**Neuromuscular transmission,**
Understanding SFEMG

**Erik Stålberg**

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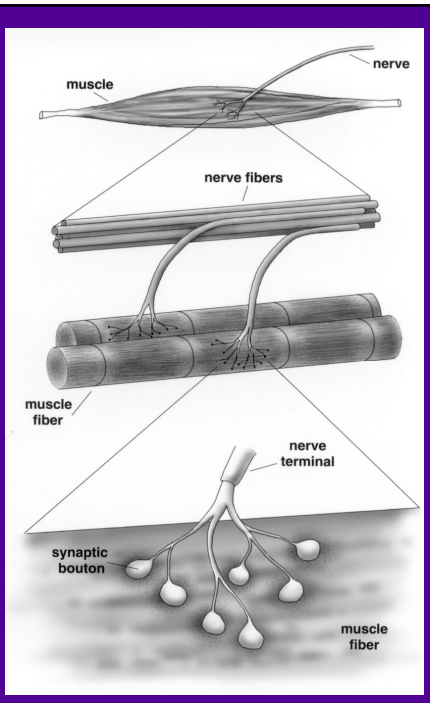


Howard in Stålberg, 2003

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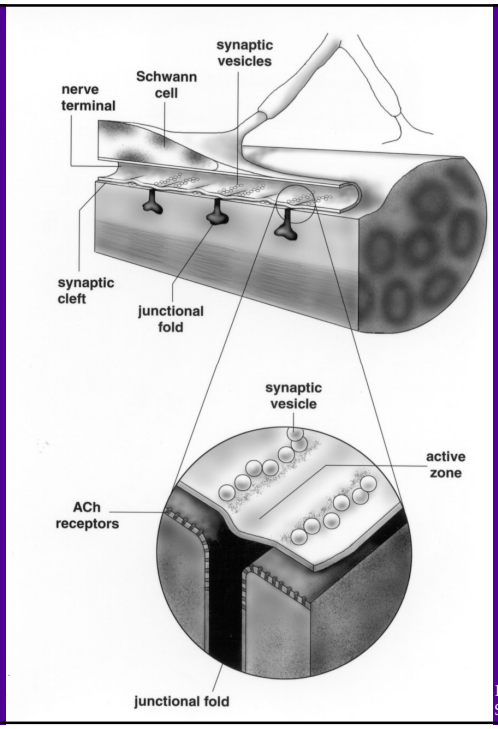
*The neuromuscular junction*



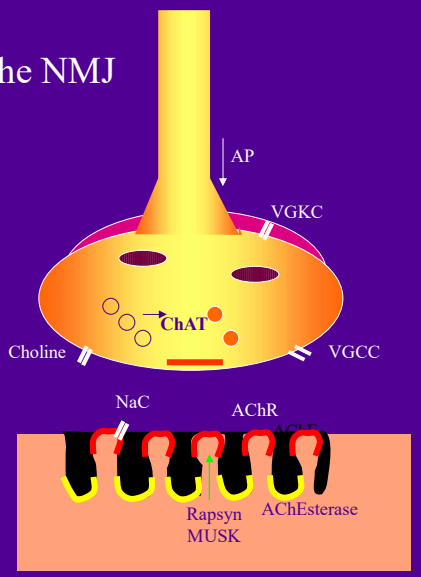

Howard in Stålberg 2003

5

Howard in Stålberg, 2003

6

## Multiple targets at the NMJ

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## *Tests for MG*

- CLINICAL — History, Tests → fatigue, Tensilon, ice test
- EMG — Rep nerve stimulation → slow-fast, postactivation facilitation/exhaustion
- EMG — Needle-EMG → shape variability
- EMG — SFEMG → jitter
- INTRACELL REC
- STAPEDIUS REFLEX
- OCULOGRAPHY
- TONOMETRY
- ACHR ANTIBODIES

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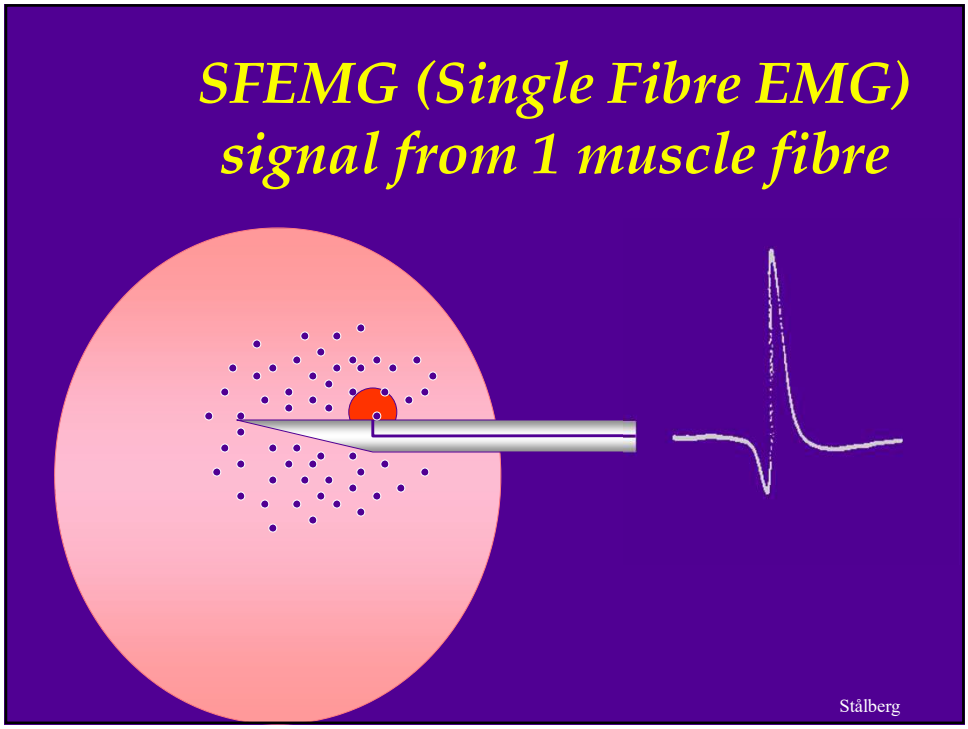
SFEMG (Single Fibre EMG)
signal from 1 muscle fibre
Stålberg

