The Magic of Basics – Technical Parameters of ECT

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Eivind Aakhus

MD, PhD, pychiatrist

Head of Research and Development

Norwegian National Centre for Ageing and Health

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A Norwegian language handbook!

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Technical Parameters of ECT
A parameter...

1. is a measurement whose variations lead to variations in the results accordingly
2. is set or adjusted by the operator, and
3. directly defines the electrical stimulus delivered

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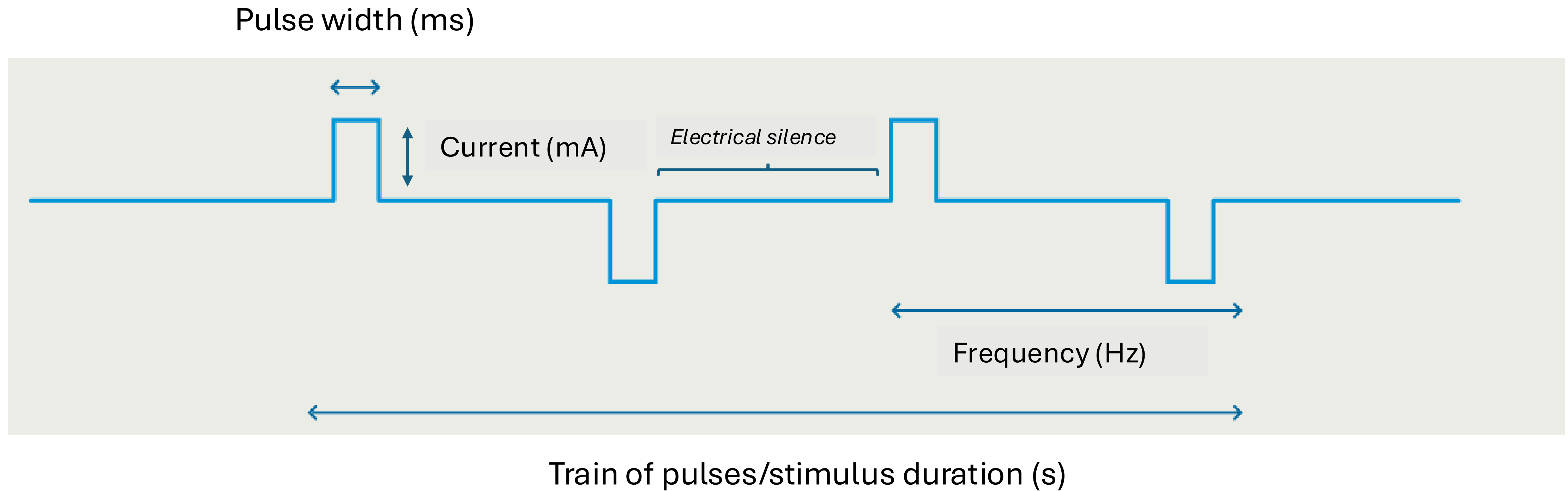
ECT parameters are

- Current (mA)
- Charge (mC)
- Frequency (Hz)
- Stimulus duration (s)
- Pulse width (ms)
- Electrode placement (RUL, BT, BF, LART…)



