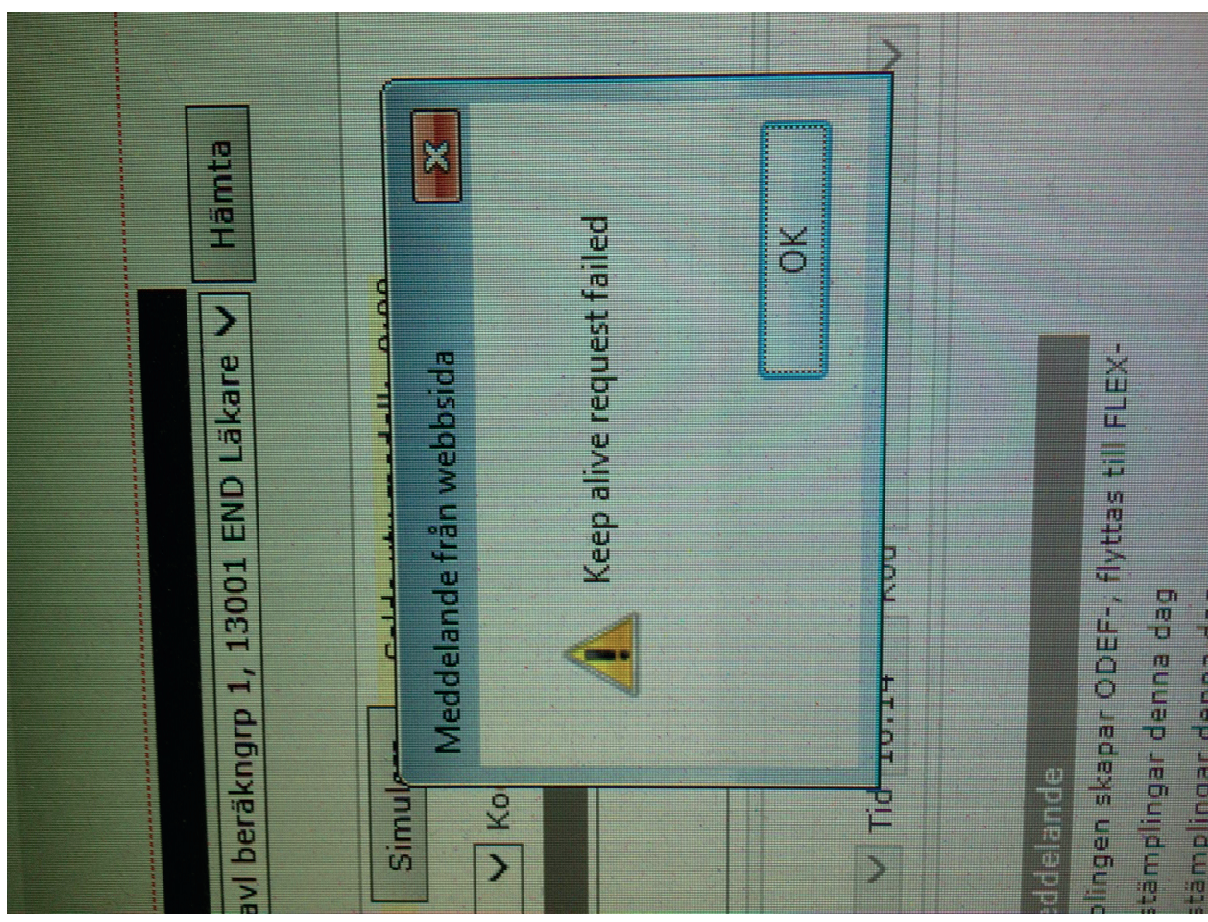


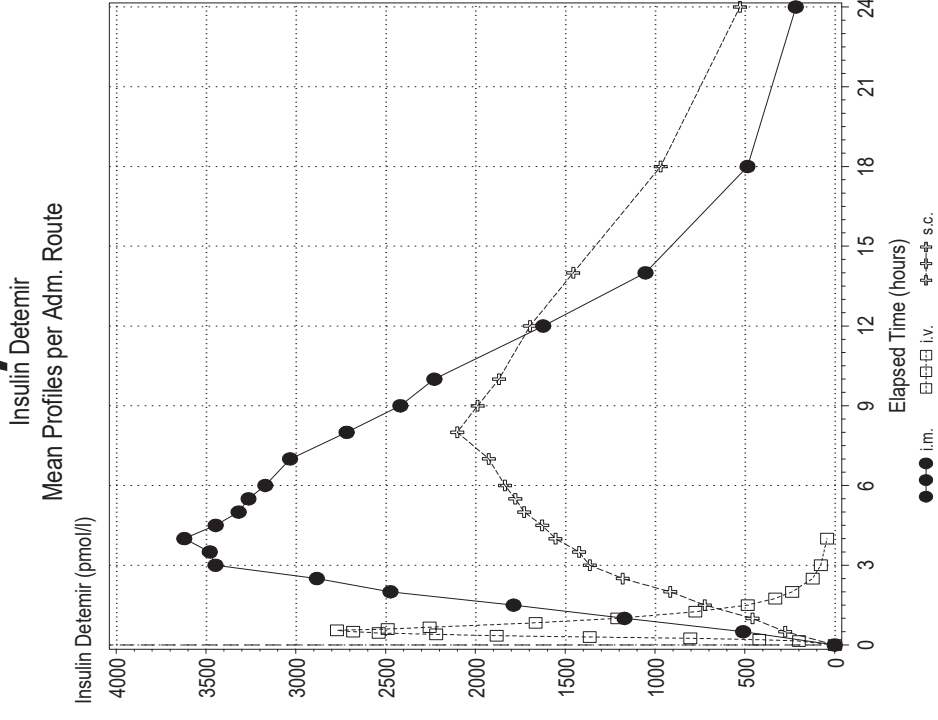
# Insuliner och injektionsteknik, hur svårt kan det vara?

Eller: Ingenting var bättre förr när det gäller diabetes.

