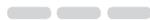


I'M CONSIDERING
AN INSULIN PUMP

Information for people with type 1 diabetes



Information developed by Diabetes Australia – Vic.

Diabetes Australia – Queensland would like to thank Diabetes Australia – Vic for providing permission to reproduce this booklet.

The quotes that appear throughout this booklet are from adults and children who attended a Diabetes Australia – Vic pump information session in April 2009. We thank them for allowing us to share their experiences.

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Introduction

This information booklet is for people with type 1 diabetes considering insulin pump therapy.

Here you will find answers to the most common questions about pump therapy. However, you will need to do more of your own research and speak with your diabetes care team before you decide if a pump is suitable for you.

Insulin pumps are small, high-tech electronic devices which can make life with type 1 diabetes more flexible. In recent years, the use of insulin pumps by people with type 1 diabetes in Australia has become increasingly popular. Currently, over five per cent of people (approximately 7200) with type 1 diabetes in Australia are using insulin pumps instead of multiple daily injections (MDI) to deliver their daily insulin requirements.

Insulin pumps are able to do three things:

- continuously deliver small doses of very rapid-acting insulin to meet your basal needs
- allow you to deliver a surge of insulin for the carbohydrates you eat. This is called a meal bolus.
- allow you to deliver extra insulin to correct high blood glucose levels (BGLs). This is called a correction bolus.

Research has shown that insulin pump therapy can reduce the frequency of severe hypoglycaemia as well as improve the quality of life of pump users¹⁻⁴. Using a pump may also improve poor blood glucose control.

Pumps have been available for many years and are widely used in the USA. In Australia, the introduction of government subsidies for pump consumables via the National Diabetes Services Scheme (NDSS) has made it a more affordable option for many people.

It is important that you have realistic expectations about pump therapy. **It is not a cure for type 1 diabetes** but a way of delivering insulin that may offer increased flexibility, improved glucose control and improved quality of life. Pump therapy requires motivation, regular blood glucose testing, the ability to learn pump technology and the willingness to keep in regular contact with your diabetes educator or endocrinologist for review and adjustment of pump rates.

“I decided to wear a pump because it took away the guess work. At times I couldn’t remember if I had injected or when I had. The pump records everything, it’s a genius.”

Diane, 38 years, pumping for two and a half years.



What is an insulin pump?

An insulin pump is a small battery-operated electronic device about the size of a pager or small mobile phone. The insulin is delivered via an infusion set which is inserted under the skin (subcutaneously). The device delivers insulin in two ways:

1. basal (sometimes called background) - delivering small amounts of insulin continuously in order to maintain cell function (replacing the need for long acting insulin)
2. bolus - delivering a dose of insulin on demand to account for the carbohydrates in meals or to correct high BGLs.

An insulin pump is worn 24 hours a day but can be detached for up to two hours when required, e.g. for swimming, contact sport or showering. Some people choose to take the pump off and go back to injections for short periods (e.g. for a trip to the beach).



What are the benefits of pump therapy?

Insulin pump therapy can help you to better manage your diabetes. The major advantage of insulin pump therapy is that insulin is absorbed more efficiently and more predictably under the skin.

Using an insulin pump may:

- reduce large fluctuations in blood glucose levels (BGLs)
- improve blood glucose (diabetes) control
- increase your flexibility in the quantity and timing of meals
- decrease your risk of hypoglycaemia during exercise without worsening diabetes control
- improve your quality of life.

Pump therapy can especially be of assistance if any of the following applies to you:

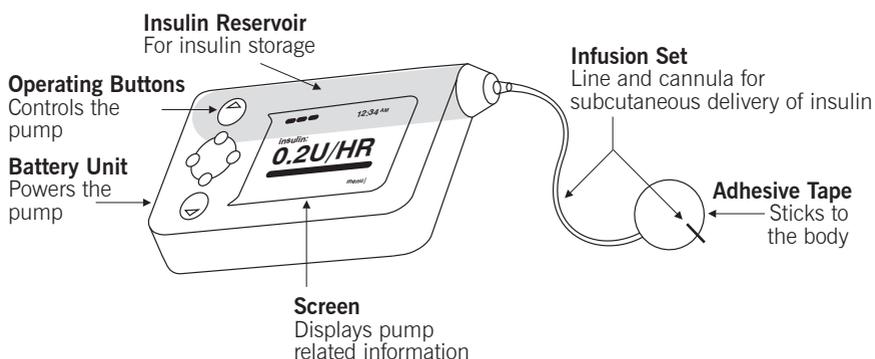
- hypoglycaemia unawareness (inability to detect 'hypos')
- severe and frequent hypoglycaemia
- frequent night time hypoglycaemia
- gastroparesis (delayed emptying of the stomach)
- an unpredictable lifestyle or daily routine (e.g. working nightshifts)
- extreme insulin sensitivity
- dawn phenomenon (rising blood glucose early in the morning)
- planning for and during pregnancy.

How does an insulin pump work?

An insulin pump can provide all the insulin requirements of a person with type 1 diabetes.

The pump contains a reservoir or cartridge filled with insulin. A microcomputer built into the pump allows you to program the pump to deliver a dose of insulin according to your needs. A small motor inside the pump controls the delivery of insulin. Insulin is delivered from the reservoir/cartridge through flexible tubing fitted with a small Teflon® (or steel) cannula that is inserted subcutaneously (under the skin) and held in place with special adhesive tape. Together, the tubing and cannula are called an infusion set. The cannula is easily inserted and removed by you; it is not surgically implanted. An introducer needle allows the cannula to be inserted under the skin. The needle is then removed leaving behind the cannula only. For those who do not want to insert the needles manually, there are disposable and reusable devices to assist with cannula insertion.

