Glucose Monitoring as a Tool for MNT: Re-thinking Meal-time Insulin Dosing in Type 1 Diabetes
Disclosures

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• Board Member/Advisory Panel
  • Professional Development Chair Diabetes Care and Education DPG
• Consultant/Contracted Trainer
  • Medtronic Diabetes
  • Tandem Diabetes Care
  • Insulet Corporation
  • Roche
  • The Dialogue Company
  • Balancing Life’s Issues
Learning Outcomes

• Participants will be able to describe current glucose monitoring trends and options
• Participants will recognize the importance and value of glucose data in MNT discussions and recommendations
Glucose Monitoring

• Glucose monitoring is the dietitian’s greatest tool when working with patients who have diabetes
  • Personalizes recommendations
  • Provides insight into the patient’s day beyond when they tell you in a 24 hr recall

• “Forgetting to bring meter is like forgetting to bring dog to the vet”
Glucose Monitoring Goals

• American Diabetes Association (ADA) [1]
  • Pre meal: 80-130 mg/dl
  • 1-2 hours Post meal: <180
  • A1c <7%

• American Association of Clinical Endocrinologists (AACE) [2]
  • Fasting <110 mg/dl
  • 2 hours post meal <140 mg/dl
  • A1c <6.5%

* Should be personalized backed on life expectancy, risk of hypoglycemia, micro and macrovascular complications, etc.
Glucose Monitoring

• When to test?
  • Type 1:
    • Test before meals and snacks [1]
    • Before critical tasks such as driving, exercise, bedtime [17]
  • May need more at different times
    • Pregnancy
    • Carb ratio and sensitivity testing
    • Activity

• How to test?
  • Important to evaluate how a patient is testing; much of the accuracy is determined by the user
    • CLEAN hands
    • Test Strip storage/expiration
Glucose Monitor Accuracy

• FDA requires meters to be within ± 15 mg/dl for values <75 mg/dl and ± 20% for glucose values >75 mg/dl 95% of the time based on 2003 International Organization for Standardization (ISO) criteria

• ISO 2013 recommends that 99% of values be within ±15% for glucose >75 mg/dl and 99% be within ±15 mg/dl for glucose values <75 mg/dl.

• FDA is suggesting tighter guidelines and more rigorous testing: 95% ±15% and 99% ±20% for all results.
  • Does not currently do post-market accuracy follow-up (generic meters do not have to maintain initial accuracy).
Glucose Monitoring Options

• Prefer “name brand” meters for best accuracy and downloading ability

• Cost/insurance are usually the determining factor
  • Price range $.83-$1.75/strip for name brand; as low as $.18 per strip Relion (Wal-Mart brand)

• 27+ brands of meters on the market
  • Diabetes Forecast® Consumer Guide 2016

• Consider patient needs: vision loss, downloading ability, meter size, blood drop size
Freestyle

• Precision Neo- test strips available over the counter for about $19.99 for 50 strips
• Strips use least amount of blood, Freedom Lite and Lite are small, easy to use
• Insulix, touch screen, allows user to keep a diary of insulin dosage
OneTouch

• OneTouch Verio® line improved accuracy from OneTouch Ultra® 2

• Shows in color if results are in or out of range, Verio® gives notifications for repeated highs and lows

• One Touch Reveal® App links to Flex and Sync meter (track carbs, activity, etc.), email log to HCP
Contour®

- Contour® Next EZ meters are easy to use, basic meters
- Contour® Next USB is rechargeable and easily downloadable
- New Contour® Next One: info coming Oct 2016
Accu-Chek®

- Accu-Chek® Aviva Expert
  - Gives user bolus advice based on carb ratio, sensitivity, active insulin
  - Only available from a HCP
  - Patient must be trained by HCP
  - Great option for non-pump users
### Device Settings

