Advances in Injection Technique: Impact on Adherence in Patients with Diabetes

Patient nonadherence to treatment for diabetes can contribute to adverse clinical outcomes, including increased glycated hemoglobin levels and risk of complications of uncontrolled diabetes. With adherence rates to insulin therapy among patients with type 2 diabetes as low as 60%, there is ample room for improvement. Recent advances in injection technique have the potential to help improve patient adherence to injectable therapy for diabetes.

Perceptions Regarding Injectable Therapy
Several currently available therapies for diabetes are administered via injection, including various types of insulin, an amylin analogue, and glucagon-like peptide-1 agonists; however, many patients fear needles and injections. According to a survey released in 2008 by the American Association of Diabetes Educators, which included a group of 500 patients who required insulin to manage their diabetes, approximately one-third of patients experienced some level of dread relating to their daily insulin injections. About half of patients indicated that they would be more adherent if they could ease the pain and discomfort associated with their insulin injection. Insulin therapy is frequently perceived by the patient as therapy of “last resort,” only used after failure of oral antidiabetic agents. When insulin therapy is described as the last remaining choice to manage a patient’s diabetes, the health care provider is conveying a message that insulin is a negative component of diabetes management. Results from the Diabetes Attitudes, Wishes, and Needs study showed that about half of patients with type 2 diabetes perceived that starting insulin therapy meant they had failed to follow treatment recommendations properly. Patient barriers to insulin therapy may also be perpetuated by health care providers who may have a general reluctance to initiate insulin because of patient and physician perceptions about the complexity of insulin administration and potential risk for adverse events (eg, weight gain, hypoglycemia).

Advances in Injection Devices
The devices required for administration of injectable therapy have changed significantly from the days of early glass syringes with detachable needles that were sterilized and sharpened with each use. Single-use, sterilized plastic syringes (introduced in the 1960s) and insulin pen delivery systems have become the mainstays of insulin administration. Over the years, needle length and diameter have progressively decreased, from 12 mm, to 8 mm, and now 5 mm and 4 mm (Figure 1). Shorter needles are easier to use, less painful, and preferred by most patients. Needles are beveled and lubricated for ease of injection with improved comfort.

Study data from Hirsch and colleagues support the use of shorter-length needles. The use of 3 different pen needles (4 mm x 32G, 5 mm x 31G, and 8 mm x 31G) was evaluated in 168 patients with type 1 and 2 diabetes. Patients were stratified by their insulin dose: up to 20 units for the low-dose group and 21 to 40 units for the regular-dose group. Patients demonstrated equivalent glycemic control between the 4-mm and 5-mm needles, and no correlation was observed with either insulin dose or body mass index (BMI). The shorter 4-mm needle was reported to be less painful and easier to use without causing increased leakage at the injection site. The 4-mm needle was also preferred by most patients. A post hoc analysis of data demonstrated that a 4-mm needle length had no association with change in glycemic control in obese and non-obese patients.

Advances in Injection Technique
Proper injection technique involves administering insulin into the subcutaneous layer without reaching the muscle layer. Common injection sites include the upper arm, antero-lateral upper thigh, abdomen, and buttocks. Intramuscular (IM) administration, which may more commonly occur in the thigh or buttocks, should be avoided to prevent the risk of increased insulin absorption and subsequent unanticipated hypoglycemia. Injection technique includes a wide range of variables such as site of injection, needle length, angle of needle insertion, and use of lifted skin fold.

Information about the thickness of the skin (epidermal-dermal layers) and subcutaneous adipose layers at commonly used injection sites is necessary to identify the most appropriate needle length. Gibney and colleagues evaluated ultrasound measurements for skin and subcutaneous tissue thickness at 4 commonly used injection sites in 388 adults with type 1 and 2 diabetes. In this study, mean skin and subcutaneous tissue thickness varied by injection site—the thinnest skin and subcutaneous tissue layers were in the thigh and the thickest skin and subcutaneous tissue layers were in the buttocks (Table). Skin thickness was generally consistent across a diverse population when adjusted for race, age, and BMI (18-24.9, 25-29.9, and ≥30 kg/m²). However, subcutane-
ous tissue thickness was more variable, particularly by injection site, BMI, and sex. Based on these data and additional magnetic resonance imaging data, the authors noted that shorter-length (4-mm and 5-mm) needles may be successfully used to administer insulin at all sites in nearly all adults with diabetes. Moreover, shorter needles reduce the risk of painful IM injections that may lead to hypoglycemic reactions.13,15 Perpendicular insertion (ie, at a 90° angle) of 4-mm needles without raising a skin fold delivers insulin into the subcutaneous space over 99.5% of the time.15

Incorporating data from Gibney, Hirsch, and other recent studies, international guidelines for injection in patients with diabetes were recently updated (2010).16 Shorter needles (4, 5, and 6 mm) are recommended for use in adult patients with diabetes, and needles longer than 8 mm are not necessary. Shorter needles should be inserted at a 90° angle to the skin surface, but a skin fold may be warranted in some cases with 4- and 5-mm needles (eg, in lean individuals).

### Role of the Pharmacist

Diabetes is a progressive disease, and injectable therapy is an important component of its management. Pharmacists can play a key role in educating health care providers and patients who may not be aware of the advances in injection devices and technique, or the implications of recent study data. For example, the results of an international survey of more than 4000 patients with type 1 and 2 diabetes showed that over half of patients were using an insulin needle 8 mm or longer in length, suggesting that increased awareness of available choices in shorter and thinner needles is needed.17 Most patients prefer the shortest needles available, such as the 4-mm pen needle and insulin syringes with the 6-mm length needle. Pharmacists are in a unique position to counsel patients new to injectable therapy, and they can help address patients’ concerns regarding needles and injections by discussing available devices (eg, shorter needles) and proper injection technique to help reduce injection pain. Patients should be reassured that injectable therapy is a positive step in taking a proactive role in managing their glycemic control and it is not used as a “punishment” for not adhering to the treatment plan. Pharmacists can also educate patients already using injectable therapy about recent innovations in injection devices and proper injection technique. Proper selection and use of injection devices can help decrease pain associated with injections, and therefore may help improve adherence to injectable therapy in patients with type 2 diabetes.

### References