The Dynamic Duo of Anesthesia and EEG:

Innovations in Sleep Technology for Chronic Sleep Disorders

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Agenda (60 Minutes)

- **Lecture Overview** (5 minutes)
- **Role of EEG in Anesthesia Management** (5 minutes)
- **EEG Monitoring Technology** (5 minutes)
- **Exploring EEG Monitoring Features in Anesthesia** (15 minutes)
- **Comprehensive EEG Data Interpretation** (10 minutes)
  - **Case Studies**
- **Enhancing Patient Outcomes & Sleep Health** (5 minutes)
- **Future of EEG in Anesthesia and Sleep Medicine** (5 minutes)
- **Key Takeaways, Q&A and Closing Remarks** (10 minutes)

Lecture Overview

- **The Critical Role of EEG in Anesthesia & Sleep Medicine**

This lecture explores the essential role of EEG monitoring in optimizing anesthetic delivery, enhancing intraoperative care, improving postoperative outcomes, and advancing clinical sleep medicine.

- **Key Areas of Focus**
  - Advanced EEG technologies and their integration into modern anesthesia practice
  - Data-driven insights into EEG's role in surgical and sleep-related brain monitoring
  - Bridging anesthesia and sleep science to improve patient outcomes

- **Learning Objectives**
  - Assess depth of anesthesia using real-time EEG monitoring
  - Identify sleep stage morphologies and their relevance in perioperative care
  - Detect potential neurological deficits through EEG signal analysis
  - Explore future advancements in sleep therapies and EEG applications

- **Advancing Clinical Practice**

By integrating EEG into anesthesia and sleep medicine, this lecture highlights cutting-edge developments that refine patient monitoring, enhance clinical

Role of EEG in Anesthesia Management

- **Assessing Depth of Anesthesia & Preventing Awareness**
  - EEG helps determine hypnotic depth, ensuring patients receive an adequate level of anesthesia while minimizing the risk of intraoperative awareness
  - EEG-based parameters provide quantifiable measures of sedation depth to guide anesthetic titration

- **Detecting Burst Suppression & Avoiding Over-Sedation**
  - Burst suppression, identified through EEG spectrogram analysis, is a critical indicator of excessive anesthetic dosing, which can lead to postoperative cognitive dysfunction (POCD) and prolonged emergence
  - Continuous EEG monitoring allows real-time adjustments to optimize anesthetic dosing and reduce neurotoxicity risks

- **Limiting Anesthetic Dosage to Minimize Toxicity & Costs**
  - Overuse of anesthetic agents can lead to systemic toxicity, delayed emergence, and increased healthcare costs
  - EEG-driven anesthetic management ensures precise dosing, reducing exposure to excessive anesthesia while maintaining surgical conditions

Role of EEG in Anesthesia Management

- **Maintaining Hemodynamics & Cerebral Perfusion**
  - Anesthetic depth correlates with cerebral blood flow and perfusion pressure
  - EEG monitoring enables clinicians to balance anesthesia levels with hemodynamic stability, preventing hypotension-induced cerebral ischemia

- **Enhancing Depth of Anesthesia Monitoring to Control Sleep States**
  - EEG allows real-time assessment of sleep stage transitions during anesthesia, mirroring natural sleep architectures in REM and NREM stages
  - This is critical in procedures requiring targeted sedation levels, such as pediatric anesthesia, neuroanesthesia, and sleep disorder treatments

- **Identifying Neurological Deficits & Seizure Activity**
  - EEG monitoring enables early detection of neurological impairments, including hypoxic injury, stroke, and post-anesthetic delirium
  - Burst suppression analysis helps identify various neurological dysfunctions in patients

Role of EEG in Anesthesia Management

- **Enhancing Depth of Anesthesia Monitoring to Control Sleep States**
  - EEG allows real-time assessment of sleep stage transitions during anesthesia, mirroring natural sleep architectures in REM and NREM stages
  - This is critical in procedures requiring targeted sedation levels, such as anesthesia-induced sleep therapy

- **Identifying Neurological Deficits & Seizure Activity**
  - EEG monitoring enables early detection of neurological impairments, including hypoxic injury, stroke, and post-anesthetic delirium
  - Burst suppression analysis helps identify non-convulsive seizures and neurological deficits

EEG Monitoring Technology

Electroencephalography (EEG) technology has advanced significantly, allowing clinicians to monitor brain activity with varying degrees of precision depending on electrode placement.

There are three primary types of EEG monitoring used in clinical settings—***Scalp EEG, Intracranial EEG* and *Forehead EEG*** —each with distinct applications in anesthesia,
critical care, and sleep medicine.

- **Scalp EEG** (Conventional EEG Monitoring)
- **Intracranial EEG** (iEEG and Electrocorticography - ECoG)
- **Forehead EEG** (Frontal EEG Monitoring)

EEG Monitoring Technology

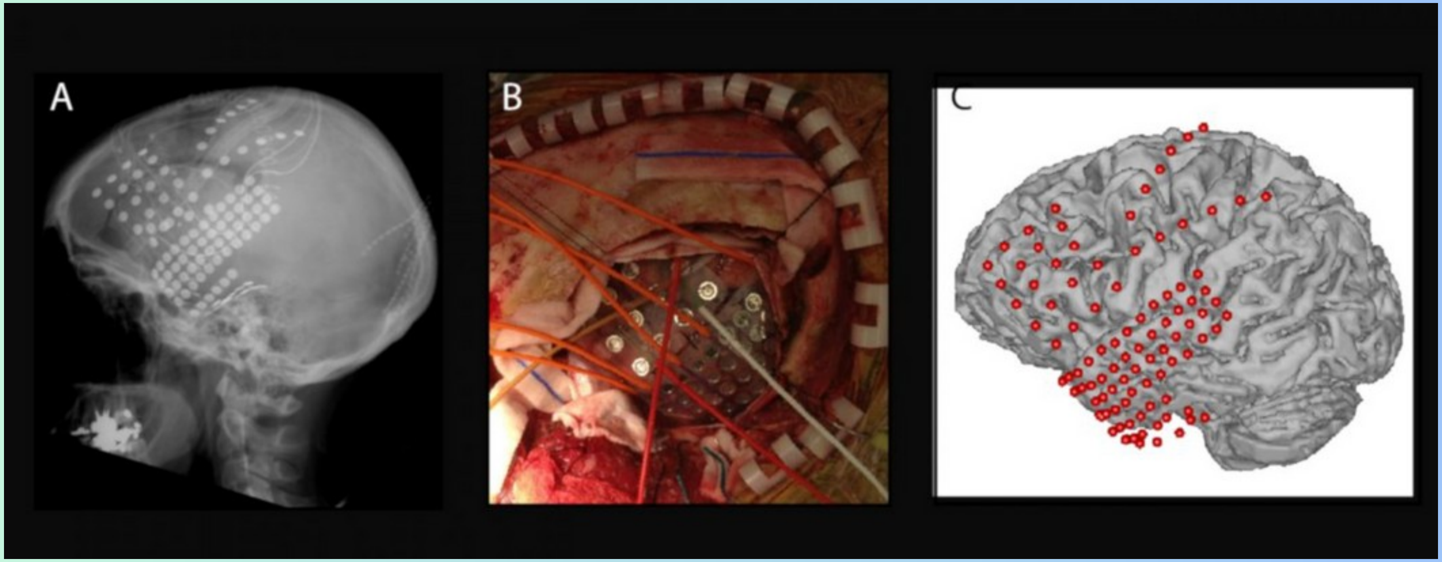
Scalp EEG (Conventional EEG Monitoring)

Scalp EEG (Conventional EEG Monitoring): Scalp EEG is a widely used, non-invasive
method that employs 10-20 small electrodes placed across the scalp to record brain activity.
The 10-20 international system ensures standardized electrode placement for comprehensive neural monitoring.

