Forum for Injection Technique Singapore

FIT-SG

Recommendations for Best Practice in Injection Technique

fit odc™

Optimising Diabetes Care

ADES

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DISCLAIMER

This document will be distributed to Healthcare Professionals involved in insulin injection therapy.

The information and recommendations stated in this publication is not a substitute for individual, medical and/or nursing assessment and treatment by professional staff. Implementation of these recommendations may have an impact on the health outcomes of those individuals living with diabetes who require subcutaneous insulin injection therapy.

Although the publisher has taken every care to ensure the accuracy of the professional, clinical and technical components of this publication, it accepts no responsibility for any loss or damage suffered by any person as a result of following the procedures described or acting upon information set out in this publication.

PREFACE

In Singapore, diabetes is a serious health concern, with over 400,000 Singaporeans living with the disease. The number of people with diabetes is projected to reach one million by 2050.

With our constant pursuit of improving the lives of people with diabetes and in the midst of current War on Diabetes declared by Minister of Health in 2016, this Injection Technique Recommendations certainly empowers nurses with skills and knowledge to deliver excellent care and education to their patients and caregivers.

Safety is also paramount importance in our delivery of care to our patients and caregivers. To ensure safe use of injections, recommendations for best practice in injection techniques are needed. Association of Diabetes Educators Singapore (ADES) has taken on this responsibility of ensuring safety in injections by developing this Recommendations for Best Practice in Injection Technique.

The recommendations will help increase awareness of the importance of safe injection administrations and provide an easy source of reference for the nurses. The main areas covered are psychological challenges of injection, injection techniques, injection issues and safety.

As ADES continue to promote optimal health and well-being of people with diabetes, we are committed to uphold the standard of care by adopting the new recommendations of injection techniques.

Lim Pei Kwee
President
Association of Diabetes Educators Singapore

FORWORD

Guidelines for best practice of insulin injection technique have been published in many countries to make best recommendation injection and infusion techniques. It is time that Singapore's diabetes educators play the integral role to advocate for evidence based and best practice in injection technique to all involved in diabetes care.

Over the years it has shown that optimal injection technique is essential to improve health outcomes. According to the study by Blanco et al (2013), it shown that almost two thirds of patients have lipohypertrophy due primarily to incorrect or no rotation of injection sites. Out of the patients with lipohypertrophy, 39.1% had unexplained hypoglycemia and 49.1% had glycaemic variation. People with lipohypertrophy were found to use much more insulin than those without lipohypertrophy and indirectly increase the cost of care.

The key aims are to raise awareness of existing and emerging research relating to injection technique and the impact this may have on health outcomes for those with diabetes that require subcutaneous injection therapy.

In 2012, ADES developed educational flipcharts on the best recommendations of injection techniques for people with diabetes. The content of the flipchart was based on a number of significant published studies that led into a further review of critical evidence. This has supported the development of these injection recommendations thereby setting a high standard of expectation in the care for people with diabetes.

This year, ADES will broaden the awareness of new injection recommendations to all levels of healthcare professionals and caregivers through the recommendations.

We look forward to the adoption of the new recommendations (Golden Rules) of injection techniques by healthcare professionals in Singapore and ADES will continue to participate actively in ensuring recommendations remain relevant and useful for now and the future.

Brenda Lim
Project Chairperson (FIT-SG)
Vice-President (Special Projects)
Association of Diabetes Educators Singapore

ENDORSEMENTS

"Congratulations to ADES for taking the initiative and labouring to produce the FIT-SG document to guide on the best practice for insulin injection in Singapore. It has been long awaited and now aligns Singapore with countries around the world who are part of the FIT program. I hope that all relevant parties and institutions in Singapore will unite and adopt these best practice recommendations."

DIABETES SINGAPORE

Dr Kevin Tan
President
Diabetes Singapore

"This publication with clear and practical advice backed by up-to-date scientific evidence should benefit patients coping with daily insulin injections and healthcare providers tasked to teach the fundamentals of safe insulin injection techniques and skills."

EMSS
Endocrine & Metabolic Society of Singapore

A/Prof Melvin Leow
President
Endocrine and Metabolic Society of Singapore (EMSS)

The FIT-SG working committee would like to thank College of Family Physicians Singapore and Pharmaceutical Society of Singapore for supporting this Recommendations for Best Practice in Injection Technique.

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We would like to extend our gratitude and appreciation to BD Medical – Diabetes Care for the support in the development of the recommendations.

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KEY

A Scientific Advisory Board (SAB) (Athens 2009) led the review of available evidence and decided that for the strength of a recommendation the following scale would be used:

- A STRONGLY RECOMMENDED
- B RECOMMENDED
- C UNRESOLVED ISSUE

For the scientific support the following scale was used.

1. At least one randomised controlled study.
2. At least one non-randomised (or non-controlled or epidemiologic) study.
3. Consensus expert opinion based on extensive patient experience.

A number of significant studies have been published in the intervening years since 2009. Therefore FITTER has conducted a further review of critical evidence and included this within the 1st Edition of the new Injection and Infusion Recommendations. The body of evidence has been subjected to the rigour of the strength scale of recommendations as above however with a slightly modified KEY for the scientific support:

For the scientific support the following modified scale was used.

1. At least one rigorously performed study, peer-reviewed and published.
2. At least one observational, epidemiologic or population-based study.
3. Consensus expert opinion based on extensive patient experience.

Thus each recommendation is followed by both a letter and number. The letter indicates the weight a recommendation should have in daily practice and the number, its degree of support in the medical literature. The most relevant publications bearing on a recommendation are also cited. There are few randomised clinical trials in the field of injection technique (compared, for example, with blood pressure control) so judgements such as 'strongly recommended' versus 'recommended' are based on a combination of the weight of clinical evidence, the implications for patient therapy and the judgement of the group of experts.

These recommendations apply to the majority of people with diabetes using injectable therapy, but there will inevitably be individual exceptions for which these recommendations must be adjusted.

Acknowledgement

The New Insulin Injection and Infusion Recommendations for Patients with Diabetes: Frid AH, Kreugal G, Grassi G, et al. New insulin therapy recommendations. Mayo Clin Proc. September 2016; 91(9):1231-1255. informed these recommendations and we thanked the editors of the Mayo Clinics for permission to use material from this article and also to the 4th Edition FIT-UK board and contributors.

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1.0

Therapeutic Education by Healthcare Professional (HCP)

1.1 Address barriers to starting insulin

It is necessary to explore all barriers presented by patients and caregivers when initiating insulin therapy. Barriers can be psychological (e.g. misconceptions, anxieties), physical (disabilities and impairments), financial burden (extra or hidden costs) and lack of support (family, employer etc). Individualised strategies can be developed to address these barriers.

1.2 Essential topics for discussion

- Injectable therapy regimen
- Choice and management of the devices including safety devices
- Choice, care and self-examination of injection sites
- Correct injection techniques (including site rotation, injection angle and possible use of lifted skin folds)
- Resuspension of insulin where appropriate
- Injection complications and how to avoid them
- Optimal needle lengths
- Safe disposal of used sharps
- Hypoglycaemia where appropriate. (1-7) A 1

HCP to ensure that the topics discussed are fully understood by patients and caregivers at the beginning. Subsequent assessment on the topics can be done at least annually to ensure continued understanding and adherence. (4,8) A 3

1.3 Communication and observation plan

- Develop an individual education care and document current injection practice.
- Make time to observe attitude and learning capabilities in coping with the injection regimens and injectable.
- Examine and palpate the injection sites at each visit or at least once a year. (4,5,7) A 3
- Instructions should be given in both verbal and written form, tailored to the individual needs of the person. Digital instruction could be used as a supplementary reminder.
- Ensure proper documentation in the patient's manual or electronic records. (4,5,7) A 3
- A quality management process should be put in place to ensure that correct injection technique is regularly practiced by the patient and is documented in the record.

