Teaching Injection Technique to People with Diabetes

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For people with diabetes who take insulin or other injectable diabetes medications, the diabetes educator can teach evidence-based standardized methods to improve clinical outcomes. The diabetes educator can enhance and maximize:

- Patient engagement in self-care management
- An understanding of the action of the medication
- The comfort of the injection
- Safe and effective medication dosing including when and how to take
- Site inspection and rotation to decrease absorption variability

While discussions regarding insulin and other treatment algorithms to improve glycemic control is ongoing, the aim of this advisory is to outline best practices for subcutaneous injection technique that should be covered by diabetes educators when teaching patients how to inject diabetes medications.

State laws regulate which healthcare professionals are authorized by their license to provide hands-on instruction for injection administration.

As with any type of patient education, it is essential to individualize the educational needs assessment (determining what the patient already knows/does, as well as exploring fears and barriers to self-care) and to make accommodations for patient literacy and numeracy levels, cognitive and visual abilities, and other impairment issues. The educator should assess the patient's skills and understanding by observing teach-back and having the patient describe an action plan.

Recommended Topics:

- Education about injection technique for delivery of insulin, including a review of hypoglycemia (causes, detection, treatment and prevention) as well as when to check blood glucose and individualized pre and post meal targets
- Periodic review of injection technique and sites, especially when blood glucose control is suboptimal
- Use, care and action of the medication(s) to be administered

- Choice of injection devices, considering ease of use and patient limitations e.g. manual dexterity, hearing and visual impairment
- For pre-filled devices, considering opened expiration date, total number of units/mg in device and daily dose when choosing devices, when applicable
- Injection site selection and rotation, including teaching patient to examine sites for lipohypertrophy
- Choice of needle: length and gauge to maximize comfort and efficacy
- Technique
- Timing of injection, related to the effect of the medication, meals, activity and stressors
- Targets for dosing adjustments related to monitoring, activity, stressors, and meals
- Injection discomfort and complications
- Safe disposal of used sharps
- Quality control including medication storage considerations, opened and unopened expiration dates
- Inspection of the injectable medication before each use

Use, Care and Action:

- Insulin should not be shaken since bubbles can interfere with proper dosing
- Keep unopened containers in the refrigerator until first use
- Store injectables that are in use at room temperature (65-80 degrees F) to avoid variation of absorption and comfort. Cold injections may absorb more slowly and can cause discomfort.
- Never freeze insulin. If frozen, insulin should be discarded.
- If altered in appearance, discard and use a new vial or pen (with a normal appearance) to ensure potency
- Unopened expiration dates of medications should be checked prior to use. Once vial or pen is opened, follow manufacturer's instructions on when to discard. Dates can vary greatly from medication to medication, by brand and type of insulin.

Injection Site Selection Rotation and Technique:

Rotation of the injection site helps reduce irritation and bruising and improves absorption. This is especially important for lipohypertrophy (LH) prevention, a complication reported in nearly 50% of individuals using insulin. LH is a swelling or hardening of fat tissue associated with injecting into the same site over time without rotating sites.[1] Teach individuals who are self-injecting medications to inspect the intended injection site prior to injection by looking and feeling for hardened areas; to understand the need for regular site rotation and to avoid injecting into areas of LH, inflammation, edema, scar tissue, moles or infection.[2]

- It is good practice to wash hands prior to injecting medication. Outside of institutional settings, disinfecting the site is not required unless site is not clean.[3] Patients should be advised not to inject through clothing.
- Insulin should be injected into subcutaneous fat, avoiding muscle. Careful site selection and use of shorter needles helps prevent intra-muscular (IM) injections. IM injections can lead to glycemic variability and hypoglycemia as well as an increased risk of bleeding, bruising and pain at the injection site.
- The most desirable injection site is the abdomen (or stomach) for the most predictable absorption. It is recommended to inject an inch apart each time, and rotate with each quadrant, avoiding the area within two inches of the umbilicus or within one inch of the hipbones.
- The back of the upper arms, the upper buttocks or hips, and the outer side of the thighs can also be used, but encourage patients to avoid the areas if exercising that muscle group (walking, running, weight lifting) soon after the injection as it may impact the speed of insulin absorption.
- If using the thighs, it is recommended to avoid within one hand width of the groin or the knee.

Choice of Injection Device:

The most common choices for medication injection are vial and syringe, or insulin pens that are pre-filled or have a pre-filled cartridge.

Note: Other methods for delivery of insulin are inhaled, via i-ports, or an insulin pump. These will not be addressed in this paper.

The decision for which type of delivery device used may be a function of the particular medication, which may only be available via that delivery system.

Both syringes and pens have characteristics which can be perceived as advantages and/or disadvantages. Financial factors, such as insurance coverage, can impact injection device choice. Pens are designed with audible clicks and tactile sensitivity for the visually impaired and can also be a useful alternative for dexterity considerations. Pens also have shorter needles available (4 & 5mm) compared to syringes (6mm & >).