<table>
<thead>
<tr>
<th>Time Blocks</th>
<th>IN - Insulin to Carbohydrate Ratio</th>
<th>ISF - Insulin Sensitivity Factor</th>
<th>bG Target Range</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Start Time</td>
<td>End Time</td>
<td>Insulin Units</td>
</tr>
<tr>
<td></td>
<td>00:00:00</td>
<td>05:30:00</td>
<td>1.0 U</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>20:00:00</td>
<td>00:00:00</td>
<td>1.0 U</td>
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### Advice Options

<table>
<thead>
<tr>
<th>Advice Options</th>
<th>Personal Settings</th>
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<tbody>
<tr>
<td>Advice Enabled</td>
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</tr>
<tr>
<td>Active Time</td>
<td>04:00:00</td>
</tr>
<tr>
<td>Offset Time</td>
<td>02:00:00</td>
</tr>
<tr>
<td>Meal Rise</td>
<td>50 mg/dL</td>
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<tr>
<td>Snack Size</td>
<td>15 g</td>
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</table>

### Health Event Settings

<table>
<thead>
<tr>
<th>Health Event Settings</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise 1</td>
<td>-15 %</td>
</tr>
<tr>
<td>Exercise 2</td>
<td>-20 %</td>
</tr>
<tr>
<td>Stress</td>
<td>0 %</td>
</tr>
<tr>
<td>Illness</td>
<td>20 %</td>
</tr>
<tr>
<td>Premenstrual</td>
<td>0 %</td>
</tr>
</tbody>
</table>
### Other Settings

#### Meter Settings
- **Carbohydrate Units**: g

#### Personal Settings
- **Hyper Limit**: 250 mg/dL
- **Hypo Limit**: 50 mg/dL
- **bG Units**: mg/dL

#### Bolus Settings
- **Insulin Increment**: 0.5 U
- **Maximum Bolus**: 20.5 U

#### bG Test Reminder Event

<table>
<thead>
<tr>
<th>Event</th>
<th>Enabled</th>
<th>Threshold</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>After High bG</td>
<td>Off</td>
<td>250 mg/dL</td>
<td>04:00:00</td>
</tr>
<tr>
<td>After Low bG</td>
<td>Off</td>
<td>75 mg/dL</td>
<td>00:05:00</td>
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<tr>
<td>After Meal bG</td>
<td>Off</td>
<td>15 g</td>
<td>02:00:00</td>
</tr>
</tbody>
</table>
Accu-Check®

- **Accu-Chek® Connect**
  - Links to Connect app
  - Connects to HCP Connect account
  - Can give insulin advice if programmed by HCP
  - Can send text messages to care provider
ACCU-CHEK® Connect
Patient Summary
09-14-2016 - 09-27-2016
Overview Analyses and bG Graph

Average bG: 109 ± 19 mg/dL Average Tests per Day: 1.9 Number of Hypos (< 70 mg/dL): 0

Alert Status

<table>
<thead>
<tr>
<th>Hypo Frequency</th>
<th>Low</th>
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<tbody>
<tr>
<td>Hypo Risk</td>
<td>Insufficient data</td>
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<tr>
<td>Hyper Frequency</td>
<td>Low</td>
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<tr>
<td>Variability</td>
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Blood Glucose

![Blood Glucose Graph]

Insulin

<table>
<thead>
<tr>
<th>Insulin Injections</th>
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</thead>
<tbody>
<tr>
<td>Total Insulin / Day</td>
<td>5.8 U</td>
</tr>
<tr>
<td>Short-acting Insulin / Day</td>
<td>5.8 U (100.0 %)</td>
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<tr>
<td>Injections / Day</td>
<td>2.0</td>
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Bolus Advice

<table>
<thead>
<tr>
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<th>52</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Accepted Boluses</td>
<td>26 (50.0 %)</td>
</tr>
<tr>
<td>Number of Modified Boluses</td>
<td>0 (0.0 %)</td>
</tr>
<tr>
<td>Number of Boluses without Advice</td>
<td>26 (50.0 %)</td>
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</table>
Average bG: **154 ± 79 mg/dL** Tests: 58

