COMMENT ON LEELARATHNA ET AL.

Duration of Hybrid Closed-Loop Insulin Therapy to Achieve Representative Glycemic Outcomes in Adults With Type 1 Diabetes. Diabetes Care 2020;43:e38–e39

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Diabetes Care 2020;43:e167 | https://doi.org/10.2337/dc20-1291

Leelarathna et al. (1) report a retrospective analysis linking the duration of hybrid closed-loop insulin therapy, using a single algorithm, with the achievement of stable sensor glucose metrics. They found that in adults with type 1 diabetes and baseline HbA_{1c} ≥58 mmol/mol (≥7.5%), it takes 4 weeks to observe representative data for mean glucose and percentage time spent in normoglycemia and hyperglycemia. They also suggest that 6 weeks' duration may be required for reliable estimates of hypoglycemia and glucose variability. This time may be required for control algorithm individualization and behavioral adaptation.

We looked at the database built during the multicentric trial (WP7) that tested the Diabeloop DBLG1 hybrid closed-loop system in 63 adult patients with type 1 diabetes (baseline HbA_{1c} 59.4 mmol/mol [7.6%]) during 12 weeks (2). The model predictive control–based algorithm could be customized through eight different settings: total daily insulin requirements, target glucose level, hypoglycemic threshold, reactivity in the hyperglycemic range, reactivity in the normoglycemic range, and prandial insulin ratio (breakfast, lunch, and dinner).

We had previously observed that the number of adjustments in any of the eight algorithm settings decreased from mean (± SD) 5.1 (± 4.3) per patient during the first 4 weeks to 2.3 (± 3.1) during the last 4 weeks (2). With an approach grouping the sum of setting changes per patient during each week and hierarchical clustering of patients, we report that each patient changed 7 (± 4.4) parameters during the 1st week and 2.0 (± 2.4) parameters during the 12th week. After 3 weeks, <3 changes per week were applied. In a cluster of 34 patients (54% of all patients) that had the highest rate of changes during the 1st week, <1 change in settings per week (0.8 ± 1.0) was observed after 5 weeks. Whereas the pace of setting adjustments gradually decreased, improvement in the different glucose metrics was already obtained during the 1st week and remained stable thereafter when measured on a weekly basis: the mean ± SD proportions of time spent with glucose concentration between 70 and 180 mg/dL, above 180 mg/dL, and below 70 mg/dL were 59.4 ± 10.2%, 36.3 ± 10.2%, and 4.3 ± 2.4%, respectively, in open loop versus 71.7 ± 9.3%, 26.2 ± 9.5%, and 2.0 ± 1.5% during the 1st week in closed loop and 68.9 ± 11.5%, 29.2 ± 11.6%, and 2.0 ± 1.8% at week 12. Daily monitoring of time in optimal glucose range (70–180 mg/dL) during the 1st week showed values ranging from 68.4% to 74.6%.

Our interpretation is that improvement following closed-loop initiation can already be observed after 1 week, and subsequent setting adjustments only have marginal impact. Our observations are in agreement with the findings reported by Leelarathna et al. Both closed-loop systems are about to be made available in routine practice. Overall, these results suggest that no more than 1 month is needed to achieve optimal metabolic results with this generation of closed-loop devices. This has implications for the organization of patient management, education, and monitoring.

Funding and Duality of Interest. The study was funded by the French Innovation Fund (Banque Publique d'Investissement) and Diabeloop SA. P.Y.B. and S.L. served on the advisory board panel for Diabeloop SA. S.M., A.G., and Y.T. are employees of Diabeloop SA. S.F. and G.C. own shares in Diabeloop SA. No other potential conflicts of interest relevant to this article were reported.

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Clinical trial reg. no. NCT02987556, clinicaltrials.gov

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