Folstad in Aakhus (ed): ECT og andre nevrostimulerende behandlingsmetoder

Most interesting is – how does these parameters affect…

Dosing strategy
Seizure threshold
Postictal suppression
Clinical outcome

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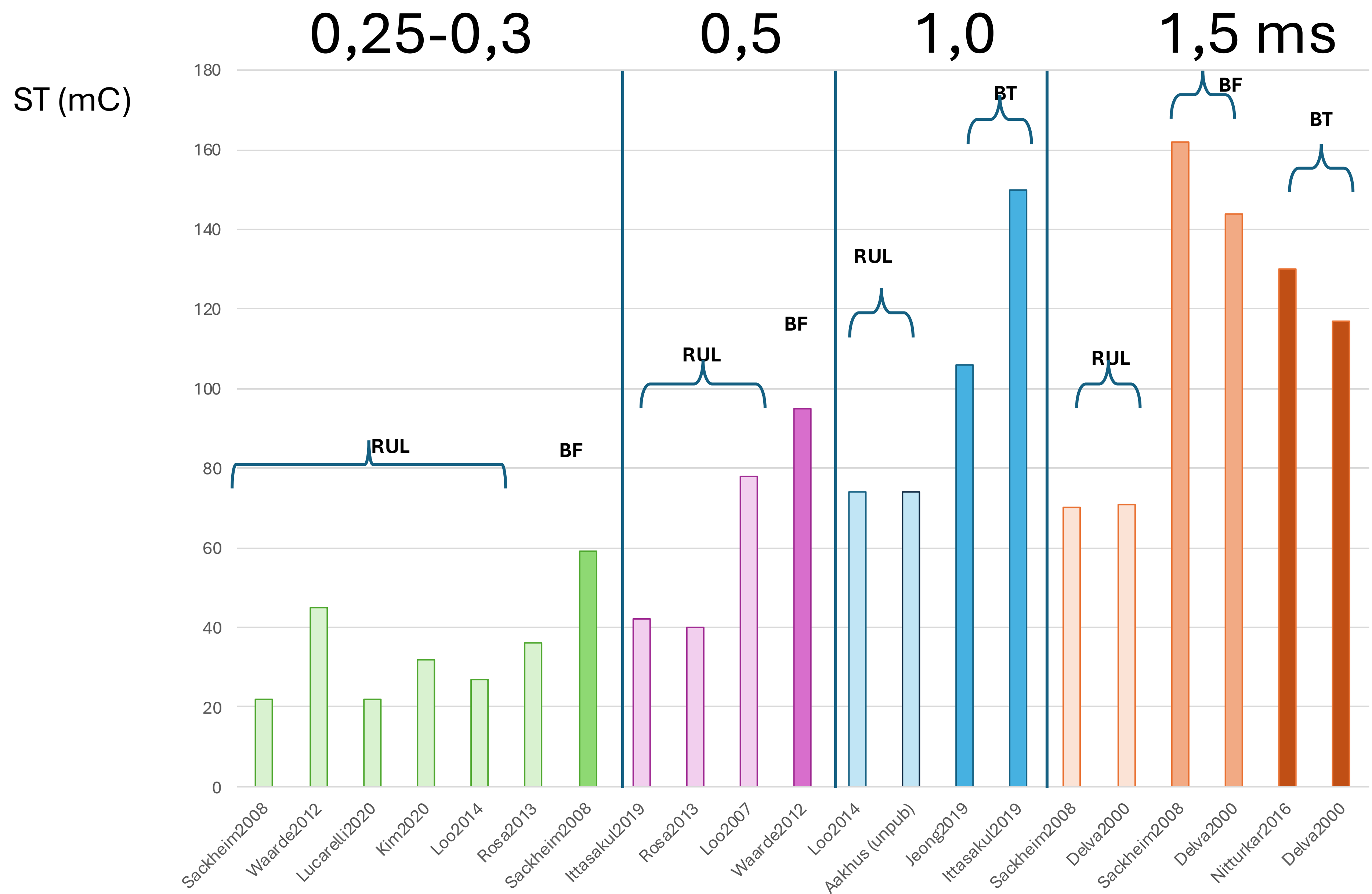
Take home message 1

- Your choice of electrode placement and pulse width substantially affects the required stimulus dose

Take home message 2

- Unilateral electrode placement requires substantially higher stimulus dose than bilateral