<table>
<thead>
<tr>
<th>Breakfast</th>
<th>Lunch</th>
<th>Dinner</th>
<th>Bedtime</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tuesday 09-27-2016</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>6:00 AM</td>
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<td>6:00 AM</td>
<td>6:00 AM</td>
</tr>
<tr>
<td>143</td>
<td>7.50</td>
<td>44</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>11:55 AM</td>
<td></td>
<td>11:55 AM</td>
</tr>
<tr>
<td><strong>Monday 09-26-2016</strong></td>
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<td>6:52 AM</td>
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<td>9:00 AM</td>
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<td>134</td>
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<tr>
<td></td>
<td>12:35 PM</td>
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<tr>
<td><strong>Sunday 09-25-2016</strong></td>
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<td>6:45 AM</td>
<td>10:30 PM</td>
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<tr>
<td>166</td>
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<tr>
<td></td>
<td>11:34 AM</td>
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<td><strong>Friday 09-23-2016</strong></td>
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<tr>
<td></td>
<td>11:34 AM</td>
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<td>12:24 PM</td>
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<tr>
<td><strong>Thursday 09-22-2016</strong></td>
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<td>7:20 AM</td>
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<td>46</td>
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<td>8.50</td>
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<tr>
<td></td>
<td>12:55 PM</td>
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<tr>
<td><strong>Wednesday 09-21-2016</strong></td>
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<td>3.50</td>
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<tr>
<td></td>
<td>07:16 PM</td>
<td></td>
<td>07:16 PM</td>
</tr>
</tbody>
</table>

FNCE 2016
Continuous Glucose Monitoring

• Future of standards of care for type 1 diabetes
• Measures interstitial glucose and provides reading to the user every 5 minutes
• Sends personalized alerts for lows and highs
• Not currently approved for insulin dosing
CGM Pros and Cons

• Pros
  • Alerts user to highs and lows before they happen
  • Can prevent severe hypoglycemia and complications
  • Gives context to BG results (arrows and trend graph)
  • Helps achieve tighter glucose control with out more lows
  • May reduce amount of self-monitoring blood glucose

• Cons
  • Cost
  • Ability to insert sensor correctly
  • Alert fatigue
  • Not as accurate as finger sticks in certain situations
    • After activity
    • After insulin
    • After hypoglycemia

Research is strongly in support of continuous glucose monitoring!
CGM Accuracy

• Fingerstick testing is still considered to be the most accurate [3]

• BG gives the glucose concentration at that moment and CGM data does have some lag time especially when blood sugar is changing rapidly [3]
  • CGM measures glucose in interstitial fluid surrounding fat cells below the skin
  • Delay in how the transmitter sends the data to the receiver (updates every 5 minutes with average of results); can lag from 6 to 12 minutes
  • Other factors- sensor insertion, site trauma, calibration technique
Mean Absolute Relative Difference (MARD)

- Medtronic Enlite® 13.6% (http://professional.medtronicdiabetes.com/para/new-enlite-sensor)
- Dexcom® G4™ 9% (https://www.dexcom.com/dexcom-g4-platinum-performance)
- Decom® G5 9% (https://www.dexcom.com/en-GB)
- Freestyle Libre 12% ? (reported by rep)
- Medtronic Guardian® 3 “9-11%” (reported by medical director)
Support for Continuous Glucose Monitoring

• JDRF trial: Type 1 patients with A1c>7%, clinical CGM use was associated with A1c reduction after 6 months and hypoglycemia decreased from 27.7 events per 100 person years to 15 events. [4]

• Patients using CGM “almost daily” for 1 year experienced a 98% decrease in fear of hypoglycemia. There was an 86% decrease in emergency medical care. They were also able to decrease their SMBG, saving costs. [5]

• Use of CGM with or without insulin pump therapy had greatest A1c lowering after 12 months compared to insulin pump therapy alone. [6]
Support for CGM cont.

