



Impact of Transcranial Direct Current Stimulation on Patients with Parkinson's disease: A report of 2 cases

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ABSTRACT

Introduction: The motor function is associated with the activity of both the motor and prefrontal cortices. The efficacy of tDCS over specific brain cortices has been examined in many psychiatric and neurologic disorders. The aim of this study is report of the tDCS effects on two female of advanced age, with idiopathic PD

Methods: We considered 50-minute sessions of bi-lateral primary motor cortices as well as left DLPFC anodal stimulation using tDCS with passive stretching exercises simultaneously for a total of 20 sessions in 7 weeks. Clinical signs and EEG waveform were assessed at distinct times.

Results: Both of the two patients showed improvement in motor function for a short time. EEG changes to some extent were in relation to clinical states.

Conclusions: It seems that tDCS can be an auxiliary treatment for motor dysfunction in Parkinson's disease, however, further studies must be carried out in order to prove the claim.

Keywords

Parkinson's disease; Transcranial direct current stimulation

Introduction

Numerous studies indicate that TDCS induces inhibitory or excitability changes in human motor cortex which can be more significant than the effects inducted by transcranial magnetic stimulation [1]. Imaging literature confirm the existence of prefrontal-premotor connectivity. It has been suggested that the rostral sector of the dorsal premotor cortex (pre-PMd) possess some cognitive and premovement processes and its caudal sector (PMd proper) essentially deal with real movement [2]. The efficacy of anodal TDCS over both the motor and DLP-

FC has been observed in PD.

It seems that the motor dysfunction in PD is due to the degeneration of dopaminergic neurons [3]. Meanwhile, visual hallucination is one of the most prevalent ones which may be due to dopamine deficiency of the visual system. This problem has especially been reported concerning the patients treated with L-dopa and dopamine agonists [4]. Surveys in brain imaging in PD patients with visual hallucination have significantly indicated the frontotemporoparietal atrophy compared with the PD controls [5].

In a clinical study, it was been shown Transcranial Direct Current Stimulation (TDCS

) might be a useful alternative for the treatment of motor performance PD patients. Studies claim that TDCS may facilitate the dopaminergic transmission. Moreover, the improvement of learning disability in healthy subjects and motor recovery in chronic stroke by TDCS approach has motivated its application. However, due to inadequate evidence, although it bears many benefits, employing this approach regarding rehabilitation is controversial.

In a meta-analytic study on 18 qualified studies, it found that TDCS protocols may present immediate positive effects on functional locomotion in persons with Parkinson's Diseases PD. Researchers insist that the prevalence of EEG abnormalities in PD is higher than in normal elderly individuals.

Materials and Methods

Two elderly right handed women with idiopathic parkinsonism not responding to medication introduced by a neurologist for the application of TDCS in order to attenuate motor dysfunction targeted in our survey. Diagnosis indicated the UK PD Brain Bank criteria in a Hoehn and Yahr stage of 1-3 while 'off' medication. The Parkinson Disease Questionnaire PDQ-39 scores for the mobility dimension were 30%-37%. The subjects developed no major psychiatric disorder. The younger woman whose head Computed Tomography (CT) scanning confirmed an apparent atrophy at the right perisylvian area complained about visual hallucination.

Their consent was obtained after being informed about the experiment. The study was approved by the institutional ethics committee of the Yazd Medical Science University.

Results

Behavioral

Improvement of the motor function began after the 4th and the 7th sessions considering the patient's age (72 and 83 years old, respectively). We witnessed a mild decrease in their walking time both in off and on states. Meanwhile, bradykinesia improved particularly in the on state. Average depletion of the PDQ-39 mobility scores were some 15%-20%. Which appeared more prominently after the sessions. The fluency and the tone of speech bore promotion for the two treated participants. None of the mentioned outcomes lasted more than forty five days.

EEG pattern analysis

Absolute differences for individual statistics and descriptive analysis were performed by the NeuroGuide and LORETA Low Resonance Electromagnetic Tomography software. The delta waves decreased across the anterior regions. Meanwhile, a delta increase was observed in the left frontotemporal areas of the patient with visual hallucination. In spite of changes in QEEG Quantitative Electro Encephalography, we observed an increase in the EEG source localization of alpha waves (especially high alpha) in the temporoparietal areas for the younger one. The rest of the bands were intact. Surprisingly, unlike the younger patient, both the alpha source localization and global alpha peak frequency alleviated in the older one.

Discussion

Except for a partial visual hallucination enhancement in the involved patient which was presumably due to an interaction between L-dopa and TDCS, no other adverse effects occurred. Even though there are no relations between the demographic characteristics and the clinical features in PD's literature, it is assumed that age and disease duration plays a vital role in the rate of im-

provement. Therefore, age effects, disease duration, stage, or a combination of them on the rate of recovery seem obscure. We observed that the anodal TDCS stimulation of the mentioned areas promoted the improvement of the motor dysfunction process. In an EEG survey on PD, they found out that the most significant aspect of the findings was the enhancement of the delta waves. Besides, the patient without dementia enjoyed an increase in the activity of the theta. Patients with both PD and dementia are of slower EEGs than those without dementia. These abnormalities are observed in the frontal and frontal-pole areas in PD with executive dysfunction (ExD). They are also present in all locations in patients with dementia. Resting alpha frequency diminishes in dementia and current density in delta and alpha bands reflect the pathological changes in the left temporal lobe and the brain deficiency. It has been showed alpha brain waves activity is relation to cognitive performance. We observed a global enhancement of alpha peak frequency together with EEG source localization in the same waves in bit emporoparietal regions of the younger patient. Hereby, we conclude that TDCS may affect the cognitive function according to the age.

Conclusion

These changes in the EEG signals of the two patients may indicate the improvement of the motor features. Even though, we didn't go through the other deficits of the Parkinson's disease, access of the patients to this know-how seems promising. Generally speaking, we suggest the TDCS as an auxiliary method for the temporary diminution of motor dysfunction in PD. However, going through more surveys considering the age, disease duration and stage in this disorder seems inevitable.

References

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