The cannula must be changed every two to three days. Steel cannulas may need to be changed every one to two days. The most common site to place infusion sets is in the abdomen (easy to access) but they can also be placed in the upper buttock, hip or upper arm.



What type of insulin is used in a pump?

An insulin pump delivers very rapid-acting insulin such as NovoRapid®, Humalog® or Apidra®. It delivers the insulin in two ways (basal and bolus), therefore replacing the need for long-acting insulin (Lantus®, Levemir® or Protophane®).

How does a pump deliver my daily insulin requirements?

An insulin pump delivers insulin continuously (basal) and on demand (bolus) to account for carbohydrates in meals or high BGLs.

Basal

The **basal** insulin is the insulin that your body needs continuously for normal metabolism. It maintains stable blood glucose in the absence of food. The pump delivers insulin automatically and continuously (at intervals of three to ten minutes), 24 hours a day. The rate of delivery (basal rate) is programmed in units per hour and adjusted according to your needs. This rate is initially calculated by your diabetes educator or endocrinologist. In time, with the support of your diabetes care team, you will learn to make adjustments to your own rates according to the patterns and trends of your BGLs.

Bolus

A **bolus** is a dose of insulin that is delivered on demand. Pump users manually activate the pump to give a:

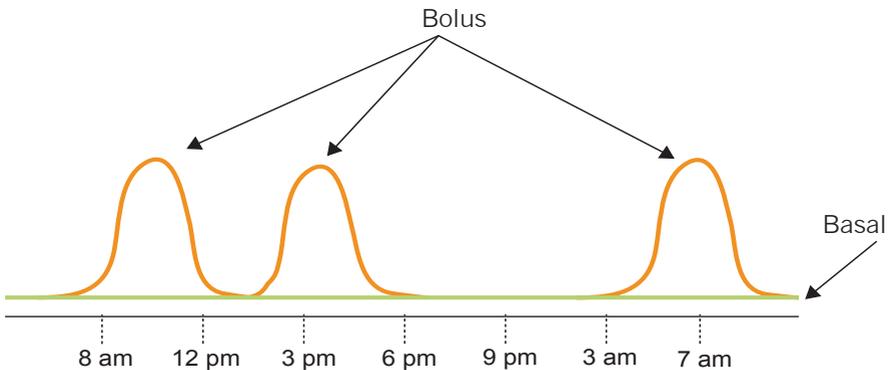
- **meal bolus** to match the amount of carbohydrate in the food you are about to eat. The amount of insulin delivered as a meal bolus is calculated using an **insulin to carbohydrate ratio** initially set by your diabetes educator or endocrinologist based on your individual needs.

Depending on the type of insulin pump you use, you either:

- calculate the amount of insulin you need and manually 'dial-up' this amount or
- program into the pump the amount of carbohydrate you intend to eat and the pump calculates the amount of insulin you need based on the programmed insulin to carbohydrate ratio ('smart pumps').

The right amount of insulin delivered as a bolus dose should return the blood glucose to the normal range within two to three hours of eating. See the section titled 'What about...?' on page 27 for more information on meal boluses.

- **correction bolus** to correct a high blood glucose reading. This is calculated according to your insulin sensitivity or **correction factor** set by your diabetes educator or endocrinologist.



Approximately half of your daily dose of insulin is spread across 24 hours (basal rate), so the hourly rate of insulin given is very small. The remainder of your daily dose is given as bolus doses at meal and snack times and to correct high BGLs. These bolus doses can be smaller than those given with injections because the insulin is more reliably absorbed.

‘Smart Pumps’

Most pumps are ‘smart pumps’ which means they will calculate the insulin dose for each meal or snack based on the insulin to carbohydrate ratio programmed into the pump. This ratio is calculated with your diabetes educator or endocrinologist. You need to know the carbohydrate content of the meal or snack you intend to eat so that you can enter the amount of carbohydrate into the pump. The pump will calculate the insulin dose required for the meal. ‘Smart pumps’ can also add a correctional bolus of insulin at this time if your pre-meal BGL is out of the target range.

Although it is possible to rely on a ‘smart pump’ to calculate the insulin dose required, it is important that the pump user understands the basis of the calculation so that the dose recommended by the pump can be verified.

Disconnecting from the pump

Insulin pumps use only very rapid-acting insulin. This insulin starts working within 10 to 15 minutes of delivery, peaks within one to three hours and ceases working after three to five hours. A lack of insulin can lead to the rapid development of ketones and diabetic ketoacidosis (DKA) which is a life threatening condition.

For this reason, **it is important to never disconnect from the pump for more than two hours without using an alternative method of insulin delivery** (e.g. insulin injections) and to regularly check that the pump is delivering insulin. Prompt attention to rising BGLs is essential in order to prevent DKA.

What about HbA1c?

HbA1c is a measure of long-term blood glucose control. Research investigating the efficacy of insulin pump therapy in relation to blood glucose control suggests that it can improve HbA1c, especially in those with an elevated HbA1c and in those who have been unable to reduce their HbA1c with MDI.⁴

It seems that for people who have a near normal HbA1c on MDI, insulin pump therapy will make little difference to their HbA1c. For people with good control, pump therapy may help to reduce the frequency and severity of hypoglycemia (hypos) and hyperglycemia (high blood glucose) because insulin is delivered continuously and in small doses.