- Type 1 patients who used CGM had significantly less time per day spent in hypoglycemia than the control group. This group also had lower A1c’s at 26 weeks. [7]

- Type 1 diabetes with poor control, short/intermittent use of CGM resulted in lower A1c, in conjunction with diabetes education program [8]

- Pregnant women with type 1 and type 2 diabetes, intermittent use of CGM for 4-6 weeks throughout pregnancy, CGM group had lower A1c levels at 32-36 weeks (5.8% vs 6.4%) and had decreased risk for macrosomia [9]
CGM Options

• Professional
  • Placed on patient in HCP office and worn for 4-7 days; patient keeps food, glucose and insulin records
  • Patient comes back for download and data interpretation visit
  • RDN can interpret report and bill for MNT or send recommendations to MD and they can write note/letter and bill under the physician schedule fee (must be in office that day)
• CPT Codes:
  • 95290 placement
  • 95251 interpretation by physician
  • RDN can bill interpretation as MNT 97801 (initial) or 97803 (follow-up)
Professional CGM Options

• Dexcom® G4™
  • Worn for 7 days
  • Receiver must be within 20 feet
  • Calibrate 2x/day (every 12 hours) after initial start up period
  • Carb amounts and activity can be logged on the receiver or paper records
  • Patient can see glucose trends in real time

• Medtronic iPro2®
  • Worn for 6 days
  • Patient continues to check blood sugars on home monitor; pre-meal and bedtime is suggested (4x/day)
  • Data is download and reviewed retroactively
  • No alarms or entering data on device required
  • Paper food records
Professional CGM Options Cont.

• FreeStyle Libre Pro [15]
  • Just approved 9/28/2016!
  • Small, round sensor is placed on back of the arm
  • Can be worn up to 14 days
  • No calibrations required
  • Records glucose every 15 minutes
  • HCP uses Freestyle Libre Pro reader to download data in the office for review
  • May be less expensive option
Patient Selection: Professional CGM

• AACE Consensus statement 2010 [10]
  • Type 1 or type 2 adults
    • With A1c not in goal
    • Who experience hypoglycemia unawareness
  • Type 1 youth
    • Treatment change
    • Nocturnal hypoglycemia or hypoglycemia unawareness, post prandial hyperglycemia,
  • Type 1 & pregnancy
Case Study 1

• LH, female, age 63, type 1 since age 5
• A1c 7.9%, has used an insulin pump for >10 years
• Scheduled RDN appointment because of concerns with some high blood sugars and exercise adjustments
MNT Recommendations

- Upon reviewing records, patient felt much better about blood sugars; average BG on pump printout 138 mg/dl
- Discussed exercise pattern: BG dropping post exercise, has pump suspended during exercise class
  - Suggested: eat ½ sandwich before class with out insulin
- Discussed CGM option and recommended Dexcom® professional
- Other option
  - Start temp basal at 50-70% an hour before the class so she doesn’t have as much active insulin going into the class
Professional CGM

Statistics
- Average Glucose: 153 mg/dL
- Sensor Usage: 7 of 7 Days
- Calibrations/day: 2.3
- Standard Deviation: ± 56 mg/dL

53% High
44% Target
3% Low

Target Range: 80 - 130 mg/dL
Nighttime: 10:00 PM - 6:00 AM

Pattern Insights Summary

<table>
<thead>
<tr>
<th>Nighttime Lows (0 Found)</th>
<th>Daytime Lows (0 Found)</th>
<th>Nighttime Highs (0 Found)</th>
<th>Daytime Highs</th>
</tr>
</thead>
<tbody>
<tr>
<td>No significant patterns detected</td>
<td>No significant patterns detected</td>
<td>No significant patterns detected</td>
<td>Most significant pattern of highs found</td>
</tr>
</tbody>
</table>

Note: See above graph for other patterns as well as review any individualized considerations.