2.0

Role of the Healthcare Professional

- Able to identify psychological issues which impact insulin therapy and administration. (4,6) A 3
- Know the time action profile of the different types of injectable therapies and the absorption profiles from different injection sites. (9-12) A 2
- Teach patients and caregivers how to inject correctly and address the psychological hurdles patient may face when injecting or infusing, especially at the initiation of treatment. (4,6) A 2
- Understand the anatomy of insulin delivery sites in order to help patients avoid intramuscular (IM) injections.
- Ensure that injections and infusion cannulae are consistently given into the subcutaneous (SC) tissue, without leakage/backflow or other complications. (13-17) A 3
- Utilize various methods of **minimising** barriers, pain and/or fear of injection in order to reduce psychological distress and impact on insulin therapy and administration. (4,6) A 3

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3.0

Psychological Challenges of Injection

Diabetes management poses many challenges in patients and caregivers' lives especially people requiring injection. The challenges include disrupted daily routine, increased family expenditures, meal planning, social stigma, fear and anxiety. The use of therapeutic education in providing diabetes self-care management is beneficial to assist and prepare adult and children with diabetes requiring injection.

3.1 Key points

Encourage all patients and caregivers to:

- Express feelings about injecting, particularly their fears, frustration, anger and struggles.
- Know that they are not alone and is a learning process.
- Feel reassured that the HCP team is here to help along the way and they will be supported to self-manage as much as possible and involved in designing their regimen to fit their lifestyle.
- Understand that injection is not a punishment or failure but insulin when used correctly is the most effective treatment to optimize glucose control. (1,3,8) A 3
- Explore strategies to overcome psychological barriers on injection.
- Improve blood glucose levels which may make them feel better in the long run and prevent long term complication. (2,4) A 3

3.2 Strategies for Healthcare Professional

Reducing fear, pain and anxiety

3.2.1 Adults

- Invite caregiver or family members in the planning and education if patient is agreeable.
- Tailor the therapeutic regimen to fit the individual needs and lifestyle. Emphasize both the short-term and long-term advantages of optimal glucose management including injectable as a goal.
- Have clear and compassionate approach when teaching correct injection technique.
- Demonstrate the correct injection technique to the individual and assess their ability to self-inject.
- Use devices which hide the needle in the event when fear is provoked by sight of needles.
- Usage of 4 mm pen needle is reported by patients to be less painful than longer needles. (18-21) A 2
- Usage of pen devices may have psychological advantages over syringes and therefore maybe more acceptable. (18-21) A 2
- Consider the use of cold compress to suppress pain if needed. (22) A 3
- Use only culturally-appropriate pictures and stories to show injectable therapy.

3.2.2 Children and Adolescents

- Address pain tolerance and anxiety issues of children due to their lower threshold for pain and fear of the unknown. (19) A 2
- Brief parents that a well-preparedness beforehand will transmit less anxiety to their children. In fact, the presence of a calm and reassuring parent is the most effective support for a distressed child.

3.0

Psychological Challenges of Injection

- Use distraction techniques or play therapy (e.g. injecting the child's own soft toy or doll). (23) A 2
- Use cognitive behavioral therapies that includes relaxation training, guided imagery, graded exposure, active behavioral rehearsal, modelling and positive reinforcement as well as appropriate rewards for older children. (18,23,24) A 2
- Encourage self-injection using a dry injection on the person (parent or child), and most are surprised at how relatively painless the injection is.
- Use of injection ports may help reduce fear of injections and associated pain. (25,26) B 1
- The HCP should instruct parents and adolescents on the need for a proper system of site rotation. Parents need to be firm about not injecting into "favourite spots".
- Parents can teach children over the age of ten years either to give their own injections or help them.
- **If insulin dose manipulation is suspected of confirmed, the HCP should instruct parents to be more involved or provide close supervision in insulin administration. (27) A 2**
- Adolescents should be reassured that no one manages diabetes perfectly all the time and that occasional slip-ups, as long as they do not become habitual, are not signs of failure.
- Any steps which enhance the adolescent's sense of control (e.g. flexible injection schedule for weekends and holidays) will have positive consequences.

Recommendations:

Evaluate injection techniques if:

1. bleeding or bruising occur, assess and reassure the patient that these do not affect the absorption of insulin or overall blood glucose control.
2. bruising continues or hematoma develop, observe the injection technique and suggest improvements (e.g. correct rotation of injection sites).
3. patients occasionally experience sharp pain on injection, they should be reassured that the needle may have touched a nerve ending which happens randomly and will not cause any damage.

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4.0 Injection Techniques

Proper injection techniques is important to avoid intramuscular injections and ensures the appropriate delivery of insulin to the subcutaneous tissue.

4.1. Choosing injection sites

The Figure 1 shows the current recommended injection sites for injectable medication.

A. Abdomen within the following boundaries ~1cm above the symphysis pubis,~1cm below the lowest rib,~1cm away from umbilicus and laterally flanks
B. Upper third anterior lateral aspect of both thighs
C. Posterior lateral aspect of both upper buttocks and flanks
D. Middle third posterior aspect of the upper arm

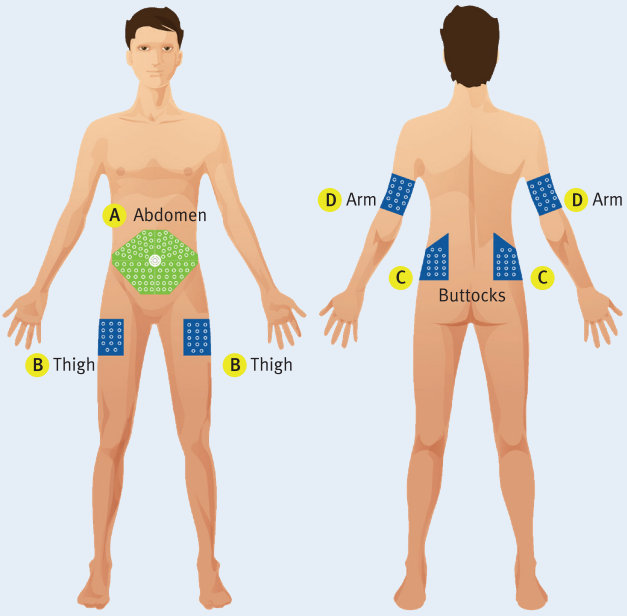

Figure 1. Current recommended injection sites.

4.1.1 Insulin absorption

- Optimal absorption of insulin depends on injection into subcutaneous tissue. Absorption rate can be affected by various factors such as type of insulin, insulin storage, skin temperature, site of injection and exercises.
- The abdomen is the preferred site for soluble human insulin since absorption of this insulin is fastest there. (28,29,30) A 1
- Soluble human insulin /NPH mix should be given in the abdomen to increase the speed of absorption of these short-acting insulin, in order to cover post- prandial glycaemic changes. (17) A 1
- Intramuscular (IM) injections of Neutral pH suspension of crystalline insulin, protamine and zinc (NPH) and long acting insulin must be strictly avoided due to the risk of hypoglycaemia. (31,32,33) A 1
- Rapid-acting insulin analogues may be given at any of the injection sites, as absorption rates do not appear to be site-specific. (34,35,36) A 1
- Rapid-acting insulin analogues should be given subcutaneous and not IM. (35,36,37) A 2

4.0 Injection Techniques

- Patients using non-insulin injectable therapies should follow the recommendations already established for insulin injections with regards to needle length, site selection and site rotation.

