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# rTMS as a Treatment for Anorexia Nervosa

*To the Editor,*

Anorexia nervosa (AN) has the highest mortality rate among psychiatric disorders [1]. Of those who manage to recover, relapse is extremely common, with 30–50% who have regained normal weight relapsing within a year of treatment [2].

Recovery in AN is most frequently characterized by weight gain; however, this physical symptom is a consequence of psychological factors like body dysmorphia. Ignoring psychological recovery is likely partly responsible for the high rate of relapse. Multiple studies have shown that recovered AN patients often still have significant body image disturbance and endorse more body shame than healthy participants [3]. A study by Bachner-Melman, Zohan, and Ebstein [4] showed that women whose recovery was defined by behavioral criteria – healthy weight and eating habits – but not cognitive criteria scored much more similarly to patients with ongoing AN than healthy controls on measures of body satisfaction. Women whose recovery was defined by behavioral *and* cognitive criteria were identical to healthy controls. The cognitive aspects of AN need to be given as much emphasis during recovery as the physical ones.

Repetitive Transcranial Magnetic Stimulation (rTMS) could target the neurobiological underpinnings of these psychological symptoms. rTMS is a non-invasive means of stimulating or depressing cortical brain areas and can induce long-lasting changes in cortical function [5] The negative side effects [5] are far outweighed by the potential for therapeutic benefit.

Previous studies investigating the use of rTMS in eating disorders have focused on bulimia which may not share the same underlying neurobiology as AN. Those that have limited their participants to those with anorexia [6] stimulated the dorsolateral prefrontal cortex (DLPFC), but have been very limited in scope. None have followed the participants through to recovery. The stated reasoning for stimulating the DLPFC in anorexia is to reduce the sensation of feeling full and anxiety in response to food stimuli—encouraging weight gain rather than reducing the psychological symptoms such as the intense fear of gaining weight or the perception of being overweight.

Future work would benefit from using rTMS to target regions associated with body dysmorphia. Patients with AN have an inaccurate sense of how their body interacts with space. Keizer et al. [7]. observed that AN patients have decreased interoceptive awareness and deficits in somatosensory perception. They tested whether their estimations of tactile distances would vary significantly from the normal population. They blindfolded AN patients and healthy participants and pressed two points of a caliper to their forearms and abdomens. Participants estimated the space between the two points by holding up their thumb and forefinger. AN patients consistently overestimated the distance compared to controls [7]. Treating this dysfunctional body-perception may have a positive effect not only on body image, but also on weight maintenance. If a patient with AN can accurately perceive his/her body, their eating habits may become less restrictive.

Constructing an accurate body representation draws on a number of neural systems, but the parietal cortex is the brain region most consistently involved in AN according to functional neuroimaging studies [1]. The right posterior parietal cortex is responsible for the production of spatial awareness [8,9] and is where proprioceptive and visual information of one's body are integrated [1]. Grunwald and colleagues have conducted a series of studies elucidating the role of the right parietal lobe in patients with AN. They blindfolded anorexic patients and healthy controls and had them feel shapes carved into wood and then had both groups reproduce the shapes they felt on paper. The healthy controls had virtually no trouble in reproducing the images, but subjects with AN had great difficulty with the task. The shapes they recreated were much farther from the stimulus than the control group, often only loosely resembling the original shape [9]. In another study, Grunwald had AN patients perform the same task while an EEG was recorded. The EEG revealed decreased activation in the right parietal cortex in patients with AN during the task compared to healthy controls [9].

Nico and colleagues also compared AN patients to those that had suffered damage to their right parietal due to stroke or other brain injury. Anorexic patients, patients with RP damage, and healthy controls were strapped in place in a dark room. A mechanical arm with an LED light moved toward the participants, stopping 16 cm away. They were then asked to mentally complete the trajectory of the light and estimate whether it would have eventually hit them. It was hypothesized that AN patients would have similar spatial judgment deficits as those with right parietal lesions (RPL), with markedly worse performance on the left side of the body as is seen in RPL patients. The performance of AN patients was indeed in line with RPL patients, with accurate collision predictions on the right side of the body but distorted predictions on the left. The implicit nature of the test and the one-sided results make it unlikely that top-down, affective attitudes toward body weight played a role in the overestimation [8].

What we know of the right parietal's role in haptic processing paired with the frequency with which this area shows deficits in AN strongly suggests that it is a key component in the body dysmorphia characteristic of the disorder. As treatments that focus on weight-gain have a relatively low success rate, the time has come to treat the more psychological symptoms of AN. TMS provides a safe, non-invasive means of stimulating the under-active parietal cortex and restoring an accurate body-image, which would likely improve body weight with a lower rate of relapse.


Katie Bainbridge*

*Department of Psychology, Sarah Lawrence College, New York, USA*

Adam Brown
*Department of Psychology, Sarah Lawrence College, New York, USA*

*Department of Psychiatry, New York University School of Medicine, New York, USA*

* Corresponding author. Department of Psychology, Sarah Lawrence College, 1 Mead Way, Bronxville, NY 10708, USA.
*E-mail address:* kbainbridge@gm.slc.edu

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