Interpretation

- Adjustment to the timing of insulin delivery
CGM Trial Outcome

• Patient was completely unaware of post-breakfast spike
  • Typically eats high fiber cereal at 8am, walks at 11am and by 12pm BG is 70mg/dl or less, uses slight temp basal for walk

• Recommendation: add protein to breakfast cereal or try toast and eggs or Greek yogurt instead of cereal

• Other option: along with change in meal, start temp basal of 50% 30-60 minutes before walk
Personal CGM Options

• Dexcom®
  • Dexcom G5 Mobile® system
    • Sensor data transmits to receiver or G5 app on phone
    • Share app allows care giver to receive alerts
    • Sensor can be worn for 7 days
    • Reports are upload via cloud to Clarity which can be linked to HCP
    • Can be used independently of insulin pump therapy
Insulin Pumps with Dexcom® Integration

Animas® Vibe®

Tandem® t:slim G4™
CGM Options Cont.
• Medtronic MiniMed® 530G or 630G
  • Sensor transmits glucose value to insulin pump
  • 530G can link to Connect app
  • Both feature low glucose SmartGuard™ technology to suspend insulin from pump for up to 2 hours
  • Sensor can be worn for 6 days
CGM Options Cont.

- Coming Spring 2017- Medtronic 670G\cite{16}
  - Uses Guardian\textsuperscript{\textregistered} Sensor 3, improved accuracy, 7-day life
  - Approved by FDA for hybrid closed loop therapy
    - Adjusts basal rate insulin 24 hours a day based on sensor readings
    - Patient enters mealtime carbohydrates, calibrates the sensor and accepts bolus corrections
    - Approved for ages 14 and up
PIVOTAL TRIAL DATA FOR MINIMED 670G SYSTEM
NON-RANDOMIZED STUDY – NO CLAIMS CAN BE MADE*

The pivotal study was conducted in 124 patients. There was a 2-week run-in period followed by a 3 month study period with 12,389 patient-days of Automated Basal Delivery use.

MORE PATIENTS ACHIEVED A1C <7% WITH AUTOMATED BASAL DELIVERY: RUN-IN VS. STUDY PERIODS

Pivotal Trial Outcomes:
Improvement in A1C: 
- A1C 7.4±0.9% at baseline and 6.9±0.6% at study end - (0.5% improvement)

No Severe Adverse Events During Study: 
- No DKA and no severe hypoglycemia

Reduction in Glycemic Variability: 
- Improvement in “time-in-range” (66.7% during run-in, 72.2% during study period)
- 44% less low glucose* events comparing run-in to study periods

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*Bergenstal RM, et al. JAMA. Published online September 15, 2016. 
*Data as measured by device sensor. Range defined as 71-180mg/dL during study period.
Study of 124 adults and adolescents (ages 14-20) with type 1 diabetes. Diagrams rounded for illustrative purposes only. *Since this study did not include a control group, no claims regarding effectiveness can be made. However, the study does support that the device is relatively safe for use.
CGM Insurance Coverage

• Biggest barrier to CGM therapy
  • Medicare currently does not cover personal CGM but will cover professional 1x/quarter
  • Most private insurance covers personal and professional CGM for type 1 diabetes
    • Glucose records (4x/day testing)
    • Evidence of hypoglycemia or hypoglycemia unawareness

• Cost out of pocket:
  • $1,000-1,400 for receiver (up to $8,000 as part of an insulin pump), up to $500 for transmitter (3-12 months of use), $50-$100 per sensor (1 week use)
MNT and Type 1 Diabetes

• ADA Standards of Care:

