FIT Forum for Injection Technique Canada

Recommendations for Best Practice in Injection Technique
2nd Edition
Objectives

• Identify the injection techniques currently being used by people with diabetes in Canada.

• Raise awareness of the impact that existing and emerging research regarding injection technique may have on health outcomes.

• Facilitate opportunities in which best practice can be discussed, developed, implemented and evaluated across Canada.

Introduction

The recommendations within this document aim to raise awareness of existing and emerging research regarding injection technique. Implementation of these recommendations may have a direct impact on the health outcomes of people with diabetes who are using subcutaneous injection therapies.

Following the precedent set by the United Kingdom FIT initiative,1 as well as other international injection technique initiatives,2,3 the recommendations presented in this document are designed to promote best practice in injection technique for healthcare professionals who are involved in diabetes care, and their patients.1,3

A meeting of Canadian diabetes education experts was convened to identify unmet educational needs regarding injection technique. The top 3 educational priorities identified were as follows:

1. Techniques to avoid intramuscular injection
2. Steps to ensure healthy injection sites
3. Provision of clear and concise direction to healthcare professionals regarding proper injection technique

Utilizing these priorities as a framework, this best practice document was developed by the Canadian FIT Board and has been reviewed by an expert committee of diabetes educators. Where evidence was unavailable, expert opinion guided the recommendation.

The evidence is compelling to continue to assess injection technique, examine patients for the presence of lipohypertrophy, and provide patient/healthcare professional education to ensure the prevention and management of lipohypertrophy.

The development of FIT and the subsequent Canadian recommendations for injection technique are supported by BD Canada and endorsed by Canadian pharmaceutical companies that manufacture insulin and glucagon-like peptide-1 (GLP-1) receptor agonists.

The Canadian FIT Board 2nd Edition:

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- Raise awareness of the impact that existing and emerging research regarding injection technique may have on health outcomes.
- Facilitate opportunities in which best practice can be discussed, developed, implemented, and evaluated across Canada.

Introduction

The results of an international survey led to an increased awareness among healthcare professionals of the issues associated with improper injection technique. The Canadian Forum for Injection Technique (FIT) initiative was developed in response to these concerns.

Following the precedent set by the United Kingdom FIT initiative, as well as other international injection technique initiatives, the recommendations presented in this document are designed to promote best practice in injection technique for healthcare professionals who are involved in diabetes care, and their patients.

A meeting of Canadian diabetes education experts was convened to identify unmet educational needs regarding injection technique. The top 3 educational priorities identified were as follows:

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Utilizing these priorities as a framework, this best practice document was developed by the Canadian FIT Board and has been reviewed by an expert committee of diabetes educators. Where evidence was unavailable, expert opinion guided the recommendation.

The recommendations within this document aim to raise awareness of existing and emerging research regarding injection technique. Implementation of these recommendations may have a direct impact on the health outcomes of people with diabetes who are using subcutaneous injection therapies. This document will be distributed to all Canadian healthcare professionals who are involved in injection therapy for people with diabetes.

Since the initial FIT recommendations were published in October 2011, a Canadian injection practice survey was conducted. Analysis of this data, new evidence regarding injection technique and – most importantly – new learnings regarding best practice, resulted in a revision to the document. Research regarding injection technique and the role of lipohypertrophy in glycemic variability has been increasing steadily since the launch of the international survey in 2009. Most recently, 2 trials have examined enhanced glycemic control through improved injection technique and cost analysis of improved injection technique.

Of note, in both of these studies the rate of lipohypertrophy was significant. Grassi and colleagues noted the incidence of lipohypertrophy as follows: females, 48.1%; males, 51.9%. Blanco and colleagues observed a lipohypertrophy incidence of 64.4% in total participants.

The evidence is compelling to continue to assess injection technique, examine patients for the presence of lipohypertrophy, and provide patient/healthcare professional education to ensure the prevention and management of lipohypertrophy.

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Endorsements

**AstraZeneca**  As a company heavily committed to diabetes for the long term and with a large and diverse portfolio of medicines, AstraZeneca Canada endorses the FIT recommendations. Further educating healthcare professionals on better injection techniques is needed and will definitely benefit all those patients living with diabetes who require injectable medicines.

Neil Maresky MD, Vice-President, Scientific Affairs, AstraZeneca Canada

**BD**  BD is proud to be a supporter of FIT worldwide. Through our ongoing research and collaboration with healthcare professionals, we strive to elevate the importance of injection technique practices for people living with diabetes who take injections, so that they can achieve the best possible diabetes outcomes. FIT Canada has done an outstanding job leveraging this new research to deliver a timely, comprehensive set of recommendations for best practice in injection technique.

Larry Hirsch MD, Worldwide Vice President, Medical Affairs, BD Medical - Diabetes Care

**Eli Lilly**  Utilizing the correct technique to administer injectable therapies for diabetes is critically important to help ensure patients benefit fully from their treatment. Eli Lilly Canada is dedicated to improving care for people with diabetes and welcomes this update to the FIT recommendations, as a means to improve both healthcare professional and patient understanding of good injection technique. The comprehensive, evidence-based guidelines provided through FIT will play an important role in supporting improved diabetes care in Canada.

Joanne Lorraine MD FRCP MED, Medical Director, Diabetes Care, Eli Lilly Canada

**Sanofi Canada**  Sanofi Canada is committed to improving diabetes management through our integrated offering of treatments, medical devices and services. We are proud to support the FIT Canada recommendations, whose goal is to promote best practice in diabetes injection technique. Proper injection technique is key to ensuring that patients receive the full benefit of injectable therapies. At Sanofi Canada, our focus is to simplify the management of a complex disease for people with diabetes and their healthcare providers. We are working hard, in partnership with everyone committed to diabetes care, to develop innovative solutions to help people with diabetes live as people, not as patients.

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Franca Mancino MSc, Vice-President, Medical and Regulatory Affairs, Sanofi Canada

**Novo Nordisk**

“The burden of managing diabetes can be overwhelming for patients, families and healthcare providers. The FIT recommendations are a valuable way to support best practice sharing and ensure appropriate injection technique, which Novo Nordisk proudly endorses. Novo Nordisk is committed to supporting healthcare professionals to deliver the highest quality of care possible as their patients navigate the complexities of diabetes care. This includes the appropriate use of innovative devices, needles and therapeutics, as outlined in the FIT guidelines.

Hossam Ali Saad MD, Associate Director, Medical Affairs, Novo Nordisk Canada
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### 1.0 Preparing for Injection

#### 1.1 Psychological challenges of injections: Adults

1. The healthcare professional should inform all people with type 2 diabetes early after diagnosis that they will likely require injectable therapy in the future to treat their diabetes. It is important to explain the natural progression of diabetes and that initiation of injection therapy at any point during the course of the disease should not be seen as personal failure.

2. Few adults have true needle phobia (i.e. a fear of needles); however, many experience anxiety regarding injecting, particularly when embarking on an injectable therapy regimen. The healthcare professional should explore a patient’s anxieties regarding the injection process and address any concerns or barriers to treatment, with the goal of working together to improve treatment adherence and quality of life.

3. Both the short- and long-term advantages of achieving and maintaining target blood glucose levels should be emphasized to people with diabetes. Furthermore, it is important that healthcare professionals explain that finding the right combination of therapies – which may include injectable therapy – to achieve optimal glycemic targets is a primary treatment goal.

