Transcranial Magnetic Stimulation for Adolescents With ADHD

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Attention-deficit/hyperactivity disorder (ADHD) is the most common neuropsychiatric condition of children and adolescents, and it often persists into adulthood.[1,2] Medications and cognitive-behavioral therapy are the main interventions to address ADHD symptoms. Psychostimulants have proven efficacy as a standard pharmacotherapy for ADHD; however, these drugs are sometimes not prescribed because they can induce reductions in appetite, weight, or height among children; alterations in cardiovascular function; and sudden death associated with structural heart disease.[3,4] The delayed impact of psychotherapies and unacceptability of medication in some patients has prompted consideration of other ways to manage their ADHD concerns.

Transcranial magnetic stimulation (TMS) is a noninvasive, well-tolerated, and promising therapy for various neuropsychiatric disorders.[5] TMS was approved for treating patients with depression in 2008.[4,5] Later research focused on pediatric subjects for conditions including bipolar disorder, depression, schizophrenia, myoclonus, and progressive myoclonus epilepsy.[4] TMS has been employed as a diagnostic tool for patients with ADHD, bipolar disorder, depression, schizophrenia, obsessive-compulsive disorder, and Tourette's syndrome.[5]

TMS therapeutically induces a blood flow change, gene modulation or expression, and release of peptides and trophic factors.[4] Dysregulation of dopamine is part of the biochemistry involved with ADHD, depression, schizophrenia, and Parkinson's disease, and TMS enhances dopamine release from the prefrontal cortex.[6] TMS can diminish symptoms of ADHD in adolescents.[3]

TMS improves understanding of the pathophysiology of ADHD and augments research to discover other interventions for patients.[7,8] Dysfunctions of dopamine modulation are documented in the pathology of ADHD; diminished ADHD symptoms induced by dopamine-regulating medications add to the evidence of this correlation at lessening ADHD manifestations.[4] During an ADHD intervention, TMS relies on evoked potentials (eg, N100), causing cortical inhibition. There may also be an association between ADHD and gene anomalies of dopamine receptors that explains cortical neuron inhibition.[4] These neurons are noninvasively depolarized by TMS-evoked potentials to become intracortical facilitatory or inhibitory pathways.[3–8] TMS can differentiate developmental delays from persistent inhibitory deficits of ADHD by documenting differences in latency and amplitude of evoked potentials. These features open inquiry about cortical development as an inhibitory deficit associated with ADHD.[4] TMS-evoked potential observations facilitate an assessment of cortical inhibition mediated by corticostriatal fibers without spinal inhibitory influence.[9]

TMS has promise as an intervention for treating adolescents and also adults with manifestations of ADHD.[1,3] Besides efficacy, advantages of TMS are that it is noninvasive and well tolerated. Disadvantages include high cost and risk of adverse events. Seizures, short-term memory impairment, and headaches are documented in some study subjects.[3,4]

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