NeuroTrace Study Guide

Domain: Domain II – EEG Procedures & Data Acquisition
Section: EEG Electrode Types & Application
Style: Practical, stepwise, ABRET-focused

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1. Core Principles (Must Know)

Electrodes Convert Ionic Currents to Electrical Signals

- **Electrodes convert ionic currents to electrical signals:** Basic function
- Brain activity creates ionic currents
- Electrodes detect these currents
- Convert to electrical signals
- Essential for EEG recording

Proper Application Ensures

Low Impedance

- **Low impedance:** Essential for quality
- Good contact = low impedance
- Poor contact = high impedance
- Target: <5–10 kΩ
- Critical for signal quality

Stable Recordings

- **Stable recordings:** Consistent signal
- Stable contact = stable signal
- Unstable contact = artifact
- Essential for interpretation
- Prevents artifacts

Electrode Choice Affects Signal Quality

- **Electrode choice affects signal quality:** Selection matters
- Different electrodes for different needs
- Material affects performance
- Type affects application
- Must choose appropriately

Key Principle

- **Good electrodes cannot compensate for poor application**
- Best electrodes fail with poor application
- Application technique is critical
- Cannot rely on electrode quality alone
- Technique is essential

Practical Application

- Choose appropriate electrodes
- Apply correctly
- Maintain good contact
- Monitor impedance

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2. Common EEG Electrode Types

Cup Electrodes

Most Commonly Used

- **Most commonly used:** Standard choice
- Routine EEG recordings
- Standard application
- Versatile use
- Primary electrode type

Reusable

- **Reusable:** Cost-effective
- Can be cleaned and reused
- Proper disinfection required
- Infection control essential
- Standard practice

Require Conductive Paste

- **Require conductive paste:** Application requirement
- Conductive paste or gel needed
- Ensures good contact
- Reduces impedance
- Essential for function

Disk Electrodes

Flat Surface

- **Flat surface:** Design characteristic
- Flat contact surface
- Good for routine use
- Easy application
- Standard design

Often Disposable

- **Often disposable:** Single-use
- Disposable option available
- Infection control benefit
- Convenient for some settings
- May be preferred

Quick Application

- **Quick application:** Time-saving
- Faster to apply
- May use adhesive
- Convenient option
- Useful for some scenarios

Needle Electrodes

Subdermal Placement

- **Subdermal placement:** Under skin
- Placed under scalp skin

- Direct contact
- Lower impedance possible
- Specialized use

Used When Scalp Access Is Limited

- **Used when scalp access is limited:** Special indication
- Hair prevents surface access
- Burns or wounds
- Surgical sites
- Limited access scenarios

Higher Infection Risk

- **Higher infection risk:** Safety concern
- Invasive placement
- Increased infection risk
- Requires strict protocols
- Safety considerations

ABRET Emphasis

- **Needle electrodes require strict safety protocols**
- Infection control essential
- Proper technique required
- Documentation needed
- Safety first

Best Practice

- Know electrode types
- Choose appropriately
- Apply correctly
- Follow safety protocols

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3. Electrode Materials

Gold

- **Gold:** Electrode material
- Good conductivity
- Low polarization
- Expensive
- Less commonly used

Silver

- **Silver:** Electrode material
- Good conductivity
- May polarize
- Common material
- Standard option

Silver/Silver Chloride (Ag/AgCl)

- **Silver/silver chloride (Ag/AgCl):** Preferred material
- Most stable

- Low polarization
- Preferred for routine
- Standard choice

Key Points

Ag/AgCl Preferred for Stability

- **Ag/AgCl preferred for stability:** Best choice
- Most stable signal
- Minimal polarization
- Standard for routine EEG
- Preferred material

Material Affects Polarization and Noise

- **Material affects polarization and noise:** Performance impact
- Different materials perform differently
- Polarization affects signal
- Noise levels vary
- Material choice matters

Best Practice

- Use Ag/AgCl for routine
- Understand material effects
- Choose appropriate material
- Maintain electrode quality

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4. Application Technique

Steps

Measure and Mark 10–20 Locations

- **Measure and mark 10–20 locations:** Standard placement
- Use 10–20 system
- Measure accurately
- Mark locations
- Ensure proper placement

Prep Scalp (Abrasion/Cleaning)

- **Prep scalp (abrasion/cleaning):** Essential step
- Clean scalp thoroughly
- Remove oils and products
- Abrade gently if needed
- Ensure good contact

Apply Conductive Paste/Gel

- **Apply conductive paste/gel:** Contact medium
- Use appropriate paste/gel
- Apply sufficient amount
- Ensure good contact
- Reduce impedance