#### 1.2 Injection site care

1. Injections should be administered in a clean site on the body, using clean hands.

2. If necessary, people should clean their hands and the injection site with soap and water (Figure 1).

3. Disinfection of the injection site is generally not required; however, alcohol swabs may be mandated for use prior to injections administered in a hospital or long-term care setting, or wherever nosocomial infection are more prevalent. If alcohol is used to clean the site, the skin must dry completely before the injection is administered. Cleaning the medication cartridge or vial with an alcohol swab is required (Figure 2).
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7.0 Injectable Therapy – GLP-1 Receptor Agonists 24
2.1 Use of syringes

1. Proper syringe selection is crucial. The decision regarding which syringe is appropriate should be based on the amount of insulin to be administered (volume: U-30, U-50 or U-100 syringes) and length of needle. The use of a 6-mm needle is recommended with or without a skin lift, depending on assessment of the site and amount of subcutaneous tissue. Ensure a skin lift with an 8-mm needle. The use of 12-mm or 12.7-mm needles is not recommended, due to an increased risk of intramuscular injection.

2. When preparing to draw up the insulin, the air equivalent to the dose should be drawn up first and injected into the vial, to facilitate easier withdrawal.

3. If air bubbles are seen in the syringe, hold it with the needle pointed upwards, tap the barrel to bring them to the top, and then remove the bubbles by pushing the plunger to expel the air (Figure 3).

4. When using an 8-mm needle, injections should be administered into a skin lift at a 90-degree angle (Figure 4). To prevent intramuscular injection, lean individuals may need to inject into a skin lift at a 45-degree angle (Figure 5). This method may also be required with a 6-mm needle in particularly lean individuals.

5. When administering injections, the following steps should be taken if a skin lift is required:
   a) Insert the needle completely into the skin lift.
   b) Depress the plunger and hold for 5 seconds, while maintaining the lift.
   c) Remove the syringe quickly, at the same angle that it was inserted.
   d) Release the skin lift.

6. Syringes should be used only once.

2.2: Use of pen devices

When teaching patients proper pen use, healthcare professionals should consult the instruction manual for the specific device being used. Obstruction of insulin flow in a pen is rare, but could lead to serious consequences. Understanding how to monitor movement of the rubber plunger within the pen is an important learning to ensure adequate insulin delivery.

1. Insulin pen devices should be primed with the needle pointing upwards; a flow of insulin should be observed at the needle tip before each injection. Once flow is verified, the desired dose should be dialed and the injection administered.

2. Pen devices and cartridges are for single-person use only and should never be shared, due to the risk of cross-contamination.

3. Pen needles should be used only once. Using a new needle each time may reduce the risk of needle breakage in the skin, clogging of the needle, complications (e.g. lipohypertrophy, abscess) and inaccurate dosing.

4. After pushing the thumb button in completely, the individual should count to 10 slowly (approximately 10 seconds) before withdrawing the full dose and prevent medication leakage (Figure 6). Counting past 10 may be necessary for higher doses.

5. Pen devices with a dose window should be checked after each injection; the number 0 should be displayed when the desired dose has been injected. If a number other than 0 is showing, then the correct insulin dose has not been administered. In this event, replace the cartridge, prime the needle and administer the remainder of the dose.

6. Needles should be safely disposed of immediately after use and should not remain attached to the pen. This prevents the entry of air or other contaminants into the cartridge, or leakage of medication from the cartridge, which can affect subsequent dose accuracy.

7. Non-disposable pen devices should not be stored in the refrigerator, as they contain parts (e.g. rubber) whose consistency is compromised by cold temperatures, which in turn affects pen functioning.

8. Patients should keep a spare syringe or a second pen at hand in case of breakage or malfunction.
2.1 Use of syringes

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3. If air bubbles are seen in the syringe, hold it with the needle pointed upwards, tap the barrel to bring them to the top, and then remove the bubbles by pushing the plunger to expel the air (Figure 3).

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When teaching patients proper pen use, healthcare professionals should consult the instruction manual for the specific device being used. Obstruction of insulin flow in a pen is rare, but could lead to serious consequences. Understanding how to monitor movement of the rubber plunger within the pen is an important learning to ensure adequate insulin delivery.

1. Insulin pen devices should be primed with the needle pointing upwards; a flow of insulin should be observed at the needle tip before each injection. Once flow is verified, the desired dose should be dialed and the injection administered.1,29

2. Pen devices and cartridges are for single-person use only and should never beshared, due to the risk of cross-contamination.27,30

3. Pen needles should be used only once. Using a new needle each time may reduce the risk of needle breakage in the skin, clogging of the needle, complications (e.g. lipohypertrophy, abscess) and inaccurate dosing.26,28,32,33

4. After pushing the thumb button in completely, the individual should count to 10 slowly (approximately 10 seconds) before withdrawing the full dose and prevent medication leakage (Figure 6). Counting past 10 may be necessary for higher doses.24,34,35

5. Pen devices with a dose window should be checked after each injection; the number 0 should be displayed when the desired dose has been injected. If a number other than 0 is showing, then the correct insulin dose has not been administered. In this event, replace the cartridge, prime the needle and administer the remainder of the dose.

6. Needles should be safely disposed of immediately after use and should not remain attached to the pen. This prevents the entry of air or other contaminants into the cartridge, or leakage of medication from the cartridge, which can affect subsequent dose accuracy.26,35

7. Non-disposable pen devices should not be stored in the refrigerator, as they contain parts (e.g. rubber) whose consistency is compromised by cold temperatures, which in turn affects pen functioning.

8. Patients should keep a spare syringe or a second pen at hand in case of breakage or malfunction.
The Correct Use of Devices

2.3: Use of pen needles

1. Choose the right needle:
   a) A shorter needle should be used at the initiation of insulin therapy.23
   b) The needle gauge should be 30G, 31G or 32G (higher gauge = smaller needle diameter).
   c) 4-mm, 5-mm and 6-mm needles are suitable for all people with diabetes, regardless of body mass index (BMI). An 8-mm needle may be preferred by some patients.
   d) Current research across a wide range of BMIs (19–65 kg/m²) supports the use of 4-mm pen needles to avoid the risk of intramuscular injection.19

2. Injections with shorter needle lengths (i.e. 4 mm, 5 mm, 6 mm) should be administered in adults at a 90-degree angle to the skin surface.20
   a) A skin lift may be warranted to prevent an intramuscular injection in a slim limb or abdomen, even when a shorter needle is used.21

2.4: Injections should be administered into subcutaneous tissue

1. To ensure proper injection technique (Figure 8), individuals should consult with a healthcare professional who is trained in appropriate injection techniques.6

2. When the needle is removed, check skin appearance for the following:
   a) If the injection is administered correctly, the tissue beneath the skin (subcutaneous) appears normal.19

3. Injection at a 45-degree angle with a 6-mm needle may be required in extremely lean adults, if no skin lift is used.

4. When using 8-mm needles, injections should be administered into a skin lift at a 90-degree angle. Lean individuals should administer injections into a skin lift at a 45-degree angle to prevent possible intramuscular injection.20

5. The use of 12-mm or 12.7-mm needles is not recommended.20

2.5: Tips for making injections more comfortable

1. Inspect and palpate the injection site prior to each injection. Any area showing signs of lipodystrophy, inflammation, edema or infection should be avoided.21

