

Could your contact lenses track, treat your diabetes?

April 27 2020, by Serena Gordon



Smart contact lenses fabricated on the mold. Credit: Sei Kwang Hahn, Geon-Hui Lee, Su-Kyoung Kim

Contact lenses may someday do more than correct poor vision, with new, preliminary research in animals suggesting they could also monitor your diabetes and deliver medications.

The new lenses were designed to check [blood sugar levels](#) and to deliver drugs to the eye, possibly for the eye disease related to diabetes called diabetic retinopathy. After trying them out on rabbits, scientists found the new lenses worked on both counts.

It may sound like [science fiction](#), but the researchers noted there is already a [contact lens](#) that's been approved by the U.S. Food and Drug Administration for measuring the pressure in the eye when worn overnight. Levels of eye pressure are important to know for people with the eye disease glaucoma.

"Among various wearable devices, a [smart contact lens](#) is especially promising for health care applications because it can be used as an excellent interface between the [human body](#) and an electronic device," said senior study author Sei Kwang Hahn. He's a professor at Pohang University of Science and Technology in South Korea, and a visiting professor at Stanford University in California.

Hahn said this is the first study to show a combination of blood sugar sensing and [drug delivery technology](#) in a contact lens. However, what works well in animals doesn't always work well in humans.

The smart contact lens contains ultrathin, flexible electrical circuits and a microcontroller chip. It's currently about 0.2 millimeters (mm) thick, and Hahn said the researchers hope to reduce that to 0.15 mm. Hahn said the current lens is already thinner than the FDA-approved lenses that measure eye pressure.

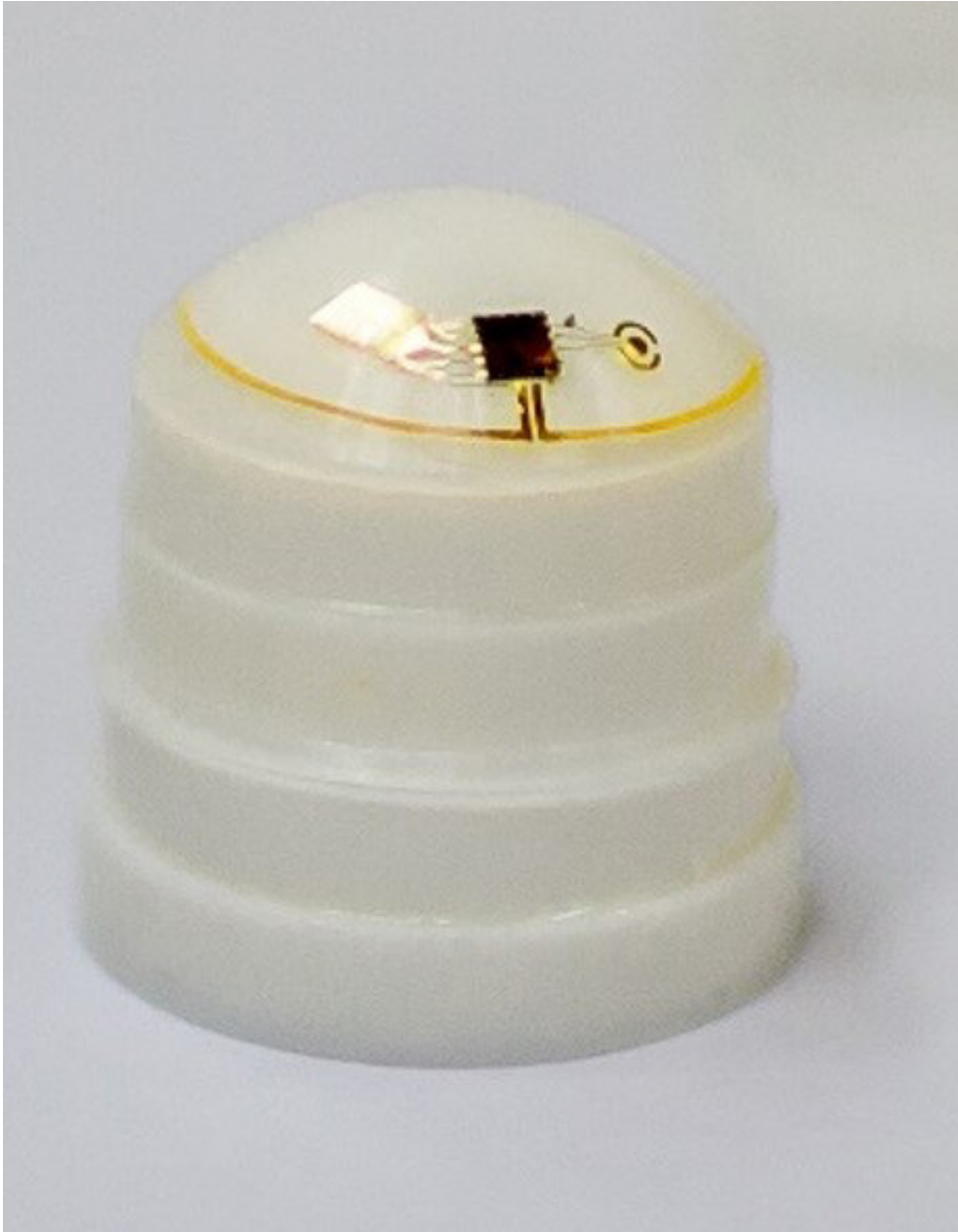
Dr. John Hovanesian, a clinical spokesperson for the American

