

Basic EMG and QEMG

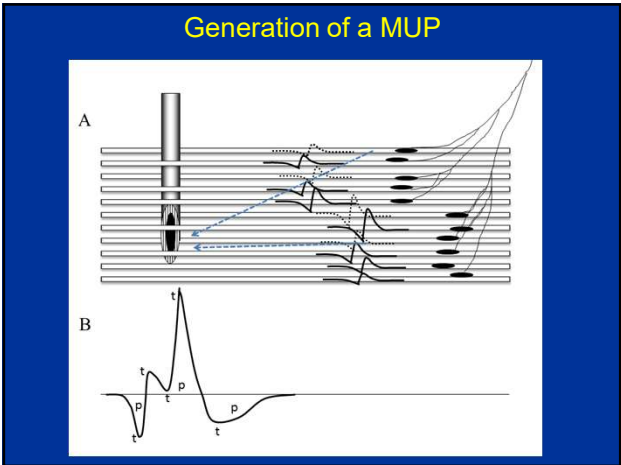
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- ### What can we assess with EMG?
- Muscle membrane function - spontaneous
 - Muscle fibre characteristics; diameter
 - MU organization
 - number of fibers
 - grouping
 - N-M transmission
 - Motor units
 - total number
 - activation; pattern, fullness
- Stålberg

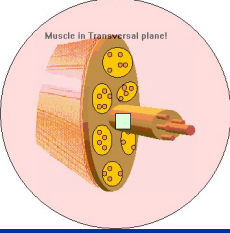
- ### Parameters to quantify in Conc/Monopolar EMG
