

Case Report

Clinical Utility of Add-On Transcranial Direct Current Stimulation for Binge Eating Disorder with Obesity in Schizophrenia

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ABSTRACT

Over the recent years, there has been an increasing application of noninvasive brain stimulation techniques such as transcranial direct-current stimulation (tDCS) to modify eating behaviors in healthy population and persons with eating disorders. tDCS is a noninvasive, neuromodulatory intervention which is well-tolerated and safe. In this case report, we describe the successful application of add-on tDCS in a patient with schizophrenia to reduce the craving for food that in turn, helped in reversing the weight gain.

Key words: *Binge eating disorder, obesity, schizophrenia, transcranial direct-current stimulation*

INTRODUCTION


Metabolic syndrome is an important physical health hazard in patients with schizophrenia. Apart from genetic, lifestyle, and drug-induced metabolic derangements, disorders related to eating behaviors are found to be high in patients with schizophrenia.^[1] Eating disorders such as bulimia, binge eating, and night eating syndromes would result in obesity and are found in substantial number of patients with psychotic disorders.^[2,3] This will have a detrimental effect on body image and subjective psychological as well as physical well-being of the individual.

Management of obesity in schizophrenia is a challenging task. Lifestyle changes and pharmacotherapy may not be effective or suitable or recommendable in certain patients or situations, requiring newer modes of interventions.^[1,4] Recently, there has been increasing application of noninvasive brain stimulation techniques such as transcranial direct-current stimulation (tDCS) to modify eating behaviors in healthy population and persons with eating disorders.^[5-8] tDCS is a noninvasive, neuromodulatory intervention which is well tolerated and safe; this technique involves the application of low intensity, direct current (2 mA) through electrodes

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placed on the scalp resulting in polarity-specific neuromodulation of focal brain regions that have been applied to treat persistent auditory hallucinations in schizophrenia.^[9] In this case report, we describe the successful application of add-on tDCS in a patient with schizophrenia to reduce the craving for food that in turn, helped in reversing the weight gain.

CASE REPORT

Ms. M, a 37-year-old single woman, had features suggestive of paranoid schizophrenia for the past 20 years with 2nd and 3rd person auditory hallucinations, thought echo, thought broadcasting, persecutory delusions, and delusional dysmorphophobia. She had shown significant improvement in the above psychopathology except for residual fleeting auditory hallucinations and referential delusions while on with aripiprazole 20 mg/day, quetiapine 200 mg/day, and depot flupentixol 40 mg fortnightly. She is also on propranolol 40 mg/day, clonazepam 0.5 mg/day, and trihexyphenidyl 2 mg/day for drug-induced extrapyramidal symptoms. She had also received modified electroconvulsive therapies 7 years ago for depressive symptoms after inadequate responses to venlafaxine, escitalopram, and fluoxetine trials. Over the past 5 years, she has been maintaining well without syndromal affective features for nearly 5 years on sertraline 150 mg/day. In addition, she has been on treatment with 150 µg/day of thyroxine supplementation for hypothyroidism. She was also diagnosed with right-sided ovarian papillary cystadenocarcinoma 10 years earlier; she underwent hysterectomy with bilateral salpingo-oophorectomy and has been on treatment with conjugated estrogen 0.3 mg/day.

Over the past 10 years, she had been having binge eating pattern (1–3 times/week) with excessive craving for carbohydrate-rich food (chocolates and ice-creams). Binge episodes were usually precipitated with psychosocial stressors, and the patient would indulge in bingeing even when not feeling hungry and would eat very fast in large amounts. Over the 10 years of follow-up with multiple admissions, and trials with antidepressants (fluoxetine 40 mg/day and sertraline 250 mg/day), chromium picolinate (1 mg/day), yoga therapy, physical exercise, and cognitive behavior therapy on multiple occasions without any significant improvement. The binge-eating behavior persisted, and her weight increased from 73 kg (body mass index: 27.14 kg/m²) to 98 kg (36.43 kg/m²) in the past 10 years. In view of persistent binge eating behavior, the potential option of add-on tDCS was discussed with the patient and family; information about tDCS including a video demonstration of the procedure was provided.

