

# Low-frequent Repetitive Transcranial Magnetic Stimulation (rTMS) in Adolescents with Tourette Syndrome

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disorders and TS may vary h

## Follow-up

Follow-up was done one, three and six months after the treatment with rTMS. The follow-up included a medical examination,

Y-BOCS test-Plus, and the same forms concerning tics, behavior and compulsion as before the treatment started.

Gender	Age (years)	Threshold % MEP to hand muscle (APB*)		Stimulation frequency (pps)	Number of stimuli per day for 10 days		Adverse effects
		Right	Left		Right	Left	

	6 months after	6	9	10
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**Table 2** Outcome on TSSS, Conners scale, BOCS, in four adolescents with Tourette syndrome (TS).

Gender	Age (years)	Motor tics	Vocal tics	ADHD/ADD	Stuttering	OCD	1 month after treatment	3 months after treatment	6 months after treatment
Case 1 male	18	+	+			+	improved	improved	Normalised
Case 2 male	15	+	+	+	+		no change	improved	improved
Case 3 female	16	+	+			+	no change	no change	no change
Case 4 female	16	+	+	+			no change	improved*	improved*

\*improved concentration

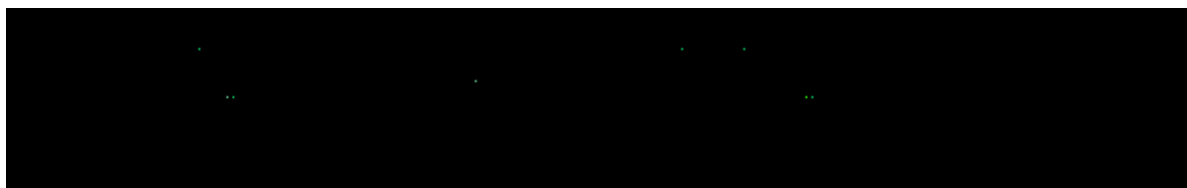
**Table 3** Clinical characteristics and total outcome in four adolescents with Tourette syndrome (TS), treated with rTMS.

**Case 1:** An 18-year old male with TS and OCD had a clinically significant improvement, with a reduction in TSSS; he had 8 points before treatment, 2 points after 3 months, and 1 point after 6 months of treatment. BOCS scores were 17 points at the beginning, 18 points after 1 month, 7 points after 3 months and 4 points after 6 months. IQ test and Conners scale were within the normal range both before and after treatment.

**Case 2:** A 15-year old male with TS, ADD and severe stuttering reported a decrease in symptom severity, from severe to moderate with significant reduction in TSSS. He had a clinically significant improvement, with a reduction in TSSS; before treatment 5 points, one month after treatment 7 points, at three months 3 points, and six months after treatment 2.5 points. Conners results were 8 points before treatment, one month after treatment 9 points, and 8 points and 6 points respectively after three and six months. According to the BOCS and IQ test there was no change before and after treatment.

**Case 3:** A female 16 years of age did not have any OCD or compulsions, TSSS scores were unchanged (8 points before and 8 points after treatment). BOCS were 20 points before treatment and 21 points after treatment. Conners scores were 6 points before and 3 points after treatment. She did not do any IQ test because she had so many motor tics, which made it difficult for her to sit in front of computer and complete it.

**Case 4:** A female 16 years of age with motor tics and ADHD scored TSSS before the treatment 8 points, one month after treatment 8 points, and three and six months after treatment 6 points respectively. BOCS were 6 points before the treatment, 6 points after one month, 3 points after three months and 10 points six months after treatment. Conners score were 20 points before treatment, one month after treatment 16 points, at 3 months 11 points and six months after the treatment 9 points. IQ tests showed an improved activity level and even better oversight. Clinically it is noticeable that she has less tics and better concentration in school (Figure 1).



**Figure 1:** IQ tests before and after the treatment.

## Discussion

This 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. This 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.

## References

1. American Psychiatric Association (1994) Diagnostic and statistical