



**INJECTION TECHNIQUE**

**IS IT IMPORTANT?**

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# Injection Technique: What Do We Know and What Do We Want to Know?

- What about insulin absorption? Are modern insulin analogues different from human insulins regarding absorption?
- In what tissue do we want to deposit insulin?
- What technique do we use to achieve that?
- Are different needle lengths suitable for different patient groups?

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# Christian Binder 1969:

- Soluble  $^{131}\text{I}$ -insulin (pig, U40) is absorbed faster from the abdomen compared to thigh with buttock in between.

C. Binder: Absorption of injected insulin. Thesis, Copenhagen 1969

% Residual activity

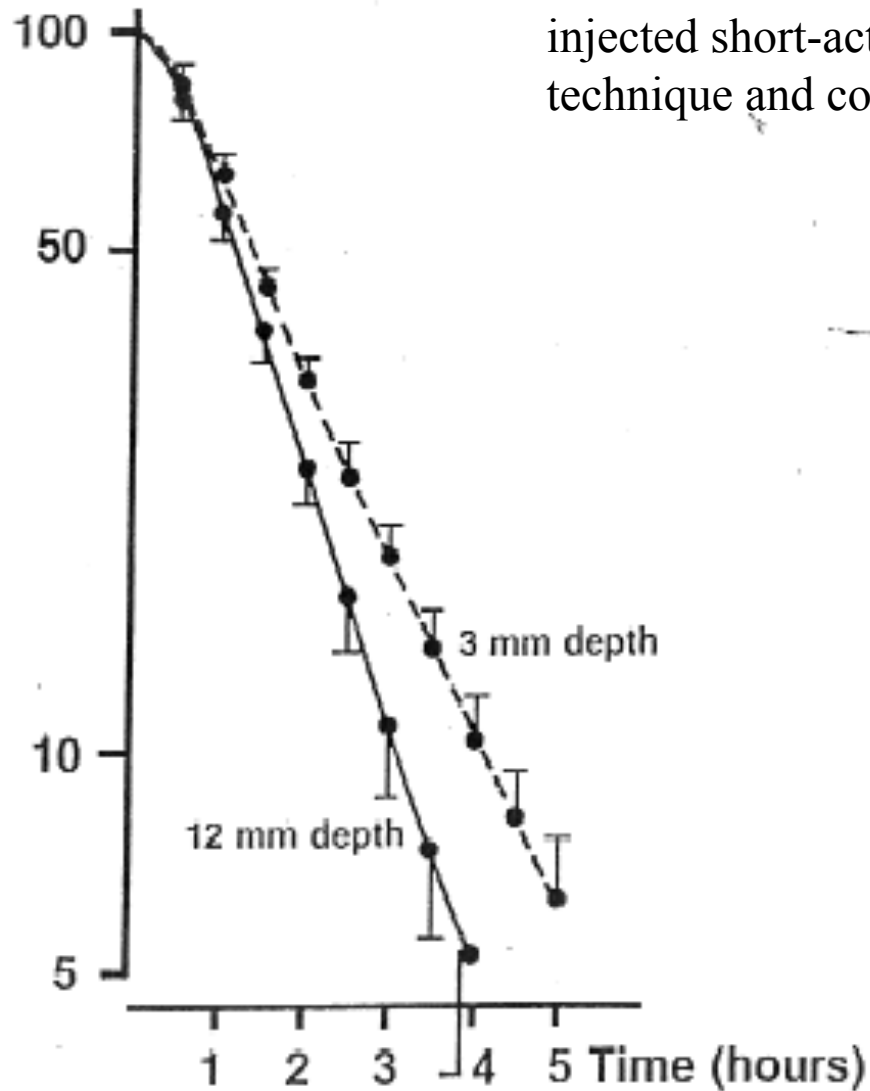


FIG. 1. Effect of injection depth on the disappearance of  $^{125}\text{I}$ -labeled insulin (Actrapid) from subcutaneous injection sites. (---) 3 mm depth; (—) 12 mm depth.  $P < 0.05$  after the first hour.  $N = 6$ .

