

# A Brief Note on the Use and Safety of Trans Cranial Direct Current Stimulation on Human Brain

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## Introduction

Trans Cranial Direct Current Stimulation (tDCS or TDCS) is a fairly old non-invasive brain stimulation method (Priori A, 2003), which remerged recently with the appearance of functional brain mapping techniques, such as functional Magnetic Resonance Imaging (fMRI) those supported to prove its efficacy. It is a seemingly simple method that causes cerebral cortical excitability modulation by application of weak direct electrical current via electrodes applied to the surface of the scalp (Nitsche MA and Paulus W, 2001). Some reports show that, tDCS induces cerebral cortical neuronal plasticity (Purpura DP and McMurtry JG, 1965; Agnew WF et al., 1983) and the effect of tDCS is highly dependant on the duration, intensity and polarity of the cortical stimulation (Nitsche MA, Paulus W, 2000; Nitsche MA et al., 2003).

## Use of DCS

Efficacy of tDCS in treating variety of neuropsychiatric conditions such as depression, bipolar disorder (Kobayashi M and Pascual-Leone A, 2003; Ferrucci R, et al 2009; Nitsche MA et al., 2009; Schutter DJ, 2010; Brunoni AR, et al 2011), epilepsy (Fregni F et al., 2006) and use in stroke rehabilitation has been evaluated in many parts of the world (Boggio PS et al., 2006; Brunoni AR et al., 2012) and showing very promising results. Not only in clinical conditions, there is a substantial amount of evidence that tDCS enhances brain functions also (Boggio PS, et al 2007; Ferrucci R et al., 2008; Boggio PS, et al 2010).

## Safety Concerns in DCS Applications

It is a common perception that the electrical current applied on brain could case neuron damage. However, with a carefully selected protocols and standards for safe tDCS stimulation and is relatively safe and the safety should be weighed against its proven benefits in proper clinical trials as in case of any other novel treatment method. Some criteria in relation to the limits of stimulation in brain stimulation experiments using direct current have been introduced fairly early to address the safety issues (Yuen TGH et al., 1981; Agnew WF and McCreery DB, 1987; McCreery DB et al., 1990). Some practising researchers have evaluated the limits given in safety criteria recently and suggested to improve/revise (Nitsche MA et al., 2003).

## Clinical Research in tDCS

Some unique characteristics of tDCS have been revealed in a comprehensive review on tDCS aiming to explore the mechanisms of action, study phase related methodologies, ethical and regulatory issues and future directions (Brunoni AR et al., 2012). Ability of tDCS to induce antagonistic effects in cortical excitability according to the parameters of stimulation has been well established in various preclinical studies on animal and human brain studies as reported in Brunoni AR and others (2012). Next important finding in their review is to ability of concomitant use of tDCS with neuropsychological and psychophysiology tests to validate the effects.

The non-invasiveness of this technique gives an additional advantage especially in acceptability. Absence of pharmacokinetics interactions makes it less cumbersome in neuropsychopharmacology studies. It is evident in preclinical research that tDCS can be a substitutive or an augmentative treatment strategy in the field of neuropsychiatry. More importantly, low-cost and portability of tDCS defines its applicability in the context of a developing country like Sri Lanka.

However, proper clinical design, immense attention to the neuroethics, regulatory and legal issues might be the two key issues (Freedman B, 1987) to be addressed properly when conducting a clinical trials using this promising but novel treatment approach.



## Concluding Remark

Centre for Behaviour Neurosciences and Computation (CBNC) of General Sir John Kotelawala Defence University (KDU) has taken up the challenge of introducing this novel technique to Sri Lanka (and to the south Asia in this case) by initiation scientific explorations in to tDCS with an enormous support granted from the renounced brain stimulation centres and scientists, collaborating from Europe and Australia.

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