Non-invasive brain stimulation for the treatment of depression: Systematic review and meta-analysis of randomised, sham-controlled trials

Julian Mutz1, Daniel R. Edgcumbe2, Cynthia H.Y. Fu2,3

1Department of Epidemiology and Biostatistics, School of Public Health, Faculty of Medicine, Imperial College London, United Kingdom; 2School of Psychology, University of East London, United Kingdom; 3Centre for Affective Disorders, Department of Psychological Medicine, Institute of Psychiatry, Psychology and Neuroscience, King’s College London, United Kingdom

Background

Non-invasive brain stimulation techniques, including repetitive transcranial magnetic stimulation (rTMS) and its modifications, deep TMS, synchronised TMS, and theta burst stimulation (TBS), as well as transcranial direct current stimulation (tDCS) have emerged as treatments to be considered for acute major depressive episodes.

However, recent reviews had included trials without randomisation to a sham stimulation treatment arm, in which there was co-initiation of another treatment, and in geriatric depression, rendering it difficult to assess the efficacy of the specific treatments in adult patients.

Objective

Perform a systematic review and meta-analysis of the efficacy and acceptability of non-invasive brain stimulation treatments in unipolar and bipolar depression.

Methods

Systematic literature search [Figure 1] of the Embase, MEDLINE, and PsychINFO databases for randomised, sham-controlled trials published between the first date available and 30th July 2017.

Inclusion criteria

• Adults aged 18 –70 years with a DSM-IV or ICD diagnosis of major depressive disorder or bipolar depression.
• Clinician-administered depression rating scale, either HRS or MADRS.
• Randomised, sham-controlled trial with parallel-group or cross-over design.

Exclusion criteria

• Patients with primary diagnoses other than major depressive disorder or bipolar depression.
• Patients with a specific subtype of depression; or patients with major depressive episode as secondary diagnosis.
• Co-initiation of any other form of treatment

Figure 1. PRISMA flow diagram of literature search.

Figure 2. Contour-enhanced funnel plot (response rates).

Statistical analyses

Random-effects model with odds ratios (Mantel-Haenszel method) as index of effect size for categorical response (±50% reduction in depression rating scale score from baseline to endpoint), remission (criteria provided by each study), and all-cause discontinuation rates.

Results

Fifty-seven studies (133 treatment arms) were eligible for inclusion. Overall, 67 treatment comparisons were included in the analyses, totaling N = 2909 patients of whom n = 1507 and n = 1402 were randomised to active and sham treatment, respectively. Examining all treatment modalities combined, funnel plots do not provide evidence for small-study effects [Figure 2], although there are limitations inherent to this approach.

Most treatment modalities are associated with increased response rates [Figure 3] and generally well tolerated by patients [Figure 4].

Conclusion

The present systematic review and meta-analysis supports the efficacy and acceptability of non-invasive brain stimulation techniques in adult unipolar and bipolar depression.

The strongest evidence was for high-frequency rTMS over the left DLPFC. TBS provides a potential advance in terms of reduced treatment duration and our meta-analysis did find support for improved rates of response associated with iTBS and bilateral TBS. tDCS is a potential first line treatment for depression which has demonstrated efficacy in terms of response as well as remission rates.

Large RCTs are needed to determine the clinical role of the more recent treatment modalities (e.g. dTMS, iTBS).

*Source: https://www.wired.com/2014/05/brain
**Source: https://www.sciencedirect.com/science/article/pii/S030105361000005X

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