Pitfalls in Measuring Jitter: Drink deep, or taste not the Pierian spring

Donald B. Sanders
Duke University Medical Center, Durham, NC
Pitfalls of voluntary jitter studies

- Mis-triggering
- VRF effects due to inconstant firing rate
- Triangular after-potentials
- Low jitter due to split fibers
- Riding potentials
- Jitter in the triggering potential of multispike potentials
- Bimodal IPI latency (e.g., ”flip-flop”)
- Unacceptable CN electrode signals
Mis-triggering
Inconstant Firing Rate
The Triangular After-Potential
Riding Potentials
Riding signals: IPIs measured at amplitude levels vs peaks
Jitter in the Triggering Potential

<table>
<thead>
<tr>
<th>Jitter between spikes</th>
<th>Sum of jitter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 2</td>
<td>1 to 3</td>
</tr>
<tr>
<td>71.2</td>
<td>32.8</td>
</tr>
<tr>
<td>2 to 1</td>
<td>2 to 3</td>
</tr>
<tr>
<td>71.2</td>
<td>83.0</td>
</tr>
<tr>
<td>3 to 1</td>
<td>3 to 2</td>
</tr>
<tr>
<td>32.8</td>
<td>83.0</td>
</tr>
</tbody>
</table>

Stålberg, Sanders & Kouyoumdjian: Pitfalls & errors in measuring jitter, 2017
Bimodal Jitter – “Flip-Flop”
Flip-Flop
Bimodal Jitter
Acceptable CNE Signals

A

B
ok

C
ok

D

E
no

F
no
Unacceptable CNE signals

Composite spikes

Rising phase not smooth (visible notches or "shoulders")

Shape not constant in consecutive discharges
Unacceptable CNE Signals
Pitfalls of stimulated jitter studies

- Liminal stimulation
- Direct muscle fiber stimulation
- VRF effect
  - at beginning of train
  - with change in stimulation rate
- F-waves
- Axon reflex
Liminal Stimulation

Submaximal stimulation
Jitter 40.9 us
Impulse blocking 24%

Right Orbicularis oculi
1 mV/20 0.5 ms/0
0.2 mV/10 0.2 ms/0
Liminal Stimulation

- Submaximal stimulation
  - Jitter 40.9 us
  - Impulse blocking 24%

- Supramaximal stimulation
  - Jitter 24.5 us
  - No impulse blocking
Direct muscle fiber stimulation

- Jitter < 5 µs: direct stimulation
- Jitter > 5 µs: axonal stimulation
VRF effect
Stimulation at different rates
VRF effect at change in stimulation rate
F-Waves

Effect of occasional F-waves on the following M-latency
Axon Reflex
Weak axonal stimulation produces retrograde activation of the recorded fiber (→).

Stronger stimulation (⇒) directly activates the branch with shorter latency.
Quality control while recording

- Acquire clean sharp signals meeting SFAP criteria.
- Maintain stable electrode position.
- Set good trigger position.
- Look & listen for blocking.
- Maintain steady firing rate.
Quality control during analysis

- Review data – look at:
  - Superimposed signals
  - Sequential histogram
- Confirm stable trigger point.
- Confirm blocking.
- Calculated values should be consistent with subjective impression.
Quality control during interpretation

• Should be consistent with clinical and other neurophysiological findings.

• Increased jitter $\neq$ MG. Other conditions must be excluded.
Drink deep, or taste not the Pierian spring

• A little learning is a dangerous thing; drink deep, or taste not the Pierian* spring: there shallow draughts intoxicate the brain, and drinking largely sobers us again. *A fountain in Pieria, sacred to the Muses and supposedly conferring inspiration or learning on anyone who drank from it.

*Alexander Pope, An Essay on Criticism, 1709

A fountain in Pieria, sacred to the Muses and supposedly conferring inspiration or learning on anyone who drank from it.
Share Your Feedback

• Please use the 2019 AANEM Annual Meeting app to rate this presentation and the speaker(s).

• Your feedback helps us enhance our annual meeting to ensure we are continuing to meet your needs.
• Claiming CME
• Course and Plenary Presentations

Visit: www.aanem.org/resources

Record your attendance hours after each session or do it all at once after the meeting is complete! Credit not recorded by December 15, 2019 will not be reported to ABPN and ABPMR. The AANEM will report ALL Annual Meeting attendees’ credit to ABPN and ABPMR by December 31, 2019.