

Transcranial direct current stimulation for lewy body dementia: A case study

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Abstract

Background: Dementia with Lewy Bodies (LBD), accounts for 15 to 20% of all types of dementia in persons over 65 years of age. The cause of LBD is not known, symptoms include a gradual decline in mental abilities, hallucinations, changes in alertness and attention, and movement difficulties. There is no FDA- approved medication that can improve, slowdown or stop the progression of LBD. Identifying effective treatments is therefore extremely important for LBD patients and their families. A potentially promising non-invasive, non-pharmacological intervention is transcranial Direct Current Stimulation (tDCS), in which a weak electric current is passed through the brain provoking neural changes.

Case: A 78-year-old, male presented with symptoms associated with cognitive decline, including periods of reduced concentration and alertness, language problems and postural changes. Despite a negative MRI scan of the brain the patient was diagnosed with LBD based on clinical assessment.

Method: DCS treatment was initiated using a small portable, apparatus. Anodal stimulation of the occipital lobes was carried out 5 times a week and stimulation of the dorsolateral prefrontal cortex twice a week.

Results: No signs of either improvement, or decline were observed during the 12 months following treatment initiation. However, the patients symptoms worsened when his apparatus broke down for 20 days.

Conclusion: Although no improvement was seen in this patient, the absence of further decline is an important result. This case study suggests that neurostimulation techniques may play a role in the management of LBD.

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Introduction

Lewy Body Dementia (LBD) is a progressive, degenerative brain disorder. Dementia with Lewy bodies (α -synucleinopathy pathology) and Parkinson disease dementia often present with similar symptoms including dementia, psychosis, movement problems, stiffness and tremor. These conditions can be differentiated clinically [1]. In most cases of LBD, dementia precedes motor signs, particularly episodes of diminished responsiveness and visual hallucinations. After Alzheimer's disease and Vascular dementia LBD is the third most common form of dementia, characterized by the deposition of Lewy bodies in the brain. Occipital and posterior-temporal structural alterations are an early signature of LBD. Progression of the condition varies greatly, however the median survival rate is 3-4 years and most individuals with LBD die of complications of the disease [2].

Pharmacological interventions are symptom related. Symptoms include cognitive, neuropsychiatric and Parkinsons related symptoms, as well as autonomic dysfunction and sleep disorders. The adverse effects of drugs used to manage these symptoms contribute to a reduced quality of life. Identifying treatment methods with lower adverse effect profiles that can replace, or supplement lower dose medication is important for overall quality of life for LBD sufferers. Neurostimulation techniques, including transcranial Direct Current Stimulation (tDCS) showed positive results in areas of memory, language and other cognitive functions in 2 different meta analyses from 2018 and 2022 [3,4]. Results showed that the effects of tDCS were best when treatments were combined with cognitive training and physical activity. Attentional, but not visuoperceptual, improvements were observed following one single tDCS treatment in a small study, which included 13 LBD patients [5]. A review of recent findings from neurophysiological, chemical, and brain-network studies, has indicated that tDCS positively or negatively modulates the activities of dopamine, serotonin, and acetylcholine transmissions in the central nervous system [6].

tDCS treatment involves the attachment of two electrodes to the scalp by either a hood or a band. During stimulation, a weak current (1-2 mA) flows between the electrodes, passing through the brain to complete the circuit. This method has a modulatory effect upon cortical excitability by increasing or decreasing the underlying neural membrane potential, depending on polarity.

Case presentation

A previously healthy 78-year-old retired male patient was referred for interdisciplinary rehabilitation and further management of progressive cognitive and physical dysfunction. A MRI scan of the brain did not reveal any pathological changes; however, an EEG showed occipital slowing. He scored 27/30 on the Mini-Mental State Examination (MMSE) [7] and 10/13 in a Hooper Visual Organization Test (HVOT), suggesting slight visuospatial impairment [8]. The patient had a 3-year history of progressive cognitive symptoms. He received a tentative diagnosis of LBD based on a clinical examination at the hospital geriatric, psychiatric department. Early symptoms included difficulties recalling recent events, prolonged attention and learning new tasks. He became very stressed when talking about his previous job as a solicitor and had developed symptoms of mild depression. Physical symptoms included movement stiffness, balance problems and postural changes.

An initial clinical interview revealed that the patient had

frequent contact with family and friends. He could look after himself adequately. In social occasions with more than 4 people he became withdrawn, not being able to cope with background noise. He remained physically healthy and despite some balance problems cycled for 60 minutes each day. He continued to drive on quiet roads on a daily basis. His sleep patterns were unchanged. However, he was pessimistic, easily stressed and worried about his future.

The patient carried out tDCS treatments using a small portable Brain Premier apparatus on a daily basis, from June 2023 to July 2024. For five days each week, he applied anodal stimulation to the occipital lobes for 20 minutes on each side. For the remaining 2 days each week he applied anodal stimulation to the left dorsolateral prefrontal cortex for 30 minutes. During all treatments the cathode was attached to the right deltoid muscle.

The patient was advised to combine treatments with either taxing mental or physical training. He chose Sudoku puzzles and either line dance or Zumba, which he danced to on youtube.

The patient and his wife recorded symptom changes using the Comprehensive LBD Symptom Checklist where symptoms are graded. The list includes cognitive symptoms, Parkinson-like symptoms, behavior and mood changes, sleep concerns, autonomic system dysfunction, reactions to recent medication changes and comments/other concerns.

Results after one year of daily treatment

The patient was assessed after one year, using the same tests that were applied pre-treatment, including MRI, EEG, MMSE and HVOT. No significant changes were recorded. Also, the patient and his wife were interviewed, they both reported a status quo situation, with no improvement or worsening. Inspection of the LBD symptom checklist confirmed their opinions.

Four weeks after the one-year assessment point, we received a worrying phone call from the patient's wife. His tDCS apparatus had stopped working and after 14 days without treatment she observed worrying changes in her husband's condition. These changes included deterioration in his memory and concentration skills; also, he was having trouble finding the right words during conversation. He had become increasingly stressed and irritated. Inspection of the LBD symptom checklist filled out by both the patient and his wife confirmed her worries.

The patient was provided with a new apparatus. After 10 days of daily treatment, his symptoms improved and stabilized. The checklist indicated symptom levels had returned to approximately the same level as they were at the one-year follow-up point.

Conclusion

Daily tDCS combined with mental and physical training appeared to prevent further worsening of LBD symptoms. It is possible that degenerative neurological disorders need daily electrical stimulation to be effective.

Declarations

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