EEG Monitoring Technology

Intracranial EEG (iEEG and Electrocorticography - ECoG)

Intracranial EEG (iEEG and Electrocorticography - ECoG): Intracranial EEG is the most invasive form of EEG monitoring, requiring surgical implantation of electrodes directly onto the cortical surface or within brain structures. When EEG signals are recorded from subdural electrodes placed on the brain's surface, this is referred to as ***electrocorticography (ECoG)***.



EEG Monitoring Technology

Forehead EEG (Frontal EEG Monitoring)

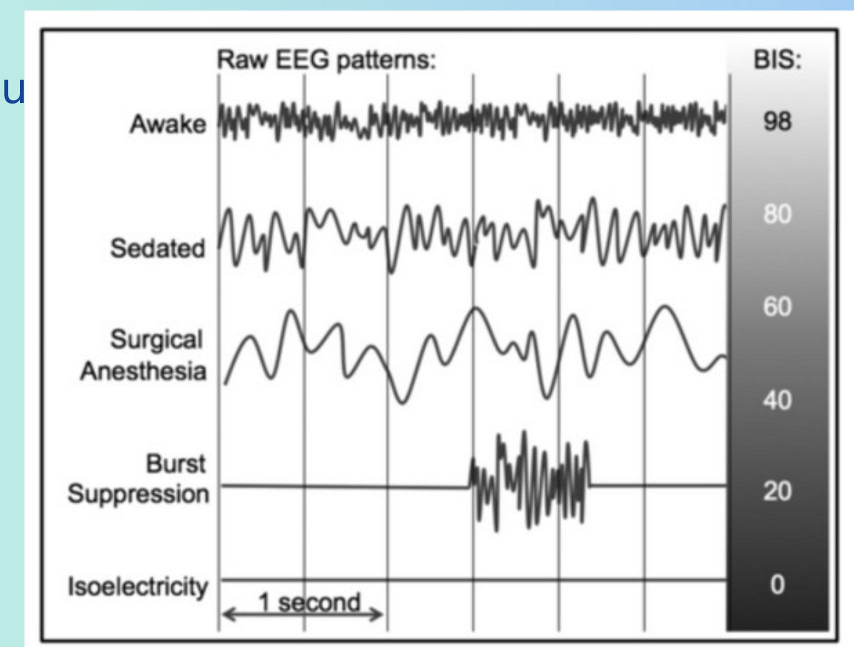
Forehead EEG (Frontal EEG Monitoring): Forehead EEG (fEEG) is a non-invasive technique that utilizes four active EEG sensors placed along the frontal forehead and temporal regions. This method is commonly used in anesthesia and critical care settings.

as it provides re … ient discomfort.

Exploring EEG Monitoring Features in Anesthesia

Parallel Signal Processing Engines (PSPEs)

Parallel Signal Processing Engines (PSPEs) represent an advanced computational approach in EEG monitoring for anesthesia, enabling real-time, multi-channel analysis of brain activity. These engines operate by simultaneously processing multiple EEG signals, allowing for faster and more precise assessments of anesthetic



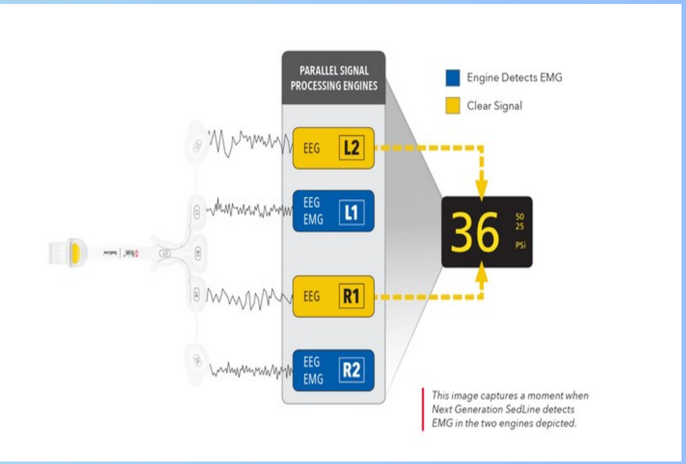
burst su ions.

Exploring EEG Monitoring Features in Anesthesia

Parallel Signal Processing Engines (PSPEs)

By integrating PSPEs with key EEG monitoring features such as Patient State Index (PSI), Spectral Edge Frequency (SEF), Density Spectral Array (DSA), burst suppression analysis,
and power spectrograms, Anesthesiologists can:

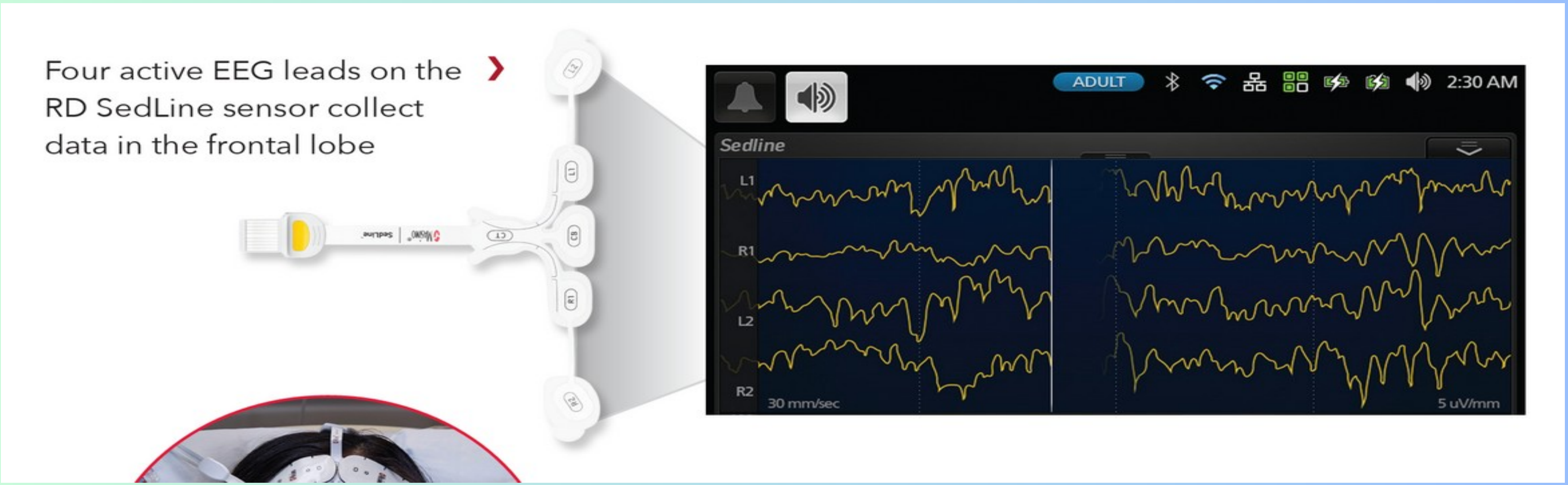
- Detect subtle changes in brain activity to optimize anesthetic depth
- Identify burst suppression patterns in real time, reducing the risk of over-sedation and postoperative complications
- Analyze brain state transitions during induction, maintenance, and emergence from anesthesia
- Enhance neurological assessments, aiding in the differentiation between sedation-related changes and underlying brain dysfunction



