NEEDLE FREE DIABETA CARE

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***Abstract*: Diabetes self-care is a pain—literally. It brings the constant need to draw blood for glucose testing, the need for daily insulin shots and the heightened risk of infection from all that poking. Continuous glucose monitors and insulin pumps are today's best options for automating most of the complicated daily process of blood sugar management – but they don't completely remove the need for skin pricks and shots. But there's new skin in this game. Echo Therapeutics (Philadelphia, PA) is developing technologies that would replace the poke with a patch. The company is working on a transdermal biosensor that reads blood analytes through the skin without drawing blood. The technology involves a handheld electric-toothbrush-like device that removes just enough top-layer skin cells to put the patient's blood chemistry within signal range of a patch-borne biosensor. The sensor collects one reading per minute and sends the data wirelessly to a remote monitor, triggering audible alarms when levels go out of the patient's optimal range and tracking glucose levels over time.**

***Keywords*: Gluco track, NovioSense, Nano sensor, Spectroscopy**

INTRODUCTION

Diabetes affects over 422 million people worldwide. Diabetics have to test their blood sugar several times a day, usually by pricking their finger with a lancet. This can be uncomfortable and painful for many, which can result in less frequent testing and therefore a poorer control of blood sugar levels.

Several companies are looking for needle-free alternatives that can make the lives of millions easier. Some of them are already available and others still in development. Let’s have a look at them.

GLUCOTRACK

Developed by Integrity Applications in Israel, GlucoTrack can measure blood sugar levels through a combination of ultrasonic, electromagnetic and thermal waves. To provide readout, the sensor is clipped on the ear.

The device is indicated for adults with type 2 diabetes and is currently approved in Europe, where the company has just recently started to commercialize the glucose monitor.

EVERSENSE

Developed by Senseonics, Eversense is a subcutaneous implant that can last for up to 3 months. The device can measure glucose in the interstitial fluid under the skin of the arm by using a polymer that fluoresces in response to the levels of glucose. The data is then sent to a transmitter that displays the glucose levels in real time.

The device recently received FDA approval and the company struck a deal with Roche to distribute the sensor.

GLUCOWISE

Gluco Wise is a sensor under development that could measure glucose levels by just placing it on the earlobe or the skin between the thumb and forefinger. The real-time measurements could then be sent directly to a smart phone app.

By using radio waves to measure glucose levels, the developers believe the device should be more accurate than other wireless glucose monitors. The company behind it, MediWise, run a first trial in healthy volunteers and is now getting ready to test a prototype in diabetics.

NOVIOSENSE

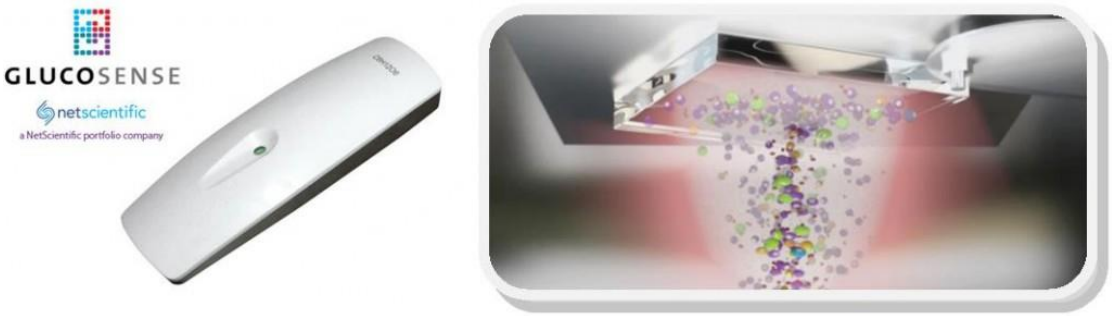
NovioSense is a Dutch startup working on a glucose sensor that is placed under the lower eyelid, from where it can wirelessly send glucose measurements directly to a smartphone. The device consists of a flexible metal coil of just 2cm in length that contains nanosensors inside. In turn, the coil is covered by a protective layer of soft hydrogel.

The coil could measure minute-to-minute changes in the glucose levels of tear fluid by using the same enzyme technology on which conventional glucose strip tests are based. The device has been tested in animals and the company is now planning clinical trials.

GLUCOSENSE

GlucoSense is a spin-out of the University of Leeds, UK, that is developing a laser technology to monitor glucose levels. The device is made of a Nano-engineered glass that fluoresces when stimulated by a low power laser.

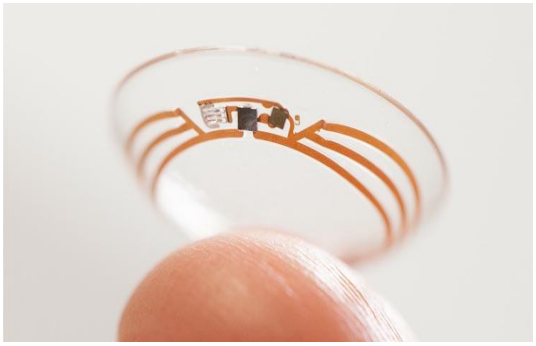
When the glass is in contact with the user's finger skin, the reflected fluorescent signal changes based on the concentration of glucose in their blood, giving a measurement in less than 30 seconds.



Google's smart contact lens

Back in 2014, Google and Novartis' eye care division partnered to develop a smart contact lens that could measure glucose levels. The lens would incorporate a thin microchip to measure glucose and an antenna to send the information to a smart phone.

However, there haven't been any major updates on the project since then and it is not known when the first trials will start. Meanwhile, researchers in South Korea have been developing their own form of a glucose-sensing smart lens, which has been shown to work in animals.



INFRARED BLOOD GLUCOSE TESTING

Use of infrared light has shown some promise as a replacement for blood glucose levels. The Massachusetts Institute of Technology have used Raman spectroscopy. The technique allows near-infrared light to be shined onto the skin of the finger or forearm.

The infrared light penetrates to a small depth, half a millimeter, below the skin's surface and by measuring vibration of chemical bonds within the skin, can take the glucose levels of our interstitial fluid, this fluid lies between the skin and muscle and provides an additional source of glucose for cells.
The level of glucose in interstitial fluid is proportional to the level of glucose in the blood but with a delay of about 10 minutes. So this means that a glucose level reading from interstitial fluid will correspond to your blood sugar level of 10 minutes ago.

CONCLUSION: With so many technologies under development, the future will certainly bring multiple options that patients will be able to choose from. The days of finger pricking are counted.

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