2. Avoid injecting into hair roots, scars, moles, stretch marks or other skin abnormalities.

3. Keep injectable therapies currently in use at room temperature.21

4. Use needles of shorter length and smaller diameter.39

5. Use a new needle for each injection.32

6. Insert the needle through the skin using a quick, smooth movement.44

7. Inject medication slowly and evenly. Ensure that the plunger (syringe) or thumb button (pen) has been depressed fully.44

8. If using alcohol swabs, inject only when the alcohol has fully dried.

9. Avoid injection through clothing, particularly in individuals who are using shorter needles, as there is an increased risk of intradermal injection and sites cannot be inspected.45

10. In some cases, the insulin dose should be distributed between 2 injection sites, as discomfort at the injection site decreases when the volume injected is <50 units.46

11. If needed, apply ice or analgesic cream to the site before injection.

12. If needed, use such devices as NeedleAid®, Injex-Ease®, Insuflon® and i-port®.

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12. If needed, use such devices as NeedleAid®, Inject-Ease®, Insuflon®, and i-port®.
Disposal of Injecting Materials

1. All healthcare professionals, individuals with diabetes and caregivers should be aware of local regulations regarding sharps disposal, and the consequences of inappropriate disposal (e.g. needle stick injuries to refuse workers).47-48
2. Proper disposal technique should be demonstrated upon initiation of injection therapy and reinforced at subsequent visits (Figure 9).
3. Where available, a needle-clipping device can be used.
4. Needles should never be re-sheathed.49

Injectable Therapy – Insulin

4.1 Temperature of the insulin
1. The temperature of insulin does not affect its pharmacokinetics or absorption, provided that it is stored at room or refrigeration temperature.43,50
2. Insulin administered at room temperature may reduce irritation, burning or painful injections, and facilitates the re-suspension of cloudy insulin.3,4,5,51

4.2 Insulin storage
1. Unopened insulin vials and cartridges should be stored at refrigeration temperature (2 to 8 degrees C). Once in use, insulin may be stored at room temperature.
2. Insulin should never be frozen or exposed to extreme heat (>30 degrees C) for prolonged periods, as this will affect its potency and alter its action. Keep the caps on insulin pens to protect the insulin from the light. Do not store insulin in direct sunlight.
3. As per product monographs, once insulin is opened it should not be used for more than 28 days, with the exception of insulin detemir, which may be used for up to 42 days.
4. Insulin should never be used past its product expiry date.

Site-related Factors That May Affect Insulin Absorption

5.0 Intramuscular injection
1. Intramuscular injection of all human insulin, as well as rapid- and long-acting analogues, should be avoided due to the risks of erratic blood glucose control and severe hypoglycemia.55-57

6.0 Ensuring Proper Preparation and Administration of Insulin

6.1 Re-suspension of cloudy insulin
1. When using cloudy insulin (i.e. NPH and premixed insulin) the vial, cartridge or pen device should first be gently rolled 10 times, then tipped (not shaken) 10 times; finally, it should be inspected to ensure the suspension has a consistently milky white appearance (Figure 10).65,66

6.2 Factors affecting volume of injection
1. Larger doses of insulin are associated with more leakage and potentially more discomfort.46,67,68
2. The largest the dose, the more delayed the action of NPH and short-acting (regular) human insulins. Evidence related to these human insulin formulations suggests a longer, flatter insulin action profile with doses >50 units, which may compromise glycemic control. When injecting >50 units of short-acting (regular) or intermediate-acting (NPH) insulin per dose, it may be more desirable to split the dose into 2 separate injections.50,67,69-71
3. The time-action profile of insulin analogues does not appear to be affected by the volume of injection. The decision to use 2 injection sites may be a function of the device (i.e. a maximum single dose of 80 units) or discomfort with injection volume, rather than a requirement to achieve a better pharmacokinetic profile.
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5.1 Intramuscular injection
1. Intramuscular injection of all human insulin, as well as rapid- and long-acting analogues, should be avoided due to the risks of erratic blood glucose control and severe hypoglycemia.55-57

5.2 Injection sites
1. Insulin is absorbed fastest from the abdomen.58-64
2. The upper arm and the lateral side of the thigh, not proximal to the knee, have moderate absorption rates.58-61,64
3. The slowest absorption of insulin occurs when it is injected in the buttock; thus, this may be the preferred injection site if slow absorption is desired.64
4. Avoid damaged skin (e.g. from surgical scars, or lipohypertrophy as described in Section 9.0) when injecting insulin and GLP-1 receptor agonists.50

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1. When using cloudy insulin (i.e. NPH and premixed insulin) the vial, cartridge or pen device should first be gently rolled 10 times, then tipped (not shaken) 10 times; finally, it should be inspected to ensure the suspension has a consistently milky white appearance (Figure 10).65,66

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Figure 9. All needles should be disposed of in an approved sharps container after use

Figure 10. Method of mixing cloudy insulin: roll 10 times, tip 10 times, then perform a visual check for milky white appearance
4. To date, there have been no clinical trials conducted to determine at which dose insulin detemir (Levemir®) should physically be split into two different volumes. However, since the insulin delivery device delivers a maximum dose of 80 units at one time, doses >80 units will require multiple, separate injections to administer a full dose. Insulin therapy should be individualized and in accordance with the needs of the individual patient; any changes made to the dose or regimen should be done under medical supervision, and close monitoring is recommended.72 (This information was provided by Novo Nordisk Canada.)

5. Clinical trials have shown that insulin glargine (Lantus®) provides a constant concentration/time profile over 24 hours, with no pronounced peak, and achieves glycemic control over 24 hours with a once-daily administration. Splitting of insulin glargine (in more than one injection) would be a function of exceeding maximum dose delivery of a device or an individualized treatment strategy for a particular patient under medical supervision.73 (This information was provided by Sanofi Global.)

6.3: Other factors affecting absorption

1. Massaging the injection site immediately before or after an injection is not recommended, as it increases the absorption rate of insulin and results in an unpredictable time-action profile.50,74

2. Injecting into an area that has an increased skin temperature (e.g. after a sauna or hot bath) can increase the absorption rate of insulin.69,75

3. Accidental intramuscular injection into an arm, leg, or buttck prior to or during exercise may increase insulin absorption, and result in a faster action and speedier decrease in blood glucose levels.51,76

Injectable Therapy – GLP-1 Receptor Agonists

The injection technique for GLP-1 receptor agonists is similar to insulin; however, there are a few practical differences. While lipohypertrophy is largely associated with insulin therapy, incorrect site rotation and using insulin needles more than once, insulin as a growth factor, contributes significantly to the development of lipohypertrophy. It is therefore not surprising that current evidence indicates that GLP-1 receptor agonist injections do not lead to lipohypertrophy. The results of ongoing trials will provide further information.

While no studies have been published regarding the effect of injecting a GLP-1 receptor agonist into an area of lipohypertrophy, it may be hypothesized that, similar to insulin, erratic absorption of GLP-1 receptor agonists may occur. Considering the time-action profile of current GLP-1 receptor agonists (i.e. exenatide [Byetta®] and liraglutide [Victoza®]), the clinical implications of these absorption distortions would have less impact than with insulin. Still, patients should be advised to avoid injecting GLP-1 receptor agonists into lipohypertrophic areas.

3. After initial use of the reusable GLP-1 pen, the product can be stored for 30 days at room temperature (no higher than 30 degrees C) or in a refrigerator (between 2 and 8 degrees C).