Anders Frid Örebro november 2019



# Insulin detemir, sc and im injection



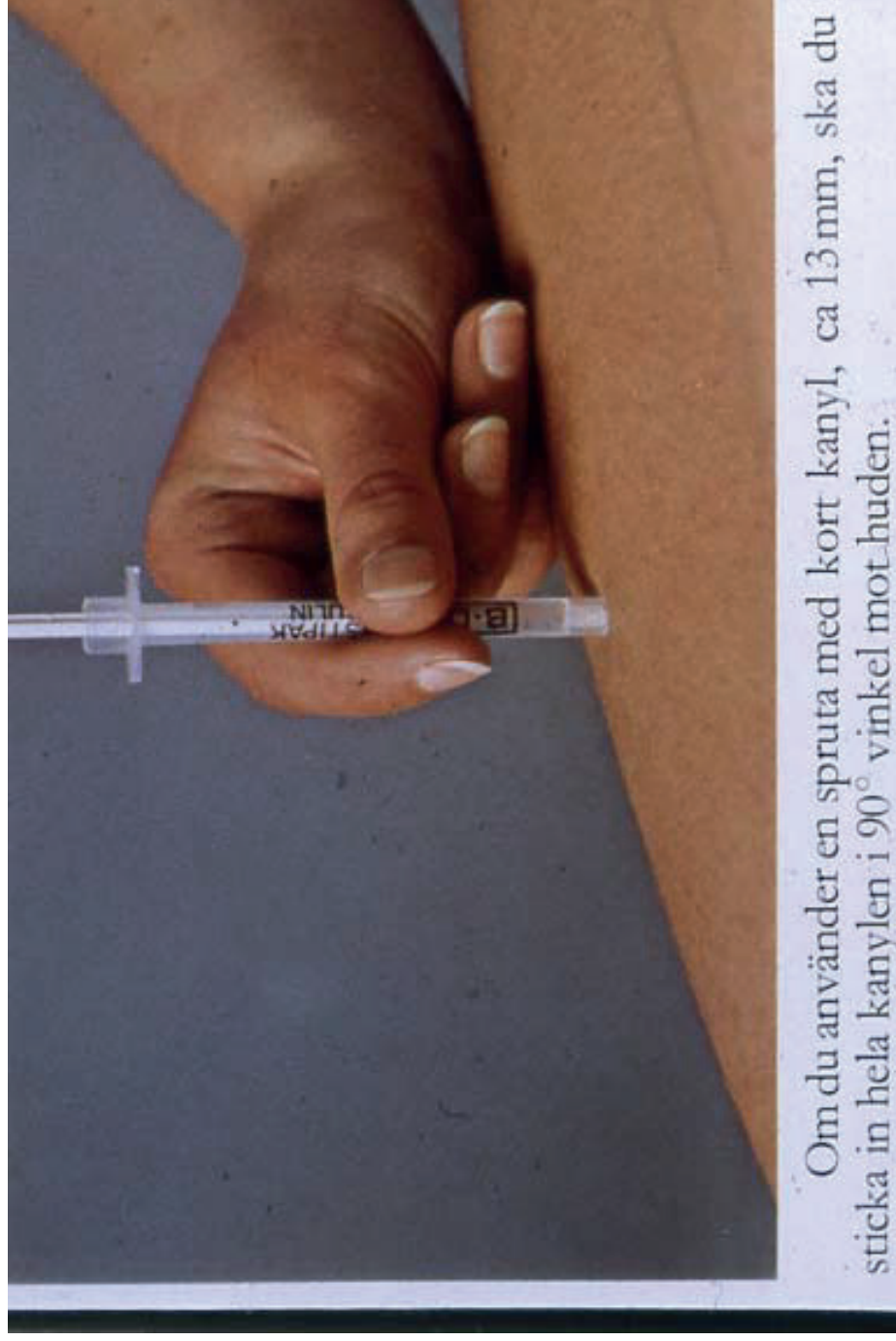
Novo Nordisk data on file

Trial ID.: NN304-1320

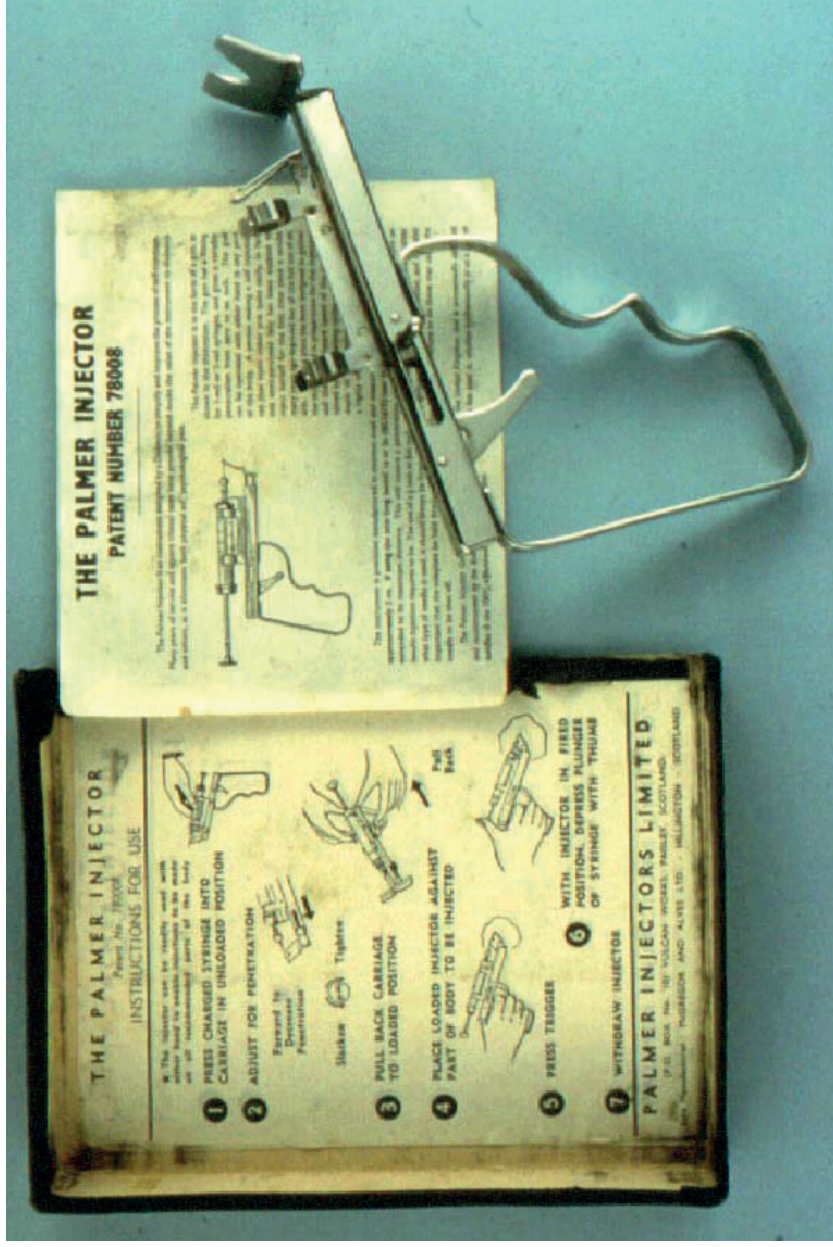
Each mean profile based on data from 16 subjects