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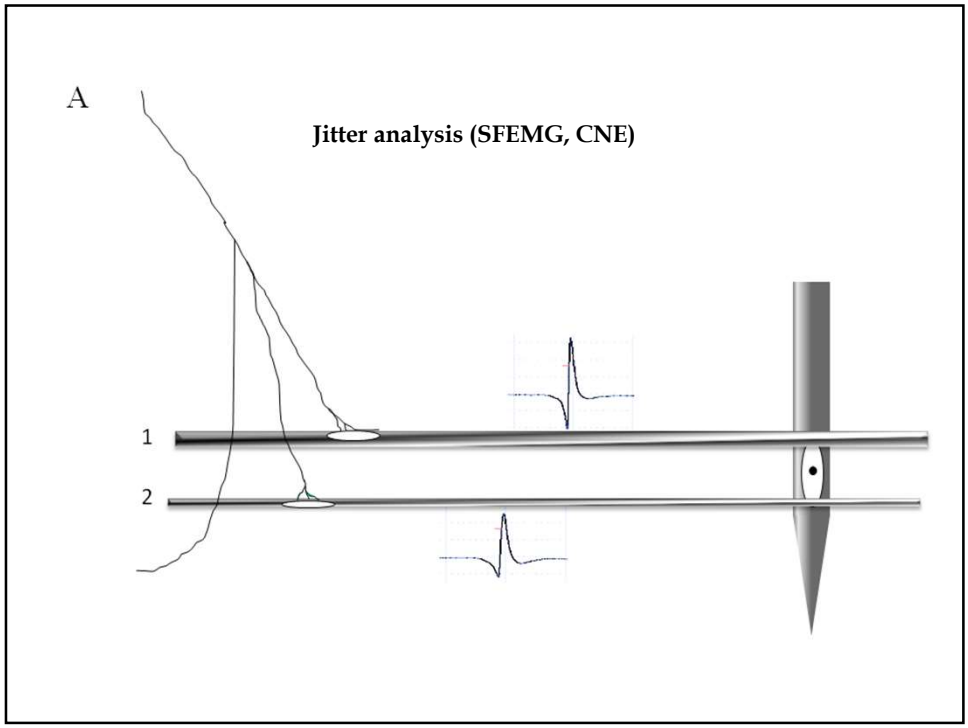
A
Jitter analysis (SFEMG, CNE)
1
2

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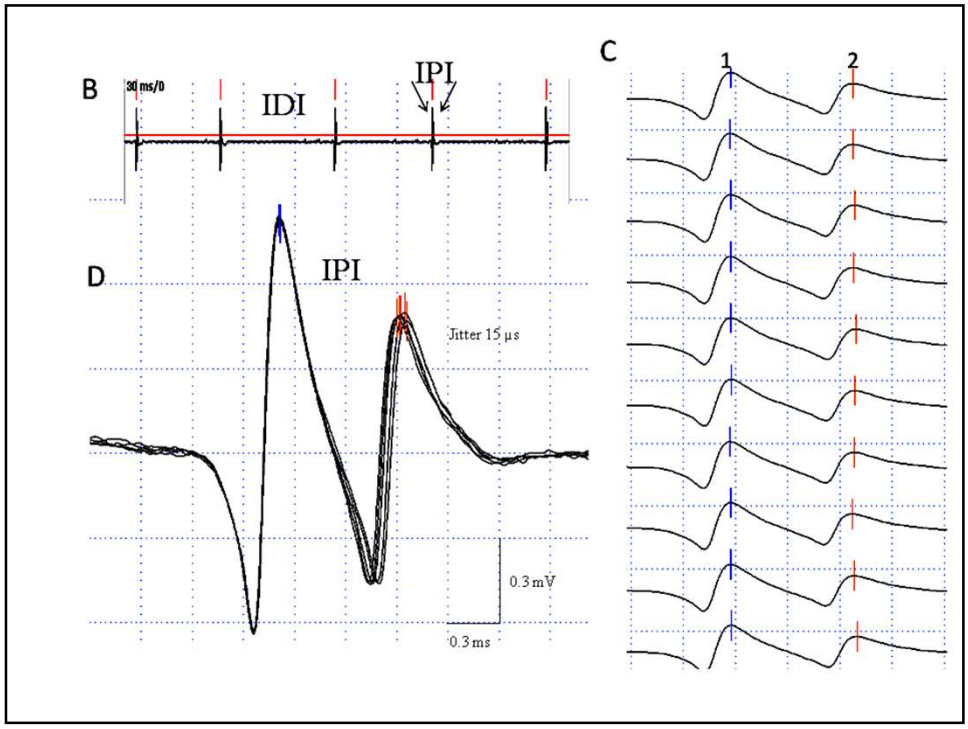


