“CGM” by Jackson Pollack

One Pollack sold for $140 million in 1996!

Make Your Own Jackson Pollack

For only $1,000!

Paradigm/Guardian® CGM Screens

On-Screen Reports
- 3 / 6 / 12 / 24-hr graphs
- Can scroll back for specific data points
- “direction” indicators
- Updates every 5 minutes
- Hi/Low Alerts
- Predictive Alerts (Guardian)

How To Read CGM Screens/Reports

Sensor daily overlay

Sensor results by meal
CareLink Online Reports

- Daily summaries & layered reports
- Sensor tracing
- Basals & boluses
- Carbs, exercise, etc

DexCom™ Seven Plus®

On-Screen Reports

- 1, 3, 6, 12, 24-hr graphs
- Updates every 5 minutes
- Hi/Low alerts
- Rate of Change alerts

DexCom™ 7 STS®

Dexcom DM2 Download Reports

- Hourly Stats
- Glucose Trend

DexCom™ 7 STS®

BG Distribution

- Trend Analysis

Alert Options

- Vibrate and/or beep
- Alerts for when glucose crosses specified high and low glucose thresholds
- Predictive alerts that you are likely to cross a high or low threshold (accurate up to ~20 min)
- Balance need for alerts against “nuisance factor” – Lack of sleep may raise your glucose

Where To Set The Alerts

<table>
<thead>
<tr>
<th>Threshold</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW</td>
<td>80 mg/dL</td>
</tr>
<tr>
<td></td>
<td>Less than 90 – only for pregnancy</td>
</tr>
<tr>
<td>HIGH</td>
<td>240 mg/dL</td>
</tr>
</tbody>
</table>
|           | To start Then gradually lower to 180 or less
|           | Higher: young children, high risk jobs
|           | Lower: as alerts tolerated to get earlier alert for rising BG

Hi/Low thresholds are not BG target ranges

Predictions And Trends
- Both help minimize highs and lows
- Good for:
  - Driving
  - Sports
  - Basal tests
  - Reducing uncertainty

Can CGM Replace Fingersticks?
- Not right away – wait at least 12 hrs after new sensor is started
- Trust CGM only if recent calibrations are in line
- Only if you ongoing fingersticks are done to ensure accuracy

Hypoglycemia Alerts
- Predictive hypo alert or hypo alert & stabilizing: less treatment
  - Less than usual carbs?
  - Medium G.I. food
- Hypo alert & dropping: aggressive treatment
  - Full or increased carbs
  - High G.I. food

Adjust Boluses Based on BG Direction
- BG Stable: Usual Bolus Dose
- BG Rising Gradually: ↑ bolus 10%
- BG Rising Sharply: ↑ bolus 20%
- BG Dropping Gradually: ↓ bolus 10%
- BG Dropping Sharply: ↓ bolus 20%

How Many Grams For A Low?
If DIA time and pump settings are accurate:
1. Carbs for low itself = 8-15 grams (based on wt & BG)
2. Then add the grams needed to offset BOB:
   add. grams = BOB X CarbF
3. Example:
   If BOB = 1.5 u and CarbF = 12 g/u,
   total grams needed = 15 g + (1.5 u x 12 g/u)
   = 15+18 or 33 grams of carb for this low BG
   Consider extra grams when needed for increased activity.

Help With Hypo Detection

Many thanks to Gary Scheiner, MS, CDE for help generating next 4 slides.
Use of 2 / 3 / 6 Hr Trend Graphs

- How different foods impact BG
- How did bolus work
- Discover postprandial spikes
- Exercise effects
- Impact of stress
- Pramlintide/acarbose influence

Use of 6 / 12 / 24 Hr Trend Graphs

- Helps decide basal insulin doses
- Shows delayed effects of exercise, stress, high-fat foods
- Reveals overnight glucose patterns
- Lets user know when bolus action is complete

5 Hr CGM Trend Analysis

Determine why glucose went high or low.

