BACKGROUND

- Variability in experimental design and outcome reporting has resulted in inconclusive evidence surrounding the behavioural and neurological effects of transcranial direct-current stimulation (tDCS) (1, 2).
- Functional near-infrared spectroscopy (fNIRS) is an effective neuroimaging approach to investigate the brain’s response to neurostimulation (3).

AIMS

- To critically evaluate studies combining tDCS and fNIRS.
- To provide an overview of cortical hemodynamic responses to neurostimulation.

METHODS

- Systematic review of Embase, MEDLINE and PsycINFO was conducted with cross-references from Google Scholar (Fig. 1).
- Last date of literature search was 12 July 2019.
- Following deduplication and exclusions, qualitative analysis of included studies was performed.

RESULTS

- Concurrent stimulation and fNIRS measurement were performed in 20 of 28 studies (Fig. 4). 22 studies recorded haemodynamic changes at the stimulation site.

Haemodynamic Responses

- Overall increase in cortical activation at the stimulation site was associated with rest condition (Fig. 5).
- Tendency for tDCS to increase HbO₂ was observed at stimulated M1 and PFC.
- Less-pronounced general effect at non-stimulated brain regions was observed.
- With motor tasks, decrease in HbO₂ at stimulated M1 was identified, while with cognitive tasks decrease in HbO₂ at stimulated PFC was observed.
- During functional tasks, reduced cortical activation at the stimulation site was observed during online stimulation.
- Offline and poststimulation effects lacked consistency through the cohort.
- Clinical impact on patient populations and their symptom correlation was inconsistent.

CONCLUSION

- The combination of tDCS and fNIRS is becoming an increasingly popular and promising technique to investigate neuromodulation.
- Despite the high degree of methodological heterogeneity several consistent results across the included studies can be identified.
- Further randomised controlled studies with standardised reporting and higher sample sizes are required to confirm existing evidence.

References

(2) V. López-Alonso et al., Brain Stimul. 7 (3), 372–380 (2014).