Tandem t:slim X2

Tandem t:slim X2 and Dexcom G6

I got the Tandem t:slim X2 on November 11, 2019, so as of Veteran's Day 2020, I've spent a year with the device managing my day-to-day blood glucose.

The timing of my purchase in the fall of 2019 meant that Tandem offered a free upgrade to its Control IQ technology when the pump shipped with Basal IQ technology installed. The long story short is that Basal IQ could prevent lows by diminishing insulin supply but it could not do what Control IQ does which is to provide increased basal rates and automatic correction boluses. I got the upgrade from Basal IQ to Control IQ around late spring 2020. It has made a difference in my control, particularly around exercise, sleep, and peace-of- mind.

Basal IQ was a leap forward given its event-driven (closed-loop) nature, since low blood sugars are high risk events that correlate with injury and death. By comparison, Control-IQ is a quantum leap, since dosing on the high side is still difficult, mostly owing to carb-to-insulin ratios and the guess work involved in calculating doses between insulin-on-board and carbohydrate-on- board. I'd like to say Control-IQ is like a 1-2 punch in diabetes control, but that's understating the difficulty of lows around intense exercise and post- prandial highs. There's more algorithmic development required to keep those totally in check. But I'm splitting hairs - the difference between 70% in range being good enough and 100% in range being perfect.

I expect the next few years will lead to algorithmic improvements that are truly mind-blowing and remove the need for David Goggins levels of self- regulation. In addition, I'm sure there are machine learning researchers looking at this data now since Dexcom and Tandem have a treasure trove of easily-anonymized data. Combine that data with data from a fitbit or Apple Watch and you've got three pillars for significant improvement. The only thing that leaves out is precise measurement of food in grams of carbohydrate. That can be overcome with ketogenic diets as several proponents have demonstrated and I've leaned in that direction for a decade or so. I link to some of those proponents below.

Control IQ has sleep and exercise activities or modes. The exercise mode helps, but it's generally not tunable enough to completely prevent lows around exercise.

I can usually leave the pump on the default Control-IQ mode and get good but not perfect results most of the time assuming no exercise and normal diet, but the best results come from a hack that I learned watching a youtube video. That is, use sleep mode to impose a lower target and more aggressive algorithmic behavior to reach that 110 target. I leave the pump in sleep mode most of the time. I get the best results when I use sleep mode 24x7x365, even when exercising. I can go out now with a BG of 110 and run 5K at a moderate pace with little rise or fall. That was never possible prior to my switch to using sleep mode to manage exercise. It may be an outlier, but it works for me and indeed, it's a game-changer.

Reservoirs and Infusion Sets

A big difference between the Tandem/Dexcom ecosystem and Minimed/Medtronic ecosystem is disposable parts: reservoirs, infusion sets, sensors, and transmitters. I'm not going to go into every detail here but my experience with Dexcom/Tandem has been positive with few exceptions.

Before switching to Tandem/Dexcom, I'd had frequent issues with infusion site redness, dislodged cannulas, and dislodged CGM sensors, regardless of insulin, site change frequency, or location. After a year with the Tandem pump, I've had zero issues with site redness after 365 days and not a single time that the cannula dislodged from my skin in the same time period despite having dropped the pump from waist high or caught the tubing on a door handle. I use 23" tubing which puts the pump about knee high when it drops, so no damage occurs from it hitting the floor.

Software

The software ecosystem evolving around these devices is growing rapidly, as the devices have proliferated.

The first insight for me when I got the X2:G6 combo was that it was tiresome to reach for the pump frequently just to check my blood glucose. Getting the BG from the Dexcom G6 on my phone took more effort because I have a Google Pixel 4a, which was not supported by Dexcom at the time. Luckily, there's a very capable individual doing custom builds of the Android version of the Dexcom app on the internet. Just go through the form and you'll receive an APK build that can be loaded on an unsupported phone like my Pixel. It has worked perfectly for a year for me. That person deserves kudos!

Once I realized that checking BG on my phone was going to be nearly as tiresome as on the insulin pump itself, I decided to

check out watches, reflecting that blood glucose is arguably the killer app for digital watches, especially for someone who is highly active. I quickly realized that the Dexcom supported the Apple Watch pretty well, but that wasn't an option for me having an Android phone.

I was also concerned about the cost of the Apple ecosystem having used it previously.

The real leap in learning came when I discovered an app on Github that runs on Fitbit Versa and similar devices. A quick trip to BestBuy and some configuration meant that I could track my BG on my wrist while exercising for a little over $100. Glance has been a game changer for me since I use it daily when running or walking the dog and at-a-glance while sleeping has alerted me to problems that I otherwise would have missed. Kudos to Ryan Mason! Once you get past the excellent Dexcom Clarity app, the most well-designed of the apps available is SugarMate. I use it everyday for information-rich spot checks.Sugarmate joins the list of quick exit diabetes startups acquired by either Dexcom or Tandem, like TypeZero.

Usability

Tandem x2:slim has thoughtful design. The direct manipulation interface that Tandem presents on it's main screen is intuitive since you can just tap the 3 HR indicator to toggle through the hourly graph modes and tap the status indicator to see status details.

That direct manipulation intuitiveness goes away when you descend into the options menu. Most of these functions are not frequently accessed, so probably aren't important day-to-day. However, the ones that are used more frequently do not have the at-a-glance one tap reachability that they should while discoverability is poor and menus are long and scrolling. The options menus frequently require too many taps to reach the leaf node of the options tree. When I first used the Tandem infusion sets and reservoirs, the design of the injector and reservoir seemed weird. The crinkly sound of filling the reservoirs as the bag expands with insulin and the transformer rocket launcher design of the infusion sets had me puzzled. However, after a year of using them daily, they seem clever and reliable. I've not had an infusion set fail due to manufacturing issues.

Results

I'm a big believer in evidence-based medicine. It's early but there's some interesting evidence available already. The easiest way to demonstrate the effectiveness of a medical device is 24x7x365 use for a year or so with results. That population suvey is n of 1 or quantified self, and there's more to it than just the medical device (diet, exercise, and self-regulation); however, the medical device plays an outsized role in making good results possible, probable, and predictable, if not perfect.

The gold standard of results in diabetes control is Hemoglobin A1c. My HbA1c was 8.9 prior to acquiring the Tandem t:slim X2 in the fall of 2019, and it tested in the same lab at 6.4 in February of 2020, and 6.3 in January of 2022, both below the diagnostic threshold for type 1 diabetes, after only 3 months with the X2, G6, and Basal IQ. I've found GMI to be conservative, meaning that GMI is generally .5 higher than my lab's HbA1c.

Regardless, the evidence speaks for itself. Prior to acquiring the X2, I had no way of approaching perfect control, where perfect control is defined as 100% in range for T1D which is is generally accepted as 70-180. Today, I routinely have days where my blood sugar is 100% in control and most days are above the 70% in control benchmark, regardless of diet or exercise.