<table>
<thead>
<tr>
<th>Starting BG</th>
<th>In Target</th>
<th>Insulin &amp; carbs balanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can be high, low, or normal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If BG 4-5 hrs later is:</th>
<th>Insulin/Carbs in last 5 hrs:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Too High</td>
<td>Insulin too low or carbs in excess</td>
</tr>
<tr>
<td>Too Low</td>
<td>Excess insulin or too few carbs</td>
</tr>
</tbody>
</table>

CGM As Behavior Mod Tool

- First 3 days
- Next 3 days

Chef with Type 1 Diabetes for 13 years on insulin pump

First Two Days On CGM

CGM Two Days Later
Dosing Tips

Why Use TDD To Improve Control?

- Average TDD = Average BG
- Makes finding accurate basal rates, CarbF, and CorrF easy
- Right TDD and settings lead to lower and more stable BGs

Use pattern management to fine tune.

Find The TDD

TDD = 35.19 u
Low basal at 36%
2 gr of carb/day means Bolus Wizard is not used

Raise The TDD

For frequent highs, increase the current avg. TDD from a recent A1c or a 14 day BG average from meter.

Avg BG on pumps is 184.5 mg/dl (10.2 mmol) – most pumpers need a higher TDD

Basal / Carb Bolus Balance

Insulin use from best control tertile (132 of 396 pumps with avg BG of 144 mg/dl) in our Cozmo data study

Does Your Pump Have The Right Settings?


*Insulin use from best control tertile (132 of 396 pumps with avg BG of 144 mg/dl) in our Cozmo data study
Your Smart Pump Arrives Dumb

Your average BG and BG stability depend on:

- An accurate TDD
- Accurate basal rates (about 50% of TDD)
- An accurate CarbF
- An accurate CorrF
- An accurate DIA
- An accurate accounting of BOB*
- Appropriate correction target

Carb Factors Found in 405 Pumps

Carb factors from pumps are not physiologically distributed. Less accurate “magic” numbers – 5, 10, 15, and 20 g/unit – are preferred.

Pump Setting Formulas*

**Basal** = ~ 48% of TDD

**CarbF** = 2.6 x Wt(lbs) / TDD

Carb factor is directly related to insulin sensitivity = average carb factor times individual’s insulin sensitivity

**Corr. Factor** = 1960 / TDD

Correction factor is inversely related to TDD and also inversely related to avg. BG


How Pumps Handle BOB

<table>
<thead>
<tr>
<th>What's In the BOB &amp; What Is It Applied Against?</th>
<th>BOB Includes This Type Of Bolus</th>
<th>BOB Is Subtracted From This Type Of Bolus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Carb</td>
<td>Correction</td>
</tr>
<tr>
<td>Injection</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Animas Ping</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Deltec Cosmo</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Insulet Omnipod</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Medtronic Reval</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

* Except when BG below target BG
** Except when BG is below target and reverse correction is turned on

OVERNIGHT BASAL CHECK

Lower basal here: 4 to 8 hrs before BG drop begins

BG drop begins here: 70 mg/dl drop in 4 hrs

**YES = Safer**
Test The Carb Factor

1. **Clearout**
   - No bolus for 5 hrs
   - No carbs for 3 hrs

2. **Peak glucose doesn’t matter unless excessive**
   - Eat carbs = half wt (lbs) in grams

3. **Glucose back to target at end of DIA time**
   - No eating and no lows for 5 hrs after bolus

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Is This A Carb Factor Issue?

**Glucose Trend 12/27/2007**

- Glucose near target by end of DIA time
- And no lows for 5 hrs after bolus

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Test The Correction Factor & DIA

1. **Clearout**
   - No bolus for 5 hrs
   - No carbs for 3 hrs

2. **Give corr. bolus when BG is over 250 mg/dl**

3. **Glucose near target by end of DIA time**

4. **And no lows for 5 hrs after bolus**

CGM helps check both correction factor and DIA time

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Is This A CorrF or DIA Issue?

**Glucose Trend 4/27 thru 4/29/2010**

- Frequent lows followed by high BGs ~2/day

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Stop Lows First

**Frequent lows followed by high BGs ~2/day**

- 50 mg/dl (~3 mmol)

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Lower The TDD?

**Need a lower TDD with new basal rates, CarbF and CorrF derived from it.**
Highs And Lows – What To Do?

5 day average:
- Avg BG: 203.4 (11.3)
- Range: 39 to 401 (2.2 to 22.3)
- SD: 89.9

Breakfast Spikes After Night Lows

Raise The TDD?