# NPH insulin

- Henriksen et al: Absorption of NPH (isophane) insulin in resting diabetic patients: evidence for subcutaneous injection in the thigh as the preferred site.

Diabet Med. 1991 Jun;8(5):453-7.

# Effect of intramuscular injection, regular human insulin

31

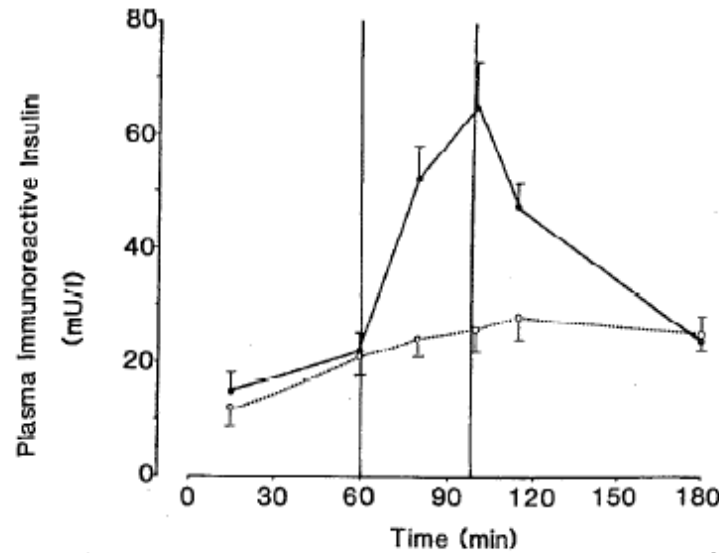
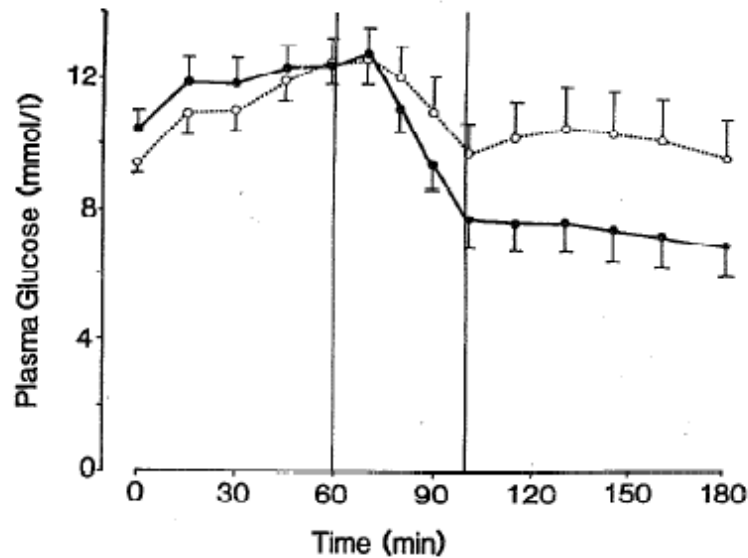
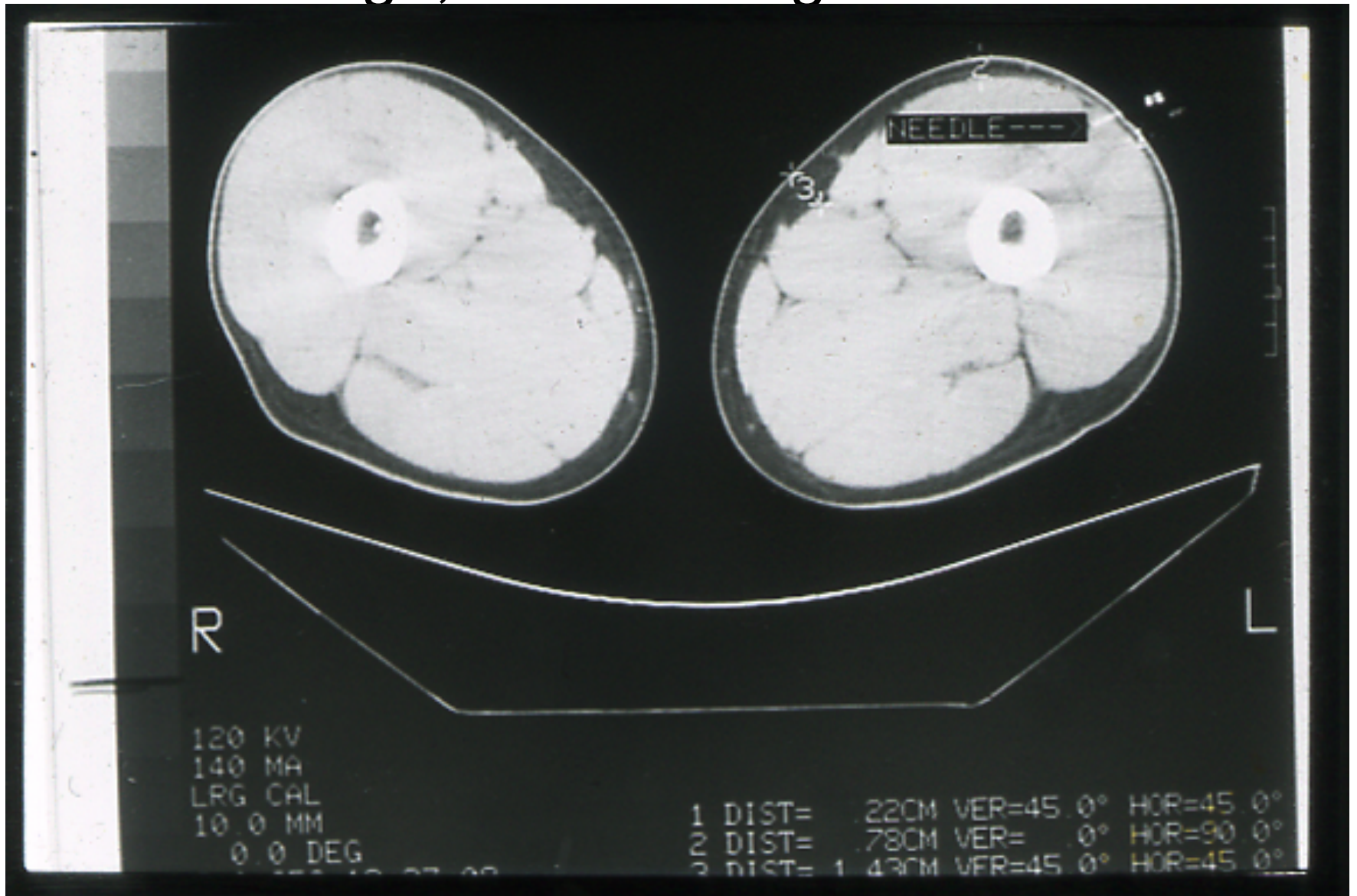