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

## Broschyr av Novo om injektionsteknik från 1985



# The Palmer Injector 1955-1970



Courtesy Debbie Hicks, London, UK



Helinos 1954 - 1986

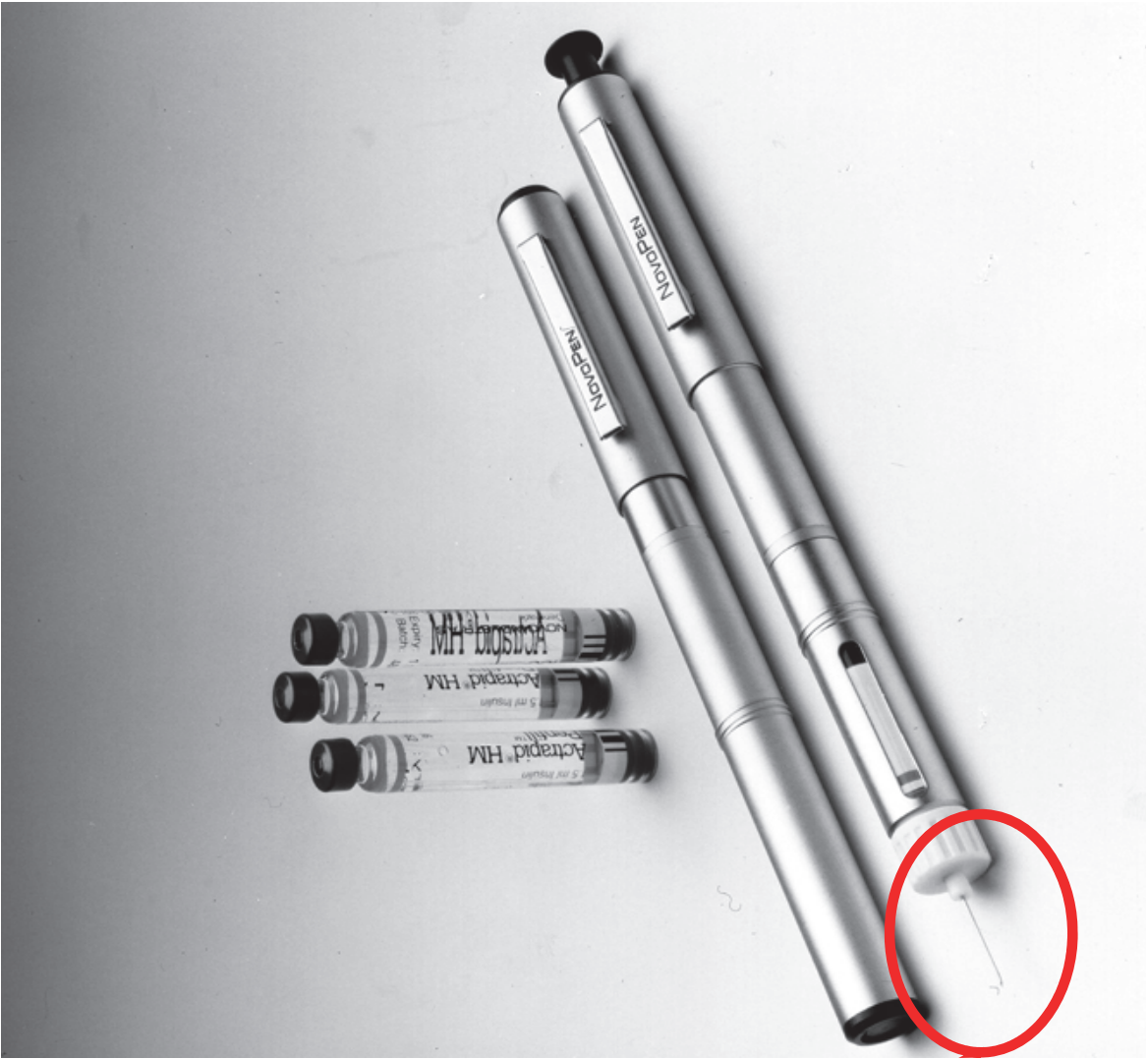


Helinos 1954 - 1986

# NovoPen 1985

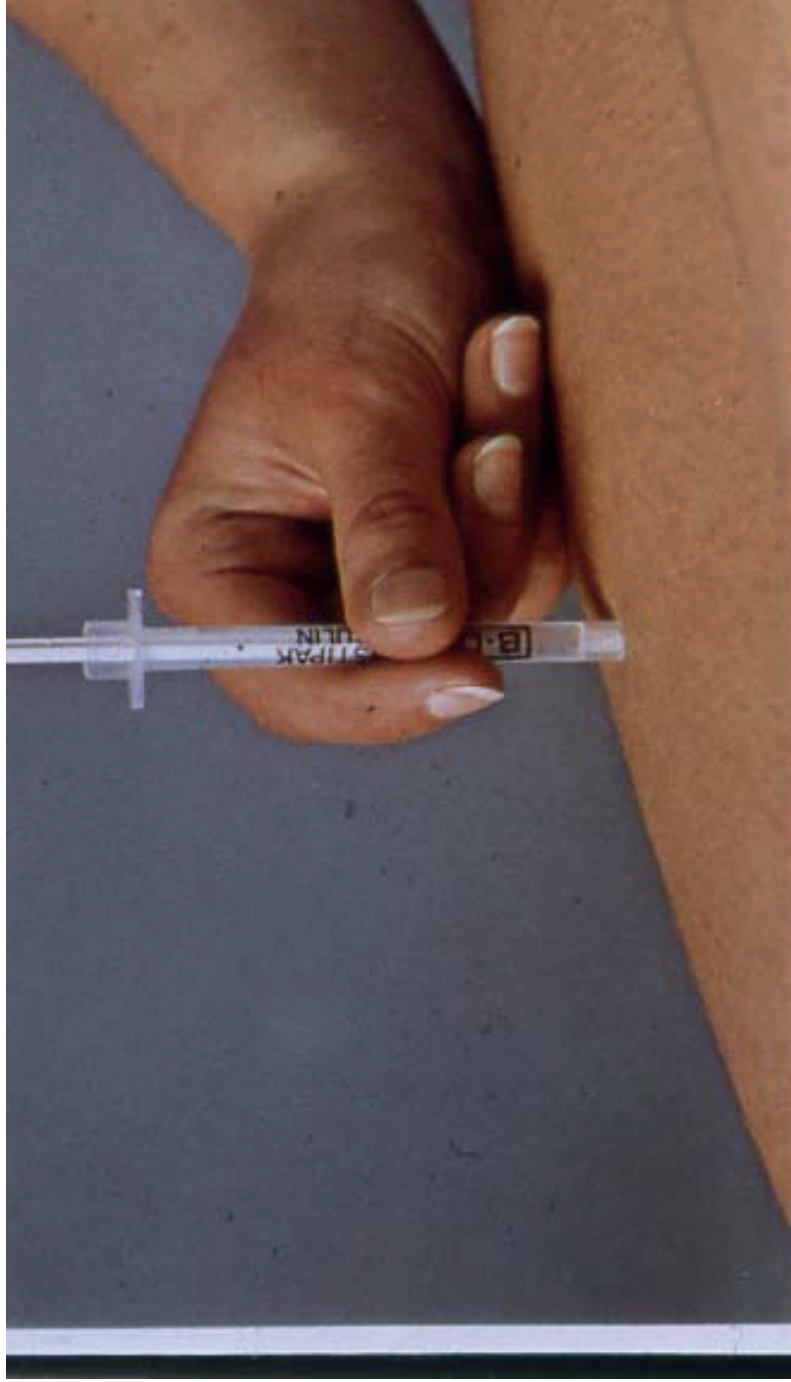






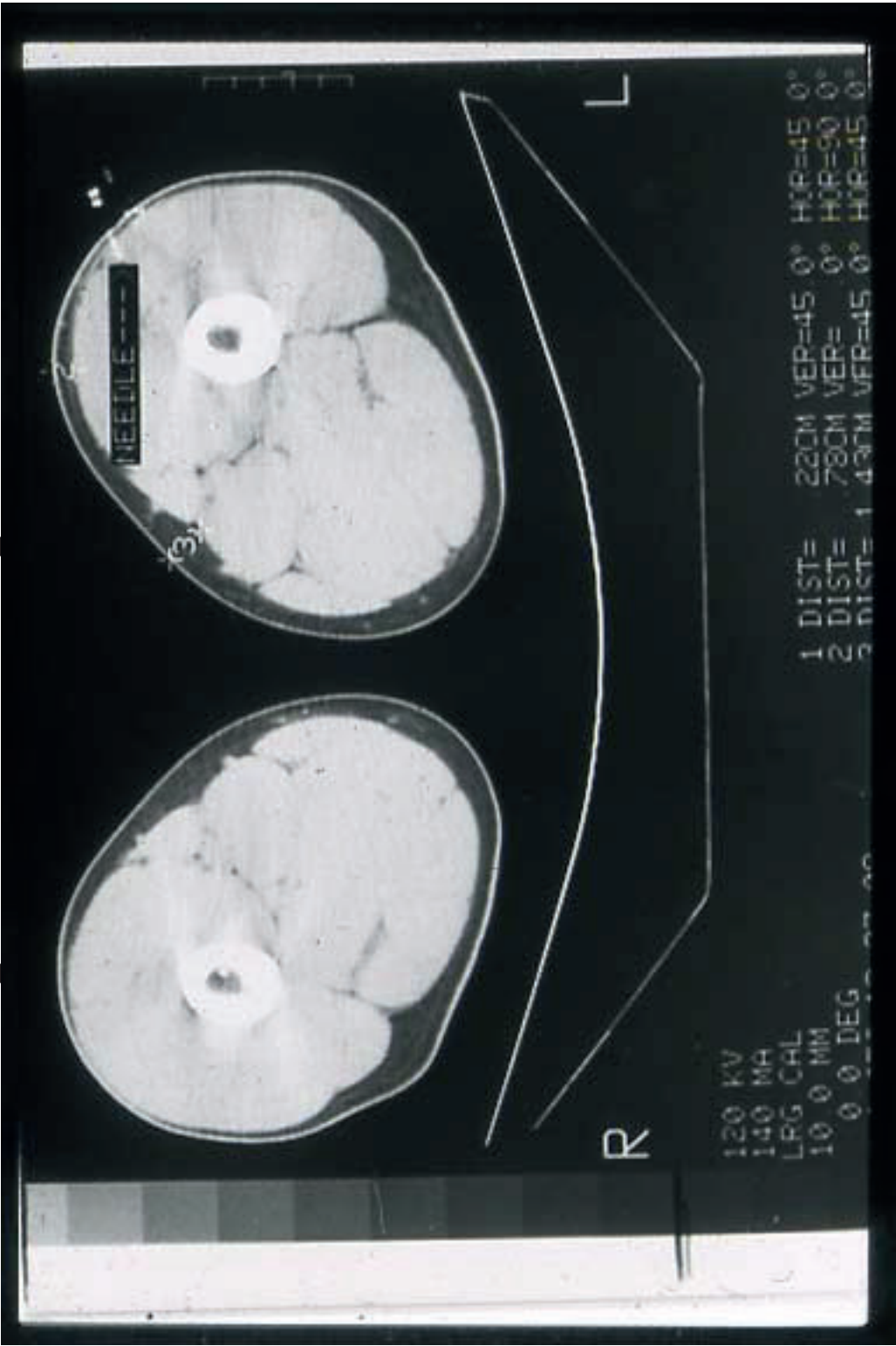


**Novo Fine 8 mm 1991**



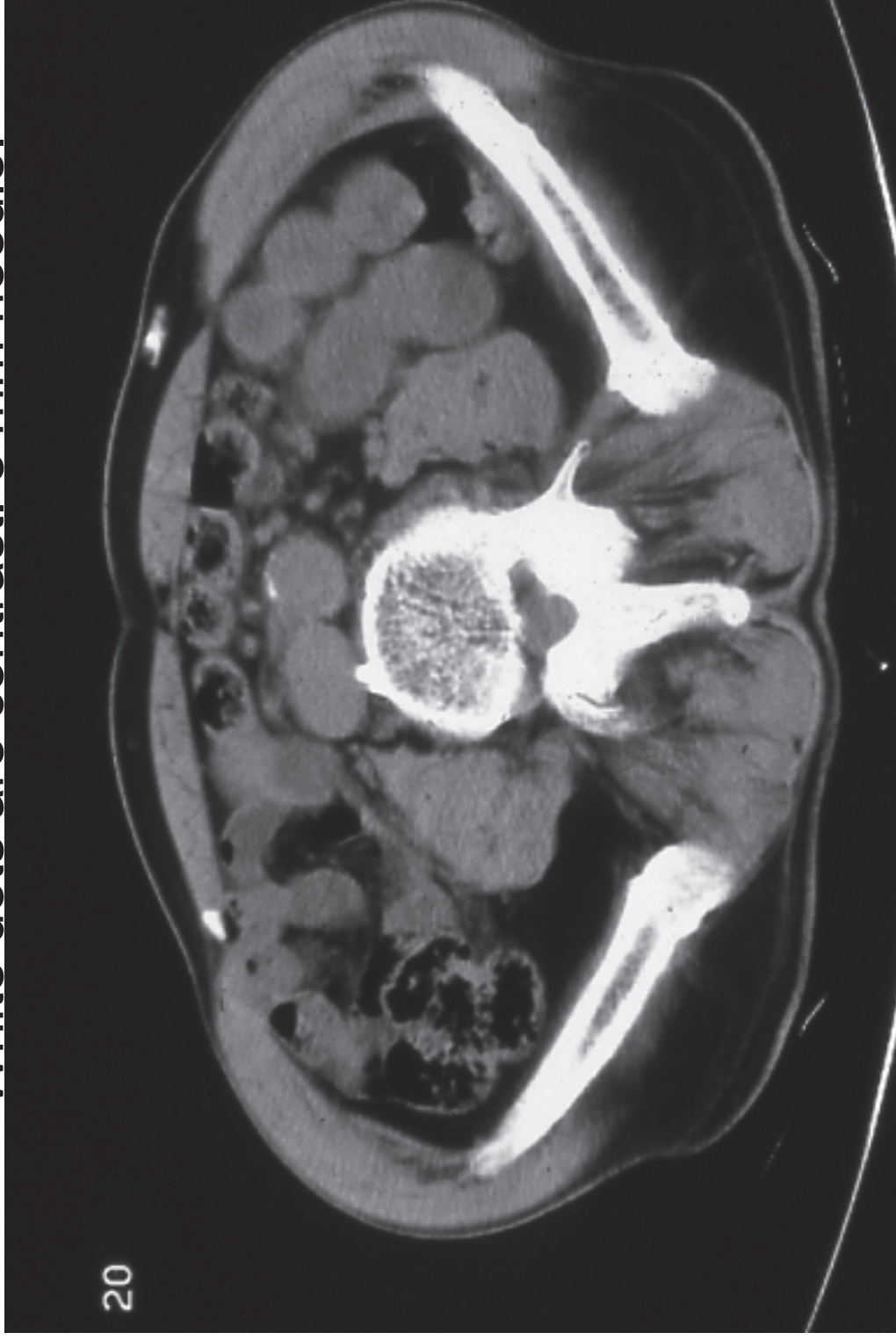
Om du använder en spruta med kort kanyl, ca 13 mm, ska du sticka in hela kanylen i 90° vinkel mot huden.

CT of thigh, normal-weight adult male



CT scan of abdomen, normal-weight male.

White dots are contrast. 8 mm needle.