7.2: Practical tips

1. GLP-1 receptor agonists are absorbed equally from each of the usual injection sites (i.e. abdomen, arm and thigh).77,78,80

2. Priming with each injection is not required for GLP-1 receptor agonists. Due to the design of the pen device, priming of a GLP-1 pen is required only once, prior to administration of the first dose.77,78

7.1 Storage of GLP-1 receptor agonist

1. GLP-1 receptor agonists should be stored in a refrigerator, at a temperature between 2 and 8 degrees C. They should not be stored directly adjacent to a refrigerator cooling element or in a freezer.

2. GLP-1 receptor agonists should not be frozen; if freezing occurs accidentally, the medication should be discarded.
4. To date, there have been no clinical trials conducted to determine at which dose insulin detemir (Levemir®) should physically be split into two different volumes. However, since the insulin delivery device delivers a maximum dose of 80 units at one time, doses >80 units will require multiple, separate injections to administer a full dose. Insulin therapy should be individualized and in accordance with the needs of the individual patient; any changes made to the dose or regimen should be done under medical supervision, and close monitoring is recommended. (This information was provided by Novo Nordisk Canada.)

5. Clinical trials have shown that insulin glargine (Lantus®) provides a constant concentration/time profile over 24 hours, with no pronounced peak, and achieves glycemic control over 24 hours with a once-diaily administration. Splitting of insulin glargine (in more than one injection) would be a function of exceeding maximum dose delivery of a device or an individualized treatment strategy for a particular patient under medical supervision. (This information was provided by Sanofi Global.)

6.3: Other factors affecting absorption
1. Massaging the injection site immediately before or after an injection is not recommended, as it increases the absorption rate of insulin and results in an unpredictable time-action profile.50,74
2. Injecting into an area that has an increased skin temperature (e.g. after a sauna or hot bath) can increase the absorption rate of insulin.69,75
3. Accidental intramuscular injection into an arm, leg, or buttock prior to or during exercise may increase insulin absorption, and result in a faster action and speedier decrease in blood glucose levels.51,76

7.0 Injectable Therapy – GLP-1 Receptor Agonists

The injection technique for GLP-1 receptor agonists is similar to insulin; however, there are a few practical differences. While lipohypertrophy is largely associated with insulin therapy, incorrect site rotation and using insulin needles more than once, insulin as a growth factor, contributes significantly to the development of lipohypertrophy. It is therefore not surprising that current evidence indicates that GLP-1 receptor agonist injections do not lead to lipohypertrophy. The results of ongoing trials will provide further information.

While no studies have been published regarding the effect of injecting a GLP-1 receptor agonist into an area of lipohypertrophy, it may be hypothesized that, similar to insulin, erratic absorption of GLP-1 receptor agonists may occur. Considering the time-action profile of current GLP-1 receptor agonists (i.e. exenatide® [Byetta®] and liraglutide® [Victoza®]), the clinical implications of these absorption distortions would have less impact than with insulin. Still, patients should be advised to avoid injecting GLP-1 receptor agonists into lipohypertrophic areas.

7.1 Storage of GLP-1 receptor agonist
1. GLP-1 receptor agonists should be stored in a refrigerator, at a temperature between 2 and 8 degrees C. They should not be stored directly adjacent to a refrigerator cooling element or in a freezer.
2. Priming with each injection is not required for GLP-1 receptor agonists. Due to the design of the pen device, priming of a GLP-1 pen is required only once, prior to administration of the first dose.210
3. The incidence of injection site reactions with GLP-1 receptor agonists is very low (approximately 2.0% to 3.0%) and include pruritus, erythema, bruising and pain. Discontinuation rates due to injection site reactions are even lower (0.2%).79
4. Injection site nodules with liraglutide occurred at a rate of 2%. Discontinuation rates were low (0.4%).77-79
5. After initial use of the reusable GLP-1 pen, the product can be stored for 30 days at room temperature (no higher than 30 degrees C) or in a refrigerator (between 2 and 8 degrees C).
9.0 Lipohypertrophy

9.1 Identification of lipohypertrophy
Lipohypertrophy is the most common lipodystrophy found at injection sites. Lipohypertrophic areas may be visible or palpable, and are identified as thickened or rubbery lesions that may feel hard when palpated with the fingertips (Figure 12). Lipohypertrophic areas can develop under the skin where the same injection or infusion sites are used repeatedly. The lesions vary in size; some are visually apparent, while others require palpation for detection. Lipohypertrophic areas can also be identified by pinching the skin: while healthy skin can be pinched together tightly, lipohypertrophic areas cannot (Figure 13).

9.2: Effects of lipohypertrophy
Although the exact cause has not been substantiated, factors known to be associated with increased areas of lipohypertrophy are: the use of non-purified insulins (prior to the introduction of human insulin and insulin analogues); repeated injections or infusions into a small area (i.e. smaller than the size of a postage stamp); reuse of needles; and failure to inspect injection or infusion sites on a regular basis. It is important to understand that insulin is a growth factor, and therefore plays a role in the development of lipohypertrophy, unlike other injectable agents such as heparin or GLP-1 receptor agonists.

The resulting effects of injecting or infusing medication into a lipohypertrophic site have been documented as a decrease in the rate of insulin absorption – as well as a variable rate of absorption – thereby resulting in variable glycemic response and the development of disfiguring anatomical lesions.

It has been reported that some patients repeatedly choose lipohypertrophic sites for injections or infusions, as these areas have limited nerve innervation and thereby render injections to be relatively painless.

A recent international study found that nearly two-thirds of participants had lipohypertrophy that was most strongly associated with a lack of injection site rotation. A previous international survey found that 28% of participants could not remember ever having their injection sites checked by a healthcare professional. This clearly indicates the need for a heightened level of awareness among both healthcare professionals and patients to check injection sites daily and rotate sites as necessary, to reduce the risk of lipohypertrophy.

8.0 Injection Area

8.1 Injection area selection
A plethora of research has demonstrated that the skin thickness (epidermis and dermis) – regardless of age, BMI, gender or race – is relatively consistent and varies, on average, between 1.6 mm and 2.4 mm. The thickness of subcutaneous tissue has a much wider variance, and is related to gender, body site and BMI (Figure 11). The abdominal site is noted to have the thickest subcutaneous fat layer, followed by the arm and then the thigh. Women have a higher percentage of abdominal subcutaneous fat than men.

1. To avoid intramuscular injection and in consideration of ease of self-injection, the abdomen, thighs and buttocks are the recommended injection areas for adults.
2. The abdomen offers the most consistent absorption.
3. The arm is not a preferred area for self-injection, due to difficulty accessing the correct zone, difficulty in handling the delivery device to achieve the necessary 90-degree angle and the lessened thickness of subcutaneous fat, which could create a greater potential for intramuscular injection.

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Click here to read FIT Technique Plus – Lipohypertrophy

Figure 11. Subcutaneous tissue (in mm) in male and female adults. The mean values (bold) and ranges (in parentheses) are the result of a series of studies using ultrasound.

Figure 12. Lipotropic lesions

Figure 13. Pinch characteristics of normal (right side of patient) vs. lipohypertrophic (left side of patient) tissue.
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Lipohypertrophic areas can develop under the skin where the same injection or infusion sites are used repeatedly. The lesions vary in size; some are visually apparent, while others require palpation for detection. Lipohypertrophic areas can also be identified by pinching the skin: while healthy skin can be pinched together tightly, lipohypertrophic areas cannot (Figure 13).

