Injection Technique in Adults

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BD

Injection Technique Questionnaire (ITQ)
Australian Results

2014-2015

How can we give proper guidelines until we really know how our patients are injecting?

The Australian Perspective

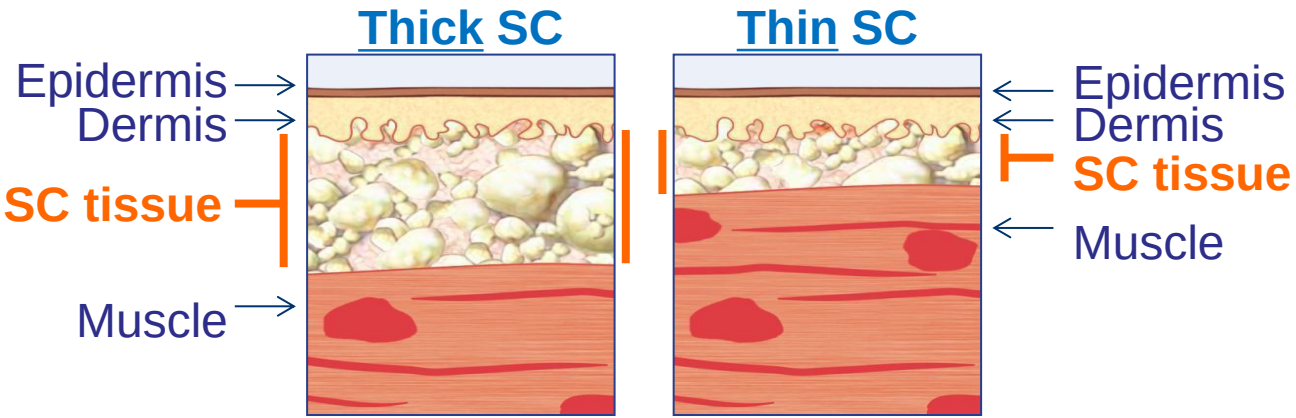
Worldwide Injection Technique Survey (ITQ):

- 95 subjects in Australia from 7 centres[1]
- 0.7% of the worldwide sample[1]
- Inclusion criteria:
  - people with diabetes injecting insulin for a minimum of 6 months.[2]
  - parents and caregivers who give injections were also allowed to participate.

Methodology:

- Self-administered questionnaires completed by patients
- An HCP evaluation during the same visit which includes physical examination, inspection of devices and questionnaire

SC adipose tissue thickness varies[3,4]



- Skin and SC tissue thickness predict insulin depot: ID, SC, IM
- Needle must be long enough to cross skin into SC tissue, but short enough to not enter the muscle.

3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1232-1233.
4. Gibney M, Arce C, Byron K, Hirsch L. *Curr Med Res Opin.* 2010; 26(6): 1519-1530.

What needle length did patients say they used?[1]

Needle Length	% Patient Reported
12.7 mm	**0**
8 mm	**23**
6 mm	**18**
5 mm	**36**
4 mm	**23**
Don’t know	**0**

What needle length did nurses observe?[1]

Needle Length	% Nurse Observed
12.0 mm	**0**
8 mm	**27**
6 mm	**20**
5 mm	**20**
4mm	**28**
Other	**0**

1.ITQ Australian Data. https://public.tableau.com/profile/adam.yeung#!/vizhome/ITQsurveydataMayo/ Accessed April 2017.

Pen needle length[3]

- The 4 mm needle is long enough to transverse the skin and enter the SC tissue. Therefore, it is considered the safest pen needle for adults and children regardless of age, sex, ethnicity, or BMI.
- The 4 mm needle should be inserted perpendicular to the skin (at 90^{o} to the skin surface), not on an angle, regardless of whether a skinfold is used.
- Avoid pushing the needle hub in so deeply in that it indents the skin because this increases the risk of IM injections.
- Patients with tremors or other disorders that make them unable to hold a 4-mm pen needle in place may need longer needles.