***“My new best friend!
I have been able to
exercise more, eat
when I want to, enjoy
meals more and
experience a lot more
freedom with having
diabetes. Now I feel I
have a future as some
of the complications
cloud has lifted.”***

***Karen, 59 years,
pumping for one year.***



Insulin pump therapy and blood glucose monitoring

It is vital that people using insulin pumps monitor their blood glucose at least four times a day.

Insulin pumps use only very rapid-acting insulin that lasts a relatively short period of time in the blood stream. For this reason you need to do regular blood tests so that you are aware of any possible problem with insulin delivery.

Whilst insulin pumps now have sophisticated features and are an efficient means of delivering insulin, they cannot do the thinking for you. A pump is only as good as its operator so you do need to put in the effort to achieve results. In the future, it is hoped that blood glucose sensors will 'talk' to the pump and automatically adjust insulin doses as required.

Insulin Pumps and Continuous Glucose Monitoring Systems (CGMS)

There have been significant advances in the development of continuous glucose monitoring systems (CGMS) in recent times. CGMS is a means of measuring glucose levels continuously in order to gain insight into patterns and trends in glucose levels throughout the day and night. A CGMS sensor is worn separately to the pump, inserted under the skin, and measures the level of glucose in the interstitial fluid (fluid in the tissue). The sensor is disposable and changed according to manufacturer recommendations.

Currently there are two types of CGMS products available in Australia:

1. One type of CGMS product includes a sensor and a separate unit of similar appearance to a normal blood glucose meter (worn separately in a similar fashion to a pump). This type does not communicate with the pump and, therefore, can be used by people who do not have an insulin pump (those on MDI) or who use an insulin pump that does not include the capacity to augment with continuous sensing.

The trends in glucose levels are displayed on the CGMS unit's screen. Guardian® REAL-Time produced by Medtronic is one such CGMS product currently available in Australia. A second product, FreeStyle Navigator® produced by Abbott Diabetes Care, is soon to be released.

2. The other type of CGMS product combines CGMS with an insulin pump. A sensor and an attached transmitter are worn separately to the pump and transmit glucose levels to the insulin pump (not a separate unit) via radio frequency. Medtronic is the only company that currently offers such a product in Australia. It is called the MiniMed Paradigm® REAL-Time System.

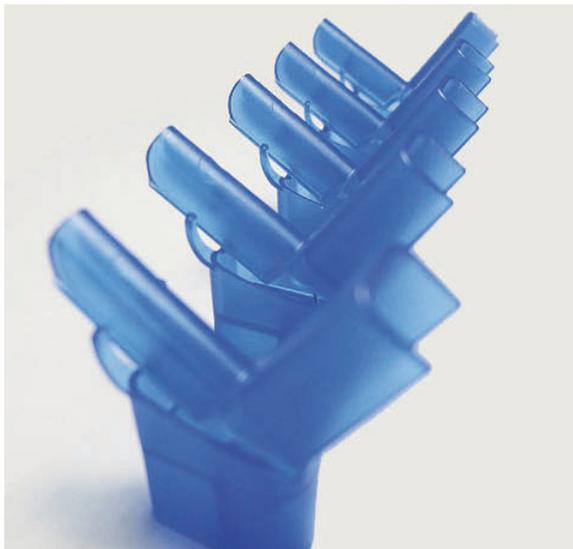
Currently, the CGMS is not capable of automatically triggering the pump to increase or decrease delivery of insulin based on glucose levels. The cost of the sensor and transmitter is not included in the price of the insulin pump and must be purchased separately. Furthermore, there is no private health insurance rebate currently available. Please consult the pump company for more information.

Whilst CGMS sensor readings provide excellent information regarding BGL trends and patterns, the readings are not yet accurate enough to use in order to adjust insulin doses. Normal blood glucose tests must still be done.

The blood test results are used to calibrate the sensor to help maintain sensor accuracy. Sensors need to be changed every three to five days. Note that some sensors need to be refrigerated.

Note

As yet, none of the disposable glucose sensors which are used for continuous blood glucose monitoring are available on the National Diabetes Services Scheme (NDSS), so the cost of the sensors must be wholly met by the consumer.



How do I choose an insulin pump?

There are a variety of insulin pumps by different manufacturers on the market. All pumps work in the same basic manner but will vary in their specific functions and features. Your diabetes educator can support you in the process of choosing an insulin pump and help you to work out which one is best for you. If you do not have a diabetes educator you can access one in the following ways:

- contact your nearest hospital or community health centre
- ask your doctor or endocrinologist to refer you to a credentialled diabetes educator who is experienced in insulin pump therapy
- contact the Australian Diabetes Educators Association (ADEA) www.adea.com.au.

Currently there are four brands of insulin pumps available in Australia (photos of the pumps and company contact details can be found on page 44). This booklet does not discuss the individual pump models. If you would like more information about individual pumps and their features, the websites listed at the end of this booklet contain comprehensive detail. Pump companies will also send out information packs for potential purchasers.

Pump technology is constantly changing. Be sure to thoroughly research the various pumps you are interested in and make an informed choice. If you have any questions about pump functions speak to your diabetes educator, or the relevant pump company representatives who will be able to help you.

