DIABETES CLINICAL SUMMARIES

MINIMED™ 640G WITH SMARTGUARD™ TECHNOLOGY - REAL LIFE DATA:

The real life effectiveness of the SmartGuard technology within the MiniMed 640G system.

STUDY RATIONAL

- Hypoglycaemia remains a major burden for people with Type 1 diabetes. It can cause confusion, disorientation, loss of consciousness and in the worst cases coma and even death.
- SmartGuard technology is the automated suspension of insulin delivery in response to predicted hypoglycaemia (suspend before low) or hypoglycaemia detected (suspend on low) based on sensor glucose values from Continuous Glucose Monitoring (CGM).
- SmartGuard suspend on low has been shown to reduce hypoglycaemia compared to Continuous Subcutaneous Insulin Infusion (CSII) therapy[1] and Sensor Augmented Pump (SAP) therapy[2] without automated suspension.
- Evidence shows that SmartGuard suspend before low , may allow patients with Type 1 diabetes to further reduce or avoid hypoglycaemia[3]. Analyses of CareLink™ database, a patient self-uploaded database, has been conducted to assess if real life data corroborates the existing clinical setting findings.

OBJECTIVES

- To evaluate the effectiveness and usage patterns of the SmartGuard suspend before low automated insulin management feature of the MiniMed 640G system, in real life conditions.

DESIGN AND METHODS

- This was a retrospective analysis of CareLink data voluntarily uploaded by patients with diabetes mellitus collected between October 1, 2011 and January 14, 2016. Data from a total of 87'230 users (7,164,972 user-days of data) were analysed:
  - 4,818 subjects using SmartGuard technology available within the MiniMed 640G system - suspend before low and suspend on low (286,149 user-days of data)
  - 43,193 subjects using the MiniMed Veo™ system with the suspend on low feature only (4,101,706 user-days of data)
  - 39,219 subjects using the MiniMed 530G* system with suspend on low only (2,777,117 user-days of data)
- All users included in the analysis had at least 5 days of CareLink data during the time period, including information on insulin delivery from the pumps and information from CGM sensors.
- Users were not provided with specific training beyond the standard practice from their health care providers.
- Comparisons were made between:
  - SmartGuard ON versus OFF
  - Automatic (by pump) vs manual (user intervention) resumption of insulin delivery following insulin suspension events
  - Glycaemic parameters of users who switched to SmartGuard suspend before low (MiniMed 640G) from SmartGuard suspend on low (MiniMed Veo), based on 851 users with at least 7 days of data.
- Hypoglycaemia and hyperglycaemia were defined as sensor glucose (SG) values ≤70 mg/dL (≤3.9 mmol/L) and 240-300 mg/dL (13.3-16.7 mmol/L), respectively. Hypoglycaemic and hyperglycaemic excursions were defined as ≥2 consecutive hypoglycemic or hyperglycaemic SG values. Severe hyperglycemia was defined as ≥300 mg/dL (16.7 mmol/L).
- To characterize the post-suspend behavior of SG values, "recovery time" was defined as the interval from pump suspension to the start of the first 20-minute period with SG values 68-119 mg/dL (3.8-6.6 mmol/L).

*US commercial product not sold in Europe, Middle East and Africa.

KEY POINTS

- 75% of SmartGuard predicted hypoglycaemic events did not reach the pre-set low limit
- Less glycemic variability and faster hypoglycaemia recovery when user does not intervene with suspension
- MiniMed 640G users were utilizing Automatic Insulin delivery suspension (and sensor use) for 94% of days, aprox 20% more than on MiniMed Veo and 530G

STUDY TYPE

- Retrospective analysis of CareLink database (patient self uploaded electronic database)
- 87'230 subjects with Diabetes Mellitus
- 7'164'972 days of user data were analysed

PARAMETERS ASSESSED

- Percentage of events reaching the pre-set low limit
- Time spend ≤70mg/dL (≤3.9 mmol/L) and ≥240mg/dL (≥13.3 mmol/L)
- Glycemic variability following suspension/resumption

REFERENCE

Zhong A. et al, Effectiveness of Automated Insulin Management Features of the Medtronic 640G Sensor-Augmented Insulin Pump. Diabetes Technol Ther. 2016; 18(10): 657-663.