3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

Lifting a skin fold[3]

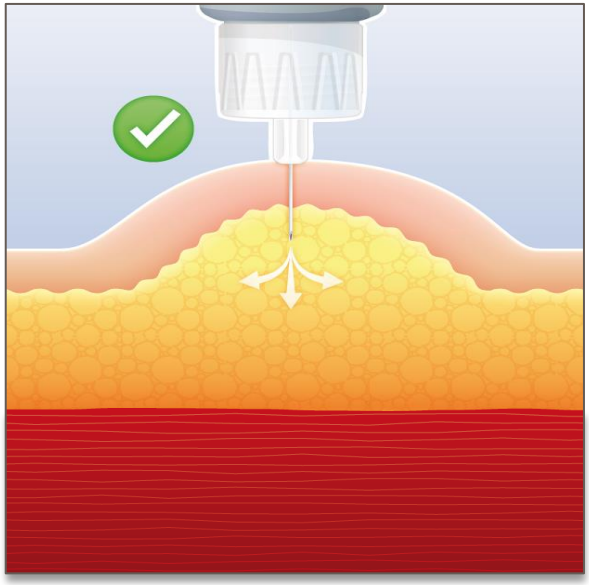
- Lifting a skin fold is required when the distance from skin surface to the muscle is less than or equal to the pen needle length.
- Lifting a skin fold in the abdomen nearly doubles the skin-to-muscle distance. In the thigh it is sometimes difficult to lift a skin fold, and the mean increase in skin-to-muscle distance may be only 20%.
- In thin individuals, thigh skin-folds may actually decrease distance to muscle fascia – the exact opposite of what is desired.

3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

Using a correct skin fold[3]

- Very young children (≤ 6-years old) and very thin adults should use the 4 mm needle **by lifting a skin fold** and inserting the needle perpendicularly into it. Others may inject using the 4 mm needle without lifting a skin fold.

- A correct fold is made by lifting the skin with the thumb and index finger (possibly adding the middle finger). If the skin is lifted using the whole hand, muscle may be lifted as well as SC tissue which can lead to IM injections.

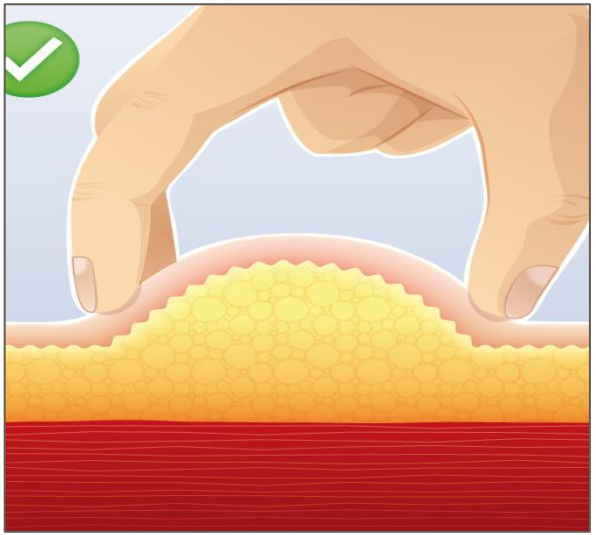


3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

Correct method of lifting a skin fold[3]

The optimal sequence should be:

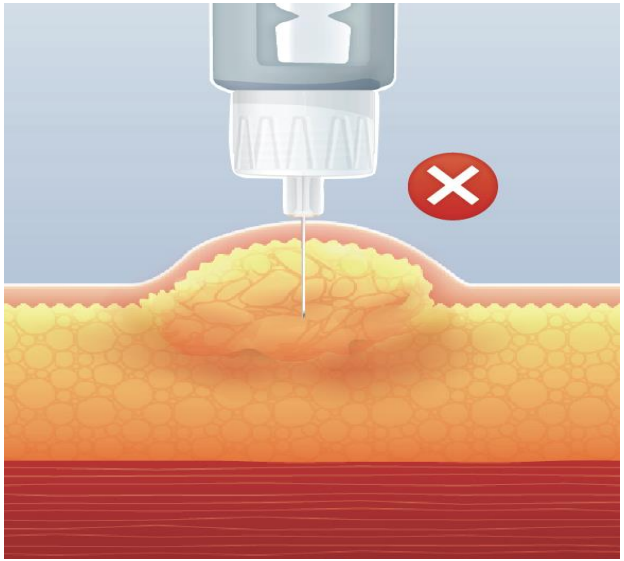
1. Gently lift a skin fold;
2. inject insulin slowly at 90˚ angle to surface of skin fold;
3. leave the needle insitu for a count of 10 after the plunger is fully depressed;
4. withdraw needle from the skin at the same angle it was inserted;
5. release skin fold;
6. dispose of used needle safely.



3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

Tips for injection education[3]

- If the same injection site is used repeatedly it may become lumpy, firm, and enlarged. The insulin will not work correctly if injected into these areas.
- If pain is experienced when injecting large volumes of insulin the dose may need to be divided into 2 injections of a smaller volume or the concentration of insulin may need to be increased.
- Some patients note discomfort when injecting insulins that have a low pH.



