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Resetting The Brain

Can a pulsing magnet really change a personality? Doctors--and patients--are cheered by early tests

By CHRISTINE GORMAN

Martha, a mother of two from Connecticut, has suffered from depression for the better part of two decades. She has been to psychiatrists and psychologists and tried dozens of medications, but nothing seemed to work very well or for very long. Then last June she heard about an experimental treatment being tested at the New York State Psychiatric Institute at Columbia University. It involved aiming a powerful magnet at a spot on the brain to reset the wayward neural circuits that keep Martha, and millions like her, stuck in the downward spiral of depression.

Figuring she had little to lose, Martha agreed to the treatment and soon found herself sitting in a chair under a squat, gray crescent that administered a series of magnetic pulses to the top of her head. The treatment lasted for one hour, five times a week, for six weeks. "I started to see signs of change by about the third week," she says. "By September, I was on top again. I could take pleasure in things like food and sunshine." Returning to the institute every once in a while for repeat sessions of what researchers call repetitive transcranial magnetic stimulation (rTMS), Martha has kept her symptoms at bay for the better part of six months.

That's no fluke, according to a small group of doctors who have reported similar successes at research centers around the world. The National Institute of Mental Health (NIMH) is sufficiently intrigued that it has asked the New York institute and three other groups to conduct a rigorous study of 240 depressed patients, comparing the effects of magnetic stimulation against a placebo. "Within the next few years, we'll have a better idea of whether rTMS is safe and effective for depression," says Dr. Sarah Lisanby, who is leading the study at the institute. There is also growing interest in exploring the use of the technique for the treatment of anxiety disorders, schizophrenia, stroke and perhaps epilepsy.

It's all preliminary, but researchers believe they can use rTMS at the very least to develop a new understanding of how different parts of the brain are wired together and what goes wrong when some of its signals get crossed.

What they cannot do at the moment, somewhat to their embarrassment, is explain why magnetic stimulation might ease anyone's suffering.

But first we should make a couple of things clear. This kind of magnetic stimulation has nothing to do with the little bar magnets that arthritis sufferers sometimes wrap around their wrists or attach to their backs. Instead rTMS relies on sophisticated electromagnets similar to the ones used in MRI scanners, but these are small enough to hold in your hand and don't make all that racket.

Moreover, it's not the magnetic pulses that affect the brain but the modest electrical currents that the pulses induce--almost like an echo--in the brain's nerve cells. At some frequencies, those electrical currents seem to stimulate neural pathways but at other frequencies inhibit them.

That may sound a lot like electroconvulsive (or electroshock) therapy, but it's not. "Magnetic stimulation is a clever way to induce current without actually having an electrical connection," says Dr. George Wittenberg, a neurologist at Wake Forest University, who is studying magnetic pulses for their potential to help stroke patients recover more quickly. Unlike electroconvulsive therapy, which affects the whole brain, the magnets are focused only on specific regions at the surface, or cortex. And because the treatment does not trigger a seizure (as electroconvulsive therapy does), there's no need for muscle relaxants or anesthesia and no problem with memory loss. Patients undergoing magnetic stimulation usually feel only a kind of tapping on their skull as the current starts to flow.

Why would anyone want to generate tiny electrical currents in their brain? "You have to remember the brain is both an electrical and a chemical organ," says Dr. Mark George, a psychiatrist at the Medical University of South Carolina who is investigating magnetic stimulation as a treatment for depression for the NIMH. Drugs like Prozac and Zoloft address chemical imbalances, but that's only part of the problem. Electroconvulsive therapy, despite its troubling side effects, is still one of the most effective treatments available for severe, unrelenting depression.

Although researchers freely confess that they don't know how rTMS works, they do have some ideas. It has long been clear that neurons in different parts of the brain can act in concert. Of particular interest are the circuits that link the areas of the cortex that help us reason and plan our lives with more deeply embedded zones of the brain such as the limbic system, where emotions are processed. One theory holds that depression is either caused by or results in an imbalance in the activity in those regions. Applying periodic bursts of electrical current at the cortex may reset the network in a process that's akin to rebooting a computer.

No one knows how long such a reset might last and whether aiming the magnet at a different part of the brain would work any better. But that hasn't stopped neurologists from trying rTMS on other conditions. For example, specialized MRI scans can pinpoint where stroke damage has occurred and what parts of the brain are trying to take over for the affected

regions. Could the right combination of stimulation and inhibition help stroke victims overcome their disabilities?

At Wayne State University in Detroit, Dr. Randall Benson is studying 28 stroke patients to see if he can enhance their impaired speech after existing therapies are no longer effective. First they undergo a brain scan to see which of their language centers are still at least partially active. Then Benson targets those regions with rTMS. "Because things like language are regulated in the brain by a network, when we stimulate in one place, we find activation all over the brain," Benson says.

Using a slightly different approach, Dr. Alvaro Pascual-Leone at Harvard Medical School is beginning to see improvements in his stroke patients' speech. Instead of boosting activity in the compensating areas of the brain, Pascual-Leone is trying to disrupt the neural pathways that block recovery. "What the brain tries to do as a first-line response is to shut down activity in damaged areas," he explains. That gives the neurons that are only slightly damaged a chance to recover before coming back online. But in some stroke patients, the inhibitory network never lets up. By weakening those neurons with magnetic stimulation, Pascual-Leone thinks he can give the recovery process a gentle boost.

These scientists are the first to admit that they are treating a dizzyingly complex organ--the human brain--with not much more than educated guesswork. But when you hear the gratitude in Martha's voice as she talks about what it's like to get her life back after so many years of deep depression, it seems a risk worth taking. --With reporting by Alice Park/ New York

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