

Let's Get Pumped!

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Objectives

- Understand the basic physiology of Type 1 Diabetes
- Review history of Diabetes technology
- Understand continuous glucose monitoring
- The basics of insulin pumps
- Understanding automated insulin pumps
- Questions about school orders



What is Type 1 Diabetes

"High blood sugar"

Autoimmune condition that destroys insulin producing cells in the pancreas

Often triggered by a virus

Often there is no family history

Must take insulin for survival

Prevalence of Type 1 Diabetes

Over 1.7 million Americans living with Type 1 Diabetes

Most common chronic condition in children

Vanderbilt Pediatric Diabetes Clinic sees 3,400 patients from Tennessee, Alabama, and Kentucky

85% have Type 1 Diabetes

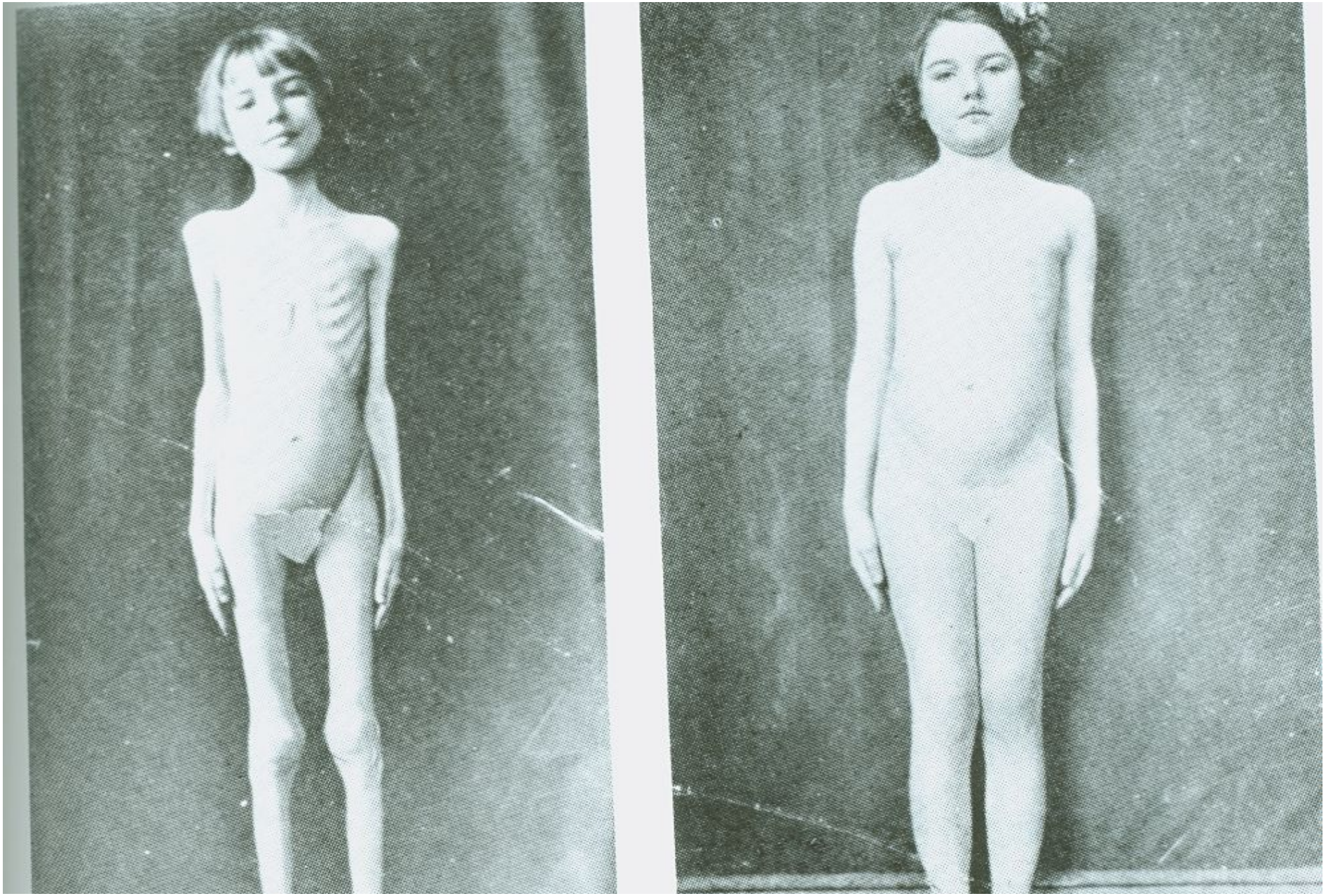
90% on some type of CGM

60-70% on insulin pumps

The Discovery of Insulin

- Insulin was discovered in 1922 at the University of Toronto, Canada
- By Dr. Banting and Dr. Best
- The first patient to receive insulin was a 14-year-old boy named Leonard Thompson