Exploring EEG Monitoring Features in Anesthesia

This section explores key EEG monitoring features, including:

- **Patient State Index (PSI)**: A processed EEG parameter used to **quantify** anesthetic depth
- **Spectral Edge Frequency (SEF)**: An indicator of cortical activity, helping
- **Density Spectral Array (DSA)**: A real-time visual representation of brainwave activity and suppression patterns
- **Power Spectrograms**: Identifies specific brainwave frequency shifts, enhancing intraoperative monitoring



Exploring EEG Monitoring Features in Anesthesia

Patient State Index (PSI)

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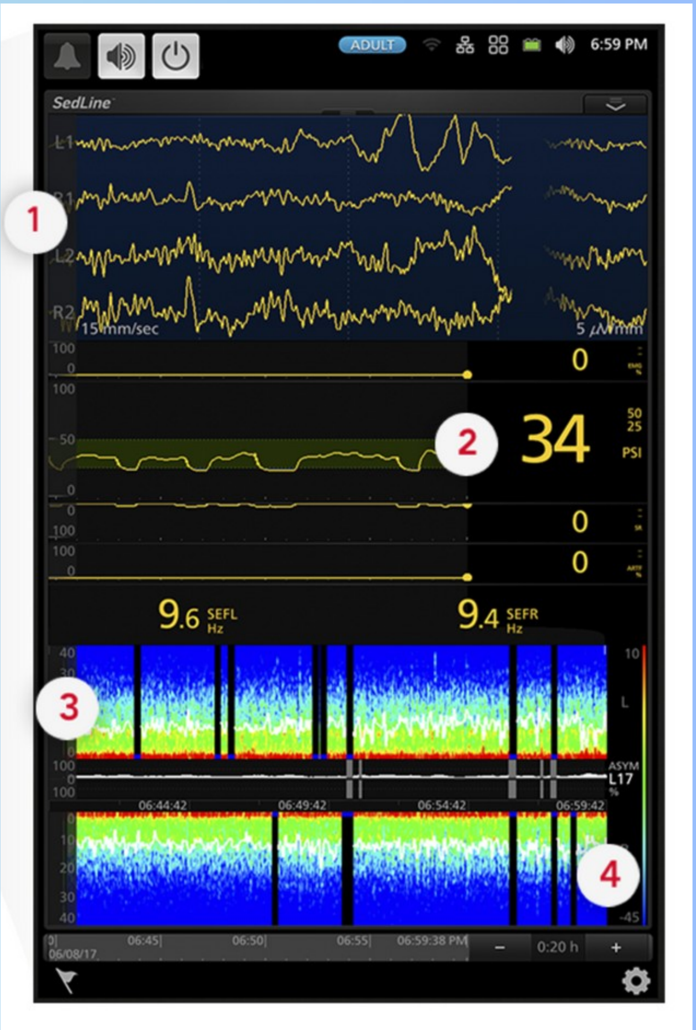
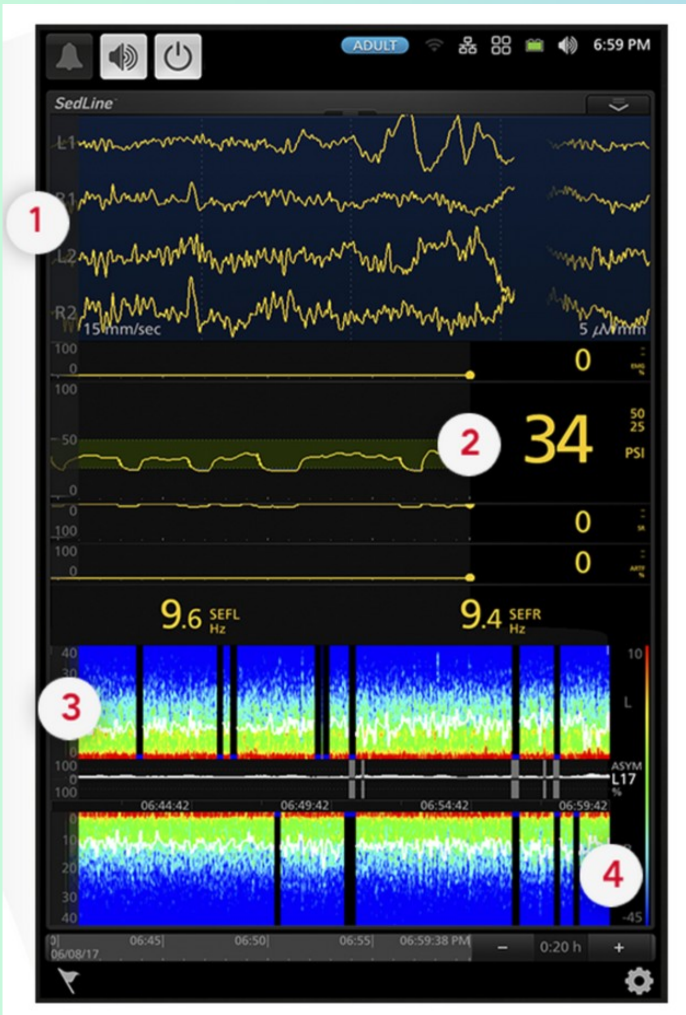
- ***Patient State Index (PSI)***: Processed EEG parameter for sedation depth
- PSI is a numerical representation of hypnotic depth, derived from frontal EEG signals using advanced algorithms
- Helps titrate anesthetics to maintain an optimal sedation level, reducing over- or under-sedation risks
- PSI values correlate with consciousness states, ensuring patient safety during surgery and sedation



Exploring EEG Monitoring Features in Anesthesia

Density Spectral Array (DSA)



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- ***Density Spectral Array (DSA)*:** Real-Time Brain Activity Visualization
- DSA provides a continuous graphical representation of EEG power distribution over time, helping anesthesiologists monitor cortical activity trends.
- Displays color-coded spectrograms, where warmer colors (red, yellow) indicate high brain activity and cooler colors (blue, green) indicate deep anesthesia.
- Facilitates trend analysis of anesthetic effects, especially in prolonged procedures or critical

Exploring EEG Monitoring Features in Anesthesia

Power Spectrograms

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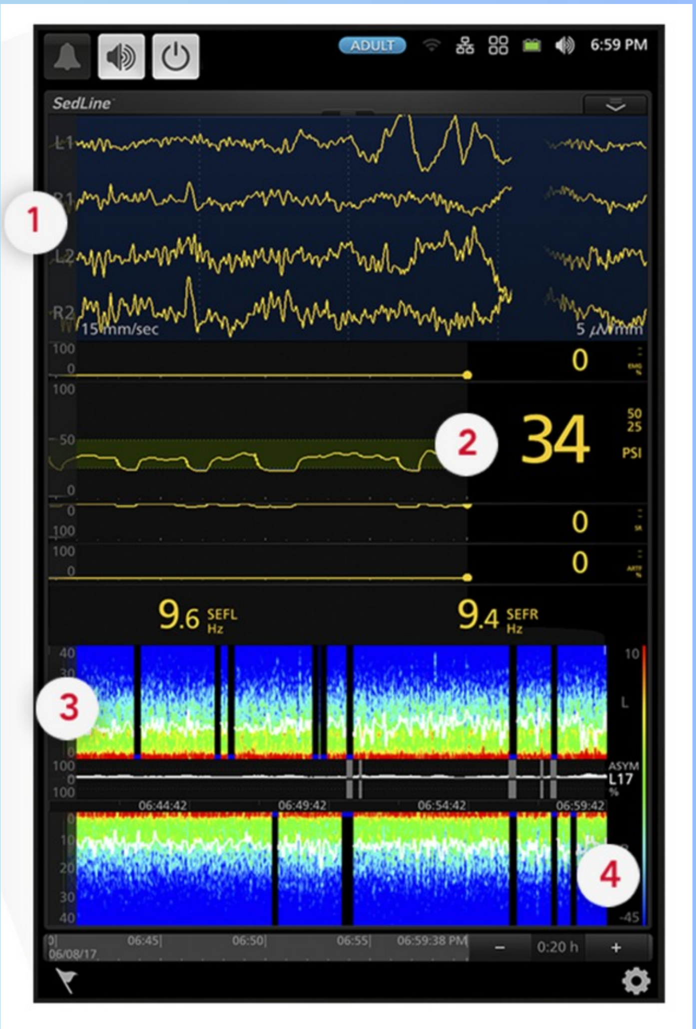
- ***Power Spectrograms:*** Identifying Brain Wave Activity Patterns