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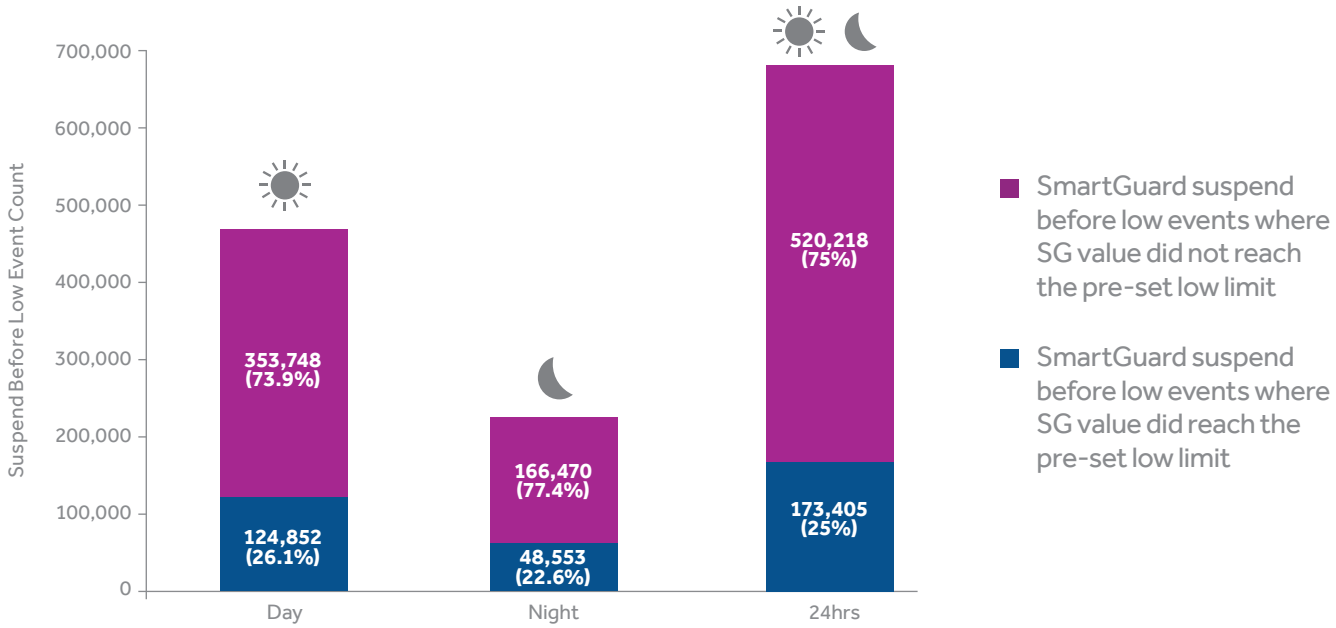
RESULTS

- More than 99% of MiniMed 640G users enabled one or both SmartGuard features at least once (SmartGuard was enabled 94% of user-days); 59% used suspend before low exclusively.
- MiniMed Veo and MiniMed 530G users enabled SmartGuard suspend on low feature on 72% and 82% of user-days respectively.
- An average rate of 2.9 basal insulin suspension events per user-day occurred when SmartGuard suspend before low was enabled (total of 693,626 events).

SmartGuard Suspend Before Low ON vs OFF

- 75% of the SmartGuard suspend before low events did not reach the pre-set low glucose limit (74% and 77% of the day time and night time events, respectively) (figure 1).

FIGURE 1: Hypoglycaemia Prevention by SmartGuard™



- Nighttime hypoglycaemia was reduced by 4 times with MiniMed 640G when suspend before low feature was turned ON vs OFF (0.1 vs 0.4 hours respectively, p<0.001). (Table 1).

TABLE 1: Duration of night time in hypoglycaemia.

	MiniMed Veo™		MiniMed 530G		MiniMed 640G	
Setting	Suspend on low OFF	Suspend on low ON	Suspend on low OFF	Suspend on low ON	Suspend before low OFF	Suspend before low ON
Hypoglycaemia [≤70 mg/dL (3.9 mmol/L)], hours/night, Mean ± SD	0.4 ± 0.8	0.2 ± 0.5	0.4 ± 1.0	0.2 ± 0.4	0.4 ± 1.0	0.1 ± 0.3
	p<0.001		p<0.001		p<0.001	
Users, N	24, 715	30, 785	13, 166	34, 402	1230	4480

- SG values associated with SmartGuard suspend before low events followed a more predictable trajectory during the recovery phase, as indicated by the narrower interquartile range. (figure 2)
- For both types of suspension events, the median SG value stabilized to around 144 mg/dL by 4 hours.