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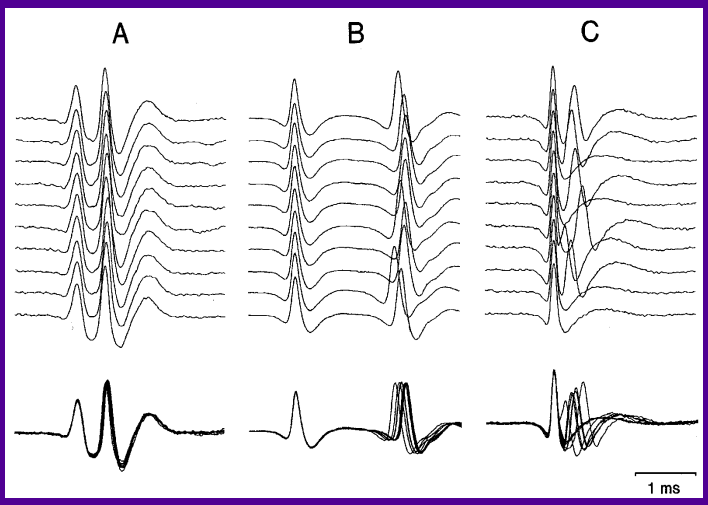
# *Single fiber action potentials*

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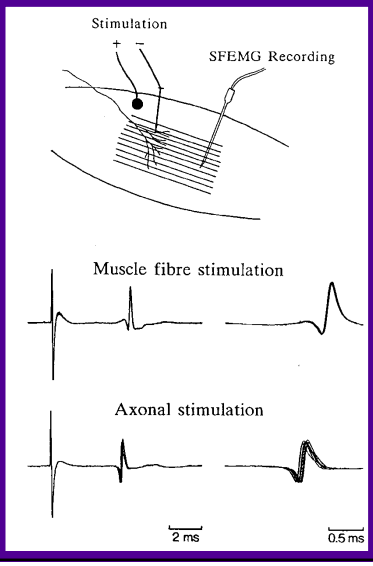
## *Intramuscular stimulation and SFEMG recording*

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## Measuring jitter with

## Concentric Needle electrodes

Erik Stålberg
Uppsala, Sweden

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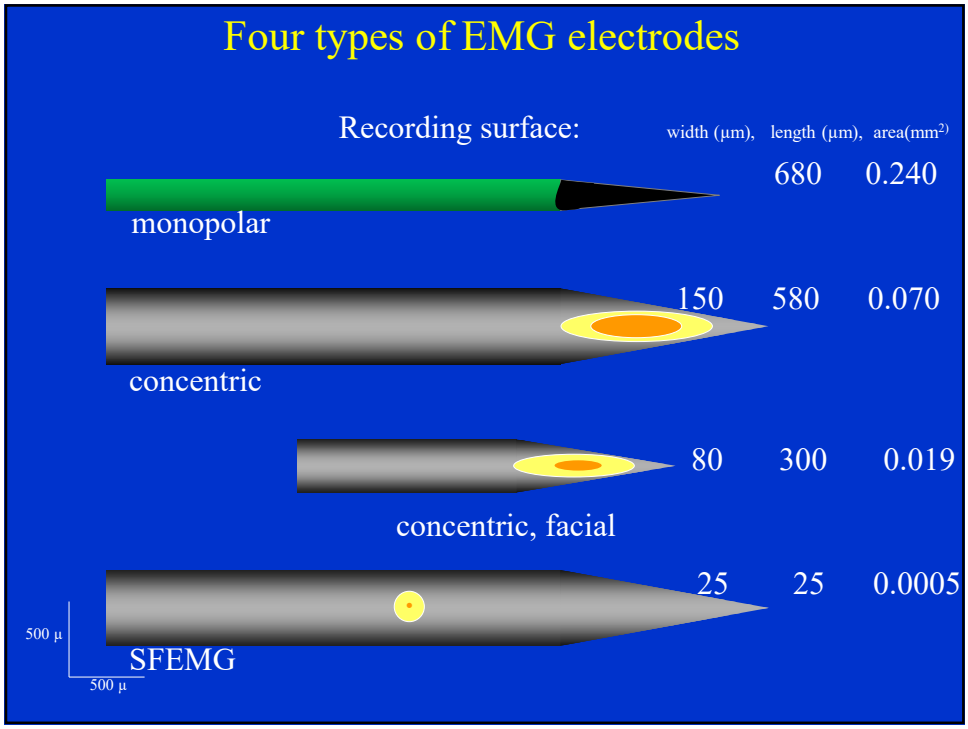
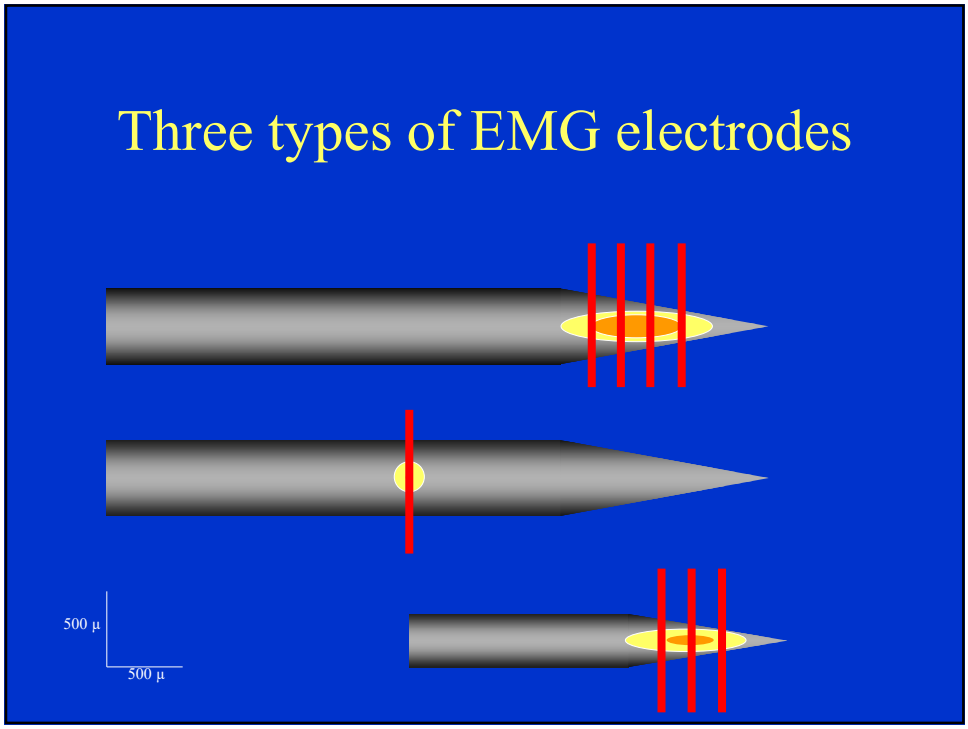

