

The shorter the better – benefits of optimal injection technique and short pen needles for obese people with diabetes

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The number of people diagnosed with diabetes in the UK is growing, as are the number of those who use injectable therapies for glycaemic management of their diabetes. Good injection technique is important as it can reduce hypoglycaemic episodes and encourage glycaemic stability. Short pen needles have been proven to reduce injection anxiety, deliver a reliable insulin dosage, and provide a less painful experience to those using injectable therapies to manage their diabetes than other methods. Short pen needles have sometimes been thought to be unsuitable for use by obese people with diabetes. This is not the case, as it has been proven that obese people can benefit from the use of short pen needles in the same way that non-obese people with diabetes are able to.

Achieving optimum glycaemic control is the main aim of people with diabetes and an optimal injection technique can help those who use injectable therapies to achieve this (Gibney et al, 2010). Reliable insulin dosage delivery is significantly affected by the length of the pen needle used and recent studies, such as those by Gibney et al (2010) and Lo Presti et al (2012), have shown that 4 mm pen needles can greatly reduce the frequency of intramuscular (IM) injection, can provide a less painful injection experience and are suitable for use by people with diabetes of all body types – even those with obesity.

The importance of subcutaneous injection

Injection into healthy subcutaneous tissue is important for the reliable, predictable absorption of insulin. Subcutaneous as opposed to IM injections help to maintain stable blood glucose levels and minimise variations in glycaemic control, which may lead to hypoglycaemia (De Coninck et al, 2010). Gibney et al (2010) have shown that skin thickness is on average 2 mm thick with little variation, regardless of age, gender, BMI and ethnicity. Subcutaneous fat thickness,

however, is highly variable and will be affected by factors such as age, gender and BMI.

The benefits of using a short pen needle

A 4 mm pen needle is the shortest pen needle available today for people with diabetes. Research by Frid et al (2010a) has indicated that 4 mm needles will consistently pass through skin and into the subcutaneous layer. Gibney et al (2010) confirm that a 4 mm needle will deposit insulin under the skin and into subcutaneous fat tissue with a substantially reduced risk of IM injection than when using longer needles (this has been confirmed with magnetic resonance imaging [MRI]). Needle lengths greater than 4 mm pose an increased risk of IM injection with every extra millimetre.

The misconception exists that short pen needles are not appropriate for use by people who are obese. In fact, 4 mm pen needles can be used by all – even the obese – as Laurent et al (2007) have found maximum skin thickness to be no more than 2.7 mm. Multiple studies such as those by Hirsch et al (2012) and Strock et al (2013) have compared pen needles with a length of 4, 5 and 8 mm and have found that the 4 mm pen needle



Online learning opportunity

See page 27 for details.

Citation: Hicks D (2014) The shorter the better – benefits of optimal injection technique and short pen needles for obese people with diabetes. *Diabetes in Practice* 3: 23–7

Article points

1. Using a short pen needle greatly reduces the risk of intramuscular injection and, therefore, glycaemic variability.
2. A 4 mm pen needle is suitable for use by obese people with diabetes.
3. People with diabetes have been reported to prefer short pen needles as they are less painful to use.
4. By reducing injection anxiety and pain associated with injecting, adherence to insulin injection therapy can be improved.

Key words

- Glycaemic control
- Hypoglycaemia
- Injection technique
- Needle length
- Short pen needles

