



**Service Priorities and Programmes**  
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**Submitting author:** Mr KA HEI WONG

**Post title:** Physiotherapist I, Tuen Mun Hospital, NTWC

**Transcranial Direct Current Stimulation: A Novel Technology for Upper Limb Rehabilitation in Stroke Patients – A controlled review**

*Wong KH(1), Ho LOL(1), Wong BLC(1), Lai BPW(1), Poon PYH(1), Chow ESL(2), Chu ACK(2), Mak MKY(3)*

*(1)Physiotherapy Department, (2)Division of Rehabilitation, Department of Medicine and Geriatrics, Tuen Mun Hospital, New Territories West Cluster, (3)Department of Rehabilitation Sciences, The Hong Kong Polytechnic University*

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**Introduction**

A pilot upper limb rehabilitation program utilizing Transcranial Direct Current Stimulation (tDCS) for stroke patients was developed in Tuen Mun Hospital (TMH) in 2012. The program evaluation showed that combined tDCS and physiotherapy treatment have positive effect on enhancing upper limb functional recovery in stroke patients. In the light of the positive results of our previous program, the present program included a control group to further review the effects of tDCS on enhancing upper limb functions of stroke patients.

**Objectives**

To further evaluate the effect of tDCS on enhancing upper limb functional recovery in stroke patients

**Methodology**

Patients diagnosed with Cerebrovascular Accident (CVA) were recruited from Rehabilitation Stroke Unit of TMH. Patients diagnosed with transient ischemic attack or having contraindications to tDCS were excluded. Patients were either assigned to intervention or control group. For the intervention group, anodal (excitatory) stimulation by tDCS was conducted to hand area of primary motor cortex (M1) of the affected hemisphere through the electrode placed over C3/C4, while the cathodal electrode was placed over the contralateral supraorbital area. Patient received 1mA tDCS for 20 minutes. 5 consecutive sessions of tDCS together with intensive physiotherapy upper limb training were given. For the control group, 5 consecutive sessions of limb maintenance exercises were given. The outcome measure was Wolf Motor Function Test (WMFT). This test includes a battery of proximal and distal motor activity tasks, and is widely used as an upper limb motor function evaluation in

neurological patients. Assessments were done before the first session of treatment and after the last session of treatment. Wilcoxon Signed Ranks Test and Mann-Whitney U Test were used for statistical testing.

### **Result**

20 stroke patients (13 female and 7 male) were assigned to intervention (n=10) and control (n=10) group. The mean age was  $66.1 \pm 12.2$  years old and the mean time between stroke onset and tDCS application was  $16.1 \pm 9.5$  days. For the intervention group, the mean score of WMFT increased from  $2.26 \pm 1.21$  to  $2.79 \pm 1.18$  ( $Z = -2.81$ ,  $p = 0.005$ ), the mean time for task completion of WMFT decreased from  $46.0 \pm 41.7$  seconds to  $35.0 \pm 33.7$  seconds ( $Z = -2.60$ ,  $p = 0.009$ ). No adverse effects of tDCS were reported. For the control group, the mean score of WMFT increased from  $1.94 \pm 2.31$  to  $2.04 \pm 2.26$  ( $Z = -1.84$ ,  $p = 0.066$ ), the mean time for task completion of WMFT decreased from  $73.3 \pm 56.3$  seconds to  $73.1 \pm 56.3$  seconds ( $Z = -1.75$ ,  $p = 0.08$ ). For between-group comparison, the changes in mean score and mean time of WMFT in intervention group were significantly larger than that in control group ( $U = 7.5$ ,  $P = 0.000$ ) ( $U = 89$ ,  $P = 0.002$ ). Findings of the present review showed that combined tDCS and physiotherapy treatment enhanced upper limb motor functional recovery in stroke patients. Since tDCS is safe, non-expensive and easily applicable, further utilization is supported in order to enhance upper limb rehabilitation in stroke patients with this advanced technology. Further study can include a sham group to examine the placebo effect of tDCS in future.