

Diabetes at Camp: Insulin Pumps

Module 8 of 12

Special thanks to the team below and everyone who contributed to this work.

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Objectives

At the end of this module, the participant should be able to:

- Explain the concept of the insulin pump device for insulin delivery
- Describe the components of an insulin pump
- Use basic functions within the pump, such as temporary basal rates and find the history of insulin pump's delivery
- Troubleshoot common problems associated with insulin pump therapy



An Insulin Pump - Basics

- There are presently 5 FDA approved insulin pump platforms
- Each pump holds 200-300 units of insulin
 - The insulin is delivered via the pump through a cannula, or small straw, that has been inserted in the subcutaneous tissue (arm, buttocks, abdomen, upper leg)
- Each pump is programmed for the following:
 - A background insulin dose (basal) that drips a very small amount of insulin every 5 minutes
 - A bolus insulin dose which is individualized and initiated by the individual
 - Correction for when BG is higher than the target (goal) BG
 - Coverage for carbohydrates eaten

Pumps on the Market

- All pumps are programmed for each individual and share many of the same basic functions
- No FDA approved pumps at this time are fully automated – so the individual must engage with the pump at least at each meal

Medtronic Diabetes

530G, Revel (not pictured), and Paradigm (not pictured) are discontinued

530G

(discontinued)



630 G



670 G



Tandem Diabetes Care

T:slim



T:slim X2

(can be updated with Basal-IQ)



Pumps on the Market (cont.)

Insulet Corporation (No Tubing)

Omnipod Dash



Omnipod



Animas Corporation (no longer sold - but supported through 2019)

Animas Ping



Animas Vibe



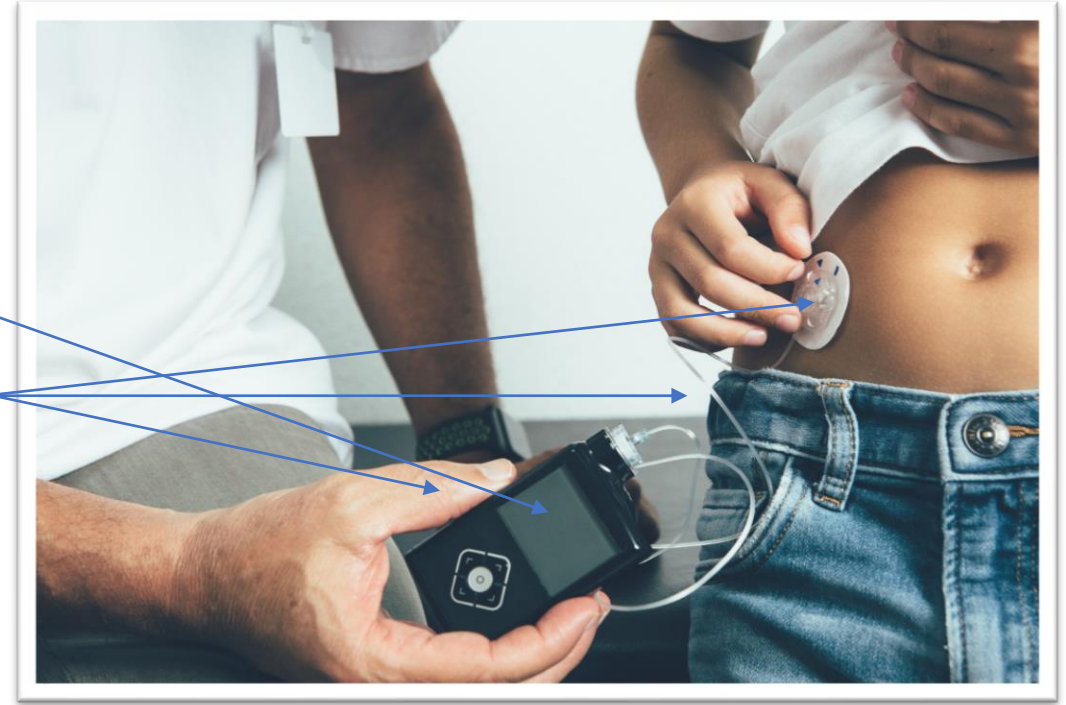
Sooil Development

Dana Diabecare IIS



Components of a Pump

- Body of the pump (the computer part)
- Reservoir (holds the insulin)
- Tubing*
- Infusion set



*The Omnipod insulin pump does not have tubing – it is considered a “patch pump” but still has a reservoir inside the POD that must be filled and a cannula on the bottom of the patch that is automatically inserted after attaching the patch to the skin.