4.1.2 Rotation of injection sites

- **Teach patient an easy to follow scheme to systematically rotate sites to prepare for injection in such a way that they are spaced approximately one finger's breadth apart in order to avoid repeat tissue trauma.**
- Divide the injection site into quadrants using one per week and moving quadrant to quadrant in a consistent direction. (Figure 2)
- Prepare patients that the sites rotation may be adjusted as needed while therapy progresses. Follow up with patients on their rotation scheme taught at each visit and provide advice where necessary. The HCP should review the site rotation scheme with the patient at least once a year. (38,39,40) A 1

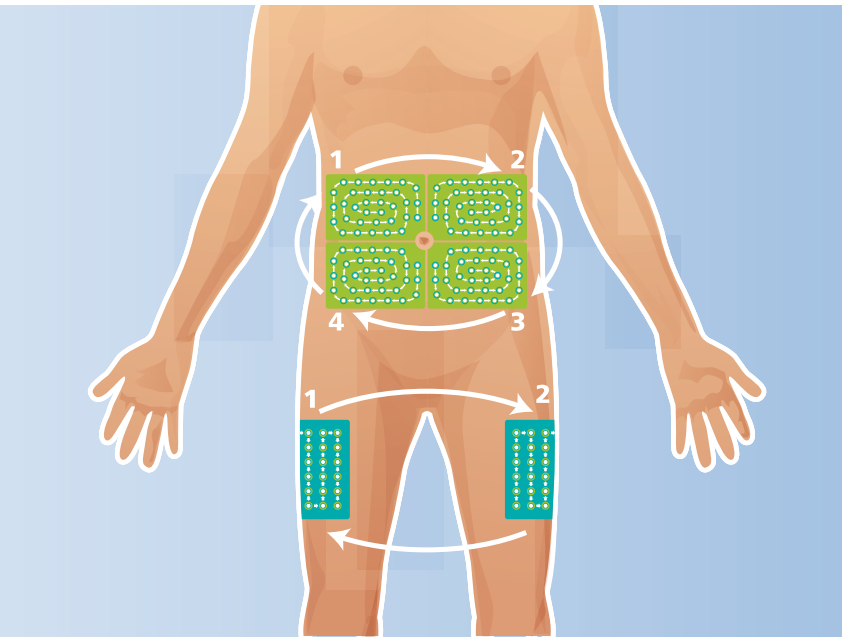

Figure 2. Sample rotation plan - Divide the injection area into zones. Use 1 zone per week and move clockwise.

4.2. Injection Process

4.2.1. Preparing injection site

- Ensure both the injection site and the hands are clean prior to injection.
- The site should be inspected and palpated by the individual prior to injection. (41,42,43) A 2
- The site should be cleansed with soap and water when found to be unclean. Injections should be given into a clean site using clean hands. (44,45) A 3
- Disinfection of the site is usually not required although local decisions may be taken in a clinical setting. If alcohol is used to clean the site, the skin must be allowed to dry completely before the injection is administered. (46,47,48) A 1
- Do not inject into sites of lipohypertrophy, inflammation, edema, ulceration or infection, nodules, scar tissue, tattoos, hernias and stomas area. (49,50,51,52) A 1
- Do not inject through clothing. (44) B 2

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4.0 Injection Techniques

4.2.2. Preparing insulin suspension

- Roll the cloudy insulin (e.g. NPH and pre-mixed insulin) gently for ten times and inverted ten times (not shaken) until the crystals go back into suspension and the solution becomes milky white. (53,54) A 2
- Inversion and rolling should be performed a total of 20 times immediately before every cloudy injection. (Figure 3)
- Confirm that the re-suspended insulin is sufficiently mixed after each rolling and inversion, and repeat the procedure until the crystal mass is resolved in the cartridge. (53,54,55) A 2
- Avoid vigorous shaking as this produces bubbles which reduce accurate dosing. (53,54) A 2

4.2.3. Proper use of pen devices

- **Pen devices should be primed (observing at least a drop at the needle tip) according to the manufacturer's instructions before the injection to ensure there is unobstructed flow and to clear needle dead space. Once flow is verified, the desired dose should be dialed and the injection administered. (48)** A 3
- Pens and cartridges are for a single patient and should never be shared between patients due to the risk of biological material from one patient being drawn into the cartridge and then injected into another. (56) A 2
- Needles should be disposed of immediately after use instead of being left attached to the pen. This prevents the entry of air (or other contaminants) into the cartridge as well as the leakage of medication out, which can affect subsequent dose accuracy. (50,51,52) A 2

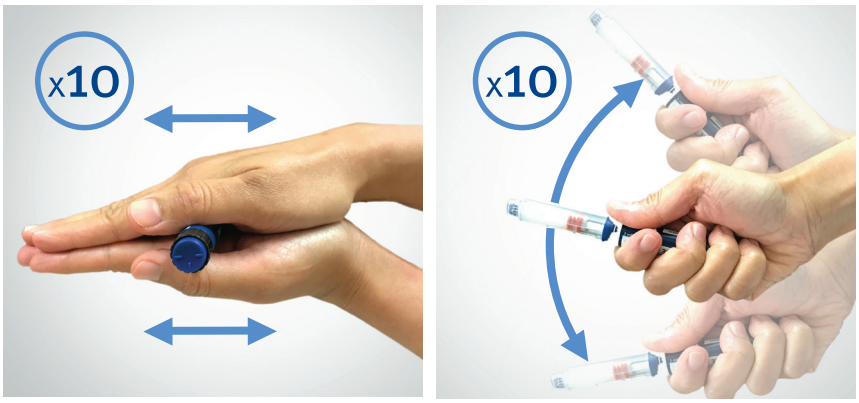

Figure 3. Method of mixing cloudy insulin; roll 10 times and invert 10 times.

4.0 Injection Techniques

- Pen needles should be used only once. (57,58,59,60) A 2
- After pushing the insulin pen's dose delivery button in completely, patients should count slowly to 10 before withdrawing the needle in order to get the full dose and prevent the leakage of medication. Counting past 10 may be necessary for higher doses (41,50,61) A 1

4.2.4. Proper use of insulin syringes

- When drawing up insulin, the air equivalent to the dose should be drawn up first and injected into the vial to facilitate insulin withdrawal
- If air bubbles are seen in the syringe, tap the barrel to bring them to the surface and then remove the bubbles by pushing up the plunger.
- Unlike pens, it is not necessary to hold the syringe needle under the skin for 10 seconds after the plunger has been depressed. (50,61) A 2
- Syringe needles should be used only once. (57,58,59,60) A 3

4.3. Lifting a Skin Fold

- Each injection site should be examined individually and a decision made as to whether lifting a skin fold is required, taking into account the needle length used. The recommendation should be provided to the patient in writing and documented in their care plan.
- The lifted skin fold should not be squeezed so tightly that it causes skin blanching or pain. (Figure 4)
- The optimal sequence should be:
  - Lift a skin fold;
  - **Inject insulin slowly at ninety degree angle to the surface of the skin fold;**
  - Leave the needle in the skin for a count of 10 after the dose button is fully depressed when injecting with a pen;
  - Withdraw needle from the skin at the same angle it was inserted;
  - Release skin fold;
  - Dispose of used needle safely.