3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

Injection technique in adults[3]

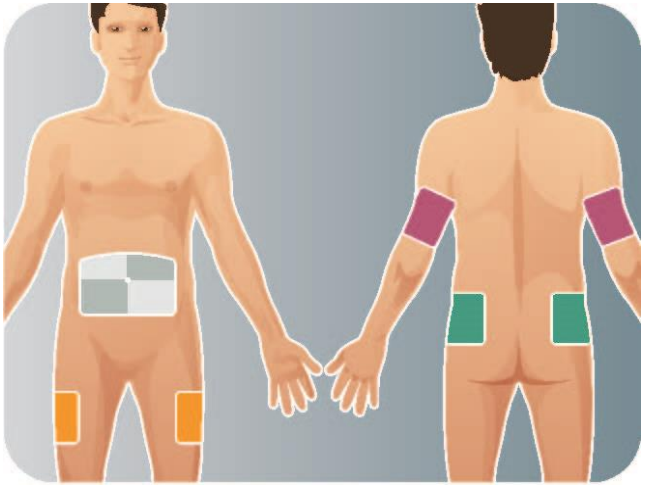
Recommended sites for injection are abdomen, thighs, buttocks and upper arms:

a. Abdomen within the following boundaries: ~1 cm above symphysis pubis, ~1 cm below lowest rib,~ 1 cm away from umbilicus, and laterally at the flanks

b. Upper 3rd anterior lateral aspect both thighs

c. Posterior lateral aspect of both upper buttocks and flanks

d. Middle 3rd posterior aspect of upper arms.



3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

Insulin Analogues & GLP-1 Receptor Agonists[3]

- Rapid-acting insulin analogues may be given at any of the injection sites, as absorption rates have note been shown to be site-specific.
- IM injection of rapid-acting insulin analogues should be avoided if possible.
- Long-acting analogues may also be given at any of the injection sites, with appropriate injection technique. IM injection should be avoided because it can lead to profound hypoglycemia.
- Pending further studies, patients using non-insulin injectable therapies such as GLP-1 receptor agonists should follow the recommendations already established for insulin injections with regards to pen needle length, site selection and site rotation.

3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

Pregnancy[3]

- When foetal ultrasounds are performed, SC fat patterns in the mother may be assessed at the same time and recommendations given to her regarding safe zones for injections.
- The abdomen is a safe site for insulin administration in pregnancy. Given the thinning in abdominal fat from uterine expansion, pregnant women with diabetes (of any type) should use a 4 mm pen needle.

3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

Pregnancy[3]

- ***First trimester***: Women should be reassured that no change in insulin site or technique is needed.
- ***Second trimester***: Insulin can be injected over the entire abdomen as long as properly raised skinfolds are used. Lateral aspects of the abdomen can be used to inject insulin when no skinfold is raised.
- ***Third trimester***: Injections can be given into the lateral abdomen as long as they are made into properly raised skinfolds. Apprehensive patients may use the thigh, upper arm, or buttock instead of the abdomen.

3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

How do patients rotate?[1]

How They Rotate	%
I move back and forth from right side of my body to left	**37**
I move from one injection site to another	**15**
I inject about a finger's breadth (1 cm) from where I previously injected	**7**
My injections describe a circle around my injection sites	**16**
My injections describe lines across my injection sites	**2**

1.ITQ Australian Data. https://public.tableau.com/profile/adam.yeung#!/vizhome/ITQsurveydataMayo/ Accessed April 2017.

Rotation of injection sites[3]

- Injections should be systematically rotated in order to avoid lipohypertrophy. This means injecting at least 1cm (or approximately the width of an adult finger) from previous injections, a vital procedure which requires careful planning and attention.
- Patients should be given an easy-to-follow rotation scheme from the beginning of injection/infusion therapy. The HCP should review the site rotation scheme with the patient at least once a year.
- One evidence-based scheme involves dividing the injection site into quadrants (or halves when using the thighs or buttocks), using one quadrant per week and rotating quadrant to quadrant in a consistent direction (e.g. clockwise).

