

Technology

An insight into the factors that improve glycaemic control in young people using insulin pumps



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We are well aware of the challenge of improving glycaemic control in young people, which – even with the use of technological advances, such as insulin pump therapy and continuous glucose monitoring – remains challenging. Insulin pump users can achieve similar levels of glycaemic control by using different strategies, in terms of basal and bolus insulin usage, yet intuitively it would be expected that those who make the most use of the advanced pump functions will be more likely to achieve optimal glycaemic control.

The study by Wilkinson et al (2010; summarised alongside) looked at what factors influenced glycaemic control in 85 insulin pump users between the ages of 5 and 20 years and bears out these preconceptions. Unsurprisingly, the pump users with an HbA_{1c} level within the optimum range test their blood glucose levels more often. They also give more insulin bolus doses, which may reflect greater use of insulin with snacks or more use of correction bolus doses, and consequentially have a greater bolus to basal insulin ratio.

While the 50:50 bolus to basal insulin ratio that is often recommended for the achievement of good glycaemic control is close to that seen in the two groups with better control in Wilkinson et

al's study, a trend towards a higher bolus intake appears to confer better control than a higher basal intake. The group with an HbA_{1c} level of 5.0–7.5% (31–58 mmol/mol) had a bolus to basal ratio of 53:48, while those with an HbA_{1c} level of 9.0–14.0% (75–130 mmol/mol) had a ratio of 44:56. Carbohydrate intake does not seem to result in worsening control, with those with the best HbA_{1c} levels recording greater carbohydrate intake.

Greater use of the bolus calculator feature was also seen in those with the best glycaemic control; in the 85 pump users in whom there was longitudinal data, an HbA_{1c} improvement ≥ 0.5 percentage points (≥ 6 mmol/mol) was associated with longer duration of temporary basal rates. This suggests, as expected, that those who better understand their pump, or have greater motivation to use it, achieve the best glycaemic control and the greatest improvements. It is also worth noting that the age group who did best was the 5–10 year olds, so parental control is also likely to have played a part in achieving these differences. The 10–15 year olds did as well as the 15–20 year olds.

Awareness of the factors that are particularly important in optimising control for insulin pump users should allow healthcare professionals to focus on these factors during pump training sessions and when reinforcing pump education.

DIABETIC MEDICINE

More bolus dosing associated with lower HbA_{1c}

Readability	✓✓✓✓
Applicability to practice	✓✓✓✓
WOW! factor	✓✓✓✓

1 This study evaluated the factors associated with young people with T1D not achieving optimum HbA_{1c} levels using insulin pump therapy.

2 Data were downloaded from the insulin pumps of 150 young people aged 5–20 years. Of the participants, 85 were able to provide data every 3 months. These data were assessed against changes in HbA_{1c} levels.

3 Participants were included in the study if they had been diagnosed with T1D >1 year prior to the start of the study, had used continuous glucose monitoring for at least 6 months and had a downloadable insulin pump. All insulin pumps were manufactured by Medtronic MiniMed (Northridge, California).

4 More frequent daily use of bolus doses and more frequent blood glucose tests were associated with lower HbA_{1c} levels (both $P < 0.0001$).

5 Out of 85 participants, 48 had a change in HbA_{1c} level of $\geq 0.5\%$ (≥ 6 mmol/mol) between downloads (24 of them improved).

6 Using logistic regression, increased bolus insulin dosing (odds ratio [OR], 1.15; $P = 0.03$) and setting a longer duration of temporary basal rate (OR, 1.017; $P = 0.01$) predicted a ≥ 0.5 percentage point (≥ 6 mmol/mol) decrease in HbA_{1c} level.

7 The authors highlighted the importance of blood glucose testing, bolus insulin administration and use of the temporary basal rate for longer time periods for good glycaemic control.

Wilkinson J, McFann K, Chase HP (2010) Factors affecting improved glycaemic control in youth using insulin pumps. *Diabet Med* **27**: 1174–7

DIABETES TECHNOLOGY & THERAPEUTICS

Fewer adverse events with new catheter system

Readability	✓✓✓✓
Applicability to practice	✓✓✓✓
WOW! factor	✓✓✓

1 The incidence of catheter-related adverse events was studied in 45 insulin pump users.

2 Participants used their existing catheter system for 1 month (period 1) and then used the Accu-

Chek FlexLink (Roche Diagnostics, Burgess Hill) catheter for the following 3 months (period 2).

3 A total of 8.9% of catheter insertions initially failed during period 1 compared with 3.1% in period 2 ($P < 0.001$). In both periods 8% of catheter insertions subsequently failed.

4 The authors suggested that the incidence of initial failures and premature catheter replacements was reduced with the use of the Accu-Chek FlexLink catheter model.

Renard E, Guerci B, Leguerrier AM et al (2010) Lower rate of initial failures and reduced occurrence of adverse events with a new catheter model for continuous subcutaneous insulin infusion: prospective, two-period, observational, multicenter study. *Diabetes Technol Ther* **12**: 769–73

DIABETES CARE

Treatment with CGM did not affect quality-of-life

Readability	✓✓✓✓
Applicability to practice	✓✓✓
WOW! factor	✓✓✓

- 1 The effect of continuous glucose monitoring (CGM) on quality of life (QOL) was assessed in people with T1D.
- 2 A total of 451 children and adults were randomly assigned to treatment with CGM or a control group.

