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Research shows stem cells regrow damaged bones

Technology could reduce healing time for patients whose fractures can't heal on their own.

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CHAPEL HILL, N.C. -- Medical researchers have made strides in the technology to rebuild damaged bone tissue using stem cells, doctors at the University of North Carolina announced this week.

Researchers derived the stem cells from bone marrow samples, using them to repair broken bones in mice. Now the work is poised to move to humans.

"What we have done here is shown a reason to move to a real clinical trial," said Dr. Anna Spagnoli, who led the team.

Twenty percent of broken bones cannot heal on their own, affecting 600,000 people in the United States each year. A significant number of these cases involve women who suffer from osteoporosis, but the problem is not restricted to older patients. Children diagnosed with a condition known as brittle bone disease can suffer from multiple, painful fractures over their lifetimes.

Stem cell technology could significantly reduce healing time, Spagnoli said. The development also could help trauma patients.

The UNC development comes as scientists worldwide are leaning more on stem cells. In Germany, scientists treated a man who had lost his jaw by giving him a prosthetic laced with stem cells, the journal Lancet reported in 2004. The prosthetic served as a mold for a new jawbone to grow from the cells.

"These cases are very promising, but one case does not make science," Spagnoli said.

The UNC study coaxed the stem cells to become cartilage using a compound called growth factor.

"The first step in bone healing is to create cartilage as a glue," Spagnoli said. "Without that glue, the bone will not be able to heal."

But just creating cartilage is not enough to fix a broken bone. The cartilage glue needs to form at the site of the fracture for it to heal.

"Nobody knew if the stem cells would even go to the place where they were needed -- the fracture," Spagnoli said.

To address this, Spagnoli's team injected healthy mice with the same substance that makes fireflies glow. When they extracted bone marrow from these glow-in-the-dark mice, they got glow-in-the-dark stem cells, which the researchers then injected into ordinary mice with bone fractures.

"We put the mice in a dark box, and we saw the light, and we could see it was going to the right place," Spagnoli said. But how do the stem cells know where to go when they are injected into the body? Spagnoli's team noticed that a certain molecule in the stem cells was the key to homing in on the fracture. The molecule, called CXR4, was responding to a chemical signal sent out by the damaged bone.

"It's like the fracture is sending out a message that says 'please come here, " Spagnoli said. there is help needed here,'

Elizabeth Loboa, an assistant professor of biomedical engineering at N.C. State University who studies the effect of mechanical stress on stem cell tissue generation, said she was intrigued by the UNC-CH results.

"You always have the challenge of going from the animal to the human model, depending on the research," said Loboa, who was not involved in Spagnoli's research. "But this sounds very promising. There's a lot of exciting research going on in North Carolina on tissue engineering right now, especially in the Triangle area."