- **spontaneous activity**
 - **shape of individual MUPs**
 - **jiggle**
 - **recruitment (early, reduced)**
 - **fullness at strong activation**
 - **dynamic changes with time (fatigue)**

Spontaneous activity

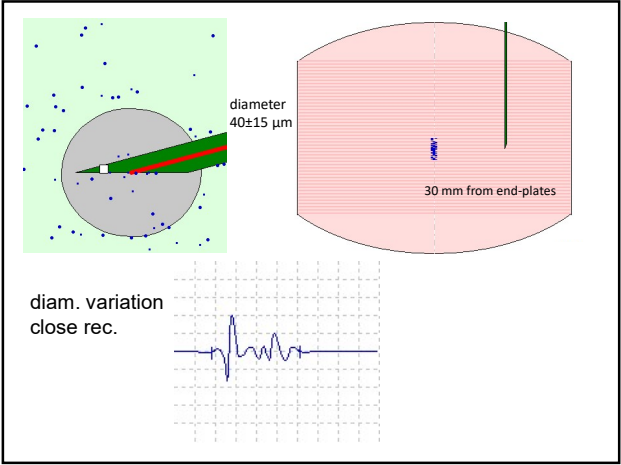
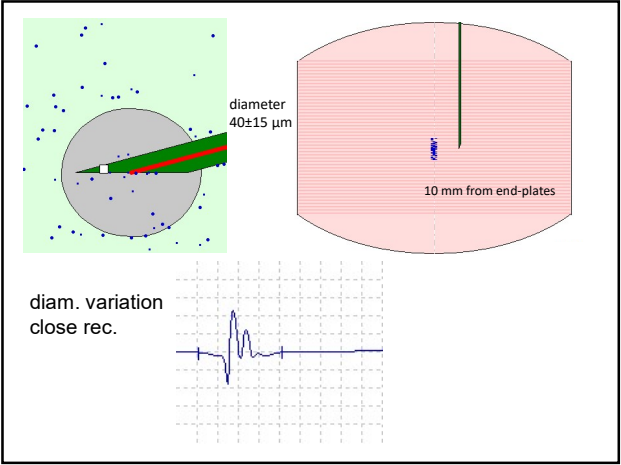
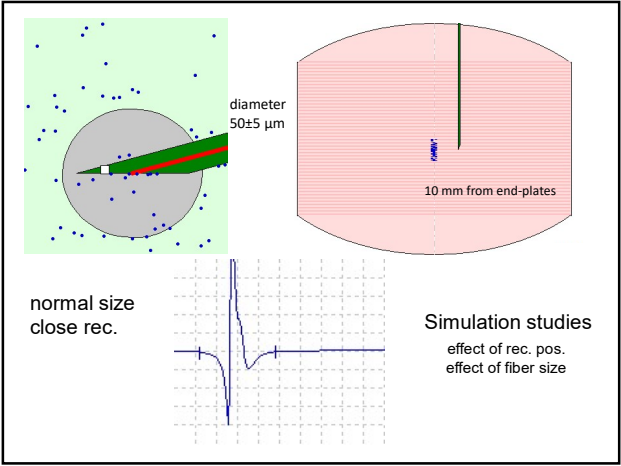
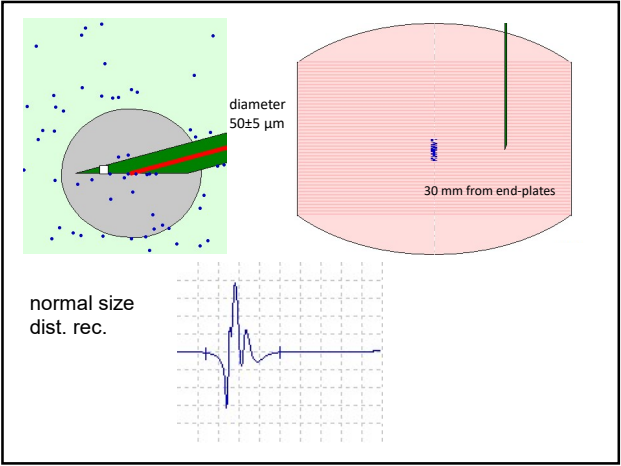
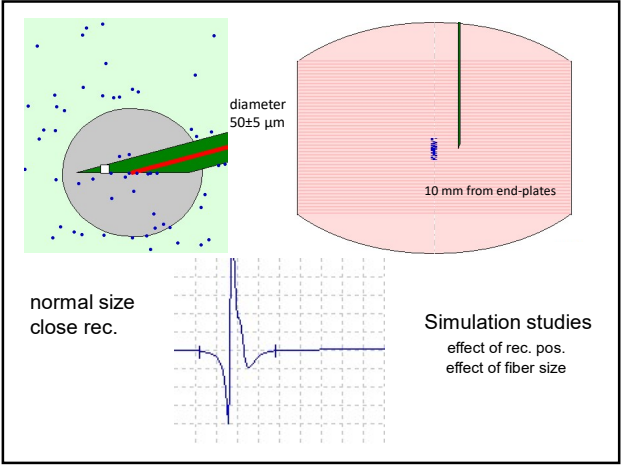
Voluntary EMG