# FITTER Rome October 2015







# New Insulin Delivery Recommendations

Anders H. Frid, MD; Gillian Kreugel, DSN; Giorgio Grassi, MD; Serge Halimi, MD;  
Debbie Hicks, DSN; Laurence J. Hirsch, MD; Mike J. Smith, DSN;  
Regine Wellhoener, MD; Bruce W. Bode, MD; Irl B. Hirsch, MD; Sanjay Kalra, MD;  
Linong Ji, MD; and Kenneth W. Strauss, MD





# Injektioner för vuxna och barn med diabetes

Svensk Förening för Sjuksköterskor i Diabetesvård  
i samverkan med Svensk sjuksköterskeförening



Publicerad 3 mars 2018

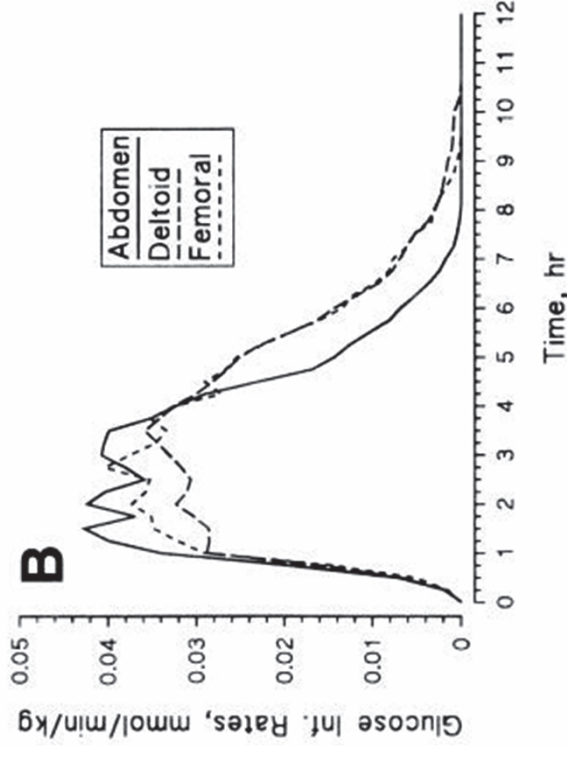
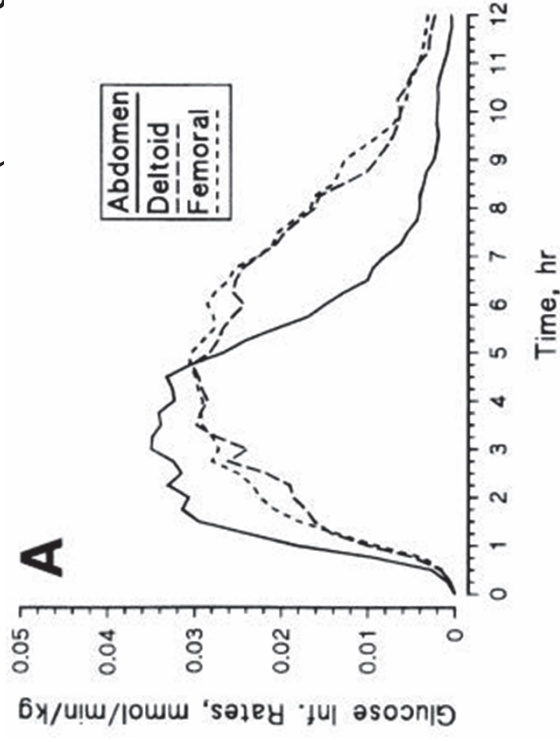
# Absorption av direktverkande insulinanaloger

- Ingen skillnad i absorptionshastighet mellan buk och lår.
- Något längre verkan från lår.

