



## Diabetes (A New Era of Glucose Monitoring)

In recent years, survey results showed that 10 million adults in Japan are strongly suspected of having a diabetes, an alarming statistic where diabetes is a national disease. Various drugs are used for treatment; however it is important to know a patient's glucose level in detail before selecting medication / determining effects or giving guidance on medical treatment. The Japan Diabetes Society (JDS) says that not only medical professionals but also patients themselves should understand in detail their own glucose fluctuations, especially those who are taking insulin.

Glucose monitoring technology development started with the advent of urinary sugar test strip in the early 1900s. Now, glucose levels can easily be measured with a simple self-monitoring blood glucose meter. Blood glucose must be measured frequently at appropriate timing to grasp glucose fluctuations in detail. However, self-measurement of blood glucose presented issues including pain due to fingertip pricks and the inability to obtain glucose levels other than measured points in time.

In 2009, a Continuous Glucose Monitoring (CGM) system that continuously measures the glucose concentration in interstitial fluid became available. The CGM captured in detail glucose fluctuations that had been difficult to grasp. Thereafter, the concept of "quality of glucose control" attracted more attention. Treatment to avoid hypoglycemia and minimize glucose fluctuations has been sought. The CGM back then was designed for professional use; medical professionals used it to obtain detailed data and it required specialized knowledge to analyze data. Its specifications did not allow patients to check data in real-time by themselves. Then, a system that allowed patients to check their glucose fluctuations in real-time was marketed, but such functions were accompanied by the insulin pump, and its use was limited to few patients.

In January 2017, a Flash Glucose Monitoring system\* was launched in Japan. It was a system that allowed patients for the first time to check their glucose fluctuations in detail. Unlike other CGM systems, it did not require daily calibration, saving time for healthcare workers and patients alike. It has been clinically adopted as a monitoring system that allows both healthcare professionals and patients to quickly and easily grasp glucose fluctuations. In December 2018, clinical application of real-time CGM\*\* started. This enabled real-time monitoring of glucose for non-insulin pump users. With real-time CGM, patients can check their glucose fluctuations, and be alerted for hypoglycemia or hyperglycemia, thereby allowing them to take early actions against hypoglycemia and hyperglycemia.

These systems make glucose fluctuations visible, enabling strategic treatment planning, medical guidance, and changes in patient behavior. This is expected to bring better glucose control. The waves of digital transformation are also affecting the field of diabetes; as we move into the future, with the expansion of the eco-system and further incorporation of AI, the distance between patients, healthcare professionals and caregivers will be considerably narrowed, and the level of diabetes treatment will be further enhanced.

### \* Flash Glucose Monitoring system

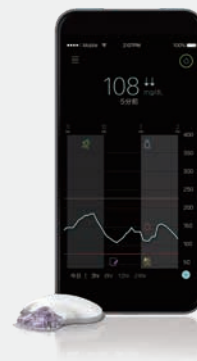
A sensor the size of a 500-yen coin is attached to the back of the upper arm, and the data stored in the sensor is read by scanning it with the reader (main unit). Scanning the sensor, a patient can check and confirm their current glucose level, changes in their glucose level over the preceding 8 hours, and future glucose trends. The sensor can be easily attached, and it measures glucose levels continuously for up to 14 days without the need for calibration that requires the fingertip prick. (A device for medical professionals is also available. A patient wears only the sensor and has no reader, and the medical institution reads the data.)



Flash Glucose Monitoring system

### \*\* Real-time CGM

In real-time CGM, a sensor electrode that is as fine as a hair is placed under the skin and connected to a transmitter for continuous measurement of subcutaneous glucose, and the data is then continuously sent to a monitor. Patients can monitor their own glucose fluctuations in real-time, and can receive alerts should hypoglycemia occur. In 2015, an insulin pump that can display real-time CGM on screen became available in Japan, and in 2018, a pump that automatically suspends and resumes insulin administration based on those CGM values was also rolled out. At the end of 2018, a device was launched, which allowed even patients receiving insulin pen injections to check real-time CGM on a mobile device or on a dedicated monitor, and share data with family members and medical professionals.



Real-time CGM