

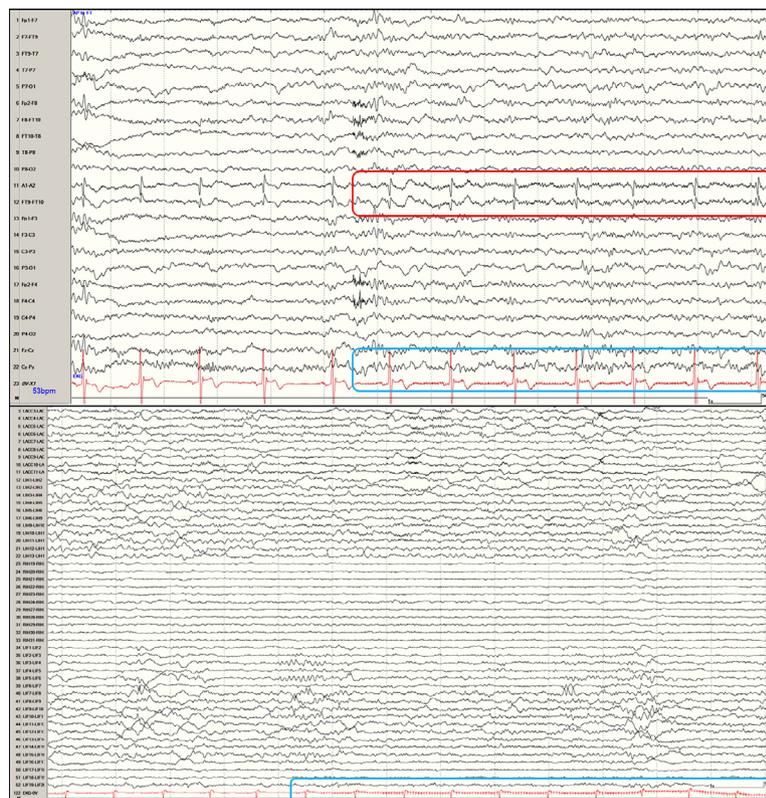
Neurostimulation EEG artifacts: VNS, RNS, and DBS

Artefatos de neuroestimulação no EEG: VNS, RNS e DBS

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Accurately recognizing artifacts on electroencephalogram (EEG) is necessary to prevent EEG misinterpretation and epilepsy misdiagnosis. EEG artifacts generated by neurostimulation devices (Figures 1 and 2) can be identified based on their unique spatial and frequency properties¹.

VNS and RNS artifacts display an electrical interference-like “spiky” morphology with a distribution that is incompatible with a cerebral source and frequencies that mirror stimulation settings. DBS artifact features diffuse electrical interference with a relatively monomorphic appearance, and



Scalp EEG (top), extended longitudinal bipolar montage (with additional frontotemporal electrodes) showing a burst of low-voltage sharply contoured artifact mostly at the EKG channel but also at the across FT9-FT10 and A1-A2 bipolar channels. Invasive EEG (bottom), bipolar montage showing a burst of low-voltage 20 Hz sharply contoured artifact at the EKG channel. The artifacts' 20 Hz frequency corresponded to the stimulating frequency in both cases.

Figure 1. Vagus nerve stimulation (VNS) EEG artifact. Scalp EEG: sensitivity 7 $\mu\text{V}/\text{mm}$, LF 1 Hz, HF 70 Hz, notch on; invasive EEG: sensitivity 100 μV , LF 0.53 Hz, HF 600 Hz, notch off.