Fig 10. Plasma immunoreactive insulin following injection of  $^{125}\text{I}$ -labelled soluble insulin (Actrapid H 40U; 10U) in muscle (solid line) and fat (dashed line) tissue in 10 IDDM patients. Bicycle exercise is indicated between bars.

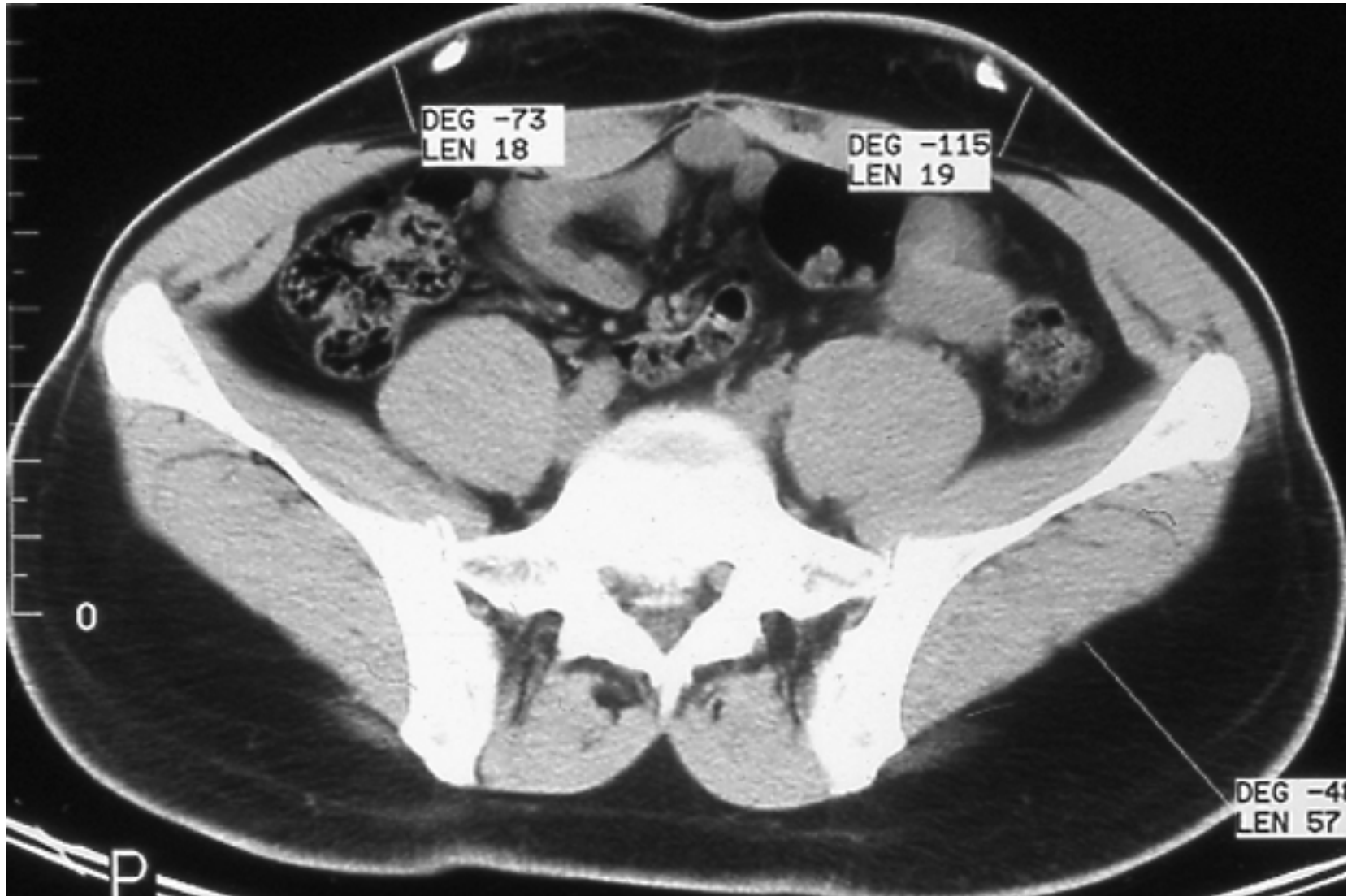


# CT of thigh, normal-weight adult male





CT, abdominal area, female with DM2, BMI 28.0



# Some Observations of Human Fat Tissue Distribution

## Adult females

- Many have less than 8 mm of fat tissue laterally in the thigh
- All have more than 12 mm of fat tissue in the gluteal area
- Some may have less than 5 mm of fat tissue laterally in the abdominal area

