Glycemic Outcomes for People with Type 1 and Type 2 Diabetes Using Control-IQ Technology: Real-World Data from Early Adopters

Steph Habif EdD MS,* Alexandra Constantin PhD,* Lars Mueller PhD,† and Harsimran Singh PhD*

Introduction

The Food and Drug Administration recently cleared the t:slim X2™ insulin pump with Control-IQ™ technology in the United States. This advanced hybrid closed-loop system automatically adjusts insulin based on predicted sensor glucose levels to help increase sensor time in range (TIR) (70-180 mg/dL).

Pump therapy offers a promising approach for insulin therapy intensification in people with type 2 diabetes (T2D) resulting in improved clinical and psychological outcomes.

The pivotal Diabetes Closed-Loop Trial, Protocol 3 (DCLP3) demonstrated valuable glycemic improvements in people with type 1 diabetes (T1D) using Control-IQ technology. However, DCLP3 did not include people with T2D. It is yet to be ascertained how this new technology can assist people with T2D in their efforts to achieve their recommended diabetes goals.

Aim

To compare real-world glycemic outcomes between individuals with type 1 diabetes and type 2 diabetes from a sample of early adopters of Control-IQ technology.

Method

This retrospective study included both T1D and T2D individuals who had recently updated their insulin pump software to initiate use of Control-IQ technology. Analysis included at least 14 days of pre- and post-Control-IQ software usage data that participants had uploaded to the t:connect® web application from Tandem Diabetes Care as of March 11, 2020. Only individuals who had ≥75% continuous glucose monitoring (CGM) data were included in the analysis.

Outcomes evaluated included total daily insulin and sensor glucose values during open- and closed-loop use of Control-IQ technology. Wilcoxon signed-rank tests were used to examine pre-post differences in outcomes.

Percent time in closed-loop automation was calculated as the percent of the total basal rates delivered by the pump that were decided by the Control-IQ algorithm. If CGM was unavailable for 20 or more minutes, the system switched from algorithm-commanded basal rates to using a user's personal profile rate.

Results

The overall sample included 2,896 participants with type 1 diabetes and 144 participants with type 2 diabetes. Table 1 has additional details on participant demographics. During 14 days of using Control-IQ technology, both T1D and T2D participants recorded 96% time in closed-loop automation.

T1D Subgroup: Participants showed significant improvements in their sensor TIR (67.2% median pre vs. 77.1% median post; +9% median change from pre-Control-IQ, p<0.001), significantly reduced time in sensor glucose <70 mg/dL (1.1% median pre vs. 1.0% median post; -0.04% median change from pre-Control-IQ, p<0.001), and in sensor glucose >180 mg/dL (31.0% median pre vs. 21.2% median post; -8.45% median change from pre-Control-IQ, p<0.001). Median total daily insulin post was 48 units (pre=46 units, p<0.001) (Figure 1).

T2D Subgroup: Post 14 day use of Control-IQ technology, sensor TIR for T2D participants had significantly improved (73.9% median pre vs. 79.3% median post, +6% median change from pre-Control-IQ, p<0.001). There was a significant reduction in sensor time in glucose >180 mg/dL (25.2% median pre vs. 19.7% median post, -5.8% median change from pre-Control-IQ, p<0.001). There was no change in sensor time in glucose <70 mg/dL (0.2%). Median total daily insulin post was 82 units (pre=73 units, p=0.003) (Figure 1).

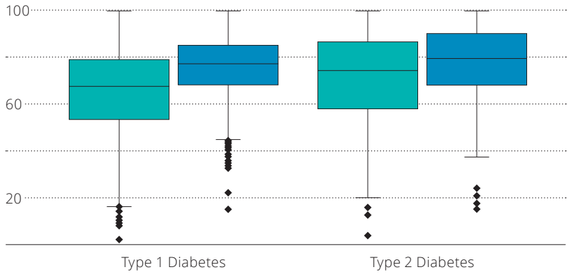
TABLE 1: Demographics. All study participants had type 1 or type 2 diabetes.

2,896 Type 1

144 Type 2

Variables	Type 1 Diabetes	Type 2 Diabetes
Female Participants	53% (1,532)	67% (96)
Age (years)	42.8 (±17.3)	58.7 (±12.6)
Diabetes Duration (years)	22.9 (±15.2)	19.3 (±10.9)

FIGURE 1: Sensor Time in Range. Percentage of time participants (by diabetes type) spent in range pre- (■) and post-Control-IQ (■) technology use.



Conclusions

These early results from the use of Control-IQ technology showed valuable improvements in TIR (based on sensor glucose values) and other glycemic variables for people with T1D and T2D. Improved sensor TIR, if maintained long-term, can help reduce the risk of diabetes-related complications.

Longitudinal studies involving the use of Control-IQ technology are encouraged to evaluate clinical and psychosocial outcomes related to the use of this technology in diverse groups of people with diabetes.

KEY MESSAGE

Use of **Control-IQ technology showed significant improvements in time in range** (based on sensor glucose values) for people with T1D and T2D.

Acknowledgments: The authors would like to acknowledge and thank all our participants for contributing to this research study.

* Tandem Diabetes Care † UC San Diego Design Lab Center for Health

References: 1. Reznik Y, et al. Insulin Pump for Type 2 Diabetes: Use and misuse of continuous subcutaneous insulin infusion in type 2 diabetes. *Diabetes Care.* 2013; 36(Supp 2): S219-S225. **2.** Singh P, et al. Insulin Pump in Difficult to Control Type 2 Diabetes: A Single Center, Five Years' Experience. *Cureus.* 2018;10(8):e3240. **3.** Brown SA, et al. Six-month randomized, multicenter trial of closed-loop control in type 1 diabetes. *N Eng J Med.* 2019;381(18):1701-1717. **4.** Beck RW, et al. Validation of time in range as an outcome measure for diabetes clinical trials. *Diabetes Care.* 2018; 42(3): 400-405.