FACILITATION OF LEFT DORSOLATERAL PREFRONTAL ACTIVITY BY tDCS AND NEUROFUNCTIONAL TRAINING IN CHILDREN WITH AUTISM SPECTRUM DISORDER: A RANDOMIZED, PLACEBO-CONTROLLED, DOUBLE-BLIND CLINICAL TRIAL

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ABSTRACT

The aim of the study is to compare the effects of ten sessions of neurofunctional training associated with active anodal transcranial direct current stimulation (tDCS) over the left dorsolateral prefrontal cortex versus sham on the Activity and Participation domain of the ICF in children with ASD.This is a randomized, placebo-controlled, double-blind clinical trial involving 24 children diagnosed with ASD, aged between three and eight years. The children will be randomly assigned to two groups: Experimental group - neurofunctional training associated with anodal tDCS on the left dorsolateral prefrontal cortex and Control group - neurofunctional training associated with placebo tDCS. Participants will be assessed one week before, and one week and one month after the end of the intervention, using the Childhood Autism Rating Scale, Functional Strength Assessment, the 10-m Walk Test, the Timed Up and Go, the Pediatric Balance Scale, and the Participation and Environment Measure – Children and Youth (PEM-CY). The interventions will consist of five sessions per week, carried out over two consecutive weeks. Neurofunctional training and tDCS application will be performed synchronously for 20 minutes of each session. Neurofunctional training will consist of an activities circuit (10 minutes) and treadmill gait training (10 minutes). tDCS will be applied to the left dorsolateral prefrontal cortex at an intensity of 1mA. The results will be analyzed statistically assuming a significance level of $p \leq 0.05$.

Keywords: autism spectrum disorder, gait, balance, child, physical therapy, transcranial direct current stimulation.

Introduction

Autism spectrum disorder (ASD) is characterized as a condition that develops into a symptom complex, in which various developmental markers occur in a peculiar manner. It is considered a highly complex condition with a multifactorial etiology. In general, the disorder is characterized by cognitive-behavioral and

communication impairments, in which social interaction dysfunctions occur in multiple contexts, with restricted and repetitive patterns of behavior and interests (APA, 2014).

Motor difficulties are among the earliest correlated difficulties to emerge. Studies show delays in the acquisition of motor milestones and fundamental motor skills, as well as deficits in postural stability and motor coordination, movement speed, and balance (BIFFI et al., 2018).

Neurofunctional physical therapy plays an important role in sensory and motor rehabilitation. This involves activities and neurofunctional circuits, as well as activities that explore motor coordination, learning, and the acquisition of motor skills. One of its most promising effects is the possibility of promoting adaptive neural plastic processes through specialized motor training tailored to the individual needs of each child. It is known that children with this neurodevelopmental disorder present learning-related changes in the acquisition, retention, and transfer of motor skills (COLIZZI; LASALVIA; RUGGERI, 2020), aspects directly related to the neurological control of movement.

Greater knowledge of the neurological dysfunctions involved in ASD has led to growing scientific interest in the effects of transcranial direct current stimulation (tDCS). Neuromodulation provided by the application of anodal tDCS to the left dorsolateral prefrontal cortex is resulting in a reduction in cognitive-behavioral symptoms and an improvement in the overall abilities of children and adolescents with ASD (LUCKHARDT et al., 2021). However, there is a gap in the literature regarding the effects of anodal tDCS over the left dorsolateral prefrontal cortex, when associated with neurofunctional training, on motor activities and participation in children with ASD.

Considering the prospect of optimizing the effect size of neurofunctional training, the complexity and intensity of the negative impact of ASD on motor activities and child independence, a better understanding of the effects of tDCS in this population is necessary. As it is considered a safe, inexpensive, and easy-to-apply resource, tDCS may contribute positively to the rehabilitation of children with ASD if it is scientifically demonstrated that its neurophysiological effects are capable of promoting the improvement of learning new voluntary motor strategies and postural control.

Thus, the objective of the project is to compare the effects of ten sessions of neurofunctional training associated with active anodal tDCS over the left dorsolateral prefrontal cortex versus sham on the ICF domains of Activity (functional mobility and functional balance) and Participation in children with ASD.

Methodology

This is a randomized, placebo-controlled, double-blind clinical trial involving 24 children diagnosed with ASD, aged between three and eight years. Participants will be randomly assigned to two groups: Experimental group - neurofunctional training associated with anodal tDCS on the left dorsolateral prefrontal cortex and Control group - neurofunctional training associated with placebo tDCS.

Participants will be assessed one week before the intervention, one week and one month after the end of the interventions. Each assessment will consist of the following instruments: the Childhood Autism Rating Scale (CARS-BR) (PEREIRA; RIESGO; WAGNER, 2008), the Timed Up and Go (MARTÍN-DÍAZ et al., 2023), the 10-m Walk Test (SIVARAJAH et al., 2018), the Pediatric Balance Scale (FRANJOINE; GUNTHER; TAYLOR, 2003), and the Measure of the Participation and Environment – Children and Youth (GALVÃO et al., 2018).

The interventions will take place five times a week for two consecutive weeks, totaling ten sessions lasting 30

minutes. Neurofunctional training and tDCS application will be performed synchronously for 20 minutes of each session. Neurofunctional training will consist of an activities circuit (10 minutes) and treadmill gait training (10 minutes). tDCS will be applied over the left dorsolateral prefrontal cortex, following the location proposed by the 10–20 EEG (electroencephalogram) system. Active tDCS (transcranial stimulation) will be applied at an intensity of 1mA.

Expected Results

Considering the potential effect of anodal tDCS on the left dorsolateral prefrontal cortex, it is expected that the intervention will increase the effect size of motor neurofunctional training in children with ASD, improving their performance in motor activities and participation. The therapeutic approach studied may represent a paradigm shift in the neurofunctional rehabilitation of children with ASD through an effective, low-cost, and short-term intervention.

Conclusion

The research project schedule involves the start of recruitment and assessment procedures in October 2024. The results obtained will be analyzed and presented in scientific articles.

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