DIABETES AND TECHNOLOGY

The future is here
PETER V CLARKE MD
FRCPC FACP

Waterloo Wellington/Caledon Dufferin Diabetes Care
Here are some examples of the prehistoric tech I had to work with. I thought it was great at the time....
B-D INSULIN SYRINGE
For use with
20 OR 40 UNIT INSULIN

Becton, Dickinson & Co.,
Rutherford, N. J.
Early Insulin Pumps (early 1970s)
Placing insulin-pump needle under skin

Puzzling Ailment

Hope for juvenile diabetics
THE LAST DECADE HAS SEEN MANY NEW INNOVATIONS IN DIABETES MANAGEMENT.

THE NEXT DECADE PROMISES EVEN MORE CHANGE AND BETTER CARE OF DIABETES.

HERE ARE A FEW EXAMPLES OF WHAT WE HAVE AND WHAT’S IN STORE.
Artificial pancreas at a glance

1. CGM sensor
   Continuous glucose monitoring (CGM) sensor is inserted under the skin to continuously measure glucose concentrations in the patient's cells.

2. CGM receiver
   CGM receiver displays the updated readings as graphs and trends minute-by-minute, and translates the readings from USB to Bluetooth.

3. Control algorithm device (CAD)
   Readings are sent to a control algorithm device (CAD) - e.g., a smartphone, tablet, or PC - where an algorithm analyses them and calculates the correct insulin dose, if required.

4. Insulin pump
   The CAD communicates with a body-worn insulin pump that automatically administers the correct insulin dose via a cannula inserted under the skin.
COMPONENTS OF A HYBRID CLOSED LOOP SYSTEM

CONTOUR® NEXT LINK Wireless Blood Glucose Meter

4th Generation Sensor

Insulin Pump

CareLink™ Software

One-press Serter

WARNING: Medtronic performed an evaluation of the hybrid closed loop system and determined that it may not be safe for use in children under the age of 7 because of the way that the system is designed and the daily insulin requirements. Therefore, this device should not be used in anyone under the age of 7 years old. This device should also not be used in patients who require less than a total daily insulin dose of 8 units per day because the device requires a minimum of 8 units per day to operate safely. 1. Sheer J, et al. ISPAD 2017; ePoster session 1: Technology; eP006
Patient with diabetes – open loop insulin delivery system

Patient with diabetes – closed loop insulin delivery system

Data on File: Medtronic Confidential February 2016
Hybrid closed loop resulted in:
- Increased time in range
- Reduced time spent low and high
- Reduced variability
- Less post-prandial excursion

Due to inherent study limitations, caution is advised when attempting to extrapolate these results to new patients. There could be significant differences.

SUMMARY

- Three months of unsupervised at-home use of the hybrid closed loop system resulted in no severe hypoglycemia or DKA.

- The new 4th generation sensor was accurate.

- Study phase vs. run-in results
  - Increased time in target range
  - Decreased glycemic variability (lows and highs)
  - Reduction in HbA1c

Due to inherent study limitations, caution is advised when attempting to extrapolate these results to new patients. There could be significant differences.

TANDEM T:SLIM X2 INSULIN PUMP

Coming to Canada mid to late 2018.

Integrated insulin delivery using Dexcom G5 CGM device operating in hybrid closed loop function.

In USA, will be using Dexcom G6 CGM with both basal and corrective bolus functions, so called “artificial pancreas”.

Pump features include Bluetooth connectivity, rechargeable lithium ion battery, USB port, and water tight construction.
• New version will work with Dexcom G6; will provide trending data and alerts as well as operating the pump in hybrid closed loop fashion
OMNIPOD FEATURES

No infusion tubing
Built –in 200 unit insulin reservoir
Hand held PDM wirelessly connected to pump with customizable function
Port for remote data downloads
Next iteration (now in US) will integrate with Dexcom G5 or G6 for hybrid closed loop pump function.
• Guardian Connect device designed as a stand alone for MDI or type 2 patients.

• Will transmit data to smart device and will integrate with a number of smart phone apps to enable trending and insulin dose selection, similar to a Freestyle Insulinx device.
University of Bath UK researchers have developed a reliable working prototype of a trans dermal sensor for continuous blood (or rather interstitial fluid) glucose levels.

Usual 15 minute lag behind plasma glucose levels, similar to other CMG devices.
# IMPLANTABLE CGM

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<tr>
<td>1</td>
<td>Subcutaneously implanted device with a three month life</td>
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<td>Transmits to a removable transmitted adherent to the skin just above the device which in turn sends data to a smart phone app.</td>
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<td>Currently in use in Europe, probably in the US by later this year, FDA willing.</td>
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University of Wollongong in Australia researchers are clinically testing at the Royal Adelaide hospital synthetic, 3-D printed islet cell using a PICT 3D printer.

We can’t wait to see if this is a viable option for insulin replacement therapy.
GLOWING CONTACT LENSES

• Worn overnight to reduce risk of retinopathy progression by reducing retinal oxygen uptake, reducing ischemic stress.
Smartphone screen

Dexcom G5 Mobile Si...
Medical
DEXCOM TREND ARROWS
REMEMBER TREND ARROWS ARE
BRAND SPECIFIC

What do the arrows mean?

- **Glucose rapidly rising**
  - more than 0.2 mmol/L each minute
  - more than 2.5 mmol/L in 15 minutes
  - more than 5 mmol/L in 30 minutes

- **Glucose rising**
  - 0.1-0.2 mmol/L each minute
  - up to 2.5 mmol/L in 15 minutes
  - up to 5 mmol/L in 30 minutes

- **Glucose slowly rising**
  - 0.06-0.1 mmol/L each minute
  - up to 1.7 mmol/L in 15 minutes
  - up to 3.4 mmol/L in 30 minutes

- **Not increasing/decreasing**
  - more than 0.06 mmol/L per minute
  - up to 0.9 mmol/L in 15 minutes
  - up to 1.8 mmol/L in 30 minutes
7. AGP

- Statistics Summary
- Glucose Profiles for 24-hour picture
- Single-day glucose charts
FREESTYLE LIBRE/ LIBRE LINK APP

Device links to smartphone, or by Bluetooth to up to 20 other smartphones

Other apps in the offering to provide alerts as well selection of insulin dosages
DEXCOM G6 CGM DEVICE

- Dexcom gets better - NO fingersticks, calibrations needed
- Transmits directly to smartphone
- 10 day sensor wear
- Trending and predictive alerts for high/low glucose levels
- Insulin low suspend feature with pump integration.
QUESTIONS?

THANK YOU