

Abstract

Background: Cognitive deficits of various degrees are nearly ubiquitous among patients with schizophrenia and were shown to be negatively correlated with their functional outcomes. Of the different types of cognitive function studied in these patients, working memory (WM) has consistently been shown to be a key domain for determining their functional status. This suggested that improving patients' working memory could enhance their clinical outcome. Nonetheless, effective cognitive enhancement strategies for schizophrenia patients are limited and costly. In this regard, transcranial direct current stimulation (tDCS) promises to be a potential tool for the cognitive rehabilitation of patients with schizophrenia. It is a low-cost and non-invasive procedure that is believed to modify cognitive and other brain functions through its neuroplastic properties. Yet, while evidence for the application of tDCS in patients with depression is fast growing, research on its application in enhancing the cognitive function of patients with schizophrenia is limited and inconclusive. Accordingly, a randomized controlled trial is warranted to investigate its clinical efficacy in the cognitive rehabilitation of patients with schizophrenia.

Objectives: We aimed to investigate the effect of a course of tDCS on the cognitive function, depressive symptoms, and schizophrenic symptoms of adult day-patients with schizophrenia.

Method: Our study was a parallel-group, double-blinded, randomized controlled trial.

Participants with a diagnosis of schizophrenia were recruited from two local psychiatric day hospitals, and were randomly allocated into either the intervention group or the control group. Participants in the intervention group received a 4-week course (12 sessions in total) of active tDCS in addition to their usual psychiatric care. The control group received a course of sham tDCS in addition to their usual psychiatric care. Changes in outcome in the two groups (as

tDCS for Cognitive Function in SCZ

measured with Forward and Backward Digit Span, Forward and Backward Block Spatial Span, Trail Making Tests A and B, Verbal Fluency, Hamilton Rating Score for Depression, and Positive and Negative Syndrome Scale) after undergoing their assigned intervention were compared upon completion of the intervention and at 4 weeks post-intervention.

Results: 36 subjects from two psychiatric day hospitals were recruited into the study. 18 of these subjects were allocated to the intervention group and 18 were allocated to the control group. The subjects in both groups showed statistically significant improvement over time in the majority of outcome measures, but significant difference between the changes in the two groups over time was found only for visual working memory measure (Backward Block Spatial Span score, *Backward BSS score*). Backward BSS score increased by 1.66 points (+29.9%) upon completion of tDCS course when compared to baseline ($F= 4.37$, $p< 0.05$, partial eta squared= 0.21). However, no maintenance effects were observed at 4 weeks post-tDCS course. There were no statistically significant effects between groups over time for depressive symptoms and schizophrenic symptoms.

Conclusion: The results of our study demonstrated a statistically significant effect of tDCS on visual working memory measures of subjects with schizophrenia with an effect size of partial eta squared= 0.21. The use of tDCS for the treatment of cognitive deficits in patients with schizophrenia should be further investigated.

Key words: *tDCS, Transcranial Direct Current Stimulation, Cognitive Function, Schizophrenia*