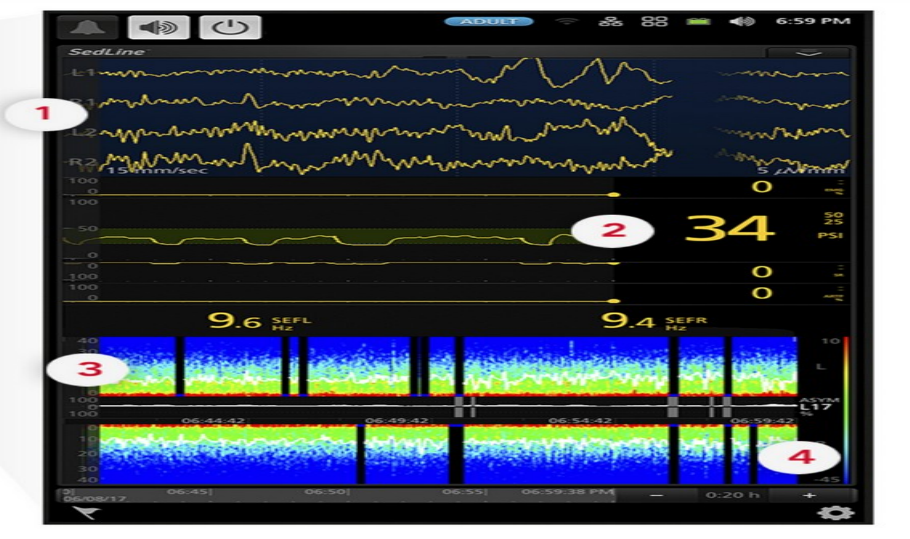
- Spectrograms allow visualization of brain wave frequencies—delta, theta, alpha, and beta—helping clinicians assess anesthetic depth
  - ***Delta*** (0.5-4 Hz): Deep anesthesia, sleep states
  - ***Theta*** (4-8 Hz): Light sedation, drowsiness
  - ***Alpha*** (8-13 Hz): Transition between wakefulness and sedation
  - ***Beta*** (13-30 Hz): Higher cortical activity, arousal states

- Spectrogram analysis aids in real-time adjustments of anesthetic agents to maintain the desired depth of sedation



Exploring EEG Monitoring Features in Anesthesia

Spectral Edge Frequency (SEF)

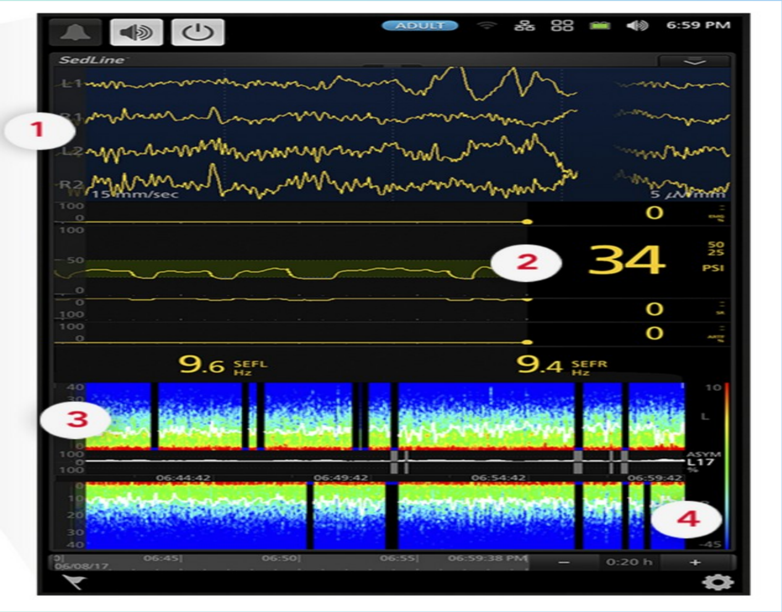


- ***Spectral Edge Frequency (SEF)***: Indicator of Cortical Activity
- SEF is the EEG frequency below which a defined percentage (typically 95%) of total power is contained
- A higher SEF suggests wakefulness and lighter sedation, while lower SEF values indicate deeper anesthesia
- SEF is particularly useful in detecting transitions between wakefulness, anesthesia, and burst suppression states

Exploring EEG Monitoring Features in Anesthesia

Spectral Edge Frequency (SEF)- Left and Right

- ***SEFL (Left Spectral Edge Frequency):*** Represents cortical activity in the left hemisphere, providing insight into regional brain function and asymmetries.



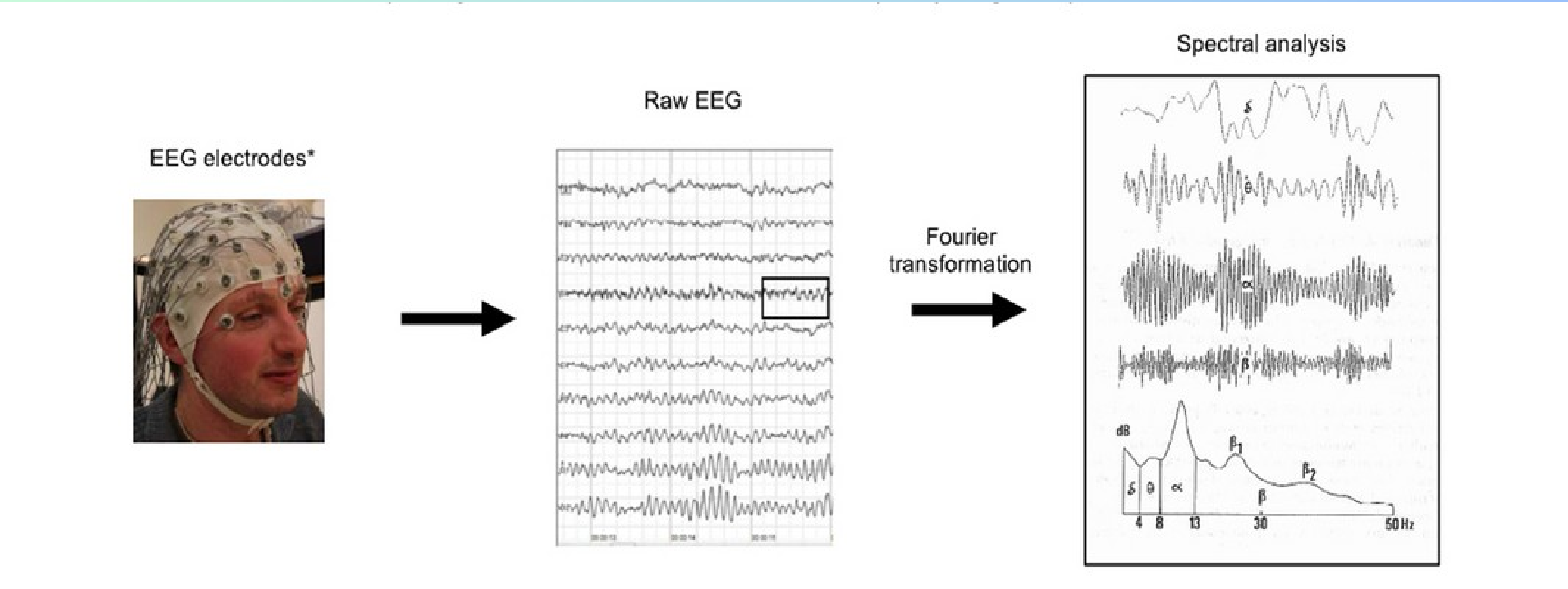
- ***SEFR (Right Spectral Edge Frequency***): Represents cortical activity in the right hemisphere, providing insight into regional brain function and asymmetries