# Absorption of regular insulin and insulin lispro<sup>2</sup>

Mean GIR versus time of all treatments (n = 12): Regular

insulin (0.2 U/kg; A, insulin lispro (0.2 U/kg; B).



# Absorption av direktverkande insulinanaloger

- Ingen skillnad i absorptionshastighet mellan buk och lår.
- Något längre verkan från lår.

# Absorption av direktverkande insulinanaloger

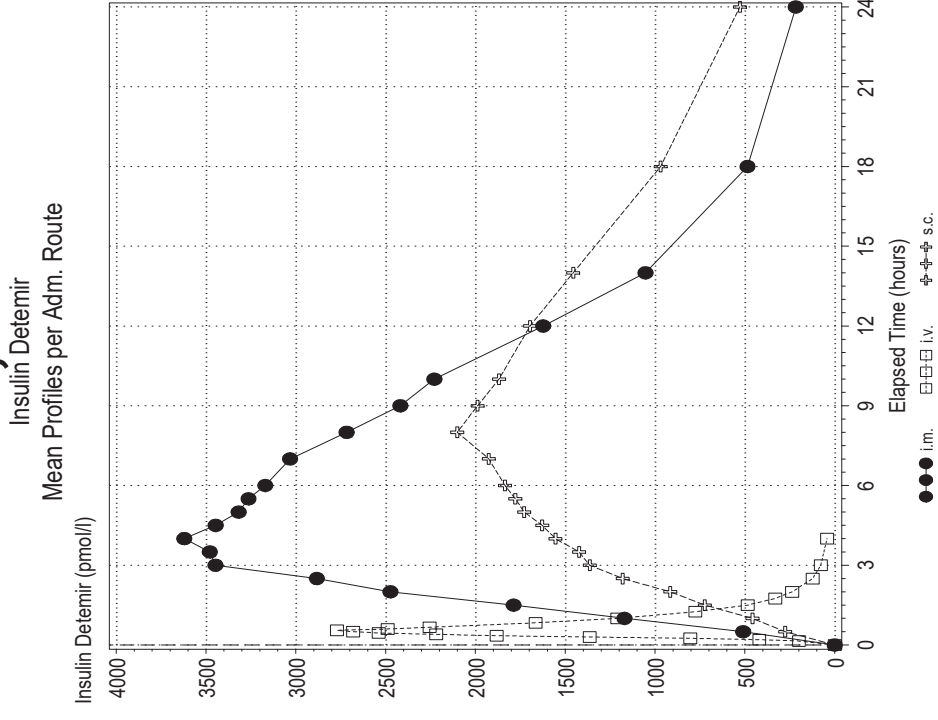
- Ingen skillnad i absorptionshastighet mellan buk och lår.
- Något längre verkan från lår.
- Ingen skillnad i absorptionshastighet mellan fett och muskel, bara studerat i vila.

# Absorption av långverkande insulinanaloger

- Små skillnader i absorption mellan lår och buk (något långsammare från buk för glargin)
- Stor skillnad i absorptionshastighet mellan fett och muskel.



# Insulin detemir, sc and im injection



Novo Nordisk data on file

Trial ID.: NN304-1320  
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

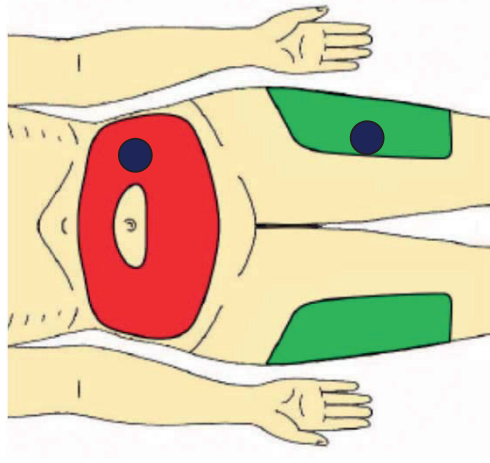
Spadille ApS (08FEB02)

# Absorption av Humaninsuliner

- Snabbare absorption från muskel jämfört fett.
- Snabbare absorption från buk jämfört lår.

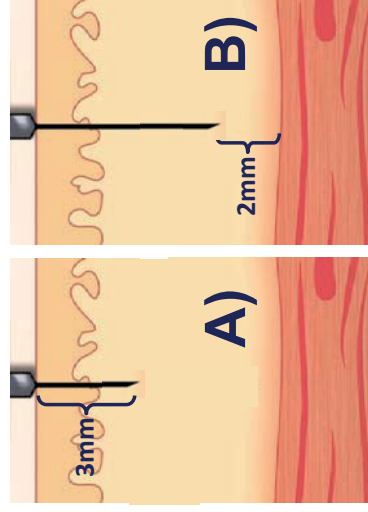
**Injektionsdjup har sannolikt ingen  
betydelse (två studier)**

# Injection Depth and Insulin Absorption



- $^{125}\text{I}$ -labelled short acting insulin was injected ( 5 units each patient)
- Radioactivity decreased by insulin absorption (in %)
- One defined injection site was chosen for each abdomen and thigh
- 2 injection depths, controlled by ultrasound:

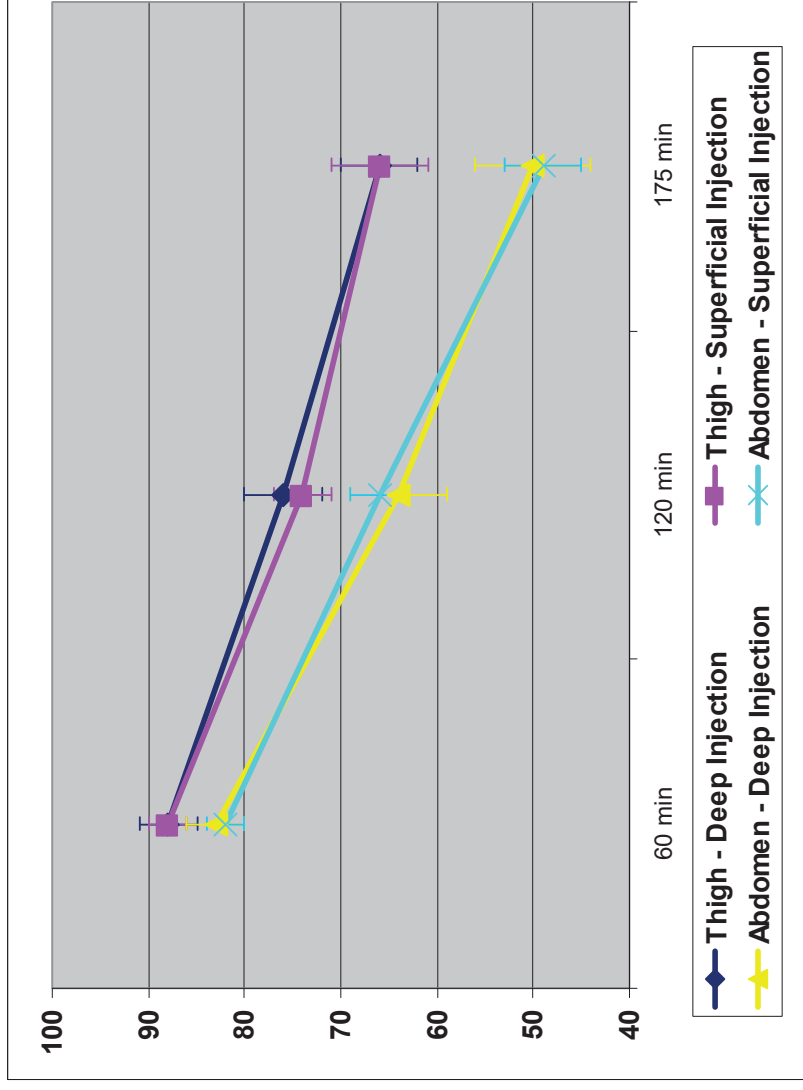
- A) 3mm below the skin surface
- B) 2mm above the muscle facies