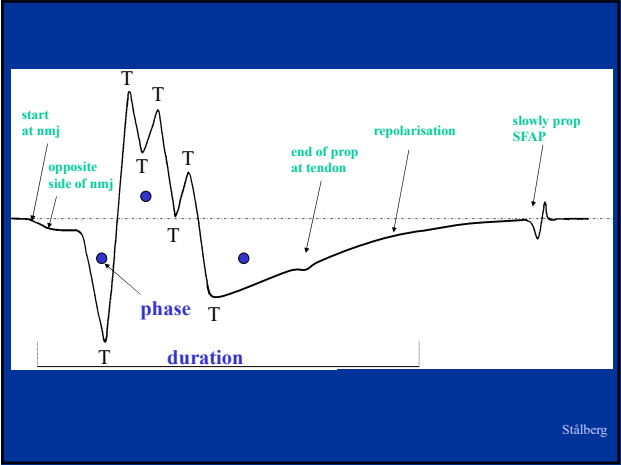


The EMG Simulator



Muscle in Transversal plane





Parameters used in MUP analysis

parameter	significance	measurement
• Amplitude	# fibers/0.5mm	peak-peak
• Area	# fibers/2 mm	within dur
• Duration	# fibers in 2.5 mm	slope criteria
• Thickness	# close fibre	area/ampl
• Size index	MU size	normalized thickness
• Phases	temp dispersion	0-cross + 1
• Turns	"	change in dir
• Irregularity	"	length/ampl
• Rise time	closeness to fibre	neg-pos peak
• Satellites	extreme delay	late spike
• Jiggle	n-m trans	shape stability

Parameters that can be assessed visually/manually

parameter	significance	measurement
• Amplitude	# fibers/0.5mm	peak-peak
• area	# fibers/2 mm	within dur
• Duration	# fibers in 2.5 mm	slope criteria
• Thickness	# close fibre	area/ampl
• Size index	MU size	normalized thickness
• Phases	temp dispersion	0-cross + 1
• Turns	"	change in dir
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• Rise time	closeness to fibre	neg-pos peak
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• Jiggle	n-m trans	shape stability