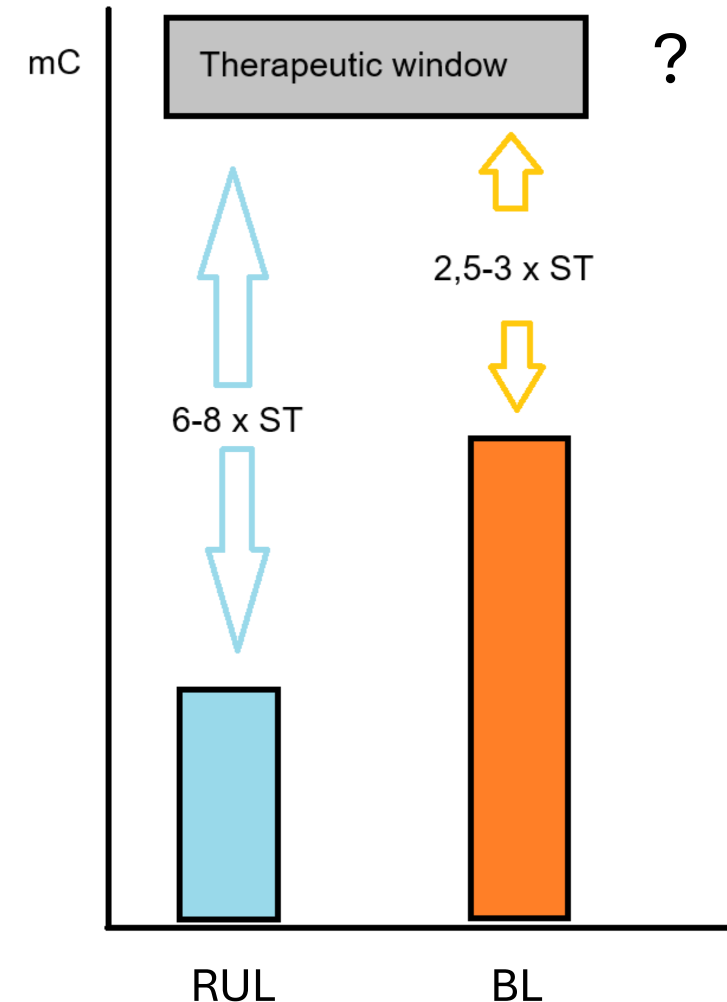
The relationship between electrode placement, pulse width and seizure threshold



Limitations: Age, sex, medication , shows means, not variation

Is there a «therapeutic window» the operator needs to access?

- Unilateral ECT (RUL)
  - Has low ST
  - Requires 6-8 x ST or age dose
- Bilateral (BT/BF)
  - Has high ST
  - Requires lower dosing, 2,5-3 X ST or half age dose



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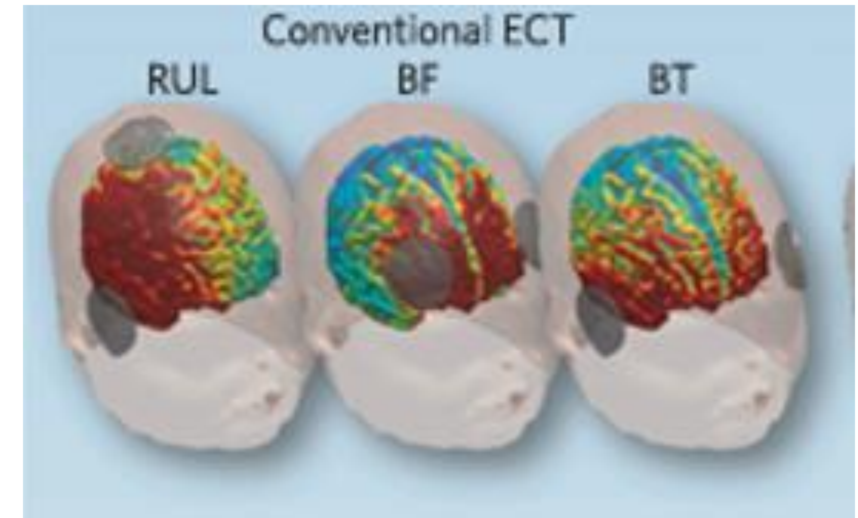
Probably not…

- It’s all about the electrical field!
- In RUL ECT:
  - large portions of the left hemisphere receive only weak stimulation
  - frontomedial and bilateral limbic activation is limited

➢ we must substantially exceed the minimal seizure threshold, hence 6–8× ST.



