IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 20, Issue 3 Ser.12 (March. 2021), PP 01-05
www.iosrjournals.org

Continuous Glucose Monitoring In Patients With Type 2 Diabetes: Sharing Of Our Experience.

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Summary
The use of continuous glucose monitoring (CGM) in type 2 diabetic patients provides an answer to some of the deficiencies attributed to usual capillary self-monitoring (CSM). Using CGM adds information on postprandial glucose excursions, nocturnal hypoglycemia, or hyperglycemia previously not detected by SMBG. This makes it easier to tailor treatment regimens to each patient to achieve goals without incurring an increased risk of hypoglycemia and provides a useful tool for patient education and involvement in self-management.

Date of Submission: 14-03-2021 Date of Acceptance: 28-03-2021

I. Introduction:

The development of continuous glucose monitoring technology has created an opportunity to improve glycemic control in patients with type 2 diabetes and thereby reduce complications of diabetes due to its ability to provide increased data not available via CSM

Recent studies have shown that there is a role for its use both professionally and personally in the management of people with T2D.

II. CGM technology:

Most continuous glucose monitors work on the same principle. Only the electrochemical method has proved its value and reliability.

This method is based on a system (electrode or microfiber) [1]: the sensor is composed of a platinum microelectrode covered with a thin layer of glucose oxidase implanted directly in the subcutaneous tissue, measuring glucose concentrations in the interstitial tissue.

The system can therefore be worn by the patient during their usual activities, without modifying their habits,
or their daily ASG; he should only note the various events: treatments, meals, physical activity, hypoglycaemia or signs felt, etc.), hence the terminology used of "glycemic Holter".

The operation of the glucose sensor is based on the principle of concordance between interstitial and blood glucose concentrations (Figure 1). Glucose found in interstitial fluid is measured enzymatically (glucose oxidase which is on the needle of the sensor). Oxidation of glucose by this enzyme results in the formation of gluconic acid and hydrogen peroxide, the latter on contact with the potential, decomposes to form water, oxygen, and a flow of electrons generating an electric current whose intensity is proportional to the quantity of glucose present in the interstitial fluid [1].

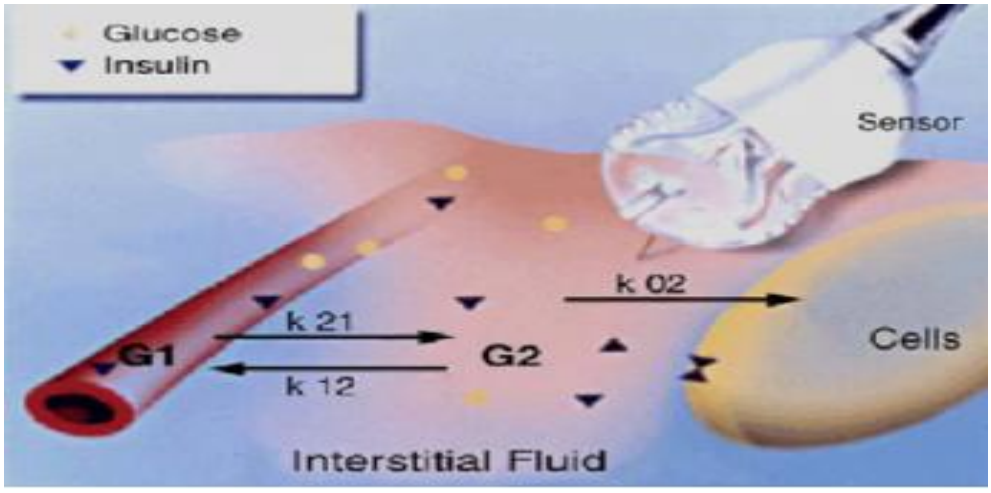


Figure 1: Mechanism of action of glycemic holters (conversion of interstitial glucose to electrical signal) [1].

