# The effects of add-on non-invasive brain stimulation in fibromyalgia: a meta-analysis and meta-regression of randomized controlled trials.

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# **Abstract**

## **OBJECTIVES:**

The effects of non-invasive brain stimulation (NBS), including repetitive transcranial magnetic stimulation (rTMS) and transcranial direct current stimulation (TDCS), in treating FM remain inconclusive. The aim of this study was to investigate present evidence of using NBS as an add-on treatment in treating FM.

## **METHODS:**

We conducted a database search of the Medline, Embase, PsycINFO and Cochrane Library electronic databases, from inception to July 2015, to analyse randomized controlled trials of NBS in treating FM. A total of 16 studies were included in the current meta-analysis.

### **RESULTS:**

The pooled mean effect sizes of the 16 included studies revealed significant favourable effects of NBS. The weighted mean effect size in reducing pain, depression, fatigue, sleep disturbance and tender points and improving general health/function were 0.667 (95% CI 0.446, 0.889), 0.322 (95% CI 0.140, 0.504), 0.511 (95% CI 0.247, 0.774), 0.682 (95% CI 0.350, 1.014), 0.867 (95% CI 0.310, 1.425) and 0.473 (95% CI 0.285, 0.661), respectively. rTMS stimulation yielded a greater effect size compared with that of TDCS (effect size 0.698 and 0.568, respectively; P < 0.0001). The primary motor cortex (M1) stimulation yielded a subtle greater effect size in pain reduction compared with that of the dorsolateral prefrontal cortex (effect size 0.709 and 0.693, respectively; P < 0.0001). No linear relationships were found between the effect sizes and treatment regimens and dose. Most of reported adverse effects were minor.

### CONCLUSIONS:

Both rTMS and TDCS may be feasible and safe modalities for treating FM. The general effects of rTMS and TDCS are compatible in FM patients. M1 stimulation may be better in pain reduction and the dorsolateral prefrontal cortex may be better in depression improvement.

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