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It has been reported that some patients repeatedly choose lipohypertrophic sites for injections or infusions, as these areas have limited nerve innervation and thereby render injections to be relatively painless.

A recent international study found that nearly two-thirds of participants had lipohypertrophy that was most strongly associated with a lack of injection site rotation. A previous international survey found that 28% of participants could not remember ever having their injection sites checked by a healthcare professional. This clearly indicates the need for a heightened level of awareness among both healthcare professionals and patients to check injection sites daily and rotate sites as necessary, to reduce the risk of lipohypertrophy.
Lipohypertrophy

Ultrasound and other research have shown that the subcutaneous fat layer may vary within a particular anatomical area, e.g., the abdomen. The use of a 4-mm needle minimizes the potential for intramuscular injection and allows patients to use a larger area for injection, i.e., a postcard-size area as opposed to a postage-stamp-size area for injection, allowing patients to use a larger area for intramuscular injection and 4-mm needle minimizes the potential for intramuscular injection and allows patients to use a larger area for injection, i.e., a postcard-size area as opposed to a postage-stamp-size area for injection.

Higher A1C levels have been reported in patients who administer injections into lipohypertrophic sites. Pen devices and syringes (all needle lengths and gauges), and insulin pump cannulae have all been reported to be associated with lipohypertrophy.

Currently, there is no conclusive research suggesting the length of time required for a lipohypertrophic area to heal. The benefits of reducing the risk of lipohypertrophy include: a potential decrease in glycemic variability, with a resulting decrease in hyperglycemia and/or hypoglycemia; a decrease in insulin requirements; lowered costs; and improved quality of life.

9.3: Assessment, prevention and avoidance of lipohypertrophy

1. Education regarding lipohypertrophy should be included during all insulin initiations and reinforced during all discussions with insulin-using patients.
2. Injection or infusion sites should be inspected and palpated by a healthcare professional at each visit:
   a) The inspection should be performed while the patient is in a standing- or supine position.
   b) Adequate lighting should be ensured.
   c) The injection area should be palpated in a circular, sweeping motion using the fingertips.
   d) Assessment may be enhanced with the use of examination gel or lotion.
3. Patients should be taught how to manually inspect and palpate their injection sites to detect lipohypertrophy.
4. To prevent lipohypertrophy and maintain consistent medication absorption, patients should rotate their injections within an anatomical area, use larger injection zones and use a new needle with each injection.
5. Patients should be instructed never to use lipohypertrophic sites when injecting medication.
6. When changing from a lipohypertrophic injection site to a healthy site, patients should be cautioned to reduce their insulin dose initially and monitor their blood glucose levels more frequently.

Site Rotation

Site rotation is essential to avoid lipohypertrophy and to facilitate consistent medication absorption. This caveat pertains to the use of all insulin delivery systems.

10.1: Implementation

1. To prevent lipohypertrophy and maintain consistent medication absorption, patients should be taught a personalized, structured rotation regimen for injection and insertion sites.
2. For insulin injections, structured rotation is recommended in the same anatomical area (e.g., abdomen, thigh) at the same time of day, with injections administered at least 1 cm to 2 cm apart (i.e., the width of 1 finger) across the entire area (Figure 14, Figure 15).
3. Patients should be encouraged to use as large a zone as possible in the anatomical area, i.e., a postcard-sized vs. postage-stamp-sized zone (Figure 15).
4. The abdomen remains the preferred injection infusion area; however, patient preference remains an important consideration. Care should be taken to avoid injecting or inserting within 2-3 cm of the umbilicus.
5. Injection or insertion site rotation should be discussed with, and demonstrated by, each patient at every visit.

Bruising and Bleeding

Local bruising and/or bleeding may occur occasionally at an injection site, and is more common in patients who are taking antithrombotic therapy. Bruising and bleeding do not appear to be associated with needle length or injection site; however, they may be affected by injection technique. Studies suggest that bruising and bleeding do not affect medication absorption.

11.1 Recommendations

1. Patients should be reassured that occasional bruising or bleeding at an injection site will not affect medication efficacy.
2. Frequent bruising or bleeding at an injection site warrants a review of injection technique.
Lipohypertrophy

Ultrasound and other research have shown that the subcutaneous fat layer may vary within a particular anatomical area, e.g. the abdomen. The use of a 4 mm needle minimizes the potential for intramuscular injection and allows patients to use a larger area for injection, i.e. a postcard-size area as opposed to a postage-stamp-size area for injection, allowing patients to use a larger area for intramuscular injection and 4-mm needle minimizes the potential for injection.

Higher A1C levels have been reported in patients who administer injections into lipohypertrophic sites. Pen devices and syringes (all needle lengths and gauges), and insulin pump cannulae have all been reported to be associated with lipohypertrophy.

Currently, there is no conclusive research suggesting the length of time required for a lipohypertrophic area to heal. The benefits of reducing the risk of lipohypertrophy include: a potential decrease in glycemic variability, with a resulting decrease in hyperglycemia and/or hypoglycemia; a decrease in insulin requirements; lowered costs; and improved quality of life.

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3. Patients should be instructed never to use lipohypertrophic sites when injecting medication.

4. When changing from a lipohypertrophic injection site to a healthy site, patients should be cautioned to reduce their insulin dose initially and monitor their blood glucose levels more frequently.

5. Injection or insertion site rotation should be discussed with, and demonstrated by, each patient at every visit.

6. When changing from a lipohypertrophic injection site to a healthy site, patients should be instructed never to use lipohypertrophic sites when injecting medication.

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3. Patients should be encouraged to use as large a zone as possible in the anatomical area, i.e. a postcard-sized vs. postage-stamp-sized zone (Figure 15).

4. The abdomen remains the preferred injection infusion area; however, patient preference remains an important consideration.

5. Injection or insertion site rotation should be discussed with, and demonstrated by, each patient at every visit.

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11.1 Recommendations

1. Patients should be reassured that occasional bruising or bleeding at an injection site will not affect medication efficacy.

2. Frequent bruising or bleeding at an injection site warrants a review of injection technique.
12.0 Pregnancy

Due to the paucity of evidence regarding insulin injection technique during pregnancy, the following recommendations are based upon available research and clinical experience.22,24 During pregnancy, questions often arise from women regarding why, where and how insulin is used. The initial concerns of the mother regarding the effect of insulin injections or infusion on the fetus must be explored, to facilitate medication adherence. Ease of use and safety issues (e.g. hypoglycemia) should also be discussed.46

12.1 Recommendations

1. Education regarding insulin use during pregnancy is essential for all pregestational women, and women with gestational diabetes who require insulin.

This education should include discussion of the psychological adjustment to insulin use, changes to insulin requirements during pregnancy, appropriate injection sites and their rotation, and prevention of hypoglycemia.

2. The abdomen is the preferred area of injection for pregnant women.22,40

3. The thigh may be used as an alternate area.21

4. Shorter needles (4 mm or 5 mm) should be used to decrease the potential for intramuscular injection.48,110

5. Injections within 2–3 cm of the umbilicus,122 or areas on the abdomen where the skin is taut, should be avoided.

6. During the third trimester of pregnancy, when the skin is taut over the central abdomen, the lateral sides of the abdomen are the recommended zones for injection (Figure 16).