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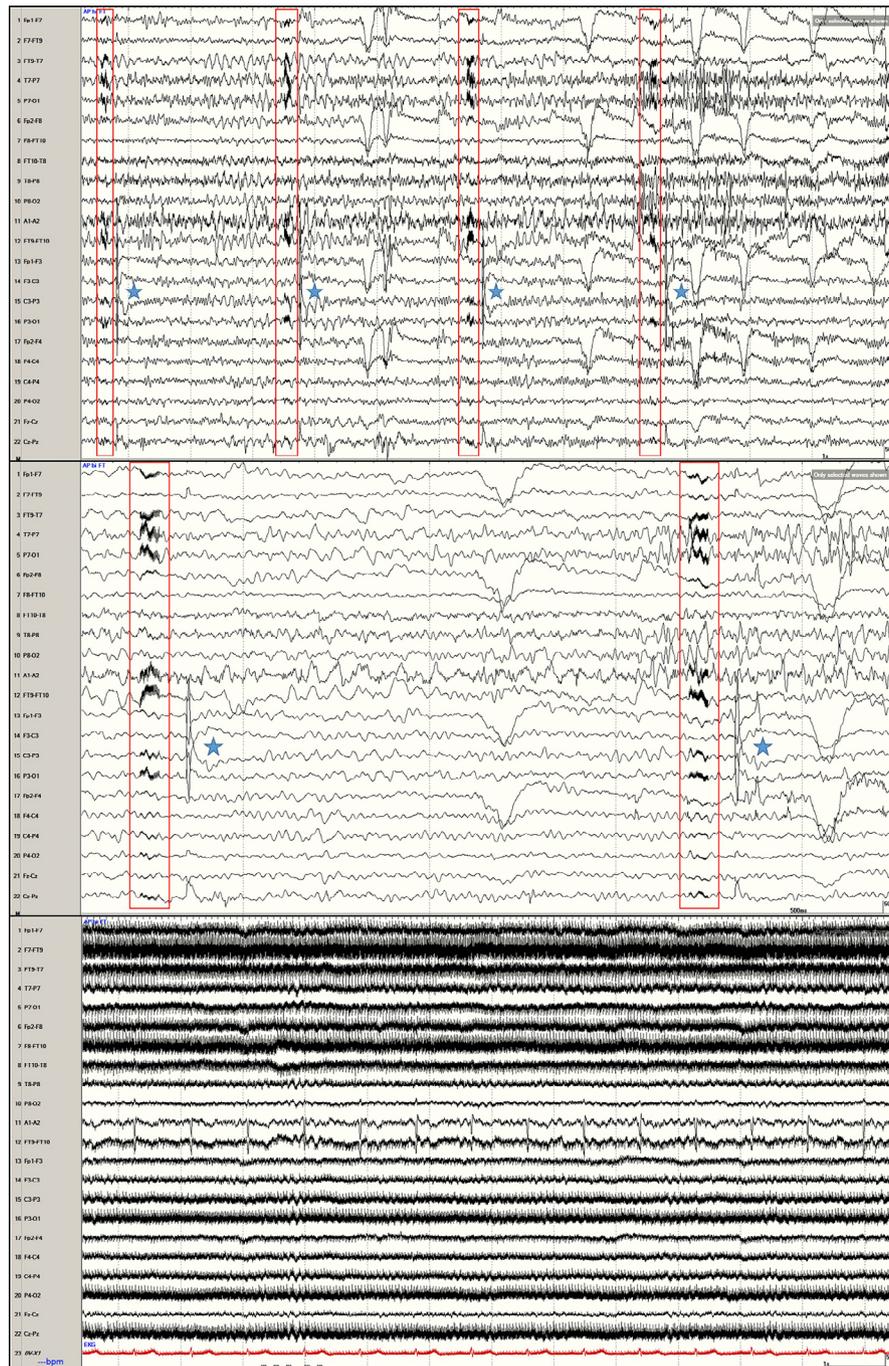
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Conflict of interest: There is no conflict of interest to declare.

Authors' contributions: JC, SF, VK, AM: collected, analyzed, and interpreted the data, revised the manuscript; JRG: conceptualized and designed study, collected, analyzed and interpreted the data, revised the manuscript; FAN: conceptualized and designed study, collected, analyzed and interpreted the data, drafted the manuscript.

Statement of ethics: This study was conducted ethically and in compliance with the guidelines for human studies. Informed consent was not obtained because all patient data in this manuscript was de-identified.

Received on August 23, 2020; Received in its final form on October 24, 2020; Accepted on October 28, 2020.



RNS (top, 15-second; middle, 5-second view): repetitive 200 Hz stimulation artifact (red rectangles) followed by C3-P3 device detection artifact (blue stars). RNS strip electrodes were in the left posterior temporal topography with generator in the left frontal region. DBS (bottom): continuous, diffuse, electrical interference without evolution.

Figure 2. Responsive neurostimulation (RNS) and deep brain stimulation (DBS) scalp EEG artifacts – extended longitudinal bipolar montages (with additional frontotemporal electrodes). EEG: sensitivity 7 μ V/mm, LF 1 Hz, HF 70 Hz, notch on.

its frequency can vary depending on intermittent versus movement disorders, respectively. continuous neurostimulation – indicated for epilepsy and

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