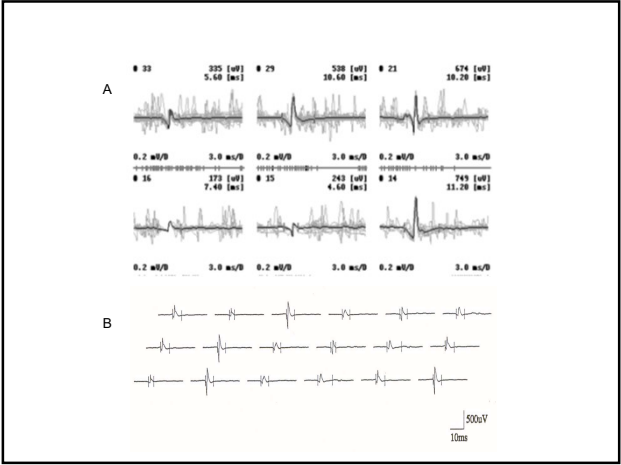
Computer aided analysis

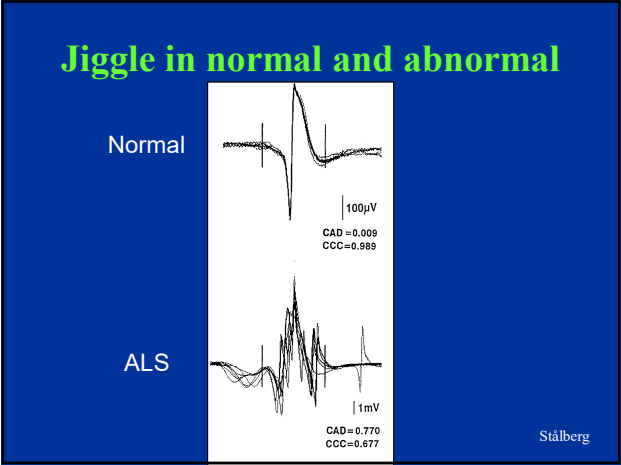
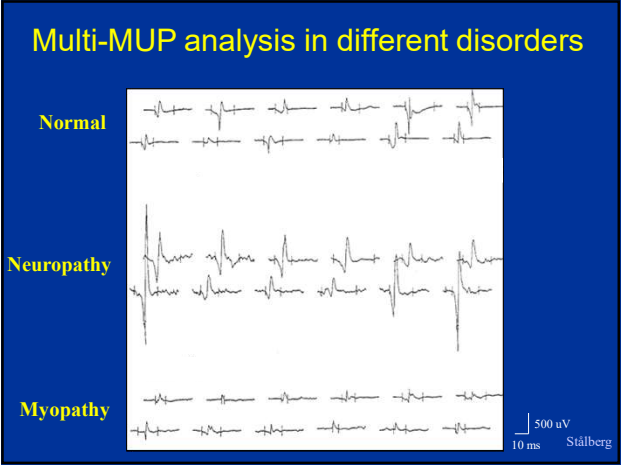
Decomposition;

techniques to decompose a mixed signal into its constituents

This example: Multi MUP analysis

The diagram shows a mixed EMG signal (yellow) being decomposed into individual motor unit potentials (MUPs, green). Each MUP is shown in a separate box, illustrating the process of signal decomposition.