13.0 Elderly

Education and treatment approaches for the elderly population are challenged by both physical and psychological issues, including loss of muscle mass and strength, decreased skin integrity and changes in memory, sight and hearing. Impaired counter-regulatory hormones reduce the recognition of hypoglycemia, creating a greater potential for falls and fractures.122 The approach to elderly patients must be highly individualized, while integrating all aspects of patients’ lives (i.e. physical, social and spiritual realms).122,124

Assessing cognitive and functional abilities affected by aging is a primary concern when evaluating safety in injection technique in the elderly.118

13.1: Special considerations

1. Individualized assessment should be done using standardized tests for cognitive and functional abilities.122 The clock drawing test is recommended as an assessment tool to determine cognitive function.20,48 Depression screening should be mandatory.5,118,119,122

2. A structured diabetes management and injection technique plan should be written, based upon a comprehensive physical and psychological assessment.122,123,124

3. The use of premixed insulin in the elderly results in greater accuracy in insulin dose, compared with self-mixed insulin.122,124

4. Pen use – including the use of memory pens and other assistive devices – is recommended.42

5. Education of family members and friends is encouraged for support and safety. Encourage family members to be involved on a daily basis.48,118,120 Telephone follow-up with this group is recommended.118,120,122

6. The recommended area for self-injection in elderly patients is the abdomen. The use of 4-mm pen needles is encouraged to avoid the need for a skin lift. Healthcare professionals may recommend the outer aspect of the arm as an alternate site.122,118,119,122

7. All training regarding injection therapy should include a return demonstration.122,119,122

14.0 Pediatrics

Physiological Challenges

14.1 Thickness of subcutaneous fat

Many children and adolescents are emaciated at the time of diabetes diagnosis. As well, children aged 2 to 6 years, those who are slim and very lean teenage boys have minimal subcutaneous fat tissue. All of these factors render the administration of insulin into subcutaneous fatty tissue very challenging. Appropriate injection techniques are key to achieving optimal blood glucose control.

1. The healthcare professional should conduct an individualized assessment to determine the amount of subcutaneous fat thickness at each injection site. This assessment will guide the choice of needle length and administration technique.122,123

2. Insulin pens are the injection devices of choice, due to their shorter needle lengths (4 mm, 5 mm or 6 mm); 4-mm needles are the safest needle length currently available.121

3. If a young child cannot remain immobile during the injection procedure – as is required with pen use – a syringe with a 6-mm needle may be used. It is critical to inject into a site with sufficient adipose mass, perform a skin lift and angle the injection, in order to avoid an intramuscular injection.20,44

14.2: Injection sites

Small children have less surface area at injection sites. As well, since many children and adolescents do not adhere to an adequate site rotation plan, lipohypertrophy is a common occurrence. Barriers to the use of multiple sites include fear that a new site will be painful to inject into and comfort with an existing routine.20,44

a) A 4-mm needle can be inserted at a 90-degree angle without a skin lift in adolescents and children over age 6; children aged 2 to 6 years require a skin lift to avoid an intramuscular injection.20,44

b) If a child or adolescent is lean, 5-mm and 6-mm needles require a 45-degree angle injection with a skin lift.20,44
Pregnancy

Due to the paucity of evidence regarding insulin injection technique during pregnancy, the following recommendations are based upon available research and clinical experience.12,40 During pregnancy, questions often arise from women regarding why, where and how insulin is used. The initial concerns of the mother regarding the effect of insulin injections or infusions on the fetus must be explored, to facilitate medication adherence. Ease of use and safety issues (e.g. hypoglycemia) should also be discussed.48

12.1 Recommendations

1. Education regarding insulin use during pregnancy is essential for all pregestational women, and women with gestational diabetes who require insulin.

2. The abdomen is the preferred area of injection for pregnant women.22,40

3. The thigh may be used as an alternate area.21

4. Shorter needles (4 mm or 5 mm) should be used to decrease the potential for intramuscular injection.22,40

5. Injections within 2–3 cm of the umbilicus,81,83 or areas on the abdomen where the skin is taut, should be avoided.

6. During the third trimester of pregnancy, when the skin is taut over the central abdomen, the lateral sides of the abdomen are the recommended zones for injection (Figure 16).

Figure 16. Recommended injection sites during the third trimester of pregnancy

Elderly

Education and treatment approaches for the elderly population are challenged by both physical and psychological issues, including loss of muscle mass and strength, decreased skin integrity and changes in memory, sight and hearing. Impaired counter-regulatory hormones reduce the recognition of hypoglycemia, creating a greater potential for falls and fractures.129 The approach to elderly patients must be highly individualized, while integrating all aspects of patients’ lives (i.e. physical, social and spiritual realms).129

13.1: Special considerations

1. Individualized assessment should be done using standardized tests for cognitive and functional abilities.129 The clock drawing test is recommended as an assessment tool to determine cognitive function.20 Depression screening should be mandatory.129

2. A structured diabetes management and injection technique plan should be written, based upon a comprehensive physical and psychological assessment.129,130

3. The use of premixed insulin in the elderly results in greater accuracy in insulin dose, compared with self-mixed insulin.130

4. Pen use – including the use of memory pens and other assistive devices – is recommended.49

5. Education of family members and friends is encouraged for support and safety. Encourage family members to be involved on a daily basis.129,130 Telephone follow-up with this group is recommended.129,130

6. The recommended area for self-injection in elderly patients is the abdomen. The use of 4-mm pen needles is encouraged to avoid the need for a skin lift. Healthcare professionals may recommend the outer aspect of the arm as an alternate site.129,130

7. All training regarding injection therapy should include a return demonstration.129,130

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1. The healthcare professional should conduct an individualized assessment to determine the amount of subcutaneous fat thickness at each injection site. This assessment will guide the choice of needle length and administration technique.129

2. Intra-muscular injection is contraindicated due to the risk of side effects.129

3. If a young child cannot remain immobile during the injection procedure – as is required with pen use – a syringe with a 6-mm needle may be used. It is critical to inject into a site with sufficient adipose mass, perform a skin lift and angle the injection, in order to avoid an intramuscular injection.129

14.2: Injection sites

Small children have less surface area at injection sites. As well, since many children and adolescents do not adhere to an adequate site rotation plan, lipohypertrophy is a common occurrence. Barriers to the use of multiple sites include fear that a new site will be painful to inject into and comfort with an existing routine.129

a) A 4-mm needle can be inserted at a 90-degree angle without a skin lift in adolescents and children over age 6; children aged 2 to 6 years require a skin lift to avoid an intramuscular injection.20

b) If a child or adolescent is lean, 5-mm and 6-mm needles require a 45-degree angle injection with a skin lift.129

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Recommendations for Best Practice in Injection Technique (2nd Edition)
14.0 Pediatrics

1. The healthcare professional should educate parents, children and adolescents regarding the need for injection site rotation. Indeed, parents must reinforce the consequences of injecting into “favourite spots.”

2. For children and adolescents who self-inject, supervision may be required in order to ensure adequate site rotation.

**Psychosocial Challenges**

**14.3: Self-Injection**

The age at which children can self-inject is related to developmental maturity rather than chronological age. Most children >10 years of age can either administer their own injections or help with them.128,134

1. If self-injecting, young children should do so under supervision, and share the responsibility with their parents.128,134

2. If omission or overdosing is suspected or confirmed, the healthcare professional should instruct parents to be more involved in insulin administration.128,134

3. Younger children may be helped by:128

   a) Distraction therapy (provided it does not involve trickery, e.g. injecting while watching a favourite television show, blowing bubbles, or looking for hidden objects in picture books).
   b) Play therapy, e.g. injecting a favourite stuffed toy.