How does the insulin get from the pump into the body

- With the exception of the Omnipod models, pumps have a tube that connects the reservoir holding the insulin to an infusion set
- The infusion set (small plastic cannula) is inserted via a needle which is then retracted
- Approximately, every 3 days a new infusion set is inserted
- A few infusion sets are different and the needle stays in the skin

Basics - Basal

- The insulin pump uses only rapid acting insulin
- A basal rate is programmed into the insulin pump and provides incremental doses of insulin 24 hours per day, delivering the insulin continuously

***Example:** Kelly will be getting 0.3 units of insulin per hour from 0000-0600 and 0.4 units per hour from 0600-2400*

Note: the Medtronic 670G pump makes automatic adjustments for basal rate based on the sensor glucose values and recent insulin delivery needs on a regular basis when the pump is in Auto Mode and will recommend a correction dose if the CGM is a certain amount above the target range. This recommended correction dose must be confirmed before it is delivered.

Basics - Bolus

A bolus insulin dose is also programmed to deliver insulin for correction* (1 unit for a blood glucose number over a preset target) and carbohydrates (insulin to carb ratio).

*Some pumps call this a sensitivity factor.

Example: Kelly has an insulin to carb ratio of 1:10 for meals and correction of 1:30 for blood glucose over 150. The number of grams of carbs for the meal and premeal blood glucose need to be manually entered into the pump for the delivery of the bolus.

There may be different insulin to carb ratios, correction factors, and targets throughout the day.



Basics - Basal and Bolus (cont.)

- Basal and bolus settings are set with the patient and provider at home
- A consideration for temporary camp settings should be discussed with camper's diabetes health care provider.
- Some camps will change the pump basal and bolus settings during camp week in coordination with the care team - this decision will be determined by the camp medical director or camper's home diabetes care team.

Note: If settings are changed during camp week, it is important to change them back to home settings upon camper return home

Basics – Insulin on Board / Active Insulin Time

- Another excellent feature of the insulin pump is the “Insulin on Board” or “Active Insulin Time.”
- This is a setting that reflects the amount of insulin remaining in the body from a recent bolus dose.
- This helps to prevent insulin stacking where a high blood glucose check 1-2 hours post meal may not need a correction as some of the insulin from the previous meal is still circulating. (See Module 2.)
- This is programmed into the pump by the individual and the diabetes care team based on the knowledge of the individual’s response to insulin.
- Generally it is set at 3 or 4 hours and not adjusted often.

Basics (cont.)

To check for how to set a temporary basal rate on each insulin pump or check the history, download these tip sheets **before camp** at:

www.diabetes.org/summerncamp

And

www.professional.diabetes.org

(example on the next slide)

Note: when the Medtronic 670G is in Auto Mode, it does not allow for a temporary basal rate setting.



Welcome to Camp - Omnipod

Insulet Omnipod Insulin Pump

- ✓ This is a tubeless pump.
- ✓ The insulin is put into the Pod and delivery is directed on the personal data management (PDM) system .
- ✓ The PDM does not have to be with the individual for basal delivery but must be available for bolus delivery.
- ✓ This pump does not receive sensor data.

Common Actions

- To **turn on the PDM screen**, press the “home” icon, the bottom left button on the PDM.
- To **set a temporary basal rate**, on the home screen use the up/down controller buttons and choose “temp basal” and press “select.” Discuss this with your medical care team before initiating.
- To **check the pump history**, on the home screen use the up/down controller buttons and choose “my records” and press “select.” Choose “all history” and press “select.” The day will be displayed in the top right corner. Use the up/down arrow buttons to change day. You can review the bolus and blood glucose history to check on accuracy of the dosing if in question (or as a double-check).
- The POD must be changed every 3 days. To **change a POD**, deactivate the current POD. On the home screen, choose “more actions” and “change POD” then press “select.” Press “confirm.” Remove the POD. Follow directions on the screen to fill the next POD with insulin and activate.
- To **deliver a bolus**, go to the home screen and press the up arrow and highlight “bolus” on the top of the screen and press “select.” Use the up/down arrow buttons to enter the current BG values. You will then be asked if you want to enter carbohydrates. You can give a bolus for BG or carbohydrates or both. A suggested bolus will be on the screen. Press “enter” to accept.
- To **deliver a manual bolus (without the pump algorithm)** if directed by your medical team, go to the home screen and select “bolus.” Enter the amount to be given. If directed by your medical team, to deliver a manual bolus (without the pump algorithm), make sure to complete all steps on the screen to deliver the bolus.