Ancient Devices

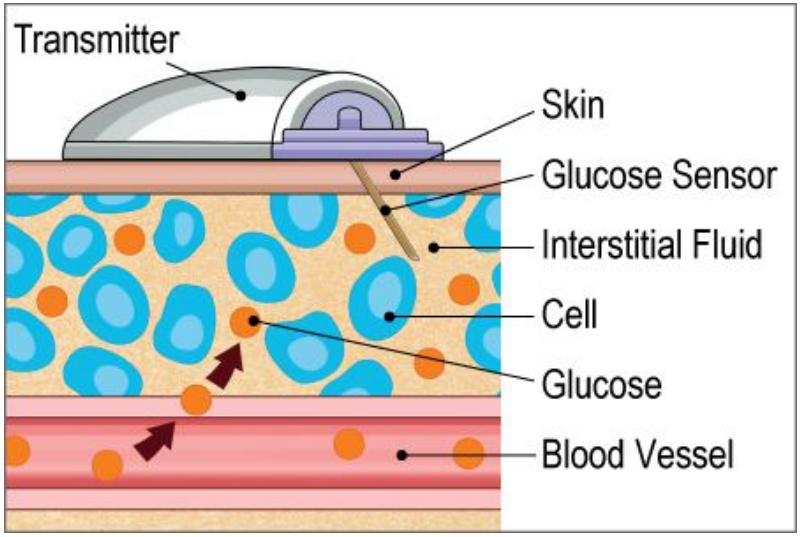








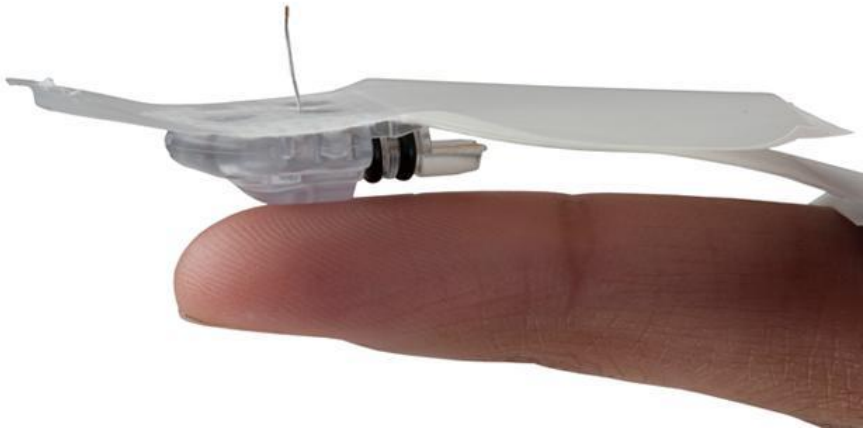
Continuous Glucose Monitoring System (CGM)



- Measures the Glucose in the body's interstitial fluid
- Not the same thing as a finger stick
- Interstitial glucose levels lag behind blood glucose levels by 15-20 minutes.

Three Parts to a CGM: The Sensor

- Worn on the body, inserted with a needle, and changed out every 7-14 days.
- The sensor under the skin is the thickness of an eyelash.





Three Parts to a CGM: The Transmitter

- The Transmitter hooks into the sensor and sends all the glucose information to the receiver/monitor.
- This is the expensive part of the system and re-used with each new sensor.





