Training the brain to beat pain

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Plasticity: one’s neural pathways can be altered. Picture: John Lund / Getty

MICHAEL Moskowitz is a psychiatrist turned pain specialist who has often been forced to use himself as a guinea pig.

Burly, buoyant and tall, Moskowitz looks a decade younger than his 60-odd years. He wears oval John Lennon glasses, has slightly long, greying curls of hair, a moustache and a beatnik’s soul patch beneath his lower lip. He smiles a lot.

I first saw Moskowitz in Hawaii, where he was moderating a serious and sober panel at the American Academy of Pain Medicine. He was in a suit, but he seemed too big a personality, too boyish, to be wearing one. A few hours later, on the beach, wearing shorts and wild colours, he was unconstrained, joking. We got acquainted and everything about him – his love of singing and playing the guitar, his engaging manner and youthful voice – suggested he was still very much a creature of the happy-go-lucky world of the 1960s in which he came of age.

Not so. Moskowitz spends most of his time immersed in the chronic pain of others. Their agony is unknown to most people, in part because they are often so drained by their pain that they stop wasting what little energy they have to express distress to those who can’t help them. Chronic pain may be invisible on a patient’s face, or it can give its victim a drawn, ghostly presence, because it sucks the life out of a person.

Moskowitz and another psychiatrist turned pain specialist, Robert Hines, set up a pain clinic in Sausalito, California, which treats patients with “intractable pain”: those who have tried all other

treatments, including all known drugs, “nerve blocks” (regular anaesthetic injections) and acupuncture. “We are the end of the line,” Moskowitz says. “We are where people come to die with their pain.”

Moskowitz came to pain medicine after working for years as a psychiatrist. He has all the professional and scholarly credentials: he was on the examination council for the American Board of Pain Medicine (setting the exams for doctors in pain medicine); he is a former chairman of the education committee of the American Academy of Pain Medicine; and he has an advanced psychiatric fellowship in psychosomatic medicine. But Moskowitz became a world leader in the use of neuroplasticity – using the brain’s own structure and functioning in response to activity and mental experience – for treating pain only after making some discoveries while treating himself.

In 1994, while water-skiing with his daughters, big-kid Moskowitz was speeding, splashing, and pounding at 60km/h in an inflated inner tube when he flipped over and hit the water with his head bent backward. The resulting pain persisted. It was often an 8/10, on many days making it impossible for him to work. (Pain is rated from 0/10 to 10/10 – 10 is being dropped into boiling oil.) It soon dominated his life as no pain ever had. Morphine and other heavy-duty painkillers, and all the known treatments – physical therapy, traction (stretching the neck), massage, self-hypnosis, heat, ice, rest, anti-inflammatory drugs – barely touched it. That pain haunted and tormented him for 13 years, becoming more severe as time passed.

He was 57 when he hit rock bottom with his neck pain and began researching the discovery that the brain was neuroplastic and relating it to pain. The idea that chronic pain was caused by a neuroplastic event of the brain had been proposed by the German physiologist Manfred Zimmermann in 1978, but as neuroplasticity would remain generally unaccepted for another 25 years, Zimmermann’s idea was hardly known, and its applications to treat pain unexplored. Acute pain alerts us to bodily injury or disease by sending a signal to the brain, saying: “This is where you are hurt – attend to it.” But sometimes an injury affects both our bodily tissues and the neurons in our pain system, including those in the brain and spinal cord, resulting in neuropathic pain (sometimes called central pain because the brain and spinal cord together make up our central nervous system).

Neuropathic pain occurs because of the behaviour of neurons that make up our “brain maps” for pain. The external areas of our body are represented in our brain, in specific processing areas, called brain maps. Touch a part of the body’s surface and a specific part of the brain map, devoted to that spot, will start to fire. When the neurons in our pain maps get damaged, they fire incessant false alarms, making us believe the problem is in our body when it is mostly in our brain. Long after the body has healed, the pain system is still firing. The acute pain has developed an afterlife: it becomes chronic pain.

Moskowitz defines chronic pain as “learnt pain”. It not only indicates illness; it is itself an illness. The body’s alarm system is stuck in the “on” position because the person has been unable to remedy the cause of an acute pain and the central nervous system has become damaged. “Once chronicity sets in, the pain is much more difficult to treat.”

Wishing to take charge of his own pain, in 2007 Moskowitz read 15,000 pages of neuroscience. He wanted to better understand the laws of neuroplastic change and put them into practice. He

learnt that not only can one strengthen circuits between brain areas by getting these areas to fire at the same time, but that one can weaken connections by making sure areas don't fire in synch. Could he, by fiddling with the timing of input to his brain, start to weaken links that had formed in his pain maps? He also learnt that in our use-it-or-lose-it brain there is an ongoing competition for cortical real estate, because the activities the brain performs regularly take up more and more space in the brain by "stealing" resources from other areas.

