

SMART PEN

A “smart” insulin injection pen is a diabetes management tool that tracks rapid-acting insulin doses (Humalog, Novolog, Fiasp), calculates recommended doses, and shares the data through the use of a mobile app (IOS, Android).

There is “potential benefit on glycemic control and dosing behavior when insulin data from a connected pen is used to manage type 1 diabetes” [Adolfsson, 2020].

FOR WHOM WOULD THIS BE AN APPROPRIATE DEVICE?

A person with diabetes (PWD) type 1 or type 2 who is treated with multiple daily injections, particularly mealtime insulin, would benefit from this technology if he/she uses a smart phone and is comfortable using apps. The user must be willing and motivated to check blood glucose levels at mealtimes and log those into the app, or be comfortable wearing a compatible continuous glucose sensor, which can be paired with the pen. Users are required to place an insulin cartridge into the pen, attach a pen needle for each injection, and then simply rotate the dial on the pen to select and inject the appropriate dose. In doing so, the pen keeps track of the dosing and allows for tracking and analysis.

DOES YOUR PATIENT MISS INSULIN DOSES?

A PWD can use a smart pen and its dedicated app to track all insulin dosing (rapid and long-acting

insulins), including the timing of the last administered dose. Mealtime bolus reminders can be set to prevent missed dosing. Missing just 2 doses per week of mealtime insulin can increase A1C by 0.4% [Randlov and Poulsen, 2008].

DOES YOUR PATIENT USE CARBOHYDRATE COUNTING TO DETERMINE PREMEAL INSULIN DOSES?

Yes:

The most accurate insulin dosing can be accomplished by a user who can count carbohydrates to be consumed and then use this information to help determine premeal insulin doses. People using such programs can more accurately provide insulin replacement that replicates natural physiologic insulin patterns. Smart pens can be programmed with a person’s insulin-to-carbohydrate ratio. This calculation focuses on matching 1 unit of rapid-acting insulin with a self-estimated measurement of carbohydrate grams to be consumed at a meal in order to keep postprandial blood-glucose levels on target.

A sensitivity or correction factor is also programmed. This is a ratio that estimates the amount of decrease

in blood sugar for each 1 unit of rapid insulin injected. A blood-sugar target is also individualized as the goal for correcting higher blood sugars when using this sensitivity factor. These sensitivity or correction factors can be used in addition to insulin determined by carbohydrate intake to target desired glucose levels, further improving the accuracy of the insulin treatment program. Smart pens assist people in using these calculations regularly and accurately.

The insulin on board or active insulin time is a calculation that reflects how much insulin remains active in the body from a prior insulin bolus injection that is still working to lower the glucose level. This number is calculated based on a time duration and can be set in a smart pen. Having that calculation guides the user on how frequently and how much insulin is recommended. This feature also reminds patients that injecting too soon or “stacking” insulin can cause hypoglycemia.

Once a smart pen is loaded with individualized data for a specific patient, it will recommend the amount of insulin needed at each meal based on the glucose level and anticipated carbohydrate intake. Note also that dosing can be given in smaller ½-unit increments using the pen.

No:

If the PWD is not educated on or does not have experience with carbohydrate counting, the smart pen can be programmed to give specific fixed doses of rapid insulin at mealtime. If programmed, the PWD can also give insulin based on the estimation of carbohydrates in the meal (low, medium, or high).

A smart pen will automatically save all logged insulin doses and can recommend insulin dosing based on preprogrammed settings, current blood sugar, and active insulin time.

Meeting with a CDCES (diabetes educator) can facilitate the education and confidence necessary for patients to successfully use a smart pen.

HOW CAN I SEE MY PATIENT’S PROGRESS?

Smart pens can generate reports, which can then be shared with care providers through printouts, faxes, or emails. These reports will provide key statistics to help guide insulin treatment. Included in reports are average blood glucose, percentage of time in range (70-180mg/dL), and missed insulin doses, in addition to other pertinent information. These reports help identify patterns and determine the overall effectiveness of insulin dosing. Blood-sugar datapoints are collected using a blood-glucose meter and blood sugars can be logged by users or measured with a continuous glucose monitor (CGM), which can be effectively paired with a smart pen.

WHY WOULD I RECOMMEND USE OF A SMART PEN?

In summary, smart pens can help PWDs improve adherence to self-care regimens, while providing data to help both patients and care providers more effectively assess glucose control and recommend insulin-dosing adjustments. When paired with a CGM, smart pens can help assess time in range, guide it, and provide key care support to people unable to utilize a pump device.

Smart-pen technology is constantly evolving, and newer models are often released. Individual smart-pen websites can provide specific and up-to-date information on available products.

References:

Adolfsson P et al. Increased time in range and fewer missed bolus injections after introduction of a smart connected insulin pen. *Diabetes Technol Ther.* 2020;22(10):709-718.

Randlov J, Poulsen JU. How much do forgotten insulin injections matter to hemoglobin A1C in people with diabetes? A simulation study. *J Diabetes Sci Technol.* 2008;2(2):229-235.