Three Parts to a CGM: The Receiver

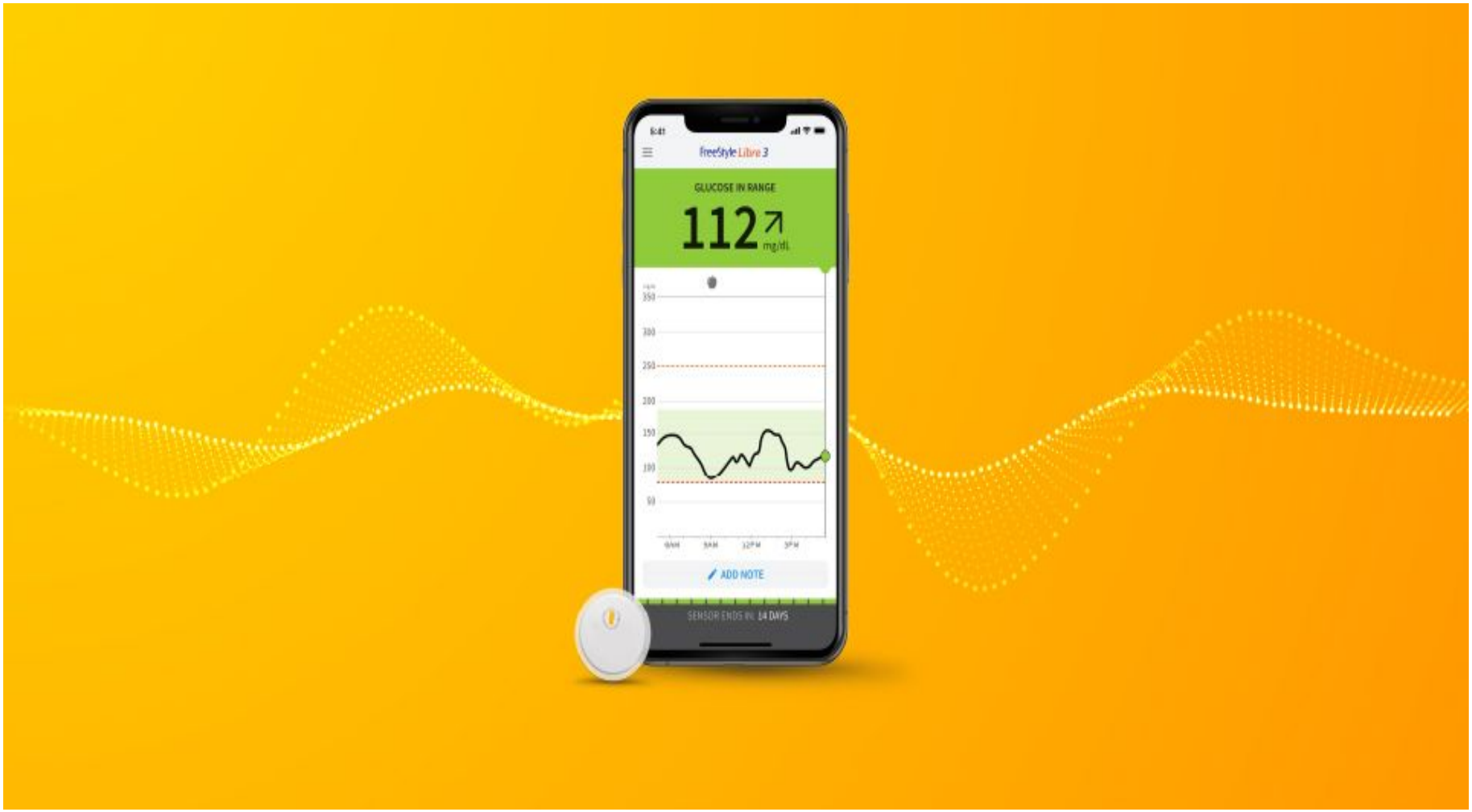
- The Receiver has a screen where you can check your current glucose level, look at historical data, and get trends about whether the glucose is likely to go up or down and how fast.
- Can be a traditional receiver, a phone, or an insulin pump.







Freestyle Libre 3



Continuous Monitoring Systems: What makes them better than finger sticks?

- Throughout the day, the wearer can look down and see what their glucose value is within a 90% accuracy.
- Perhaps even more valuable than the immediate glucose level is the direction and speed at which glucose levels are heading.