Deng et al. 2024

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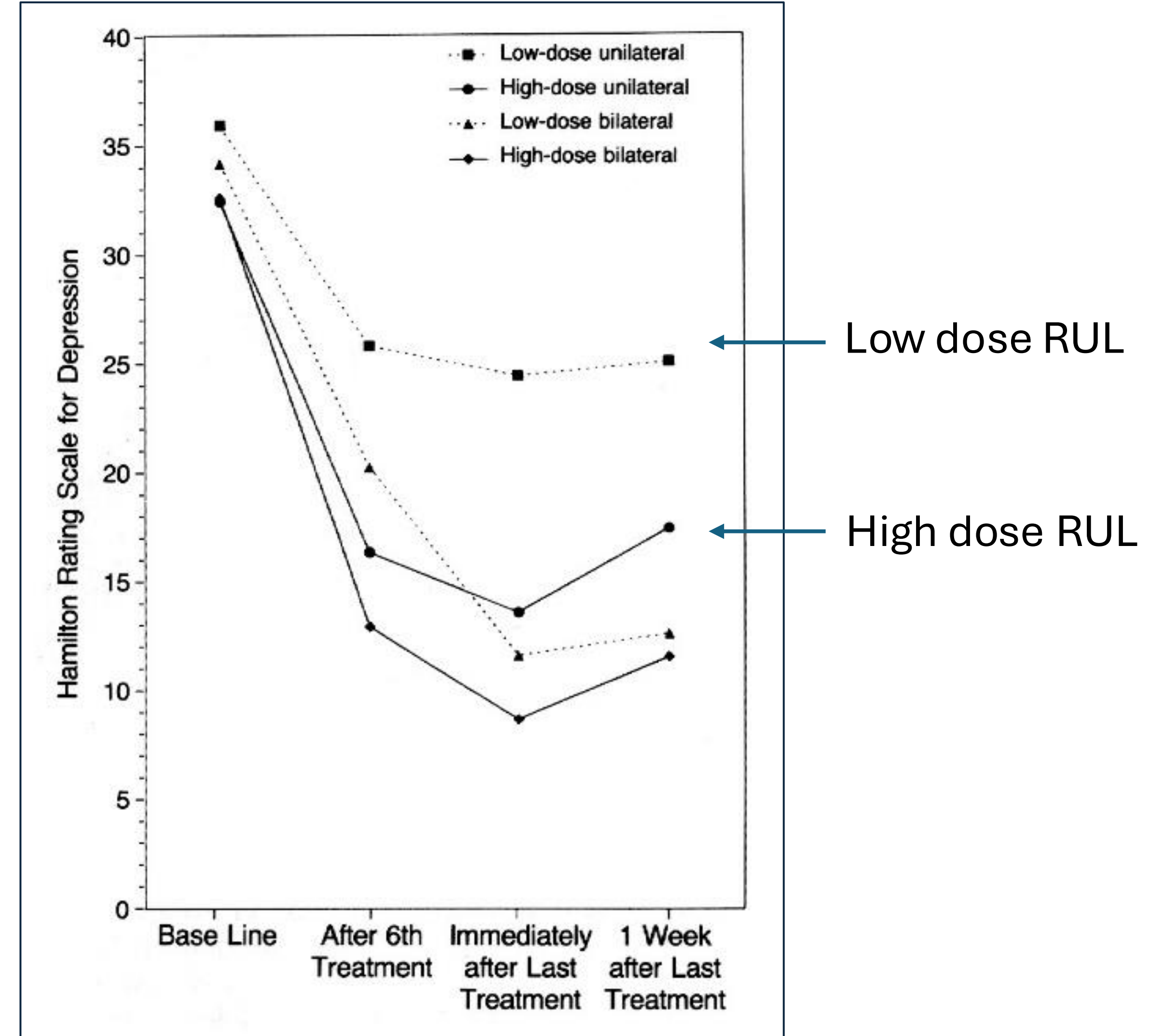
Take home message 3

- It is not the seizure itself that alleviate depressive symptoms
  - It's the distance between the seizure threshold (in mC) and the stimulus dose



Low dose RUL

High dose RUL

Sackeim 1993

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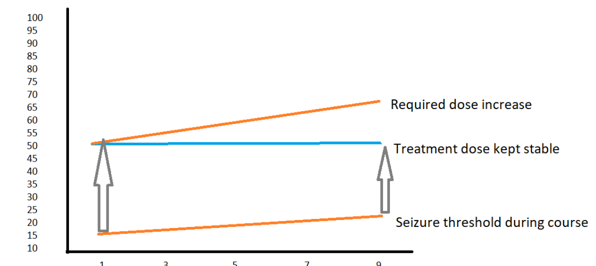
Seizure threshold is not a fixed value