Pump features to consider

‘Smart pumps’

‘Smart pumps’ calculate the amount of insulin required to cover the carbohydrate eaten (using rates set by your diabetes educator or endocrinologist). ‘Smart pumps’ also calculate the insulin dose required to correct any high BGL that you enter in the pump that is outside your target range.

Tracking active insulin

‘Smart pumps’ have a feature that prevents you from ‘stacking’ or giving too much insulin. When you enter your BGL and carbohydrate intake, the pump will calculate the dose required after considering the insulin still active or ‘on board’ from a previous bolus. This may assist with avoiding hypos.

Bolus types

Pumps can be programmed to deliver a meal bolus in different ways. A meal bolus may be delivered, for example, over a period of two hours rather than all at once. These different bolus types can make eating a variety of foods and eating out much easier. See the section titled ‘What about...?’ on page 27 for more information.

Insulin delivery

Pumps vary in the increments of the basal rate and bolus dose that can be delivered. If you have a very small total daily dose of insulin or are very insulin sensitive (e.g. small children) then small delivery doses will be important.

Insulin reservoir/cartridge size

The reservoir/cartridge size varies between pumps, so depending on your daily dose of insulin some pumps will be more suitable than others.

Pump features to consider continued

Infusion sets

Not all infusion sets are suitable for everybody. Some people with very little subcutaneous (under the skin) fat will need a different type of infusion set to those with more. Some people have skin sensitivities so will require a set with little tape in contact with the skin.

Insertion devices

Some infusion sets have an insertion device that assists you to insert the cannula with its introducer needle. This can make infusion set changes much easier, especially for children.

Computer software

Some pumps have software that allows you to upload pump activity into a program that can analyse the data. The program can save the data in a format that makes it suitable for sharing electronically with diabetes health professionals.

Food database

Pumps with a food database allow you to store the carbohydrate content of a large range of foods that you commonly eat for easy reference.

Water resistance

Some pumps are splash resistant and others are waterproof to certain depth specifications. See the manufacturer's website for individual water resistance specifications.

What are the costs?

Insulin pump cost

The cost of an insulin pump ranges from \$4000 to \$8000, depending on the brand.

Who pays?

Private health insurance

In most cases, private health insurance (hospital cover) will rebate the full cost of the pump provided you are admitted as an inpatient at the time the pump is initiated.

Note

Insulin pumps are covered under the prostheses list of private hospital cover, not the health appliances section of ancillary or extras cover.

You therefore do not need extras cover to claim a pump, just hospital cover.

It is necessary that you meet any requirements set by your individual health fund relating to qualifying periods before you can claim a rebate on an insulin pump. Most private health funds have a waiting period between claims for an insulin pump before a new pump will be covered. This is usually the warranty period of the pump, which is often four years.

To ensure that you will not experience any out of pocket expenses when you are fitted with a pump, it is advisable that you check with your private health insurer about your level of cover and the rebate they will provide. You will need to get a specific item number or code from the pump company before you call your health insurance provider.

If you are considering purchasing private health insurance for the first time in order to claim a pump, keep in mind that although you cannot be denied insurance for having a pre-existing medical condition, you will have to meet qualifying periods (usually 12 months) before you can make a claim for an insulin pump.

Loan pumps

Some pump companies will loan pumps for trial purposes to people considering going on a pump while the individual meets all private health insurance qualifying periods.

Type 1 diabetes insulin pump grant program for people under 18

Since 1 November 2008, a **person under the age of 18 years** can apply for an **insulin pump subsidy** through the **Type 1 Diabetes Insulin Pump Grant Program**.

The Program is a collaboration between the Juvenile Diabetes Research Foundation, Diabetes Australia and the Australian Government. The government has allocated \$5.5 million over four years to the Program.

Means tested insulin pump subsidies range from 10% of the cost of the insulin pump (or \$500, whichever is greater) to 80% of the costs of the insulin pump. The subsidy you are eligible for will vary depending on your circumstances.

For more information about the Program or to apply for a subsidy, go to **www.jdrf.org.au** where you will find answers to commonly asked questions about the program and an online application form.

Pump consumable costs and the National Diabetes Services Scheme (NDSS)

Insulin pump consumables (infusion sets and reservoirs/cartridges) are subsidised by the NDSS for eligible consumers only. Under the NDSS, the cost of an infusion set is currently about \$1.30. The cost of an insulin reservoir/cartridge is about \$1.00 per unit. Batteries and other pump accessories are not subsidised by the NDSS.

To access insulin pump consumables under the NDSS you must:

- already be an NDSS registrant
- meet the additional criteria set out for insulin pump consumables.

People with type 1 diabetes who do not meet the eligibility criteria for subsidised consumables (or people with type 2 diabetes) can still use pump therapy but will be responsible for the ongoing costs. For people not eligible, pump consumables (i.e. the reservoirs/cartridges and infusion sets) will cost more than \$250 per month.

For frequently asked questions, eligibility criteria, assessment forms and order forms see:

www.ndss.com.au/Products--Outlets/Insulin-pump-consumables/

“I wanted to improve my diabetes control so I started pumping. I now have the freedom to eat, not eat and do things spontaneously. My control has improved and I feel almost normal.”

Kris, 58 years, pumping for one and a half years.

What are the challenges of pump therapy?