Following this, add-on tDCS was administered using standard equipment (Neuroconn DC-Stimulator Plus, http://www.neuroconn.de/dc-stimulator_plus_en/) with stringent safety measures. The anode was placed with the middle of the electrode over a point midway between F4 and FP2 (right dorsolateral prefrontal cortex [DLPFC]), and the cathode was located at supraorbital region using 5 cm × 7 cm electrodes. The stimulation was provided for 10 consecutive daily sessions (with 1-day gap after 4th session) at 2 mA for 30 min. During the tDCS sessions, the patient was alert, comfortably seated, and did not perform any activity. The patient-tolerated tDCS well without any adverse effect as ascertained by a structured questionnaire after each session.^[10]

Baseline scores for positive symptoms (Scale for the Assessment of Positive Symptoms-6), negative symptoms (Scale for the Assessment of Negative Symptoms-14), depressive symptoms (Beck Depression Inventory-6, Calgary Depression Rating Scale-3, and Hamilton Depression Rating Scale-4), and anxiety symptoms (Hamilton Anxiety Rating Scale-2) remained unchanged over the course of tDCS. Three-factor eating questionnaire,^[11] satiety score card^[12] after 30 min of last full meal (10-point visual analog scale for hunger, fullness, satiety, and prospective food consumption), and repeat satiety scorecard after exposing to pictorial cues (of chocolates and ice-creams) was applied before tDCS, after 5th day and after 10th day of tDCS [Table 1]. The patient showed improvement in subjective reporting on cognitive restraint and control over eating as well as feeling of satiation and ability to eat after exposure to cues. A weight loss of 3 kg was noted by the end of tDCS treatment. On follow-up evaluation after 10 months of tDCS, the improvement in binge eating pattern persisted with further weight loss of 7 kg.

DISCUSSION

In this schizophrenia patient who had persistent binge-eating pattern and obesity, we noted a significant reduction in cue-induced food craving was noted after 10 daily sessions of add-on tDCS; this improvement prevailed over the next 10 months with significant reduction in binge-eating behavior with resultant decrease in weight by 7 Kg. Interestingly, the weight reduction noted after tDCS was never seen in the patient in the preceding 10 years of regular consultations at our institute.

This case illustrates the role of right DLPFC in craving for food and regulating eating pattern. Earlier systematic studies and meta-analysis have suggested similar effect,^[6,8,13] though results have been inconsistent owing to single-session stimulation used

Table 1: Changes in weight, three-factor eating questionnaire, and satiety scores at full stomach and after 5 min of cue exposure before and after transcranial direct current stimulation sessions

Tool	Before tDCS	5 th day of tDCS	10 th day of tDCS	10 th month follow-up
Weight in kg (BMI in kg/m ²)	98 (36.43)	97 (36.19)	95 (35.32)	88 (32.72)
Three-factor eating questionnaire				
Emotional eating	8	10	10	9
Cognitive restraint	9	22	23	20
Uncontrolled eating	12	30	32	34
Satiety score (after 30 min of food intake)				
How hungry do you feel?	3	1	2	0
How full do you feel?	9	10	9	10
How satisfied do you feel?	9	10	9	10
How much do you think you can eat now?	2	1	1	0
Satiety score after 5 min cue-exposure				
How hungry do you feel?	5	2	2	0
How full do you feel?	8	8	9	9
How satisfied do you feel?	5	8	9	9
How much do you think you can eat now?	8	4	2	1

BMI – Body mass index; tDCS – Transcranial direct current stimulation

in most studies on healthy or obese individuals. The multisession therapeutic studies in obesity and eating disorders are still coming up with preliminary results and are encouraging.^[13] Some of the variation in results could be due to the lateralization of the stimulation as studies have suggested right DLPFC to be better than left DLPFC in alleviating food craving.^[14]

DLPFC is known to have direct neuronal projections to the ventral tegmental area. Hypoactivation of DLPFC is known in patients with schizophrenia and eating disorders.^[15] The stimulation of prefrontal glutamatergic neurons would change the dopaminergic sensitivity of the reward pathway thereby reducing the craving for specific food.^[13] However, it is not just the craving, but the increase in cognitive control^[14,16] and general reduction in the appetite^[13,14] has been hypothesized to reduce the food consumption behavior through the effects on limbic structures.

Altered synaptic plasticity and neuronal connectivity across brain regions is a hallmark of schizophrenia resulting in heterogeneous symptom manifestation.^[17] tDCS has been shown to be effective in targeting hallucinations, negative symptoms, insight and cognitive symptoms in schizophrenia^[9,18-20] by inducing neuronal plasticity.^[21] Add-on treatment with tDCS is a potential novel intervention in managing obesity in patients with schizophrenia. This needs further systematic research.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that

their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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