III. Benefits of continuous glucose monitoring (CGM) [2,3]:

Interstitial glucose can be lagged behind blood sugar for up to 20 minutes when blood sugar changes rapidly. Currently available devices (Ex Poctech 2) require calibration using capillary blood determinations. Each sensor can measure blood glucose continuously for up to 3 to 7 days (for the "Poctech 2" 10 days), giving a reading every 1 to 10 min. CGM devices can provide historical or real-time readings, including "trends". They are also equipped with range alarms and trend alarms that warn the patient of either hypo or impending hyperglycemia [4]. The values vary from 2 to 16% (25–30 mg / dl). Hypoglycemia (<70 mg / dl) is detected with a sensitivity of 60 to 70% and a specificity of 90% but up to 50% of false alarms.

Hyperglycemia (> 250 mg / dl) is detected with a sensitivity of 63% and specificity of 97% but 19% of false alarms. The introduction of trend alarms significantly reduces the incidence of false alarms.

Optimal use of CGM requires that staff and patients be well trained.

To date, CGM systems have not been approved as a replacement for traditional CSM devices. Traditional blood sugar tests should be performed:

(1) To determine the doses of insulin;
(2) When the results of continuous monitoring do not match what the patient is feeling;
(3) Before administering diabetes medication or responding to threshold alarms;
(4) When the CGM system needs to be calibrated to ensure accurate glucose calculation
(5) To assess the response to treatment of hypoglycemia.

IV. Indications for continuous glucose monitoring (CGM):

Current clinical practice uses two forms of CGM [5]:

Professional (retrospective or "hidden") and personal (real time) to assess and / or monitor blood sugar control. Most studies using professional and personal CGM have been done in people with type 1 diabetes (T1D). However, this technology is independent of the type of diabetes and can also be used in people with type 2 diabetes (T2DM). The value of professional CGM in T2DM for physicians, patients and researchers derives from its ability to:

- Discover previously unknown hyper- and hypoglycemia (silent and asymptomatic);
- Measure glycemic control directly rather than by measuring hemoglobin A1C (HbA1C) allowing the observation of a wide variety of parameters which include glycemic variability, percentage of time in, below and above target glucose levels, severity of hypo- and hyperglycemia throughout the day and night;
- Provide actionable information to health care providers from the CGM report;
- Better management of hemodialysis patients; and Effectively analyze the glycemic effects of new interventions, whether pharmaceutical (duration of action, pharmacodynamics, safety and efficacy), devices, or psycho-educational.
- Personal CGM has also been used successfully in a small number of studies as a behavior modification tool in people with T2DM.

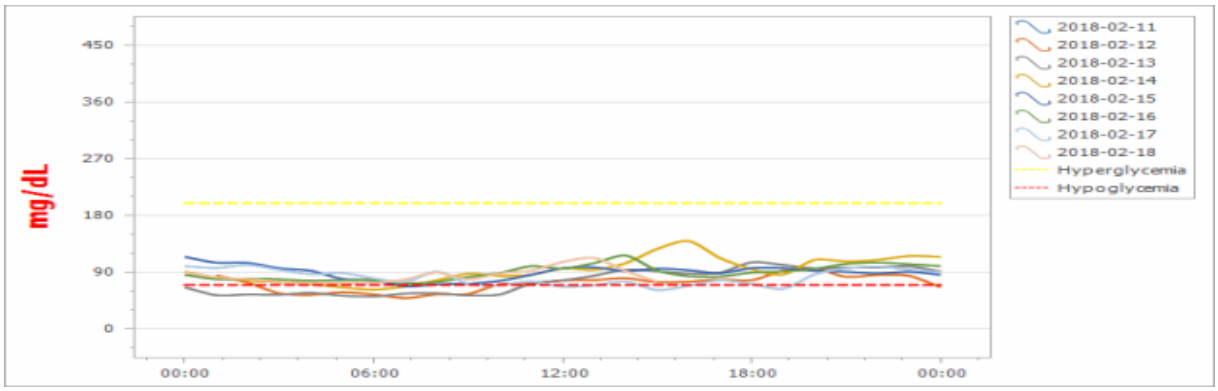
V. Benefits of using CGMS in type 2 diabetic patients: [6]

In 2011, a randomized controlled study showed a decrease in HbA1c of 1.0% (versus 0.5% for the control group) after 12 weeks when using CGMS in patients on oral antidiabetics with or without basal insulin,

but without rapid (meal) insulin. The drop was even greater the longer the CGMS was worn. Subsequently, an extension of the study showed a persistence of this improvement for up to 40 weeks after its end.

