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Just like the pancreas, new device monitors glucose and delivers insulin automatically

The Medtronic MiniMed 670G, which the FDA recently approved for type 1 diabetics ages 14 and older. It's due to go on the market in the spring; it monitors glucose levels and administers insulin automatically.

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Type 1 diabetics are one step closer to living their lives without worrying about how much insulin they need to take. In September, the FDA approved a new device that monitors glucose levels and automatically administers insulin.

The Medtronic MiniMed 670G, which will be available in the spring for patients 14 and older, is a hybrid closed-looped system, which means while it administers a background, or basal, insulin dose, patients will still need to add insulin before they eat.

"The exciting thing about this is it's bringing the insulin pump and continuous glucose monitor together, so they can talk to one another," said Dr. Joshua Tarkoff, a pediatric endocrinologist at Nicklaus Children's Hospital in Miami. "This is the first step to the goal of one day having a machine that does everything, a machine that can measure blood sugar and can deliver the insulin as needed."

The classical way to treat type 1 diabetes is with insulin shots. "A long-acting insulin keeps you alive. A different kind of insulin is given for food and high blood sugar," Tarkoff said. "You have to decide on your own — I'm eating X amount of carbohydrates, therefore I give Y units of insulin. Or if your blood sugar is X amount of points above where it should be, you give extra insulin. It requires that calculation."

Another way to treat type 1 diabetes is with an insulin pump, a small electronic device worn close to the body that delivers insulin through a small catheter under the skin.

An insulin pump "always gives off a little bit of the long-acting insulin, a small amount over a long time, and then when you eat, you count up the carbs and administer the appropriate amount of insulin," Tarkoff said. "It lessens the amount of shots."

The new Medtronic device's glucose monitor checks your blood sugar every five minutes, and reacts to that, he said. "For instance, your blood sugar might start rising overnight, and the device can react to that by giving a little more insulin. Or conversely, if your blood sugar is lowering, it can give less," he said. "It can help with parental concerns about monitoring glucose overnight, because the device takes care of that."

The new device has a continuous glucose monitor attached to a catheter under your skin, plus an insulin pump with a different catheter.

"What's unique is that these two things are able to link in one place," Tarkoff said.

While the device has been approved for patients 14 and older, there are ongoing clinical studies for use in patients ages 7 to 13.

"This was recently approved based on a study that included 123 patients, so it's important to put it in perspective that once more people start using this, we could see more benefits and complications," said Dr. Ernesto Bernal-Mizrachi, chief of the division of endocrinology, diabetes and metabolism at UHealth, University of Miami Health System. "But so far, this type of device is a big improvement in the way we treat type 1 diabetics, and it will probably be a big game changer in the way we treat some of our patients."

The device does require training, and its glucose sensor must be calibrated several times a day, so it requires some work by the patient, Bernal-Mizrachi said.

"This is most likely for patients who are already on a pump and who want to try and get better control," he said.

People don't realize how difficult it is to manage diabetes, especially for younger kids, Tarkoff said. "There's not many illnesses that we put the onus so much on the families," he said. "If you have a strep throat, you take this amount of antibiotic for this long. Someone with diabetes has to make dosing decisions multiple times a day without a physician."

Young children are very sensitive to small amounts of insulin, which can cause huge swings, he said.

Still, insulin pumps are not for everyone. "There are plenty of people who are on the shots and the families say, 'This works for us. My kid's in control. It's working for our lifestyle.'"

Bernal-Mizrachi said the Diabetes Research Institute at UHealth is researching other modes of treatment for type 1 diabetes, including islet transplantation, an experimental therapy it has been studying for 15 years.

Islets are clusters of cells in the pancreas that make insulin. In islet transplantation, islets from a donor are implanted into a diabetic. "The way this was done in the past was infusing islets into the liver, where the islets would produce the insulin that the patient needs," Bernal-Mizrachi said. "Some of those patients were able to maintain glucose control for a long time."

There are some drawbacks. Medication to suppress the immune system is usually required so islets are not rejected, and some medications have side effects. More than one islet transplantation may be needed, so it may not be a one-time process.

"We are still studying where the best sites are to have the longest response for the islets," Bernal-Mizrachi said. "We are now studying a site in the abdomen, as opposed to the liver, and hoping that the islets will function better in that location."

The hope is always to develop better therapies, he said. "If we can design new therapies that could induce the production of insulin or regenerate the cells that produce insulin, those

probably will be, at some point, better approaches," Bernal-Mizrachi said. "But as far as what we have now, these are incredible tools that can be used to help the life of patients with type 1 diabetes. This is a big improvement."

There are other companies, not far behind Medtronic, that are developing even better devices, Tarkoff said.

"The future is incredibly bright for technology and diabetes and making the lives of kids with type 1 diabetes a lot less stressful and a lot more normal," he said. "The eventual goal is, you just live your life. We're not quite there yet, but this is a great first step."