Insulin is the main injectable therapy used by people with diabetes, but often they do not receive adequate education on injection technique.

Injection technique in insulin therapy

In this article...

- Why some people need insulin
- Various aspects of good injection technique
- The importance of injection site/side rotation

**5 key points**

1. More than 3.7 million people in the UK have diabetes.
2. Many people do not remember receiving education on injection technique.
3. Poor technique can mean insulin is absorbed in an unpredictable manner, causing hypoglycaemia and/or hyperglycaemia.
4. Patients' injection technique should be reviewed regularly.
5. Specific areas of patients' knowledge and practice should be revisited at least every year.

**Why some people need insulin**

More than 3.7 million people in the UK have diabetes, with 2.9 million diagnosed and an estimated 850,000 undiagnosed (Diabetes UK, 2012). Around 30% of those with diabetes use injectable therapies, which means over 800,000 use injections to manage their condition (Hicks et al, 2011).

Insulin is the main injectable treatment used by people with diabetes; this therapy is designed using high levels of technology to finely tune its peak of action and precisely time its duration of action. However, if technique is flawed, this directly affects the way in which the insulin works and will affect glycaemic control.

Glucose is essential in providing the body with energy. However, without an adequate supply of insulin, the body is unable to use glucose for energy and glucose levels can rise in the bloodstream, which may cause hyperglycaemia.

Insulin helps to control blood glucose levels by allowing glucose to enter the cells, where it is used to provide energy; this reduces glucose levels in the blood.

Several different aspects of injection technique need to be considered to allow the injectable therapy to work as designed.

**Re-suspension of insulin**

Cloudy insulin must be properly re-suspended before use or the strength of the insulin delivered can vary dramatically and the expected impact will not be achieved. This may result in hypoglycaemia or hyperglycaemia (Gin and Hanaire-Brouitin, 2005).

Re-suspension is achieved by rolling the
vial or cartridge 10 times then gently inverting it 10 times and visually checking that it is a milky white colour before it is injected.

**Lifted skin fold technique**
If a needle longer than 8mm is used (in adults), a lifted skin fold must be used to avoid the risk of injecting insulin into muscle (Hicks et al, 2011; Gibney et al, 2010).

The technique used for this is another area of concern. While making a lifted skin fold reduces the chance of intramuscular injection, releasing the skin fold too soon, lifting it incorrectly or using the whole hand to lift it increases this risk.

The best method is to lift the skin between thumb and two fingers with one hand, pulling the skin and fat away from the underlying muscle, and holding until the insulin has been injected (Figs 1a and 1b).

A lifted skin fold should be used with a needle length less than 8mm in patients who are very thin and in children (Hicks et al 2011).

**Pen devices**
When injecting using a pen device, the needle should be kept in the skin (with a lifted skin fold, if necessary) for at least 10 seconds after delivering the drug.

This helps to ensure complete expulsion of the injectable therapy through the needle and avoid dribble through equalisation of pressure inside the pen and in the fat layer injected into (Hicks et al, 2011).

**Sequence for injecting**
The optimal sequence for injection technique should be:
- Make a lifted skin fold if necessary;
- Insert the needle into the skin at a 90° angle;
- Administer insulin;
- Leave the needle in the skin for at least 10 seconds after the insulin has been injected;
- Withdraw the needle from the skin;
- Release the lifted skin fold if used;
- Dispose of the used needle safely following local sharps disposal guidelines (Hicks et al, 2011).

**Absorption of insulin**
Insulin absorption can be affected by many factors, which can either speed up or slow down the rate of absorption (Chowdhury and Escudiet, 2003). A change in the rate will either strengthen or weaken the predicted action of the insulin.

Factors that can speed up absorption and so increase risk of hypoglycaemia are:
- Warm/hot environment, increasing blood flow to the injection area;
- Rubbing or massaging the area;
- The injection being delivered into a deeper layer of skin.

Factors that may slow down insulin absorption and so cause a potential increase in blood glucose are:
- A cold environment, reducing blood flow to the injection area;
- Increased volumes of insulin, as the ability to absorb larger amounts is reduced;
- More concentrated insulin, such as 500 units per ml instead of the usual 100 units per ml and which is only available in UK on a named patient basis;
- Unhealthy injection sites, for example those that are bruised or scarred.

**Sites for administering insulin**
For insulin to work in a predictable way, it has to be injected into subcutaneous tissue (Guerici and Sauvanet, 2006) (Fig 2).

**Complications of poor technique**
Poor technique, including using the incorrect needle length, can lead to insulin not being absorbed in a predictable manner.

This may cause immediate problems such as hypoglycaemia (a sudden drop in blood sugar because of accelerated insulin absorption if the insulin is injected into muscle) and hyperglycaemia (a rise in blood sugar because of slow insulin absorption or insulin running out too quickly).

Gibney et al (2010) demonstrated that it does not matter if insulin is injected into fat just under the dermis or just above the muscle, as long as it is injected into fat. In patients with very little fat, short needles may be useful or the area with very little fat or subcutaneous tissue should be avoided and a more suitable injection site found (Figs 3a and 3b).

**Lipohypertrophy**
A common problem resulting from poor injection technique is the development of lipohypertrophy (commonly referred to as lipo).

This is the accumulation of fat under the skin, partly caused by injecting too frequently in the same area. Lipohypertrophy can be unsightly and painful (Figs 4a and 4b); in some people the lesions can be hard or scar like. To detect lipohypertrophy, injecting sites should be both inspected and palpated, as some lesions can be more easily felt than seen. Healthy skin can be pinched tightly together, while areas of lipohypertrophy cannot.

In some cases, lipoatrophy can develop, which is the wasting of subcutaneous tissue. It is less common now due to the purification of human and analogue insulin but is once again being seen occasionally in clinical practice because impure insulin is being used in some developing countries.

**Injection site rotation**
The site should be changed at each injection (rotated) to reduce the risk of lipohypertrophy developing.

A simple way to reduce this risk is to systematically rotate the site where the insulin...
is injected (Chowdhury and Escudiet, 2003). There are four main injection sites – abdomen, thigh, arm and buttocks (Fig 5). Each of these has different characteristics, and the rate at which human insulin is absorbed differs for each one (however, there does not appear to be any difference with analogue insulin).

One scheme with proven effectiveness involves dividing the injection site into quadrants (or halves when using the thighs, buttocks or arms) (Hicks et al, 2011). One quadrant should be used per week and moving always in the same direction, either clockwise or anti-clockwise, keeping the injections at least 2cm apart (Fig 5).

Reusing needles
Reuse can lead to bruising and bleeding as a result of the needle being blunted by overuse. Infection is possible if needles are reused or an injection is given through clothing. It is recommended needles are used only once, and injections should not be given through clothing (Hicks et al, 2011).

Principles for teaching patients
Some patients do not remember being taught all the aspects of injection technique when they started insulin therapy. It is therefore essential to review injection technique regularly; nurses should not assume that patients injecting insulin are doing it correctly either from the start or over a period of time. The following should be revisited at least every year:

- Injection technique (including angle of injection, time needle left in skin after injection complete, needle length);
- Correct technique for lifted skin fold if needed;
- Site rotation;
- Ability to check for lipohypertrophy;
- Ability to re-suspend insulin correctly before injection;
- Disposal of sharps.

Conclusion
Nurses have a vital role to play in educating people with diabetes about aspects of good injection technique, and in regularly reviewing patients’ knowledge and understanding to ensure they follow evidence-based practice in injectable therapies.

References