FIGURE 2: Glycemic holter of a type 2 diabetic in perfect glycemic control.

Regarding hypoglycemia [7], a recent study showed that 50% of type 2 diabetic patients present with moderate to severe hypoglycemia and that 75% of these hypoglycemia are asymptomatic and therefore unrecognized (hypoglycemia unawareness). These asymptomatic hypoglycaemias were evidenced by the wearing of a CGMS, which allowed a modification of the treatment in 64% of the patients. A high rate of hypoglycaemia (93%) was also reported in the elderly (mean age 75 years) taking oral antidiabetics and / or insulin with an average HbA1c of 9.3%, indicating poor glycemic control. The use of CGMS has shown in a randomized study a decrease in the time spent in hyperglycemia or hypoglycemia and a significant decrease in nocturnal hypoglycemia in type 1 and type 2 diabetic patients treated with insulin. In fact, hypoglycaemia was reduced by 23%, nocturnal hypoglycemia 38% and hyperglycemia above 13.3 mmol / l by 21%. Patients were spending 26% more time within blood sugar standards.



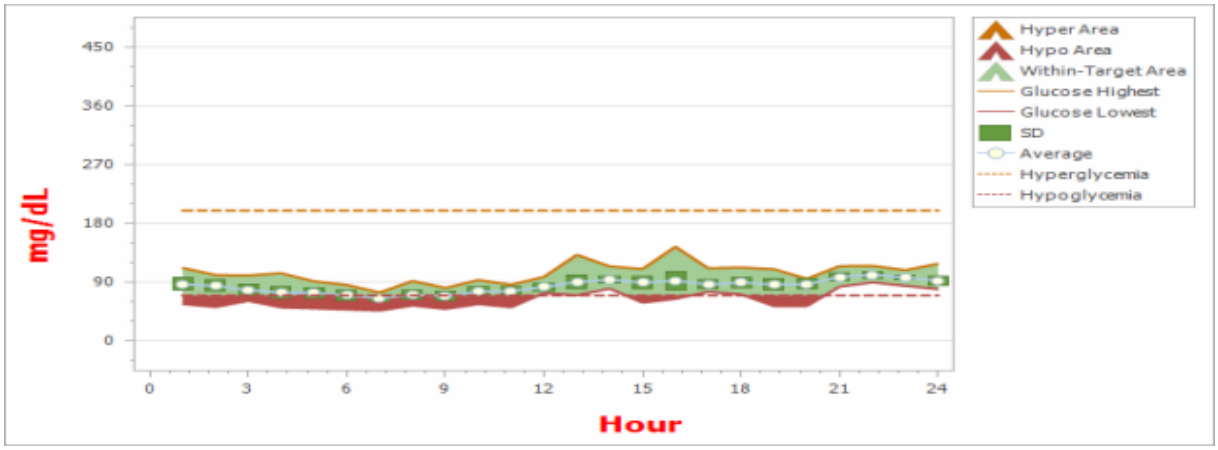


FIGURE 3: Glycemic Holter of a patient with asymptomatic hypoglycaemia with HbA1c in the objectives.

One study also used CGMS to alter patients' physical activity levels [8]. After 8 weeks, the results showed a 1.2% decrease in HbA1c, 0.5 kg / m2 in BMI and an increase in daily physical activity.

The use of CGMS has also been shown to be useful in patients with end-stage renal disease [9], in particular due to the unreliability of HbA1c due to the increased turnover of red blood cells and the use of erythropoietin, but also the risk of hypoglycemia in these patients.

Although the studies are not numerous [10,11], the use of CGMS for diagnostic purposes for therapeutic adaptation in type 2 diabetic patients, especially if insulin-treated, is therefore clearly beneficial (Figure 4).

