NONADJUNCTIVE FLASH GLUCOSE MONITORING USE DURING SUMMER CAMP IN CHILDREN WITH TYPE 1 DIABETES - THE FREE-SUMMER STUDY

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BACKGROUND

- **FreeStyle Libre™**, a factory-calibrated sensor for Intermittently scanned Continuous Glucose Monitoring (isCGM), is **accurate and safe in children with type 1 diabetes** (T1D).
- There are **no published data on isCGM effectiveness as a replacement** for self-monitoring of blood glucose (**SMBG**) in this population.
- The **aim** of this study was to evaluate the **nonadjunctive use** of this isCGM **in children with T1D** during two weeks in a **summer camp**.

METHODS

STUDY DESIGN AND PARTICIPANTS

This **randomized, double-blinded, parallel design study** was conducted in a **supervised outpatient setting at a 2-week summer camp** for children with T1D engaging in free-living conditions.

Major inclusion criteria:

- Age ≥ 6 years and ≤ 15 years;
- T1D > 6 months;
- CSII use > 3 months;
- HbA1c ≥ 6.3% and ≤ 10% (45-86 mmol/mol);
- Daily regular SMBG.

Major exclusion criteria:

- Significant concomitant diseases and co-morbidity that could influence metabolic control or compromise a participant's safety;
- oral or parenteral glucocorticoid therapy;
- hypoglycaemia unawareness or more than 2 episodes of severe hypoglycemia with seizure and/or coma within the 6 months prior to the screening visit.

RANDOMIZATION AND PROCEDURES

Forty-five participants were randomized:

- **Intervetion - isCGM group:** 25 subjects were blinded for the SMBG and insulin dosing was isCGM based, except in the following circumstances when participants and caregivers used SMBG measurements:
  a) symptoms of hypoglycemia but the sensor glucose concentration not hypoglycemic or dropping rapidly
  b) for 20 min after treating a low sensor glucose concentration if the sensor glucose level had not begun to rise
  c) before a bolus when the sensor glucose value was above 13.9 mmol/l (250 mg/dL)
  d) for a fasting glucose above 16.7 mmol/l (300 mg/dL) or glucoseduring the day above 16.7 mmol/l (300 mg/dL) for more than one hour.
- **Control - SMBG group:** 20 subjects were blinded for isCGM and performed SMBG based insulin dosing.

No standardized treatment protocols or insulin titration algorithms were used.

OUTCOMES

- The **primary outcome** was between-group difference (isCGM vs. SMBG) in **time in range 3.9-10 mmol/l (TIR)**.
- **Prespecified secondary endpoints** were
  - **sensor-derived glycemic measures**
  - evaluation of **nonadjunctive use in the intervention group**
  - **isCGM system performance** through accuracy analysis measurements.

RESULTS

Data representing **glycemic control outcomes** are shown in *Table 1*.

- The **primary outcome** TIR (3.9 -10 mmol/l) and the other secondary outcomes related to glycemic control were **not different between the two groups**.
- For the **subpopulation** with **suboptimal metabolic control (HbA1c >7%)** we observed a significant increase in the proportion of TIR and a decrease in the time in hyperglycemia above 10 mmol/. There was no change in time in hypoglycemia below 3.0 mmol/L
- **No severe hypoglycemic events or serious adverse events occurred**.

Accuracy performance

- For assessment of accuracy there were **2788 paired isCGM-SMBG results**.
- Overall **MARD** was **18.3%**, **median ARD** was **8%**, **MRD** was **8.3%** and **MAD** was **1.2 mmol/l** (22.1 mg/dL).
- The **CEG analysis** demonstrated **82.2%** of results in **zone A** and **95.2%** of results in **zones A and B** (*Figure 1*); these results with analysis of values > 4.4 mmol/l (80 mg/dL) (2392): the combined zone A and B percentage was 99% with only 1% of the paired samples in zone C.
- **Regression analysis** resulted in high agreement between the sensor glucose results compared to capillary BG readings (slopes of 1.01, intercepts of 0.2 mmol/l (3 mg/dL), and correlation coefficient of 0.91).
- The **percentage of isCGM results within and outside the range ± 2 mmol/l** (36 mg/dL) of capillary results was **82.4%** (n=2297) with 50.7% of the sensor outside values been found with analysis for reference glucose below 4.4 mmol/L (80 mg/dL) (*Table 2*).

Table 1. Glycemic control of children with type 1 diabetes

	Participants (n= 45)			Participants with HbA1c>7% (n=29)		
	SMBG (n= 20)	isCGM (n=25)	P-value	SMBG (n= 13)	isCGM (n=16)	P-value
Time within Range 3.9 – 10.0 mmol/l (%)	50.8 ± 13.75	50 ± 11.25	0.64	10.5 ± 1.7	12.2 ± 2.4	0.05
Time < 3 mmol/L (%)	1.4 ± 2.2	1.3 ± 1.7	0.98	1.0 ± 1.9	1.5 ± 1.6	0.35
Time > 10 mmol/L (%)	44.7 ± 15.8	45.2 ± 12.5	0.69	53.0 ± 8.0	43.9 ± 11.6	0.03

Figure 1. Consensus Error Grid graph.

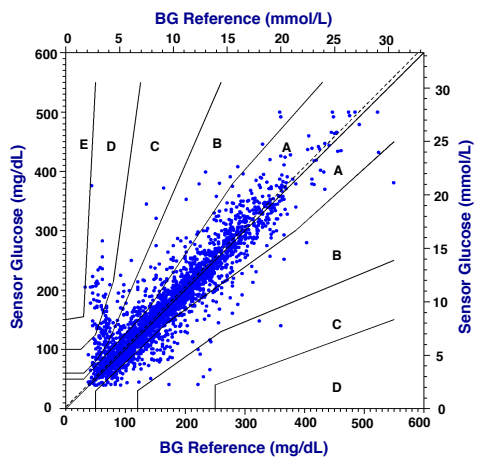

Table 2. The percentage of isCGM results within and outside the range ± 2 mmol/l of SMBG.

	Number	%
Results outside range ± 2 mmol/L (36 mg/dL) All < 4.4 mmol/L (80 mg/dL)	491 249	17.6 8.9
Result within range ± 2 mmol/L (36 mg/dL)	2297	82.4
Total	2788	100

CONCLUSIONS

- This randomized, double-blinded, controlled clinical trial assessed **the effect on glycemic control of using isCGM alone to make insulin dosing decision compared to SMBG based decision making** in children with T1D during a summer camp.
- Our data showed that for the primary outcome of CGM-measured TIR, **use of isCGM alone was non-inferior to SMBG** and was associated with **reduced time in hyperglycemia and improvement of time in range in patients with sub-optimal glycemic control**.
- **For all other efficacy outcomes** for CGM-measured time in hyperglycemia, hypoglycemia and glucose variability **there was no significant difference between the two groups**.

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