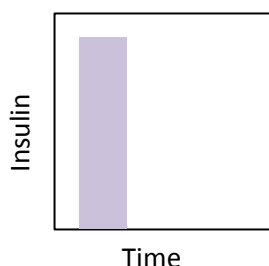


Types of Boluses for Pump Therapy

Different types of boluses may be used based on the type and the amount of carbohydrate you are eating, as well as the amount of fat, protein, and fiber being consumed. By choosing the appropriate bolus you will be able to better match the amount of insulin to the amount glucose entering the bloodstream.

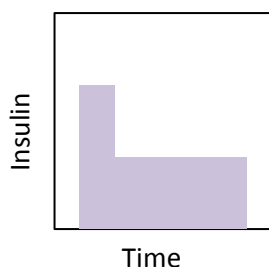
There are 3 different types of bolus doses that can be used to help match your insulin dose to your carbohydrate intake and activity.

Normal Bolus



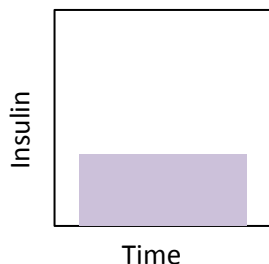
The most common type of bolus used is a normal bolus. The insulin is delivered all at once and is like how injection therapy gives insulin. When you eat, you program your pump to release a specific amount of insulin to match the amount of carbohydrate in your meal. This type of bolus would be used for meals or snacks consisting mostly of carbohydrate with low to moderate amounts of protein and fat.

Dual Wave or Combo Bolus



With a dual wave or combo bolus, some of your insulin is given right away, and the rest is spread out over the next few hours. You have the flexibility of choosing how much insulin is given immediately and how much is given as an extended bolus and for how long. This helps to reduce the delayed highs caused by the fat and protein portion of some meals. Some meals tend to have an early peak and then a delayed release of glucose into the blood and could benefit from this type of bolus. They are especially useful when eating high carb, high fat meals such as pizza, creamy pasta, cheesecake, ice cream, and restaurant food. It may also be used for high carb, high fiber meals such as bean dishes. *Note: You may need to add extra insulin to the bolus for high fat or high protein foods. Please discuss with your educator.*

Square Wave or Extended Bolus



A square wave or extended bolus will deliver the entire bolus over an extended period of time. Because it allows a slow infusion of insulin over a long period of time, this bolus would be useful in situations where you are eating small amounts of food over a longer period of time. Examples include parties, special dinners, buffets, or snacking at the movie theatre. It can also be used for high fat, high protein meals with very little carbs such as a steak dinner with non-starchy vegetables. It is also helpful if you have gastroparesis, or a slowing of your digestive process. It is a good idea to have a rough estimate of how much you are going to eat in total before setting this dose. If you are starting your meal with a lower blood sugar, this may be a good option for you to allow the carbs to get absorbed before much of the insulin is released.

Other Bolusing Techniques:

Super Bolus

The super bolus is a way of increasing the spike of the normal bolus. In this scenario, basal insulin is “borrowed” and added to the bolus spike to allow for the fastest delivery of insulin that can be achieved with a pump. The super bolus can be useful for high glycemic index foods such as sugary breakfast cereals, candy, pop, juice, white grain products, and potatoes. This type of bolus is only appropriate when these foods are eaten alone because other complex foods will slow their digestion. If you are consuming high glycemic index foods, another type of bolus to consider is a pre-bolus.

For example, if someone is taking 4 units for a sugary breakfast cereal and their basal rate is 0.5 units/hour, they can add the basal dose for the next 2 hours to their bolus ($0.5 \text{ units} \times 2 \text{ hours} = 1 \text{ unit}$) and set a temp basal to zero for the next 2 hours. The total bolus with the cereal will be 5 units (4 units + 1 unit), which will help control the post-meal spike.

Pre-bolus

An insulin bolus only becomes active in your body about 15-20 minutes after being taken. A pre-bolus simply means that the bolus of insulin is taken earlier so that the insulin begins working before glucose is absorbed into the blood. If you are consuming a high glycemic index food alone, you may find a pre-bolus useful because it will allow you to mitigate the large and rapid increase in your blood sugars. It is commonly used for breakfast cereals. Pre-bolusing may also be useful when blood sugars are above target range before a meal. You can time your bolus so that the insulin reaches the blood first and fixes the high blood sugar before more glucose is absorbed.

Bolus Tips and Tricks

- When eating out at a restaurant you may not know exactly how many carbs you will be eating. Before your meal, take half the total bolus you expect you will need. When your food arrives, adjust the second half to the amount of carbs you will be eating.
- Reduce post-meal spikes in your blood sugar levels by eating balanced meals that contain carbohydrates along with protein and fat. Also choose carbohydrate options that are high in fiber.
- Avoid taking your bolus without testing your blood sugar levels first, also called “blind bolusing”
- If you find that you are continuously high many hours after the same meal or wake up high in the morning, you may want to consider using a square wave or dual wave for that meal.
- If you are high shortly after consuming your meal (up to an hour) and low or in target before your next meal, a super bolus and/or pre-bolus may work better.

Examples

Dave is eating a meal of pasta with creamy Alfredo sauce, chicken, peas, and carrots for dinner. His pre-meal blood sugar is 6.0mmol/L. He determined his carbs to be 50g for this meal. His insulin to carb ratio is 1u:10g. His pump suggests 5 units and he gives it as a normal bolus.

Dave notices his blood sugar levels are low an hour after eating and high during the night. Why might this be and what type of bolus may better suit this meal?

The carbs in Dave's meal (pasta) are low GI and the Alfredo sauce is high in fat and together would cause a slow release of glucose into the blood. For these types of meals, a combo bolus is a better choice than a normal bolus because it allows less insulin to be given initially and some insulin to be released over a period of time.

Dave is having this exact meal a week later and decides to try a combo bolus this time. He chooses a ratio of 70% immediately and 30% over 3 hours. What dose will Dave's pump give initially and how much will it give him for the next 3 hours?

Initial dose: Total dose x 70% = 5 units x 0.7 = 3.5 units

Remaining dose to be given over time: Total dose x 30% = 5 units x 0.3 = 1.5 units

Dave's pump will give him an initial dose of 3.5 units and 1.5 units over the next 3 hours.

Dave checks his blood sugars each hour for the next 4 hours. His blood sugar readings are as follows:

Before meal: 6.0 mmol/L

Post meal:

1 hour: 3.8 mmol/L

2 hours: 7.8 mmol/L

3 hours: 10.5 mmol/L

4 hours: 13.7 mmol/L

Based on these readings, would you make any changes to his insulin bolus and if so, what would they be?

A low reading soon after eating followed by a later rise suggests that too much insulin was given initially and not enough over the next several hours (the extended portion). Also, because the last reading is the highest, Dave should consider extending his bolus for a longer period of time.

The next time Dave has this meal he may want to try a ratio of 50%:50% over 4 hours.

There is some trial and error in choosing the appropriate ratio and duration. By testing your sugars every hour after your meal, it will help you determine if you need to adjust the ratio and/or the length of the extended bolus. Once you have determined the proper ratio and duration of the bolus, make note of it so that you remember for next time you have that meal.