Four types of EMG electrodes
Recording surface:
width (µm),
length (µm),
area(mm2)
680
0.240
monopolar
150
580
0.070
concentric
80
300
0.019
concentric, facial
25
25
0.0005
500 µ
500 µ
SFEMG

30


Three types of EMG electrodes
500 µ
500 µ

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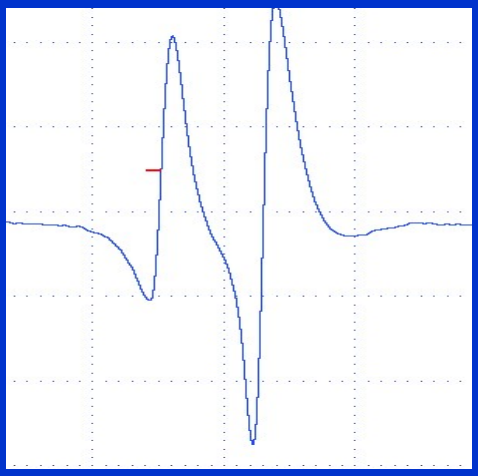
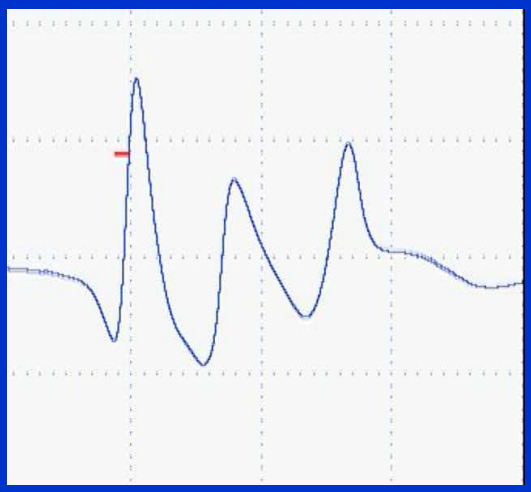
# SFEMG



50

# Jitter with conc needle electrode



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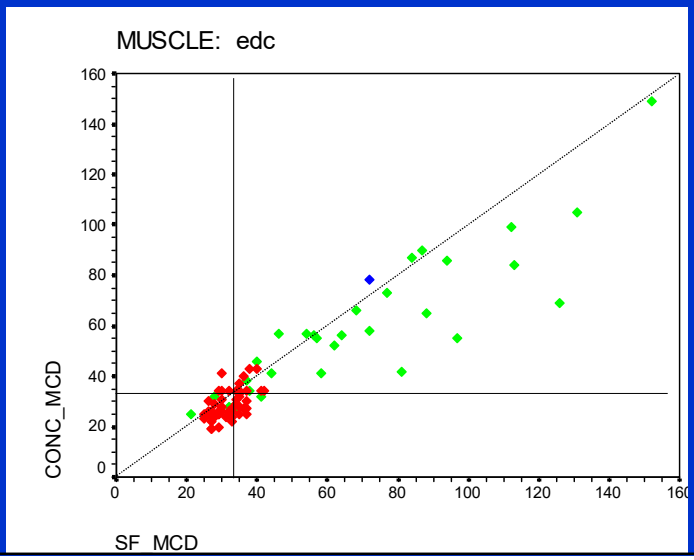
# Jitter SF vs Conc, mixed diagn

