Crippled arm leads to changes in brain

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The researchers think the finding may have relevance for 'constraint-induced therapy' which is often used in stroke victims *(Source: Nikki Lowry/iStockphoto)*

Plastic connections Swiss scientists have shown that breaking your arm can affect your brain. It appears that immobilising the broken limb reduces the thickness of part of the cerebral cortex.

The study highlights how rapidly the brain can adapt in response to environmental changes, a phenomenon known as brain 'plasticity'.

Professor Lutz Jäncke and colleagues at the University of Zurich (http://www.uzh.ch/index_en.html) in Switzerland report their findings in the journal *Neurology* *(http://www.neurology.org/content/78/3/182.abstract)* this week.

"This is the first human study to look at immobilised arms and actually see the plastic effect on the brain", says Jäncke.

Jäncke and his team investigated ten right-handed people who had broken their right arms. He scanned their brains using an MRI scanner within 48 hours of their accidents, just before their arms were immobilised by putting them in a sling or plaster cast.

Two other measurements were made at this stage: a fibre tract in the brain that sends commands to the arm was measured and the dexterity of their left hand assessed. Being right-handed, they would normally not use their left hand extensively.

The measurements were repeated about 16 days later, while their right arms were still immobilised.

The motor cortex on the left side of the brain controls the right arm, and the team found that its thickness had decreased significantly in response to the arm's lack of use. They also found thinning in the fibre tract.

"What we have found so far from studies on the plasticity of the brain is that we need to use it or lose it", says Jäncke.

As one might expect, left-hand dexterity also increased as patients got better at using their left hands for everyday tasks like eating and brushing their teeth. There were increases in the thickness of the brain cortex controlling the left hand too - but this was primarily in the pre-motor cortex, rather than the motor cortex itself.

"The pre-motor cortex is especially involved in doing something complicated", says Jäncke. "It installs and erects new motor programs."

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Implications for stroke treatment

Jäncke thinks his findings may have relevance for 'constraint-induced therapy' which is often used in stroke victims. In this therapy, when a stroke has affected one arm of a patient, the remaining (good) arm is immobilised using a sling, forcing the patient to use and improve their stroke-affected limb. Jäncke's work suggests that the motor cortex controlling the good arm will thin with disuse.

Dr Penelope McNulty of Neuroscience Research Australia (http://www.neura.edu.au/) says, "This is a nice demonstration. It just shows how dynamic the brain remodelling really can be. As far as I'm aware, this is one of the first studies to show that inactivity produces plasticity in the human brain."

As far as the implications for constraint-induced therapy are concerned, McNulty thinks there is unlikely to be a problem. "Nowadays we don't immobilise the arm in a sling. For safety reasons patients wear a mitt which can be taken on and off." This means that the arm is not completely immobile.

The next step for Jäncke's group is to see how long lasting the brain thinning is.

"We want to get all the subjects to come back", he says. Now that their broken arms are fixed and they are out of their casts, he expects their brains will be back to normal.

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