

Brain Changes Associated With Chronic Pain May Be Reversible

Chronic pain has long been associated with changes in the structure of the brain, raising questions about whether prolonged pain can cause permanent damage. A large new study suggests that many of these changes may be reversible when chronic pain resolves.

Researchers from several US universities analyzed data from 35,052 participants in the UK Biobank, including 18,597 women (53%). Participants completed pain assessments approximately nine years apart and underwent brain MRI scans at the second assessment. Chronic pain was defined as pain lasting more than three months. The researchers divided participants into four groups based on their pain histories:

- **No chronic pain:** 14,150 participants who reported no chronic pain at either assessment.
- **New chronic pain:** 4,656 participants who reported chronic pain only at the second assessment.
- **Persistent chronic pain:** 10,532 participants who reported chronic pain at both assessments.
- **Resolved chronic pain:** 5,716 participants who reported chronic pain at the first assessment but not the second.

The researchers then compared measurements of gray matter, the brain tissue involved in processing information, across the four groups. They examined the surface area and thickness of the brain's outer layer, known as the cortex, as well as the volume of several deeper brain structures.

People with new chronic pain had reduced cortical surface area in 26 brain regions compared with people without chronic pain. Those with persistent chronic pain had more widespread differences, involving 88 regions. Changes were found in areas associated with sensation, movement, and higher-level processing of pain.

The most interesting results involved participants whose chronic pain had resolved. In this group, only one of the 88 regions that differed in people with persistent pain continued to show a statistically significant reduction in cortical surface area compared with pain-free controls. Other measures of brain structure also showed evidence of recovery, although some differences remained.

These findings support the concept of neuroplasticity, the brain's ability to change and reorganize in response to experience. Rather than representing permanent damage, many of the structural differences associated with chronic pain may reflect adaptations that can diminish when pain resolves.

However, there are important limitations. Because MRI scans were obtained at only one time point, the study did not directly demonstrate that individual patients' brains changed as their pain developed or resolved. In addition, the differences in brain structure were generally small, and the researchers could not determine whether the changes contributed to chronic pain or resulted from it. The study also did not evaluate specific pain treatments.

For people with Chiari malformation, chronic pain can be a major concern, including pain that persists after decompression surgery. Although this study did not specifically investigate Chiari, it provides a broader perspective on the relationship between chronic pain and the brain. Its findings suggest that many pain-associated brain changes are not necessarily permanent, while reinforcing the importance of finding effective ways to treat persistent pain.

Source: Zorina-Lichtenwalter K, et al. Brain gray matter changes across chronic pain trajectories: MRI evidence from 35,000 individuals. PAIN. Published online October 2, 2026. DOI: 10.1097/j.pain.0000000000004125.

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