Expense

Using an insulin pump with its disposable infusion sets, cartridges and batteries is more costly than using insulin pens or syringes. Private health insurance will cover the cost of the pump but the consumables must be purchased. This cost will vary according to the brand of pump and the supplies required but will probably amount to approximately \$20–\$30 a month if you qualify for NDSS subsidised pump consumables.

Insulin dose adjustment

Life on an insulin pump can take some getting used to. It may take some time to get your insulin dose regulated on the pump. Initially you can expect lots of ups and downs in your BGLs while you and your diabetes care team intensively monitor and make the necessary adjustments. In the first week or so you need to contact your diabetes educator daily to make adjustments to your rates. As your BGLs stabilise, the contact will be less frequent.

Being connected

Being connected to a piece of equipment 24 hours a day is probably the issue that most concerns people when they are considering insulin pump therapy. There is no doubt that life with a pump provides greater flexibility in day-to-day living, eating and exercising, but getting used to wearing it around the clock can take some time.

Modern pumps are small and compact, which means that they are easy to disguise. You can conceal them in pockets, bras, on belts, clips or in carry cases. Many come in bright colours or have interchangeable covers like a mobile phone. Most infusion sets have quick-release connections so the pump can be easily detached from the cannula for showering or swimming. It does not take long before most pump users forget that they are attached.

“I’ve been on a pump for four and a half years. It’s much more flexible – I can get tighter control with fewer hypos. Negatives – doorknobs (I’m serious).”

Daniel, 29 years, pumping for four and a half years.



Skills required

Although insulin pumps are quite user-friendly in terms of programming and daily use, they still require a certain level of skill to program and make changes to basal rates, set bolus doses, alarms and so on. You also have to learn to change cartridges and infusion sets.

You will have at least one intensive training session with your diabetes educator when you are fitted with your pump, but there is also a lot of ‘on-the-job training’ as you get to know your pump in the first few weeks.

You will need to keep in frequent contact with your diabetes educator in the beginning to safely adjust insulin rates and learn the skills needed.

A special note about kids and teens

For children and teenagers operating the pump themselves, emotional maturity is essential. Pumping requires a lot of motivation and diligence. The child or teenager needs to be able and prepared to:

- check BGLs 8-10 times a day initially
- check BGLs at least four times a day once BGLs stabilise
- count the carbohydrate content of the foods they eat.

Body image is also an important consideration. A pump is worn 24 hours a day and is a visible sign of type 1 diabetes. Consider this when thinking about a pump at a time when body image is important, especially during adolescence.

If you are a parent of a child with type 1 diabetes, you also have the responsibility to ensure that you are committed to pump therapy. You need to understand that although the benefits of pump therapy are immense, the level of commitment is high.

You need to know as much about the pump as if it were your own and you need to be prepared to problem solve should an issue arise at school or at social activities.

“Couldn’t be happier with my pump. Have had it for just one year but it has given me so much freedom. I now have the freedom to eat when I want and still keep good BGLs. I even wore it swimming whilst on holidays. But, it’s not a free ride... I’m learning all the time and continue to improve my control.” Brian, 53 years, pumping for 14 months.

Technical problems

Even the most reliable equipment encounters technical problems at times. Insulin pumps and their in-built micro-computers are very reliable but problems can arise. Infusion sets can become blocked, computers can fail, screens and pump bodies can be damaged. Pumps do have some alarms and safety features to alert the user to possible problems.

Technical assistance is available from individual pump companies 24 hours a day. It is important to make sure you have insulin pens or syringes available to administer your insulin in case of any problem. This means having a back-up supply of in-date long-acting insulin in your refrigerator in case of pump failure.

Skin problems

One of the most common problems associated with insulin pump use is skin irritation. Infusion sets feature hypoallergenic adhesive tape that is designed to minimise skin irritation. Those with sensitive skin may still experience itching, rashes or minor inflammation. There are many different brands of infusion sets on the market and you may need to experiment to find a brand that suits your skin.

Skin infections are another potential problem. Skin infections will not normally occur as long as you:

- wash or disinfect your hands
- disinfect your skin
- use a proper technique when changing infusion sets
- change the set on a regular basis.

More rapid development of ketones

Ketones are chemicals produced when the body breaks down stored fat for energy because there is not enough insulin in the blood. Insulin pumps do not use long-acting insulin, so any interruption in insulin delivery for more than a few hours can lead to ketosis.

Ketosis is a state characterised by elevated levels of ketones in the blood. If not treated promptly, ketosis can lead to diabetic ketoacidosis (DKA); a life threatening condition that requires emergency treatment in hospital. For this reason, pump users need to test their BGLs at least four times a day. Ketones must be tested when BGLs are greater than 15mmol/L or at the first sign of illness.

If this situation should arise, always make urgent contact with your diabetes care team. Always have in-date ketone test strips (either blood or urine) available for use.

“I’ve only been on an insulin pump for four weeks but have already seen small improvements in my daily BGL averages. There seems to be more stuff to carry around, but not doing injections is great! Looking forward to much greater improvements and actually looking forward to my next HbA1c check-up!”

Mark, 35 years, pumping for one month.

What about...?

Food & carbohydrate counting

Insulin pump therapy can offer many benefits relating to the dietary management of type 1 diabetes. An insulin pump offers:

- more flexibility about the **timing** of meals and snacks
- more flexibility about the **amount** of carbohydrate eaten
- ability to **eat to appetite**.