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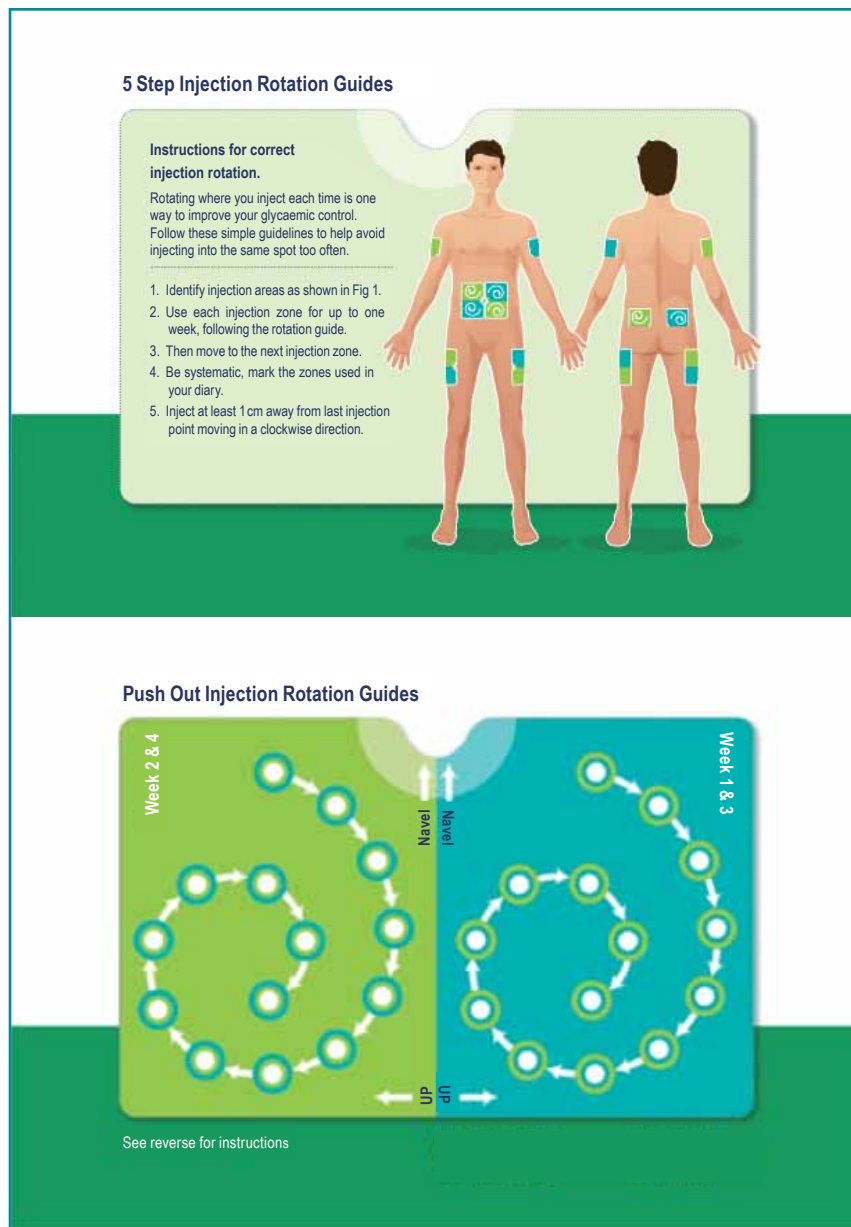


Figure 1. Five-step injection rotation guides — abdomen, thighs, buttocks and arms. (Source: Becton Dickinson)

provided equivalent glycaemic control in both obese and non-obese people compared with the 5 mm and 8 mm needles, and with no increase in reports of insulin leakage from the skin. A study by Hirsch et al (2010) confirmed the 4 mm pen needle is also the most preferred needle length among people with diabetes. It revealed that subjects preferred the 4 mm pen significantly more than either the 5 mm or 8 mm pen needles. This was reported to be because they were found

to be less painful, easier to use and to cause no additional leakage of insulin.

It is incredibly important that the benefits of short pen needles are highlighted to clinicians and obese people with diabetes. Not only do they give a reliable subcutaneous insulin delivery, they are also known to contribute to a less painful injection experience, which is important when encouraging good glycaemic control. Injection discomfort can lead to fear and anxiety that, in turn, can lead to poor adherence to insulin injection therapy. A study by Peyrot et al (2005) noted that 20% of insulin users “often or sometimes skipped their injections”, while 10% restricted their number of daily injections. The 4 mm pen needle is less painful (Hirsch et al, 2010) and, therefore, may help people with diabetes to adhere to their insulin injection regimen.

Injection technique best practice

Needle length is not the only factor that can affect whether an insulin dosage is reliably absorbed; there are multiple aspects to consider when trying to achieve optimum glycaemic control. For example, injecting into lipohypertrophic tissue will cause erratic absorption (Blanco et al, 2013), which should not be accepted as an inevitable consequence of the condition. Studies, such as Vardar and Kizilci’s (2007), have confirmed associations between the presence of lipohypertrophy and a failure to rotate sites, injecting into small zones or the same location repeatedly, and reusing needles.