Asymmetry between SEFL and SEFR may suggest localized brain dysfunction, ischemia, or anesthetic imbalances. By analyzing SEFL and SEFR together, clinicians can fine-tune anesthesia depth, detect neurological impairments, and optimize patient care.

Exploring EEG Monitoring Features in Anesthesia

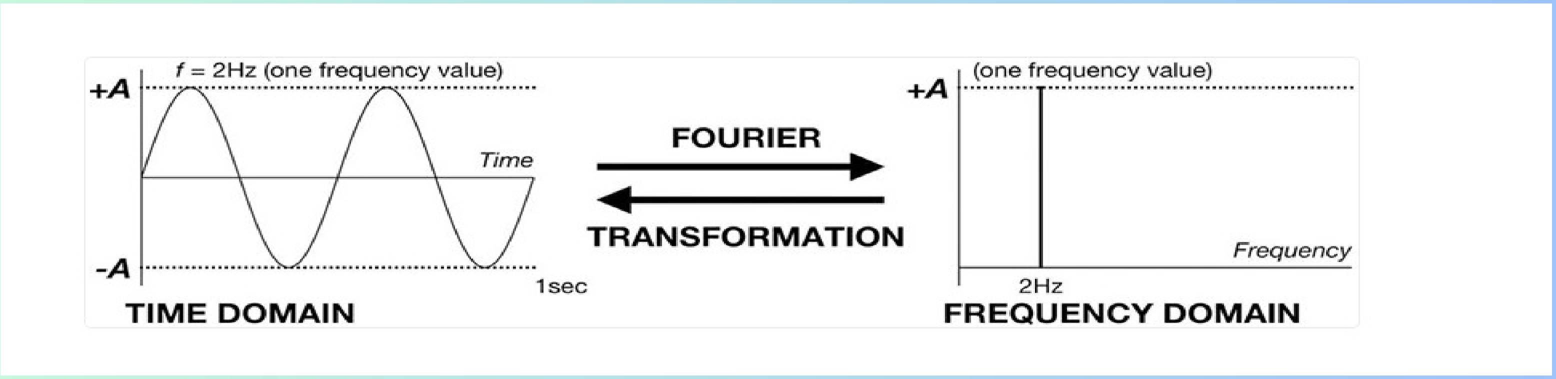
Fourier Transform (FT) and Spectral Analysis

Fourier Transform (FT) is a mathematical tool used to convert raw EEG signals from the time domain into the frequency domain, allowing for the identification of different brainwave frequencies. This transformation is essential in EEG monitoring for anesthesia, as it provides a quantitative analysis of brain activity.



Exploring EEG Monitoring Features in Anesthesia

Fourier Transform (FT) and Spectral Analysis



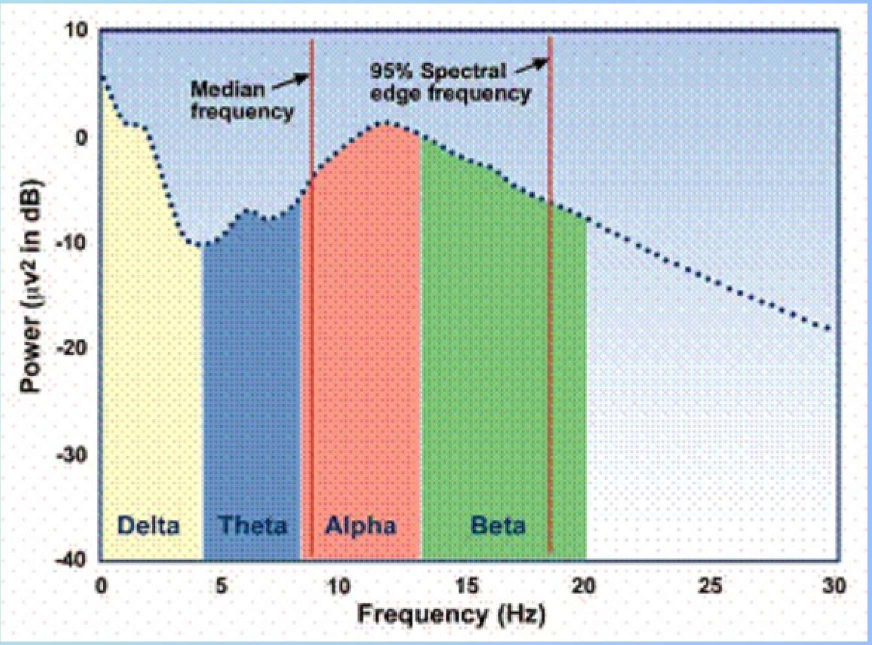
- ***Raw EEG Signal Processing***: EEG signals are recorded as continuous voltage fluctuations over time. These signals contain a mix of different frequency components corresponding to various brain states

Exploring EEG Monitoring Features in Anesthesia

Fourier Transform (FT) and Spectral Edge Frequency (SEF)

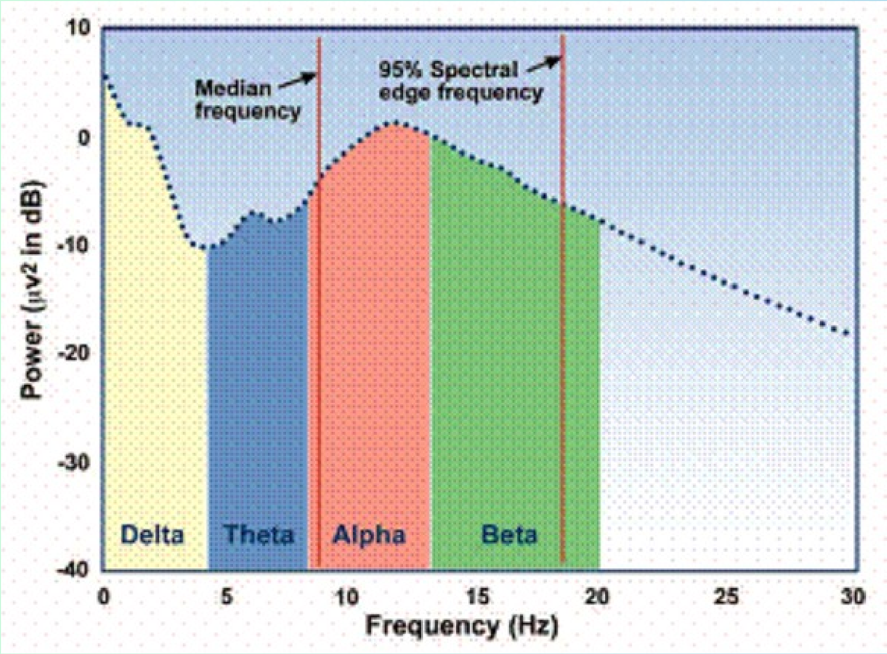
- FT decomposes the complex EEG signal into its individual sine wave components, each characterized by a unique frequency and amplitude

