Steady, as She Goes – **Consistent Low Impedance** of Ultra Long-Term **Subcutaneous EEG** Ensures High-Quality Recordings

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Key Points

- **Ultra long-term subcutaneous EEG (sqEEG) impedance values are low and remain stable month after month throughout everyday-life monitoring periods.**
- **The consistency of the temporal impedance reassures the reliability of sqEEG recordings.**

Introduction

- Continuous monitoring of brain activity over extended periods of time can be achieved through ultra long-term sqEEG recordings.
- Robust everyday sqEEG measurements (e.g., for automated electrographic seizure detection) rely on a stable connection between electrodes and body tissue.
- The aim of the study is to investigate the temporal evolution of the sqEEG signal impedance.

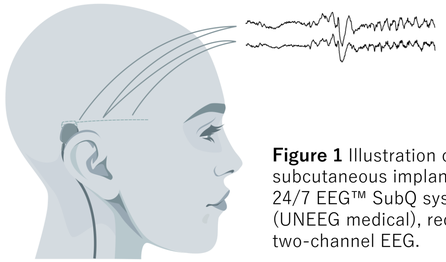

Figure 1 Illustration of the subcutaneous implant of the 24/7 EEG™ SubQ system (UNEEG medical), recording two-channel EEG.

Methods

- Multicenter cohort of ultra long-term sqEEG impedance measurements, including 36 subjects (healthy people* and people with epilepsy**) recording at least 100 days each.
- Median number of recording days was 370 (range 107-538). All data was recorded with the 24/7 EEG™ SubQ solution (figure 1), starting 7-21 days after the implantation procedure.
- Temporal trends in recorded signal impedance were examined using subject-specific linear regression models and by pooling data from all subjects.

Results

- All measurements of electrode impedance remained low (median 3.3 kΩ, maximum 6.5 kΩ; figure 2, mid panel)
- The subject-specific linear regression models (figure 2, top panel) revealed long-term trends close to zero, with a median absolute gradient of 0.009 kΩ/month.
- Pooling data from all subjects demonstrated temporal consistency in impedance measurements (figure 3).

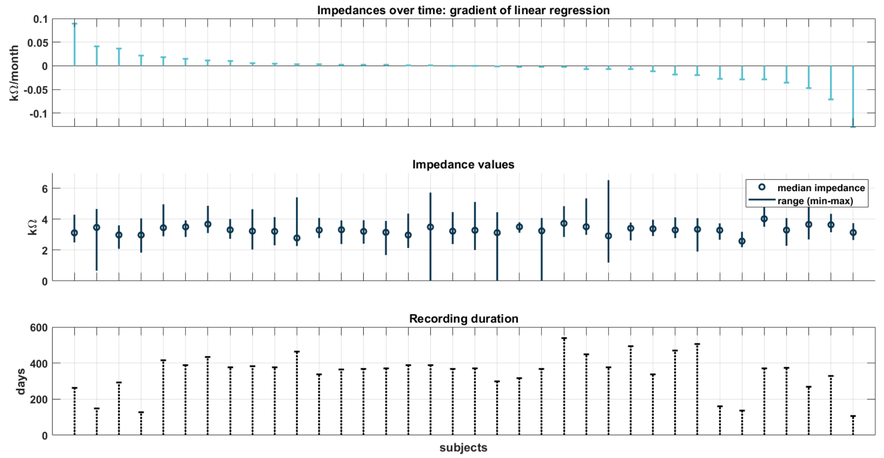

Figure 2. Top: gradients of subject-specific linear regression models. The horizontal histogram sums up the values. Mid: Impedance values. The median and range for each subject. Bottom: Recording durations for each subject.

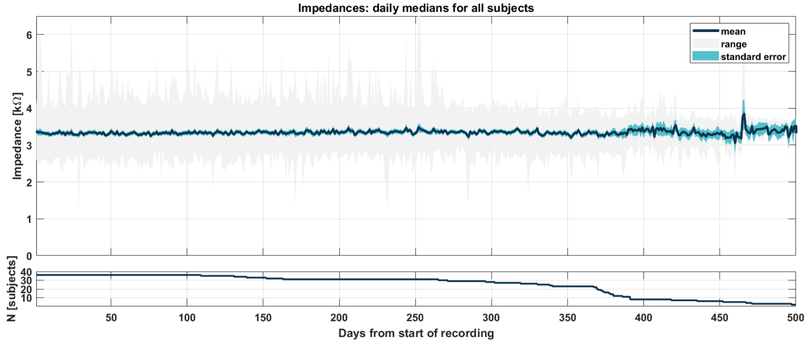

Figure 3. Impedance change throughout days of recording, pooling data from all subjects. Top: Dark blue line, blue shaded and grey shaded areas represent the mean, standard error and range of daily impedance measurements for each subject, respectively. Bottom: Size of the impedance measurements database as it evolves in time, depending on the recording duration of each subject.

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