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IT'S ALL IN YOUR MIND

NEW TECHNOLOGY HELPS PATIENTS REDUCE CHRONIC PAIN

"Chronic pain is an epidemic. It's only going to get worse as our population is going to age."

Aimee Chagnon
pain doctor

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Special to the Herald

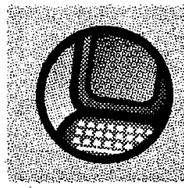
Researchers have for the first time used powerful brain imaging technology to reduce pain in chronic pain patients.

Patients were shown real-time images of their brain activity so they could learn to reduce the activity in a pain-control area called rostral anterior cingulate cortex. After only a few training sessions in a brain scanner, most of the patients could reduce activity in that area and relieve their pain.

"If you learn how to control your brain activation, your pain improves," said Christopher deCharms, lead author of the study and CEO of Omneuron Inc. in Menlo Park. The company has patents pending on brain scanning-based training methods.

Results of the study were released last Monday in the journal Proceedings of the National Academy of Sciences.

Chronic pain is considered a widespread problem, often with few, if any, treatment options. Some 57 percent of Americans say they suffer from chronic pain, according to a 2003 telephone survey by Research America, a nonprofit public education and advocacy alliance based in Alexandria, Va.



Go to: **montereyherald.com** for a link to the full study.

The annual cost of pain to U.S. employers, estimated as lost productivity, is more than $60 billion, according to a 2003 study in a medical journal.

"Chronic pain is an epidemic," said Aimee Chagnon, former director of clinical research and teaching at the Pain Management Center at the University of California at San Francisco and now a private practice pain physician in Mill Valley. "It's only going to get worse as our population is going to age."

'Real-time' imaging

In their study, the researchers used a method called real time fMRI, or functional magnetic resonance imaging. Although it is called "real time," there is a delay of up to 10 seconds from when "thoughts" happen to when the fMRI scanner shows them on the screen.

That's because fMRI doesn't directly measure nerve cell activity in the brain; rather, it measures elevated oxygen levels in active brain areas. The higher oxygen levels are the body's response to active nerve cells, which need oxygen to keep functioning.

Most patients, deCharms said, didn't have any problem adapting to the brief delays.

For the scans, patients lie on their back in the scanner, a truck-sized machine that makes noises like a huge diesel engine, so loud that the patients had to wear ear plugs. Since any head movements can cause problems during the scan, researchers made the patients bite on a piece of plastic that was fixed to the bed.

The researchers showed the patients their own brain activity as a flame changing in brightness. They used a prism to project the image just into the patient's eyes, in the few inches of space between the patient's head and the machine.

Not all of the eight chronic pain patients in the study could reduce their brain activity equally well, perhaps because there are several pain control areas in the brain, said Sean Mackey, a pain physician at Stanford University and co-author of the study.

"Maybe for different people we should be looking at different brain regions," Mackey said.

But deCharms said there was a "very high correlation" between the patients who learn successfully to control brain activation and a significant effect on their pain.

This shows, he said, that the pain reduction was really the result of reduced activity in the pain control areas of the brain.

Long-term possibilities

While the research is still preliminary, it seems to offer the possibility that one day, pain could be reduced without drugs or surgery, by focused thought, as long as sufferers can be taught how to mentally "turn it off."

This neuroimaging therapy

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may one day help patients with types of pain currently considered almost untreatable, such as cluster headaches, said Rainer Goebel, a brain researcher at the University of Maastricht in the Netherlands who was not involved in the study.

"These people want to commit suicide, even if they are given painkillers," said Goebel, who was involved in the first study to use real time fMRI to teach people to control their own brain activity in 2003.

Neuroimaging therapy is a big step forward compared with current methods used to teach patients to reduce their pain, deCharms said, because it measures localized brain activity. One current method called electroencephalography, for example, measures general changes in brain activity. But these measurements only indicate how relaxed or stressed a subject is, deCharms said.

Still, even if the new fMRI method turns out to be working, it may be too expensive for most pain patients. At Stanford, scanning can cost as much as $600 per hour.

And the price is not the only limitation.

With just a few inches between the head and the machine, there is not much room to move, so claustrophobic people can't be scanned. People with any metal pieces in their body are excluded because of the strong magnetic field used by the machine.

Questions remain

It's also not always clear just how the test subjects reduce activity in their brains.

Initially, the patients are given the instruction to distract themselves from the pain.

Fumiko Maeda, a co-author of the study of Stanford University, said attention is important for the perception of pain.

"When you are playing a baseball game and you break your finger, you don't realize it and you can play the game," she said. "But as soon as it's over and you focus on your hand, it suddenly starts hurting."

Distraction from pain is not enough to reduce it, however, as a control group that was distracted but didn't receive neuroimaging training failed to show any improvement.

Many patients had a difficult time explaining how they did it, said deCharms, who has tried it himself. He compared it with trying to explain "what tastes so good about a raspberry."

Not so for Laura Tibbitts. The 31-year-old chronic pain patient said she sometimes tried to focus on areas of her body that weren't in pain.

"Other times," she said, "I would literally imagine tiny people marching in my back and scooping the pain out." Tibbitts, a conference manager at Stanford University, has been suffering from chronic pain in her shoulder blade area since she was thrown from a horse seven years ago, breaking her right arm and shoulder.

Goebel is skeptical as to whether the brain changes are permanent. He said the chronic pain patients may not be able to turn off their pain once outside the scanner, for example when they are back at work doing other things.

In Goebel's 2003 study, people were told to increase activity in a brain area involved in thoughts about buildings while decreasing activity in another area involved in motion. They couldn't do this without actively thinking about houses and being unable to move, which makes it impossible to do too many other things at the same time, he said.

"Perhaps you can do this while working as a manufacturing worker," Goebel said, "but not if you want to read something."

But the pain researchers hope their brain training will have a similar long-lasting effect on the brain as the effect going to the gym has on the muscles. DeCharms compared the effect this way:

"If you see someone's face, you may remember that face for days, weeks or years thereafter," he said. "You don't have to be constantly trying to maintain that memory. We are trying to alter the functioning of the pain system in what we hope will one day be long term or even permanent."

Already, there is evidence that the changes in the brain's pain area may indeed be permanent, deCharms said.

For one, the patients still showed reduced pain immediately after the scanning was over, which is when they were asked how strong their pain was. They were not at that time actively trying to engage in a cognitive process to control their pain, deCharms said.

Tibbitts also said the pain reduction sometimes lasted for hours after the session under the scanner. But to reproduce it at home takes a lot of concentration. "Sometimes I use music, headphones, turn the phone off," Tibbitts said.

The researchers are now looking at the long-term effects of repeated fMRI training, Mackey said. They are also investigating whether training of other pain control regions in the brain can affect pain perception.

"We still have a lot of work to do before this can even be talked about as a possible therapeutic tool," Mackey said.

Whatever the case, the most important thing for Tibbitts was to see that her pain is real and can be controlled. "It's very validating and empowering," she said.