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Editorial

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Diabetics say good bye to painful insulin injections

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Editorial

Diabetes Mellitus affects more than 387million people worldwide, and it is expected to increase very sharply to 592 million by the year 2035. Patients with diabetes especially with type 1 and advanced type 2diabetes try to maintain their blood sugar levels as normal with regular finger pricks and repeated insulin shots. This type of management is considered painful and imprecise.

Painful insulin injections could become a thing of the past for those diabetic patients all over the world, thanks to new inventions in insulin delivery systems. Previously Inhalable insulin was introduced in the markets of United States as well as several markets of the world. It was considered as a new method of delivering insulin to the body. Afrezza, a new inhalable insulin product was approved for sale in the United States by the FDA in June of 2014.

The first such product to be marketed was Exuberant, a powdered form of recombinant human insulin, delivered through an inhaler into the lungs where it is absorbed. Once it has been absorbed, it begins working within the body over the next few hours. Type 1 diabetics still need to take longer acting basal insulin by injection.

A systematic review concluded that inhaled insulin "appears to be as effective, but no better than injected short-acting insulin. But the cost is so much more that it is unlikely to be cost-effective. The inventions did not stop there, following insulin inhalers, the first "smart insulin patch was created by researchers at North Carolina State University and the University of North Carolina at Chapel Hill. Though it has thus far only been tested in a mouse model of type 1 diabetes. According to the paper published in the *Proceedings of the National Academy of Sciences*. The painless insulin patch has been shown to detect increases in blood sugar levels and secrete doses of insulin into the bloodstream whenever needed. The patch was able to regulate the insulin levels of diabetic mice for nine hours straight.

The new 'smart patch' lined with painless micro needles full of insulin can be placed anywhere on the body and senses when blood sugar levels get too high and rapidly discharges the right amount of insulin into the bloodstream. The thin square 4cm patch no bigger than a penny in size, features more than a 100 of these eyelash-sized micro needles, and not only they contain enough insulin to provide the same dosage as a single injection, but they also contain glucose-sensing enzymes that can identify when blood-sugar levels are too high and release the insulin into the blood stream.

The smart insulin patch works by mimicking the body's own system for generating insulin - the beta cells of the pancreas - which produce and store insulin in tiny sacs or vesicles. They also sense changes in blood sugar and signal insulin to be released from the vesicles as needed.

The team of the researchers constructed artificial vesicles that perform in a similar way out of two natural materials - Hyaluronic acid (HA) used in cosmetics and 2-Nitroimidazole (NI), an organic compound used in diagnostics.

These materials, Hyaluronic acid and 2-nitroimidazole, were combined to make a new type of molecule, one end of which loves water - hydrophilic - and the other is repelled by it - hydrophobic. When great numbers of these molecules are mixed together, they automatically assemble into a vesicle structure, with the hydrophobic ends pointing inward and the hydrophilic ends pointing outward. The researchers inserted insulin and glucose-sensing enzymes into these vesicles.

The glucose was then converted into gluconic acid by the enzymes within, and the resulting lack of oxygen turned the hydrophobic 2-nitroimidazole molecules hydrophilic, which destroyed the structure of the vesicles and released the insulin. These "micro needles" are packed with microscopic storage units for insulin and glucose-sensing enzymes that rapidly release their cargo when blood sugar levels get too high.

In lab experiments, when blood sugar levels increased, the excess glucose crowded into the artificial vesicles. The enzymes then converted the glucose into gluconic acid, consuming oxygen all the while. The resulting lack of oxygen or "hypoxia" made the hydrophobic NI molecules turn hydrophilic, causing the vesicles to rapidly fall apart and send insulin into the bloodstream.

The researchers tested the ability of this approach to control blood sugar levels in a mouse model of type 1 diabetes. They gave one set of mice a standard injection of insulin and measured the blood glucose levels, which dropped down to normal but then they quickly climbed back into the hyperglycemic range. In contrast, when the researchers treated another set of mice with the micro needle patch, they saw that blood glucose levels were brought under control within thirty minutes and stayed that way for several hours.

In addition, the researchers found that they could tune the patch to alter blood glucose levels only within a certain range by varying the dose of enzyme contained within each of the micro needles. They also found that the patch did not pose the hazards that insulin injections do. Injections can send blood sugar plummeting to dangerously low levels when administered too frequently.

It seems very promising for diabetic patients and only the future and the trial of the patch on human will tell us about the effectiveness of such an invention which at the end aims to relief patients from painful insulin shots and to manage Diabetes mellitus in better way.

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Conflict of interest

Author declares that there is no conflict of interest.

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