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Varied Antidepressant Response and Subjective Experience Across Three Different rTMS Devices: A Case Report

Carter Paul, BS^a, Alvaro Pascual-Leone, MD, PhD^{a,b}, and Adam P. Stern, MD^{a,b,c}

^aBerenson-Allen Center for Noninvasive Brain Stimulation, Department of Neurology, Harvard Medical School and Beth Israel Deaconess Medical Center, 330 Brookline Avenue, Boston, MA, 02215

^bDivision of Cognitive Neurology, Department of Neurology, Harvard Medical School and Beth Israel Deaconess Medical Center, 330 Brookline Avenue, Boston, MA, 02215

^cDepartment of Psychiatry, Harvard Medical School and Beth Israel Deaconess Medical Center, 330 Brookline, Boston, MA, 02215

To the Editor

Repetitive TMS (rTMS) is an effective treatment for Major Depressive Disorder (MDD) [1]. Since 2008, there have been four devices cleared by the Food and Drug Administration (FDA) to treat MDD: Neurostar TMS Therapy System (Pennsylvania, USA) [1], Brainsway Deep TMS System (Jerusalem, Israel) [2], Magstim Rapid² (Wales, UK) [3], and Magventure (Farum, Denmark) [4]. There have been limited comparisons of device efficacy in populations with MDD [5], and little is known about comparing rTMS device efficacy in a single individual across multiple depressive episodes. We report a patient presenting with treatment-resistant MDD who had three separate rTMS treatment courses on three different devices (Neurostar, Magstim, and Brainsway).

Mr. A is a 63 year old Caucasian male presenting with recurrent, episodic MDD since age 40. Over the course of three years, he was referred to our TMS Center on three occasions. Prior to each induction, a psychiatrist confirmed that he met the criteria for treatment-resistant MDD, having failed at least four prior antidepressant treatment courses across multiple classes in this case. Each induction is comprised of 30 sessions (1 session a day, 5

Please address correspondence to Carter Paul, who is located at the Berenson-Allen Center for Noninvasive Brain Stimulation, Department of Neurology, Harvard Medical School and Beth Israel Deaconess Medical Center, 330 Brookline Avenue, Boston, MA, 02215, Fax: 617.975.5322, Phone: 617.667.0242, cpaul6@bidmc.harvard.edu.

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consecutive sessions a week) and is concluded with a brief taper phase. An individual session consists of high frequency stimulation performed over the left dorsolateral prefrontal cortex (DLPFC) as per each device's recommended protocol. The 24-item Hamilton Depression Rating Scale (HAMD-24) ^[6] was administered before and after each induction to measure response. The Beck Depression Inventory-II (BDI-II) ^[7] was also administered on a weekly basis to assess response throughout the duration of treatment.

Mr. A's first induction was performed using the Neurostar device, and consisted of 34 sessions (37 minutes, 3000 pulses at 10 Hz, 5.5 cm anterior to motor hotspot, 110% resting motor threshold (RMT)). He remained on stable doses of his medications, which included Duloxetine, Vilazodone, Gabapentin, and Methylphenidate. After 34 sessions, Mr. A reported at his final session that he "felt like a new person" and, on numerous occasions throughout this induction, that "the heavy weight on [his] shoulders [was] not there anymore". He initially described the treatment itself as "very uncomfortable", noting it felt like "a hammer on [his] head". However, he was able to acclimate to the treatment after the first 5 sessions. Clinically, Hamilton scores decreased from 26 to 16 (38.46%) with a similar Beck reduction from 32 to 22 (31.25%).

Mr. A returned to the clinic for a second induction 13 months after his first induction ended noting that his depression had returned and had again been unresponsive to antidepressant approaches. At that time, he was taking Amitriptyline, Atorvastatin, Clonazepam, Duloxetine, Gabapentin, L-Methylfolate, Lisinopril, Metformin, Methylphenidate, Quetiapine, Tamsulosin, Tolterodine, Vortioxetine. He began this second induction again on the Neurostar device but was switched to Magstim Rapid² device after one session due to intolerable discomfort. Neither he nor our clinical staff could identify a clear reason that his comfort level dropped so dramatically between courses. The remainder of this course of treatment consisted of 36 sessions on the Magstim Rapid² device. The treatment parameters for Magstim were the same as his first induction, with the exception of the stimulation intensity, which was set at 120% of RMT instead of 110% RMT. Subjectively, he reported on his final session feeling slightly better overall than at the start of his second induction, although he also noted that he did not experience the desired reduction in depressive symptoms from TMS as compared to his first induction. Clinically, both the Hamilton and Beck scores decreased from 24 to 20 (16.67%).

Mr. A had a third induction more than 12 months after his second induction concluded. At this time, his medications were unchanged and his outpatient psychiatrist was recommending electroconvulsive therapy, which he adamantly refused due to fear of cognitive side effects. He agreed to a retreat of TMS using a novel device, in this case the Brainsway DeepTMS device. Treatment consisted of 36 sessions over a longer course of 11 weeks as a result of adherence to the evidence-based DeepTMS protocol (21 minutes, 1980 pulses at 18 Hz, 6 cm anterior to motor hotspot, 120% RMT). Subjectively, Mr. A reported a "huge improvement" in mood by the end of his induction and noted that his friends and family noticed an improvement as well. Clinically, Hamilton scores expressed a small reduction from 19 to 17 (10.53%), followed by a more pronounced Beck reduction from 27 to 20 (25.93%).

Of the three courses, his treatment on the Neurostar device trended the most towards a full response, defined as a 50% reduction in score with both HAMD-24 and BDI-II measures. While the Neurostar course had the most clinically meaningful HAMD-24 score change, all three trials contained individual BDI-II data points that were approaching a full response. Subjectively, however, Mr. A felt that his treatment was most effective on the Brainsway DeepTMS device, followed by Neurostar, and then Magstim Rapid². When asked about this, he could not articulate why he felt his experience did not translate to the rating scales we use, but he was certain that his depression was best treated in that order. He ranked comfort and tolerability as Brainsway DeepTMS, followed by Magstim Rapid², and then Neurostar.

To our knowledge, this is the first report of a patient who has undergone three separate inductions on three separate devices within the same clinic. Although each induction led to an insufficient response as per our depression scales, both the data and, more importantly, Mr. A's report suggest satisfactory clinical response but also reveal differences in efficacy between each device that warrant further investigation.

Limitations of this report include the narrow scope of one case, as well as the large and uncontrollable number of variables affecting each treatment course. There were also varying severities of depressive episodes, medication changes between episodes, and multiple technicians performing sessions across each device. Comparative studies across devices under controlled settings are indicated.

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Biographies

Carter Paul, BS

Berenson-Allen Center for Noninvasive Brain Stimulation, Department of Neurology, Beth Israel Deaconess Medical Center, Boston, MA, Cpaul6@bidmc.harvard.edu

Alvaro Pascual-Leone, MD, PhD

Berenson-Allen Center for Noninvasive Brain Stimulation, Department of Neurology, Beth Israel Deaconess Medical Center, Boston, MA, Division of Cognitive Neurology, Department of Neurology, Beth Israel Deaconess Medical Center, Boston, MA

Adam P. Stern, MD

Berenson-Allen Center for Noninvasive Brain Stimulation, Department of Neurology, Beth Israel Deaconess Medical Center, Boston, MA, Division of Cognitive Neurology, Department of Neurology, Beth Israel Deaconess Medical Center, Boston, MA, Department of Psychiatry, Beth Israel Deaconess Medical Center, Boston, MA