Injection Depth B) [from skin surface in mm]:

Abdomen	♂	$9 \pm 2$	♀	$15 \pm 3$
Thigh	♂	$7 \pm 1$	♀	$14 \pm 3$

# Injection Depth and Insulin Absorption



**No influence of the injection depth on the kinetics of insulin absorption has been shown in the study.**

# Subcutaneous Injection Depth Does Not Affect the Pharmacokinetics or Glucodynamics of Insulin Lispro in Normal Weight or Healthy Obese Subjects

Amparo de la Peña, PhD<sup>1</sup>, Kwee P. Yeo, PhD<sup>2</sup>, Helle Linnebjerg, PhD<sup>1</sup>, Edward Catton<sup>1</sup>, Shobha Reddy, BS<sup>1</sup>, Patricia Brown-Augsburger, PhD<sup>1</sup>, Linda Morrow, MD<sup>3</sup>, and Debra A. Ignaut, BS, RN, CDE<sup>1</sup>

Journal of Diabetes Science and Technology  
1-7

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DOI: 10.1177/1932296815573865

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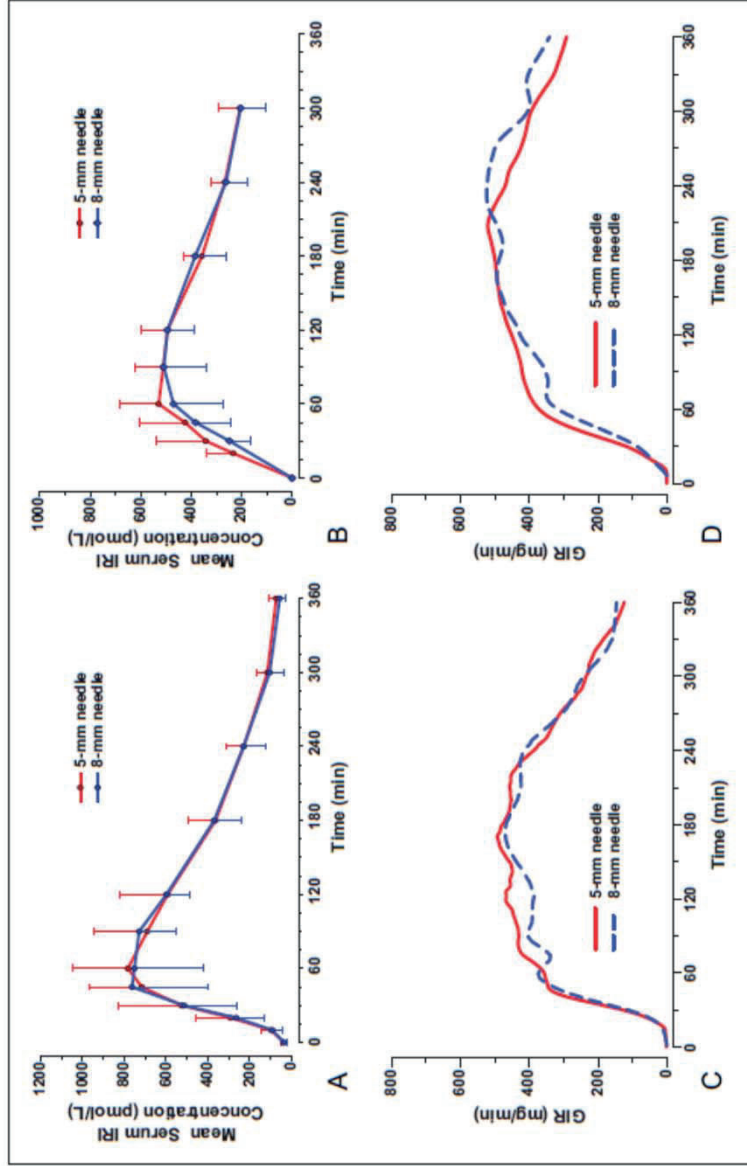


Figure 1. Mean ( $\pm$  SD) serum immunoreactive insulin (IRI) concentration versus time profiles in normal weight subjects (A) and obese subjects (B), and locally weighted scatter plot smoothing (LOESS) fits of glucose infusion rate (GfR) versus time data in normal weight subjects (C) and obese subjects (D) following the administration of 0.25 U/kg insulin lispro at 5-mm and 8-mm injection depths.

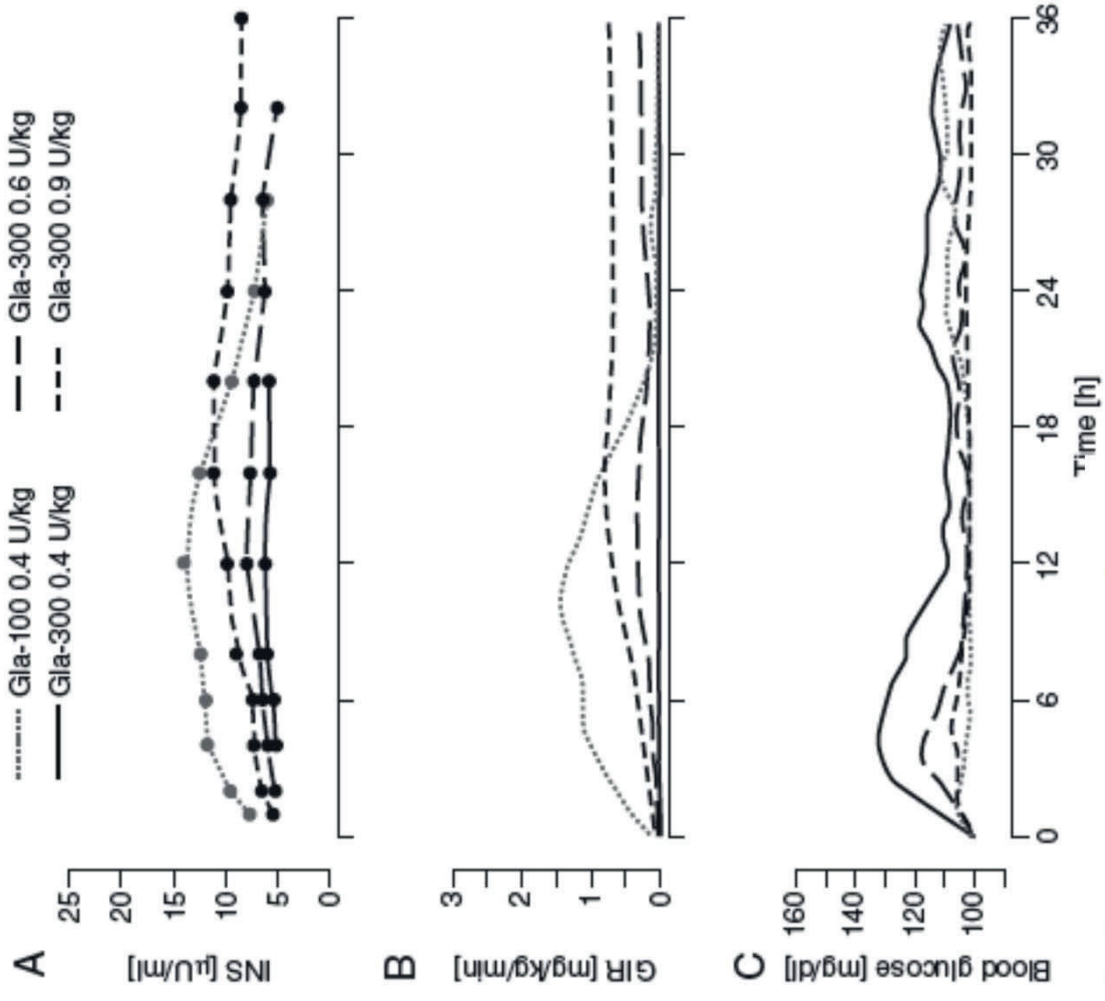
J Diabetes Sci Technol. 2015 Jul;9(4):824-