- This process enables the creation of a frequency spectrum that represents power distribution across different frequency bands (*Delta, Theta, Alpha, Beta, and Gamma*)



Exploring EEG Monitoring Features in Anesthesia

Fourier Transform (FT) and Spectral Edge Frequency (SEF)



- SEF is derived from the power spectral density (PSD), which represents the squared magnitude of each frequency component obtained through FT
- SEF95 is the frequency below which 95% of the total EEG power is contained, commonly used in anesthesia to assess sedation levels
- SEF changes dynamically based on anesthetic depth, helping to differentiate between wakefulness, light sedation, deep anesthesia, and burst suppression

Revealing the power distribution of brainwave activity in Hertz (Hz). The Fast Fourier Transform (FFT) makes this process computationally efficient for real-time EEG analysis allowing for real time anesthetic adjustments.

Comprehensive EEG Data Interpretati

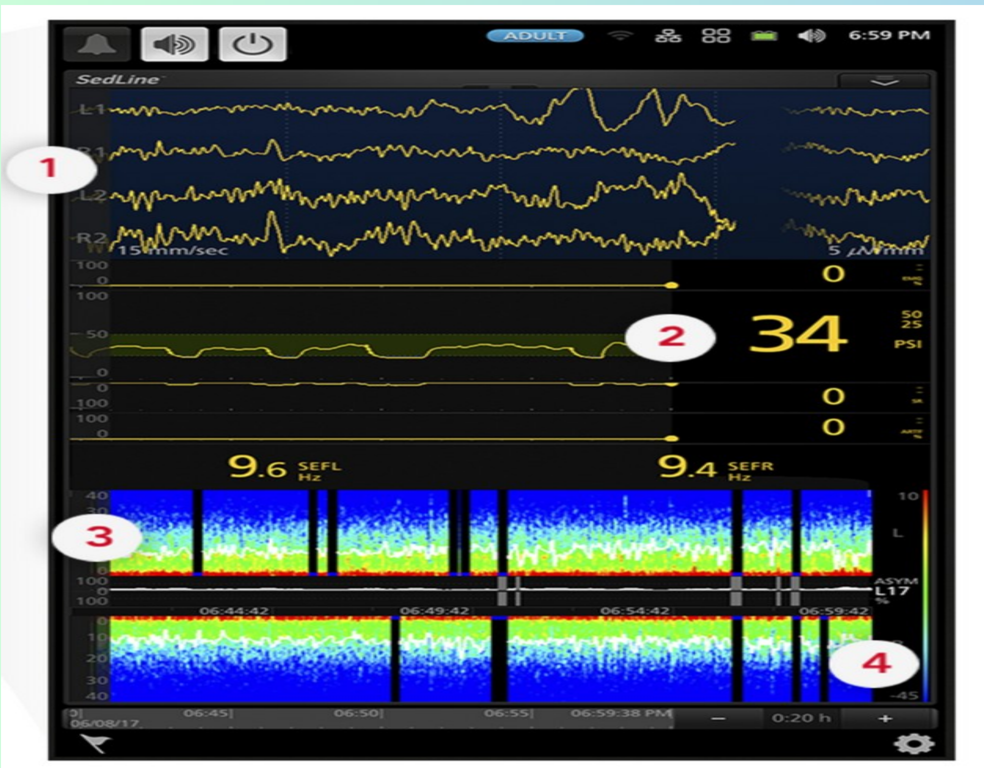
Burst Suppression Analysis & Suppression Ratio

In anesthesia, excessive anesthetic depth leads to a significant reduction in cortical activity, resulting in a pattern known as ***burst suppression***—characterized by alternating periods of high-amplitude bursts and near-flatline suppression on EEG.
This phenomenon occurs due to over-sedation or severe sleep inertia, where the brain’s electrical activity is profoundly inhibited, reflecting a state of metabolic suppression.

- **Loss of Power & Frequency:** Burst suppression is marked by a dramatic reduction in EEG power and frequency, indicating a near-silent cortical state
- **Clinical Implications:** Prolonged burst suppression is associated with delayed emergence from anesthesia, increased risk of postoperative delirium, and potential neurocognitive impairment
- **Neurological Monitoring:** EEG-based burst suppression analysis helps differentiate between anesthetic-induced suppression and pathological conditions, such as neurological deficits, seizures or chronic sleep deprivation
- **Optimizing Patient Outcomes:** Real-time EEG monitoring allows anesthesiologists to adjust anesthetic dosing to prevent excessive

Comprehensive EEG Data Interpretation

Burst Suppression Analysis & Suppression Ratio



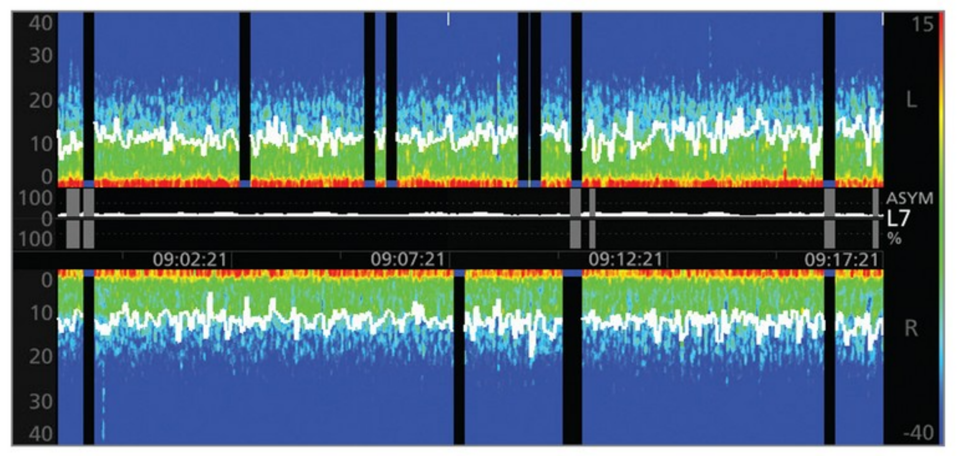
- Burst suppression is a pathological EEG pattern of alternating high-voltage bursts and isoelectric suppression, indicating profound cerebral depression

- ***The Suppression Ratio*** quantifies the percentage of time EEG activity is suppressed, guiding anesthetic dosing to prevent excessive sedation

- Burst suppression is often seen in high-dose anesthesia, coma states and severe sleep inertia. Making real-time monitoring essential for neuroprotection and recovery optimization

Case Studies: Bilateral Burst Suppression with Inconsistent Bursts

This image represents conditions associated with profound bilateral cortical suppression, as seen in EEG patterns marked by multiple, inconsistent burst suppression states.