- Age (old>young)
- Sex (male>female)
- Medication
  - Anticonvulsants ↑
  - Benzodiazepines ↑
  - Antipsychotics ↓
  - Betablockers ↑(?)
- Head anatomy
- ECT-related factors
  - 800mA > 900 mA (?)
  - Electrode placement
  - Pulse width
  - The ECT treatment number (early<late)



Van Waarde et al EurArchPsychClinNeurosci 2009

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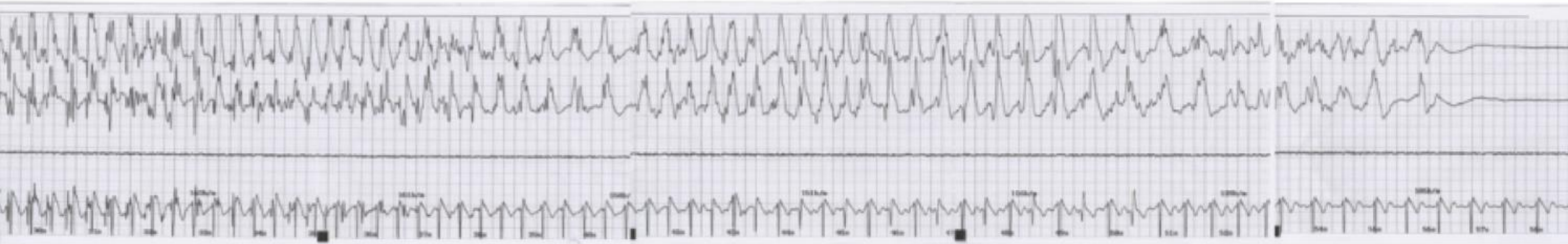
Two core features of ECT assessment

The EEG

Postictal suppression



The EEG

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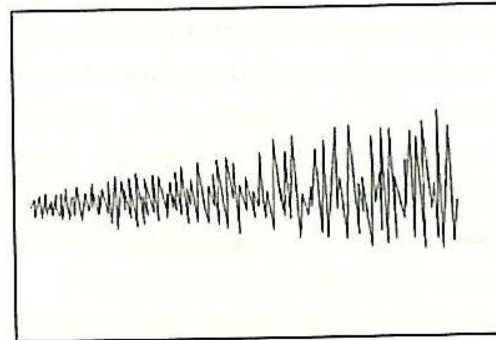
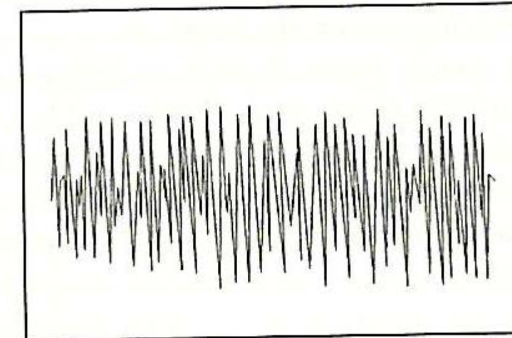
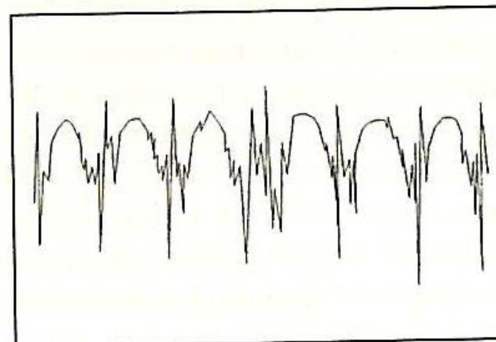
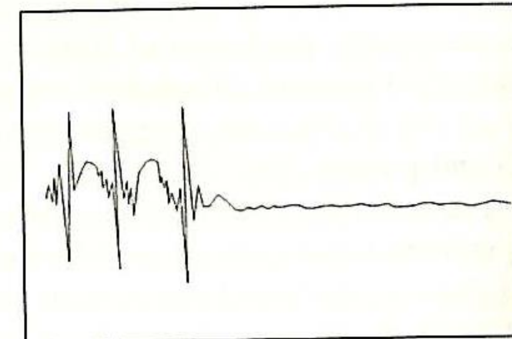
EEG patterns

EEG-appearance vary. Look for rythmic discharges alternating between sharp spikes and round waves









From Abrams, R. Electroconvulsive therapy, 2002

Narrow or wide?