He drew three pictures of the brain that summarised what he had learnt. The first was a picture of the brain in acute pain, with 16 areas showing activity. The second was of the brain in chronic pain, showing those same areas firing but expanded over a larger area of the brain, and the third picture was of the brain when it is not registering pain at all. As he analysed the areas that fire in chronic pain, he observed that many of those areas also process thoughts, sensations, images, memories, movements, emotions and beliefs when they are not processing pain. That observation explained why, when we are in pain, we can't concentrate or think well; why we have sensory problems and often can't tolerate certain sounds or light; why we can't move more gracefully; and why we can't control our emotions very well, become irritable and have emotional outbursts. The areas that regulate these activities have been hijacked to process the pain signal.

Moskowitz's inspiration was simple: what if he could use competitive plasticity in his favour? What if, when his pain started – instead of allowing those areas to be pirated and "taken over" by pain processing – he "took them back" to their original main activities, by forcing himself to perform those activities, no matter how intense the pain was? What if, when he was in pain, he could try to override the natural tendency to retreat, lie down, rest, stop thinking and nurse himself?

Moskowitz decided the brain needed a counterstimulation. He would force those brain areas to process anything but pain, to weaken his chronic pain circuits. Years as a pain medicine specialist had fixed in his mind the key brain areas he was targeting. Each of them could process pain and do other mental functions, and he listed what each did other than process pain, so he would be prepared to do those things while he was in pain.

For instance, a part of the brain called the somatosensory area processes much of the body's sensory input, including pain, vibration and touch. What if, while he felt pain, he was to flood himself with vibration and touch sensations? Might those sensations prevent the somatosensory areas from being able to process pain? Moskowitz knew that when a particular brain area is processing acute pain, only about five per cent of the neurons in that area are dedicated to processing pain. In chronic pain, the constant firing and wiring together of neurons lead to an increase, so that 15 to 25 per cent of the neurons in the area are now dedicated to pain processing. So about 10 to 20 per cent of neurons get pirated to process chronic pain. Those were what he would have to steal back.

In April 2007 he put this theory into practice. He decided that he would first use visual activity to overpower the pain. A huge part of the brain is devoted to visual processing, and it couldn't hurt to have it on his side in this competition. He knew of two brain areas that process visual information and pain, the posterior cingulate (which helps us to visually imagine where things are in space) and the posterior parietal lobe (which processes visual input). Each time he got an attack of pain he immediately began visualising. But what? He visualised the very brain maps he had drawn, to

remind himself that the brain can really change, so he'd stay motivated. First he would visualise his picture of the brain in chronic pain – and observed how much the map in chronic pain had expanded neuroplastically. Then he would imagine the areas of firing shrinking, so that they looked like the brain when there was no pain. "I had to be relentless – even more relentless than the pain signal itself," he said. He greeted every twinge of pain with an image of his pain map shrinking, knowing that he was forcing his posterior cingulate and posterior parietal lobes to process a visual image.

In the first three weeks he thought he noticed a very small decrease in pain and he doggedly continued to apply the technique, telling himself to "disconnect the network, shrink the map". After a month he was getting the hang of it and applying the technique so conscientiously that he never let a pain spike occur without doing some visualisation or other mental activity to oppose it. It worked. By six weeks, the pain between his shoulders in his back and near his shoulder blades had completely disappeared, never to return. By four months, he was having his first totally pain-free periods throughout his neck. And within a year he was almost always pain-free, his average pain 0/10. If he had a brief relapse (usually from his neck being in a weird position, after a long drive, or having the flu), he was able to get his pain down to 0 in a few minutes. His life was totally changed after 13 years of chronic pain. During those 13 years, his average pain had been 5/10, but could range up as high as 8/10 even on medication, and even his best days were 3/10.

Moskowitz started to share his discovery with his patients. His first "neuroplastic" patient was Jan Sandin, a nurse in her 40s at Sequoia Hospital in Redwood City, California. An accident at work had left all five of her lumbar (lower back) discs damaged, and the bottom one slipped and pressed against a nerve root. Over the next few years she was given all the usual treatments for pain, including physiotherapy and heavy-duty opioid medications. Nothing helped, and the pain became chronic. Surgeons told her there was too much damage in her lower back to operate. After several brave attempts to return to work she was declared disabled. She felt her life was over.

By the time she got to Moskowitz, she had been disabled with chronic pain for a decade. Moskowitz worked conventionally with her for five years, using heavy-duty painkillers; then, in June 2007, he introduced her to the idea of training herself using his neuroplastic technique. He showed her his three pictures of the brain and told her that she had to be more relentless than the pain in focusing on them. He asked her first to look at the pictures, then put them down and visualise them, while thinking about transforming her brain into the no-pain version.