  “MNT is an integral component of diabetes prevention, management, and self management education. All individuals with diabetes should receive individualized MNT, preferably provided by a registered dietitian who is knowledgeable and skilled in providing diabetes-specific MNT. MNT delivered by a registered dietitian shows A1C decreases of 0.3–1% for people with type 1 diabetes and 0.5–2% for people with type 2 diabetes.” [1]
MNT and Type 1 Diabetes

• Carbohydrate Recommendations
  • Fixed insulin doses: consistent carb intake [1]
    • Women: 45-60g carb/meal, 0-15g carb/snack
    • Men: 60-75g carb/meal, 0-30g carb/snack
  • Adjustable insulin doses: personalized insulin dosing based on carbohydrate intake [1][11]
    • Involves comprehensive nutrition education and glucose monitoring to best achieve glycemic control
    • Food records
    • Insulin records
    • Intensive glucose monitoring
MNT and Type 1 Diabetes

• Standards of care suggest use of insulin to carbohydrate ratios and MNT to optimize glucose control (ADA) [1]

• Most research shows individualized MNT vs specific “diabetic diet” was the most effective (SOP 2008) [12]

• Most research focuses on total carbohydrate intake at meals [11]

• Recent research on dietary fat and insulin adjustment because of CGM technology

• More research is needed to develop algorithms in regards to dosing insulin based on carb, fat and protein composition of meals [13]

• Glucose monitoring is key to personalizing recommendations!
“Current clinical approaches to intensive diabetes management tend to be insulin-centric; however, a focus on dietary quality and mealtime routine, with referral to a registered dietitian for medical nutrition therapy, may be just as important for optimizing glycemic control. In the coming years, as continuous glucose monitoring becomes the standard of care in the management of type 1 diabetes, the challenges of keeping postprandial glucose concentrations in range will become an inescapable and increasing focus in the daily lives of people with diabetes.” [13]

New Diagnosis- Adult

• “Half of All Type 1 Diabetes Develops After 30 Years of Age” [14]

• First MNT Visit:
  • Review glucose monitoring technique, timing and goals
  • Focus on carbohydrate food sources, label reading and carbohydrate counting (grams), hypoglycemia treatment
  • May start with fixed insulin dose and consistent carbs or carb ratio of 1:15 and total grams of carb
  • Food records and glucose monitoring pre and post meals are key to personalizing
Hypoglycemia Treatment

• Rule of 15
  • Treat blood sugar <70mg/dl with 15g of fast acting carbohydrate
    • 4 oz. soda or juice
    • 3-4 glucose tablets
    • 1 oz. Skittles (~25 or 1 “fun size”), 4 Starburst
    • 1 tbsp. sugar, honey, maple syrup
  • Wait 15 minutes and re-test
  • If still low re-treat

• Emphasize importance of waiting 15 minutes!
Follow-up Visit

• Evaluate carb ratio based on food records and glucose monitoring
• Begin looking at total diet composition and meal planning (if patient is ready)
• Start discussing effect of high fat/protein, glycemic index
• Follow-up visits until carb ratios are established and glycemic control most of the time
• Standards of care suggest follow-up at least yearly [1]
Case Study 2

- Patient: AL, new referral to endocrinology clinic
- Age 38, male, diagnosed 2 1/2 years ago with type 1 by PCP
- Insulin: detemir 10 units daily & aspart 6-6-7 plus correction scale of 1 unit/50>200 mg/dl
- Recently was hospitalized with diabetic ketoacidosis because PCP told him to stop taking glargine (due to lows overnight); has never counted carbs or dosed insulin for carbs
- Endo ordered RDN visit and use of carb ratio 1:15 to start
Initial MNT Visit

• Patient works night shift, eats out frequently, very limited understanding of type 1 diabetes, states he is fully ready to learn and has a positive attitude

• Discussed carbohydrate foods and label reading. Focused on foods he frequently eats (fast food); provided resources for carb counting (Eating Out Guide, Calorie King, apps)