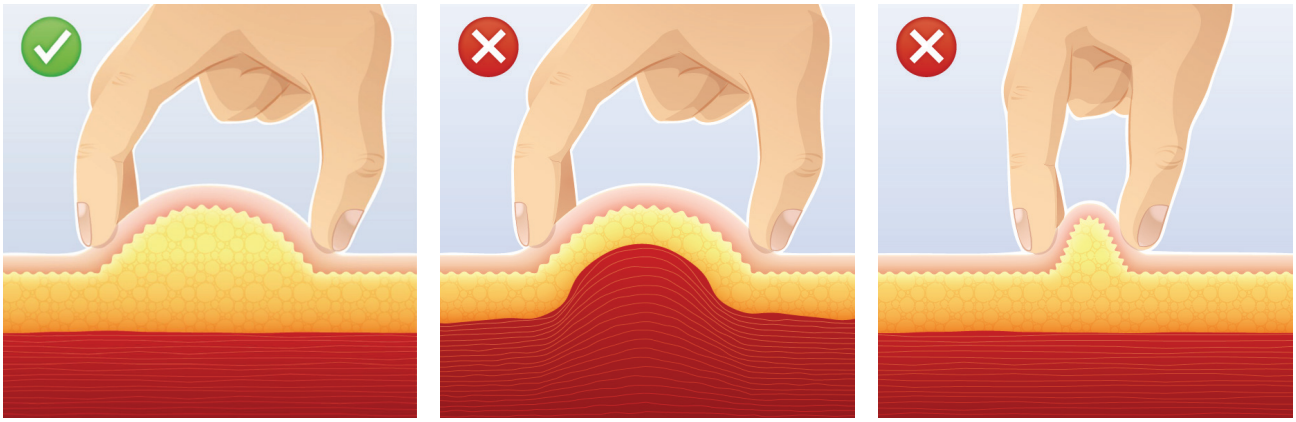

Figure 4. Correct and Incorrect Technique of Performing Skin Fold

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4.0 Injection Techniques

4.4. Post injection care

4.4.1. Needle reuse

- Syringe or pen needles should only be used once. Reusing insulin needles is not optimal injection practice and patients should be discouraged from doing so. (48,62) A 2 (Figure 5)
- There is an association between needle reuse and the presence of lipohypertrophy, although a causal relationship has not been proven. Patients should be made aware of this association (and also the association between reuse and pain or bleeding). (48,49) A 2

4.4.2. Bleeding and Bruising

- Patients should be reassured that bleeding and bruising do not appear to have adverse clinical consequences for the absorption of insulin or for overall diabetes management. (63) A 2

4.5. Storage of injectable medication (cartridge or vials)

- Do not expose injectable medication to direct sunlight.
- Insulin should be removed from the fridge at least 30 minutes before injecting.
- Always check the expiry date before using.
- Injectable medication not opened or not in use should be stored in a refrigerator between two to eight degrees Celsius (2-8° C) where freezing is unlikely to occur, as per manufacturer's instructions.
- Store opened cartridges or pre-filled pens in room temperature at below thirty degrees Celsius (<30° C) for only a maximum of one month from date opened and within manufacturer's expiry date.

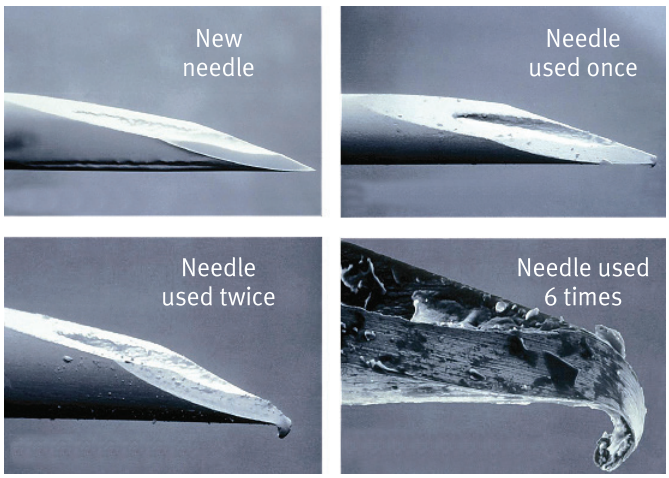

Figure 5. Needle reuse damages the tip of the needle.

Tips for Less Painful Injection

- Store in-use insulin at room temperature. (64,65) A 2
- If using an alcohol swab which is optional, allow to dry completely on the skin before injecting. (66,67) B 1
- Use needles with shorter length and smaller diameter (higher gauge). (68,69) A 1
- Insert the needle at 90 degree angle to the skin in a quick smooth movement. (70) A 3
- Inject the insulin slowly ensuring that the syringe plunger or pen's dose delivery button has been fully depressed. (70) A 3
- Single use of syringes and pen needles. (42,43,71,72) A 2
- Gentle lifting instead of squeezing tightly of skin fold if required. (73) A 3

5.0

Needle Length

5.1. Adults

- The 4mm pen needle inserted perpendicularly is long enough to penetrate the skin and enter the subcutaneous tissue, with little risk of intramuscular injection. Therefore it should be considered the safest pen needle for adults regardless of age, gender and Body Mass Index (BMI). (2,75,77,78,79) A 1
- The 4mm pen needle may be used safely and effectively in all obese patients. Although it is the needle of choice for these patients, a 5mm needle may be acceptable. (68,80-85) A 1
- The 4mm pen needle should be inserted perpendiculary (at ninety degree angle) regardless of whether a skin fold is raised. (87,89) A 2 (Figure 6)
- If arms are used for injections with needles ≥6mm long, a skinfold must be lifted, which requires injection by a third party. (87)
- Avoid pushing the pen device into the skin thus indenting the skin during the injection, as the needle may penetrate deeper than intended and enter the muscle.
- Extremely thin adults (BMI ‹19) should use the 4mm pen needle by lifting a skin fold and inserting the needle perpendicularly (at ninety degree angle) into it. Others may inject using the 4mm pen needle without lifting a skin fold. (10,15,75,84,86,87) A 1
- When any syringe needle is used in slim to normal weight adults (BMI 19-25), injections should always be administered into a lifted skin fold. (10,15,68,85,88-114) A 1
- In adult injection, there is no clinical reason for recommending needles ≥ 8mm. (68,74) A 2

5.2. Children and Adolescents

- Very young children (6 years old and below) should use the 4mm pen needle by lifting a skin fold and inserting the needle perpendicularly into it. Others may inject using the 4mm pen needle without lifting a skin fold. (10,15,75,84,86,87) A 1
- Children using the 5mm pen needle should inject using a lifted skin fold. But children using pen needles ≥5mm should be changed to 4mm pen needles if possible; and if not, should always use a lifted skin fold. (10,15,84,86,87) A 1
- When any syringe needle is used in children and adolescents, injections should always be administered into a lifted skin fold. (10,15,68,85,88-114) A 1
- In children and adolescents, there is no clinical reason for recommending ≥ 6mm. (75,76) A 2
- Healthcare authorities and payers should be alerted to the risks associated with using syringe or pen needles ≥6mm in children. (75,90,92,114) A 2

