

Findings, limitations and new directions in tACS studies in schizophrenia research: a scoping review



Adriana Farcas¹, Felicia Iftene²

¹PhD Candidate, Centre for Neuroscience Studies Queen's University
²MD, PhD, FRCPC, Associate Professor of Psychiatry and Psychology,
 Department of Psychiatry, Psychology and Centre for Neuroscience, Queen's University

Providence Care

INTRODUCTION

Schizophrenia(SZ) - complex and debilitating symptomatology

Up to 80 % of individuals with SZ will relapse over 5 years

General optimism within the scientific community regarding the use of electrical current stimulation in:

- enhancing cognitive performance in healthy people;
- ameliorating symptoms in a wide variety of conditions, including neuropsychiatric conditions.

(Elyamany et al., 2020; Struber & Herrmann, 2020; Fertoni & Miniussi, 2017).

METHODS

Systematic search on 2 databases:

Embase 2011 – 2021 Medline 2011 - 2021

Keywords:
 “Schizophrenia”
 “Transcranial alternating current stimulation”
 Boolean operator “AND”
 English language

8 articles included

RESULTS

Study	tACS Hz	Main Findings
Sreeraj et al., 2020	10 Hz	Significant reduction in severity of delusion was noted after the 5 th day of tACS stimulation.
Ahn et al., 2019	10 Hz	Enhanced alpha oscillations and modulated functional connectivity in the alpha frequency band; enhancement of the 40 Hz ASSR; reduction of auditory hallucinations.
Mellin et al., 2018	10 Hz	tACS greater effect than tDCS and Sham
Force et al., 2021	10 Hz	Shift in the sense of controllability captured by the auditory hallucination rating scale (AHRS)
Sreeraj et al., 2019	6 Hz	Improvement in working memory, attention, processing speed and emotional processing;
Kallel et al. 2016	4.5 Hz	Decrease of negative symptoms (-10%), general symptoms (-18%) and an improvement of insight into the illness (-25%)
Haller et al., 2020	40 Hz	Improvement in the PANSS, NSA and subjective well-being; improvement in the Trail Making Test and word fluency.
Hoy et al., 2016	40 Hz	tACS showed no effects on working memory.

DISCUSSIONS & CONCLUSIONS

- Non-invasive brain stimulation techniques becoming a part of the arsenal of therapeutic approaches in psychiatry (Elyamany et al., 2020).
- Improvements noted in some of the included studies may be seen as a possibly promising and inviting direction for a deeper analysis of the mechanisms involving endogenous brain oscillations and their susceptibility to modulation by external, alternative current stimulation means.
- Room for more explorations and study design improvements.
- Larger scale studies are needed, as well as a wider variety of tACS parameters

FUNDING

Providence Care Innovation Grant 2019: “Innovative pathways to impactful treatment of chronic schizophrenia: disrupting the status-quo moving toward biological –driven, combined pharmacological and non-pharmacological therapeutic approaches to define markers of therapeutic improvement in cognitive behavioral therapy for psychosis promoted recovery”.

REFERENCES

- Elyamany, O., Leicht, G., Herrmann, C. S., & Mulert, C. (2020). Transcranial alternating current stimulation (tACS): from basic mechanisms towards first applications in psychiatry. *European Archives of Psychiatry and Clinical Neuroscience*, 271(1), 135–156. <https://doi.org/10.1007/s00406-020-01209-9>
- Fertonani, A., & Miniussi, C. (2016). Transcranial Electrical Stimulation. *The Neuroscientist*, 23(2), 109–123. <https://doi.org/10.1177/1073858416631966>
- Struber, D., & Herrmann, C. S. (2020). Modulation of gamma oscillations as a possible therapeutic tool for neuropsychiatric diseases: A review and perspective. *International Journal of Psychophysiology*, 152, 15–25. <https://doi.org/10.1016/j.ijpsycho.2020.03.003>