

Personalising insulin therapy using smart pumps, pens and automated insulin delivery systems

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Diabetes management is challenging for people with diabetes as it affects their lives 24/7/365. Modern technology has facilitated diabetes management regarding documentation, insulin delivery and decision support.

Electronic diabetes diaries and connected pens

Electronic diabetes diaries and diabetes apps in combination with connected pens and pumps allow detailed documentation of glucose values, insulin doses and meal intake. These systems can also be used to communicate with the diabetes teams for telemedicine.

Connected pens are an attractive alternative for people who do not wish to use an insulin pump. Data from clinical trials show that people using connected pens and adhere to insulin dose recommendations have improved glycemic control compared to people who do not follow therapy recommendations.

Insulin pump therapy

Insulin pump use in both adults and children has been constantly increasing in recent years. This rise is predominantly due to the fact that modern insulin pumps are easy to handle. Additionally, patients consider pumps to be a comfortable way of delivering insulin resulting in improved adherence to the suggested bolus dose for snacks and when correcting slightly elevated glucose values. These doses are often missed in pen users. Thus, insulin pump therapy – especially in combination with continuous glucose monitoring – leads to improved glycaemic control in the majority of people living with diabetes.

There are currently two types of insulin pumps on the market: conventional pumps that require an infusion set to deliver insulin under the skin and patch pumps which are directly attached to the skin with an adhesive and deliver insulin via an integrated soft cannula. Patch pumps have

several advantages over conventional pumps: they are smaller, more discrete and often easier to use. The most recent development in patch pumps is the Accu-Chek® Solo micropump system.

The Accu-Chek® Solo micropump system uses a modular design. The system is comprised of two main components that communicate wirelessly: the micropump itself and the Diabetes Manager (i.e. remote control). The micropump consists of a pump base that can be used for up to four months and a disposable 2 mL (200 U) insulin reservoir attached to it. The pump base houses the motor, the electronics, the memory, two bolus buttons, and the safety alert, all of which are found in conventional insulin pumps as well. The featured bolus buttons allow the user to deliver a bolus directly from the micropump without using the Diabetes Manager. Finally, the connection to the subcutaneous tissue and fixation to the body is ensured by an infusion assembly that is available with 6- or 9-mm cannulas. The modular design also allows temporary disconnect of the micropump from the body (e.g. when exercising) as well as replacement of individual system components as required.

Hybrid closed-loop systems

Hybrid closed-loop systems consist of an insulin pump, a continuous glucose monitoring system and a control algorithm. Basal insulin delivery is automatically adjusted by the algorithm according to the glucose value derived from CGM. Bolus insulin delivery still needs to be performed by the user according to meal intake. Presently, a novel modular hybrid closed-loop algorithm, the Diabeloop system, entered the market. The Diabeloop system runs on a specific handset and can be used in combination with different insulin pumps (Accu-Chek® Insight and Kaleido pumps). Currently it is approved for the use with the Dexcom® G6 CGM but other sensors might be added in the future.

When using the Diabeloop system, reduction of time in hyperglycemia and increase in time in normoglycemia (both 80-140 mg/dl and 70-180 mg/dl) was observed compared to open-loop insulin delivery.

Summary

Personalised diabetes management by using smart pens and pumps especially in combination with electronic documentation and semi-automated systems can improve glycemic outcomes, treatment satisfaction and quality of life.