"He told me to look at the brain pictures seven times a day. But I sat in the massage chair and I looked at them *all day long*, because I had nothing else to do. I would visualise the pain centres firing, and then I thought about where my pain was coming from in my back. Then I would visualise how it went into the spine and then into my brain – but with no pain centres firing. In those first two weeks, I had moments when there was no pain… It wasn't profound, because I felt, *Oh, it's not going to last.* Then I thought, *Oh, it's back again – don't get your hopes up.*

"By the third week I was starting to have a couple of minutes a day without chronic pain. By the end of the third week, the time without pain seemed to increase. But it happened for such a short period of time that, honestly, I never really thought it would go away. By the fourth week, the pain-

free periods were up to 15 minutes to half an hour. I thought, *This is going to go away*." And it did. Next, she started going off all her medications, terrified the pain would return, but it didn't. "I wondered, *Is it a placebo?* But the pain still hasn't come back. It has never come back."

What Moskowitz has added to our understanding of this ability of the mind to eliminate a particular pain is that constant mental practice is necessary to strengthen this ability and change the firing of the brain in a way that is sustained. Unlike medication or placebo, the neuroplastic technique allows patients to reduce its use over time, once their networks have rewired.

The effects last. Moskowitz has patients who have kept their gains for five years. Many of his relatively pain-free patients still have damage in their bodies, which can, on occasion, trigger acute pain. He thinks that once they have learnt and practised the technique over hundreds of hours, their unconscious mind takes over the task of blocking pain by using competitive plasticity. When it doesn't, they can still use the spike of pain as the signal to consciously use competitive plasticity to do more rewiring. "I don't believe in pain management anymore," says Moskowitz. "I believe in trying to cure persistent pain."

He has helped patients with a wide range of chronic pain syndromes to diminish their pain, including those with chronic low-back pain from nerve injury and inflammatory damage, diabetic neuropathy, some cancer pain, abdominal pain, neck degeneration pain, amputation, trauma to the brain and spinal cord, pelvic floor pain, inflammatory bowel, irritable bowel, bladder pain, arthritis, lupus, trigeminal neuralgia, multiple sclerosis pain, post-infectious pain, nerve injuries, neuropathic pain, some central pain, phantom limb pain, degenerative disc disease, pain from failed back surgery and pain from nerve root injury, among others. I met many of his patients who had either come off their medications or radically reduced them, so that they have far fewer side--effects. Patients have had successes in all these pain syndromes, but only when they were able to do the relentless mental work required.

One of Moskowitz's most important insights is that the new opioid narcotics, so popular for pain treatment, have actually made many pain problems worse, because neither the drug companies nor many physicians take into account the role of neuroplasticity in pain. Often within days or weeks, patients become "tolerant" to such a drug: the size of the initial dose loses its effect, so they need ever more medication, or they experience "breakthrough pain" while on the drug. But as the dose is increased, so too is the danger of addiction and overdose. To better block pain, drug companies invented "long-acting" opioids, such as OxyContin, a long-acting morphine. People with chronic pain would often be placed on OxyContin-like drugs for life.

The brain makes its own opioid-like substances to block pain, and the manufactured drugs supplement them by attaching to the brain's own opioid receptors. As long as scientists believed that the brain couldn't change, they never anticipated that bombarding the opioid receptors with opioid medications could do harm. However, says Moskowitz, "once we saturate all our God-given receptors, the brain produces new ones." It adapts to being inundated by long-term opioids by becoming less sensitive to them – and thus patients become more sensitive to pain, and more dependent on their drugs, which can make their chronic pain worse.

Once he made his discoveries, he slowly began to wean many patients from their long-term opioids. A key to success was to lower the dose very slowly, thereby giving the neuroplastic brain

the time it needed to adapt to being without drugs, so the patient wouldn't experience any "breakthrough pain". Tapering slowly, down to 50 to 80 per cent of the original dose, could break the cycle of opioid-induced pain sensitivity.

Moskowitz, Sandin and others were restored by understanding how to use competitive plasticity. Many clinicians would, at that point, have focused the rest of their career on teaching visualisation, because so many patients responded to it. But not all did, and that left Moskowitz dissatisfied. Perhaps some needed approaches other than visualisation to compete with pain.

He was helped by Marla Golden, an emergency physician who specialises in chronic pain, whom he met in 2008. Golden also trained in osteopathy, a hands-on practice using touch, sound and vibration. They have pioneered a true mind-brain-body approach to chronic pain in which patients receive simultaneous neuroplastic input from the mind and body to influence the brain. Golden's hands are so sensitive, Moskowitz says, she sometimes seems to "see" with them, finding problem areas and rapid ways to ease chronic pain. I have followed a number of their patients and seen remarkable progress.

As for Jan Sandin, who was cured in 2009, I returned to visit her in 2011. Her chronic pain syndrome had not returned and she looked younger than she had in 2009. Today, she continues to be pain-free, knowing that her relentless application of her mind in those days – when she was confined to a chair, immobilised, depressed and suicidal – was the best investment of mental energy she ever made.

From The Brain's Way of Healing by Norman Doidge (Scribe, $35)