Sound vibration treatment may boost brain activity in Alzheimer’s patients

ADRIANA BARTON
HEALTH REPORTER
PUBLISHED APRIL 27, 2016
UPDATED MAY 16, 2018

The treatment, called rhythmis sensory stimulation, completed at Baycrest Health Sciences in Toronto, aims to use external sound frequencies to boost declining brain activity in Alzheimer’s patients.[/caption]

A small group of Alzheimer's patients showed temporary improvements in thinking skills and memory after sitting in a medical-grade chair that pulsated with low-frequency sound vibrations, Toronto researchers have found.

The idea behind the experimental treatment, called rhythmic sensory stimulation, is to boost declining brain activity. Studies dating to the 1990s have shown that an internal brain rhythm of 40 hertz is a fundamental frequency in a healthy brain. Alzheimer's patients have lower levels of this "gamma wave" activity compared to healthy people of the same age. But the jury is still out on whether stimulating the brain with external sound frequencies – or deep brain stimulation, a neurosurgery technique – can restore mental function in Alzheimer's patients.

In the pilot study, 18 patients with mild to severe Alzheimer's disease sat for 30-minute sessions in a $10,000 chair at Baycrest Health Sciences in Toronto. Six speakers in the chair pulsed at 40 hertz, a frequency similar to the low E on a piano. Patients not only heard the low rumbling sounds but also felt the vibrations through their bodies said the study's co-author, Lee Bartel, associate director of the University of Toronto's Music and Health Research Collaboratory.

For patients, "it's like sitting on a subwoofer," he said.

Bartel and colleagues are the first to study rhythmic sensory stimulation in Alzheimer's disease. After six sessions, held twice a week, patients scored on average nearly four points higher on a 30-point scale used to screen for cognitive deficits, according to the study, published online in March in the Journal of Alzheimer's Disease.

Patients with late-stage Alzheimer's showed minimal improvement, while test score gains among other patients faded within a week of their last session. For patients with mild to moderate Alzheimer's, however, a temporary gain of nearly four points on the scale might mean they could "more easily remember their grandchildren's names, or the three things they were going to buy at the store," Bartel said.

But Colin Dormuth, an assistant professor of anesthesiology, pharmacology and therapeutics at the University of British Columbia, questioned the findings, noting that the cognitive scale used in the pilot study is "not the most common test of Alzheimer's." Dormuth, who researches drug therapies for Alzheimer's disease, added that the study authors did not include details on important variables that might influence how patients scored on the test.

The researchers defended their modelling methods and acknowledged the difficulty in analysing results in a small patient group. However, patients in the study were not evaluated based on test scores alone. Research assistants reported that patients appeared more alert and engaged in meaningful conversation during rhythmic sensory stimulation, compared to their behaviour during the test period using visual stimulation as a comparison. (Patients sat in the same vibro-acoustic chair with the power switched off and watched 30-minute sessions of televised ocean waves and nature scenes.)

Ideally, Bartel said, patients would receive rhythmic sensory stimulation three times a week for at least six months to determine its short and long-term effects. In the meantime, it would be premature to conclude this therapy is a treatment for Alzheimer's disease. "This is not a cure," Bartel said. "There's a lot more research that needs to be done."

Rhythmic sensory stimulation is not the same as music therapy, known to rekindle memories and improve mood in Alzheimer's patients. The medical-grade chair uses electronically created sine waves that are consistently at 40 hertz. Listening to music would not give the same effect, since most pop and classical music does not dip to the 40-hertz frequency for extended periods, Bartel said.

In the pilot study, researchers hypothesized that sound vibrations could stimulate brainwaves to synchronize with the 40-hertz pulses and thereby improve cognition.

Preliminary research suggests the brain can synchronize with external vibrations. In a 2013 study at Baycrest, Bernard Ross found that vibrations delivered through the index finger could stimulate a steady 40-hertz oscillation in the brain, based on results from magnetoencephalography (MEG), a technique that measures brain activity.

The approach merits further study, said Urs Ribary, a neuroscientist who worked with Rodolfo Llinas at New York University Medical Center on the original research showing the importance of a 40-hertz oscillation in a healthy brain.

Even in an Alzheimer's brain, where nerve cells are dying, "the brain is still plastic enough that you can have a positive effect," said Ribary, who now holds the British Columbia Leadership Chair in Cognitive Neuroscience at Simon Fraser University.

Nevertheless, Ribary cautioned against putting too much stock in the results of a pilot study. Validating rhythmic sensory stimulation as a therapy for Alzheimer's would require additional studies involving at least a hundred patients in multiple research centres, he said. Future studies should include a more precise evaluation of cognitive changes using brain-imaging technologies. Researchers should test low frequency sounds in combination with other forms of cognitive stimuli, he said, noting the complex audiovisual training programs he has developed to treat dyslexia.

Even if rhythmic sensory stimulation proves to benefit Alzheimer's patients, Ribary said, "it will not fix an Alzheimer's brain. It will just kind of delay [disease progression] or help preserve what you have."

Potential side effects of rhythmic sensory stimulation include feelings of light-headedness or dizziness during the low-frequency sound vibrations. The therapy is non-invasive compared with deep brain stimulation, a surgical technique in which thin electrode wires are inserted into specific brain regions. Andres Lozano, a University of Toronto professor of surgery and Canada Research Chair in Neuroscience, developed this method as a treatment for Parkinson's disease. He is part-way through a series of multi-centre trials using deep brain stimulation in patients with mild Alzheimer's.

Last July, he presented unpublished findings from the phase II study at the Alzheimer's Association International Conference in Washington, D.C. After one year, the researchers saw partial improvements in brain areas involved in processing glucose (sugar). But of 42 patients, those who received deep brain stimulation showed similar mental declines after one year as did patients whose device remained off, Lozano said. "There was no difference in the cognitive outcome for the group as a whole," he wrote in an e-mail.