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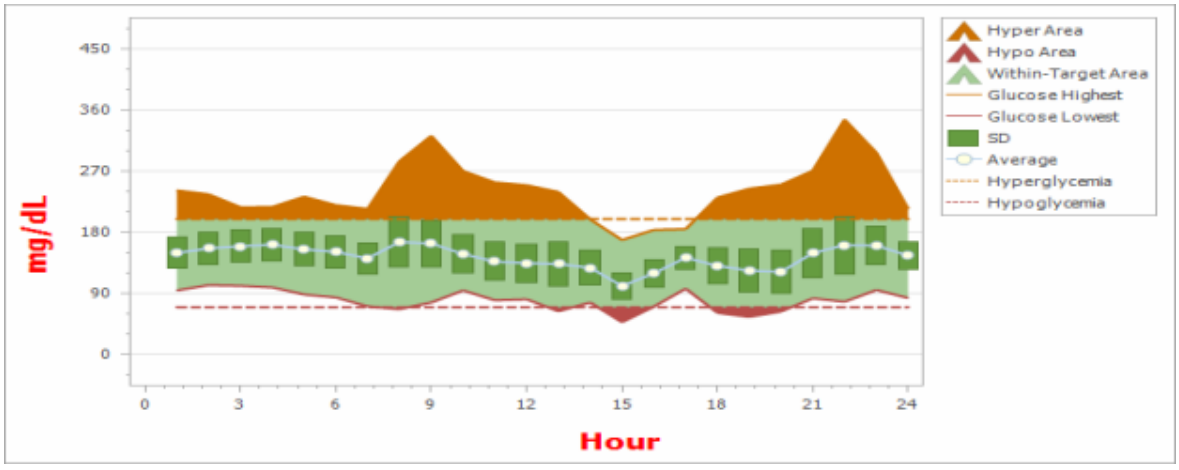

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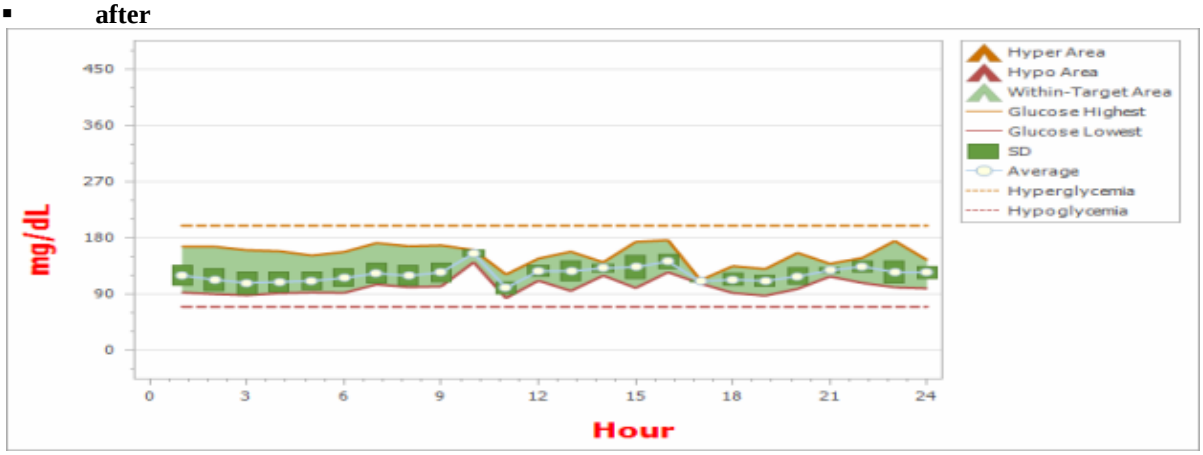

FIGURE 4: Glycemic Holter in a type 2 diabetic before and after therapeutic adjustment

VI. Conclusion

The advent of continuous glucose monitoring (CGM) is an important step forward in our ability to better understand the glycemic status of our type 2 diabetic patients.

Continuous blood glucose monitoring is a powerful tool in detecting and evaluating changes in blood sugar that cause blood sugar instability, looking for asymptomatic hypoglycaemia and improving metabolic balance. It is also a decision aid and an assessment of therapeutic efficacy.

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J. Issouani, et. al. " Continuous Glucose Monitoring In Patients With Type 2 Diabetes: Sharing Of Our Experience." *IIOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 20(03), 2021, pp. 01-05.