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5.0

Needle Length

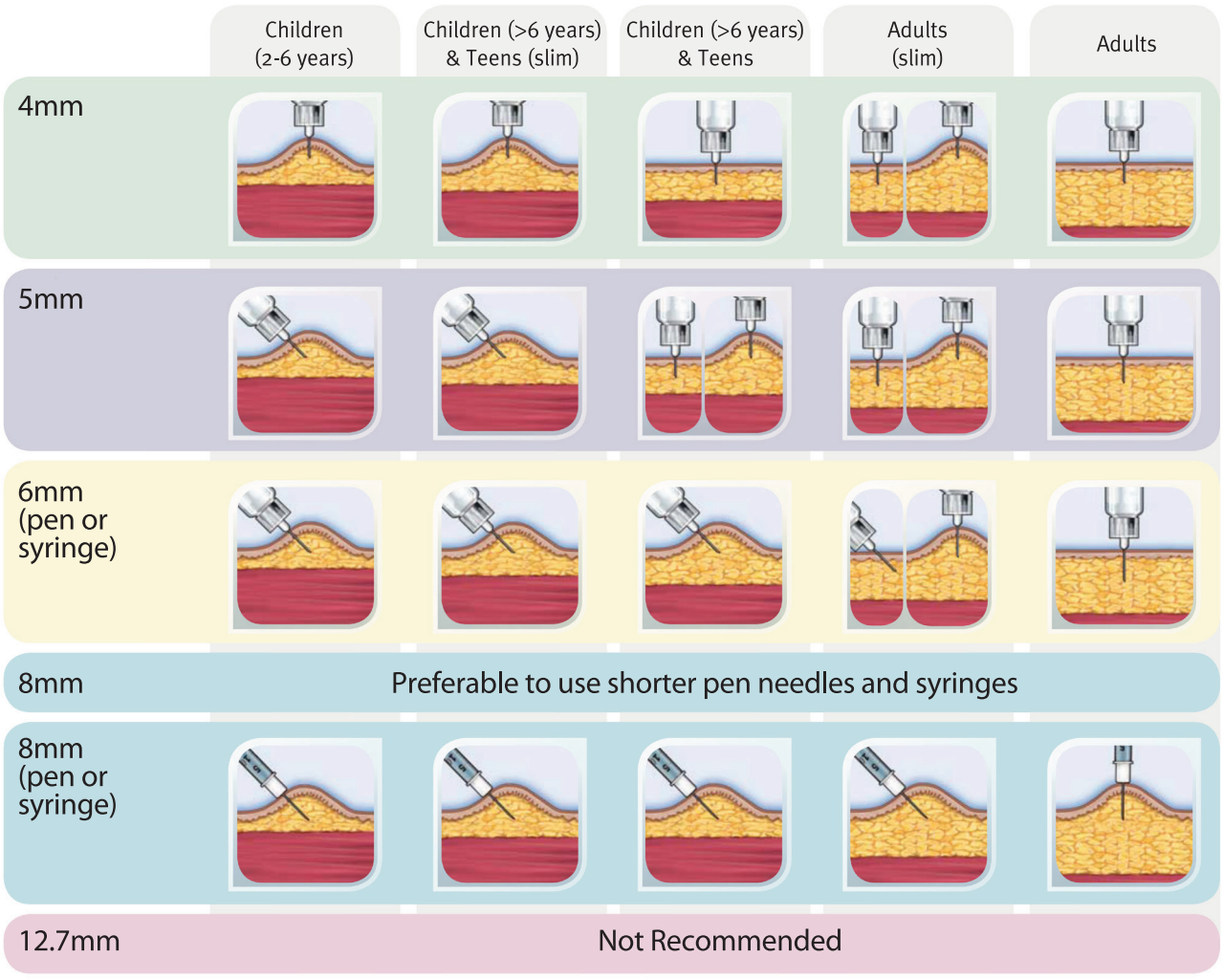

Figure 6. Selecting the correct needle length and its injection technique

6.0

Safety use of Device

- Pens and cartridges are for a single patient and should never be shared between patients due to the risk of biological material from one patient being drawn into the cartridge and then injected into another. (21,115) A 2
- Needles should be disposed immediately after use instead of being left attached to the pen. This prevents the entry of air (or other contaminants) into the cartridge as well as the leakage of medication out, which can affect subsequent dose accuracy. (21,116,117-120) A 2
- Injecting through clothing should be discouraged. As needle lengths are becoming shorter there is increased risk of intradermal injection.
- When drawing up insulin, the air equivalent to the dose should be drawn up first and injected into the vial to facilitate insulin withdrawal.
- If air bubbles are seen in the syringe, tap the barrel to bring them to the surface and then remove the bubbles by pushing up the plunger.
- Unlike syringes, it is necessary to hold the pen needle under the skin for 10 seconds after the plunger has been depressed. (116,117,121) A 3
- **Syringe and needle should be disposed of safely, for example using a sharps container. (21,117-120)** A 2
- Needle Reuse
  - Syringe or pen needles should only be used once. (42,43,72,122-125) A 2
  - Reusing insulin needles is not optimal injection practice and patients should be discouraged from doing so.

Tips for Safe use of Device

- No sharing of pens and cartridges
- Avoid injecting through clothing
- Single use of syringes and pen needles
- Disposed sharps into sharps container or its equivalent

Syringes

- Inject the same amount of air as insulin dose into insulin vial first
- Remove air bubbles from syringe by tapping the barrel and pushing up the plunger

Pens

- Dispose pen needles immediately after use
- **Unlike syringes, pen needle must be kept under the skin for 10 seconds after injecting insulin for accurate dosing**

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7.0 Lipohypertrophy

7.1 Identifying Lipohypertrophy

- HCP should examine insulin injection sites at every visit if possible or at least once a year for patients on insulin therapy. Physical examination for lipohypertrophy should be done more frequent if patient is known to have lipohypertrophy. (4,40) A 2
- Physical examination of the injection site is best done when patient is lying down (to relax abdominal muscles) but it can also be done with the patient sitting or standing. (Figure 7)
- Patient to identify the areas where they have been injecting insulin. Inspect the identified injection sites. Look out for any subtle rise across the skin surface. Lipohypertrophy usually appears as a raised bump or lump. In some patients the lipohypertrophy area may appear shiny or hyper-pigmented.
- With clean and warm hands, palpate the injection sites with the tips of the fingers. Palpate the area with light massage like motions (circular sweeps). Lipohypertrophy is present if the palpated subcutaneous tissue is hard, more rubbery or less bouncy.
- If lipohypertrophy is detected, obtain patient's consent and demarcate lipohypertrophy area with a skin-safe marker so that patient can see the lipohypertrophy area clearly. Document and record the lipohypertrophy area in the clinical record for future assessment. (58,126) A 2

Figure 7. Multiple lipohypertrophy all over abdomen. (Photo courtesy of patient)

7.2 Managing Lipohypertrophy

- Advise patient to avoid injecting over lipohypertrophy area until re-examination at next visit. (51,52) A 2
- When switching injection sites from lipohypertrophy area to normal subcutaneous tissue, encourage patient to monitor glucose level frequently as patient is at risk of developing hypoglycemia. HCP should consider insulin dose reduction when patient is switching injection sites from lipohypertrophy area to normal subcutaneous tissue. (127,128,129) A 1
- Advise patient not to re-use insulin needle as there has been association between reusing needle and lipohypertrophy. (58) A 2
- Patient should be taught on how to prevent lipohypertrophy by receiving training for proper insulin injection technique, injection site rotation and self-examination for lipohypertrophy. (47,48,61) A 2

7.0

Lipohypertrophy

Lipohypertrophy Case 1

Figure 8.