#>10 values, total mtrl; n=92

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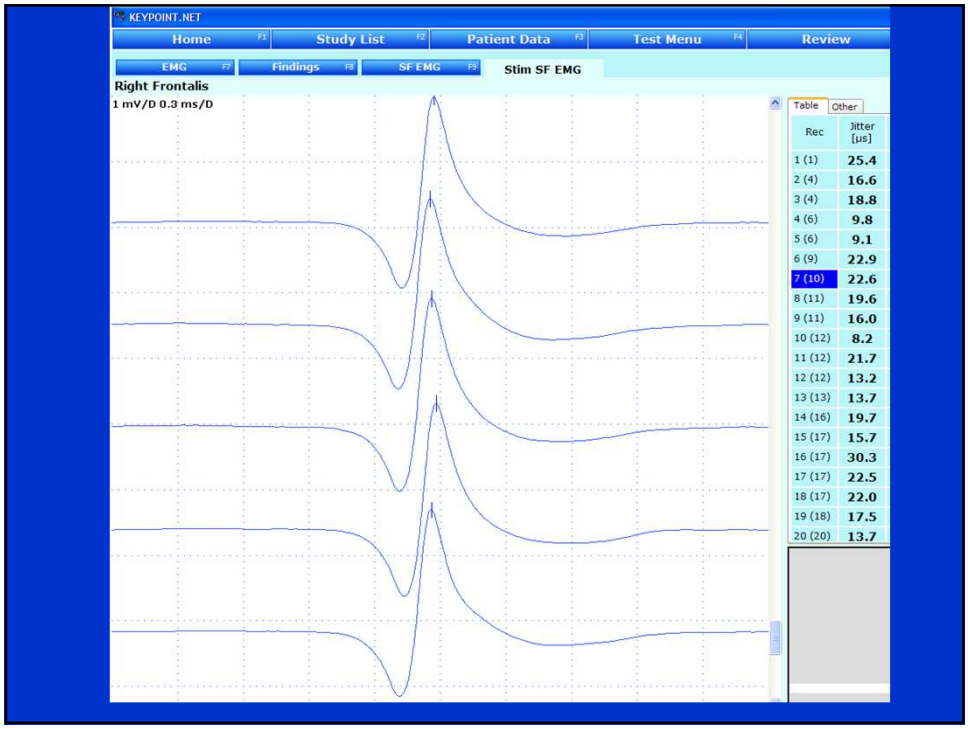
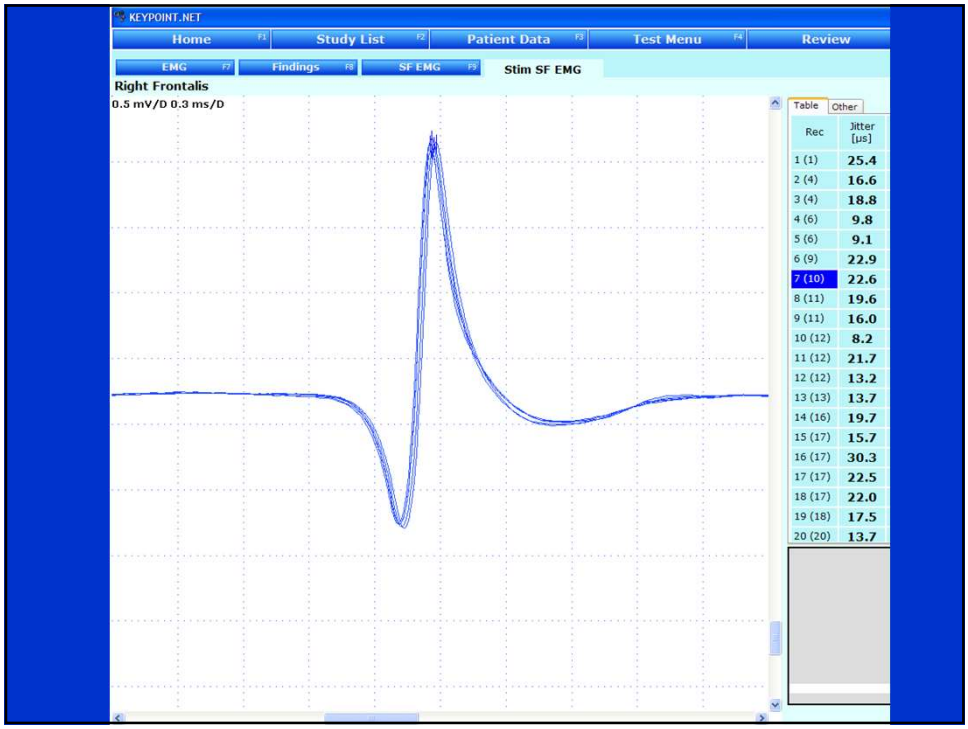

KEYPOINT.NET
Home F1
Study List F2
Patient Data F3
Test Menu F4
Review
EMG F7
Findings F8
SF EMG F9
Stim SF EMG
Right Frontalis
1 mV/D 0.3 ms/D
Table
Other
Rec
Jitter [µs]
1 (1) 25.4
2 (4) 16.6
3 (4) 18.8
4 (6) 9.8
5 (6) 9.1
6 (9) 22.9
7 (10) 22.6
8 (11) 19.6
9 (11) 16.0
10 (12) 8.2
11 (12) 21.7
12 (12) 13.2
13 (13) 13.7
14 (16) 19.7
15 (17) 15.7
16 (17) 30.3
17 (17) 22.5
18 (17) 22.0
19 (18) 17.5
20 (20) 13.7