The Forum for Injection Technique

The Forum for Injection Technique (FIT) (www.fit4diabetes.com) is an autonomous organisation with an overarching mission to support people with diabetes who use injectable therapies – and those involved in their care – to achieve the best possible health outcomes that can be influenced by correct injection technique. By establishing best practice injection technique, it is hoped that factors such as accidental IM injection, which causes erratic glucose absorption, will be reduced, as will consequential hospital stays related to severe hypoglycaemia and long-term complications.

FIT also publishes guidance and recommendations to raise awareness of existing



Figure 2. Photographs showing the type of damage that can occur to a needle with reuse. (Source: Look and Strauss, 1998)

and emerging research relating to injection technique, and the impact this may have on health outcomes for people with diabetes who require subcutaneous injection therapy. FIT is committed to supporting all those involved in diabetes care and to developing its recommendations.

This article seeks to highlight recent research on the benefits of short pen needles, such as the evidence that challenges the misconception that 4 mm needles are inappropriate for use by people with obesity.

FIT encourages clinicians to inspect injection sites regularly for any abnormalities and to document them within an individual's care plan. Ideally, injection sites should be examined at each visit and any evidence of lipohypertrophy measured and recorded for long-term follow-up. As affirmed by Teft (2002), individuals should also be taught to examine their own injection sites and to detect lipohypertrophy so that affected tissue can be avoided and allowed to recover. Franzén and Ludvigsson (1997) highlight that caution must be exercised when switching injection sites from areas of lipohypertrophy to normal tissue, as this often requires a reduction in the dose of insulin injected. This is because the person may have increased their dose to compensate for the poor or erratic absorption resulting from injecting into lipohypertrophic tissue. Too great a reduction in dose could lead to an increased risk of diabetic ketoacidosis in people with type 1 diabetes. Too small a reduction, however, could result in hypoglycaemia. The change in quantity will vary from one individual to another and should be guided by frequent blood glucose measurements.

Effective injection site rotation will help prevent lipohypertrophic tissue from developing as a result of repeated injection into the same site or zone. A proven injection site rotation scheme involves identifying the injection areas (abdomen, thighs, buttocks and arms) and using each injection zone for up to one week, following a rotation guide that always moves in the same direction, either clockwise or anti-clockwise. Injections within any zone should be spaced at least 1 cm apart from each other to avoid repeat tissue trauma (Figure 1).

As illustrated by Frid et al (2010b), reusing needles also encourages lipohypertrophic tissue to develop and leads to an incorrect dosage being administered, as air can be allowed into the cartridge or disposable device when the needle is left attached between injections. Bruising, bleeding and infection is possible if a needle is blunted by overuse and if injections are given through clothing. Recommended practice is that needles are used only once and removed immediately after the injection is given. Injections should not be given through clothing. Figure 2 shows the type of damage that can occur to a needle with reuse.

Hypoglycaemia

Diabetes UK (2014) has recorded the known population of people in the UK diagnosed with diabetes as 3.2 million. According to Stanisstreet et al (2010), people with type 1 diabetes experience about two episodes of mild hypoglycaemia per week. Hypoglycaemia is a major concern for people who inject insulin and presents clinical management challenges for their

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clinicians. Cryer (2008) cites hypoglycaemia as the most frequent side-effect of insulin treatment and elaborates that it causes both autonomic symptoms (nervousness, sweating and hunger) and neuroglycopenic symptoms (confusion, weakness and, less frequently, seizure or coma) and it may also lead to death. Any measure that might help to reduce the incidence and/or severity of hypoglycaemia will benefit people with diabetes, their carers and the NHS.

Conclusion

FIT’s overarching mission is to support people with diabetes who are using injectable therapies (and all those involved in their care) to achieve the best possible health outcomes that can be influenced by correct injection technique. The use of an appropriate needle length is essential for optimal glycaemic control and long-term health. Despite the common misconception, 4 mm pen needles are appropriate for use by obese people with diabetes and can offer benefits such as a reduced risk of IM injection, as well as increased injection comfort. It is important to acknowledge injection technique as a whole, however, and by adhering to FIT’s recommendations on injection site rotation and needle reuse, for example, a best practice routine with long-term benefits may be established. ■

The full *Diabetes Care in the UK: The First UK Injection Technique Recommendations* (2nd edition) document, published by FIT, can be accessed online at <http://bit.ly/1IHSPH5>.

