Statement on Transcranial Direct Current Stimulation (tDCS) in Depression

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TRANSCRANIAL DIRECT CURRENT STIMULATION (TDCS) IN DEPRESSION

BACKGROUND

Transcranial direct current stimulation (tDCS) is a novel neuro-modulatory treatment modality for depression and represents a potential alternative to existing pharmacological / psychological treatment options. Recent years have seen the development of a body of literature including randomised controlled trials (RCTs), systematic reviews, and meta-analyses, addressing the utility of tDCS in depression.

The National Institute for Health and Care Excellence (NICE) made the following recommendations in its interventional procedure guidance on tDCS for depression[1]:

1. The evidence on tDCS for depression raises no major safety concerns. There is evidence of efficacy but there are uncertainties about the specific mode of administration, the number of treatments needed and the duration of effect. Therefore, this procedure should only be used with special arrangements for clinical governance, consent and audit or research.
2. Clinicians wishing to do tDCS for depression should inform the clinical governance leads in their NHS Trusts, and ensure that patients understand the uncertainty about the procedure's efficacy and provide them with clear written information - the use of NICE's information for the public http://www.nice.org.uk/guidance/IPG530/InformationForPublic is recommended.
3. Audit and review clinical outcomes of all patients having tDCS for depression (NICE have developed an audit tool http://www.nice.org.uk/Guidance/IPG530/Resources)

tDCS is a non-invasive brain stimulation modality, which changes cortical tissue 'excitability' as a result of applying a weak (0.5-2mA) direct current via scalp electrodes overlying targeted cortical areas. In contrast to other neurostimulation modalities, tDCS does not directly trigger action potentials in

neuronal cells, but instead changes overall tissue excitability, and therefore may be more aptly regarded as a 'neuro-modulatory' rather than a neuro-stimulatory approach. Cortical tissue underlying the anode (positive electrode) becomes hypo-polarized, and therefore hyper-excitable; areas underlying the cathode (negative electrode) become less excitable while the average resting potential becomes more polarized. These effects continue after electrical stimulation ceases, and a single application can be associated with tissue excitability changes lasting more than 60 minutes[2, 3]. This suggests that tDCS may be associated not only with transient membrane polarization changes, but also with longer-lasting synaptic changes [4]. There are important differences between tDCS and repetitive transcranial magnetic stimulation (rTMS) in terms of adverse effect profiles, focality of stimulation, and also in the cost, availability and portability of equipment [2,3]

The most recent meta-analysis of tDCS for the treatment of Major Depressive Episodes (MDE) [5]identified 10 RCTs (n=393) of tDCS, either as monotherapy or as adjunctive treatment alongside antidepressant medication and/or Cognitive Control Training (CCT). The outcome measures were Hedges' g for continuous depression ratings, and categorical response and remission rates.

tDCS was superior to sham tDCS (k = 11, N= 393, g = 0.30, 95% CI = [0.04, 0.57], p = 0.027). Adjunctive antidepressant medication and cognitive control training negatively impacted on the treatment effect. The pooled log odds ratios (LOR) for response and remission were positive, but statistically non-significant (response: k=9, LOR = 0.36, 95% CI [−0.16, 0.88], p = 0.176, remission: k=9, LOR = 0.25, 95% CI [−0.42, 0.91], p = 0.468). The dropout rates due to adverse effects in the active Vs. Sham tDCS did not show statistically significant differences. These findings are in line with findings from previous meta-analyses [6-7]

Based on current evidence, the following conclusions may be drawn[5]: First, tDCS may represent an effective treatment option for patients presenting with major depressive episodes. Second, tDCS offers a generally acceptable tolerability profile, which may make it a useful alternative to antidepressant medication in

patients who do not wish to take medication and for those who cannot tolerate antidepressant medication. Third, the current body of evidence does not support the use of tDCS in treatment resistant depression. Fourth, the current body of evidence does not support the use of tDCS as an add-on augmentation treatment for depressed patient who are already taking an antidepressant or undergoing cognitive control training. Further research is needed, in particular, involving larger sample sizes over longer periods of treatment.

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