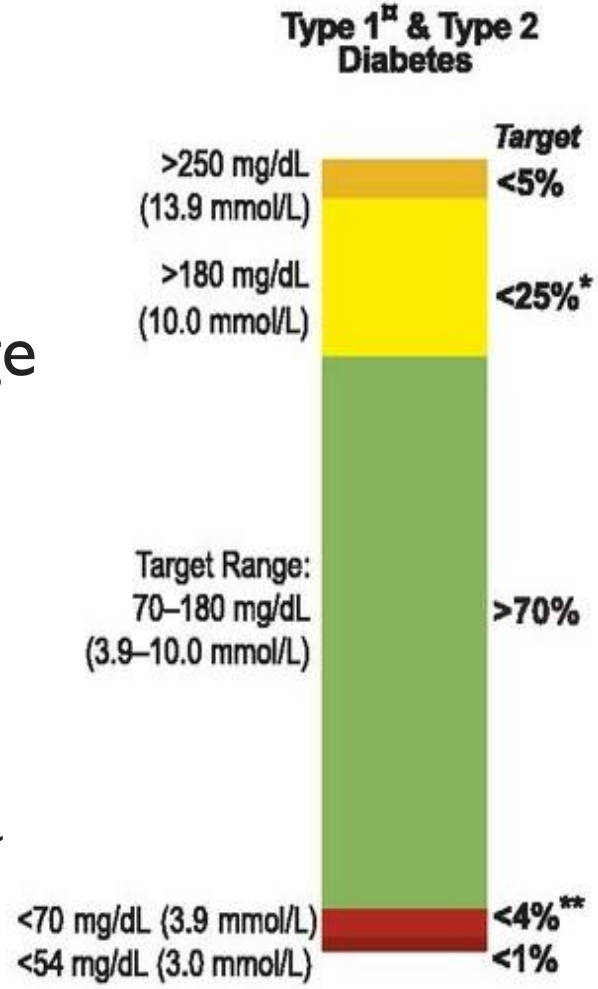


- SG and BG readings will rarely match and are expected to be different
- A greater difference between SG and BG will be seen when glucose is changing quickly, such as after eating or after taking a bolus of insulin

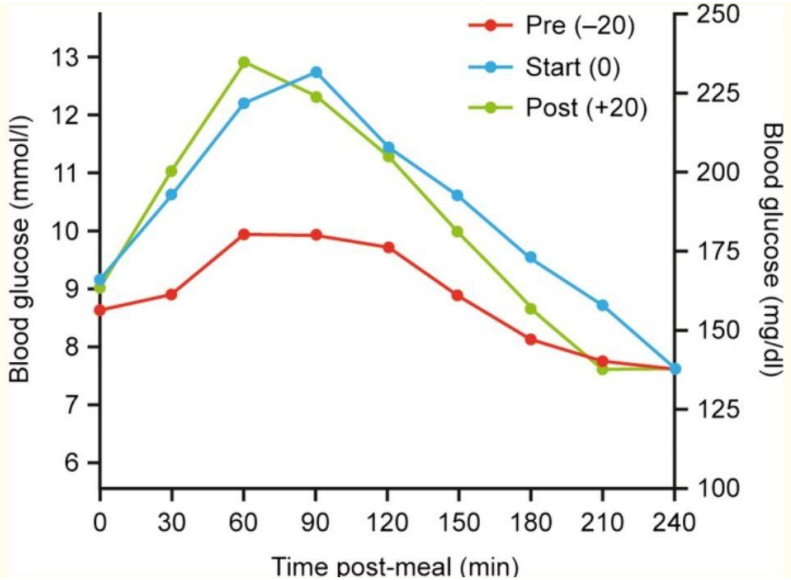
HTTPS://WWW.FREESTYLELIBRE.COM.AU/DIFFERENCE-BETWEEN-GLUCOSE-INTERSTITIAL-GLUCOSE

TIME IN RANGE

- Defined as the percentage of time that a person spends with their blood glucose levels in a target range
- Typical target range for blood glucoses: 70-180
- Captures day-to-day variations
- Able to be monitored at home on a daily or weekly basis



PRE-MEAL BOLUSING

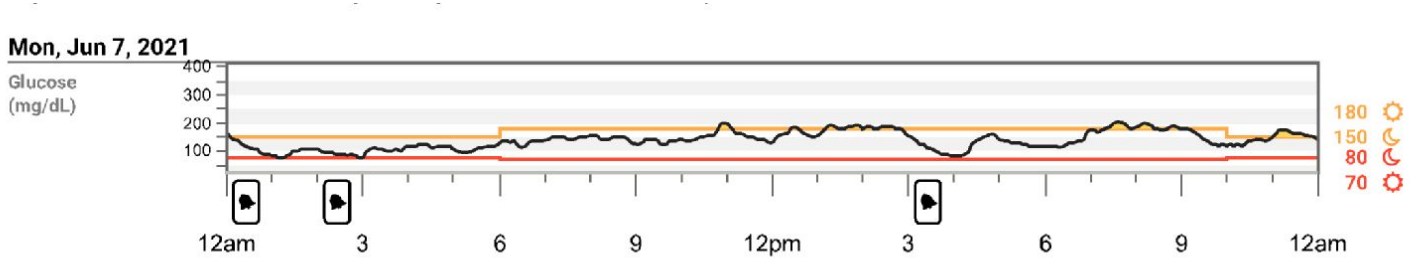


"The data from the present review of the literature provide clear clinical evidence for the **superiority and safety of injecting 15–20 min pre-food**, with almost **30% lower post-meal glucose levels**, a lower AUC for hyperglycemia and **less post-meal hypoglycemia** when the pre-meal glucose levels are in range. We therefore recommend that people with diabetes should **aim to do this whenever possible**, accepting that there may be individual circumstances when this is not practical.

