Eye surgeon uses stem cells to repair damaged corneas

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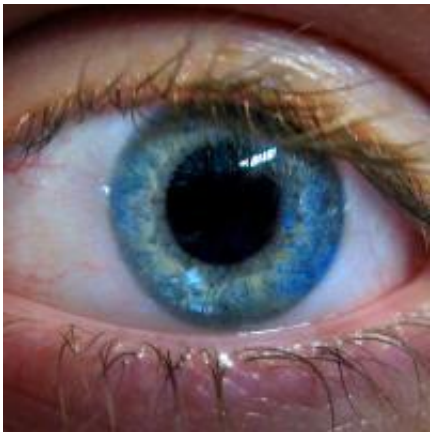

In Hyderabad, India, Sayan Basu is using stem cells in a pilot project to restore the eyesight of patients with damaged corneas. If proven successful, the procedure could mean that Indian citizens can avoid long waiting lists for cornea transplants and avoid eye surgery altogether.

But perhaps even more notable, Basu, an eye surgeon, is using a stem-cell procedure first described only last month in the journal *Science Translational Medicine*, based on research he helped complete at the University of Pittsburgh School of Medicine. It is rare for research on mice is quickly applied to treat people.

In the Pitt study, stem cells were collected from tiny biopsies in the

limbus, an area of the eye between the cornea and sclera - the white part - of the undamaged eye in the mice. Those cells were replicated in a laboratory, and then incorporated into a gel of fibrin, a protein found in blood clots and commonly used as a surgical adhesive. The gel was spread on the damaged cornea, regenerating a clear window to the eye within four weeks.

The small pilot study is showing promise in repairing scarred corneas in 10 patients, each with scarring in one eye, Basu said in emails from India. Results won't be available until spring.

"Now based on the results of the recent work at the (Pitt) lab we have initiated a trial using limbus-derived stem cells to treat corneal scars," he said. "The uniqueness of this trial is that we are using cells from the patients' own eyes to treat the cause of blindness."

He was lead author of the Pitt study led by James L. Funderburgh, professor of ophthalmology at Pitt and associate director of the Louis J. Fox Center for Vision Restoration of the University of Pittsburgh Medical Center.

For more than a century, cornea transplants have been used to repair damaged and diseased corneas. But for people worldwide, the wait for donor corneas can be long. Once one is available, surgery is necessary to remove the damaged cornea or corneal layer and replace it with a healthy one. The patient who receives a cornea transplant then faces long post-surgical follow-up care, a lifelong regimen of medications and a small chance of rejection.

The stem-cell procedure is nonsurgical and requires only a mild anesthetic. It also greatly reduces any chance of rejection.

The 80 eye banks in the United States recover, prepare and provide

enough donor corneas to meet national demand, with 48,229 transplants performed in 2013. An additional 21,000 corneas the bank collected were sent to nations unable to meet demand, according to the Eye Bank Association of America. One million Americans, ranging from 9 days old to more than 100, have had their eyesight restored with transplants since 1961. Such procedures have a 95 to 99 percent success rate.

Kevin Corcoran, association president and chief executive, said Pitt's stem-cell procedure is a step forward in stem-cell research. At first, he said, the procedure will be more beneficial in nations such as India where patients have long waits for donor corneas.

In the United States, the stem-cell procedure faces obstacles. It must be proven successful in human clinical trials, receive U.S. Food and Drug Administration approval, and be cost effective compared with transplants.

Basu said 6.8 million people in India have vision that is less than 20/200 in at least one eye because of cornea problems and diseases. That means they can't even see the giant "E" at the top of the Snellen Eye Chart. One million people in India have cornea problems in both eyes.

"The burden of corneal disease in our country is reflected by the fact that 90 percent of the global cases of ocular trauma and corneal ulceration leading to corneal blindness occur in developing countries," he said. Among the top causes in India are vitamin A deficiency, infections and injury.

While 200,000 people with corneal blindness in India would benefit from transplants, there are enough corneas available for only 10,000 to 20,000 people each year.

Basu said he received approval to conduct the pilot study through

India's Institutional Review Board and Institutional Stem Cell Committee. Since receiving the approvals, he has been performing stem-cell procedures on people at the L V Prasad Eye Institute in Hyderabad in south-central India.

He collaborated on the study with Funderburgh for a full year, ending in July 2013. Success in the mouse study boosted excitement that it could work just as well in humans. The study results exceeded expectations.

"Even at the microscopic level, we couldn't tell the difference between the tissues that were treated with stem cells and undamaged cornea," said Funderburgh, who has a Ph.D. in physiological chemistry. "We were also excited to see that the stem cells appeared to induce healing beyond the immediate vicinity of where they were placed. That suggests the cells are producing factors that promote regeneration, not just replacing lost tissue."