3 At 26 weeks, QOL was similar between the groups and compared with baseline. The adult CGM group experienced a slight improvement in QOL on several subscales ($P < 0.05$). Participants reported substantial treatment satisfaction.

4 Baseline QOL was high and was found to change little with CGM use, although a high level of treatment satisfaction was recorded.

Juvenile Diabetes Research Foundation Continuous Glucose Monitoring Study Group, Beck RW, Lawrence JM et al (2010) Quality-of-life measures in children and adults with type 1 diabetes: Juvenile Diabetes Research Foundation Continuous Glucose Monitoring randomized trial. *Diabetes Care* **33**: 2175–7

JOURNAL OF DIABETES SCIENCE AND TECHNOLOGY

Evaluation of Accu-Chek Combo system

Readability	✓✓✓✓
Applicability to practice	✓✓✓✓
WOW! factor	✓✓✓

- 1 This study evaluated a new insulin delivery system (Accu-Chek Combo; Roche Diagnostics, Burgess Hill), consisting of a blood glucose meter and a remotely controlled insulin pump.
- 2 Participants consisted of 80 established pump users with T1D whose metabolic control and treatment

satisfaction were measured, as was the safety of the device.

3 No unexpected device errors occurred. Treatment satisfaction was high at baseline and increased at study end ($P < 0.0001$).

4 HbA_{1c} levels improved from 7.9% (63 mmol/mol) at baseline to 7.6% (60 mmol/mol) at 6 months ($P < 0.0001$).

5 The authors concluded that users of the new system found it safe in daily practice, were satisfied with the treatment and experienced an improvement in HbA_{1c}.

Kerr D, Hoogma RP, Buhr A et al (2010) Multicenter user evaluation of ACCU-CHEK® Combo, an integrated system for continuous subcutaneous insulin infusion. *J Diabetes Sci Technol* **4**: 1400–7

DIABETES TECHNOLOGY & THERAPEUTICS

Nocturnal hypos associated with high-intensity exercise

Readability	✓✓✓
Applicability to practice	✓✓✓✓
WOW! factor	✓✓✓

- 1 The glucose profiles of eight men were assessed using continuous glucose monitoring (CGM) for 20 hours after either high-intensity exercise or moderate-intensity exercise.
- 2 Blood glucose (BG) levels declined during both types of

exercise. BG levels observed after high-intensity exercise (between midnight and 6am) were significantly lower than after moderate-intensity exercise (area under the curve, 23.3 vs 16 mg/dL/420 mins; $P = 0.04$).

3 A higher number of hypoglycaemic episodes were observed after high-intensity than after moderate-intensity exercise (seven vs two; $P < 0.05$).

4 CGM was found to be helpful for people with T1D who were exercising, and high-intensity exercise was associated with delayed nocturnal hypoglycaemia.

Maran A, Pavan P, Bonsembiante B et al (2010) Continuous glucose monitoring reveals delayed nocturnal hypoglycemia after intermittent high-intensity exercise in nontrained patients with type 1 diabetes. *Diabetes Technol Ther* **12**: 763–8

DIABETES TECHNOLOGY & THERAPEUTICS

Two scales are valid and reliable measures of patient-reported outcome

Readability	✓✓✓✓
Applicability to practice	✓✓✓✓
WOW! factor	✓✓✓

1 The psychometric properties of the continuous glucose monitoring satisfaction scale (CGM-SAT) and the glucose monitoring survey (GMS) were evaluated.

2 A total of 224 CGM users and 102 parents rated their experience of CGM over a 6-month period using the CGM-SAT, a 44-item scale.

3 Users ($n = 447$) or parents ($n = 221$) rated the blood glucose monitoring system they were using at baseline and at 6 months with the GMS, a 22-item scale.

4 The alpha coefficient (a measure of reliability) for all respondents was ≥ 0.94 for the CGM-SAT and ≥ 0.84 for the GMS at baseline and at 6 months.

5 At 6 months, parent–youth agreement was 0.52 for the CGM-SAT, and 0.24 and 0.20 for GMS at baseline and 6 months, respectively.

6 Two factors emerged from the CGM-SAT: benefits of CGM and hassles of CGM, which accounted, respectively, for 33% and 9% of score variance.

7 Factor analysis identified two factors from the GMS: glucose control and social complications, which accounted for 28% and 9% of variance, respectively.

8 The authors concluded that the CGM-SAT and GMS are valid and reliable measures of patient-reported outcomes.

Juvenile Diabetes Research Foundation Continuous Glucose Monitoring Study Group (2010) Validation of measures of satisfaction with and impact of continuous and conventional glucose monitoring. *Diabetes Technol Ther* **12**: 679–84

“Continuous glucose monitoring was found to be helpful for people with T1D who were exercising, and high-intensity exercise was associated with delayed nocturnal hypoglycaemia.”