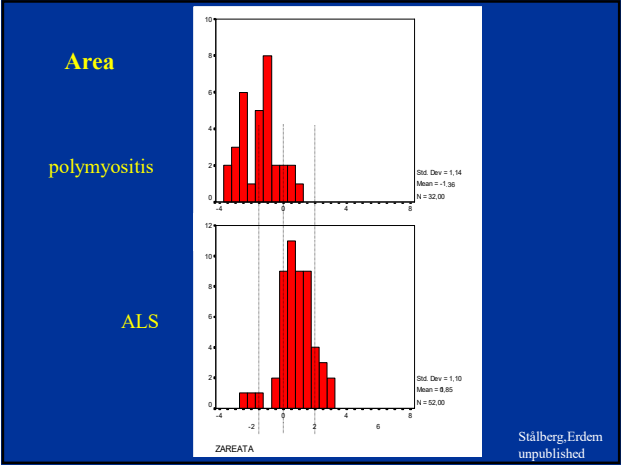
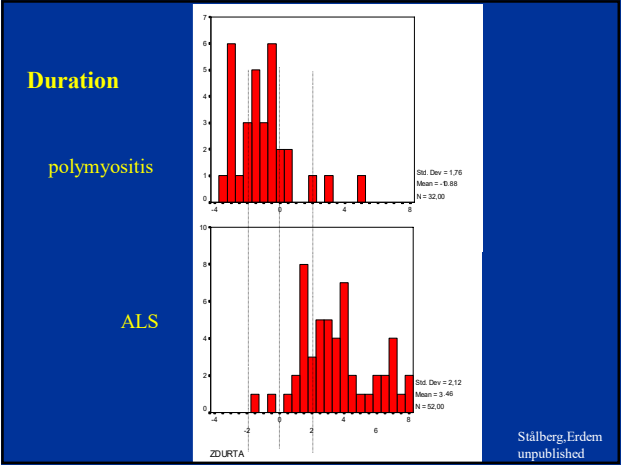
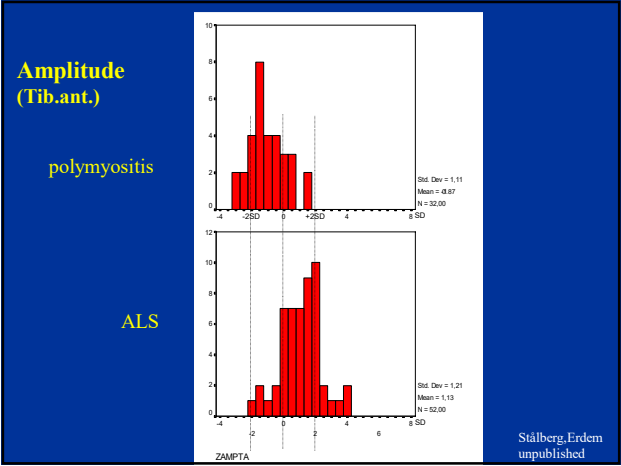


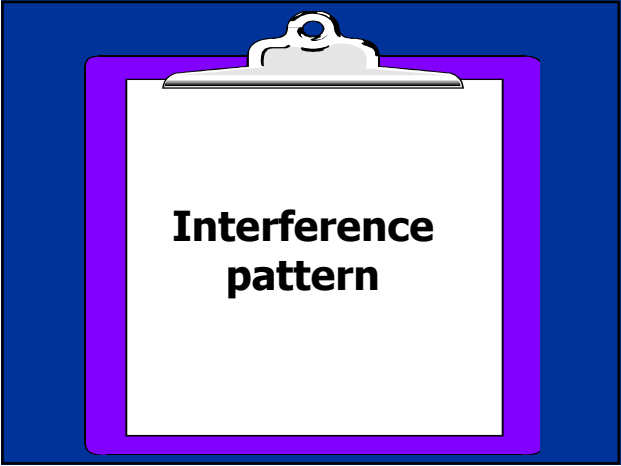
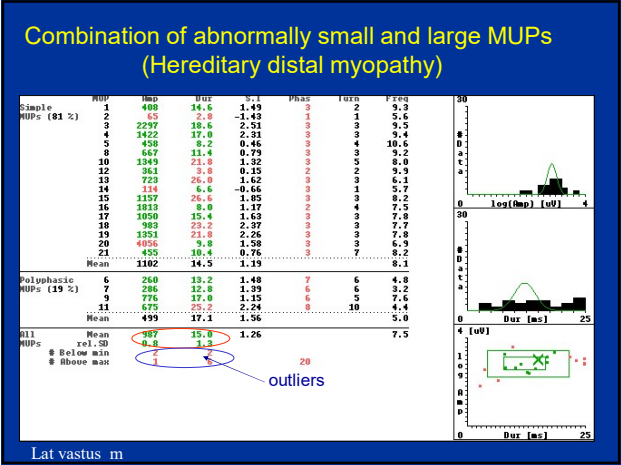
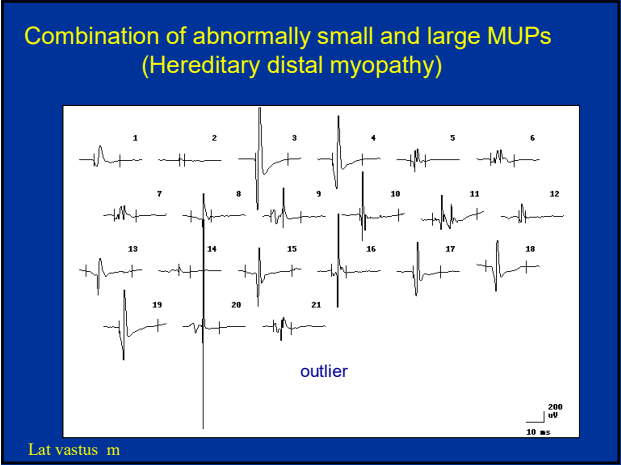


So, shall I use all these parameters??

