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Case Report

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We Need to Rehabilitate the Brains of Individuals with Parkinson's Disease: The Incredible Gains with Transcranial Direct Current Electrostimulation (tDCS)

Fracasso BV[1*] and Malysz T[1,2]

[1]Postgraduate Program in Neurosciences, Institute of Basic Health Sciences (ICBS), Federal University of Rio Grande do Sul (UFRGS), Brazil

[2]Department of Morphological Sciences, Institute of Basic Health Sciences (ICBS), Federal University of Rio Grande do Sul (UFRGS), Brazil

[*]**Corresponding author:**
Bruno Veloso Fracasso,
Postgraduate Program in Neurosciences, Institute of Basic Health Sciences (ICBS), Federal University of Rio Grande do Sul (UFRGS), Brazil

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1. Case Report

Parkinsonian syndromes are determined by the presence of at least two of the four main symptoms: bradykinesia, rigidity, resting tremor and postural instability [2, 18], caused by a reduction in dopamine in the pars Compacta of the substantia nigra [6]. Among the primary forms, Parkinson's disease (PD) stands out as the most common parkinsonian syndrome. Bradykinesia, or slowness of movement, is the most characteristic motor symptom [1] and is the main reason for functional changes in patients [27]. Tremor initially appears unilateral and progresses to bilateral, worsening in stressful circumstances or cognitive tasks, and may be attenuated during sleep or movement [10]. Stiffness, a hypertonic muscle characteristic, causes constant or oscillating resistance to passive joint movement and can be increased by tasks that require attention [13]. This sum of physical factors, also linked to conditions of cognitive decline resulting from a basically neurodegenerative disease, is capable of negatively interfering with the biopsychosocial components of its sufferers [29].

Studies that address PD epidemiological data such as prevalence, for example, are scarce in the world due to underreporting [30]. However, it is known that sociodemographic evolution leads to the emergence of diseases related to aging/neurodegeneration, in which PD is considered the second pathology with the highest incidence, affecting one in every 100 people over 60 years of age [17]. PD treatment can be subdivided into medication for motor and non-motor symptoms, prescription of neuroprotectors and surgeries, in addition to therapies such as physiotherapy, speech therapy, occupational therapy and other complementary and integrative therapies [11, 23].

In this sense, disorders related to balance, gait and posture are common in PD and have a significant influence on the functionality of individuals. Therefore, a thorough assessment that seeks to understand functional capabilities is essential to initiate appropriate treatment strategies, aiming to reduce limitations and, consequently, improve the quality of life of this population [28]. The word "disabilities" is used by the World Health Organization (WHO) to describe changes in the body that affect the individual's activities and social participation [34]. In other words, it refers to those people who face limitations due to disabilities and/or chronic illnesses, such as PD. This definition considers the fact that people with the same clinical condition may have different levels of functionality, just as individuals with the same level of functionality do not necessarily have the same health condition [34]. Furthermore, according to the WHO [35], globally disability and death due to PD are increasing faster than for any other neurological disorder, with an increase greater than 100% in these outcomes, from 2000

to 2019.

Transcranial Direct Current Stimulation (tDCS) consists of applying direct current to the scalp using electrodes wrapped in perforated sponge bags soaked in saline solution or rubber electrodes with conductive gel [9]. This technique modulates neural activity through electrical currents that, when applied as a direct current component, polarize neural tissue, inducing significant changes in the resting membrane potential threshold and subsequent modifications in synaptic plasticity [8]. Depending on the size and polarity of the conducting electrodes, current intensity, density and duration of stimulation, it is capable of inducing changes in cortical excitability [24].

For example, according to Polanía, Paulus and Nitsche [26], the application of anodal tDCS promotes depolarization, while cathodal tDCS promotes cellular hyperpolarization. The technique has also been attributed to lasting changes in the excitability of the motor cortex in humans and tDCS has been successfully studied in depression [4, 5], chronic pain [14], accident cerebrovascular disease [31], Alzheimer's disease [15], in addition to findings in PD [33] and other neurological and neuropsychiatric conditions such as schizophrenia, obsessive compulsive disorder and chemical dependency [16]. Furthermore, studies show that positioning the electrode over different areas of the cortex is essential to determine the direction and spatial distribution of the current flow and, ultimately, the effectiveness of the treatment according to the pathophysiological mechanism of the disease treated [9, 32].

In 2006, Fregni et al [12] observed that the motor evoked potential, both anodal tDCS and cathodal tDCS in the left dorsolateral prefrontal cortex, caused an immediate change in the excitability of the motor cortex after the stimulus; however, the UPDRS (Unified Parkinson's Disease Rating Scale) results showed that only anodal tDCS promoted significant improvement in the comprehensive motor function of PD patients. Subsequently, experimental studies sought to understand the mechanisms involved in the use of the technique in PD and found that tDCS induced the release of dopamine in the caudate nucleus [19, 21]. Furthermore, it was found that tDCS also modulates the functional connectivity of thalamocortical circuits, having positive effects on neuroplasticity, motor control and learning [25, 26]. According to Oliveira et al (2022), studies indicate that the use of tDCS early, in relation to diagnosis, reduces cadence, upper limb bradykinesia, freezing of gait and improvement of levodopa-induced dyskinesia.

The dorsolateral prefrontal cortex (DLPFC) has been an area of interest in the application of tDCS in individuals whose therapeutic objective involves cognitive aspects [16]. However, it is also proposed to use it in motor conditions, as cognitive functions are necessary to perform motor tasks and are partially modulated by the DLPFC [23]. In a systematic review that evaluated the use of tDCS on cognitive changes in people with Alzheimer's and PD, it was seen that in patients with PD, executive efficiency was improved thanks to the stimulation of DLPFC through variable treatment sessions (i.e., 1 to 10 sessions) with an intensity of 1 to 2 mA for 20 minutes [6, 22]. Merzagora et al [22] compare the acute effects of tDCS on DLPFC using anode and cathode current for 10 minutes; the authors observed the ability to cause a significant increase in oxyhemoglobin concentrations in this area when stimulated with anodic current, whereas no changes were seen when stimulated with cathodic current. Chang et al [7] also targeted the left DLPFC, using anotic current and observed positive results on participants' freezing of gait events.

When evaluating the acute effects of tDCS on healthy individuals, Lima [20], found that mounting the tDCS in the DLPFC position did not induce deleterious neurovegetative changes, demonstrating that it is a safe application method. Therefore, we found a favorable scientific scenario with very satisfactory results with the use of tDCS in the treatment of people with PD. Furthermore, it must be said that it is a painless treatment, with minimal side effects (itching at the site of application which ends when the therapy ends), non-invasive and cheap, which makes the technique democratic and accessible to a large number of people. part of the population.

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