• Reviewed insulin dosing using carb ratio

• Instructed to keep records over the next week with food, activity, blood sugar and insulin
<table>
<thead>
<tr>
<th>DATE: 7-29-16</th>
<th><strong>BREAKFAST</strong></th>
<th><strong>SNACK</strong></th>
<th><strong>LUNCH</strong></th>
<th><strong>SNACK</strong></th>
<th><strong>DINNER</strong></th>
<th><strong>SNACK</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Time: 10:30</td>
<td>Time: 2:30</td>
<td>Time: 4:30</td>
<td>Time: 9:00</td>
<td>Time: 1:00PM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food you consumed and the amount of carbs for each:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cinnamon Roll</td>
<td>Biscuit</td>
<td>Carrot 1/2</td>
<td>Milk 1/2</td>
<td>Bar 1/2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bagel w/ 1/2</td>
<td>130g</td>
<td>140g</td>
<td>160g</td>
<td>25g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cinnamon Sugar</td>
<td>2oz</td>
<td>15g</td>
<td>30g</td>
<td>85g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8oz OJ = 26g</td>
<td>15g</td>
<td>30g</td>
<td>85g</td>
<td>25g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total grams of carbs**</td>
<td>98g</td>
<td>115g</td>
<td>110g</td>
<td>10 units Levemir</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulin (food &amp; correction):</td>
<td>9 units NovoLog</td>
<td>10 units NovoLog</td>
<td>10 units NovoLog</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comments/Activities:</td>
<td>went to casino</td>
<td>work 5-9</td>
<td>10 units Levemir</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE: 7/30/16</th>
<th><strong>BREAKFAST</strong></th>
<th><strong>SNACK</strong></th>
<th><strong>LUNCH</strong></th>
<th><strong>SNACK</strong></th>
<th><strong>DINNER</strong></th>
<th><strong>SNACK</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Time: 12:30</td>
<td>Time: 4:30</td>
<td>Time: 9:30</td>
<td>Time: 11:30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BG: 275</td>
<td>BG: 135</td>
<td>BG: 34</td>
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</tr>
<tr>
<td>Food you consumed and the amount of carbs for each:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taco Bell -</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium Supremo</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>85g</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frito's</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>85g</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>85g</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total grams of carbs**</td>
<td>85g</td>
<td>1</td>
<td>10 units Levemir</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulin (food &amp; correction):</td>
<td>9 units NovoLog</td>
<td>5 units NovoLog</td>
<td>10 units Levemir</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comments/Activities:</td>
<td>Laundry</td>
<td>work 5-9:30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*What's BG? Blood Sugar Level **Please note this is the total of the above entry of food consumed in terms of grams of carbs.
**FOOD AND ACTIVITY RECORD PG.2**

<table>
<thead>
<tr>
<th>DATE:</th>
<th>BREAKFAST</th>
<th>SNACK</th>
<th>LUNCH</th>
<th>SNACK</th>
<th>DINNER</th>
<th>SNACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/27/16</td>
<td>Time: 8:30</td>
<td>Time: 2:45</td>
<td>Time: 4:00</td>
<td>Time: 1:35</td>
<td>Time: 12:00 AM</td>
<td></td>
</tr>
<tr>
<td>7/28/16</td>
<td>Time: 8:30</td>
<td>Time: 4:05</td>
<td>Time: 6:05</td>
<td>Time: 7:45</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Total grams of carbs** | 84g | 69g | 26g | 0g | 0g |
| Insulin (food & correction): | 9 units Novolog | | | 6 units Novolog | 10 units Levemir |

*What's BG? Blood Sugar Level  **Please note this is the total of the above entry of food consumed in terms of grams of carbs*
Follow-up MNT visit

• Positives:
  • Kept records!
  • Testing BG 3+ times per day
  • Counting carbs accurately in exact grams

• Areas for Discussion:
  • Hypoglycemia treatment
    • “Rule of 15”
  • Insulin adjustment for activity/work
  • Diet composition (very high fat, high carbs; frequent fast food)
Follow-up MNT cont.