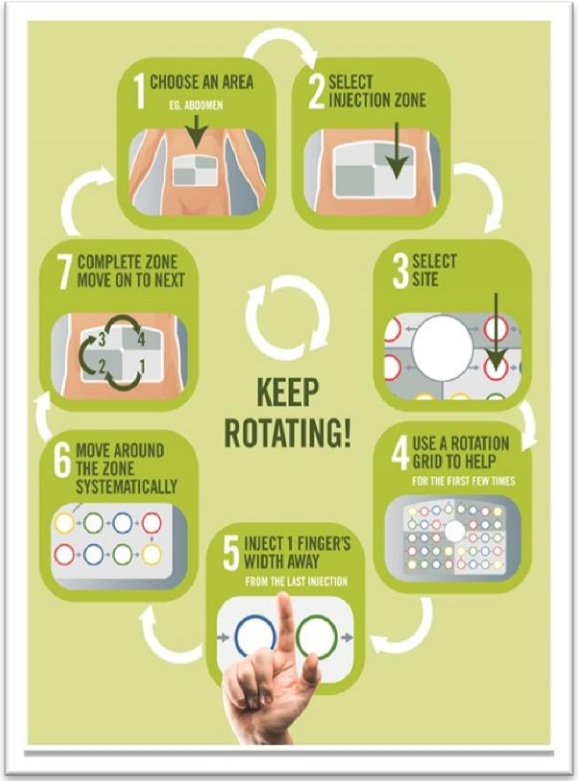
3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

Tips for injection education[3]

The HCP should teach the importance of rotation and create a rotation pattern with the patient when initiating injection therapy.

The message should be:

- ‘Insulin will not be well-absorbed if it is always injected into the same area.
- It is important to move injections at least half an inch (1 cm) away from the previous injection and to use all injection sites on the body (back of the arms, buttocks, thighs and abdomen)’.



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Do patients re-use their pen needle and, if so, how often?[1]

Reuse Needle	N	%
Yes	33	**38**
No	53	**62**

Times	%
2 times	**24**
3 to 5 times	**47**
6 to 10 times	**15**
More than 10 times	**15**

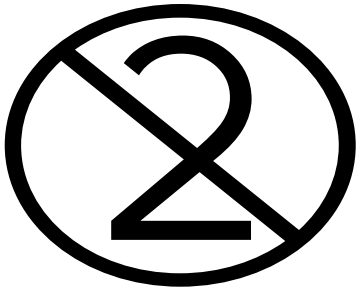
1.ITQ Australian Data. https://public.tableau.com/profile/adam.yeung#!/vizhome/ITQsurveydataMayo/ Accessed April 2017.

Why do they re-use pen needles?[1]

Reasons	%
Because I did not have another pen needle available	**0**
To save money	**3**
To prevent excess waste (environmental concern)	**13**
For convenience	**65**

1.ITQ Australian Data. https://public.tableau.com/profile/adam.yeung#!/vizhome/ITQsurveydataMayo/ Accessed April 2017.

Needle re-use[3]



- There is an association between needle re-use and the presence of lipohypertrophy, although a causal relationship has not been proven. Patients should be made aware of this association.
- Re-using insulin needles is not an optimal injection practice and patients should be discouraged from doing so. Elsewhere in the recommendations, it is stated pen needles (and syringe needles) should only be used once. They are no longer sterile after use.
- However, patients who re-use needles should not be subjected to alarming claims of excessive morbidity from this practice.

3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

Lipohypertrophy (LH)

- Lipohypertrophy is a thickened 'rubbery' swelling of tissue that is sometimes soft, sometimes firm. Various local injection-related factors appear to be at play such as the insulin itself with its strong growth-promoting properties, repeated trauma to the same site when patients fail to rotate injections and the repeated use of the same needle.[5]

- Three independent risk factors found by the international survey reviewing 13,289 patients from 42 countries injecting insulin with respect to the frequency of lipohypertrophy*:[6]

    1. Longer duration of insulin use *(p<0.001)*
    2. Incorrect rotation of injection sites *(p<0.001)*
    3. Re-using needles *(p=0.02)*

* BD sponsored Worldwide injection technique questionnaire study, 2015.[3,7]

5. Blanco M, Hernandez M, Strauss K, Amaya M *et al. Diabetes Metab.* 2013; 39(5): 445-53. 6 Frid AH, Hirsch LJ, Menchior AR *et al. Mayo Clin Proc.* September 2016:91(9):1224-1230.

What lipohypertrophy frequency did nurses find on exam by site?[1]

Site	Exam Type	% Lipos Found
ABDOMEN	Visual	**31**
	Palpation	**35**
THIGH	Visual	**15**
	Palpation	**16**
BUTTOCKS	Visual	**4**
	Palpation	**5**
ARM	Visual	**18**
	Palpation	**14**

Overall, the nurse found lipohypertrophy in 40% of patients

1.ITQ Australian Data. https://public.tableau.com/profile/adam.yeung#!/vizhome/ITQsurveydataMayo/ Accessed April 2017.