Postprandial administration of rapid-acting insulin analogues is a **less effective** method of controlling BG levels in the postprandial phase, and carries a **significant risk of hypoglycemia**."

(Battelino, et al., 2019)

18 YO M, USES OMNIPOD
A1C 6.5%



Statistics for this day

Average Glucose

140

mg/dL

Time in Range



0% Very High

18% High

81% In Range

<1% Low

0% Very Low

Legend

- CALIBRATIONS
- CARBS
- HEALTH
- FAST-ACTING INSULIN / INSULIN
- LONG-ACTING INSULIN
- ALERTS
- EXERCISE
- MULTIPLE EVENTS

Continuous Glucose Monitoring Systems

Key Point to Remember:

The systems being used today are accurate enough that they can replace finger sticks throughout the day and/or insulin can be dosed off the readings.



Introducing the dexcom G7

The Next Level in CGM Experience

- Fast Warmup 30 minutes
- 60% Smaller Wearable
  67% Less Packaging
- Simple Application
  All-in-one Applicator, Sensor, Transmitter
- Fully Disposable
- Direct To Watch Capability



- iOS & Android Compatibility
- Real-time CGM with Alerts
- Factory-calibrated
- 10 Day Wear
- Designed for Integration with AID & Smart Pens
- Personalized Insights

dexcom

* Dexcom G7 not available in US or OUS. Feature under development; Investigational use only

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Insulin Pump Evolution





Basics of Insulin Pump Therapy

- **Basal rate**
  - Continuous flow of insulin from pump to patient
  - This is background insulin
  - Controls blood glucose in a fasting state.
  - Different rates can be programmed throughout the day to deal with variable need
  - It mimics the steady and small amount of insulin secreted by pancreas throughout day and night
  - Very precise delivery

Basics of Insulin Pump Therapy

- **Bolus**
  - Insulin given at meals to “cover” food eaten and correct elevated blood glucose levels
  - **Insulin to Carb Ratio:** example) 1 unit of insulin taken for every 15 grams of carbs.
  - **Correction/Sensitivity**: amount of insulin given to correct for high blood glucose levels. Think of it as the sliding scale or correction
  - **Target Blood Glucose:** the blood glucose level you are aiming for
  - **Insulin Action/Active Insulin Time:** Affects the amount of correction that can be given and helps to prevent ‘stacking’ of correction boluses that can lead to lows. It will calculate how much active insulin is on board and not allow extra to be given. The usual setting is 2 to 4 hours.



Advantages of Pump Therapy

Using an insulin pump means eliminating individual insulin injections: LESS SHOTS!

Pumps deliver insulin more accurately and precisely than injections

Ideal for athletes/exercise to decrease insulin delivery during an event or after through Temp Basal Rates

Meal time doses can be delivered over a period of time instead of all at once—i.e. Extended boluses for high-fat/high carb meals

Insulin pumps often improve A1C and glycemic control

Disadvantages of Pump Therapy

Increased risk for Diabetic Ketoacidosis (DKA):

Pump only delivers rapid acting insulin so there is a potential for rapid onset of significant hyperglycemia and DKA if insulin delivery is interrupted

Risk for site infection

Something is always attached to the person

Cost (pump $4500-$8500+; yearly supplies ~ $1,500.) That does not include the cost of sensors.

Manual Versus Automated



Manual runs off pre-set basal rates. It will not adjust on its own



Automated means the algorithm adjusts basal delivery based on sensor glucose trends and history of patient's insulin needs.



The algorithm predicts either 30 minutes to 60 minutes in advance

Goal for Automated Delivery Systems

More time in range 70-180!



