From the desktop

Patient and practitioner: Flash glucose monitoring

Gary Kilov

I have been caring for people with diabetes for about three decades, which is similar to the length of time that I have been living with type 1 diabetes. It would, therefore, come as no surprise that I have a vested interest in keeping abreast of the latest developments and innovations as they pertain to the management of diabetes – specifically, any progress that improves quality of life and eases the burden of living with diabetes. When I am fortunate enough to be offered the opportunity to try out some of the more innovative new products, I jump at the opportunity, and such was the case with the FreeStyle Libre Flash Glucose Monitoring System (Abbott Diabetes Care, Alameda, California, USA).

Among the most significant advances in diabetes management in recent decades has been the progress in glucose sensing. For over 2000 years, urine tasters were trained to detect glycosuria (Kirchoff et al, 2008); that is, until the the first half of the 20th century, when chemical reagents took the place of taste buds to detect glucose in urine. Since then, the pace of change has been rapid, progressing from testing urine with tablets or strips to measuring glucose in blood. Regular, frequent blood glucose level (BGL) testing is essential for patients on multiple doses of insulin to guide dosing and optimise glycaemic management whilst mitigating hypoglycaemia. Until recently, the gold standard for BGL sensing for most of our patients has been self-blood glucose monitoring using finger-prick testing. Despite significant improvements in this technology, several limitations remain. Finger-prick testing is inconvenient, painful and gives only a momentary snapshot in time, falling short of providing a comprehensive profile of dynamically changing BGLs. Ideally, continuous monitoring of BGLs should be more widely available for people with diabetes as emerging data supports its effectiveness in maintaining glycaemic control, and international professional organisations endorse it as the gold standard for those with type 1 diabetes (Endocrine Society, 2016).

Since the turn of this century, access to continuous glucose monitoring (CGM) has been steadily increasing but significant limitations and barriers remain. It is more costly than traditional blood glucose monitoring and is, therefore, limited to a small cohort of patients, usually those with type 1 diabetes using insulin pumps and to whom the cost has not been a barrier. Over time, the affordability of CGM devices has improved and the entry of new players into the space has resulted in gradual, but steadily increasing access.

However, it is only with the release of the FreeStyle Libre that we have seen a democratisation of this space with the device promoted to healthcare providers, but firmly marketed directly to consumers who have driven the demand. As clichéd as this may sound, this has been a game changer. The FreeStyle Libre provides greater accessibility for consumers and, not surprisingly, has proven very popular. The system has been available in the UK and Europe for almost 3 years, while in Australia it has been available for several months. By all accounts so far, it has proven to be just as popular here as in the northern hemisphere.

So what does it do? The FreeStyle Libre offers flash glucose sensing. What this entails is the application of a sensor (which lasts for 2 weeks before requiring a replacement) to the upper arm

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About this series

The aim of the "From the desktop" series is to provide practical expert opinion and comment from the clinic. In this issue, Gary Kilov gives a first-hand patient and practitioner perspective on using flash glucose monitoring.

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Figure 1. The FreeStyle Libre Flash Glucose Monitoring System (Abbott, Diabetes Care, Alameda, California, USA), and the sensor and reader in use.

and a reader that, when waved over the sensor, connects wirelessly and downloads and displays the BGL readings. As long as the reader is waved over the sensor at least once every 8 hours, up to 8 hours of stored information will be transferred to the reader and will be instantly displayed. This includes the current BGL and a graph of the day's glucose readings, as well as a display of trend arrows indicating whether the BGL is rising or falling. The angle of the depicted arrows indicates whether the BGL is trending higher or lower, rapidly or gradually, or is in fact steady.

Whilst this information is available with CGM, flash glucose monitoring is different in that no calibration is required using finger-prick testing. This feature is particularly attractive to me, and dare I say, to all my patients using this device. On the infrequent occasion that I have to do a finger-prick test, it reminds me how much I don't miss it. There are times when it is wise to confirm BGL reading with a finger-prick test and this is detailed in the product information and borne out by real-world experience. When BGLs are trending rapidly, the lag in interstitial fluid glucose means that the accuracy of the result is compromised. This has been particularly important when my BGLs are trending down. I am also prompted occasionally to do a finger-prick test when I am experiencing symptoms that are discordant with the readings, irrespective of what the BGL readings or trend arrows might indicate. So, in general, how accurate do I find the FreeStyle Libre? I can say that, by and large, I have discontinued finger-prick testing and use it only occasionally as detailed above, as flash monitoring has proven to be very reliable.