More Information

https://www.myomnipod.com/sites/default/files/pdf/ust400_user_guide_EN.pdf



Common Problems with Pumps

Problem	Problem Solved
The infusion set comes out (water sports often soften the sticky patch)	Have a new infusion set ready to replace it!
Unexplained high BG with 2 bolus correction doses	Cannula may be kinked on insertion or later – replace infusion set
Low numbers after a meal on a teenager which are not consistent	Too much insulin for carbohydrates or misuse of the pump – check the bolus history for the actual amount dosed.

Common Problems with Pumps

Problem

A child is running low blood glucose overnight



Problem Solved

Check with the diabetes care team and use the temporary basal rate to lower the basal dose AFTER treating the low BG; consider lowering the overnight basal to prevent the same scenario the next night!

See tip sheet for how to change a basal rate TEMPORARILY

Medtronic 670G – A bit different*

When this pump is in auto mode



- It delivers a basal rate that changes based on continuous sensor data (when the sensor is being worn – of course)
- Aims for a fixed target rate of 120 mg/dL
- There is not a temporary basal rate, but a target of 150 mg/dL can be set for up to 12 hours
- A blood glucose value for correction must be entered into the pump, but the pump will advise the amount to give which cannot be adjusted - only accepts a yes or no answer
- You are still required to enter carbs when you eat and BG to calibrate the sensor
- It can switch to manual mode and then will behave like a typical pump

*this is a hybrid system – most pumps will be following in its wake in the next 1-2 years - or be further advanced

What to do with a pump at the waterfront?

Medtronic, Tandem, Animas & SOOIL

- Although all four pumps claim to be waterproof – if there is any crack in the casing, water will seep in – besides who wants to swim with a pump and tubing?
- Tubing and pump are disconnected from the pump site
- Pump site remains in place
- Put the individual pump in a plastic sealable bag with camper's name and consider placing it along with the others in a cooler or in the shade. Keep out of direct sunlight
- Check BG every 1-1.5 hours while off the pump and correct as needed

Omnipod

- Pod is waterproof and should be left on.
(PDM IS NOT!)



Ultimate Goal - Allow children to wear the technology they wear at home and to learn to incorporate management in a new and different environment.

Problem	Problem Solved
There are several non-FDA approved pumps that are being used worldwide	Discuss the ability to reach the parent/caregiver if problems arise
These include the DIY (do it yourself) and the other Dana pump systems (approved in other countries, but not the US)	Study up on the pump prior to arrival at camp and have qualified staff learn the basic functions

A Rapidly Changing World

The following will be available in the near future!

- Tandem Control
- Omnipod Horizon
- iLet dual hormone system artificial pancreas?

And perhaps the implantable insulin pump!

Summary

- An insulin pump only uses short acting insulin.
- A very small amount of insulin is delivered every few minutes (basal) to meet the body's background insulin needs 24 hours a day.
- A larger amount (bolus) is given to help correct a high blood glucose or anytime carbohydrates are being eaten.
- A SENSOR does not give insulin - it is providing glucose readings every few minutes to a receiver or the pump screen.
- A few insulin pumps integrate the sensor information to make some changes in how the pump delivers insulin and more pumps are being developed.
- There is NOT an FDA approved pump at this time that is totally automated - all require individual interaction.

Assessment

1. Which of the following insulin pumps adjusts basal rates based on sensor data?

- A. Medtronic 670G
- B. Tandem basal IQ
- C. Omnipod
- D. Animas Vibe

2. The pump function that can adjust the pump settings for a particular activity is called the:

- A. Correction dose
- B. Insulin to carb ratio
- C. Temporary basal rate or temporary target
- D. Insulin on board

3. All insulin pumps contain the following:

- A. A cannula, a reservoir for short and long acting insulin, and computer chip
- B. A cannula, pumping mechanism, and screen
- C. A pumping mechanism, sensor integration option, battery, and screen
- D. A pumping mechanism, reservoir, tubing, and cannula

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