Patient had been injecting insulin around umbilicus. Total daily dose (TDD) of insulin was 133 units a day. After switching injection sites from lipohypertrophy area to normal subcutaneous tissue, TDD reduced to 64 units a day. A reduction of > 50% of initial insulin dose. HbA1c improved from 9.4% to 7.5% within 3 months after switching injection sites on reduced dose of insulin. (Photo courtesy of patient)

Lipohypertrophy Case 2

Figure 9.

Patient had been injecting insulin on upper arm only. Frequent insulin injection over the same site caused lipohypertrophy and impaired insulin absorption. In addition,instead of injecting insulin into the subcutaneous layer of the arm, the patient above has been injecting insulin into his deltoid muscle. Injecting insulin into muscle may result to faster insulin uptake and increase risk of hypoglycemia. Since switching insulin injection from arms to abdomen, HbA1c improved from 8.3% to 7.3% in 1 month. Patient also reported more stable glycemic control with lesser hypoglycemia episode post meals. (Photo courtesy of patient)

A STRONGLY RECOMMENDED
B RECOMMENDED
C UNRESOLVED ISSUE

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2 At least one observational, epidemiologic or population-based study.
3 Consensus expert opinion based on extensive patient experience.

8.0

Troubleshooting for Injection Issues

8.1 Bleeding and Bruising

- Bleeding and bruising may occur once in a while, but it does not affect the absorption of insulin. (63) A 2
- If bleeding occurs, apply light pressure on insulin injection site to stop the bleeding. Do not rub the injection site as it may lead to bruising. Advise patient to avoid injecting insulin over bruised area until bruise has resolved.
- Injection technique has to be carefully assessed in patient who are using anticoagulant or antiplatelet agent as these may cause frequent or excessive bleeding or bruising.

8.2 Leakage of insulin

- Small amount of insulin leakage (little pearl of liquid at tip of insulin needle) can be ignored as it is usually not clinically significant. (121,130,131) A 1
- Advise patient to count up to 10 seconds after injecting insulin before removing pen needle from injection site. This is to ensure that all the insulin is delivered. (130) A 2
- For large doses of insulin, patient may need to count more than 10 seconds before removing pen needle from injection site or split the dose to reduce the insulin volume. (132) A 2
- However, if patient reports frequent leakage or dripping, to reassess patient's insulin injection technique as it may be due to poor insulin injection technique (121,130,131) A 2
- Use needles which have a wider inner diameter and improved insulin flow (e.g. Extra-thin wall needles). (133,134) A 1

9.0

Pregnancy

- The abdomen is a safe site for insulin administration in pregnancy. (135,136) B 2
- Given the thinning in abdominal fat from uterine expansion, pregnant women with any type of diabetes should use skin fold technique and shorter needles (4mm) to decrease the potential for intramuscular injections. (79,99,100,137) B 3
- Avoid injections around the umbilicus or area on the abdomen with taut skin (Figure 10) for recommended injection sites during the second and third trimesters of pregnancy. (79,137) B 3

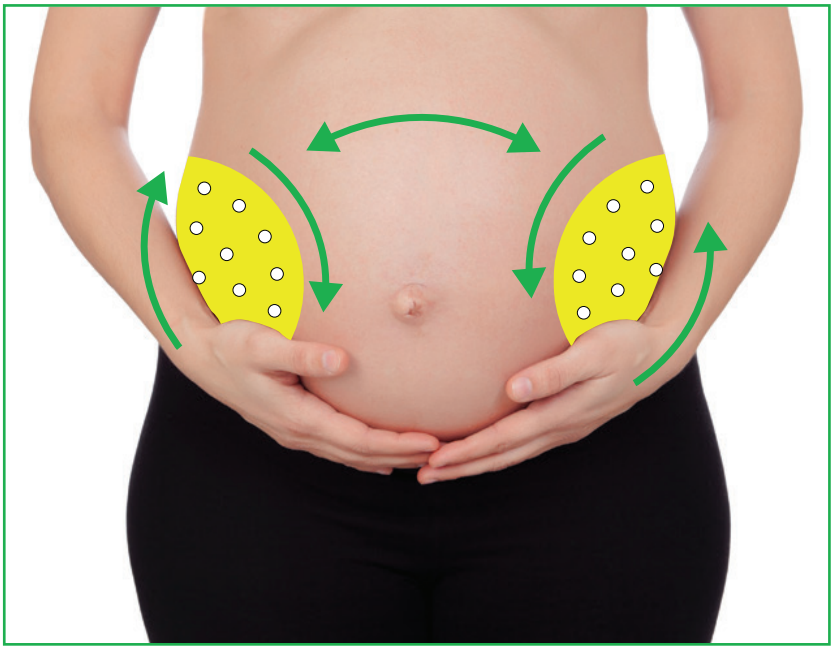

Figure 10. Recommended injection sites (highlighted in yellow) during the second and third trimesters of pregnancy

Key Points

- First trimester: Women should be reassured that no change in insulin site or technique is needed.
- Second trimester: Lateral parts of the abdomen can be used to inject insulin, staying away from the skin overlying the foetus.
- Third trimester: Patients may use the thigh, upper arm or lateral flanks of the abdomen.

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10.0

Insulin Pump Therapy

- Insulin pump cannula should be changed every 72 hours to minimise infusion adverse events over at the infusion site and potential metabolic deterioration. (138,139,140)
- All patients on insulin pump therapy must be taught to rotate infusion sites, similar to how patients are taught to rotate injection sites. (141,142)
- Patients on insulin pump therapy who presents with erratic glycemic control including unexplained hypoglycemia or hypoglycemia, should check their infusion sites for lipohypertrophy, scarring, inflammation or other conditions that could affect insulin flow or absorption (142)
- Healthcare professionals should check patient's insulin pump infusion site frequently or at least annually for lipohypertrophy. (143,144)
- If lipohypertrophy is present, instruct patient to avoid inserting insulin pump cannula over lipohypertrophy sites and insert cannula into healthy subcutaneous sites. (50,145,146)
- Suspect occlusion of insulin flow when a patient on insulin pump therapy has unexplained erratic glycemic control or unexplained hyperglycemia. (138,144,147,148)
- If occlusion or flow interruption is suspected, patients should consider changing to a new cannula (138,143,147)
- Patients on insulin pump therapy should consider using the shortest needle or cannula to minimise the risk of intramuscular infusion. (149)

Key Points

- Change insulin pump cannula every 72 hours (3 days)
- Rotate infusion sites regularly to prevent lipohypertrophy
- If glycemic control on insulin pump is erratic, check infusion sites to assess for any conditions that may affect insulin flow or absorption
- Check infusion sites for any lipohypertrophy at least once a year
- Avoid inserting infusion cannula over lipohypertrophy sites
- Choose shortest needle or cannula to reduce risk of intramuscular infusion