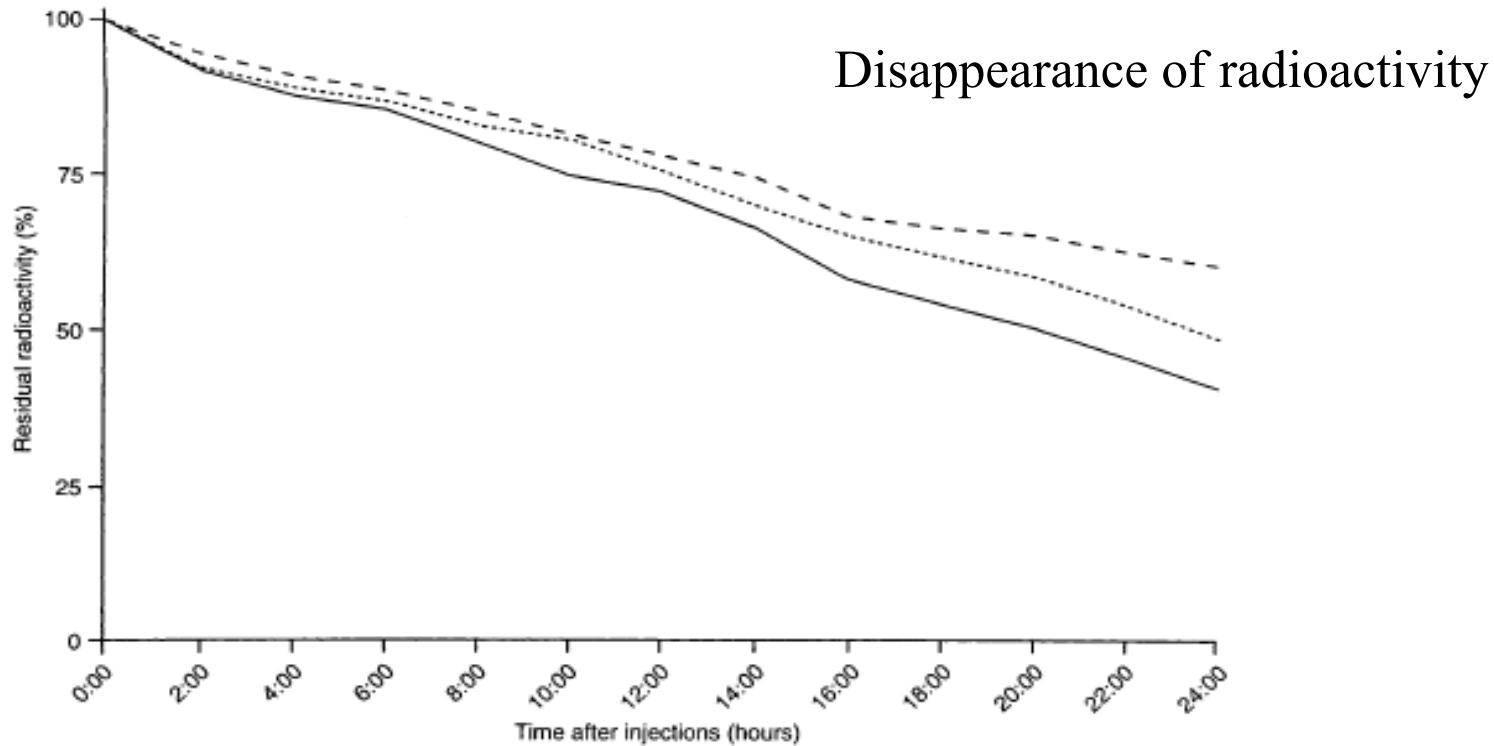
## Adult males

- A majority have less than 5 mm of fat tissue laterally in the thigh
- All have more than 12 mm of fat tissue in the gluteal area
- Many have less than 5 mm of fat tissue laterally in the abdominal area

# Absorption of Rapid-Acting Insulin Analogs

- No statistically significant difference between abdomen and thigh in time-to-peak
- Peak is somewhat lower and effect more protracted in thigh
- No statistically significant difference in insulin absorption between fat and muscle tissue; however, only studied in resting muscle
- There is a 100-fold increase in blood flow in the working muscle!
- International consensus is still to recommend subcutaneous (sc), ie, intralipomatous injection