Recommendations for the management of ipohypertrophy[3]

- Optimised to 4 mm pen needles/6 mm insulin syringes or the shortest needle length available to minimise accidental IM risk due to using larger zones.
- Optimised to advanced needle geometry including thin-walled and extra-thin-walled needles (if available) to minimise pain and discomfort and to maximise ease of dosing when injecting into healthy tissue.
- Employ the correct principles of injection site rotation.
- Patients should be encouraged by education and guidance not to inject into areas of lipohypertrophy until the next exam by a HCP. Using larger injection zones and non-re-use of needles should be recommended.
- Switching injections from lipohypertrophy to normal tissue often requires a decrease in the dose of insulin injected. The amount of change varies from one individual to another and should be guided by frequent blood glucose measurements. Reductions often exceed 20% of their original dose.

3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

Other considerations – Human Insulins[3]

- The abdomen is the preferred site for soluble human insulin (regular), since absorption of this insulin is fastest there.
- The regular/NPH mix should be given in the abdomen to increase the speed of absorption of the short-acting insulin in order to cover post-prandial glycaemic excursions.

3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

Other considerations – Human Insulins[3]

- It is preferable that NPH (when given alone) be injected at bedtime rather than earlier in the evening in order to reduce the risk of nocturnal hypoglycaemia.
- If there is risk of nocturnal hypoglycaemia, NPH and NPH-containing mixes given in the evening should be injected into the thigh or buttock as these sites have slower absorption of NPH.

3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

Other considerations – Bleeding & bruising[3]

- Patients should be reassured that local bleeding and bruising do not adversely affect clinical outcomes or the absorption of insulin.
- If bleeding and bruising are frequent or excessive, the injection technique should be carefully assessed as well as the presence of a coagulopathy or the use of anticoagulant or antiplatelet agents.

3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

Other considerations – Leakage of insulin[3]

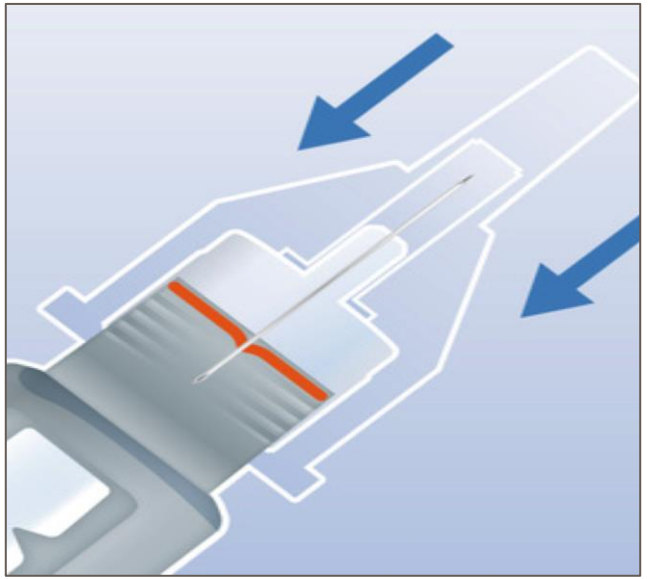
There are 3 types of leakage:

1. Leaking from the pen due to a poor seal between the needle and the cartridge of the pen.
2. Dripping from the needle occurring when the plunger is not held down correctly or the needle is removed from the skin too soon.
3. Reflux or backflow out of the injection site when the needle removed too soon or possibly due to other reasons such as obesity.

3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

Leakage at cartridge and pen needle connection[3]

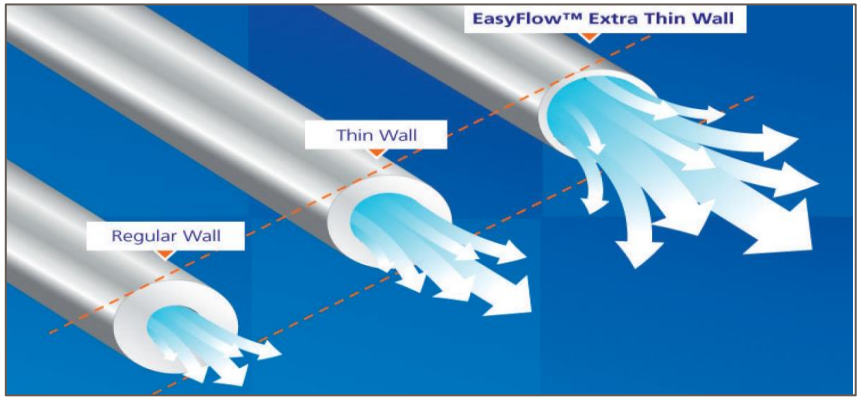
- Ensure that the pen needle is ISO-certified compatible with the insulin pen.
- Position the pen needle along the axis of the pen before screwing or snapping it on.
- Pierce straight through the septum of the cartridge.



