NeuroTrace Study Guide

Domain: Domain II – Performing the EEG Study
Section: Artifacts & Troubleshooting
Style: Practical, identification-focused, exam-oriented

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1. Core Principles (Must Know)

Artifacts Are Non-Cerebral Signals

- **Artifacts are electrical signals not originating from the brain**
- Can obscure underlying EEG activity
- Must be identified and resolved or documented
- Understanding artifacts is essential for accurate interpretation

Troubleshooting Hierarchy

- **First:** Identify the artifact type
- **Second:** Attempt to eliminate the source
- **Third:** Use filters only if source cannot be resolved
- **Last resort:** Document persistent artifacts

Key Principle

- **Eliminate artifacts at the source whenever possible**
- Do not rely solely on filters
- Document persistent artifacts

Practical Application

- Learn to identify common artifacts
- Know troubleshooting techniques
- Understand when to use filters
- Document artifacts appropriately

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2. Muscle Artifact (EMG)

Characteristics

- **Frequency:** 20-300 Hz (high-frequency)
- **Appearance:** Irregular, spiky, high-amplitude
- **Location:** Maximal in temporal/frontal regions
- **Cause:** Muscle tension (jaw, neck, face)

Identification

- **Visual:** High-frequency, irregular spikes
- **Location:** Temporal/frontal regions
- **Synchronous:** With visible muscle tension
- **Effect:** Obscures underlying EEG

Troubleshooting

- **Ask patient to relax:** Reduce jaw tension, neck tension
- **Reposition if necessary:** Adjust patient position

- **Reduce tension:** Comfort measures
- **HFF filter:** Last resort (reduces but doesn't eliminate)

Key Rule

- **Muscle artifact is common and often resolvable**
- Address the source first
- Filter only if necessary

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3. Eye Movement Artifacts

Eye Blink Artifact

- **Characteristics:** High-amplitude deflections, frontally maximal (Fp1/Fp2)
- **Synchronous:** With blinking
- **Cause:** Corneoretinal potential (cornea positive, retina negative)
- **Polarity:** Positive deflection in Fp1 when cornea moves toward it

Lateral Eye Movement

- **Characteristics:** Deflections in Fp1/Fp2, opposite polarity for left vs right
- **Synchronous:** With eye movement
- **Cause:** Corneoretinal potential
- **Identification:** Opposite polarity in Fp1 vs Fp2

Troubleshooting

- **Ask patient to keep eyes closed or open:** Consistent position
- **Reposition Fp1/Fp2:** If necessary
- **Document:** If persistent

Key Rule

- **Eye artifacts are normal and expected**
- Can be reduced but not always eliminated
- Document if persistent

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4. ECG Artifact

Characteristics

- **Frequency:** Regular, rhythmic
- **Rate:** 60-100/min (heart rate)
- **Location:** Maximal in temporal/occipital regions (near arteries)
- **Cause:** Cardiac electrical activity

Identification

- **Visual:** Regular, rhythmic deflections
- **Rate:** Matches pulse/heart rate
- **Location:** Temporal/occipital regions
- **Synchronous:** With heartbeat

Troubleshooting

- **Reposition electrodes:** Away from neck vessels
- **Use different reference:** May reduce artifact

- **Add ECG channel:** For correlation
- **Document:** If persistent

Key Rule

- **ECG artifact is common and identifiable**
- Repositioning often helps
- ECG channel can confirm

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5. 60 Hz Line Noise

Characteristics

- **Frequency:** 60 Hz (or 50 Hz in some regions)
- **Appearance:** Regular, sinusoidal
- **Location:** All channels
- **Cause:** Electrical interference from power lines, unshielded equipment

Identification

- **Visual:** Regular 60 Hz activity
- **Location:** All channels
- **Effect:** Obscures underlying EEG

Troubleshooting

- **Check grounding:** Ensure proper grounding
- **Check electrode impedance:** High impedance increases susceptibility
- **Eliminate sources:** Unshielded equipment, fluorescent lights
- **Notch filter:** Last resort (affects signals near 60 Hz)

Key Rule

- **Eliminate 60 Hz at the source**
- Check grounding and impedance first
- Notch filter is last resort

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6. Electrode Artifacts

Electrode Pop

- **Characteristics:** Sudden, high-amplitude, brief deflections
- **Location:** Single electrode
- **Cause:** Poor contact, sudden impedance changes
- **Appearance:** Sharp, brief, often returns to baseline