Before & After Insulin Adjustment

TDD 36 u

1. Raised basal by 0.05 u/hr all day (+1.2 u/day)
2. Lowered carb factor from 1u/13g to 1u/12g (+1.8 u/day)

Pattern Control Steps

<table>
<thead>
<tr>
<th>Situation</th>
<th>Steps To Take</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequent lows</td>
<td>Lower TDD by 5% or more</td>
</tr>
<tr>
<td>Highs and Lows (lows come first)</td>
<td>Lower TDD, check for short DIA</td>
</tr>
<tr>
<td>Highs and Lows (hulls come first)</td>
<td>Check for settings that don’t “fit the TDD”, raise CorrF number</td>
</tr>
<tr>
<td>Mostly high</td>
<td>Raise TDD from table or formula</td>
</tr>
<tr>
<td>Occ. Unexplained highs</td>
<td>Change infusion set technique or infusion set brand, watch for association with particular food or stress, or ?</td>
</tr>
</tbody>
</table>
Not All High Readings Are Equal

<table>
<thead>
<tr>
<th>Cause Of High</th>
<th>Corr. Dose Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jelly on the finger</td>
<td>0 (wash, repeat test)</td>
</tr>
<tr>
<td>Forgot to bolus</td>
<td>Corr. dose only</td>
</tr>
<tr>
<td>Infusion set failure</td>
<td>Corr. + basal</td>
</tr>
<tr>
<td>Ketoacidosis</td>
<td>2-3 X normal corr</td>
</tr>
<tr>
<td>Infection</td>
<td>1.5-3 X normal corr</td>
</tr>
</tbody>
</table>

Hyperglycemia Pearl

When you want to speed the fall with a high glucose reading:
Take usual correction dose
Add to this a certain amount of carb coverage, say 10 or 20 grams
Take correction + carb bolus but wait to eat

– Lets BG fall faster!
– But make sure to eat carb grams in time!

Occlusions Worsen Control

<table>
<thead>
<tr>
<th>BG Tertile</th>
<th>Low</th>
<th>Middle</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg BG</td>
<td>146.6</td>
<td>181.6</td>
<td>229.3</td>
</tr>
<tr>
<td>BGs/day</td>
<td>4.74</td>
<td>4.52</td>
<td>4.22</td>
</tr>
<tr>
<td>Blocks/month</td>
<td>1.36</td>
<td>3.04</td>
<td>3.57</td>
</tr>
</tbody>
</table>

Occlusions / Blockages

Should never happen!
More than once a month?

- Change brand of infusion set
- Or brand of insulin (less likely)

Never Stop Your Pump!*

- You may forget to turn it back on
- It’s rarely needed
- It doesn’t help when you’re low

Use a temp basal reduction for 30 to 60 min, instead, so pump restarts on time with no followup highs later.
Never go off pump more than 1 hour without giving a bolus before disconnect to cover missing basal (max time off ~4 hrs after disconnect bolus).

Common Reasons For Set Failure

Unexplained highs can occur from:
- Poor design
- Use of auto-inserters
- Bent or kinked Teflon
- Not taping down the infusion line
- Bleeding (hematoma)
- Inadequate training

Don’t accept “scarring” or “poor absorption” (blame shifting)
Another Source For Set Failure

Is There An Infusion Set Problem?

- Do sites often "go bad"
- Are you experiencing "unexplained" highs?
- Do highs correct only after you change the infusion set?

Yes?

- Anchor the infusion line with tape
- Review site prep technique
- Switch to a different brand of infusion set

Night Infusion Set Failure On CGM

Tip For CGM

- Be patient and have realistic expectations
- Don’t panic if the meter and sensor numbers differ
- Look at trends not just individual values
- Rapid rises usually mean you need more insulin
- Expect lag time
- No Tylenol with Dexcom

More Tips For CGM

- Wear CGM at least 90% of the time
- Look at the monitor 10-20 times per day
- Don’t go from BG to BG – Get the big picture!
- Don’t over-react to data – Avoid frequent between meal corrections until pattern is clear
- Take BOB into account
- Calibrate!
- Minimize “nuisance” alarms

Technology Alone Never Enough

A pump or CGM can’t adjust your doses for exercise, heat, GI index of foods, stress, infection, circumstances around high BG, etc.
Reading – Still The Best Way To Learn

www.diabetesnet.com or 800-988-4772