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Online CPD activity

Visit www.diabetesonthenet.com/cpd to record your answers and gain a certificate of participation

Participants should read the preceding article before answering the multiple choice questions below. There is ONE correct answer to each question. After submitting your answers online, you will be immediately notified of your score. A pass mark of 70% is required to obtain a certificate of successful participation; however, it is possible to take the test a maximum of three times. A short explanation of the correct answer is provided. Before accessing your certificate, you will be given the opportunity to evaluate the activity and reflect on the module, stating how you will use what you have learnt in practice. The CPD centre keeps a record of your CPD activities and provides the option to add items to an action plan, which will help you to collate evidence for your annual appraisal.

1. Which SINGLE ONE of the following is NOT a recognised benefit of using short pen needles when injecting insulin?
Select ONE option only.
 - A. Improved glycaemic stability
 - B. Improved delivery of a reliable insulin dosage
 - C. Reduced hypoglycaemia
 - D. Reduced injection anxiety
 - E. Reduced lipohypertrophy
2. Which of the following people with diabetes, if any, is LEAST likely to benefit from the use of short pen needles when injecting insulin?
Select ONE option only.
 - A. A 15-year-old with newly diagnosed type 1 diabetes
 - B. A 22-year-old with type 1 diabetes and poor injection concordance
 - C. A 35-year-old professional sportsman with type 1 diabetes
 - D. A 47-year-old with type 2 diabetes and a BMI of 39 kg/m²
 - E. A 90-year-old with poor vision, a recent cardiovascular accident and type 2 diabetes
 - F. All of the above
 - G. None of the above
3. According to recent studies, what is the OPTIMUM length of pen needle for all people with diabetes to use?
Select ONE option only.
 - A. 2 mm
 - B. 3 mm
 - C. 4 mm
 - D. 5 mm
 - E. 8 mm
4. What is the AVERAGE skin thickness?
Select ONE option only.
 - A. 0.5 mm
 - B. 1 mm
 - C. 2 mm
 - D. 3 mm
 - E. 4 mm
5. What is the EXPECTED thickness of subcutaneous fat for a 70 kg adult male?
Select ONE option only.
 - A. 1 mm
 - B. 3 mm
 - C. 5 mm
 - D. 7 mm
 - E. 1 cm
 - F. None of the above
6. According to Gibney et al (2010), which SINGLE one of the following was used to confirm whether a pen needle deposits insulin into the subcutaneous fat rather than skin or muscle?
Select ONE option only.
 - A. Aspiration cytology
 - B. MRI
 - C. Patient feedback
 - D. Ultrasound
 - E. X-ray
7. Which ONE of the following recommendations is from an internationally validated injection site rotation scheme?
Select ONE option only.
 - A. Anti-clockwise rotation is more effective
 - B. Divide an abdominal injection site into halves
 - C. Injections should be spaced at least 1 cm apart
 - D. One quadrant should be used for one month before changing
 - E. Rotate injections alternately clockwise then anti-clockwise
8. A 63-year-old man has responded to persistent high blood sugar readings by regularly increasing the amount of once-daily insulin he injects. On examination, there is evidence of injection site lipohypertrophy and he is advised to switch to areas of normal tissue.
Which is the SINGLE MOST appropriate advice to NOW give him regarding insulin dosages?
Select ONE option only.
 - A. Adjust the dose according to blood glucose readings
 - B. Increase the dose of insulin and frequency of glucose monitoring
 - C. Maintain the same dose of insulin
 - D. Reduce the dose of insulin and increase the frequency of monitoring
9. Which SINGLE one of the following is NOT a recognised complication of insulin injections regularly being given through clothing?
Select ONE option only.
 - A. Bleeding
 - B. Bruising
 - C. Hypoglycaemia
 - D. Infection
 - E. Needle blunting
10. According to Stanisstreet et al (2010), people with type 1 diabetes experience approximately HOW MANY mild episodes of hypoglycaemia a year?
Select ONE option only.
 - A. 2
 - B. 10
 - C. 50
 - D. 100
 - E. 300