4. Older children and adolescents experiencing needle anxiety may be helped by cognitive behavioural therapy, if available, including:128

   a) Relaxation training
   b) Guided imagery
   c) Graded exposure
   d) Active behavioural rehearsal
   e) Modeling and reinforcement
   f) Incentive scheduling

**14.5: Insulin under- and overdosing**

Intentional under- and overdosing of insulin is common in children and adolescents, and can lead to severe hypoglycemia or diabetic ketoacidosis.128,134

1. If insulin dose manipulation is suspected or confirmed, the healthcare professional should instruct parents to be more involved in insulin administration.128,134

2. If omission or overdosing remains an issue, parents should be instructed to assume the responsibility of injecting insulin.

3. Supervision of injections by parents or caregivers should include checking the dose prior to injection and ensuring the injection has penetrated the skin.

**15.0 Institutions**

The safety of patients and healthcare professionals in medical institutions and long-term care facilities is a primary consideration regarding injection technique.

**15.1 Special considerations**

1. Safety engineered devices (i.e. syringes or pen needles) should be used by healthcare professionals for all injections in an institutional setting, thereby eliminating the need to recap needles.128,134

2. Injectable delivery systems should be for individual use only.128,134

3. Injection sites should be clean and free of infection, edema, bruising or lipohypertrophy.128,134

4. Alcohol swabs may be used to clean the injection site (note, however, that this does not disinfect the site); the skin should be thoroughly dry before injecting.128,134

5. To avoid intramuscular injection, the use of a shorter, safety-engineered pen needle (5-mm) or an angled injection (syringe only) is preferred over a skin lift, to reduce the risk of a needle stick injury.
Pediatrics

1. The healthcare professional should educate parents, children and adolescents regarding the need for injection site rotation. Indeed, parents must reinforce the consequences of injecting into “favourite spots.”

2. For children and adolescents who self-inject, supervision may be required in order to ensure adequate site rotation.

Psychosocial Challenges 14.3: Self-injection

The age at which children can self-inject is related to developmental maturity rather than chronological age. Most children >10 years of age can either administer their own injections or help with them.128,134

1. If self-injecting, young children should do so under supervision, and share the responsibility with their parents.128,134

2. If omission or overdosing is suspected or confirmed, the healthcare professional should instruct parents to be more involved in insulin administration.142

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4. Older children and adolescents experiencing needle anxiety may be helped by cognitive behavioural therapy, if available, including:128 a) Relaxation training b) Guided imagery c) Graded exposure d) Active behavioural rehearsal e) Modeling and reinforcement f) Incentive scheduling

14.4: Needle anxiety and pain

Needle anxiety is common in children and adolescents, as well as their parents; younger children report greater fear and pain. Parents’ attitudes are important for their child’s acceptance of injections.128,134

1. If insulin dose manipulation is suspected or confirmed, the healthcare professional should instruct parents to be more involved in insulin administration.142

2. If omission or overdosing remains an issue, parents should be instructed to assume the responsibility of injecting insulin.

3. Supervision of injections by parents or caregivers should include checking the dose prior to injection and ensuring the injection has penetrated the skin.

4. Injectable delivery systems should be used by healthcare professionals for all injections in an institutional setting, thereby eliminating the need to recap needles.6,31

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15.1 Special considerations

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2. Injectable delivery systems should be for individual use only.6,31

3. Injection sites should be clean and free of infection, edema, bruising or lipo hypertrophy.17,29,41

4. Alcohol swabs may be used to clean the injection site (note, however, that this does not disinfect the site); the skin should be thoroughly dry before injecting.17,29,41

5. Prior to injecting, all healthcare professionals should have a clear line of sight to the disposal unit they will be using.

6. All institutions should have clear policies and procedures that ensure a no blame approach to the reporting of needle stick injuries.143

7. All institutions should have established education programs in injection technique to ensure best practice.134

8. Consideration must be given to the safety culture in medical facilities and long-term care institutions and long-term care healthcare professionals in medical institutions and long-term care facilities is a primary consideration regarding injection technique. Needle stick injuries are a frequent, yet largely preventable, occurrence among healthcare professionals. Consideration must be given to the safe disposal of all injection and infusion devices to prevent injury to healthcare workers.

Cross-contamination among patients is also preventable with appropriate use and disposal of injection or infusion devices. Institutions are encouraged to develop a safety culture through staff education and increased awareness of best practice.
1. Prepare patients regarding the need for injection therapy, provide proper education and ensure regular assessment of injection sites and techniques.

2. Rotation of injection sites within all zones of an anatomical area is essential to avoid lipohypertrophy.

3. Healthcare professionals and patients alike should be taught how to inspect and palpate healthy sites.

4. Shorter pen needles (e.g. 4 mm, 5 mm and 6 mm) are suitable for all injection sites, and how to prevent lipohypertrophy.

5. The abdomen is the preferred injection area, for consistency of absorption.

6. Splitting of insulin doses related to the volume of the injection should be individualized to each person after consideration of all factors.

7. Glycemic variability and poor glycemic control may be related to injection techniques. Careful assessment and management are required when encouraging use of healthy sites.

8. When using cloudy insulin, the vial or cartridge should be rolled gently 10 times and then tipped (not shaken) 10 times; the vial or cartridge should be rolled visually to ensure the suspension has a consistent milky white appearance.

9. The injection technique for GLP-1 receptor agonists is similar into areas of lipohypertrophy.

10. With respect to special populations:
   a) The lateral sides of the abdomen are the preferred injection sites for pregnant women.
   b) Safety is a primary consideration in the elderly population; as such, cognitive and functional abilities should be assessed.
   c) Young children who self-inject, and older children and adolescents who are suspected of insulin under- or overdosing, should be closely supervised by a parent.

11. Injections should be assessed.

12. With respect to special situations:
   c) Is the traditional alcohol wipe necessary before an injectable therapy injection? Sv Läkaresällskapets Hadingar (Experiences from 94000 injectable therapy injections given without skin swab.) Skin and subcutaneous adipose layer thickness in adults with diabetes at sites used for injectable therapy injections: implications for needle length recommendations. Curr Med Res Opin. 2010;26:1559-1560.

13. Pharmacists and diabetes educators should be assessed.

14. Glycemic variability and poor glycemic control may be related to injection techniques. Careful assessment and management are required when encouraging use of healthy sites.

15. Injection technique for GLP-1 receptor agonists is similar into areas of lipohypertrophy.


References


1. Prepare patients regarding the need for injection therapy, provide proper education and ensure regular assessment of injection sites and techniques.

2. Rotation of injection sites within all zones of an anatomical area is essential to avoid lipo hypertrophy.

3. Healthcare professionals and patients alike should be taught how to inspect and palpate injection sites, and how to prevent lipo hypertrophy.

4. Shorter pen needles (e.g. 4 mm, 5 mm and 6 mm) are suitable for all people with diabetes, regardless of BMI; however, 6-mm needles are recommended, if syringe use is preferred.

5. The abdomen is the preferred injection area, for consistency of absorption.

6. Splitting of insulin doses related to the volume of the injection should be individualized to each person after consideration of all factors.

7. Glycemic variability and poor glycemic control may be related to injection techniques. Careful assessment and management are required when encouraging use of healthy sites.

