

## An Analysis of Patient Acceptance and Safety of a Prefilled Insulin Injection Device

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### Abstract

This article summarizes and interprets the findings of Carter and colleagues in this issue of *Journal of Diabetes Science and Technology*, a study of the real world use of a prefilled insulin pen device. In this observational study, people with type 1 and type 2 diabetes rated their experience with the SoloSTAR pen device after 6–10 weeks of use. Data on patient satisfaction, product technical complaints, and adverse effects were reported. Randomized, controlled trials are needed that compare the various pen devices and the vial/syringe in terms of accuracy of dosing, adherence to therapy, and ease of use (including patient perception of injection force required) to assess whether a particular method of insulin delivery or pen delivery device provides a clinical advantage over another.

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Since the introduction of insulin pen devices in the mid 1980s, newer pen devices have become available that offer greater ease of use, smaller dosing increments (i.e., 0.5 U increments) and lower injection force needed to deliver the dose. Manufacturers of the insulin pen devices are quick to attempt to distinguish their product from their competitors' devices. Health care providers (HCPs) who work closely with people with diabetes do find that use of pen devices is often favorable over the tradition vial/syringe method of insulin administration. Patients may find pen devices less intimidating when starting insulin therapy, easier to use and handle,<sup>1,2</sup> more discreet when using in public,<sup>2</sup> and more portable. From a clinical perspective, pen devices may result in more accurate insulin dosing, as patients have indicated that the scales are easier to read<sup>1</sup> and have a more accurate dosing mechanism compared to the syringe.<sup>3</sup>

Also, use of an insulin delivery pen device has been shown to improve adherence to insulin therapy.<sup>2-6</sup> Numerous studies have found that patients with diabetes simply prefer the use of a pen over a vial/syringe.<sup>1,2,7,8</sup> The article from Carter and colleagues in this issue of *Journal of Diabetes Science and Technology*, provides findings from a large group of patients—2029 in total, 1067 with type 1 diabetes, 926 with type 2 diabetes, and 36 without diabetes—which is a major strength of this observational study.<sup>9</sup>

Carter and colleagues stated that the aim of the study was to “evaluate the safety, usability, and acceptance” of the SoloSTAR (SOL) pen in a clinical setting, focusing on the administration of insulin glargine in a prefilled insulin pen delivery device. The primary objective was to collect information on “real-use experience,” specifically

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**Abbreviations:** (HCP) health care provider, (SOL) SoloSTAR, (N) dispense force

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any technical complaints or safety issues with use of this insulin glargine pen. The secondary objective was to evaluate patient satisfaction with the device. The patient population was overwhelmingly an insulin-experienced group, with 90.4% having previously used an insulin pen. Only 21.2% of participants (presumably those with type 2 diabetes) were using insulin glargine alone, whereas 78.8% reported using one or more other insulins; it was not described if these insulins were administered with pens or vial/syringe. The median age of participants with type 1 diabetes was 42 years, with the median age higher (60 years) for the type 2 diabetes participants, not surprisingly. While participants with reduced vision and dexterity were included (15.5% and 16.3%, respectively), patients with severe visual or dexterity impairment were excluded, two groups who could likely benefit from use of a pen device. The majority of the 93 clinical sites were specialty clinics, with only 13% being primary care practices. The 150 HCPs who participated were a mix of primary care physicians, endocrinologists/diabetologists, and diabetes educators.

The majority of participants (74%) received in-person, one-on-one training, whereas only 12.6% of participants reported not receiving any training, not even from the user's guide booklet provided. The details of the training (e.g., length of the one-on-one training and specific items covered) was not described. It would have been interesting to assess if the type of HCP or training (one-on-one versus booklet only) were factors affecting the outcomes of the study. It appears that the only training on how to use the SOL that the participants received was at the start of the study, after which the participants were provided with a supply of insulin to last for the study duration (i.e., 6–10 weeks). Besides the instruction leaflet (this item was not described) and a toll-free helpline number (presumably a sanofi-aventis helpline), it was not stated if participants received any additional training or used other educational materials after the initial training. It was also not described (or quantified) if the participants referred to their instruction leaflet or used the helpline during the study. However, almost 90% of participants reported no problems with the SOL (either something not working properly or participant thought something was broken), suggesting little need for ongoing technical support.