FIGURE 2: Sensor Glucose Trajectories

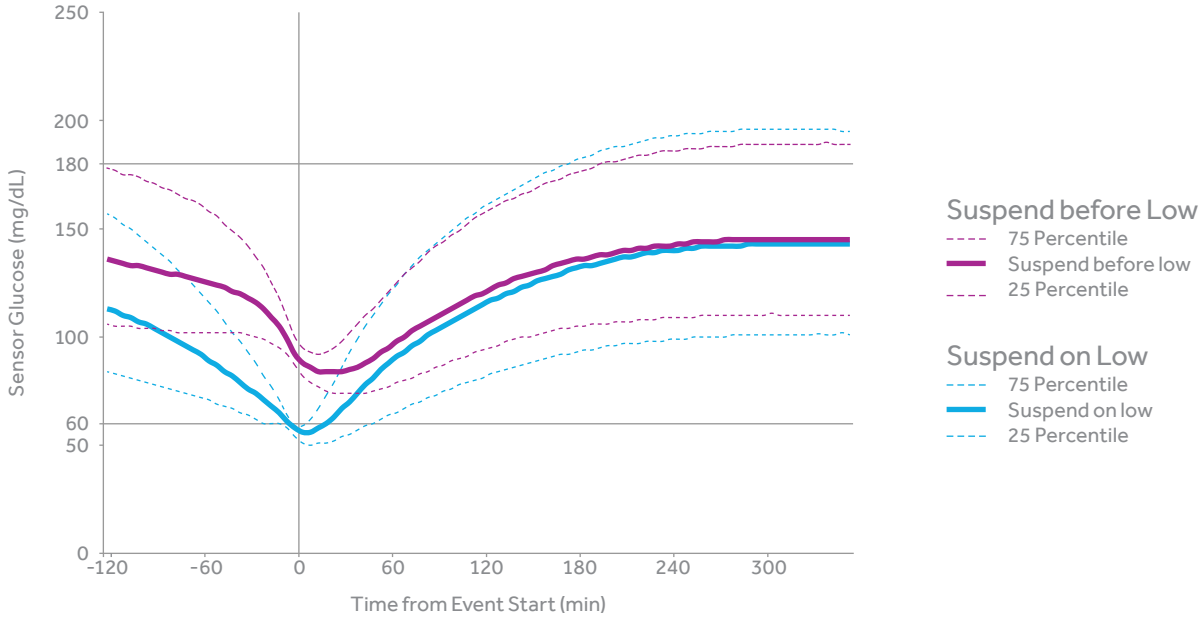


FIG. 2. SG trajectories associated with enabled event start time (min) for "suspend before low" and "suspend on low" features. The graph shows median SG values for suspension events of any duration for which the low limit was set to 60 mg/dL.

Automatic vs Manual Insulin Resumption

- 55% of the SmartGuard suspend before low events ended due to "auto-resume" based on the sensor glucose value, 11.5% due to the feature's maximum suspend duration of two-hour "auto-resume" and 33.5% due to manual resumption.
- The mean duration of suspend before low events resumed automatically was 58±25 minutes, compared to 33±23 minutes for the suspend before low events resumed manually by the users.
- Suspend before low events resumed automatically showed less glycemic variability compared to those resumed manually, as measured by the coefficient of variation (CV) (0.18 vs. 0.24 respectively, p<0.001,), and faster recovery times (29.4 vs 35.1 min. respectively, p<0.001).

Switch to MiniMed 640G from MiniMed Veo

- Subjects who switched to the MiniMed 640G system using SmartGuard™ suspend before low from the MiniMed Veo system spent:
  - 39% less time in hypoglycaemia (≤70 mg/dL) (15.7 vs 25.8 min/day, p<0.001)
  - 20% less time in hyperglycaemia (≥240mg /dL) (12.8 vs 16.0 min/day, p<0.001)

CONCLUSIONS

- With SmartGuard suspend before low, users avoided the pre-set low SG limit in 75% of events.
- Automatic resumption of insulin following suspension events resulted in a more rapid recovery and reduced glycaemic variability compared to manually resumed events.
- With SmartGuard suspend before low enabled, 66.5% of users did not intervene with the MiniMed 640G suspension event and allowed the pump to automatically resume insulin delivery.

These real-life findings corroborate existing clinical trial data regarding the efficacy of the MiniMed 640G system with SmartGuard technology.[3]

Additional References

1. Effect of Sensor-Augmented Insulin Pump Therapy and Automated Insulin Suspension vs Standard Insulin Pump Therapy on Hypoglycaemia in Patients With Type 1 Diabetes. A Randomized Clinical Trial. Ly T.T. et al. JAMA 310(12):1240-1247, 2013.
2. Threshold-Based Insulin-Pump Interruption for Reduction of Hypoglycemia. Bergenstal R.M. et al. N E 2. ngl J Med 369:224-32, 2013.
3. Choudhary P, Olsen BS, Conget I, et al. Hypoglycemia prevention and user acceptance of an insulin pump system with predictive low glucose management. Diabetes Technol Ther 2016;18:288-291.