• Recommendations:
  • Change carb ratio at breakfast and lunch to 1:20 on active days
  • Discussed with MD: Recommend long-acting insulin adjustment from 10 units to 12 units
  • Change to Accu-Check® Connect meter with insulin advice

• Other options:
  • Begin working on more balanced diet, lower carbohydrate intake, less eating out, lower fat intake
Not Newly Diagnosed

• Goals:
  • Accurate carbohydrate counting and resources
  • Balanced diet and meal composition
    • Protein, fat and carb at meals
    • Moderate carb intake
  • Discussion on effects of high fat, protein, glycemic index as appropriate
  • New resources/ideas
    • High prevalence of burnout
    • Give ideas of new foods, recipes they can try
    • Offering CGM or even new meter can give some positive motivation
Not Newly Diagnosed

• Keep in mind length of diagnosis
  • Those diagnosed 20+ years ago were taught consistent carbs and exchange lists
    • Overwhelming and difficult to follow for most
    • Many report being “bad diabetic” because they don’t follow “the diet”
    • Sign would be stating use of carb ratio 1:15, but being “bad” at it and using best guess to dose most of the time or using fixed doses of insulin at meals
  • Use of bolus advice meter is great tool in these cases
Case Study 3

• Patient: RS, male, 64 old, type 1 for 16 years
• Referred for RDN visit because of A1c 11%, introduce ICR concept
• Insulin: Glargine 10 units at bedtime, Lispro 2 units/meal plus sliding scale of 1/100>200 mg/dl
• Doesn’t take insulin as prescribed- skips meal time dose if not able to test, only tests 1-2 times/day
• States he is aware of carb counting and portions but is not currently counting carbs
• Didn’t bring meter to visit
Initial MNT

Discussed:

• BG monitoring
  • Pre-meals and bedtime

• Carbohydrate counting and using insulin:carb ratio.
  • MD suggested 1/30g to start

• Correction vs. food insulin

• Hyper/hypo glycemia treatment
Follow-up MNT

• Positives:
  • BG testing 2-3x/day; average blood glucose: 141 mg/dl (A1c 11%=269 mg/dl)
  • Using carb ratio of 1 unit/30g of carb

• Area of Concern
  • Not giving insulin if eating lunch out, so high pre-dinner BG’s those days

• Recommendation:
  • Continue using carb ratio
  • Set up with bolus advice meter
  • Discussed strategies for insulin/testing when eating out
3 years later

• A1c 8.6%
• Has a Dexcom® sensor, not using because he can’t remember how to insert it and needs a new transmitter
• Not using bolus advice meter, back to base doses and guessing
• Recovering from recent hip surgery
MNT Intervention

• Reviewed carb counting and using carb ratio, discussed some app options to help count carbs
• Called Dexcom® to start new transmitter process
• Discussed insulin pumps per patient request
Several Months Later. . .

- Started on insulin pump therapy and CGM
- Pump average = 223 mg/dl, sensor average 199
MNT Intervention

• Patient states he has lost trust in the pump
• Started discussion on carbohydrate counting skills because of late day spikes
  • Patient admits to giving insulin post eating instead of before
    • Reviewed insulin timing and delivery
  • Plan: give insulin BEFORE eating and keep food records to see if spikes could also be related to macronutrient content of meals or insulin:carb ratio
Practice Applications

• Educate patients with type 1 diabetes on importance of glucose monitoring in relation to diet and glucose control- bring meter to visits!

• Realize there are a lot of opportunities for MNT discussions even with adults who have had type 1 for years

• Always utilize glucose data (SMBG or CGM) in MNT discussion and interventions for adults with type 1 diabetes
References

1. Diabetes Care 2016;39(Suppl. 1):S43 | DOI: 10.2337/dc16-S001


References Cont.


References Cont..


