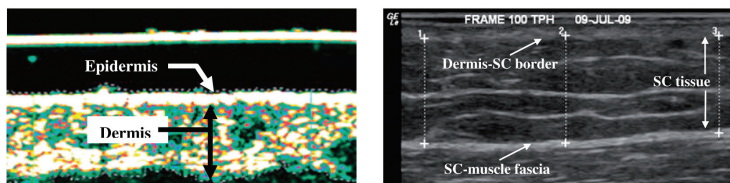


Adult skin and subcutaneous insulin injection site thickness in diabetes¹

During subcutaneous insulin therapy, inadvertent intramuscular (IM) injections may increase pain and/or adversely affect glucose control. The most appropriate needle length for patients depends on skin and subcutaneous adipose layer thickness.

Research design and methods:

388 U.S. adults with diabetes (in 3 body mass index (BMI) groups: <25; 25-29.9; and ≥30 kg/m²) with diverse demographic features were evaluated. Each subject had ultrasound measurements of skin and subcutaneous thickness (SC) at the four commonly used injection sites; rear upper arm, anterior upper thigh, anterior abdomen and upper outer quadrant of the buttock.

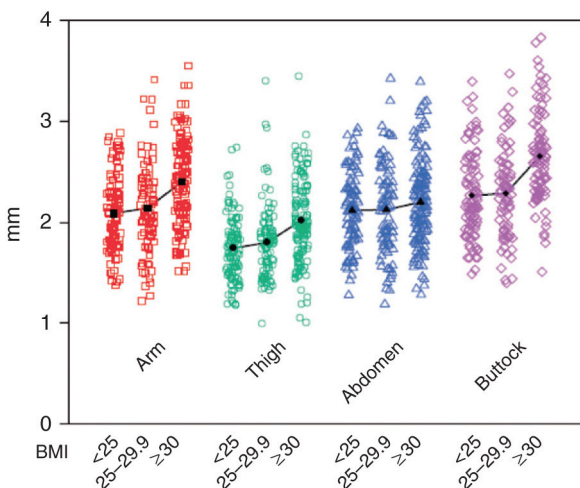


Skin and subcutaneous ultrasound images

Results:

BMI ranged from 19.4 to 64.5 kg/m², age 18 to 85 years; 40% were Caucasian, 25% Asian, 16% Black, 14% Hispanic; 28% had type 1 diabetes.

Mean skin thickness was; arm 2.2 mm, thigh 1.9 mm, abdomen 2.2 mm and buttocks 2.4 mm. Additional analyses showed body site, gender, BMI, and race are statistically significant factors for skin thickness but effects were small. Thigh skin thickness was <0.6 mm thinner than the buttocks. Differences of 10 kg/m² account for 0.2 mm skin thickness variation, i.e. the skin thickness difference between patients with BMI of 25 vs. 35 was only 0.2 mm.



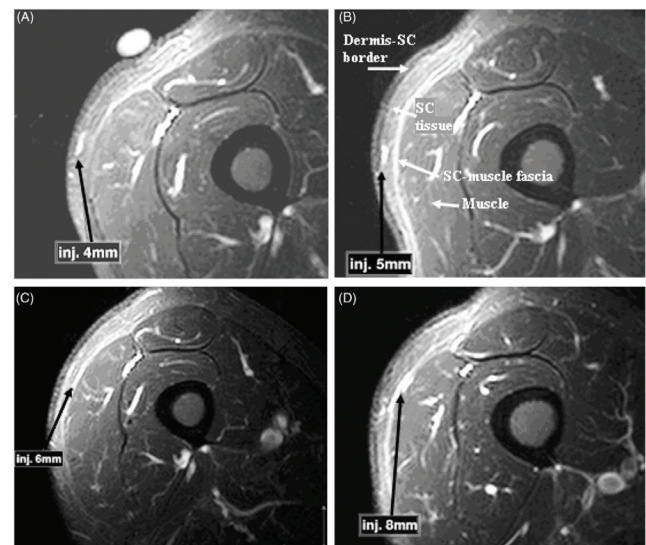
Skin thickness at each injection site by BMI

Mean subcutaneous thickness was: arm 10.8 mm, thigh 10.4 mm, abdomen 13.9 mm and buttocks 15.4 mm. Subcutaneous thickness in females was 5.1 mm greater than in males. Differences of 10 kg/m² account for a difference of 4 mm subcutaneous thickness.

Discussion:

This data supports the use of short needles for subcutaneous injection therapy. A 4 mm pen needle will successfully deliver medication subcutaneously at all sites in nearly all adults with diabetes. Specifically, it is estimated that perpendicular insertion of such needles will deliver drug into the subcutaneous space >99.5% of the time, without intradermal injections.

An additional MRI study shows precise anatomic deposition of small volume (4 “units”) saline injections into the thigh of a healthy adult male, BMI 25.2 kg/m²), using 90° insertions of pen needles 4-8 mm in length. Both the 4 mm and 5 mm pen needles deposit the saline within the SC tissue, whereas the 6mm injection is at the level of the muscle fascia, and the 8 mm injection clearly lies within the muscle tissue. Results would likely differ in patients with lower or higher BMI.



MRI images – injection depths with 4, 5, 6, and 8mm length needles²

Conclusions:

Injection site skin thickness does not differ by clinically significant degrees in demographically diverse adults with diabetes; subcutaneous thickness has a wider range. Pen needles ≥8 mm, inserted perpendicularly, may frequently enter muscle in limbs of males and those with BMI <25 kg/m². A 4 mm length pen needle, inserted perpendicularly without a raised skin fold, will consistently provide subcutaneous medication delivery.

¹ Gibney MA, Arce CH, Byron KJ, Hirsch LJ. Skin and subcutaneous adipose layer thickness in adults with diabetes at sites used for insulin injections: implications for needle length recommendations. *Curr Med Res Opin.* 2010; 26 (6): 1519–1530.

² MRI images provided by Drs. Anders Frid and Björn Lindén, 2010