Insulin delivery devices

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SYNOPSIS

Everyone with type 1 diabetes requires insulin from diagnosis and more than 30% of people with type 2 diabetes eventually need insulin because of progressive failure of pancreatic beta cells. People with type 2 diabetes are often reluctant to commence insulin and some will require assistance with their injections. Over the past five years a number of new insulin delivery systems have become available that can make insulin administration easier. A number of factors, including patient preference, influence the choice of device. A thorough assessment of the individual's self-care capacity is important and appropriate education is imperative when starting insulin.

Index words: diabetes, injections.

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Introduction

Insulin is a very effective drug and is vital treatment for people with type 1 diabetes. Type 2 diabetes is an insidious disease with progressive destruction of the insulin-producing beta cells.[1,2] Eventually more than 30% of patients require insulin to attain their blood glucose targets.[3] Many people with type 2 diabetes are reluctant to start insulin for a number of reasons including fear of needles, fear of hypoglycaemia, weight gain and believing they only have a mild form of diabetes.[4]

Historically, patients injected insulin using glass syringes with detachable needles. They had to boil the syringes and needles between injections and store them soaked in alcohol to keep them sterile. These needles were large, and injections were painful. The advent of the disposable plastic 'diabetic syringes' with a fixed needle represented a considerable advance and injections were less painful. They did, however, have a number of disadvantages, and doses and administration practices were often inaccurate. This was partly because of the range of insulins available and the need to mix each dose of short- and longer-acting insulin in the same syringe at the time of injection. The advent of biphasic insulin made drawing up insulin doses easier and less confusing for patients.

The last five years have seen an increase in the range of insulin delivery devices (Table 1). These devices have revolutionised insulin self-care, but have also placed extra burdens of choice on people with diabetes, and they do not necessarily improve compliance. One of the most significant advances has been the production of short, fine needles as they considerably reduce injection pain. In practice, patients report that blood glucose testing is more painful than insulin injections.

Choosing an appropriate insulin device

Education about all aspects of managing diabetes and counselling about living with the disease are essential and should include the patient's family and others who may be involved in the patient's care. Diabetes educators have an important role in teaching people to use insulin delivery devices. It is important that patients are given the opportunity to handle the types of devices available and choose the one that best suits their needs. Issues to consider are the person's:

- **vision and ability to see the dose indicator numbers.** Most devices, other than syringes, have an audible click for each one or two units of insulin dialled up. This can help people with impaired vision maintain their independence. Magnification aids are available with some insulin devices. The InnoLet device currently has the largest and clearest dose indicator of any device.
- **ability to perform the fine motor skills** required to load insulin cartridges into the device and dial up a dose. InnoLet and NovoLet are preloaded disposable devices that eliminate the need to load insulin into the device. NovoLet is not the device of choice for people who need large doses because it is easy to misdial and under- or overdose.
- **ability to manage the device.** This includes loading and checking the accuracy of the dose, cleaning and maintaining the device, and recognising the signs of malfunction and knowing what to do about them.
- **ability to give the injection correctly.** Most trials indicate that insulin pens are accurate, providing the patient is educated appropriately and their technique and the performance of the device are monitored regularly.
- **willingness to monitor their blood glucose.**

Diabetes education centres usually have a range of products available to help people choose appropriately before they buy a device and to ensure they can use it correctly.

Are short needles an advantage?

Short, fine needles (7–8 mm long and 29–31 gauge) look less menacing and most people prefer to use them. They also avoid inadvertent intramuscular injection. People who continually give intramuscular injections may be more prone to wide swings in blood glucose because insulin is more rapidly absorbed from muscle than from subcutaneous tissues.[5,6] Shorter needles significantly reduce this risk especially if patients are taught to pinch up and inject into a fold of skin.