- **Anesthetic Overdose**
- **Diffuse Brain Injury (TBI)**
- **Seizures (petit mal, status epilepticus or non-convulsive seizures)**
- **Hypoxic-Ischemic Injury (Stroke)**
- **Other Neurological Impairments**
- **Severe Sleep Inertia**
- **REM sleep disorders**

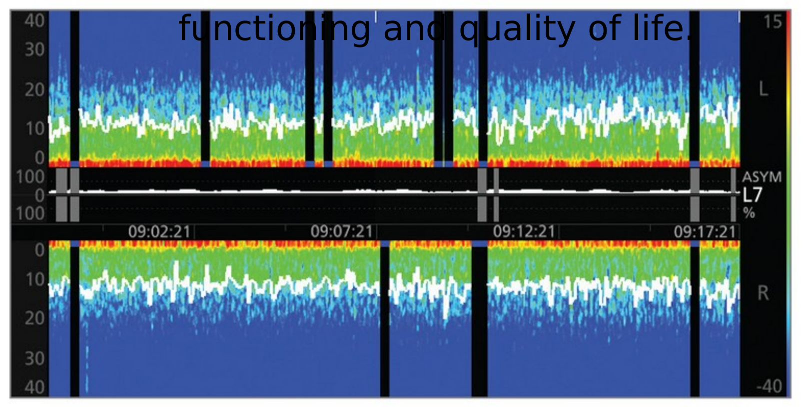
Case Studies: Bilateral Burst Suppression with Inconsistent Bursts

Clinical Presentation:

J.L. is a 26-year-old male with a complex medical history, including chronic insomnia persisting for over five years, a history of substance abuse involving previous opioid and benzodiazepine use, and PTSD resulting from past trauma. He is currently undergoing methadone maintenance therapy and has been prescribed Xanax for anxiety management. J.L. presents to the sleep clinic with concerning neurological and sleep-related symptoms. He experiences frequent episodes of staring spells occurring multiple times daily, often accompanied by sudden loss of awareness lasting between 5 to 15 seconds. During these episodes, he exhibits frequent blinking or fluttering of the eyelids, as well as mild muscle twitching, particularly in the face and hands. His family members have observed instances where he appears to be “zoning out” or daydreaming. Despite extended sleep periods, he continues to suffer from significant daytime fatigue, further impacting his daily functioning and quality of life.

Current Medications:

- **Methadone-** 100 mg QD
- **Alprazolam** (Xanax)- 2 mg PRN
- **Melatonin-** 10 mg QHS



- **Anesthetic Overdose**
- **Diffuse Brain Injury (TBI)**
- **Seizures (petit mal, status epilepticus or non-convulsive seizures)**
- **Hypoxic-Ischemic Injury (Stroke)**
- **Other Neurological Impairments**
- **Severe Sleep Inertia**
- **REM sleep disorders**

Case Studies: Unilateral Burst Suppression

This image represents conditions associated with profound cortical suppression in the left side thalamic region, as seen in EEG patterns marked by low-frequency, low-power activity or burst suppression states.

- **Anesthetic Overdose**
- **Diffuse Brain Injury (TBI)**
- **Seizures (petit mal, status epilepticus or non-convulsive seizures)**
- **Hypoxic-Ischemic Injury (Stroke)**
- **Other Neurological Impairments**
- **Severe Sleep Inertia**
- **REM Sleep Disorders**

Case Studies: Unilateral Burst Suppression

Clinical Presentation:

Ms. A.M. is a 45-year-old female with a longstanding history of chronic insomnia, presented to the sleep clinic with persistent complaints of severe difficulties with both sleep onset and maintenance, frequent nocturnal awakenings often accompanied by confusion. She reports cognitive slowing and difficulty with focus throughout the day; which has significantly worsened in the past six months. Her medical history includes a mild traumatic brain injury (mTBI) from a fall two years ago, though she has no prior diagnosis of epilepsy, seizures or stroke. She also has a history of anxiety and depression, both of which are currently managed with medication. Despite no reported apnea or restless leg syndrome, she experiences excessive daytime fatigue, further impacting her daily function. Given her complex clinical presentation, further evaluation is necessary to determine the underlying neurological factors contributing to her severe sleep disturbances.

<u>**Current Medications:**</u>

- **Zolpidem (**Ambien**)** 10 mg QHS (with minimal effectiveness)
- **Sertraline** (Zoloft) 50 mg QD
- **Melatonin** 5 mg QHS

- **Anesthetic Overdose**
- **Diffuse Brain Injury (TBI)**
- **Seizures (petit mal, status epilepticus or non-convulsive seizures)**
- **Hypoxic-Ischemic Injury (Stroke)**
- **Other Neurological Impairments**
- **Severe Sleep Inertia**
- **REM Sleep Disorders**

Comprehensive EEG Data Interpretation

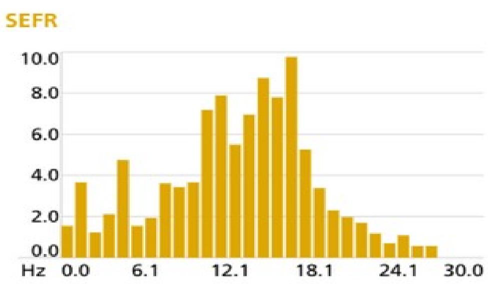
To optimize patient care, EEG monitoring integrates multiple parameters, including Spectral Edge Frequency Low (SEFL) and Spectral Edge Frequency Right (SEFR), alongside Patient State Index (PSI), Density Spectral Array (DSA), burst suppression analysis, and spectrograms.

By evaluating both the **percent of times reports** (percentage of time spent in a specific frequency range) and **actual times reports** (real-time duration spent in each frequency), anesthesiologists can gain deeper insights into anesthetic effects, sleep state activity patterns, and potential neurological impairments.

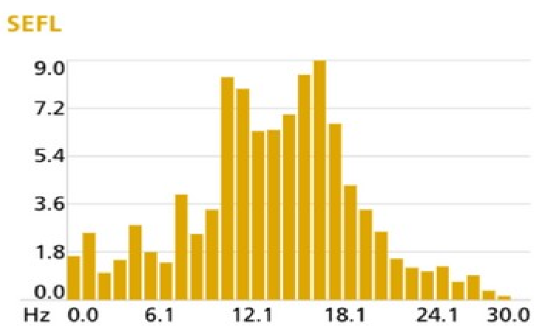
By incorporating SEFL, SEFR, and real-time EEG analytics, anesthesiologists can enhance patient safety, improve recovery outcomes, and contribute to the evolving landscape of precision-guided anesthesia and sleep medicine.

