1. Introduction
Intracranial electrode recordings are used for seizure localization in patients with pharmaco-resistant epilepsy. Due to the high spatial and temporal recording resolution of these electrodes, patients implanted with these electrodes are also increasingly being utilised for neuroscience research. As with extracranial EEG, these recordings can become contaminated with electrical artefacts. This can affect results of both clinical and research recordings as artefacts during seizures, speech production and other simple movements can obscure genuine neural events.

Here we investigate the characteristics of temporalis artefacts from our database of past patients who were surgically implanted with either subdural grid electrodes (SDEs) or stereotactically placed depth electrodes (sEEGs).

2. Methods
- Intracranial recordings were made from patients implanted with either subdural electrodes grids (SDEs; 20 patients) or stereotactically placed depth electrodes (sEEGs; 44 patients) at a sampling frequency of 1-2kHz
- Recordings were made as they performed naming studies from visual stimuli

Example Stimuli:
- Coherent (Bear)
- Incoherent (Scrambled)

Coherent stimuli each need unique responses but the incoherent stimuli always result in the response “Scrambled”
- This repetition of one word leads to a repetitive muscle activation during articulation
- Here we present recordings made during this task, averaging the recordings of all “Scrambled” repetitions
- Time axes are relative to the start of audible speech production

3. Characteristics

**Frequency Characteristics**
- One of the main distinguishing factors between muscle artefacts and genuine neural activity is the frequency profile
- In most brain regions correlates of neural processing occur in the region <150Hz whereas electrical muscle activity can show strong activity up to and beyond 400Hz
- This means using high frequency power can help distinguish muscle vs neural activity

**Temporal Characteristics**
- Temporalis artefact appears shortly (<500ms) before audible speech is first detectable and will continue for the duration of speech

**Location**
- Our group has previously identified these artefacts predominantly around the temporal poles
- These electrodes were used to define our archetypal artefact (Box 4) and those characteristics were found across other regions (Box 5)

4. Grouped Response

**Characteristic temporalis muscle artefact produced from repetition of the word “Scrambled”**
- Shows a distinct dual peaked response for the two syllable response
- Flat frequency profile from 50-400Hz
- Begins to show activation ~500ms before production of audible speech
- Averaged response from manually identified artefacts in 8 patients (3 SDE electrodes, 35 sEEG)

5. Artefact Screening Test

**Word Repetition**
- Getting patients to repeat a single word multiple times creates a time coherent temporalis muscle artefact

**Very High Gamma (VHG) Screening**
- Most cortical sources do not produce large amplitude responses above 150Hz
- By investigating the 150-250Hz band we can more easily separate muscle artefacts from neural responses
- Electrodes showing activation above a set threshold around time of articulation were identified

6. Single Electrode Responses

**Example Clean Single Electrodes**
- Superior Temporal Gyrus (STG)
- Precentral Gyrus (PCG)

**Incoherent**
- Channels contaminated with muscle artefacts can be identified by their very high gamma (>150Hz) signature

**Coherent**
- This artefact is most prevalent in temporal pole, medial frontal cortex and the motor strip

7. Conclusions
- Intracranial recordings can become contaminated with temporalis muscle artefact during jaw movement for speech
- Channels contaminated with muscle artefacts can be identified by their very high gamma (>150Hz) signature

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