**133**


KEYPOINT.NET
Home F1
Study List F2
Patient Data F3
Test Menu F4
Review
EMG F7
Findings F8
SF EMG F9
Stim SF EMG
Right Frontalis
0.5 mV/D 0.3 ms/D
Table
Other
Rec
Jitter [µs]
1 (1) 25.4
2 (4) 16.6
3 (4) 18.8
4 (6) 9.8
5 (6) 9.1
6 (9) 22.9
7 (10) 22.6
8 (11) 19.6
9 (11) 16.0
10 (12) 8.2
11 (12) 21.7
12 (12) 13.2
13 (13) 13.7
14 (16) 19.7
15 (17) 15.7
16 (17) 30.3
17 (17) 22.5
18 (17) 22.0
19 (18) 17.5
20 (20) 13.7

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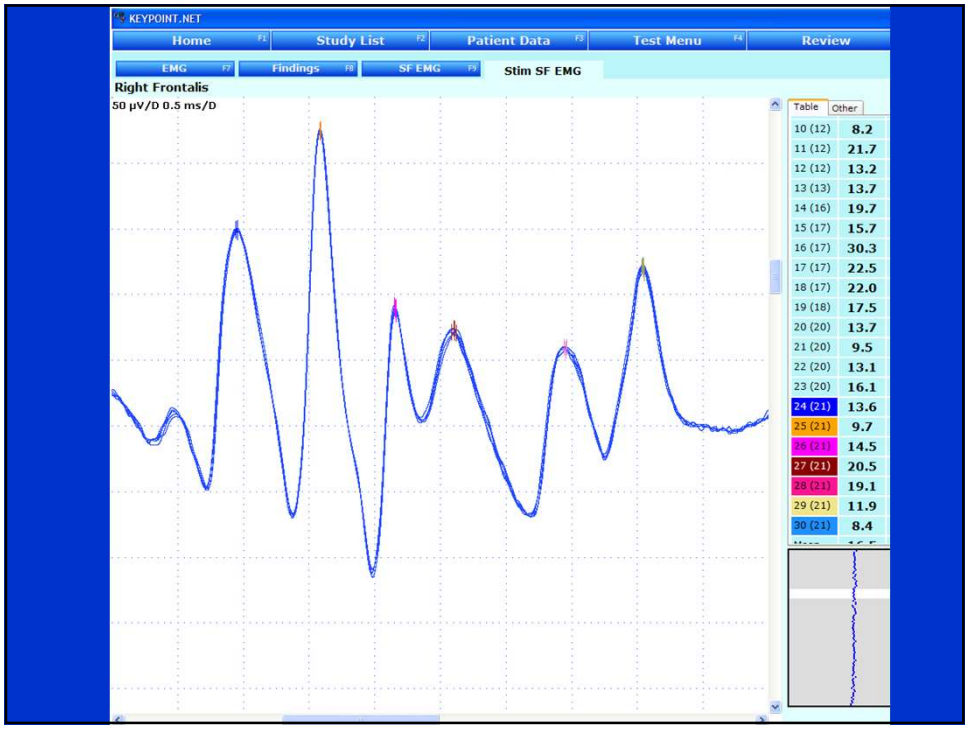
KEYPOINT.NET
Home F1
Study List F2
Patient Data F3
Test Menu F4
Review
EMG F7
Findings F8
SF EMG F9
Stim SF EMG
Right Frontalis
0.5 mV/D 0.5 ms/D
Table
Other
Rec
Jitter [µs]
1 (1) 25.4
2 (4) 16.6
3 (4) 18.8
4 (6) 9.8
5 (6) 9.1
6 (9) 22.9
7 (10) 22.6
8 (11) 19.6
9 (11) 16.0
10 (12) 8.2
11 (12) 21.7
12 (12) 13.2
13 (13) 13.7
14 (16) 19.7
15 (17) 15.7
16 (17) 30.3
17 (17) 22.5
18 (17) 22.0
19 (18) 17.5
20 (20) 13.7

**135**


KEYPOINT.NET
Home F1
Study List F2
Patient Data F3
Test Menu F4
Review
EMG F7
Findings F8
SF EMG F9
Stim SF EMG
Right Frontalis
50 µV/D 0.5 ms/D
Table
Other
10 (12) 8.2
11 (12) 21.7
12 (12) 13.2
13 (13) 13.7
14 (16) 19.7
15 (17) 15.7
16 (17) 30.3
17 (17) 22.5
18 (17) 22.0
19 (18) 17.5
20 (20) 13.7
21 (20) 9.5
22 (20) 13.1
23 (20) 16.1
24 (21) 13.6
25 (21) 9.7
26 (21) 14.5
27 (21) 20.5
28 (21) 19.1
29 (21) 11.9
30 (21) 8.4

