Aims

To introduce:
• A new measure of peak-to-peak amplitude (ppA)

And to describe:
• Its differences and similarities with another ppA measure, namely, aEEG.
**aEEG: A Representation of ppA**

**Designed for continuous long-term monitoring of ppA in unconscious adults**


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**Example of cardiac arrest**

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**aEEG: Application for Neonates**

- Found application in neonatal EEG monitoring, producing distinct patterns for different:
  - a) background states
  - b) seizures and
  - c) sleep-wake cycling
- Proved to be sensitive to high frequency artefact
But does aEEG measure ppA in neonates accurately?

**aEEG: ppA Distortion that Depends on Frequency**

- **Raw EEG**
  - 100 µV
  - 10 Hz
  - 5 Hz
  - 1 Hz

- **aEEG**
  - 100 µV
  - 57 µV
  - 8 µV
  - 1 s
How aEEG depends on frequency of cEEG?

- Reduces the values of ppA greatly around α-rhythm
- α-rhythm is not present in neonates, its average frequency is much lower
- Thus values of aEEG are about 3 to 6 times lower than ppA of raw EEG signal, but we never know how much

Effectively – a detector of α-rhythm, which is not present in neonates

The aim: to create a method for measuring ppA without frequency distortion

New method transforms raw EEG into another signal, called rEEG
What is the main idea behind our method of ppA calculation?

rEEG: The Idea

There are 3 waves in a selected interval. Values of ppA range from 34 to 45 µV. If we subtract min from max on this interval we will get a ppA-estimate of 47 µV.

It is higher than average ppA on interval but close enough.
rEEG: Calculation

New method transforms cEEG into another signal, called rEEG, from word “range”.

(Note: Range in statistics is difference between max and min)

rEEG = Max – Min on time interval

rEEG: Calculation Example – Upper Estimate of ppA

[Graph showing EEG and rEEG signals with maxima and minima highlighted, and a line graph illustrating the calculation process.]
rEEG – Examples of recording

- 25 weeks
- 34 weeks

Cut off 50 µV

rEEG is also (as aEEG) a compressed representation, it has a semi-logarithmic scale with cut off value of 50 µV

rEEG : we can discern conventional EEG amplitude from it rather accurately

- UM = 100-200 µV?
- LM = 5-15 µV?
On 5-min stretch: Yes – ppA = 10 to 250 µV

But does rEEG produce distinct patterns we used to see in neonates?
The reason for similarities in aEEG and rEEG pattern is that they both represent ppA, albeit with a different degree of accuracy.

Thresholds of 25 and 10 µV are suggested as roughly equivalent to 10 and 5 µV thresholds for aEEG.
Seizures look like the narrowing amplitude band with elevated lower margin, because ppA becomes more uniform during seizure activity.

rEEG - aEEG: High frequency artefact mimicking seizures is less pronounced.

EMG artefact
Conclusions

rEEG:

- An accurate measure of ppA (peak-to-peak amplitude)
- Has similar to aEEG patterns
- Can bridge the gap between cEEG-based and aEEG-based assessment of brain function
- For example, it can be used to assess discontinuity and IBI (inter-burst interval) on raw EEG