30

# Insuliner med koncentration > 100 E/mL

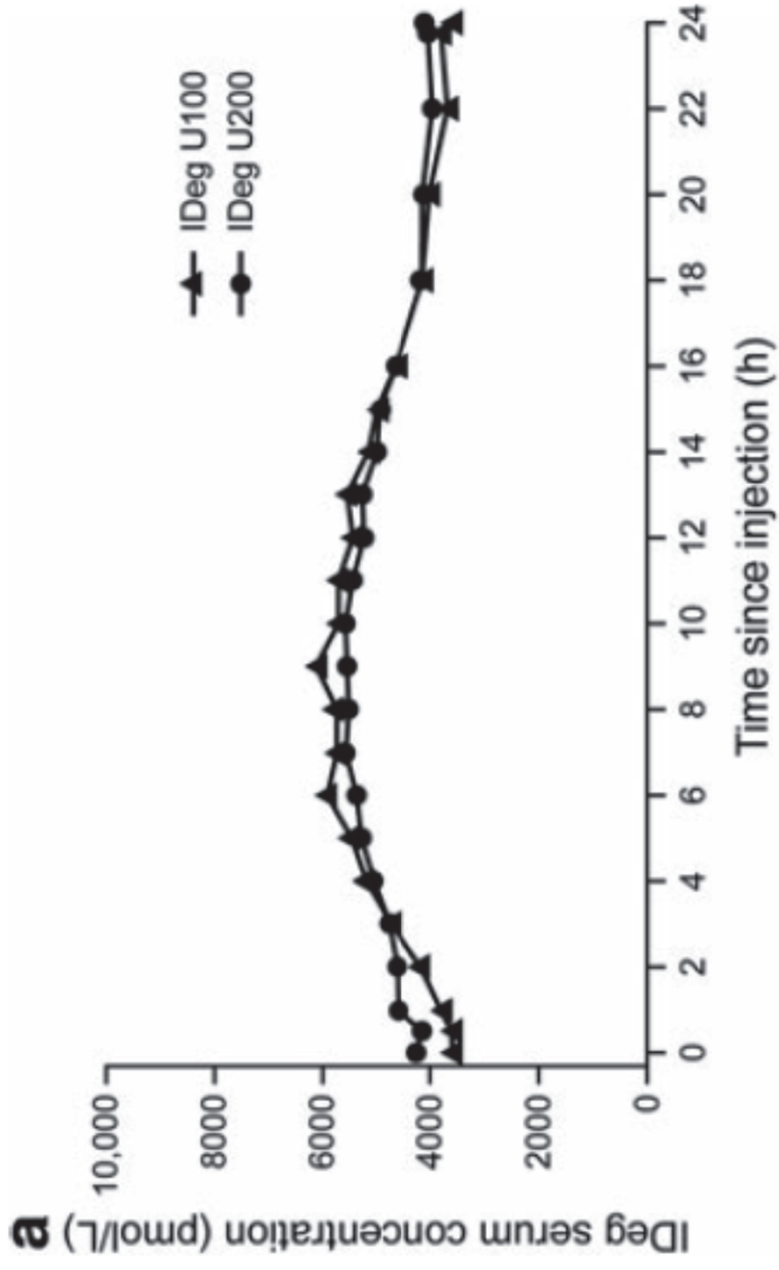
- Glargin (Toujeo) 300 E/mL
- Degludec (Tresiba) 200 E/mL
- Lispro (Humalog) 200 E/mL





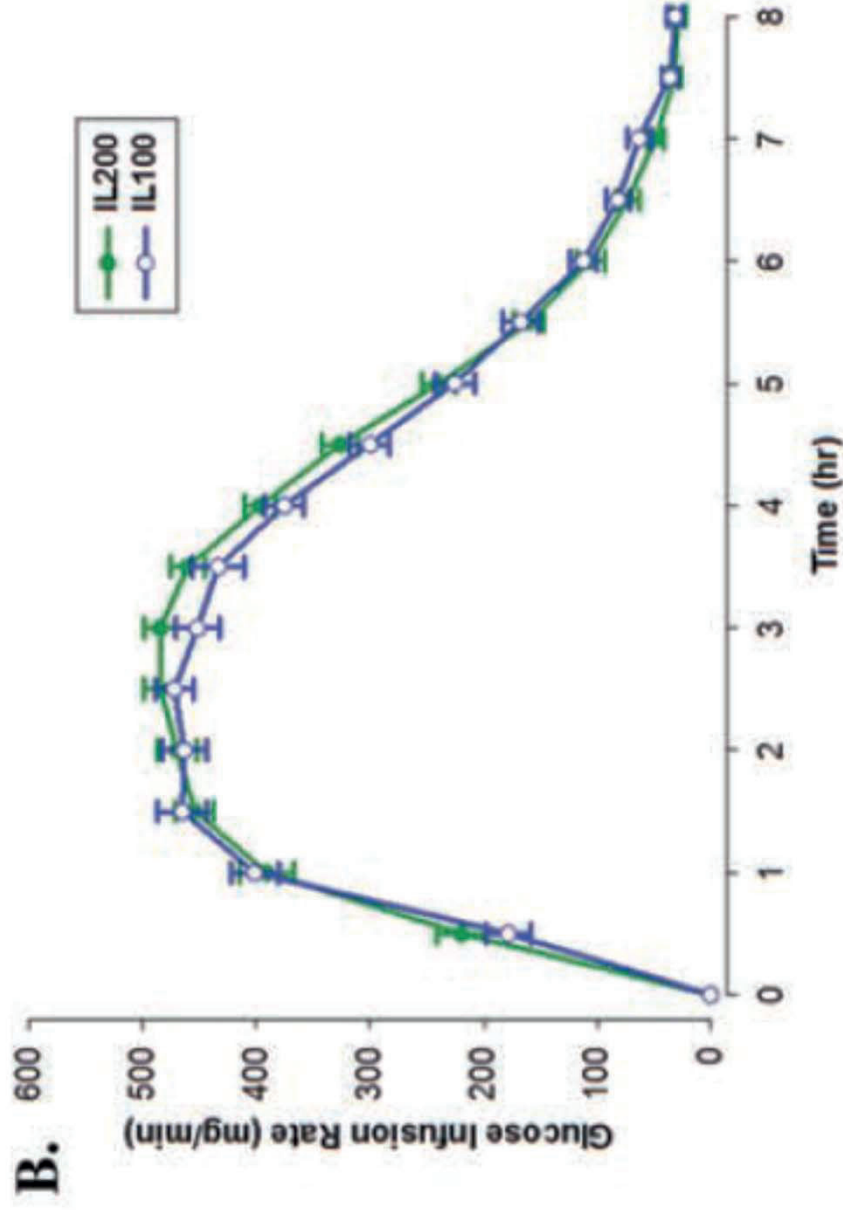
*Diabetes, Obesity and Metabolism 17: 254–260, 2015.*

