# EXPLORATORY ANALYSIS FOR SELECTED PATIENTS WITH DAWN PHENOMENON DURING THE MINIMED™ 670G HYBRID CLOSED-LOOP PIVOTAL TRIAL

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## Introduction

Glucose variability from night time to early morning resulting in fasting hyperglycemia or increased insulin requirement, often referred to as Dawn Phenomenon (DP), can be observed in more than half of patients with T1D.[1,2] While somewhat improved overnight and fasting glucose control can be achieved with sensor-augmented or -integrated insulin pump systems with programmed hourly basal rates, the MiniMed™ 670G system with SmartGuard™ technology, automates basal insulin delivery and provides a 24-hour response to changing glucose levels, that is very important during the night. The present study investigated the effect of 3-month use of the MiniMed™ 670G system in T1D patients with DP.

## Methods

Glycemic outcomes data of patients aged 14-75 years, with T1D, who completed 3-month use of the MiniMed™ 670G system with the closed-loop Auto Mode feature enabled[3,4] were analyzed when 1 of 3 criteria were met 25% of the time during the 2-week baseline run-in use of open-loop Manual Mode: 1) An increase in mean SG of 10mg/dL (0.6mmol/L) during 3:00AM-6:00AM; 2) Increased basal insulin delivery of 10% during 3:00AM-6:00AM; and 3) Increased basal rate of 0.5 unit during 3:00AM-6:00AM, if basal rate was 0 during 12:00AM-3:00AM. A total of 82 subjects (66%) were identified as DP subjects. Statistical and descriptive analyses included: comparisons between baseline and study phase percentage of SG values across different glucose ranges, mean and SD (standard deviation) of basal insulin delivered, and mean and SD of SG: 12:00AM-6:00AM, 12:00AM-3:00AM, and 3:00AM-6:00AM. Analyses were conducted with paired t-test or Wilcoxon Signed Rank test[a].

## Results

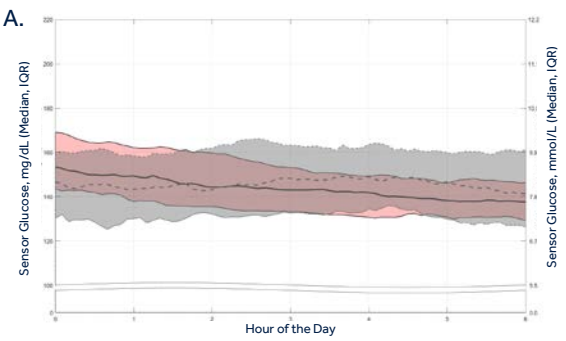
**Table 1. Glycemic metrics and basal insulin delivery, in patients meeting DP criteria, during the baseline run-in (Manual Mode) and study (Auto Mode-enabled) phase**

| | 12:00AM-6:00AM | | | 12:00AM-3:00AM | | | 3:00AM-6:00AM | | |
|---|---|---|---|---|---|---|---|---|---|
| **Percentage of SG across ranges, mg/dL (mmol/L)** | | | | | | | | | |
| | Run-in | Study | P | Run-in | Study | P | Run-in | Study | P |
| **≤70 (≤3.9)** | 6.4 ± 4.5 | 3.3 ± 2.3 | <0.001[a] | 7.5 ± 6.0 | 4.0 ± 3.1 | <0.001[a] | 5.2 ± 4.7 | 2.5 ± 2.2 | <0.001[a] |
| **71-180 (>3.9-10)** | 67.9 ± 13.3 | 77.3 ± 9.7 | <0.001 | 66.8 ± 13.7 | 72.8 ± 10.3 | <0.001 | 69.1 ± 15.4 | 81.9 ± 10.2 | <0.001 |
| **>180 (>10)** | 25.7 ± 14.2 | 19.4 ± 9.7 | <0.001 | 25.7 ± 14.9 | 23.2 ± 10.9 | 0.059 | 25.7 ± 15.7 | 15.6 ± 9.5 | <0.001 |
| **Within-period basal insulin and SG measures and variability** | | | | | | | | | |
| **Basal insulin delivered, units** | 5.8 ± 3.3 | 6.2 ± 4.2 | <0.005[a] | 2.7 ± 1.7 | 3.1 ± 2.3 | <0.001[a] | 3.1 ± 1.6 | 3.1 ± 2.0 | 0.821[a] |
| **SD of average basal insulin delivered, units** | 0.01 ± 0.01 | 0.06 ± 0.04 | <0.001[a] | 0.00 ± 0.01 | 0.07 ± 0.04 | <0.001[a] | 0.01 ± 0.01 | 0.06 ± 0.04 | <0.001[a] |
| **Average SG, mg/dL (mmol/L)** | 147.3 ± 22.5 (8.2 ± 1.3) | 144.5 ± 13.4 (8.0 ± 0.7) | 0.141 | 146.0 ± 24.5 (8.1 ± 1.4) | 147.9 ± 15.8 (8.2 ± 0.9) | 0.325 | 148.6 ± 23.8 (8.3 ± 1.3) | 141.1 ± 13.1 (7.8 ± 0.7) | <0.001 |
| **Overall SD of SG, mg/dL (mmol/L)** | 52.8 ± 11.9 (2.9 ± 0.7) | 47.1 ± 10.8 (2.6 ± 0.6) | <0.001 | 52.7 ± 12.7 (2.9 ± 0.7) | 49.8 ± 10.5 (2.8 ± 0.6 ) | 0.015 | 51.1 ± 13.3 (2.8 ± 0.7) | 42.8 ± 12.3 (2.4 ± 0.7) | <0.001 |

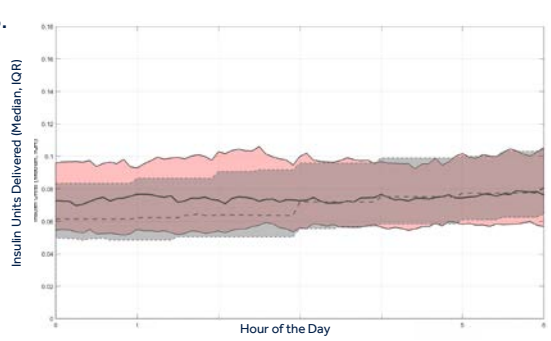
All values are shown as mean ±SD; Insulin delivered = Basal + microbolus; [a] = Wilcoxon signed rank test.

**Figure 1. Sensor glucose (A.) and insulin delivered (B.) during the baseline run-in phase and study phase are shown, from 12:00AM-6:00AM, in patients meeting DP criteria. A progressive decrease in median SG into the early morning (3:00AM-6:00AM) was observed, during the study phase compared to the run-phase. The variability of insulin delivered was greatest at nadir (12:00-3:00AM) during the study phase, with reduction in the initially high SG. Run-in: gray band (IQR) with dashed line (median). Study phase: pink band (IQR) with solid line (median).**

A.




B.




## Conclusions

- From baseline to end of study, the time in target range of DP patients for each period improved from 67.9% to 77.3%, 66.8% to 72.8, and 69.1% to 81.9%, respectively. In addition, the time in hyperglycemic range decreased, and that in hypoglycemic range significantly decreased.
- During the study phase, SG and SG variability improved most from 3:00AM-6:00AM, while the variability in insulin delivered was greatest a few hours before, from 12:00AM-3:00AM.
- These findings reveal the ability of the MiniMed™ 670G system to effectively address early morning hyperglycemia in patients exhibiting dawn phenomenon criteria.

## References

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3. Bergenstal RM, et al. *JAMA.*2016;316:1407-1408
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