Ill.: Geekymedics.com, Pixabay.com, P. Bergsholm, private

Five core features of EEG interpretation

1. Spike and wave?
2. Bilateral activation?
3. Duration OK?
4. Seizure terminated?
5. Postictal supression OK?

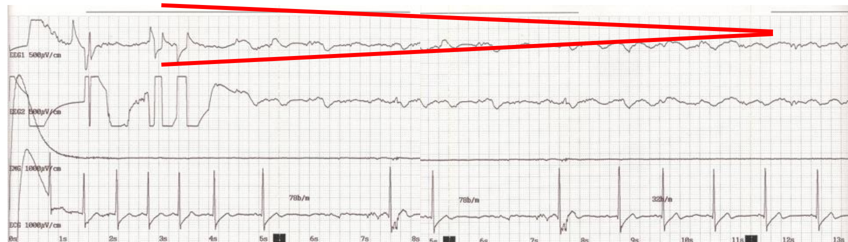
Postictal suppression (PS), parameters and the course of depression

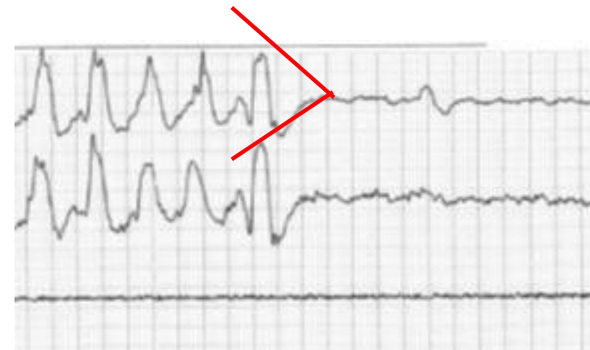
- PS reflects termination of cortical seizure activity through inhibitory processes (GABA, neuromodulatory effects)
- Already described in the 70s and calculated since the 90s
  - Higher postictal suppression were linked to better outcome
    - Nobler 1993, Krystal 1995, 1996, 2000, Nobler 2000, Azuma 2007, 2011
  - ≈ 350 patients. Prospective and retrospective studies.
- Ultra-brief pulsewidth (0,3ms) suppression comparable to brief pw (1,0ms) (Mayur 12), but less robust ictal EEG (Loo 2012)
- Bilateral ECT often higher suppression (Perera 2004)
- PS may look excellent at ST! (Personal observation)

PS index calculated vs PS visual assessment

PSI is calculated as **$(1 - A_2 / A_1) \times 100\%$**, where A_1 represents the ictal amplitude and A_2 denotes the post-ictal amplitude. (The lower A2 the higher PSI)

Or simply
The AAPS-method
The acute (narrow) vs obtuse (wide) angle assessment of postictal suppression a.m. Aakhus





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Hahn et al PNAS Nexus 2023, Sackheim et al 1991, *Aakhus (NACT) 2026*

When EEG changes… which parameters to adjust?

Typical observation

Treatment #	Charge %E (mC)	EEG (secs)	PSI (%)
1 RUL,0.5ms	50 (252)	45	72
2 RUL,0.5ms	50	44	70
3 RUL,0.5ms	50	32	70
4 RUL,0.5ms	55 (277,2)	29	50
5 RUL,0.5ms	55	26	55
6 ???	???		