# Absorption of insulin $^{125}\text{I}$ -Lantus after injection in arm, thigh and abdominal area

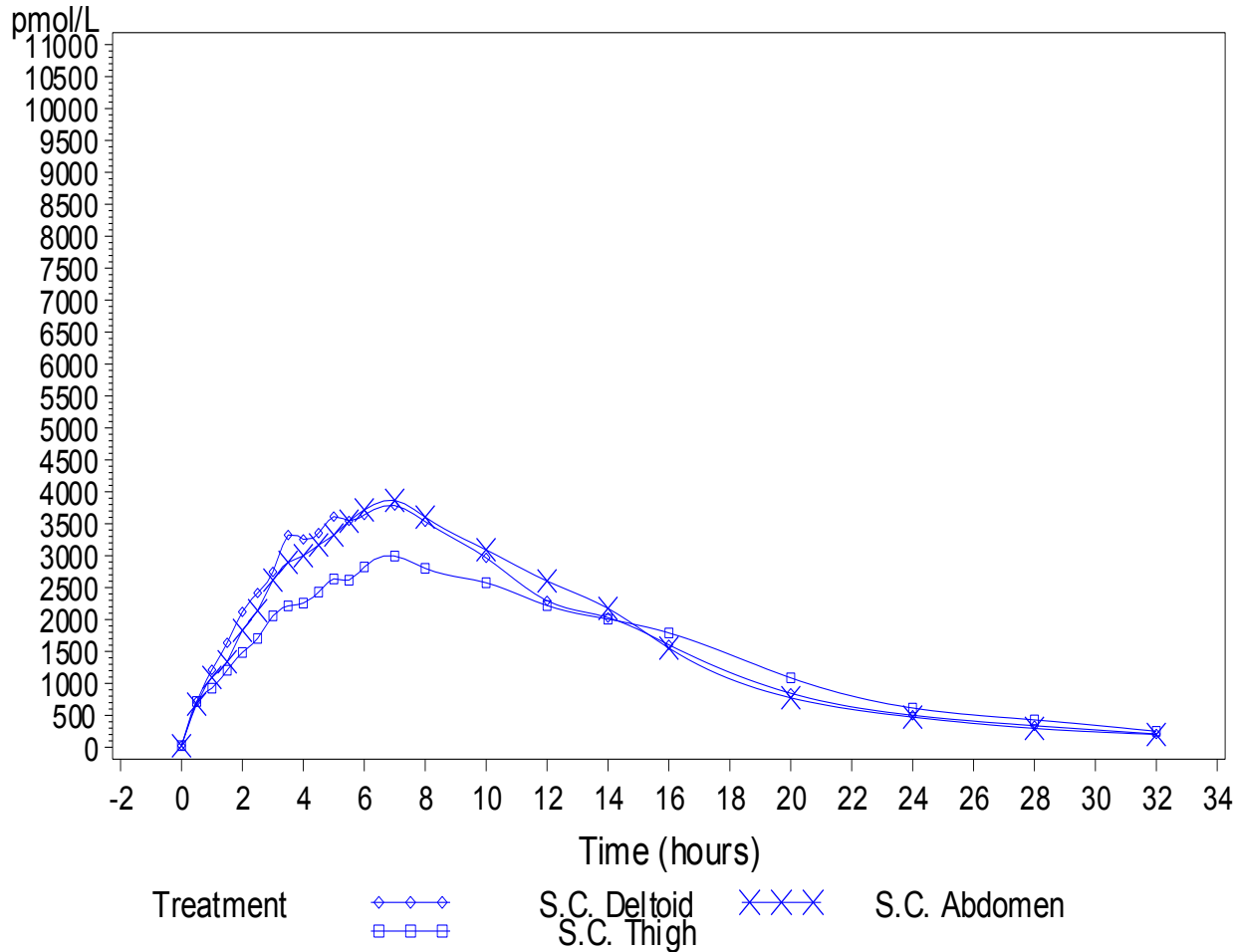


- \_\_\_\_\_ = arm
  - ..... = thigh
  - ----- = abdomen
- Owens et al, Diabetes Care 23;6, June 2000