Vial and Syringe:

Insulin is typically injected subcutaneously using an insulin syringe which is measured in units of insulin. Injecting a volume of air first equal to the amount of medication to be withdrawn from the vial greatly eases pulling the medication into the syringe. If air bubbles appear in the syringe, tapping the syringe with the needle

end held upright is an effective means to move air bubbles to the top where they can be pushed out via the plunger.[1] The patient should check the remaining insulin in the syringe to ensure the correct amount of insulin remains in the syringe. Since the aim is to inject the medication in the subcutaneous space[4] while at the same time minimizing discomfort, smaller gauge and shorter needles are preferable to decrease the chance of IM injection.[4]

Although reuse of either needles or syringes is not recommended, many patients adopt this practice.[1] Needles, syringes and insulin pens should never be used to administer insulin to more than one person and should be disposed of immediately after use in an approved sharps container. The *One & Only Campaign,* a public health campaign led by the Centers for Disease Control and Prevention and the Safe Injection Practices Coalition, offers educational resources that can be used to promote safe injection practices.[5]

Pens:

- It is important for individuals considering use of pens to understand that they will not be able to see the insulin being injected and that while obstructed flow with pens is rare, it can occur.[3]
- Priming the pen prior to each dose ensures that the flow is not obstructed. Pens need to be primed according to the manufacturer's instructions.
- It is recommended that patients properly discard needles after each injection because the needle can provide a channel for the medication to leak from the cartridge. Failure to do this may allow air to enter the pen, which will affect pressure in the device and accuracy of the dose delivered.
- It is essential to raise awareness that pens and cartridges are for use by a single individual and should not be shared.
- Drawing insulin out of a pen device can also change the pressure and affect accuracy in dosing and therefore should not be done.
- Four mm 32-gauge pen needles are appropriate for most individuals including lean, or obese adults, and children for minimizing discomfort while optimizing medication delivery. It is considered the safest pen needle for all patients.[3]

Injection Technique:

When administering medication with a syringe, the needle should be inserted quickly (but carefully), and removed from the skin at the same angle it was inserted.[6] If a 4-mm needle is used, it should be inserted at 90-degree angle. Very young children (≤6 years old) and very thin adults should use the 4-mm needle by lifting a skinfold and inserting the needle perpendicularly into it. When any syringe needle is used in children (≥6 years old), adolescents, or slim to normal-weight adults (BMI of 19-25), injections should always be given into a

lifted skinfold to lower the risk of IM injections.[6] Injecting at a 45° angle using a 6-mm syringe needle is an acceptable substitute for lifting a skinfold because the net penetration of a 45° injection using the 6-mm needle is approximately 4 mm.[7] Others may inject using the 4-mm needle without lifting a skinfold.[6]

When administering medication with a pen, after pushing the thumb button in completely, wait for a slow count to 10 before withdrawing the needle to help reduce leakage and ensure injecting the full dose of the medication.[1, 7] Patients should be advised to observe that the dose dial has returned to "0" in the dosing window, before removing the needle.

Injection Discomfort and Complications:

It is useful for individuals to be aware of possible complications from injections so that they are prepared for an appropriate course of action. Patients should recognize the appearance of lipohypertrophic tissue and avoid injecting into this tissue as it may alter kinetics of insulin absorption.[8] There are a number of practical tips for minimizing pain during injection that should be shared as part of the process of educating about injection.[9] These include:

- Take insulin and other injectable medication at room temperature.
- Always use a new needle for each injection. New needles are lubricated and glide gently through skin, lowering the risk of discomfort and LH.
- Remove air bubbles from the syringe prior to injecting.
- Wait for alcohol to evaporate completely from injection site prior to injection.
- Avoid use of rubbing alcohol after the injection.
- Insert the needle under the skin in a smooth but not jabbing movement.
- Inject insulin slowly, count to 10 before removing the needle to receive the full dose.

Disposal of Used Sharps:

There is a need to raise awareness about the risks associated with sharps, including syringe and pen needles so that persons with diabetes can minimize infection risk to themselves and others. This should include information about proper disposal both at home and in public places, as well as being alert to keep all needles and other sharps out of the reach of children and pets.[10] The Centers for Disease Control and Prevention has resources for safe needle disposal: http://www.cdc.gov/niosh/topics/bbp/disposal.html.

Conclusion:

The diabetes educator plays a key role in the initial teaching and periodic review of proper injection technique to patients receiving insulin injections. These evidence-based recommendations will help guide the education of patients and health care professionals to deliver safe and effective injections.

AADE Patient Education Resources

https://www.diabeteseducator.org/practice/educator-tools/insulin-injection-resources2

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