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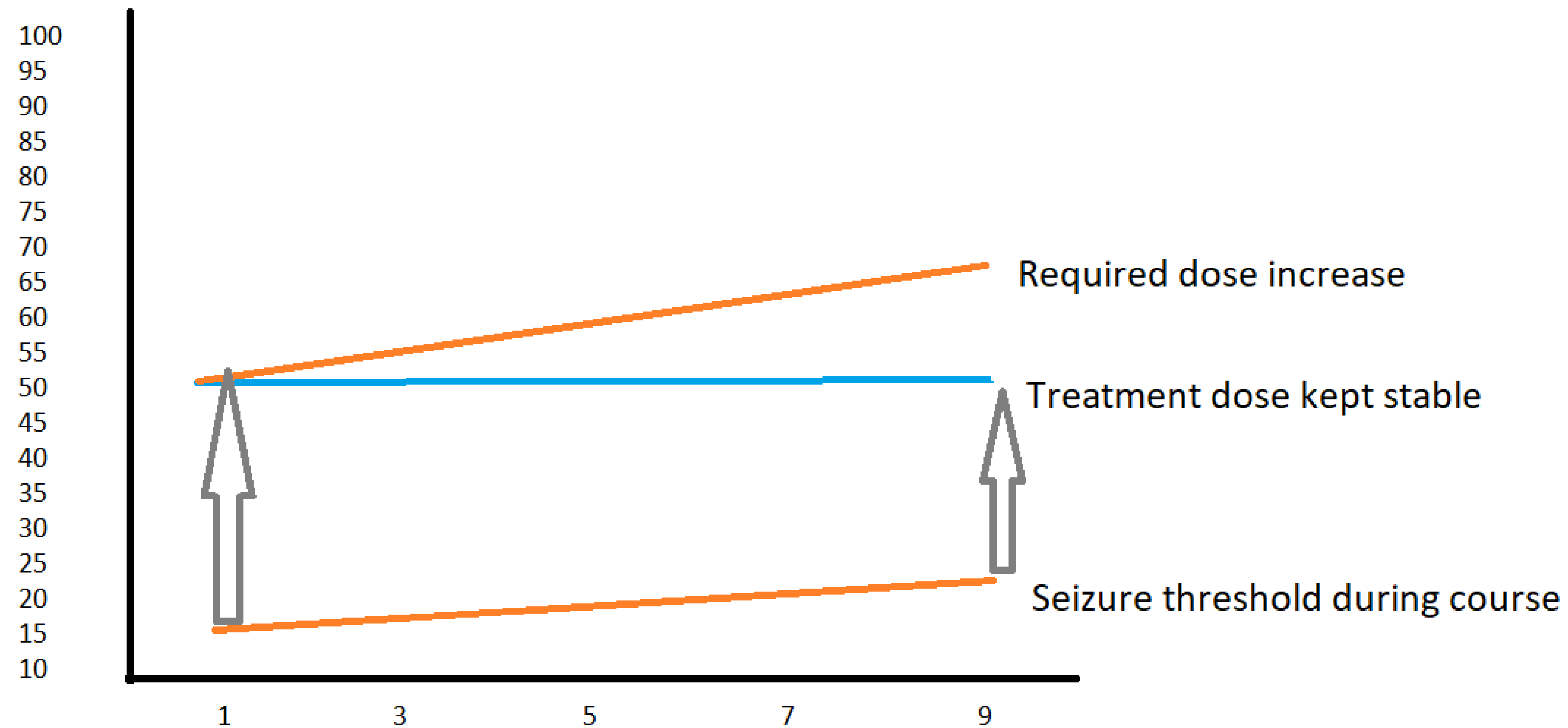
Possible explanation –increasing ST



«average of 65% increase in ST from first to last session» - *vanWaarde 2009*

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Possible strategies:

- Increase charge (ST raises during treatment)
- Change electrode placement (BT more efficient)
- Increase pulse width 0,5→1ms?
- Re-titrate (is individual ST low or high?)

- Review medication (bzd's?)
- Review anesthetic drugs?

«Older adults have the poorest EEG-recordings, and the best treatment effect»

Famous ECT-clinician

Take home message 4

- If the patient improves, and you’re doing everything wrong according to the book, just stick to your path towards victory!

Take home messages:

- Your choice of electrode placement and pulse width substantially affects the required stimulus dose
- Unilateral electrode placement requires substantially higher stimulus dose than bilateral
- It’s the required distance between the seizure threshold (in mC) and the stimulus dose that alleviates depressive symptoms
- If the patient improves, and you’re doing everything wrong according to the book, just stick to your path towards victory! (but if your patient does not improve, you should reconcider your practice)