

Effect of transcranial direct current stimulation and pharyngeal electrical stimulation on postacute dysphagia: The randomized controlled, double blinded PES-NOREST trial

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Purpose: Pharyngeal electrical stimulation (PES) and transcranial direct current stimulation (TDCS) are discussed as an adjunct to dysphagia therapy (DT). Study findings are inconsistent and seem to depend on etiology, phase of disease, severity of dysphagia, presence of a tracheostomy and study procedure. Although proof of principle studies show that the highest cortical excitability is reached 60 to 90 minutes post stimulation, a corresponding therapeutic paradigm has not yet been tested. Hence, one of the main goals of this randomized controlled trial (RCT) is to investigate effects of electrical stimulation combined with swallowing therapy on improvement of dysphagia.

Method(s): A total of 82 postacute stroke patients (in mean 58 days post unilateral lesion; 31 tracheotomized; 24 women, 58 men; in mean 75 years old; Barthel index 14.9; Functional Oral Intake Scale 2.4) were randomly assigned to a TDCS group (n=27), a PES group (n=27) and a sham stimulation group (n=28: sham TDCS=14, sham PES=14). Inclusion criteria were amongst others persistent dysphagia after a 2 week period of DT and aspiration during FEES. Participants received 5 times 10 minutes of real or sham stimulation and subsequent DT one hour afterwards. Patients and raters were blinded to group adherence. Primary outcome was change in Penetration/ Aspiration (PA) for saliva, fluids and puree. FEES was done at baseline and one week post stimulation (FU). Statistical analysis was performed by means of SPSS, using non-parametric tests (Wilcoxon, Kruskal-Wallis, Mann-Whitney-U) for ordinal variables. The statistical significance level was set at .05.

Result(s): PA-values of all tested consistencies improved significantly from baseline to FU by 1.0 point ($p < .001$) on the 8-point scale for all participants (TDCS 0.67; PES .91; sham 1.4) but showed no significant effect of stimulation group ($p = .326$). Subanalysis of tracheotomized and non-tracheotomized patients showed significant improvements ($p = .028$; $p < .001$) but again no significant group effects ($p = .588$; $p = .531$).

Conclusions: The results of this RCT show no influence of electrical stimulation neither by TDCS nor by PES

on PA-grades in tracheotomized or non-tracheotomized stroke patients. In their article on metaplasticity, Cheng and Hamdy [1] report that cortical preconditioning can not only be achieved by electrical, but also by gustatory, thermal or sensory stimulation. Sham and real stimulation consisted of awakening the patient, bringing her/him in an upright position and induced swallowing. Given the relevant improvements observed in the entire study population, benefits seem to be induced by a combined therapy scheme (prestimulation/ cerebral preconditioning to increase arousal – pause – DT). Future studies should be designed to test the effects of novel therapy schemes in order to be transferred into clinical practice.

References:

1. Cheng I, Hamdy S. Metaplasticity in the human swallowing system: clinical implications for dysphagia rehabilitation. *Neurol Sci.* 2022 Jan; 43(1): 199–209. doi: 10.1007/s10072-021-05654-9. Epub 2021 Oct 16