Using Electricity to Treat Migraines

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Roughly 30 million Americans suffer from migraines each year. Migraines are inherited neurological disorders characterized in part by painful, throbbing headaches. Migraine headaches are usually characterized by severe pain on one or both sides of the head and can last an unbearable amount of time. These types of headaches are found to be more common in adult women than men and studies suggest that healthy diets and exercise can reduce the risk of migraine headaches.

There are two main types of migraine headaches. An **aura** is the perceptual disturbance experienced by some migraine sufferers before a migraine headache.

A Migraine without aura is the most commonly seen form of migraine. This type lasts 4-72 hours and typical characteristics of the headache are unilateral location, pulsating quality, moderate to severe intensity, aggravation by routine physical activity and association with nausea.

A Migraine with aura is the second most commonly seen form of migraine. This type lasts for less than 60 minutes. Less commonly, the aura may occur without a subsequent headache or the headache may be non-migrainous in type.

In ancient Rome, patients experiencing headaches were treated with the electrical shock from electricity-producing black torpedo fish, or the electric ray. Today most patients with headaches, especially migraines are treated with pharmaceuticals. In recent research, electrical or electromagnetic devices have proven more effective than previous treatments for migraines.

The two kinds of stimulatory approaches now in large-scale clinical trials are:

1. Occipital nerve stimulation, or O.N.S.
2. Transcranial magnetic stimulation, or T.M.S.

In **occipital nerve stimulation**, a pacemaker-like device is connected to electrodes placed at the back of the head just under the skin. Electrical current is delivered through these electrodes, with the goal of inhibiting or preventing migraine pain. In **transcranial magnetic stimulation**, a magnetic device is pressed to the back of the head, and brief pulses are delivered, altering electrical activity inside the brain in hopes of halting the migraine before it progresses. This approach is being studied only for patients whose migraines begin with an aura, or premonitory phase, that is typically characterized by flashing lights or other visual disturbances.

Cheryl Meyers, a case study patient, complained of migraine suffering for 9 to 10 years. The migraines lasted for several hours and disrupted her from normal daily activities. “The only thing that helped was narcotics,” said Ms. Myers, 49. “But I couldn’t be taking them three or four times a week” (her migraines were frequent). In 2004, Ms. Myers enrolled in a clinical trial at the Michigan Head-Pain and Neurological Institute, where she had an occipital nerve stimulator surgically implanted. The pacemaker-like device was placed on her lower back and connected, by way of wires tunneled under the skin, to electrodes at the base of her neck, on either side. Soon after the device was turned on, Ms. Myers said, she began having fewer migraines, and those she did have were less severe. Within a few months, she was also able to return to work several days a week. “I am not headache-free,” she said, adding that she still has “one or two headaches a week” and takes Percocet, a pain-relieving narcotic. Although the treatment did not cure her migraines, she enjoys a much more productive and normal lifestyle with the surgical treatment and it is much more effective than the pharmaceuticals she was taking before.

According to Dr. Saper, director of the neurological institute where Cheryl attended, electrodes were positioned to stimulate the greater occipital nerve. The occipital nerve converges in the upper spinal cord, where there are neurons and neural pathways responsible for conveying much of the throbbing pain associated with a migraine.

Unlike the previous procedure, transcranial magnetic stimulation does not require any surgical procedures and is non-invasive. It uses magnetic pulses, delivered through the skin, to induce electrical changes in a particular brain area. In a study of 43 patients conducted by Dr. Mohammad in 2004 and 2005, participants came to the medical center’s emergency room when they began to experience an aura, and were then given transcranial magnetic stimulation. Two hours after being treated, 74 percent of the patients who received magnetic stimulation said they had no headache or a mild headache, compared with 45 percent of the patients in the control group. Dr. Mohammad presented the results at the annual conference of the American Headache Society in June 2004. The goal of transcranial magnetic stimulation is to interfere with the initial wave of excitation, thereby preventing the migraine from proceeding to the headache phase.

Although both treatments have shown remarkable outcomes, they have yet to become FDA approved and still need further researching. Both treatments have given us a better understanding of how and why migraines occur. “We are treating electricity with electricity rather than treating electricity with chemicals,” Dr. Mohammad said.

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