For pump therapy to be effective it is necessary to **count carbohydrate** intake in order to either calculate and 'dial-up' the required bolus dose of insulin, or program the amount of carbohydrate into the pump so that the pump can calculate and deliver the correct bolus dose at meal and snack times.

Meal bolus doses are calculated according to the amount of carbohydrate to be eaten, your insulin to carbohydrate ratio and your BGL at the time.

Example

Sarah's insulin to carbohydrate ratio is 1.0 unit of insulin for 10 grams of carbohydrate. If Sarah was to eat 50g of carbohydrates, she must 'dial-up' 5.0 units of insulin. If Sarah was using a 'smart pump', she would enter this amount of carbohydrate in the pump and the pump would calculate and deliver 5.0 units of insulin. This, of course, is in addition to the basal insulin delivered to Sarah continuously.

Pumps can be programmed to deliver meal bolus insulin in a variety of ways to:

- cope with meals that are spread over long periods of time
- cope with foods which have a lower glycaemic index (GI) or are higher in fat, which affects glucose absorption.

A pump can deliver, for example, a 5-unit bolus with a small amount of insulin delivered initially and the remainder spread over a two hour period.



“Since I started on my insulin pump, I have had better control over my BGLs and have been able to eat more freely. I don’t have to eat at exact times anymore or eat a set amount of carbohydrates. I would not like to go back to having needles.”

Renee, 12 years, pumping for six months.

Carbohydrate counting is important!

It is important that you consult with a dietitian prior to starting on a pump. Further consultations are important to reinforce and practice carbohydrate counting as well as emphasise healthy eating.

A carbohydrate counting guide is a very useful resource for this purpose as it lists carbohydrate values for a large range of foods. An example is **The Fat, Fibre and Carbohydrate Counter: The Essential Guide to Healthy Eating 2003**, Murdoch Books, Sydney.

Some people find that they gain weight after starting pump therapy because they are more likely to eat things they would not have previously eaten, because of the ease of 'dialing-up' an insulin dose. This reinforces the need to see an accredited practicing dietitian for individualised dietary advice.

How to access a dietitian

- Contact your local community health centre

- Dietitians Association of Australia

Phone: **1800 812 942**

Website: **www.daa.asn.au**

- Diabetes Australia in your state

Phone: **1300 136 588**

Places to wear the pump

Some people are comfortable with wearing the pump on their belt. The pump may come with a leather carry case or clip, which holds the device and gives the appearance of a pager or small mobile phone.

Others simply carry the pump in a pocket. Some women prefer to wear the pump in their bra or attached to a garter on the leg. Each of the pump suppliers has accessories and there are now also many websites selling pump accessories.

The cannula, which is inserted under the skin, is often placed in the abdominal area but can also be placed in the upper buttock, hip or upper arm.

Swimming

Swimming is a very healthy activity for people with diabetes including those using a pump. Some pumps are waterproof and tested to an international standard while others are watertight. This means it is possible to swim, shower and surf without taking your pump off if you so choose. If you participate regularly in water sports it is advisable to check the individual product specifications regarding waterproof status before choosing your pump.



If you do swim with your waterproof pump you should check for any cracks or loose cartridge or battery covers and so on. If you fail to check these things the pump may not be covered under the warranty, as they may be deemed 'user error'.

Most infusion sets are fitted with a quick-release connection, which allows the pump to be disconnected without removing the cannula from under the skin. This means that it is possible to quickly disconnect from your pump to take a shower, bath or swim. Pump users can safely disconnect from their pump for up to two hours but should monitor BGLs and replace missed basal insulin if necessary.

Diabetes specialists or diabetes educators can advise on the replacement of basal insulin during periods of not using the pump. An insulin pump should not be worn in a spa or sauna as the heat can affect the pump and the insulin.

Sleeping

One of the questions most commonly asked about pump therapy is 'Where do I put the pump when I go to sleep?'

Some common places people leave their pumps are:

- under their pillow
- clipped to their pyjamas or in a pyjama pocket
- many let the pump 'float' around in the bed.

Sex

Some people find that the pump can be worn during sexual activity without causing problems, but for many the pump may get in the way. Pumps can be easily disconnected using the quick-release connection whenever required (for no longer than two hours), but of course it is important to remember to reconnect. The pump can be put in 'suspend' or 'stop' mode and it will alarm regularly to remind you to reconnect.

Exercise

Regular physical activity is recommended as part of the diabetes management plan. Physical activity can be much easier with a pump because it is possible to temporarily reduce the basal rate of insulin before, during and after the period of exercise to help prevent hypos.

During a long bushwalk or bike ride, for example, it is possible to reduce the basal insulin to 30 per cent of normal in order to reduce the risk of hypos. It is recommended that you remove the pump during vigorous contact sports. Missed basal insulin can be given as a small bolus if required. The pump should not be removed for longer than two hours or you will risk developing ketones and feeling unwell.



“I had hypo unawareness and major hypos often due to exercise. A pump has required a lot more blood tests, but has provided a lot more flexibility in terms of my activities. I can fix bad BGLs more quickly and I can sleep without waking up with a horrendously high BGL.”

Dave, 42 years, pumping for eight years.

School

It is important that all teachers and staff caring for the student be informed of the student's insulin pump and that this detail be recorded in the student's type 1 diabetes school management plan and kept on file.

Using a pump may make participating in school sports and managing BGLs during times of sickness easier because basal rates can be adjusted to prevent hypos and hyperglycaemia.