8. When using cloudy insulin, the vial or cartridge should be rolled gently 10 times and then tilted (not shaken) 10 times; the vial or cartridge should be rolled slowly 10 times; the vial or cartridge should also be inspected visually to ensure the suspension has a consistent milky white appearance.

9. The injection technique for GLP-1 receptor agonists is similar to insulin injections: the lateral sides of the abdomen are the preferred injection sites for pregnant women. Safety is a primary consideration in the elderly population; as such, cognitive and functional abilities should be assessed.

10. With respect to special populations:
   a) Young children who self-inject, and older children and adolescents who are suspected of insulin under- or overdosing, should be closely supervised by a parent.
   b) Safety is a primary consideration in the elderly population; as such, cognitive and functional abilities should be assessed.
   c) Patients with diabetes should be assessed.

11. The lateral sides of the abdomen are the preferred injection sites for pregnant women. Safety is a primary consideration in the elderly population; as such, cognitive and functional abilities should be assessed.

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16. Splitting of insulin doses related to the volume of the injection should be individualized to each person after consideration of all factors.

17. Glycemic variability and poor glycemic control may be related to injection techniques. Careful assessment and management are required when encouraging use of healthy sites.

18. When using cloudy insulin, the vial or cartridge should be rolled gently 10 times and then tilted (not shaken) 10 times; the vial or cartridge should be rolled slowly 10 times; the vial or cartridge should also be inspected visually to ensure the suspension has a consistent milky white appearance.

19. The injection technique for GLP-1 receptor agonists is similar to insulin injections: the lateral sides of the abdomen are the preferred injection sites for pregnant women. Safety is a primary consideration in the elderly population; as such, cognitive and functional abilities should be assessed.

20. With respect to special populations:
   a) Young children who self-inject, and older children and adolescents who are suspected of insulin under- or overdosing, should be closely supervised by a parent.
   b) Safety is a primary consideration in the elderly population; as such, cognitive and functional abilities should be assessed.
   c) Patients with diabetes should be assessed.


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The presence of excessively high levels of glucose in the blood, which occurs when the body does not have enough insulin or cannot use the insulin it does have to turn glucose into energy. Chronic hyperglycemia in diabetes is associated with microvascular complications (i.e. retinopathy, nephropathy, neuropathy) and macrovascular complications (i.e. hypertension, acute coronary syndrome, stroke, heart failure).

**Hyperglycemia:**
An abnormally low concentration of glucose in the circulating blood. Hyperglycemia is defined as a blood glucose level ≥ 7.0 mmol/L.

**Injection area (anatomical area):**
Appropriate injection areas are as follows: abdomen, thighs, buttocks, back of arm.

**Injection site:**
The point of insertion or injection of medication.

**Injection site rotation:**
A system to ensure that people do not inject medication into the same site each time they administer an injection. Rotating injection sites is crucial for people who injected continuously.

**Injection Zone:**
The injection area divided into quadrants (abdomen) or halves (thighs).

**Insulin pen:**
A pen-sized injection device that is used to inject insulin, and is composed of an insulin cartridge (either integrated or bought separately) and a dial to measure the dose.

**Lipatrophy:**
The loss of subcutaneous fat from one area of the body.

**Lipodystrophy:**
A medical condition characterized by abnormal or degenerative conditions of the body's adipose tissue.

**Lipohypertrophy:**
An accumulation of subcutaneous fat tissue at a site where insulin has been injected continuously.

**Needle:**
A hollow, pointed instrument used to deliver injectable medications into the body. A needle can be used with an insulin syringe to deliver medication from a vial. A pen needle consists of a hollow needle which is embedded in a plastic hub and attaches to the end of an injection pen.

**Skin lift:**
A manoeuvre used when injecting insulin or other injectable medications to ensure optimal medication uptake. To perform a skin lift correctly, an individual should lift the skin and subcutaneous tissue delicately between the thumb and index finger, leaving the muscle behind.

**A1C (glycated hemoglobin):**
A test that measures the average level of blood glucose over the past 2 to 3 months. According to the Canadian Diabetes Association, the target A1C for most people with diabetes is 7.0%.

**2-hour postprandial blood glucose:**
• Fasting blood glucose: 4.0–7.0 mmol/L.

**Blood glucose targets:**
The blood glucose level range recommended by a diabetes healthcare professional for successful diabetes management. According to the Canadian Diabetes Association, blood glucose targets for people with diabetes are as follows:
- Fasting blood glucose: 4.0–7.0 mmol/L.
- 2-hour postprandial blood glucose: 5.0–10.0 mmol/L (5.0–8.0 mmol/L in those whose A1C remains above 7.0%).

**Blood glucose:**
The concentration of glucose in the blood, which is represented in millimoles per litre (mmol/L) of blood.

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**Diabetes:**
A metabolic disorder characterized by the presence of hyperglycemia due to defective insulin secretion, defective insulin action, or both.

**Glycemic variability:**
The degree to which a person’s blood glucose fluctuates between high and low levels.

**Hyperglycemia:**
A metabolic disorder characterized by the presence of excessively high levels of glucose in the blood, which occurs when the body does not have enough insulin or cannot use the insulin it does have to turn glucose into energy. Chronic hyperglycemia in diabetes is associated with microvascular complications (i.e. retinopathy, nephropathy, neuropathy) and macrovascular complications (i.e. hypertension, acute coronary syndrome, stroke, heart failure).

**Hypoglycemia:**
A hormone produced in the pancreas that regulates the amount of sugar in the blood by stimulating cells – especially liver and muscle cells – to absorb and metabolize glucose. Insulin also stimulates the conversion of blood glucose into glycogen and fat, which are the body’s chief sources of stored carbohydrates.

**Insulin analogues:**
A tailored form of insulin in which certain amino acids in the insulin molecule have been modified. The analogue acts in the same way as insulin, but with some beneficial differences for people with diabetes.
Glossary

**A1C (glycated hemoglobin):** A test that measures the average level of blood glucose over the past 2 to 3 months. According to the Canadian Diabetes Association, the target A1C for most people with diabetes is 7.5%.

**Blood glucose:** The concentration of glucose in the blood, which is represented in millimoles per litre (mmol/L) of blood.

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**Hypoglycemia:** An abnormally low concentration of glucose in the circulating blood. Hypoglycemia is defined as a blood glucose level ≤4.0 mmol/L.

**Injection site:** The point of insertion or injection of medication.

**Injection site rotation:** The injection area divided into quadrants (abdomen) or halves (thighs).

**Injection technique:** A method used when injecting insulin or other injectable medications into the body. The injection technique is essential for successful diabetes management. According to the Canadian Diabetes Association, the target A1C for most people with diabetes is 7.0%.

**Insulin pen:** A pen-sized injection device that is used to inject insulin, and is composed of an insulin cartridge (either integrated or bought separately) and a dial to measure the dose.

**Lipohypertrophy:** An accumulation of subcutaneous fat at a site where insulin has been injected continuously.

**Lipoatrophy:** The loss of subcutaneous fat from one area of the body.

**Nanomole (nmol):** A unit of measurement for blood glucose or insulin.

**Prescription drug:** A medication prescribed by a healthcare professional to treat a medical condition.

**Skin lift:** A manoeuvre used when injecting insulin or other injectable medications to ensure optimal medication uptake. To perform a skin lift correctly, an individual should lift the skin and subcutaneous tissue delicately between the thumb and index fingers, leaving the muscle behind.