Journal of Diabetes Science and Technology
Volume 5, Issue 5, September 2011

ORIGINAL ARTICLE

Analysis: Desirable Attributes of Insulin Injection Pens That Drive Patient Preference and Compliance

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Abstract

Insulin pens are used by approximately half of worldwide insulin users. Insulin pens have made insulin injections easier compared to traditional vial and syringe injections. In an article in this issue of *Journal of Diabetes Science and Technology*, Dr. Asakura discusses several important design parameters, which are considered during refillable insulin-injection pen design. Ease of cartridge replacement, insulin-dose setting dial use, injection, and prominence of audible clicks can all affect overall dose accuracy and user friendliness of insulin pens in patients suffering from diabetes and related comorbidities. These parameters, along with patient introduction from prescribing physicians and level of training provided, drives patient pen selection and injection-regimen compliance to control their blood sugar.

J Diabetes Sci Technol 2011;5(5):1210-1211

Introduction

Insulin pens have emerged as alternative devices over traditional manual vial and syringe use for insulin injections. The popularity of insulin pens stems from their intuitiveness and ease of use, accuracy in insulin delivery, and overall user friendliness.[1,2] Several attractive attributes of insulin pens are their availability in either prefilled or durable designs, with interchangeable insulin cartridges; availability for use with different insulin formulations (i.e., short acting versus long acting versus premixed insulin); precise dosing with maximum doses up to 80 IU in 1 IU increments in some pen designs, sometimes with half-unit dose accuracy[3]; and memory functions to recall previous dosing.[4] They can also be color coded to assist patients in visual distinction between different insulin formulations, to reduce patient pen-selection errors.[5] These factors, along with introduction from their prescribing physician, the level of training given to new patients in pen use, a patient's familiarity with a specific pen design, and personal preference drives patient selection of insulin pens. These insulin pens are the predominant insulin delivery devices used in Europe and Japan, where approximately 67% and 75% of insulin prescriptions are for pen devices, respectively. The usage in the United States, however, accounts for only ~15% of insulin prescriptions. This lower usage is attributed to a lack of awareness of their availability to U.S. healthcare providers, prescription plan coverage or need for prior authorization to obtain insulin pens, and higher prescription costs of insulin cartridges and prefilled pens compared to insulin vials, although the actual pen cost varies and may even be lower than the cost of vial and syringe use depending on a patient's needs, frequency of use, amount of expired insulin discarded, and insurance coverage.[1]

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Keywords: diabetes mellitus, durable, ease of use, insulin pen, preference, prefilled

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In this issue of *Journal of Diabetes Science and Technology*, the article by Dr. Asakura entitled *Comparison of Clinically Relevant Technical Attributes of Five Insulin Injection Pens* considers clinically relevant parameters that could drive design and selection of durable insulin injection pens. These parameters include ease of cartridge fitting, ease of dose-setting dial use, ease of injection, and prominence of audible clicks as perceptible cues to guide use, especially for patients afflicted with arthritis or diabetes-related blindness and/or polyneuropathy.[6] The work compared these characteristics on the NovoPen® 4 (Eli Lilly, Kobe, Japan), ClikSTAR® (sanofi-aventis, Paris, France), HumaPen® Luxura® (Eli Lilly), iTango® (sanofi-aventis), and Biosulin® Pen (Bioton S.A., Warsaw, Poland), fitted with a BD Micro-Fine™ 31G thin-wall needle.

In the study, the torque required to screw the insulin cartridge into the body of the pen was first assessed. Ease of cartridge fitting is an important parameter to consider for patients with polyneuropathies and/or deficiencies in strength, dexterity, and motor control. Different pen designs had different fitting mechanisms: the NovoPen 4 and ClikSTAR pens required only a cartridge rotation of 70° and 180° respectively; the HumaPen Luxura, iTango, and Biosulin Pen required the cartridge to be screwed through several cartridge rotations. The lowest fitting torque was found in the iTango pen. However, in practical operation for patients with motor control deficiencies, there will be a tradeoff between ease of screwing and number of cartridge rotations to properly fit the cartridge. Another issue that may arise is that if the cartridge fitting requires too little rotation, it may be more prone to improper fitting in the pen body.

Next, the push-button injection force required for insulin injection was evaluated as measured in both a vertical and an oblique (14°) pen orientation. Ease of injection is important for patients with neuropathies or arthritis performing self-injections, to ensure they can inject the correct insulin dose with minimal or no discomfort. Each pen injection force was measured, with the exception of the Biosulin Pen, which has an automatic injection mechanism. Low injection forces are desirable to allow patients to inject a full dose properly with minimal effort. The advantage of an autoinject mechanism is single-push button operation, but the injection cannot be stopped if an error in dosing or insulin type is noticed. Some patients prefer autoinject mechanisms because they are uneasy giving themselves prolonged injections or have trouble injecting because of motor control deficiencies.

Dial-setting torque was measured for each pen. The dial-setting torque along with larger dosage numbers than on a standard insulin syringe determines how easily a patient can accurately adjust their insulin dose. Certain insulin pen designs do not allow dial back of dosage or require partial disassembly of the pen if the set dosage is higher than the patient's needs, although newer pen designs typically allow dialing back of dosage. Some pen designs also do not allow a dosage setting larger than the remaining insulin in the cartridge, to ensure accurate dosing. These considerations are important factors in correct pen use.

Finally, the prominence of audible clicks during dosage setting and insulin delivery was considered. These clicks assist patients, especially those with visual impairments who cannot read dosing numbers, in ensuring correct dosage setting. They also allow patients to know that the appropriate insulin dose was delivered.

Conclusion

Insulin pens offer many benefits over traditional vial and syringe insulin dosing, which in turn improves patient compliance and overall health maintenance. Ease of pen assembly, ease of dosage setting, ease of injection, and visual and audible cues are all important design considerations when developing insulin pens. Pen design is also driven, in part, by patient preference studies,[2] with newer designs increasingly preferred by patients due to new features that make pen use easier for those who suffer from diabetes and diabetes-related complications.

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