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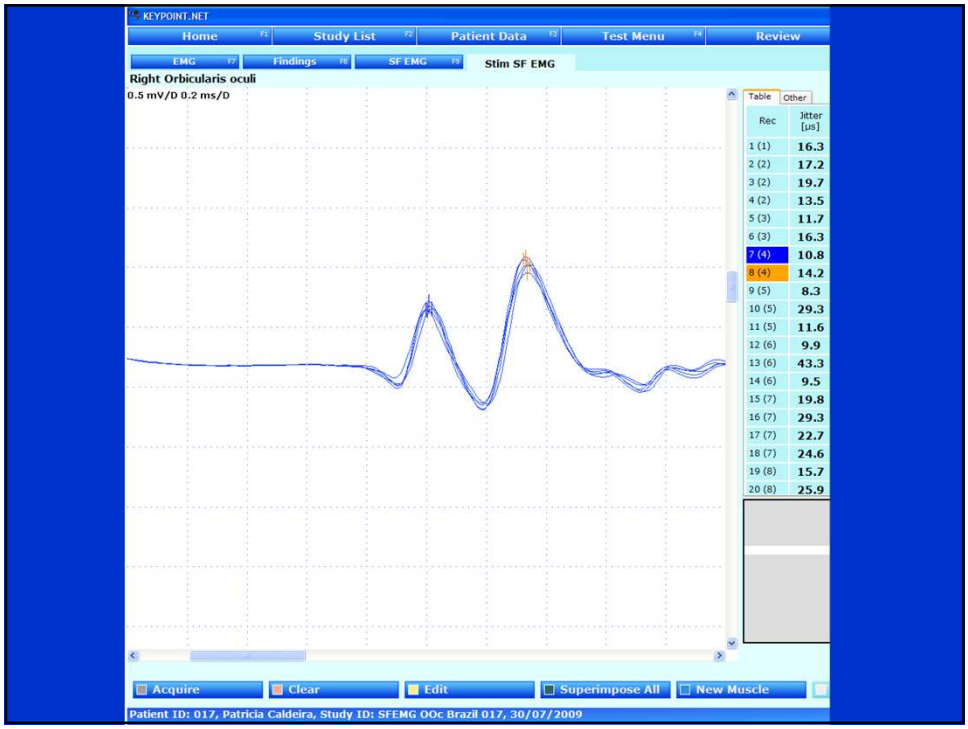
KEYPOINT.NET
Home
Study List
Patient Data
Test Menu
Review
EMG
Findings
SF EMG
Stim SF EMG
Right Orbicularis oculi
0.5 mV/D 0.2 ms/D
Table
Other
Rec
Jitter [µs]
1 (1) 16.3
2 (2) 17.2
3 (2) 19.7
4 (2) 13.5
5 (3) 11.7
6 (3) 16.3
7 (4) 10.8
8 (4) 14.2
9 (5) 8.3
10 (5) 29.3
11 (5) 11.6
12 (6) 9.9
13 (6) 43.3
14 (6) 9.5
15 (7) 19.8
16 (7) 29.3
17 (7) 22.7
18 (7) 24.6
19 (8) 15.7
20 (8) 25.9
Acquire
Clear
Edit
Superimpose All
New Muscle
Patient ID: 017, Patricia Caldeira, Study ID: SFEMG OOc Brazil 017, 30/07/2009

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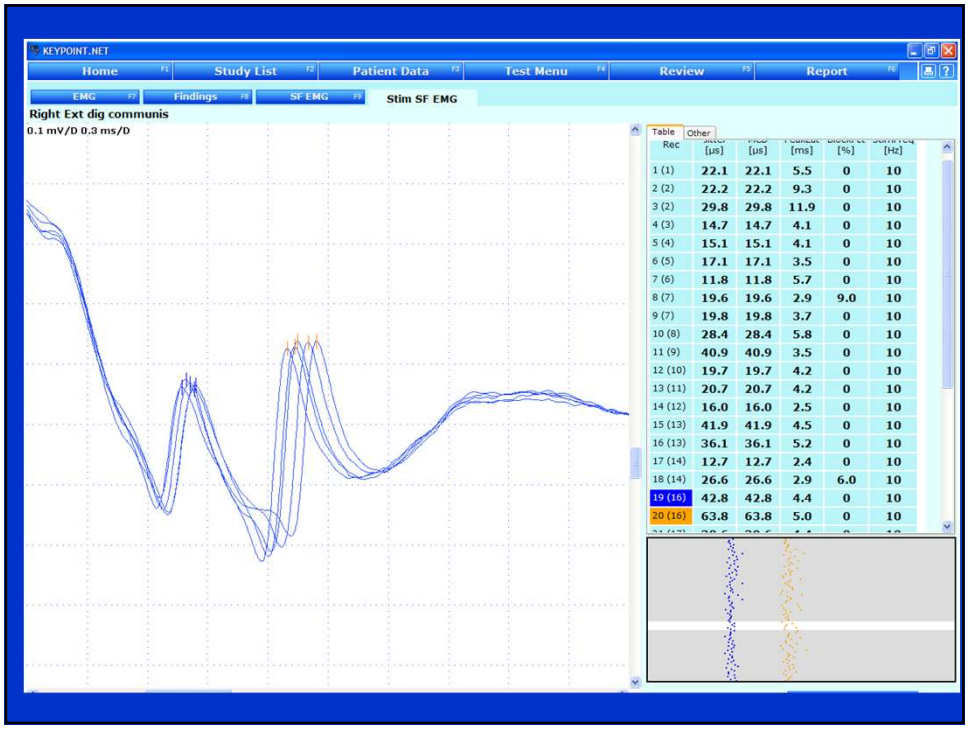
KEYPOINT.NET
Home
Study List
Patient Data
Test Menu
Review
Report
EMG
Findings
SF EMG
Stim SF EMG
Right Ext dig communis
0.1 mV/D 0.3 ms/D
Table
Other
Rec
[µs]
[µs]
[ms]
[%]
[Hz]
1 (1) 22.1 22.1 5.5 0 10
2 (2) 22.2 22.2 9.3 0 10
3 (2) 29.8 29.8 11.9 0 10
4 (3) 14.7 14.7 4.1 0 10
5 (4) 15.1 15.1 4.1 0 10
6 (5) 17.1 17.1 3.5 0 10
7 (6) 11.8 11.8 5.7 0 10
8 (7) 19.6 19.6 2.9 9.0 10
9 (7) 19.8 19.8 3.7 0 10
10 (8) 28.4 28.4 5.8 0 10
11 (9) 40.9 40.9 3.5 0 10
12 (10) 19.7 19.7 4.2 0 10
13 (11) 20.7 20.7 4.2 0 10
14 (12) 16.0 16.0 2.5 0 10
15 (13) 41.9 41.9 4.5 0 10
16 (13) 36.1 36.1 5.2 0 10
17 (14) 12.7 12.7 2.4 0 10
18 (14) 26.6 26.6 2.9 6.0 10
19 (16) 42.8 42.8 4.4 0 10
20 (16) 63.8 63.8 5.0 0 10