High-Impedance Artifact

- **Characteristics:** Increased noise, baseline instability, 60 Hz
- **Location:** Affected channels
- **Cause:** High or unstable impedance
- **Effect:** Reduced signal quality

Troubleshooting

- **Re-prepare electrode:** Clean skin, reapply paste/gel
- **Check impedance:** Verify <5 kΩ

- **Replace electrode/cable:** If problem persists
- **Document:** If persistent

Key Rule

- **Electrode artifacts indicate technical problems**
- Re-preparation usually resolves
- Replace equipment if necessary

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7. Movement Artifacts

Characteristics

- **Appearance:** Irregular, high-amplitude deflections
- **Location:** Multiple channels
- **Synchronous:** With patient movement
- **Cause:** Patient movement, cable movement

Troubleshooting

- **Secure cables:** Prevent cable movement
- **Ensure patient comfort:** Minimize movement
- **Cable management:** Organize cables
- **Document:** If persistent

Key Rule

- **Movement artifacts are preventable**
- Secure cables and ensure comfort
- Document if persistent

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8. Other Artifacts

Sweat Artifact

- **Characteristics:** Slow, irregular baseline drift
- **Location:** Multiple electrodes
- **Cause:** Sweat changing electrode impedance
- **Troubleshooting:** Cool environment, ensure comfort, maintain good contact

Pulse Artifact

- **Characteristics:** Regular, rhythmic at pulse rate (60-100/min)
- **Location:** Temporal/occipital regions (near arteries)
- **Cause:** Arterial pulsation
- **Troubleshooting:** Reposition electrodes if possible, document

Glossokinetic Artifact

- **Characteristics:** Slow, rhythmic deflections, temporal regions
- **Cause:** Tongue movement (electrical potential)
- **Troubleshooting:** Ask patient to keep tongue still

Chewing Artifact

- **Characteristics:** Irregular, high-amplitude, temporal regions
- **Cause:** Jaw movement, masseter muscle

- **Troubleshooting:** Ask patient to stop chewing, relax jaw

Shiver/Tremor Artifact

- **Characteristics:** Regular, rhythmic at tremor frequency (4-8 Hz)
- **Cause:** Visible tremor
- **Troubleshooting:** Document, may be unavoidable

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9. Troubleshooting Strategy

Systematic Approach

1. **Identify artifact type:** Visual characteristics, location, frequency
2. **Determine source:** Patient, equipment, environment
3. **Attempt resolution:** Address source directly
4. **Use filters if necessary:** Last resort
5. **Document:** Persistent artifacts and resolution attempts

Key Rule

- **Follow troubleshooting hierarchy**
- Eliminate source first
- Filter only if necessary
- Document appropriately

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10. Exam Readiness Checklist

Use this checklist to verify your understanding:

- ☐ Can identify muscle artifact (EMG)
- ☐ Can identify eye movement artifacts (blink, lateral)
- ☐ Can identify ECG artifact
- ☐ Can identify 60 Hz line noise
- ☐ Can identify electrode artifacts (pop, high-impedance)
- ☐ Can identify movement artifacts
- ☐ Know troubleshooting techniques for each artifact type
- ☐ Understand troubleshooting hierarchy (source first, filter last)
- ☐ Know when to document artifacts
- ☐ Can distinguish artifacts from cerebral activity

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11. Internal Cross-Links

Workflow

- **Recording Procedures:** Artifact prevention in workflow
- **Electrodes & Impedance:** Impedance-related artifacts
- **Filters:** Filter use for artifacts

Quizzes

- **Artifact identification MCQs:** Questions on artifact characteristics
- **Troubleshooting questions:** Questions on resolution techniques

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Study Tips

1. **Memorize artifact characteristics:** Frequency, location, appearance
2. **Learn troubleshooting techniques:** Source elimination first
3. **Understand troubleshooting hierarchy:** Source → Filter → Document
4. **Practice identification:** Visual recognition is key
5. **Know common artifacts:** EMG, eye, ECG, 60 Hz, electrode
6. **Understand filter limitations:** Filters don't eliminate, they reduce
7. **ABRET focus:** Expect questions on artifact identification, troubleshooting techniques, and when to use filters

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End of Study Guide

For additional practice, complete quiz questions tagged: artifacts, emg, eog, ecg, 60hz, electrode-artifact, troubleshooting