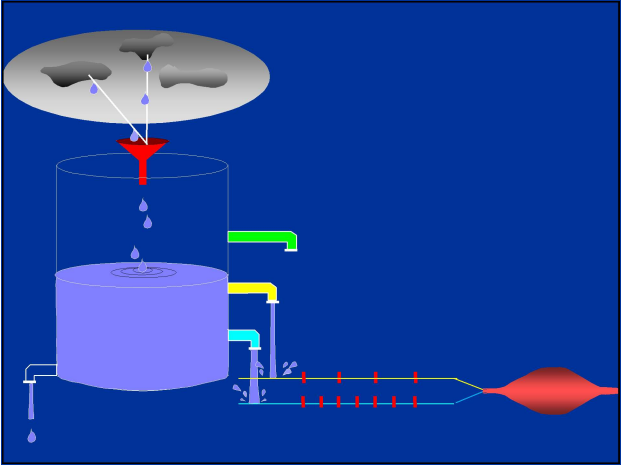
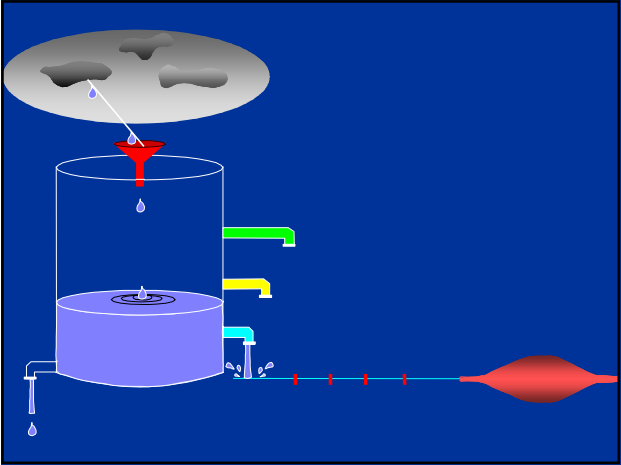
Which one is best?

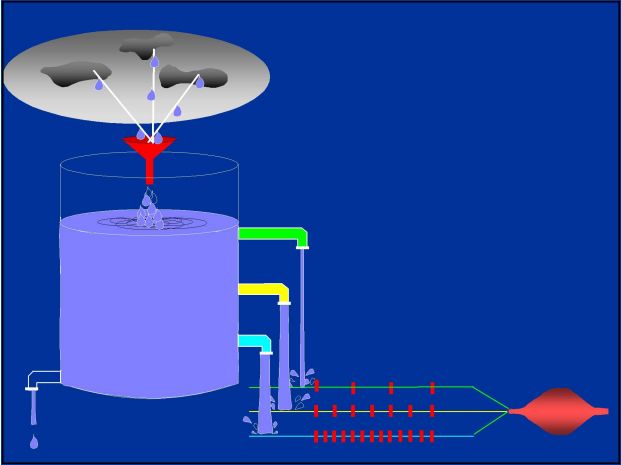
Let us look at the diagnostic power of a few parameters



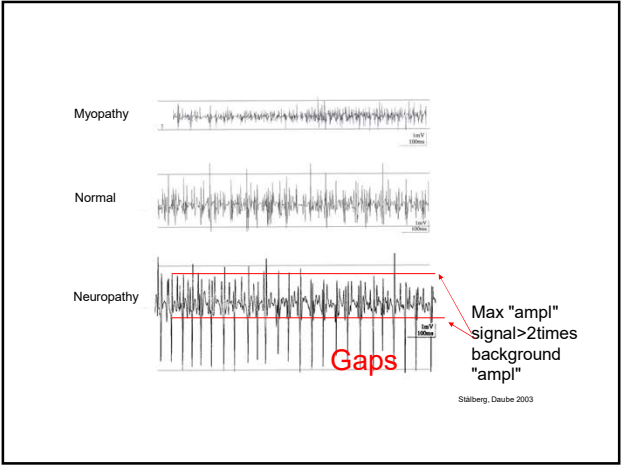
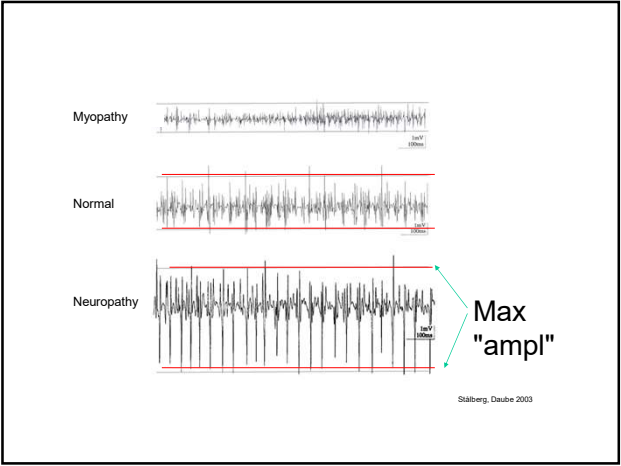