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# Jitter with CNE

| Muscle | Mean MCD limit µs | Individual data limit µs |
|---|---|---|
| OO vol | 31 | 45 |
| OO stim | 27 | 36 |
| Frontalis vol | 28 | 38 |
| Frontalis stim | 21 | 28 |
| Ext dig vol | 30 | 43 |
| Ext dig stim | 24 | 35 |

*Multicenter study, 2015*

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# *Diagnostic tests for MG*

% positive results from a total of 291 patients

| Group | SFEMG | Decrement ADM | Decrement Delt | Stapedius reflex | Anti-AChr |
|---|---|---|---|---|---|
| **Ocular** | | | | | |
| EDC + Frontalis | 85 | 4 | 19 | 90 | 76 |
| **EDC** | 59 | | | | |
| **Mild generalized** | 96 | 31 | 68 | 91 | 76 |
| **Mod-severe generalized** | 100 | 68 | 89 | 63 | 88 |
| **Remission** | 62 | 0 | 0 | 83 | |

Stålberg Sanders 1981

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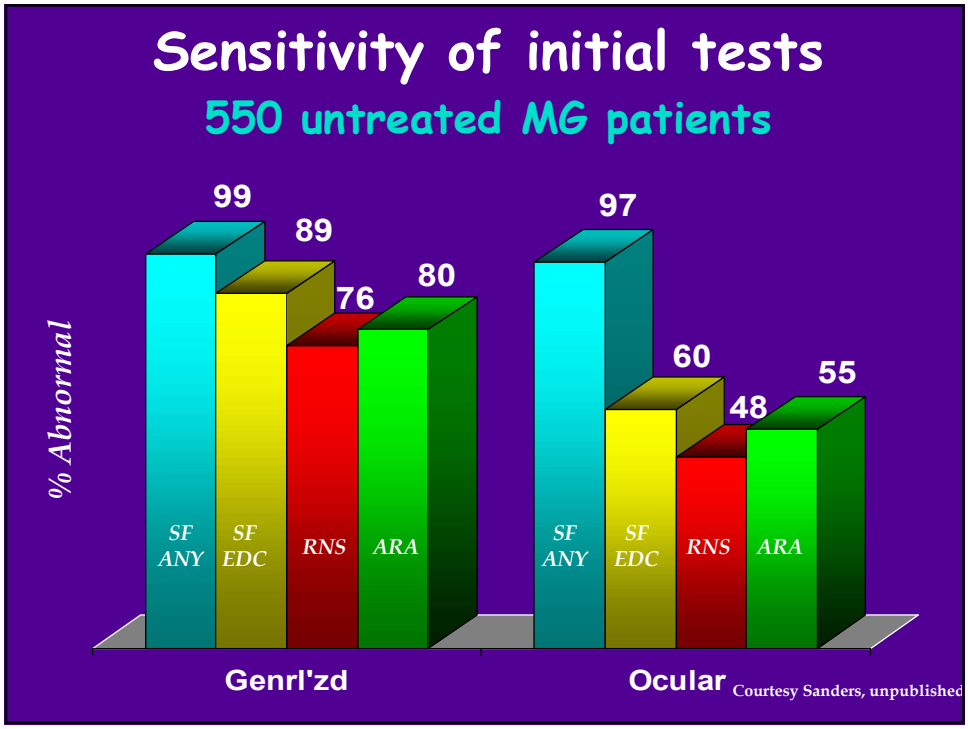


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## *EDX in MG; start with jitter analysis if available*

Jitter analysis → normal → STOP

Logics: we have "never" seen normal jitter and abnormal RNS

Jitter analysis → abnormal → RNS

Why RNS in this case: to see specific patterns (LEM, cong MGs, other disorders, to follow over time

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## *RNS if jitter analyis is unavailable*

Why RNS

- To see MG profile of decrement
- to see specific patterns
  (LEM, cong MGs, other disorders,
- to follow over time

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## *Some links*

Sfemg.info (SFEMG meetings videos)

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