11.0

Needle Stick Injuries/ Blood-borne Infection Risk

- The use of shorter needles (e.g. 4mm pen needles) without a skin fold is recommended to minimise the risk of needle stick injury through a skin fold. (68,78,112,150) A 2
- If a lifted skin fold is used, the patient, caregiver, or healthcare provider should ensure that index (and/or middle) finger and thumb are approximately 2.5cm (1 inch) apart and should make the injection into the centre of the fold to minimise the risk of needle stick injury through a skin fold.(150) A 2
- Needle should not be recapped. (151-155) A 1
- Sharps containers must be easily accessible at the point of care beside the patient, prior to the injection or infusion. (151-156) A 2 (Figure 11 & 12)
- Patients, caregivers, and all others who may be in contact with needles, should be provided information on needle stick injuries prevention and safe needle disposal. (155) A 2
- Potential adverse events of needle stick injuries (i.e. blood-borne infection such as Hepatitis and HIV) should be emphasized to the patients' caregivers and service providers.
- Healthcare Institutions should carry out needle stick injury awareness roadshows regularly and should include all persons in potential contact with medical sharps. (152-158) A 1
- Healthcare Institutions should mandatory screen new healthcare workers' Hepatitis B status and offer all workers exposed to sharps Hepatitis B vaccination should they have no immunity against the disease and have never receives the vaccination. (153,159,160) A 1
- All persons in potential contact with medical sharps should be familiar with first aid and healthcare institution's needle stick injury protocol. (155,160) A 2
- Healthcare Institutions must provide a safe culture for healthcare workers to report needle stick injury or non-compliance to guidelines for the safety of the healthcare workers and the assessment of educational needs. (151-155,160,161) A 1
- Insulin pens, pen cartridges and vials should not be shared in order to prevent the transmission of infectious diseases. (162,163) A 2

Figure 11. Sharps container for Pen Needles

Figure 12. Sharps container for Insulin Syringes

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12.0

Ensuring Quality and Safety

- All healthcare providers, employers, and employees must comply with relevant international, national, and local legislation for the use of sharps.
- Inform health workers in possible contact with sharps to be aware of local safety and disposal regulations, and legal, societal and health related consequences of noncompliance. (164) A 3
- Provide standardized sharps containers that is easily accessible at the point of care beside the patient.
- Provide safety injection devices and ensure there are protective mechanisms for all sharps. Figure 13 is an example. (165) B 1
- Ensure health workers are scheduled for vaccination on hepatitis and review annually.
- Train health workers to avoid needle recapping.
- Provide education to health workers who are required to use a lifted skin fold must exhibit caution to avoid needle stick injury.
- Encourage health workers in reporting of near misses and needle stick injuries. Employers should establish a blame-free culture, review of all needle stick injuries and near misses should take place regularly to assess educational needs and allow for policy change.
- Provide education to patients, care-givers and all others on safe disposal of sharps, and never placed sharps directly in public or household trash bin.
- Encourage use of a needle clipping device, a sharps container to dispose according to local policy.

Figure 13. Safety pen needle with patented automatic dual-protection shields on both ends of the needle

13.0

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Appendix
Golden Rules
Injection Technique in Adults [1-4]

1. Insulin and GLP 1 receptor agonists must be deposited into healthy subcutaneous fat tissue, avoiding the intradermal and intramuscular spaces as well as scars and lipohypertrophy.

2. 4mm pen needles inserted at ninety degree angle are recommended for all adults regardless of age, gender or BMI. If patients need to use needle lengths >4mm or a syringe (or where the presumed skin surface to muscle distance is less than the needle length) they must use a correctly-lifted skinfold to avoid IM injections.

3. Recommended sites for injection are abdomen, thighs, buttocks, 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 third anterior lateral aspect both thighs

    c. Posterior lateral aspect of both upper buttocks and flanks

    d. Mid third posterior aspect of upper arms

4. Detect and avoid injection into areas of lipodystrophy.

5. Rotation of injection sites is critically important and can be correctly performed by:

    a. Spacing injections within a site approximately one finger's breadth apart

    b. Using a single injection site no more frequently than every 4 weeks

1. Frid et al, 2015 , New Recommendations, Anatomy and Physiology. Accessible at www.FITTER4Diabetes.com
2. Frid et al, 2015 , New Recommendations, Pathology. Accessible at www.FITTER4Diabetes.com
3. Frid et al, 2015 , New Recommendations, Psychology and Technology. Accessible at www.FITTER4Diabetes.com
4. Frid et al, 2015 , New Recommendations, Glossary, Attendees, Golden Rules. Accessible at www.FITTER4Diabetes.com

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Golden Rules
Injection Technique in Children and Adolescents [1-2]

1. Insulin must be deposited into healthy subcutaneous fat tissue, avoiding the intradermal and intramuscular spaces as well as scars and lipohypertrophy.

2. Injection should avoid bony prominences by one to two adult finger widths. Preferred sites are:
   a. Abdomen, two adult finger widths away from umbilicus
   b. Upper third anterior lateral aspect of both thighs
   c. Posterior lateral aspect of both upper buttocks and flanks
   d. Mid third posterior aspect of upper arms

3. Consideration should be given to the type of insulin and the time of (injection) day when selecting injection sites.

4. Correct rotation of injection sites must be followed at all times to prevent lipohypertrophy and 4mm pen needles should be used for all children and adolescents regardless of age, gender or BMI.

5. Children and adolescents are at risk of accidental IM injection. A two-finger lifted skinfold usually prevents IM injection except in the thigh. Lean children should use a lifted skinfold when the presumed skin surface to muscle distance is less than the needle length plus 3mm.

1. Frid et al, 2015 , New Recommendations, Anatomy and Physiology. Accessible at www.FITTER4Diabetes.com
2. Frid et al, 2015 , New Recommendations, Pathology. Accessible at www.FITTER4Diabetes.com

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Golden Rules
Treating and Preventing Lipohypertrophy [1-3]

1. All patients who inject or infuse insulin must have their injection sites checked at every regular visit, or at least every year:
    a. HCPs in diabetes must be trained to correctly screen for lipohypertrophy and other site complications
    b. All persons who self-inject/infuse insulin or other injectables must be taught to self-inspect injection sites and be able to distinguish healthy from unhealthy skin
2. Clinicians must monitor and record evolution of lipohypertrophy, possibly using photography (with patient's consent), body maps with descriptors for size, shape, texture or transparent graduated recording sheets.
3. With patient consent clinicians should mark the border of all lipohypertrophy and other site complications with skin-safe single-use markers and instruct patients to avoid using marked areas until instructed otherwise.
4. Patients with lipohypertrophy who have been instructed to stop injecting/infusing into affected tissue must be:
    a. Allowed to experience the actual metabolic difference it makes to use normal tissue instead of lipohypertrophy (as this is a key to long-term adherence)
    b. Informed that some pain may be experienced when injecting into normal tissue
    c. Supported by a HCP to monitor glucose levels frequently due to the risk of unexpected hypoglycemia
    d. Assisted in the reduction of their insulin doses in line with glucose results, knowing that reductions often exceed 20% of their original dose
    e. Use 4mm Pen Needles/6mm Insulin Syringes or the shortest needle length available to minimise accidental IM risk due to using larger zones
    f. Use advanced tip geometry including thin gauge and extra thin wall needles (if available) to minimise pain and discomfort and to maximise ease of injection
5. All patients must be supported to correctly rotate injection/infusion sites and cautioned of the risks of reusing needles to minimise risk of injection site complications.
    a. Principles of correct rotation technique must be taught to patients and rotation technique assessed at least every year and more frequently if required
    b. Correct rotation ensures that injections are spaced out approximately 1 cm (a finger breadth) from each other and that a single injection site is used no more frequently than every 4 weeks

1. Frid et al, 2015 , New Recommendations, Anatomy and Physiology. Accessible at www.FITTER4Diabetes.com
2. Frid et al, 2015 , New Recommendations, Pathology. Accessible at www.FITTER4Diabetes.com
3. Frid et al, 2015 , New Recommendations, Psychology and Technology. Accessible at www.FITTER4Diabetes.com

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Golden Rules
Psychological Issues around Insulin Delivery [3]

1. All patients and care givers should be offered general as well as individualized education/ counselling which will facilitate optimal care.
2. Ensure all patients and care givers are supported by their HCP using patient-centered evidence-based psychological educational tools / strategies to achieve mutually-agreed goals.
3. Diabetes care HCP should be skilled in identifying psychological issues which impact insulin delivery.
4. HCPs must have a range of therapeutic behavioral skills to minimize the psychological distress and the impact of insulin therapy.
5. Various methods of **minimising** pain and/or fear of injection should be utilized in order to reduce psychological impact.