3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

Other considerations – Dripping from the needle[3]

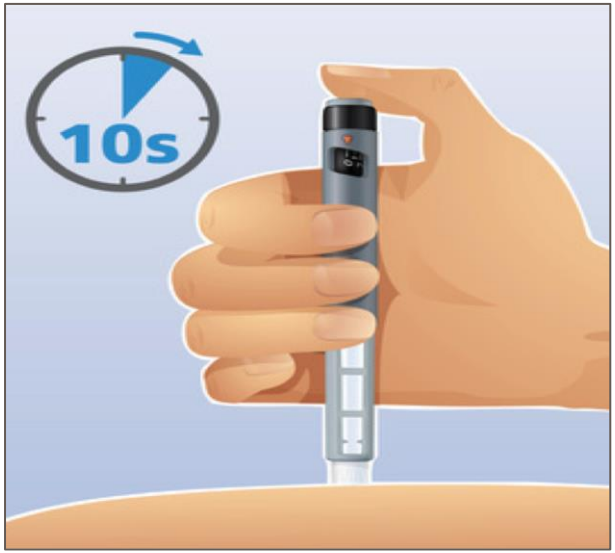
- Use needles that have a wider inner diameter and improved insulin flow (e.g. extra-thin-walled needles).
- Larger doses may be split to reduce the volume of insulin.



3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

Other considerations – Dripping from the needle[3]

- Count to 10 after the plunger is fully depressed before removing the needle from the skin to allow time for expulsive forces to be transmitted through all the pen parts to the insulin column in the cartridge.
- By trial and error, patients may learn how long they need to hold the button down and the needle under the skin to avoid dripping from the needle tip or backflow out of the skin. This may be less than 10 seconds.



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Other considerations – Reducing fear, pain & anxiety[3]

- Keep insulin at room temperature for a more comfortable injection. Injection insulin while it is still cold often produces more pain.
- If bleeding or bruising occurs, reassure the patient that these do not affect the absorption of insulin or overall diabetes control.
- If bruising continues or haematomas develop, observe the injection technique and suggest improvements (e.g. better rotation of injection sites).

3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

Other considerations – Reducing fear, pain & anxiety[3]

- Insulin pens with very short needles may be more acceptable to patients than the syringe and vial. This should be discussed with the patient and family when teaching injection therapy.
- The 4 mm pen needle is reported by patients to be less painful than longer needles.
- Patients who occasionally experience sharp pain on injection should be reassured that the needle may have touched a nerve ending, which happens randomly and will not cause any damage. If pain persists the HCP should see the patient and evaluate the injection technique.

3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

The role of the healthcare professional[3]

- Despite more than 90 years of use, insulin injections and infusions are often performed incorrectly with adverse clinical consequences for patients and additional costs for payers.
- Often even simple rules are not taught or followed.
- Correct technique is essential to achieve optimal diabetes control, reduce variability and achieve desired outcomes.
- Often the most important determinant of patients' injection technique is the knowledge and commitment of their HCP.
- Several essential topics should form the basis of therapeutic education provided by the HCP.

3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.

Reference List:

1. ITQ Australian Data. https://public.tableau.com/profile/adam.yeung#!/vizhome/ITQsurveydataMayo/ Accessed April 2017.
2. Frid AH, Hirsch LJ, Menchior AR *et al. Mayo Clin Proc.* September 2016:91(9):1212-1223. Australian ITQ Findings data on file.
3. Frid AH, Kreugel G, Grassi G *et al. Mayo Clin Proc.* September 2016:91(9):1231-1255.
4. Gibney M, Arce C, Byron K, *et al*. *Curr Med Res Opin.* 2010; 26(6): 1519-1530.
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7. Frid AH, Hirsch LJ, Menchior AR *et al. Mayo Clin Proc.* September 2016:91(9):1212-1223.

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