Academy of Ophthalmology, said the lens would likely be comfortable enough for people to wear, but it is significantly thicker than a standard contact lens.

Chemicals on the contact lens bind with glucose and trigger an electrical current change that is proportional to the amount of glucose. The electric current is also used to dissolve gold membranes that seal drug reservoirs, triggering the release of a dose of the drug, Hahn explained.

"This study is ambitious and bold. They're trying a moonshot. But, I would be cautious in my expectations," Hovanesian said.

"One of the biggest challenges to monitoring glucose in the eye with contacts is that you have to be cautious about the use of [contact lenses](#) in people with diabetes because infections and injuries can become more serious," he noted.



A smart contact lens on the mold for diabetes diagnosis and diabetic retinopathy therapy. Credit: Sei Kwang Hahn, Geon-Hui Lee, Su-Kyoung Kim

Still, he added, "there are a lot of exciting possibilities with this."

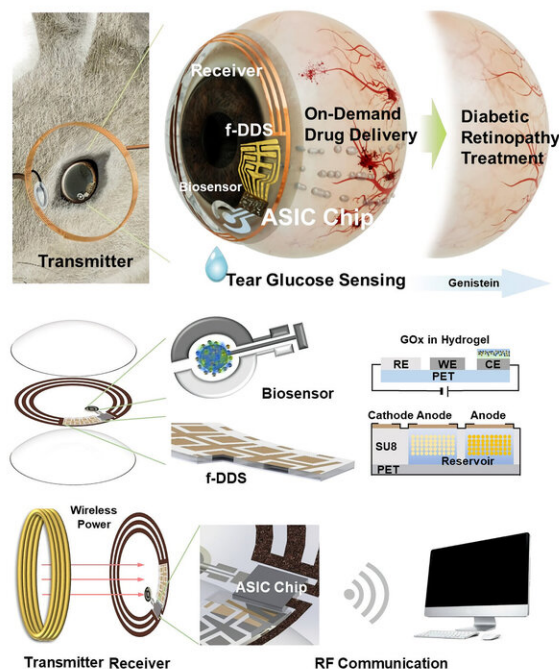
One big possibility is the potential to deliver drugs that are commonly

used to treat diabetic retinopathy via the contact [lens](#). Those drugs are currently delivered via injections to the eye.

In this study, the researchers used a drug called genistein, which isn't approved by the FDA in the United States.

Sanjoy Dutta, vice president of research at JDRF (formerly the Juvenile Diabetes Research Foundation), said, "They've done good preliminary preclinical work. Looking forward, we need to know how accurate is tear glucose compared to blood glucose. And, the Achilles' heel may be in connecting the two components (glucose sensing and drug delivery)."

Dutta said that there are a number of research projects looking at ways to measure glucose levels without having to draw blood or wear a continuous glucose monitor. Some other options that have been tried or are being tried are monitoring through sweat, tears, saliva and infrared light.



Smart contact lens for diabetes monitoring and diabetic retinopathy therapy.
Credit: Sei Kwang Hahn, Geon-Hui Lee, Su-Kyoung Kim

"Any non-blood-based glucose monitoring is very challenging," Dutta noted.

Hahn and his team are hoping to begin human clinical trials in 2021. If those go well, their hope is to have a commercial product as soon as 2023.

The findings were published April 24 in the journal *Science Advances*.

More information: D.H. Keum et al., "Wireless smart contact lens for diabetic diagnosis and therapy," *Science Advances* (2020). [DOI: 10.1126/sciadv.aba3252](https://doi.org/10.1126/sciadv.aba3252)

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