# Degludec 100 vs 200 E/mL



## Insulin lispro (Humalog)

Clinical Pharmacology  
in Drug Development  
2016, 5(1) 69–75



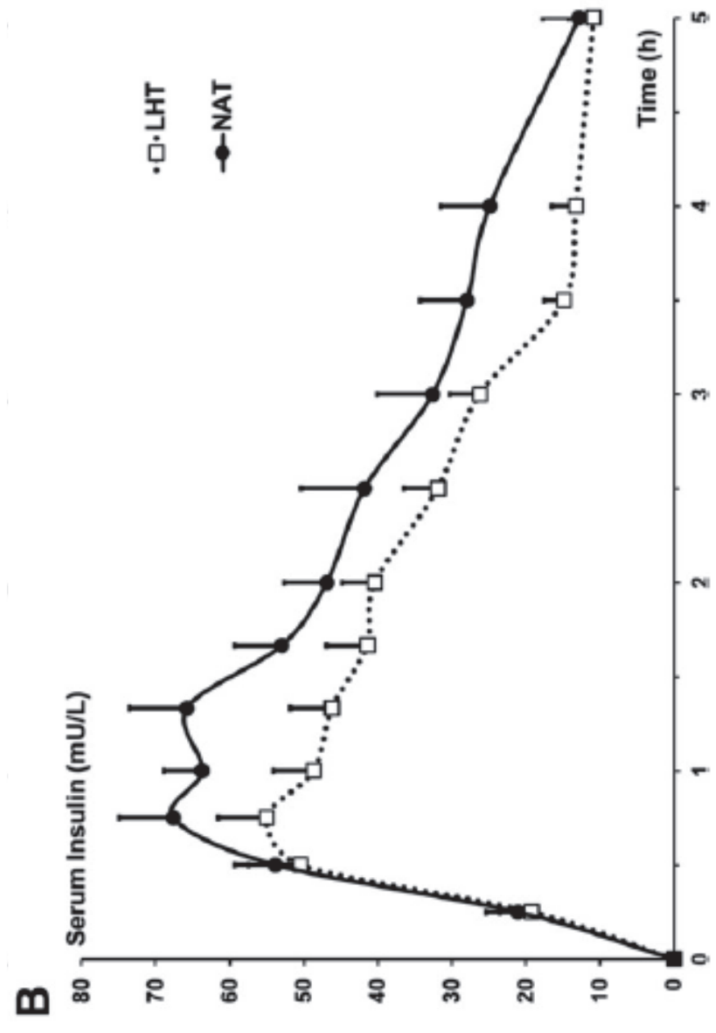
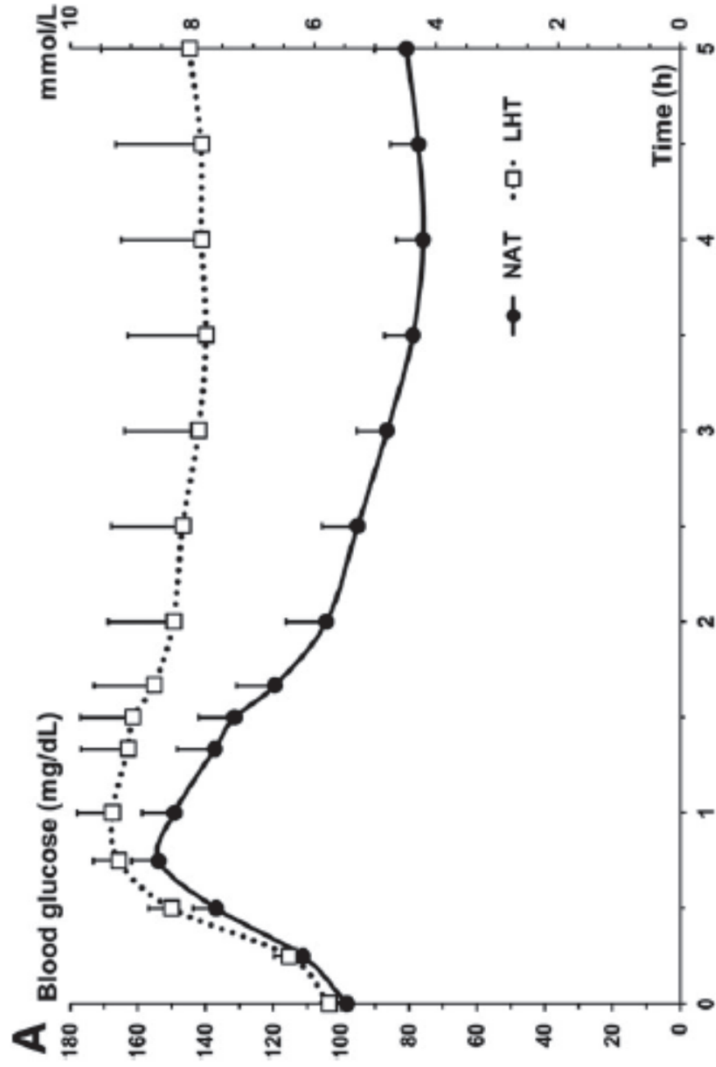
Lines represent the overall LOESS smooth per treatment; symbols represent the LOESS smooth values (+SE) of glucose infusion rates at 30-minute intervals which were chosen for better graphic representation.



CrossMark

# Insulin Injection Into Lipohypertrophic Tissue: Blunted and More Variable Insulin Absorption and Action and Impaired Postprandial Glucose Control

Susanne Famulla,<sup>1</sup> Ulrike Hövelmann,<sup>1</sup>  
Annelie Fischer,<sup>1</sup> Hans-Veit Coester,<sup>1</sup>  
Lidia Hermanski,<sup>1</sup> Matthias Kaltheuner,<sup>2</sup>  
Lars Kaltheuner,<sup>2</sup> Lutz Heinemann,<sup>1</sup>  
Tim Heise,<sup>1</sup> and Laurence Hirsch<sup>3</sup>



*Diabetes Care* 2016;39:1486–1492

Total bioavailability based on  $AUC_{INS0-5h}$  and total biopotency based on  $AUC_{GIRO-5h}$  were significantly reduced with LHT injections to 78–80% of the effect seen with NAT injection



# Worldwide Injection Technique Questionnaire Study: Population Parameters and Injection Practices

Anders H. Frid, MD; Laurence J. Hirsch, MD; Astrid R. Menchior, MS;  
Didier R. Morel, PhD; and Kenneth W. Strauss, MD

# Needle reuse



# Reuse Percentages by Country (1)



Country	REUSE	
	Yes	No
USA	18.4	81.6
Canada	38.7	61.3
Russia	90.3	9.7
South Africa	96.7	3.3
Netherlands	18.5	81.5
Belgium	86.7	13.3
France	20.1	79.9
Spain	37.7	62.3
Italy	15.5	84.5
Switzerland	52.7	47.3
Austria	71.9	28.1
UK	26.1	73.9
Sverige	49.0	51.0



# Results



	2 times	3-5 times	6-10 times	>10 times
Nurse-Reported	31.2	41.0	15.4	12.4
Patient-Reported	30.7	39.7	16.0	13.6
<b>Sverige</b>	<b>12</b>	<b>45</b>	<b>12</b>	<b>31</b>

# Why do they reuse the pen needles?



Reasons	%	Sverige
Because I did not have another pen needle available	9.2	2
To save money	23.3	2
To prevent excess waste (environmental concern)	6.8	4
For convenience	41.2	78

# How often does the nurse or doctor examine injection sites?

Frequency	%
Routinely every visit.	<b>28.3</b>
Once a year	<b>12.6</b>
Only if I complain of a problem at a site	<b>20.2</b>
I can't remember my sites ever being checked	<b>38.9</b>



# Lipo Percentages by Country (1)



Country	YES	NO	Number
USA	6.9	93.1	304
Canada	28.8	71.2	281
Russia	24.0	76.0	104
South Africa	34.8	65.2	155
Netherlands	40.8	59.2	76
Belgium	33.1	66.9	136
France	36.2	63.8	224
Spain	60.2	39.8	196
Italy	39.4	60.6	310
Switzerland	29.1	70.9	55
Austria	28.4	71.6	95
Argentina	65.3	34.7	72
<b>Sweden</b>	<b>56.4</b>	<b>43.6</b>	<b>101</b>

## 6 enkla råd om insulininjektioner

- Det finns inga medicinska skäl att använda längre nål än 4 mm
- Injicera aldrig i muskel.
- Moderna insulinanaloger tas upp i stort sett lika från fettväven på alla injektionsställen.
- NPH-insulin och mixinsuliner ges helst i buken på morgonen och baken/låret på kvällen.
- Nytt ställe varje gång. Regelbunden undersökning av injektionsställen.
- Använd högre insulinkoncentration när det är möjligt.