

Qb test-Plus, and [b] in the same forms concerning tics, behavior

6 months after

6

Discussion

Our pilot study sought to discern whether there is a possible benefit of rTMS in subjects diagnosed as having TS. A clinically significant improvement in TS symptoms with rTMS lasting up to 6 months was seen in two of the patients, similar to that reported [19-22]. Improvement in ADHD was also seen in one patient and another one was improved in his OCD symptoms. There were no side effects of rTMS. Our pilot study is the open design and the small size of the group. Making a placebo response is less likely since TS patients are recognized to have a low placebo response [32,33] in comparison to patients with other psychiatric disorders, and our patients had been ill for a long period of time and had tried many treatments previously without success. Further studies using repetitive transcranial magnetic stimulation in TS are warranted. Careful consideration of target regions and stimulation parameters, longer follow-up, and the use of a double-blind, sham-controlled design may allow us to draw founded conclusions in the future.

Declaration of Interest

The authors report no conflict of interest. The authors alone are responsible for the content and writing of the paper.

Acknowledgment

We are grateful to all parents and children who participated.

References

1. American Psychiatric Association (1994) Diagnostic and statistical manual of mental disorder. In: Williams JBW, Spitzer RL (eds) Washington DC.
2. Khalifa N, Von Knorring AL (2003) Prevalence of the tic disorders and Tourette syndrome in a Swedish school population. *Dev Med Child Neurol* 45: 315-319.
3. Groenewegen HJ, Van den HOA, Cath DC, Vroom P, Veltman DJ (2003) Does an imbalance between the dorsal and ventral striatopallidal systems play a role in Tourette's syndrome? A neuronal circuit approach. *Brain Development* 25: 3-14.
4. Leckman JF (2002) Tourette's syndrome. *Lancet* 360: 1577-1586.
5. Dean W, James B, Harvey S, David JS, Hiroto K (2008) Mechanisms of Dopaminergic and Serotonergic Neurotransmission in Tourette Syndrome: Clues from an In Vivo Neurochemistry Study with PET. *Neuropsychopharmacology* 33: 1239-1251.
6. Khalifa N, von Knorring AL (2006) Psychopathology of Tourette syndrome and other tic disorders in a total population of school children. *J Am Acad Child Adolesc Psychiatry* 45: 11-1346.
7. Kadesjö B, Gillberg C (2000) Tourette's Disorder: Epidemiology and comorbidity in primary school children. *J Am Acad Adolesc Psychiatry* 39: 548-555.
8. Khalifa N, Dalan M, Rydell AM (2010) Tourette syndrome in the general child population: cognitive functioning and self-perception. *Nordic Psychiatry* 64: 1-11.
9. Robertson MM (2000) Tourette syndrome, associated conditions and the complexities of treatment. *Brain* 123: 425-462.
10. Barker AT, Jalinos R, Freeston IL (1985) Non-invasive magnetic stimulation of the human motor cortex. *Lancet* 1: 1106-1107.
11. Transcranial magnetic stimulation (TMS) at depression (2001) SSM-rapport Nr 6.
12. Frye RE, Rothenberger A, Ousley M, Pascual-Leone A (2008) Transcranial magnetic stimulation in child neurology: Current and future directions. *J Child Neurol* 23: 79-96.
13. George MS, Belmaker RH (2000) Transcranial Magnetic Stimulation in Neuropsychiatry. American Psychiatric Press, Washington DC.
14. Buchmann J, Wolters A, Haessler F, Bohne S, Nordbeck R (2003) Disturbed transcallosally mediated motor inhibition in children with attention deficit hyperactivity disorder (ADHD). *Clin Neurophysiol* 114: 2036-2042.
15. Moll GH, Heinrich H, Rothenberger A (2001) Transcranial magnetic