Important information

It is essential that parents or guardians provide the school with an emergency kit. This should include:

- hypo food (quick-acting carbohydrates such as jelly beans)
- emergency contact numbers
- spare pump batteries
- back-up insulin with spare syringe or pen
- spare pump consumables
- alcohol wipes or disinfectant.

It is strongly recommended that the emergency kit be kept in the school sickbay and be available on school excursions.

Travel

When going on trips it is important to remember to take extra supplies of:

- pump batteries
- pump consumables
- insulin (including long-acting) and insulin pens or syringes
- blood and ketone test strips.

It is highly recommended that you carry a letter from your doctor in case you get inspected at airport security.

Some pumps may be affected if scanned by a 'wand', but walking through metal detectors at airport security will not affect the pump. The pump may or may not trigger the alarm as all airport security systems are different. It is always advisable to notify airport security of your pump.

Remember to pack your extra supplies in your carry-on luggage in case your checked-in luggage goes missing.

Insulin must be packed in carry-on luggage as the temperature of the cargo hold may cause insulin to freeze.

Insulin pumps have clocks as a built-in feature. For international travel it is recommended that the new time zone be entered once the final destination has been reached – NOT whilst in transit in case there are any delays or other problems along the way. Bolus doses are given as you usually would according to the carbohydrate content in your meals and snacks served whilst in transit. Do not forget to put your clock back to local time when you return home.

Important information

It is essential that people using a pump also travel with an alternative method of delivering insulin (pens or syringes), in case the pump fails in an isolated area where a replacement pump is not available. Don't forget to carry long-acting as well as short-acting insulin.

Pregnancy

Ideally, pump therapy should be initiated at least three months prior to conception. This allows time to optimise control and become proficient in the operation of the pump. Of course, if you are already pregnant it is still possible to commence pump therapy and you should discuss this with your diabetes care team. Some hospitals and pump companies may loan you a pump so that you may trial pump therapy before you commit to a purchase.

The advantages of using an insulin pump during pregnancy include:

- tighter diabetes control with less frequent hypoglycaemia
- ability to fine-tune the changing insulin requirements that occur during pregnancy
- lower likelihood of the baby developing macrosomia (large birth weight)
- more convenience and flexibility during labour because insulin delivery rates are able to be changed according to your needs
- easier management of morning sickness
- variable rates allow more flexibility whilst breastfeeding.

Hospitalisation

In the event that you are admitted to hospital, you will need to inform hospital staff of your diabetes and that you use an insulin pump. Given that pumps are a relatively new management tool in Australia, it is important that you keep in mind that some hospitals may not be experienced in dealing with pumps. Hospital staff may try to remove your pump during a surgical procedure, for example, if they are not comfortable with you wearing a pump under general anesthetic. If it is necessary to remove your pump, an alternative method of insulin delivery needs to be arranged and administered immediately.

Important information

An insulin pump should not be worn during an X-ray, CT or MRI scan.

Other medications and illnesses

Just like anybody with diabetes, pump users should always advise their doctors or diabetes educator of any other illnesses they have or medications that they take. Some medications will influence insulin requirements and make it necessary to temporarily adjust basal insulin rates.

Sick days

During periods of illness, your insulin requirements may change. A pump can make sick days easier to manage because there is greater flexibility with adjusting insulin doses and delivery rates. A sick day management plan should be prepared in advance with your diabetes educator or endocrinologist and put into action during illness. Your diabetes educator can support and guide you through sick day management so it is important to make contact if you do not have experience in managing sick days yourself.

You will need to test BGLs and blood or urine ketones regularly and adjust insulin rates accordingly. The pump's basal rate can be temporarily adjusted to deliver more or less insulin during periods of illness if necessary.

It is important to remember that your risk of DKA is increased on a pump because there is no long-acting insulin available. Children and pregnant women are at an increased risk of developing DKA during illness so the guidance of their diabetes care team is extremely important.

Identification

It is advisable that people with type 1 diabetes wear medical identification so that treatment for hypoglycaemia or ketoacidosis can be given quickly if needed. If you are a pump user, identification is particularly useful to alert health care providers to your method of insulin delivery. In the case of extreme hypoglycaemia it would be important for the pump to be suspended or disconnected to prevent further lowering of your BGLs.

“I started using the pump to get better control and prevent hypos. This was achieved and I discovered a new freedom to be able to live life normally. Researching the pump prior to starting eliminated all negatives. I’m extremely grateful for it and my diabetes educator who introduced me to it.”

Robert, 62 years, pumping for three years.

Important things to remember about pump therapy

Using an insulin pump means you no longer have to give yourself injections, although there may be the odd time when you need insulin via injection. There are other things, however, which you will need to be willing to do.