# Levemir thigh – abdomen - arm

Mean Profiles of Insulin Detemir by S.C. Injection Site

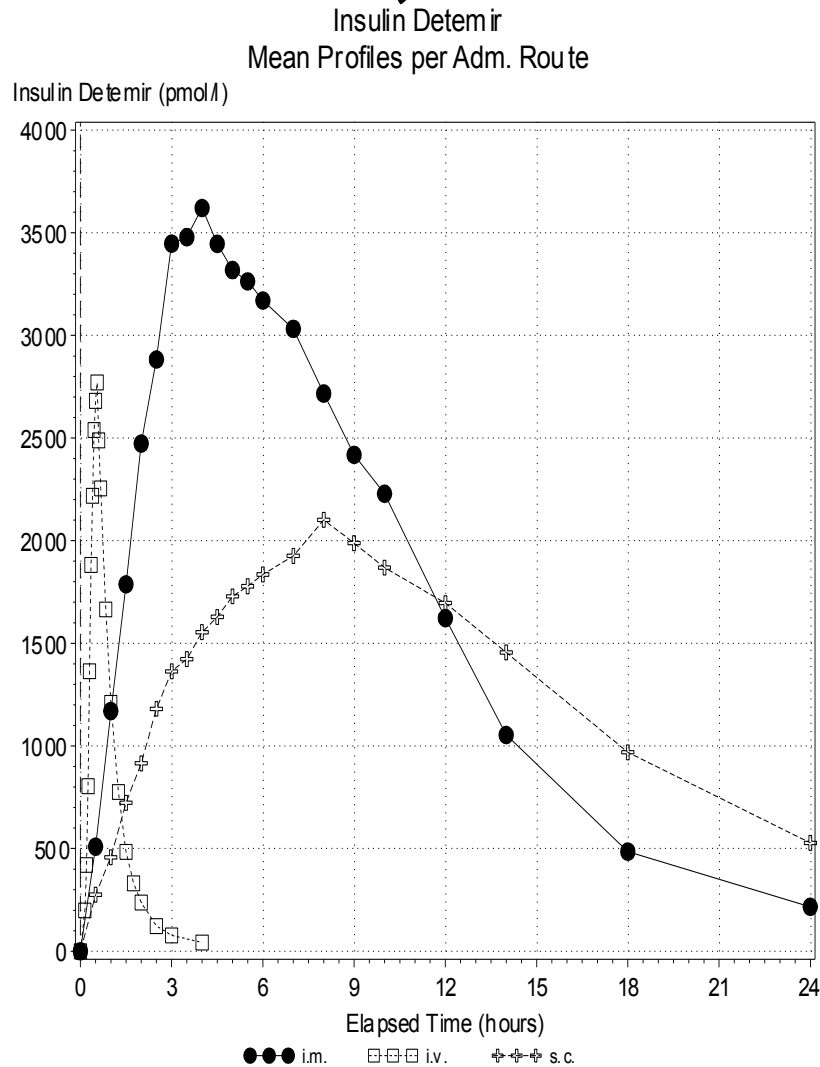
Mean



S.C. - Subcutaneous

Spadille Sweden (fiq01 2 1.sas/fiq01 2 1.cqm)23APR02

# Insulin Levemir, sc and im injection



Trial ID.: NN3041320

Spadille ApS (08FEB02)

Each mean profile based on data from 16 subjects

Note that at least two measurements must be available to calculate a mean concentration of Insulin Detemir. Thus at time points where there is one or no valid measurements no markings occur on the figure e.g. at time points later than 240 minutes for the i.v. adm. route

**IDM**

## **Early hypoglycaemia after accidental intramuscular injection of insulin glargine**

B. Karges, B. O. Boehm\* and W. Karges\*

Diabetic Medicine 2005;22:1444-45

# What Insulins at What Injection Site?

- All insulins should normally be given sc
- Soluble human insulins in the abdominal area
- NPH-insulins in the thigh or gluteal area
- Rapid-acting insulin analogs in the abdomen, may be given elsewhere
- Insulin glargine in abdomen, thigh, or gluteal area (no studies), strictly sc
- Insulin Detemir in the thigh (or gluteal area, no studies), strictly sc
- Premix insulins abdominal area in the morning; thigh or gluteal area in the afternoon/evening





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