Another attraction of this system for me has been the deeper understanding that I have gained. The FreeStyle Libre has afforded me a greater degree of finesse in managing my diabetes. Whilst this may be a honeymoon phase with my new-found love, the Libre, my HbA_{1c} has dropped by 0.5% (5.5 mmol/mol), from already low levels, without an increase in hypoglycaemia. I've also developed some insights into what happens to my BGLs in certain situations that would have previously been difficult to discern. A case in point is real-time BGL monitoring during exercise. This has allowed me to manage my glycaemia more confidently by understanding my blood glucose patterns in response to certain stimuli and, therefore, anticipate my BGL trajectory and the appropriate proactive interventions to take. For example, as readers would know, BGLs tend to rise with exercise followed by the potential risk for delayed hypoglycaemia, as muscles replenish their spent stores of glycogen, and increased post-exercise insulin sensitivity. What I discovered by careful experimentation was that by giving myself just one unit of rapid-acting insulin 15 minutes before I exercise (something I would never have been comfortable doing prior to having the FreeStyle Libre) I have been able to mitigate the exercise-induced hyperglycaemia. By simply removing that one unit from the next

dose, I have also been able to reduce the rate of post-exercise hypoglycaemia.

And what of patient experience? For users of flash monitoring, this has generally been very positive. Sensor failure or a sensor failing to adhere occurred rarely in the early days. This has been easily corrected by improving the application technique of the sensor, and there have been no subsequent sensor failures or loss of sensors reported. I now make a point of inviting patients to see me or the practice's diabetes educator for the initial application of the sensor in a bid to obviate potential errors with the system. The FreeStyle Libre can also be a boon for "significant others" who may fear undetected nocturnal hypos. My wife need only "flash" my sensor for a quick check of my BGLs and decide, with confidence, whether to wake me to treat a hypo or allow me to slumber on. A win–win situation.

However, sadly, nothing is perfect. So what are the downsides? Whilst the system is a great improvement on self-monitoring of BGLs, it is not without room for improvement. Cost remains prohibitive for some. At $100 per fortnight on an ongoing basis, this is unaffordable for many. One compromise is to use the FreeStyle Libre much as we currently use CGM – using a sensor intermittently to provide insights and make adjustments as necessary. When a sensor is not in use, the reader can be used as a standalone BGL meter that will measure both BGLs and ketones using the same strips used in the FreeStyle Optium Neo.

One of the great strengths of the system is the enormous amount of information that it provides. Paradoxically, for some, this is a disadvantage. Having lots of data at one's disposal is one thing, what to do with it is another. It can also be quite difficult for some patients, particularly those who like to micro-manage, to curtail the urge to react to every trend or nuanced change highlighted by the Libre. Additionally, there is no low glucose alarm on the Libre, a feature present in CGMs. Even though low BGLs may be recorded by the Libre sensor, no alerts are sounded until the sensor is scanned.

What's on the wish list for glucose monitoring? It has recently been announced that there will be CGM subsidies for children and young people with type 1 diabetes, and it is on my wish list for subsidies to be available for adults, as well as for flash glucose monitoring to be covered in addition to CGM. If CGM or flash glucose monitoring were more affordable, it would unquestionably be the system of choice for both individuals with type 1 diabetes and those with type 2 diabetes on complex insulin regimens.

Overall, the FreeStyle Libre has been a boon for me and many other people with diabetes who have used flash glucose monitoring. It has improved our quality of life as well as improved our ability to manage our diabetes, and I am looking forward to the next innovation. Perhaps I could give the bionic pancreas a test drive…? ■

Declaration

Selected healthcare professionals, especially endocrinologists, diabetes educators, and GPs specialising in diabetes management, were offered the opportunity to participate in the FreeStyle Libre Healthcare Professional Experience Program. A FreeStyle Libre Reader and two FreeStyle Libre Sensors were provided, free of charge to Gary Kilov, as part of the FreeStyle Libre HCP Experience Program. All subsequent sensors used by Gary Kilov have been purchased from the Australian Freestyle Libre website as per all consumers. No inducements, honoraria or support was provided to write this comment, which is an independent and personal reflection on the Flash Libre and its utility.

Endocrine Society (2016) *Experts recommend continuous glucose monitors for adults with type 1 diabetes.* Endocrine Society, Washington DC, USA. Available at: http://bit.ly/2i4MKeT (accessed 30.11.16)

Kirchhof M, Popat N, Malowany J (2008) A Historical Perspective of the Diagnosis of Diabetes. *UWOMJ* **70**: 7–11

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