- Check your BGL at least 8-10 times a day when you start using a pump. When BGLs are stabilised, a minimum of four tests a day (before each meal) are needed so that you can program your pump to deliver the appropriate amount of insulin you need according to your BGLs.
- Learn to:
 - count carbohydrates and get lots of practice, preferably well before you start on a pump
 - adjust your insulin rates according to BGL patterns and trends
 - adjust your insulin doses or rates according to activity levels, ketones or sick days.
- Respond quickly when BGLs show hyperglycaemia (high BGL) and/or if ketones are present in the blood. Long acting insulin is not used in a pump so if there are any technical problems with the pump or the infusion set, BGLs can rise very quickly, increasing your risk of DKA.
- Regularly monitor your pump. Also monitor:
 - tubing for air bubbles. Air bubbles themselves cause no harm, however the risk is that you would miss out on some of your insulin dose

- the insertion site for any problems. Redness or itchiness around the site, for example, may indicate the need to change your cannula.
- Learn and accept responsibility for pump use, trouble shooting, and self-care behaviours.
- Remember that your pump settings, basal rates, insulin sensitivity factor (correction factor) and insulin to carbohydrate ratios will change over time with weight loss or weight gain, different activity levels and age. You should keep in frequent contact with your diabetes educator at first and at regular, intermittent intervals. Make sure you have follow-up appointments and annual reviews with your diabetes care team.
- Always keep back-up in-date long-acting insulin and have extra syringes or pens at home for insulin delivery in case of pump failure.

“I was experiencing severe hypos whilst attempting to become pregnant. Starting on my pump refocused me on regular BGL testing and the ease with which I could make adjustments to insulin delivery improved my BGL control enormously – and made keeping excellent HbA1c during my pregnancy very achievable!”

Anne, 40 years, pumping for two years.

When is pump therapy not recommended?

Pump therapy is not recommended for people who:

- are not performing or are not willing to perform frequent blood glucose checks
- are not willing or able to calculate the amount of carbohydrate in meals and snacks
- are not able to detect air bubbles in the infusion line (vision impaired)
- are not able to hear the alarms (hearing impaired), although most modern pumps have a vibration alarm as well as an audible alarm
- are not able to press the buttons on a pump
- are not able to manage possible problems which may arise, including site infections and blocked lines
- have an intense fear of needles
- are not willing to keep in regular contact with their diabetes educator or have regular reviews by their endocrinologist.



How do I get started on an insulin pump?

Once you have discussed pump therapy with your diabetes care team and you have chosen a pump, you will need to receive pump education. This education must be provided by a team consisting of at least a credentialed diabetes educator and an endocrinologist or specialist physician.

Many major public hospitals are starting to offer insulin pump training and this will increase as the demand for insulin pump therapy grows. There are also diabetes educators who work privately providing training in some private hospitals. This education must be provided in consultation with your diabetes specialist.

Pump training will usually cover topics such as:

- pump functions
- dose calculation (including working out your insulin to carbohydrate ratio and correction factor)
- changing basal and bolus doses
- line changing, filling the insulin cartridge/reservoir
- carbohydrate counting
- sick day guidelines and emergency contact
- when to monitor
- exercise
- 'holidays' from the pump
- hypoglycaemia
- hyperglycaemia and ketone testing
- insulin doses if pump fails
- problem solving.

How can I get more information?

- Discuss pump therapy with your diabetes specialist or diabetes educator.
- Contact Diabetes Australia in your state (1300 136 588) for information about local hospitals with insulin pump clinics.
- Contact Australian insulin pump suppliers (see page 44).

Useful Websites

www.diabetesaustralia.com.au

For general information on insulin pumps.

www.jdrf.org.au/pumps

For information on the Type 1 Diabetes Insulin Pump Grant Program such as eligibility criteria, subsidy estimates or to submit an application.

www.ndss.com.au

Download an NDSS Assessment form for access to subsidised insulin pump consumables and an order form for pump consumables.

www.diabetesnet.com

This site provides diabetes information, research findings, product information, books on diabetes and lots of pump therapy information including a pump comparison table (note that not all the pumps shown are available in Australia).

www.insulinpumpers.org

Insulin Pumpers® provides information and support for adults and children with diabetes and their families interested in insulin pump therapy. There is a special section devoted to children with diabetes and the stories about how an insulin pump has changed their lives.

www.childrenwithdiabetes.com

An online community for kids, families and adults with diabetes with a section on insulin pumps.

www.diabetekidsandteens.com.au

A website for kids and teens with type 1 diabetes. Here you can find information and a comparison table on all the various types of insulin delivery devices, including pumps and pens.

www.diabetes.org

This is the American Diabetes Association's official site and provides lots of useful information on pumps, including links to pump resources.

www.realitycheck.org.au

A peer support site for young adults with type 1 diabetes.

Useful Books

Insulin Pump Therapy Demystified: An essential guide for anyone pumping insulin Gabrielle Kaplan-Meyer 2003 Marlowe & Company New York.

Pumping Insulin

(4th ed) John Walsh & Ruth Roberts 2006 Torrey Pines Press San Diego.

Smart Pumping: A Practical Approach to the Insulin Pump

Howard Wolpert (Ed) 2002 American Diabetes Association.

The Fat, Fibre and Carbohydrate Counter The Essential Guide to Healthy Eating 2003 Murdoch Books Sydney.

Useful Journal Article

Elizabeth A. Doyle, Stuart A. Weinzimer, Amy T. Steffen, Jo Ann H. Ahern, Miranda Vincent, and William V. Tamborlane: A Randomized, Prospective Trial Comparing the Efficacy of Continuous Subcutaneous Insulin Infusion with Multiple Daily Injections Using Insulin Glargine Diabetes Care 27: 1554-1558.

Pump Companies

Animas

Australasian Medical and Scientific

Ph: 1300 851 056

www.animascorp.com



Medtronic

Ph: 1800 668 670

www.medtronic-diabetes.com.au



Roche Diagnostics

Accu-Chek Pump Hotline

Ph: 1800 633 457

www.accu-chek.com.au



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