- ### Methods
- recruitment analysis
 - visual inspection (ampl, fullness)
 - spectral analysis
 - broad band filter analysis
 - turns/amplitude analysis
 - "ampl", "turns", activity



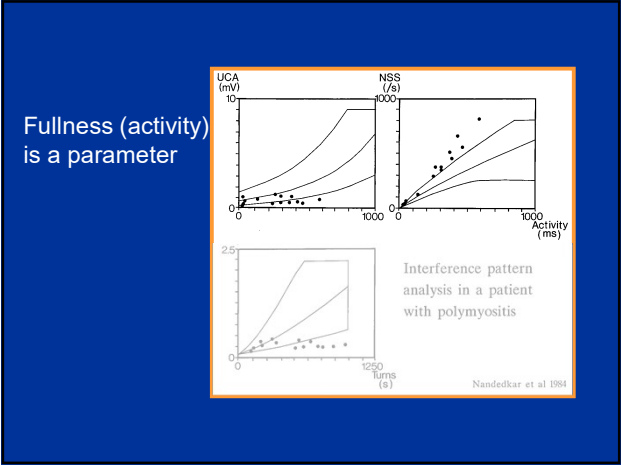
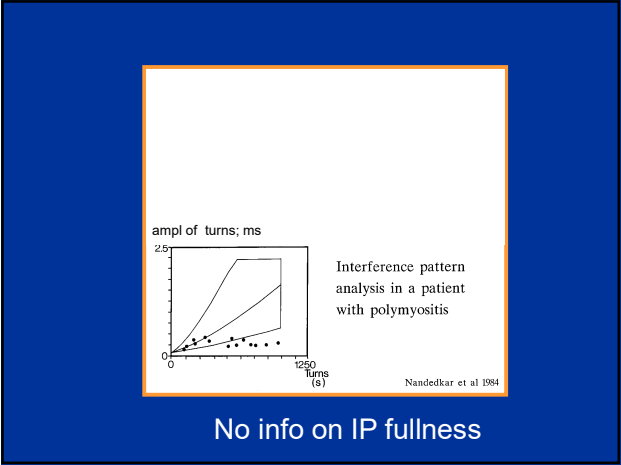
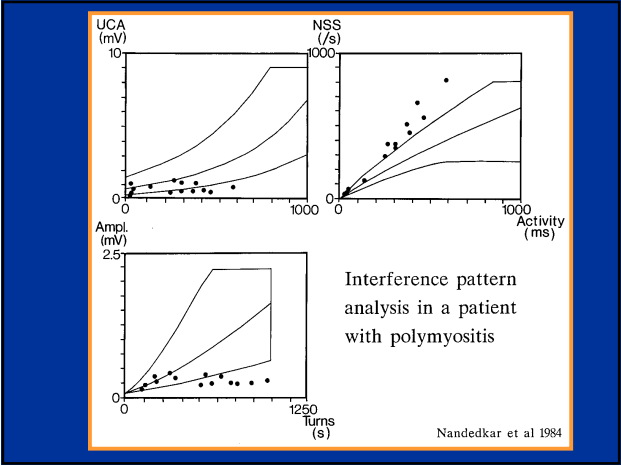
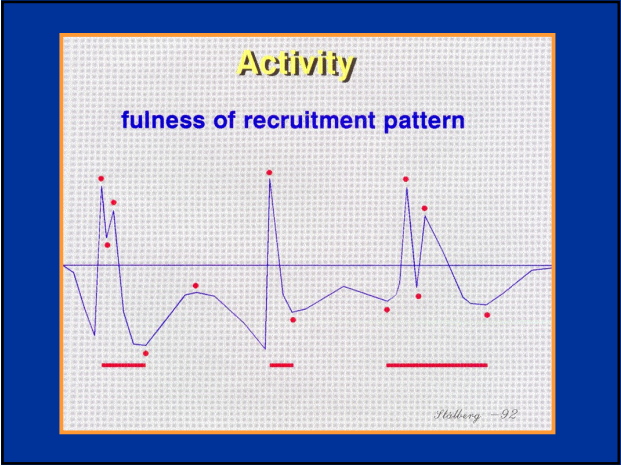
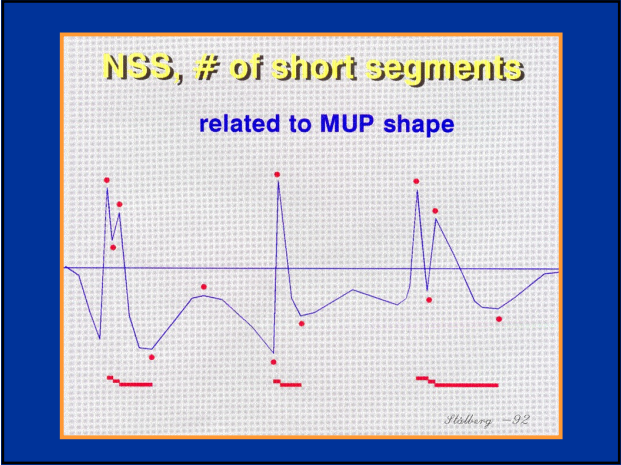
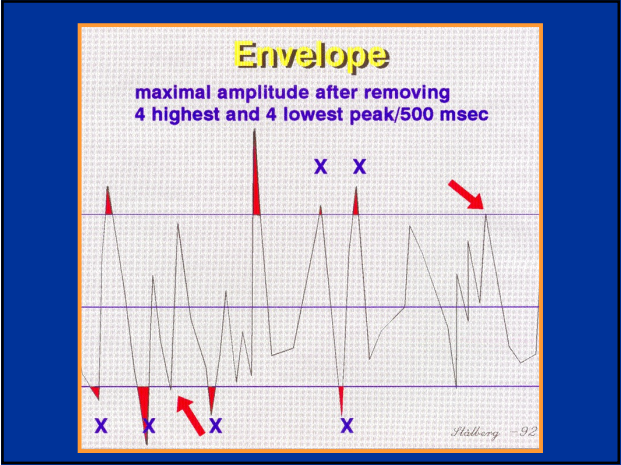


