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Commentary Open Access

Facilitating Effects of Transcranial Direct Current Stimulation on Motor Imagery Brain-Computer Interface with Robotic Feedback for Stroke Rehabilitation

Patricia Zambone da Silva*, **Rafael Silva Vargas**, **and Maurício Friedrich**

Physiatrist, Mae de Deus Hospital, Brazil

***Corresponding author:** Patricia Zambone da Silva, Physiatrist, Mae de Deus Hospital, Brazil, Tel: 555191625416; E-mail: patzambone@uol.com.br

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Commentary

As stroke is a leading cause of serious disabilities in the world, new rehabilitation techniques are necessary to minimize the negative effect of this disease. Based on that, the cited article investigates the efficacy and effects of transcranial direct current stimulation (tDCS) on motor imagery brain-computer with robotic feedback for stroke rehabilitation [1]. The exact mechanism by which tDCS modulates brain excitability to induce plasticity and promote subsequent behavioral gains is not totally clear. It has been demonstrated that facilitation of cortical excitability can be achieved with anodal stimulation and inhibition with cathodal stimulation. Both inhibition of excitability in the contralesional hemisphere and facilitation of excitability in the ipsilesional hemisphere have been shown to improve motor performance in stroke [2].

The article describes a scenario where the individual does not actively perform any movement, but imagine it. So it is captured by the cortical activity through an electroencephalogram. The robotic apparatus then executes the affected arm movement that it is coupled, giving a positive feedback thinking movement.

The contribution brought by Ang et al. [1] is the evaluation of the efficacy of tDCS on MI-BCI in post stroke motor recovery, however the sample size is too small, nineteen subjects were selected from a hospital stroke rehabilitation program. The intervention group received ten sessions of 20 minutes of tDCS or sham before 1 hour of motor imagery brain computer interface (MI-BCI) with robotic feedback upper limb stroke rehabilitation for 2 weeks. This short period of intervention can be insufficient to observe significant motor improvements. Another fact that can negatively interfere is the population heterogeneity. Involved subjects aged 21 to 70 years, so other conditions related to age can promote interference in the results, besides neurological responses may differ in individuals just by the age difference. Although some studies have been published on tDCS and post stroke motor recovery involving small sample sizes, the data has not been consistent regarding the efficacy of tDCS in motor recovery [3]. In the present study, this is also true, because there is no significant Fugl-Meyer Motor Assessment score gains at week 2 compared to baseline at week 0. In addition to the fact that there is no significant intergroup (tDCS x sham) differences at any time point during the study.

New technological hardware, like tDCS MI-BCI, can contribute to rehabilitation, however, subjects are repeating an action throughout the process and this movement provides no motor learning. A variety of neurorehabilitation techniques aimed at improving motor recovery after stroke has been developed and trialed over the past 3 decades. However despite a numerous randomized controlled trials in stroke rehabilitation there is very little translation of this evidence into clinical practice and real gains to patients.

References

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