3. Frid et al, 2015 , New Recommendations, Psychology and Technology. Accessible at www.FITTER4Diabetes.com

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Golden Rules
Needlestick injuries and Sharps disposal [3]

1. All HCP, employers and employees must comply with relevant international, national and local legislation for the use of sharps.

2. Sharp medical devices present a potential risk for injury and transmission of disease. All HCP, employers and employees must ensure the safest possible working environment by
   a. Conducting regular risk assessment and providing continuing education and training
   b. Providing and using a means of safe disposal of used sharps
   c. Prohibiting needle recapping (except by the self-injector)
   d. Encouraging reporting of incidents

3. **Safety engineered devices must be used by all HCP and by all caregivers to minimise risk for disease transmission (i.e. HIV and hepatitis).**

4. Safe needle disposal requires that:
   a. Correct needle disposal procedures and personal responsibility be taught and reinforced regularly to patients and caregivers
   b. Safe sharps disposal systems and processes be present and known to all persons at risk of sharps contact
   c. Patients diagnosed with blood borne diseases such as HIV and Hepatitis be supported to use safety-engineered devices and dispose of them safely
   d. Sharps must never be discarded directly in public or household trash bin

1. Frid et al, 2015 , New Recommendations, Anatomy and Physiology. Accessible at www.FITTER4Diabetes.com
2. Frid et al, 2015 , New Recommendations, Pathology. Accessible at www.FITTER4Diabetes.com
3. Frid et al, 2015 , New Recommendations, Psychology and Technology. Accessible at www.FITTER4Diabetes.com

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Golden Rules
Insulin Infusion[1,3]

1. Insulin infusion cannula must be inserted into healthy subcutaneous fat tissue, avoiding underlying muscle as well as areas of skin irritation, scarring, lipohypertrophy and lipoatrophy.

2. If bleeding or significant pain occurs upon insertion, the set should be removed and replaced.

3. Preferred sites for infusion cannula should be individualized but include:
    a. Abdomen, avoiding bony prominences and umbilicus
    b. Posterior lateral aspect of both upper buttocks and flanks
    c. Mid third posterior aspect of upper arms
    d. Upper third anterior lateral aspect of both thighs

4. Infusion cannula sites should be rotated to avoid complications. This usually involves moving to a new location. In-site duration should be individualized but typically should not be more than 72 hours.

5. If kinking occurs consider a shorter cannula or an oblique or steel set. If silent occlusions or unexplained hyperglycemia occur, consider using a different type of infusion set, including a cannula with a side port, if available.

1. Frid et al, 2015 , New Recommendations, Anatomy and Physiology. Accessible at www.FITTER4Diabetes.com
3. Frid et al, 2015 , New Recommendations, Psychology and Technology. Accessible at www.FITTER4Diabetes.com

Note

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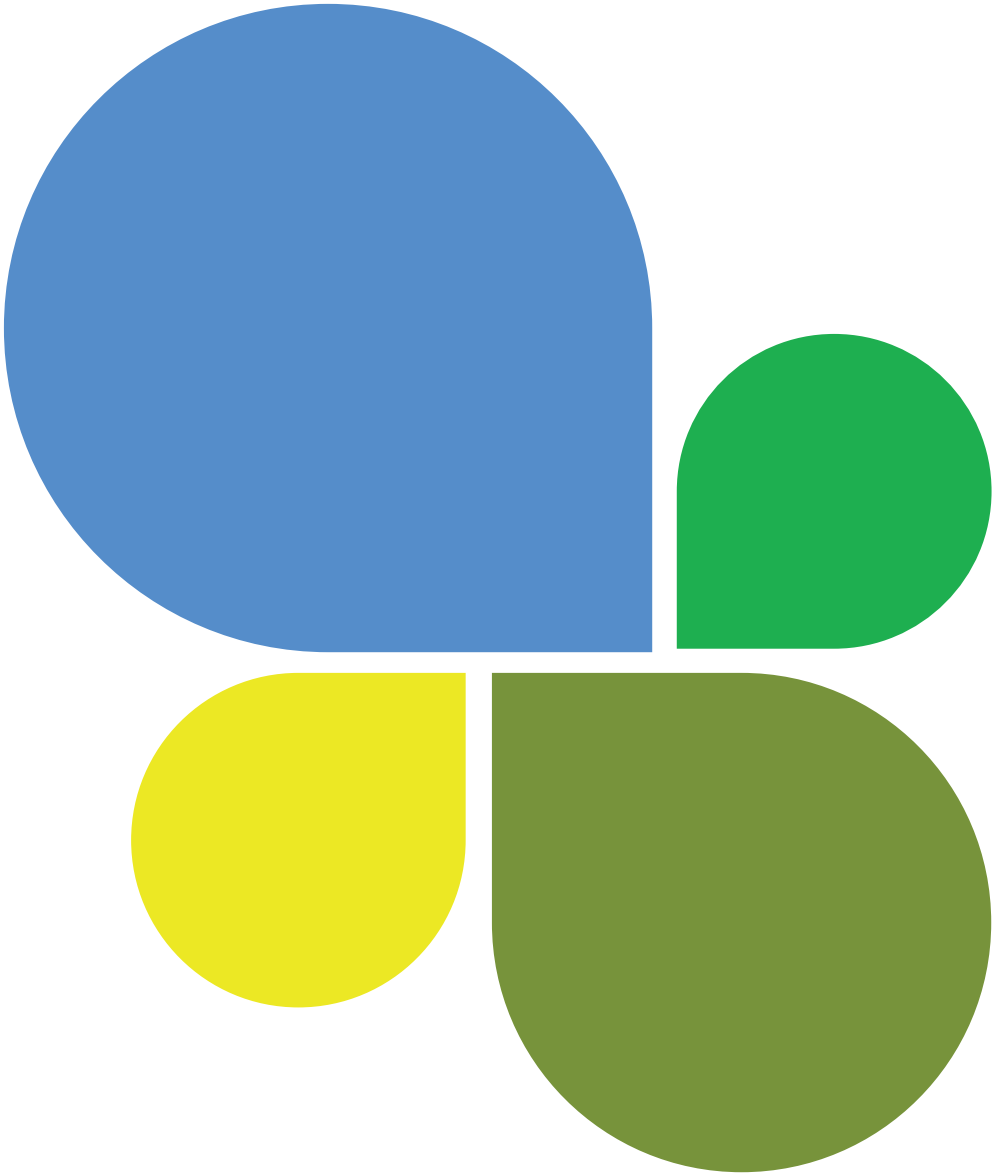

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