Comprehensive EEG Data Interpretation

Spectral Edge Frequency Based on Percentage of Time (**Qualitative Analysis**)



Value	% Time	Value	% Time	Value	% Time	Value	% Time
30	--	20	1.97%	10	7.19%	<1	1.55%
29	--	19	2.30%	9	3.66%		
28	--	18	3.38%	8	3.43%		
27	--	17	5.26%	7	3.62%		
26	0.56%	16	9.77%	6	1.93%		
25	0.56%	15	7.80%	5	1.55%		
24	1.08%	14	8.74%	4	4.74%		
23	0.70%	13	6.95%	3	2.11%		
22	1.17%	12	5.50%	2	1.22%		
21	1.69%	11	7.89%	1	3.66%		
Total	5.78%	Total	59.56%	Total	33.11%	Total	1.55%



Value	% Time	Value	% Time	Value	% Time	Value	% Time
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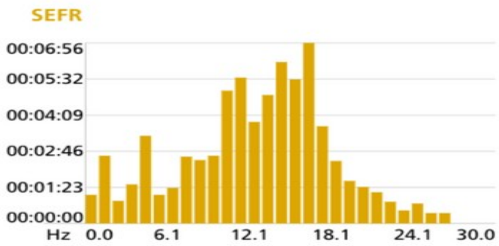
29	--	19	3.39%	9	3.39%		
28	0.15%	18	4.31%	8	2.47%		
27	0.34%	17	6.63%	7	3.97%		
26	0.92%	16	9.00%	6	1.40%		
25	0.68%	15	8.47%	5	1.79%		
24	1.26%	14	6.97%	4	2.81%		
23	1.06%	13	6.39%	3	1.50%		
22	1.21%	12	6.34%	2	1.02%		
21	1.55%	11	7.93%	1	2.52%		
Total	7.16%	Total	61.97%	Total	29.22%	Total	1.64%

Comprehensive EEG Data Interpretation

Spectral Edge Frequency Based on Actual Times (**Quantitative Analysis**)



Value	Time	Value	Time	Value	Time	Value	Time
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27	--	17	00:03:44	7	00:02:34		
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25	00:00:24	15	00:05:32	5	00:01:06		
24	00:00:46	14	00:06:12	4	00:03:22		
23	00:00:30	13	00:04:56	3	00:01:30		
22	00:00:50	12	00:03:54	2	00:00:52		
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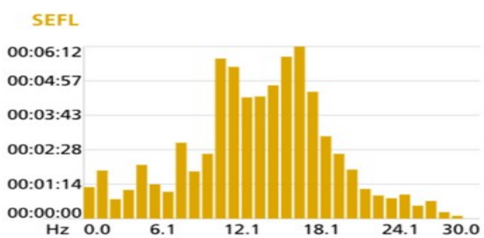

Value	Time	Value	Time	Value	Time	Value	Time
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27	00:00:14	17	00:04:34	7	00:02:44		
26	00:00:38	16	00:06:12	6	00:00:58		
25	00:00:28	15	00:05:50	5	00:01:14		
24	00:00:52	14	00:04:48	4	00:01:56		
23	00:00:44	13	00:04:24	3	00:01:02		
22	00:00:50	12	00:04:22	2	00:00:42		
21	00:01:04	11	00:05:28	1	00:01:44		
Total	00:04:56	Total	00:42:42	Total	00:20:08	Total	00:01:08

Enhancing Patient Outcomes & Sleep Health

- **Data-Driven Decision Making**
  - EEG parameters provide real-time, quantitative insights into brain activity, enabling precise anesthetic titration based on individual patient responses
  - Key EEG metrics such as Patient State Index (PSI), Spectral Edge Frequency (SEF), burst suppression ratio, and Density Spectral Array (DSA) allow for a comprehensive assessment of cortical function, improving perioperative management and sleep architecture
  - EEG-guided anesthesia helps prevent intraoperative awareness and excessive sedation, reducing postoperative delirium, cognitive dysfunction, and extended recovery times
  - Sleep-wake dysregulation can be identified by analyzing EEG metrics and spectrography patterns, to diagnose underlying sleep disorders

- **Reducing Neurological & Sleep-Related Risks**
  - EEG monitoring minimizes the risk of neurological impairment, particularly in patients with preexisting cognitive conditions and neurodegenerative disorders
  - Burst suppression analysis provides critical insights into disrupted thalamocortical connectivity, a feature observed in REM sleep disorders, sleep inertia, and neurocognitive disorders
  - By analyzing SEF fluctuations and suppression ratios, anesthetic dosing can be optimized to prevent hypoxic injury, neuroinflammation, and prolonged unconsciousness.
  - EEG-based anesthetic protocols are particularly beneficial for patients with PTSD, neurological deficiencies or sleep disorders, as excessive sedation can exacerbate REM fragmentation and maladaptive neuroplasticity

Enhancing Patient Outcomes & Sleep Health

- **Advancing Anesthesia & Sleep Science**
  - EEG-guided anesthesia provides a bridge between sedation and sleep physiology, allowing for deeper insights into REM/NREM transitions, circadian regulation, and thalamocortical connectivity

- The combined analysis of EEG spectrography and spectral power distributions enables identification of disordered **sleep-wake regulation**, which is seen in:
  - ***Idiopathic hypersomnia***: Characterized by prolonged slow-wave sleep and reduced REM sleep stability
  - ***REM sleep disorders***: Abnormal REM patterns, often linked to PTSD, neurodegenerative diseases, and disrupted cortical regulation
  - ***Neurocognitive disorders*** (e.g., Alzheimer's, Parkinson's): Sleep architecture disruption due to altered brain network activity, contributing to cognitive dysfunction

- EEG-based assessment of sleep stage morphologies during anesthesia informs personalized sedation strategies, improves recovery and provides pre-emptive therapeutic options for patients with chronic sleep disturbances

Future of EEG in Anesthesia and Sleep Medicine

- **Advancing EEG in Sleep Medicine**: Enhancing diagnostics and treatment for sleep disorders, including REM sleep disturbances and neurological deficiencies
- **Early Detection & Intervention**: Identifying early-onset dementia, Alzheimer’s, and neurological deficits for proactive care
- **Personalized Neurological Therapies**: Developing targeted interventions based on real-time EEG insights
- **Minimizing Postoperative Complications**: Reducing delirium and cognitive dysfunction through EEG-guided anesthesia
- **Anesthesia-Induced Sleep Therapy**: Exploring EEG’s role in developing, personalized, targeted, therapeutic sleep interventions- ***PROSOMNIA Sleep Therapy™***

Key Takeaways: EEG-Guided Anesthesia & Sleep Medicine Integration

- **Enhancing Anesthetic Precision & Neurological Outcomes**
  - Real-time EEG spectrography enables personalized anesthetic delivery, reducing the risks of over-sedation, intraoperative awareness, and cognitive dysfunction
  - Continuous EEG monitoring ensures optimal depth of anesthesia, improving both surgical outcomes and postoperative recovery

- **EEG as a Tool for Sleep-Wake Regulation & Perioperative Care**
  - EEG helps detect disordered sleep-wake regulation in patients with conditions like REM sleep disorders, idiopathic hypersomnia, PTSD, and neurodegenerative diseases
  - Identifying abnormal thalamocortical connectivity patterns aids in understanding how anesthesia affects brain function and long-term sleep health

- **Optimizing Sleep Health & Cognitive Function Through Anesthetic Management**
  - EEG-guided sedation reduces postoperative delirium and neuroinflammation, crucial for high-risk populations such as older adults and patients with preexisting sleep disorders

Key Takeaways: EEG-Guided Anesthesia & Sleep Medicine Integration

- **Enhancing Patient Safety, Efficacy & Cost Efficiency**
  - Precise anesthetic dosing based on EEG data minimizes unnecessary drug use, reducing both toxicity risks and hospital costs
  - By limiting excessive sedation, EEG monitoring lowers ICU stays and readmission rates, improving healthcare efficiency

- **The Future of EEG & Anesthesia Integration**
  - Combining EEG with AI and machine learning will refine predictive modeling for anesthetic response, enhancing patient-specific care
  - EEG applications extend beyond the OR, with potential use in diagnosing sleep disorders, monitoring neurodegeneration, and optimizing treatment for insomnia and hypersomnia

Questions ? Comments?

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Thank You!!

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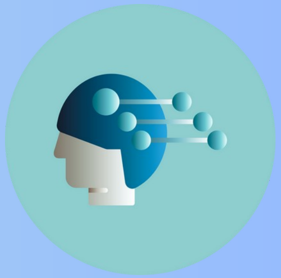

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