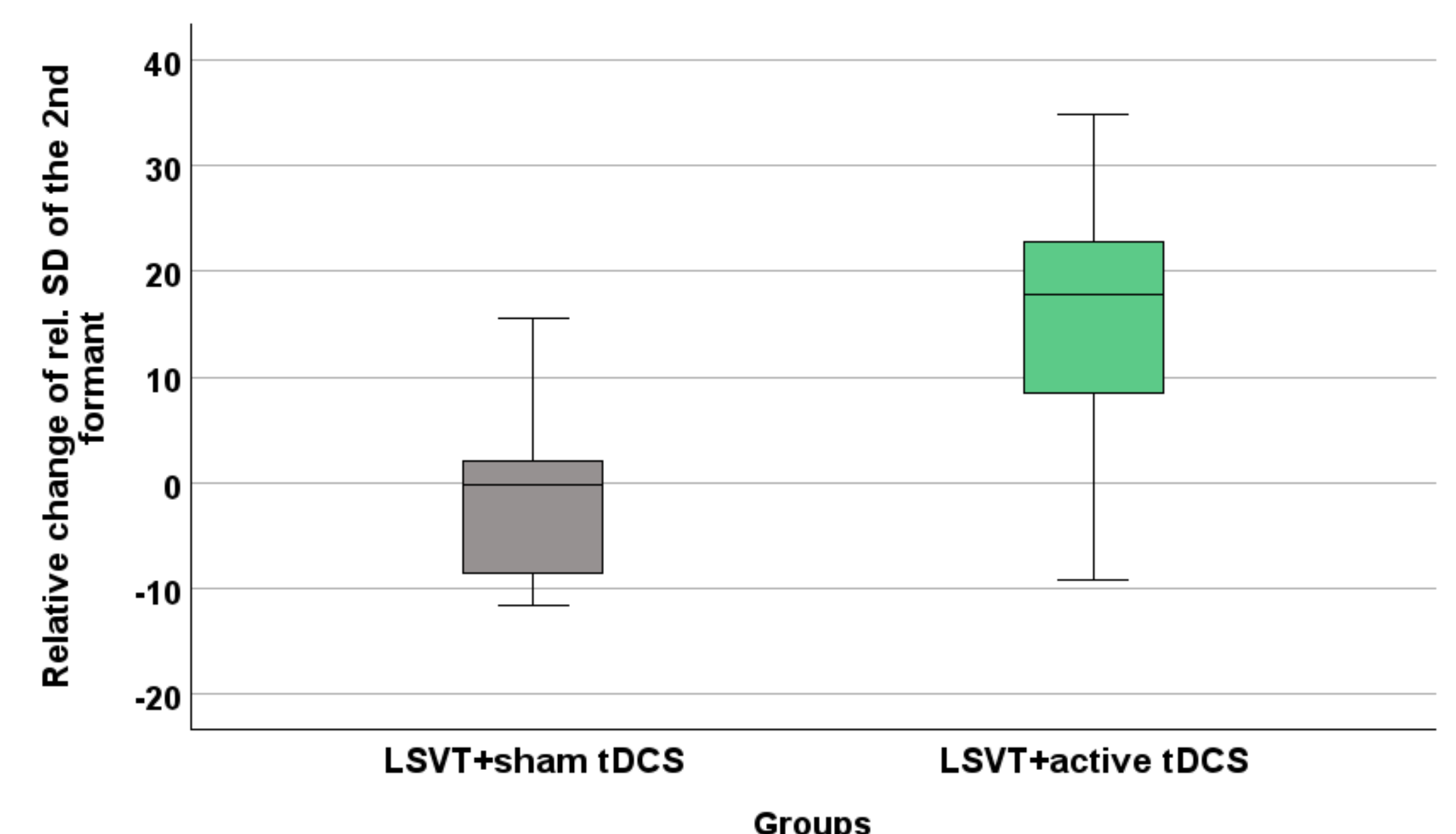


Figure 4: Relative changes of articulation 8 weeks after baseline (V2-V0)

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