

NOT QUITE AN ARTIFICIAL PANCREAS

Insulin Pumps and Glucose Sensor Devices

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If people with diabetes can keep their blood glucose levels close to normal, their chance of living a life free of the complications of diabetes increases significantly. Although not for everybody, the insulin pump currently offers the best technology we have to accomplish precise control over the amounts of insulin delivered.

State-of-the-Art Pumps

Insulin pumps are mainly used by people with type 1 diabetes—that is, those who cannot produce their own insulin. Insulin is necessary to get glucose into the body's

cells where it is needed for energy. The pump eliminates the need for individuals to give themselves multiple injections of insulin throughout the day. About the size of a pager, the pump is worn next to the body, delivering a continuous stream of insulin over 24 hours via a thin tube inserted into the body.

Although the user still has to take frequent blood samples to measure blood glucose levels, the state-of-the-art “smart” pump features computer software that, based on information the user inputs, calculates how much insulin is needed to regulate blood glucose and then releases it. Users can also program an additional booster dose of insulin when needed, such as before a meal.

We've found that the plummeting of blood glucose levels is far less likely to occur with pump usage. In addition, people who use the pump and are trying to lose weight are more successful because they can adjust their

insulin dosage rather than take in extra snacks to compensate for the increased need for glucose during physical activity.

Currently there are about 200,000 pump users in the United States. Children, even as young as toddlers, now use them successfully. Many people with diabetes find that pumps give them more flexibility in their daily lives. However, users need to be motivated. Learning how to use the pump properly and safely, and how to troubleshoot problems, is necessary. For example, if the tube gets clogged and insulin delivery is interrupted, blood glucose levels can go up rapidly if the user doesn't know how to manage this problem.

On the Horizon

We expect to see more pump users in the future as technological advances create even more convenience. For example, in the next few years look for “real-time continuous glucose sensors” to come on the market. These sensors, for people with type 1 diabetes and type 2 diabetes, will also be worn on the body, continuously monitoring blood glucose levels, and will eliminate the need for taking blood samples several times a day to measure glucose levels manually.

The use of these glucose sensors will be as significant as when we moved from measuring glucose in the urine to measuring it in the blood. That advancement enabled the introduction of intensive (physiologic) insulin therapy, which has reduced the medical complications of diabetes. The glucose sensor, paired with a pump and eventually “housed” together in one unit, will be another giant step toward achieving control that approximates what the normal pancreas would do. It will, however, take several years for manufacturers to refine glucose sensors, reducing their size and increasing accuracy and ease of use.

There are other new technologies under development, such as pumps that are surgically implanted under the skin, and alternative ways to measure blood glucose using radio, energy or light waves instead of pricking the finger for blood samples.

The future promises greater convenience and freedom and more precise control for people with diabetes.

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Diabetes has never slowed down Major League Baseball pitcher Jason Johnson, whose insulin pump is a constant companion both on the mound and while working out.