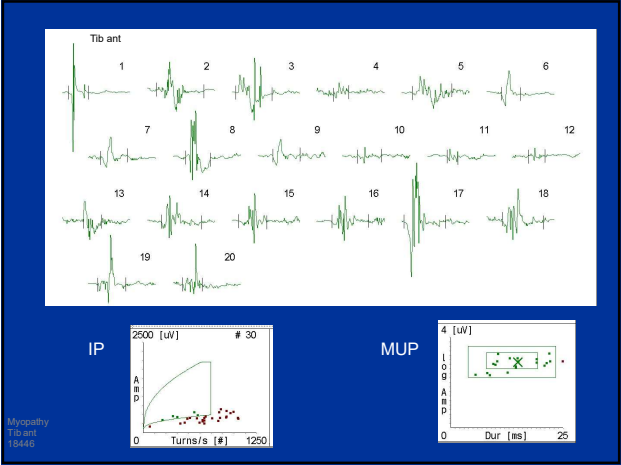
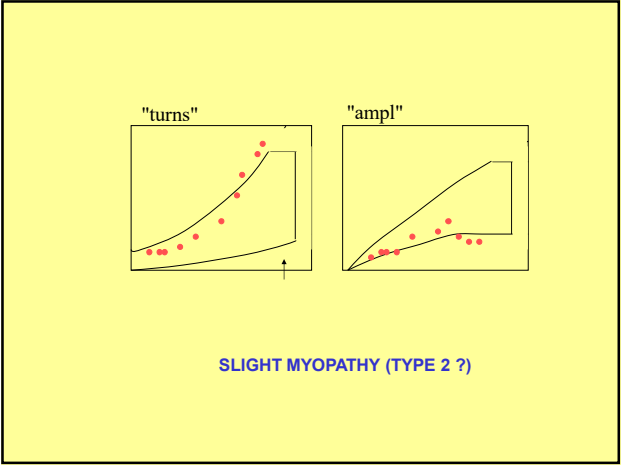
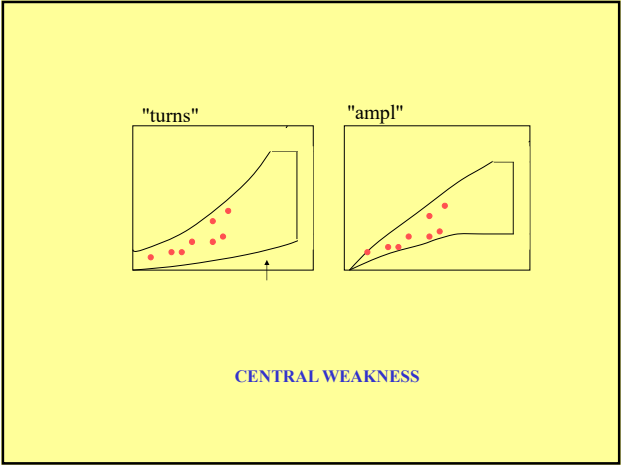
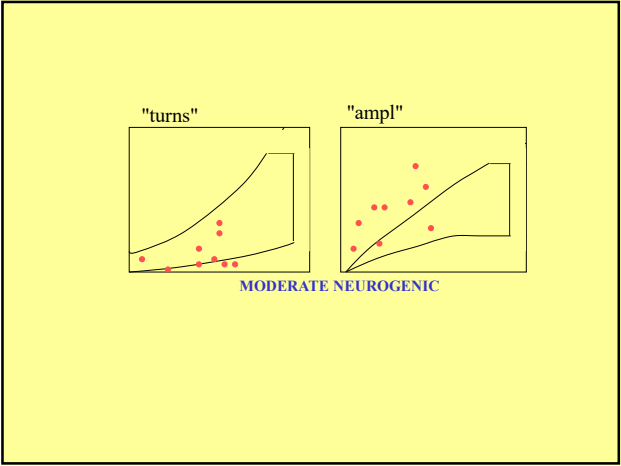
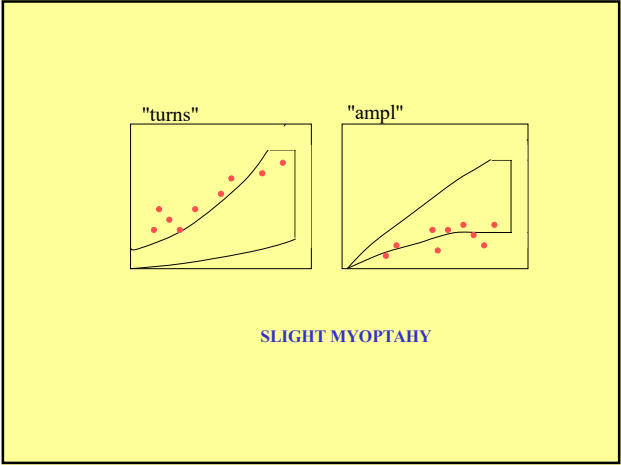
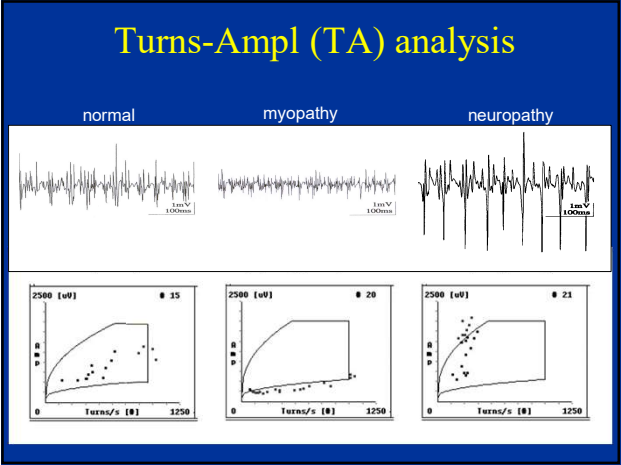
Visual analysis of EMG at full effort



Computer analysis of EMG at full effort

- Turns Amplitude analysis
- Turns and Ampl vs force
 - Turn vs Amplitude
 - Turns vs Fullness
 - Amplitude vs Fullness





How to quantitate Central drive

Parameters:

- pattern - firing rate, onset frequency
- fullness - RMS, integration, “activity”
- stim/voluntary difference
 - CMAP vs. RMS of voluntary EMG
 - superimposed twitch

Stålberg

Reasons for performing QEMG

- standardized way of measuring
- improved sensitivity
- results can be transferred
 - from one time to the other - follow up
 - from one physician to the other
 - from on lab to the other
- reliable results also from less experienced EMGers
- good during training