Omnipod 5

Tubeless Automated Insulin Delivery System



- **Wearable** tubeless insulin-filled Pod communicates directly with Dexcom G6 sensor (continuous glucose monitor)
- **Algorithm is built into the Pod** – automated insulin delivery can continue without the handheld controller nearby
- **Omnipod 5 App** is used to start and stop Automated Mode, deliver boluses, view data, and change settings
- **Customizable glucose targets** from 110 to 150 mg/dL, in 10 mg/dL increments, adjustable by time of day
- **HypoProtect** feature for times of elevated hypoglycemic risk, such as exercise

Investigational Device. Limited by Federal (or United States) law to investigational use.

Omnipod DASH

FDA Approved June 2018

- Replaces current PDM with “locked down” android phone
- CalorieKing® food library with carbohydrate content for up to 80,000 foods
- Optimized for use with the CONTOUR®NEXT ONE Blood Glucose Meter for wireless transfer of blood glucose readings to the DASH™PDM
- Approved for all ages.



Omnipod Ero



- Only Tubeless insulin pump
- Waterproof
- Auto-Cannula insertion
- Approved for all ages: Pediatric through elderly

- PDM must be within 5 feet to communicate with Pod (for boluses)
- The Pod will deliver basal insulin 24 hours a day regardless of PDM location
- Personal Diabetes Manager (PDM) includes a Freestyle glucose meter
- 80 hour forced change-out (Pod can not be worn longer than 80 hours)

Tslim X2 with Control IQ



FDA approved on 12/13/2019

Approved for ages 6 and above

Control-IQ advanced hybrid closed-loop technology makes it easier by predicting and helping to prevent highs and lows.

- **AUTOMATIC INSULIN ADJUSTMENTS**

  Control-IQ™ technology automatically adjusts insulin levels based on Dexcom G6 continuous glucose monitoring (CGM) readings.†

- **ACTIVITY SETTINGS**

  Control-IQ technology includes optional settings for Sleep and Exercise Activities that adjust treatment ranges for more control.

- **CORRECTION BOLUSES**

  Control-IQ technology can also deliver automatic correction boluses (up to one an hour) to help prevent hyperglycemia.

Treatment values in Control-IQ technology

		Control-IQ	Sleep Activity	Exercise Activity
Delivers	Delivers an automatic correction bolus if sensor glucose is predicted to be above ____ mg/dL	180	--	180
Increases	Increases basal insulin delivery if sensor glucose is predicted to be above ____ mg/dL	160	120	160
Maintains	Maintains active Personal Profile settings when sensor glucose is between ____ - ____ mg/dL	112.5 - 160	112.5 - 120	140 - 160
Decreases	Decreases basal insulin delivery if sensor glucose is predicted to be below ____ mg/dL	112.5	112.5	140
Stops	Stops basal insulin delivery if sensor glucose is predicted to be below ____ mg/dL	70	70	80

Tslim X2 Control IQ

Sleep Activity

Narrower and lower range of treatment values from 112.5-120 mg/dL

- To enable the Sleep Activity:
  - Program Sleep Schedule(s)
  - Manually enable Sleep
- Recommended to program at least 1 sleep schedule:
  - Scheduling Sleep will automatically turn Sleep Activity on and off at pre-programmed times.
  - No need to remember to turn Sleep ON/OFF
- No Automatic Correction Boluses when a Sleep Activity is enabled



TANDEM

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Tslim X2 with Control IQ

Exercise Activity

Narrower and higher range of treatment values from 140-160 mg/dL

- To enable the Exercise Activity:
  - Manually from the home screen, tap Options, and select "Activity." Then, tap "START" which is located next to "Exercise"
- To confirm Exercise is enabled:
  - Exercise icon displayed next to the Control-IQ diamond icon in the upper-left hand corner of the CGM graph
- An Exercise Activity must be turned off in order to enable a Sleep Activity

  Note: *A Sleep schedule will not start if Exercise is enabled.*



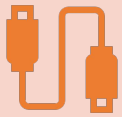
TANDEM

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Tandem Insulin Pumps: t:slim x2



Two-way Bluetooth radio allowing it to communicate with more than one external device at a time. (i.e. Phone, meter, CGM)



Fully Upgradable Pump: Tandem Device Uploader is a tool for the remote update of Tandem insulin pump software, allowing users to update their pump from a personal computer as new features are approved by the FDA.

Tandem Insulin Pumps: Tslim X2 with Control IQ

The T slim X2 with control IQ is designed to help increase time in range (70-180) using Dexcom G6 values to predict glucose levels 30 minutes ahead and to adjust insulin delivery accordingly.

T:Connect Mobile App

Allows patients and providers to view insulin pump data integrated on their phone.





Questions??????

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