Repetitive transcranial magnetic stimulation and Tourette syndrome: new findings and future directions

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Tourette syndrome is a neurodevelopmental condition which affects approximately 0.6% to 1% of 5- to 18-year-olds.[1] The condition is characterized by the occurrence of tics, which are stereotyped movements and/or vocalizations. Having Tourette syndrome can have a substantial negative impact on an individual's quality of life; consequently, many people with the condition seek treatment to help manage their tics. Pharmacological and behavioural interventions can be effective. However, individual outcomes are highly varied and issues relating to access, availability, and side effects can be barriers to treatment. There has been increased interest in the therapeutic application of non-invasive brain stimulation approaches, including interventions using repetitive transcranial magnetic stimulation (rTMS).

rTMS has been shown to modulate neural plasticity for a period of time extending beyond stimulation.[2] These after-effects have been hypothesized to be reliant on synaptic events similar to those involved in long-term potentiation and depression, but the exact mechanisms are not yet understood.[2] The capability for rTMS to modulate plasticity has resulted in many studies exploring the therapeutic potential of this approach for a range of conditions. These studies typically involve delivering rTMS pulses to a targeted cortical region across a number of sessions, with the aim of modulating synaptic plasticity and consequently reducing symptoms.

Studies exploring the use of rTMS as a treatment for Tourette syndrome have typically targeted the primary motor cortex (M1) or supplementary motor area (SMA). This is because dysregulation between the balance of excitation and inhibition within the motor system has been identified as a core feature of Tourette syndrome, and several lines of evidence have implicated alterations within these cortical regions.[3] The most recent example of such work comes from Kahl et al.[4] in which 10 children/adolescents diagnosed with Tourette syndrome received bilateral stimulation of the SMA over 15 sessions. Tics significantly reduced for all participants over the course of the study, a finding that corroborates reports from several small-scale, open-label trials.[5] The authors also endeavoured to measure physiological change using single/paired-pulse TMS and magnetic resonance spectroscopy. This approach has the potential to reveal important biomarkers of change; however, in this instance few statistically significant differences were found, likely owing to the small sample size.

Small-scale, open-label studies provide valuable contributions to the investigation of the therapeutic use of rTMS, though the lack of a sham control is an important limitation to consider. To date, two small-scale, sham-controlled studies have been published using the SMA as a stimulation site, both of which revealed strong placebo effects.[5] Yet, numerous methodological differences between this work and existing open-label studies limits the strength of conclusions which can be drawn.

The results of studies such as Kahl et al.[4] are encouraging. But to truly assess the therapeutic potential of rTMS it is essential that large-scale, randomized controlled trials are conducted. Sample sizes should be large enough to yield sufficient statistical power to assess differences between sham and active groups, and to assess factors such as medication use, symptom severity, and the presence of any comorbid conditions—all of which may contribute variability to the outcome. Future work should also endeavour to include measures of physiological change and include sustained follow-up periods to assess the duration of any effects. By conducting this type of work, it is possible that rTMS could become a viable alternative treatment for people with Tourette syndrome, an outcome which would be welcome by patients and clinicians alike.

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