In terms of this study's outcome measures, captured via a 10 min telephone survey by an independent customer service group, the SOL performed well. Participants had used the SOL on average for 60.5 days, an adequate length of time to gain experience with the device. Impressively,

only eight technical problems with the SOL were reported (pens jammed, leaked, hard to push, or pen/plunger was "faulty"), of which five were deemed to be related to handling errors by the participants. Yet these participants still rated their satisfaction with the SOL as very satisfied ( $n = 6$ ) or satisfied ( $n = 2$ ). The safety profile of the SOL was excellent. While 77 adverse events were reported by 62 participants, none were related to the pen device itself. For "acceptance," or more specifically general patient satisfaction, participants reported a high level of satisfaction with using the SOL—74.4% were very satisfied and 21.0% satisfied. During the study period, even pen-device naïve participants reported no "occurrence of any issue or question" with the SOL, suggesting this pen device was easy to use. For factors that could be improved, 4.2% of participants reported "injection" (this was not described), 0.8% for "reading anything on the pen," 0.6% for "attaching a needle," and 0.3% for "removing air bubbles." While only 3.2% of participants discontinued use of the SOL, it was unfortunate that the reasons for discontinuation were not captured. The authors concluded that the study demonstrated "high patient usability," presumably from the low discontinuation rate and high patient satisfaction reported.

As with any industry-sponsored trial, the obvious limitation of this study was its funding by the manufacturer of the SOL (sanofi-aventis). Indeed, much of the published literature on insulin pen devices has been funded by the various manufacturers, so findings should be interpreted in light of this potential for bias. Another main limitation was that this study did not have a comparison arm, which Carter and colleagues acknowledged. Therefore, patient preference of the SOL over another pen device cannot be claimed or suggested. Simply, this study demonstrated that participants were highly satisfied with use of this particular pen.

The authors go on in the discussion to bring in the concept of injection force, or force to dispense the insulin (or push on the dosing knob), with the various pen devices. They cite an unpublished, laboratory-based study (presumably conducted by sanofi-aventis) in which three pen devices were compared in terms of their "dispense force" for a 60 U dose, using a dispense rate of 6 U/s. The SOL had a lower dispense force (N),  $7.15 \pm 0.69$  N, compared to the FlexPen ( $9.72 \pm 0.72$  N) and the newer FlexPen, the Next Generation FlexPen ( $9.72 \pm 0.72$  N). As the authors point out, the significance of these findings is unclear (i.e., is a 7.15 versus a 9.72 dispense force clinically significant?). In contrast, Rissler and

associates reported that the Next Generation FlexPen had an 18–45% lower injection force compared to the SOL for a 60 U dose, using three different push speeds and two different pen needle gauges (31 G and 32 G).<sup>10</sup> Of note, this study was sponsored by Novo Nordisk, and the authors of this study were all employees. Asakura and coworkers compared the Next Generation FlexPen with the SOL and KwikPen (the new Eli Lilly pen) using a 20 U dose, three different injection speeds, and two different pen needle gauges (31 G and 32 G).<sup>11</sup> They also found that the newer FlexPen had lower injection forces compared to the SOL (12–25% lower) and the KwikPen (35–41% lower). Lastly, Ignaut and associates compared the KwikPen and FlexPen (the older pen made by Novo Nordisk), using a measurement called glide force (units in pounds) in a laboratory-based study funded by Eli Lilly, which employed all the authors.<sup>12</sup> Not surprisingly, the KwikPen was found to have approximately 36% less glide force required at 30 and 60 U doses, compared to the FlexPen. While the injection force is certainly a potentially important issue for patients, particularly the elderly or those with dexterity problems such as arthritis, these laboratory-based findings need to be tested in the real-world setting to see if differences in injection force are clinically significant when used by diverse patients with diabetes.

In summary, the observational study of Carter and colleagues, with its large sample size, provides evidence that, in a clinical setting, an insulin pen delivery device can be provided to patients with diabetes and, after proper training, is associated with high patient satisfaction and rare technical device problems. Future studies are needed that are randomized, controlled trials that compare the use of various pen devices (along with the vial/syringe, at least in the United States, where this method is still often used due to limited health insurance coverage of pen devices) in a variety of patient groups (including insulin- and pen-naïve patients). Accuracy of dosing, adherence to therapy, and ease of use, including patient perception of injection force required, should be assessed to determine whether a particular insulin delivery device, including the vial/syringe, provides a clinical advantage over another.

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