



CASE REPORT

Transcranial direct current stimulation combined with integrative speech therapy in a child with cerebral palsy: A case report



Vania L.C. Carvalho Lima, MSc ^{a,b,*},
Luanda A. Collange Grecco, MSc ^{b,c,d},
Valéria C. Marques, MSc student ^{a,d},
Felipe Fregni, PhD MSc MD ^b, Clara R. Brandão de Ávila, PhD ^a

^a Department of Hearing, Speech and Language Pathology, Federal University of São Paulo, São Paulo, Brazil

^b Spaulding Neuromodulation Center, Department of Physical Medicine & Rehabilitation, Spaulding Rehabilitation Hospital, Harvard Medical School, Boston, MA, United States

^c Rehabilitation Sciences, Universidade Nove de Julho, São Paulo, SP, Brazil

^d Center of Pediatric Neurosurgery – Rehabilitation (CENEPE), São Paulo, SP, Brazil

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KEYWORDS

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Summary The aim of this study was to describe the results of the first case combining integrative speech therapy with anodal transcranial direct current stimulation (tDCS) over Broca's area in a child with cerebral palsy. The ABFW phonology test was used to analyze speech based on the Percentage of Correct Consonants (PCC) and Percentage of Correct Consonants – Revised (PCC-R). After treatment, increases were found in both PCC (Imitation: 53.63%–78.10%; Nomination: 53.19%–70.21%) and PPC-R (Imitation: 64.54%–83.63%; Nomination: 61.70%–77.65%). Moreover, reductions occurred in distortions, substitutions and improvement was found in oral performance, especially tongue mobility (AMIOFE-mobility before = 4 after = 7). The child demonstrated a clinically important improvement in speech fluency as shown in results of imitation number of correct consonants and phonemes acquire. Based on these promising findings, continuing research in this field should be conducted with controlled clinical trials.

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* Corresponding author. Rua Dr. Veiga Filho, 350 cj 804, CEP: 01229-000, São Paulo, SP, Brazil. Fax: +55 11 3586 4659.
E-mail address: fono.vania@gmail.com (V.L.C. Carvalho Lima).

Introduction

In patients with cerebral palsy (CP), the rehabilitation team uses methods to accomplish specific tasks aiming at improving the reorganization of the cerebral cortex and enabling or rehabilitating oral motor and communication functions. Ward et al. demonstrated the positive effects, as acquiring phonemes, of motor speech therapy in children with CP. The motor speech therapy is focused in the motor ability of lips, tongue, cheeks and palate necessary to speech. There is evidence that the use of a motor treatment approach aligned with dynamic systems theory improves motor speech movement patterns and the accuracy of speech production in such children, with a consequent improvement in overall communication (Ward et al., 2014). This dynamic systems theory approach relates the learning of motor skills necessary for the development of speech with the changes of natural growth. Therefore, the therapeutic performance enhancing natural development patterns support better outcomes.

Adequate language and cognitive processes are necessary for an effective learning, linguistics and symbolic speech (Van der Merwe, 1997). In communication disorders, inaccuracies and inconsistencies in speech production can lead to changes in the organization of sounds and, in turn, play a role in maintaining the disorder (Ávila, 2010). Thus, phonetic and phonological aspects are important to acquiring fluent speech.

Non-invasive brain stimulation has been recently been explored in the rehabilitation process as transcranial direct current stimulation (tDCS). The tDCS facilitates cortical activity acting as an enhancer of therapy. The first studies on the combination of anodal tDCS over the motor cortex and motor training in children with CP have demonstrated promissory effects on gait and gross motor function, with no adverse effects (Duarte et al., 2014; Grecco et al., 2014). Another study showed that anodal transcranial direct current stimulation (tDCS) over Broca's area in adult patients with brain lesions facilitates cortex excitability and could help improve speech (Monti et al., 2013).

However, no previous studies have addressed the effects of the anodal tDCS over Broca's area during integrative speech therapy in this population. This paper describes the first case of a child with cerebral palsy and speech articulatory disorders treated using a combination of both neuromodulating techniques.

Methods

Case description

The present case involved a female child aged five years and five months. The child was delivered by cesarean section at a gestational age of 37 weeks with a body mass, stature and head circumference within the standards of normality and Apgar scores of 9 (1st minute) and 10 (9th minute). During the first year, the patient contracted a systemic viral infection resulting in secondary brain lesions and delayed neuropsychomotor development. The patient began rehabilitation after discharge from hospital,

which involved two weekly sessions of physical therapy, occupational therapy and three speech therapy until nowadays.

The child had been diagnosed with tetraparetic spastic cerebral palsy and was classified on level IV of the Gross Motor Function Classification System (Palisano et al., 1997). The patient had regular trunk control, but difficulty maintaining a sitting position independently with good trunk alignment. She could walk short distances with a triangular walker using forearm support and always under supervision, with obvious limitations regarding the execution of manual tasks and activities of daily living.

The patient exhibited oral communication disorders and had been classified on level II of the Viking Speech Scale (Pennington et al., 2013) as well as level III on the Communication Function Classification System (Hidecker et al., 2011). Speech articulation was imprecise, with perceptible deterioration during longer sentences. Although individuals close to her could understand her speech, it was difficult for others to grasp her discourse out of context. Communication was not consistently effective with more unfamiliar individuals, but was generally effective with familiar individuals. Speech problems constituted an important limitation for the child and was the main complaint of her parents and educators.

Based on the ABWF Child Language Test (de Andrade et al., 2004), the child showed no changes in aspects of cognitive language expected for her age. Among 118 vocabulary terms, the patient responded with the Usual Vocabulary Designation for 111 expressions and used the Substitution Process for seven expressions.

To assess the occurrence of side effects, the child underwent magnetic resonance imaging (MRI) and electroencephalography (EEG) before and after interventions.

This study was approved by the Human Research Ethics Committee under protocol number 25914514.6.0000.5505/2014. The guardians agreed to the child's participation in the study and use of the images presented herein by signing a statement of informed consent.

Outcome assessment

The child was evaluated one week before and one week after the end of the intervention protocol. Assessments were performed by a speech therapist. The evaluations involved the following instruments: 1) Percentage of Correct Consonants (PCC) (Shriberg et al., 1997): an index used to quantify the changes in speech by determining the number of correct consonants; this index takes into account exchanges, omissions, substitutions and distortions; 2) Percentage of Correct Consonant – Revised (PCC-R) (Shriberg et al., 1997): similar to the PCC index, but does not consider distortion to be an error; and 3) Myofunctional Assessment Protocol with Scores (AMIOFE) (Felicio and Ferreira, 2008): used to evaluate speech organs and oral functions.

Intervention

The intervention protocol consisted of 40-min sessions five days a week over two weeks (total: ten sessions). The first

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