Table 1

Currently available insulin devices

Device	*Issues to be aware of*	*Advantages*	*Disadvantages*
Syringes			
30, 50 and 100 unit sizes	There is still a place for syringes Patients need to be able to recognise different dose increments on different sized syringes	Can be used with all available insulins	Needles are usually longer than those on other devices
Insulin 'pens'			
Two brands are available in Australia; NovoNordisk, which has six devices and Lilly, which has one. 'Pens' are not suitable for people who need to mix insulins.			
NovoNordisk devices – can only be used with NovoNordisk insulins			
NovoPen 3	Dose range 2-70 units Small, fine needles available Pen is reusable	Accurate dosing Has a function to check the accuracy of the device	Replacing the 3 mL insulin cartridge can be difficult
NovoPen Demi	Similar to NovoPen 3, but dose increments in ½ unit possible	Useful for children and insulin sensitive patients who require very small doses	
NovoLet	Disposable prefilled devices Contain 3 mL of insulin Range of insulins available Uses small, fine needles Dose range up to 78 units	May benefit people while travelling	Can be confusing to use and dose errors often occur especially with large doses
Innovo	Dose range 1-70 units Accurate dosing Uses 3 mL cartridges Range of insulin available Reusable device Battery-operated, batteries last about 4 years then the device needs to be replaced Small, fine needles	Display indicates that insulin is being delivered, the number of units delivered, the dose given and the time elapsed since the previous dose was delivered Helps people who forget whether they have taken their insulin	Can be difficult to use, especially if large doses are needed – the plunger is difficult to depress
InnoLet	Dose range 1-50 units Accurate dosing Small, fine needles Device is disposable Contains 3 mL of insulin	Clear easy-to-see numbers on the dose dial, which is an advantage for vision impaired people Easy to use for people with limited manual dexterity	Only Protaphane and Mixtard 30/70 insulin available, at this stage Larger than other devices – takes up storage space in the fridge
Pen Mate	Automatic needle insertion device Used with NovoPen 3 Hides needle and injects insulin quickly and automatically	May benefit children and people with needle phobia	
FlexPen	Prefilled Contains 3 mL of insulin	Single dose setting mechanism	
Lilly device – can only be used with Lilly insulin			
Huma*Pen*	Dose range 0-60 units Small, fine needles Takes 3 mL cartridges Pen is reusable	Insulin cartridge is easy to change	May not be available for new patients
Other devices			
Insulin pumps	Provide continuous basal insulin with a facility for giving bolus doses with meals Use only short-acting insulin Use small, fine needles	Can achieve close to normal insulin profile	Expensive Require considerable expertise and time to be used effectively
Jet injectors	No needle required Not widely used Force insulin through the skin under pressure	May benefit people with needle phobia	Bruising is common Sterilisation issues Expensive

What about reusing needles?

As syringes and needles are now supplied at no cost through the National Diabetes Supply Service in most Australian States, there is no cost incentive to reuse syringes. Reused needles are more likely to bend, and are subject to microscopic tip damage that causes local trauma. When they are left on pens, they act as a conduit to the outside allowing air to enter the insulin cartridge resulting in dose inaccuracies.[7] Safe disposal of sharps is an important consideration and should be part of the education process.

Monitoring

With time people's injection technique can become inaccurate because they have changed devices, take less care or have physical changes such as visual loss or changes in their fine motor skills. Insulin injection technique should be checked regularly if hypoglycaemia occurs frequently, if they develop a complication or if they change devices. Injection sites should be checked as part of this assessment. Children should be assessed as they begin to take responsibility for their own injections.

The future

Most people would prefer not to inject. This may become a reality in the future depending on the results of trials currently underway using inhaled insulin. In the longer term, oral insulin and/or insulin patches may become an option.

Conclusion

Most currently available insulin devices are safe and accurate. Individuals need to be carefully assessed, educated appropriately and permitted to 'try before they buy'. There is still a place for insulin syringes and some patients prefer to use them.

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FURTHER READING

Novo Nordisk Australia
http://www.novonordisk.com.au/view.asp?ID=659

LillyDiabetes.com
http://www.lillydiabetes.com/products/pens.cfm

Conflict of interest: none declared

Self-test questions

The following statements are either true or false (answers on page 151)

3. More than 30% of patients with type 2 diabetes will eventually need to inject insulin.
4. New insulin delivery devices have longer needles to enable easier intramuscular injections.