August 2013, Volume 4, Number 3

Letter to Editor:
Cheap Technology Like Transcrinal Direct Current Stimulation (tDCS) Could Help in Stroke Rehabilitation in South Asia

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Dear Editor, Stroke is caused by a disturbance in the supply of blood to the brain due to vascular pathology, thereby exhibiting a loss of brain function related its vascular territory. Stroke can be either ischemic or hemorrhagic. It is generally recognized that starting an individualized rehabilitation program as soon as possible after a stroke event, increases the chances of a patient recovering lost function sooner and to a greater extent.

Transcrinal direct stimulation (tDCS) is one type of Non Invasive Brain Stimulation (NIBS), which is a technology that holds promise for the future studies on diagnosis and therapeutic applications in different brain diseases. Major advances in this emerging field have been made relatively quickly, from new stimulation protocols for research to their application for the treatment of neurological and psychiatric diseases. But there is a serious question among developing countries with limited financial and human resources, about the potential returns of an investment in this field and regarding the best time to transfer this technology from controlled experimental settings to health systems in the public and private sectors.

With any new medical tool, the scientific community should ask what it offers that established methods do not in terms of diagnostic, prognostic, and therapeutic aspects of clinical practice. A new tool might have several benefits including: earlier establishment of a definitive diagnosis for a given clinical presentation, better prediction of the disease course, further support for sustained and intensive interventions, identification of the most suitable treatment strategy, and improvement of clinical outcome as a therapy itself. Current work indicates that NIBS may show promise in all of these areas.

Stroke is the third most common cause of death and the first leading cause of disability in developed and developing countries (American Heart Association, 2005). According to World Health Organization estimates, 5.5 million people died of stroke in 2002, and approximately 20% of these deaths occurred in South Asia (SA) (Feigin, 2005). Contrary to decline in the incidence of the disease in the Western population, the burden of the disease in SA countries (India, Pakistan, Bangladesh, and Sri Lanka) has inclined and is expected to rise (World Health Organization, 2007). Considering a high population, absolute number of stroke in SA would be in millions. Its consequences are myriad ranging form physical disability to death, to psychologic, social and economic consequences. These consequences do not only affect the individual or his/her family but also society as a whole.

There is not any published study showing that patients affected with stroke related disorder in SA receive any therapeutic treatment related brain stimulation. The main reason for this disparity is the lack of resources in such countries. We therefore propose a simple technique of brain stimulation that seemed long forgotten, but has received renewed attention, named transcranial Direct Current Stimulation (tDCS). This treatment is inexpensive, easy to administer, non-invasive and painless (Fregni & Pascual-Leone , 2007).

Advantages over tDCS by affecting a wider region of brain involving not only primary motor cortex but also premotor, supplementary motor, and somatosensory cortices, all of which have been shown to have a role in the recovery process in various studies (Nitsche et al., 2003). Stroke alters the balance between excitation and inhibition between the hemispheres, which suggests that

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down-regulation of the unaffected primary motor cortex (M1), may facilitate motor recovery following stroke (Fregni & Pascual-Leone , 2007).

tDCS is a NIBS technique in which two spongy electrodes, an anode and a cathode, are placed on the scalp after being soaked in saline solution. A current generator is connected to the two electrodes and delivers a low intensity electrical current thereby polarize membrane potential of neurons in stimulated area. Current that flows from the cathode to the anode have an inhibitory effect on the stimulated area while current that flows from the anode to the cathode is typically excitatory. The excitatory and inhibitory potentials tDCS can regulate are of great important in clinical applications (Fregni & Pascual-Leone , 2007, Nitsche et al., 2003 & 2008).

Two modes of tDCS have been used in human stroke rehabilitation studies, namely, anodal stimulation (increase in excitability) of the lesional hemisphere and cathodal stimulation (decrease in excitability) of the contralesional hemisphere. Proof-of- principle studies have been performed for both of these approaches using tDCS (Nitsche et al., 2008).

Thus, we have come to believe that tDCS might be a reasonable alternative therapeutic treatment for stroke in SA. The device to deliver tDCS is simple, can cost less than US$100 00 and can be manufactured locally. The equipment is fully reusable and utilizes one standard battery that can last several weeks. Furthermore, this treatment is easy to administer, and can be applied by technicians following appropriate instruction and training. Although further studies evaluating this method are warranted, tDCS might help to improve mental health in areas with poor resources (Nitsche et al., 2007).

Though tDCS are noninvasive by nature, tDCS technique is associated with potential risks that require certain precautions. If, however, the experienced investigator follows the appropriate guidelines and recommendations can be applied safely with minimal adverse effects ((Nitsche et al., 2003, 2008)).

The major limitation of tDCS is probably that it is not focal enough to map cortical functions precisely. Successful blinding of subjects and investigators is possible to conduct double blind and sham-controlled trials (Nitsche et al., 2007 and 2008).

Given the extensive health technologies available, it is often difficult for developing countries to decide which emerging technologies are best suited for their own needs with their current resources. In the long run, maintaining the life-style of neurologically impaired individuals can be extremely costly and time-consuming.

tDCS in clinical practice is promising as it gives another opportunity to modulate synaptic strength and brain function through top-down controlled manner, meaning that this intervention could be applied according to its patho-mechanisms and lesion locations of various clinical disorders. Moreover, by combining with bottom-up input like exercise or training, it could be used as additive therapeutic approach. Future Hopes for tDCS in clinical field would be developing more potent and disease-specific stimulation paradigm as well as training protocol for long-term therapeutic effect.

After a decade of speculation and experimentation, NIBS has not yet yielded any treatments that effectively alleviate any disorder. Despite this fact, interest remains high, perhaps due to the intuitive appeal of non-invasive stimulation and modulation of plastic neural circuits. Thus, intermittent treatments directed at the cortex may not be strong enough to provide meaningful change.

Conclusion

tDCS is useful technique to modulate and induce plastic changes in the brain thereby use it therapeutically in various disorders including stroke, which is worth to start to develop in South Asia in many aspect.

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