

Scientists set their sights on first whole-eye transplant

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Nerve regeneration is challenge, but real headway is being made in the field, researchers say.

(HealthDay)—In the world of 21st-century medicine, organ transplantation is nothing new.

The first kidney transplant took place in 1950, followed by the first liver transplant in 1963 and the first human heart transplant in 1967. By 2010, doctors had even managed the transplantation of a patient's entire face.

One major organ still eludes the transplant surgeon, however: the entire human [eye](#). But if one team of U.S. scientists has its way, that dream may become reality, too.

"Until recently, eye transplants have been considered science fiction,"

said Dr. Vijay Gorantla, an associate professor of surgery in the department of plastic surgery at the University of Pittsburgh. "People said it was crazy, bonkers."

However, "with what we now know about transplantation and, more importantly, nerve regeneration, we are finally at the point where we can have real confidence that this is something that actually can be pursued and eventually achieved," he said.

Whole-eye transplants would be of enormous benefit for many of the 180 million blind or severely visually disabled people around the world, including nearly 3.5 million Americans, experts say.

"Macular degeneration and glaucoma are the root cause of much the world's visual impairment," explained Dr. Jeffrey Goldberg, director of research at the Shiley Eye Center at University of California, San Diego.

Certainly, there are therapies that often help restore sight in these cases, or in people who've lost sight through injury. "But for some people the eye is too damaged or too far gone," Goldberg said. "For patients with a devastating eye injury where there's no remaining connective optic nerve—or perhaps not even an eyeball in their eye socket—restorative approaches are simply not enough."

In these cases, transplantation of a healthy donor eye would be a solution. "It's a scientific long shot," Goldberg said. "But it's a very attractive long shot."

So, Gorantla and Goldberg—and their two universities—have teamed up to push whole-eye transplantation from theory into practice. The effort is funded by the U.S. Department of Defense.

One of the biggest challenges is how to regenerate and regrow delicate

optical nerves.

"The chief problem," Goldberg explained, "is that when you switch out an eyeball you have to completely cut all connections between the optic nerve and the eye. So then you need to reconnect the donor eye's nerve fibers back to the recipient's brain in order to achieve vision restoration. But we know that once you make that cut, the nerve fibers just do not regrow on their own. That doesn't happen automatically."

"That's what distinguishes an eye transplant from most other types of transplants," Gorantla added. In other organ transplants, the chief hurdle is simply reconnecting a proper blood supply. "For example, if you get the plumbing connected and the blood going, then a transplanted heart will beat in the recipient patient immediately," Gorantla said.

"But an eye transplant actually has more parallels with a hand or face transplant," he said. The eye may appear healthy because of a renewed blood supply, but without reconnecting the optic nerve, "there's no motor activity and no sensation or eyesight," Gorantla said. "The result is functionless and lifeless."

Luckily, various laboratories "have made significant progress" in fostering the long distance regrowth of [nerve fibers](#), Goldberg said. "In animals with [optic nerve](#) injury or degeneration we've even started to see fibers regrow all the way back to the brain," he noted.

The regeneration of cells called retinal ganglia cells—key to achieving discernible vision—has also met with recent success in a lab setting. "The recent indications that such nerve generation *is* actually possible raises optimism that eye transplantation can really be viable," said Gorantla, who is also administrative medical director of the Pittsburgh Reconstructive Transplant Program at the University of Pittsburgh Medical Center.

Still, any first attempt at a whole-eye [transplant](#) in humans remains years away, the experts cautioned.

"There's a significant amount of work to be done before anything like this can be tried on patients," Goldberg said. "But when you survey people, losing one's vision comes in just a smidge below death as a thing we fear. There are few things people value more than their vision, so while it may be audacious, it's worth the effort."

More information: For more information on eye disease and blindness [American Academy of Ophthalmology](#).

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