Secure Electrode

- **Secure electrode:** Stable placement
- Secure firmly
- Ensure stable contact
- Prevent movement
- Maintain position

Check Impedance and Balance

- **Check impedance and balance:** Quality verification
- Measure impedance
- Target <5–10 kΩ
- Check balance
- Verify quality

Best Practice

- Follow standard steps
- Ensure good preparation
- Apply correctly
- Verify impedance

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5. Special Electrodes

Sphenoidal / Anterior Temporal

- **Sphenoidal / anterior temporal:** Special placement
- For temporal lobe epilepsy
- Deeper temporal coverage
- Specialized use
- Requires expertise

Nasopharyngeal

- **Nasopharyngeal:** Nasal placement
- For deep temporal coverage
- Nasal insertion
- Specialized technique
- Limited use

EOG Electrodes

- **EOG electrodes:** Eye movement detection
- For eye movement monitoring
- Placed near eyes
- Detect eye artifacts
- Useful for artifact identification

ECG Electrodes

- **ECG electrodes:** Heart activity detection
- For cardiac monitoring
- Detect ECG artifact
- Useful for artifact identification
- Standard addition

ABRET Trap

- **Special electrodes require additional documentation**
- Must document use
- Indication for use
- Placement location
- Essential documentation

Best Practice

- Know special electrodes
- Use appropriately
- Document use
- Follow protocols

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6. Electrode-Related Artifacts

High Impedance Noise

- **High impedance noise:** Impedance-related
- High impedance increases noise
- Unstable contact
- Poor preparation
- Technical issue

Electrode Pop

- **Electrode pop:** Sudden artifact
- Sudden sharp deflection
- Unstable contact
- Poor electrode contact
- Common artifact

Drift from Poor Contact

- **Drift from poor contact:** Baseline instability
- Unstable baseline
- Poor contact
- Intermittent connection
- Technical problem

Corrective Actions

Re-prep Scalp

- **Re-prep scalp:** Improve contact
- Clean scalp again
- Remove oils
- Abrade if needed
- Improve contact

Replace Electrode

- **Replace electrode:** If damaged
- Check for damage
- Replace if necessary
- Ensure good quality
- Fix problem

Rebalance Impedance

- **Rebalance impedance:** Restore balance
- Check all electrodes
- Rebalance if needed
- Maintain balance
- Restore quality

Best Practice

- Recognize electrode artifacts
- Apply corrective actions
- Verify improvement
- Document issues

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7. Common ABRET Exam Traps

Trap 1: Confusing Electrode Type Indications

- **Reality:** Different electrodes for different needs
- **Trap:** May use wrong electrode type
- **Solution:** Know indications for each type
- **ABRET focus:** Appropriate electrode selection

Trap 2: Ignoring Infection Control

- **Reality:** Infection control is essential
- **Trap:** May not follow protocols
- **Solution:** Always follow infection control
- **ABRET focus:** Safety protocols

Trap 3: Assuming Low Impedance Guarantees Quality

- **Reality:** Balance is also critical
- **Trap:** May only check impedance values
- **Solution:** Check balance, not just values
- **ABRET focus:** Impedance balance

Trap 4: Forgetting to Document Special Electrodes

- **Reality:** Special electrodes must be documented
- **Trap:** May not document use
- **Solution:** Always document special electrodes
- **ABRET focus:** Documentation requirements

Trap 5: Not Recognizing Electrode Artifacts

- **Reality:** Electrode artifacts are common
- **Trap:** May call artifact as pathology
- **Solution:** Recognize electrode artifacts
- **ABRET focus:** Artifact identification

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8. Case-Based Example

Scenario

Clinical Setting: Routine EEG recording
Problem: EEG shows intermittent electrode pop at Fp1
Observation: Sudden sharp deflections at Fp1
Question: What is the cause?

Root Cause

- **Poor electrode contact**
- Unstable contact at Fp1
- Intermittent connection
- Poor application
- Technical issue

Corrective Action

- **Re-prep and reapply electrode**
- Clean scalp at Fp1
- Re-prep thoroughly
- Reapply electrode
- Verify stable contact

Teaching Point

- **Stable electrode contact is essential**
- Good contact = stable signal
- Poor contact = artifact
- Must ensure stable contact
- Application technique matters

ABRET Application

- Given electrode artifact → check contact
- Given intermittent signal → reapply electrode
- Given quality issue → verify application
- Must know troubleshooting steps

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9. Exam Readiness Checklist

Use this checklist to verify your understanding:

- [ ] Can identify electrode types (cup, disk, needle)
- [ ] Can apply electrodes correctly (prep, paste, secure, check impedance)
- [ ] Can select special electrodes appropriately (sphenoidal, nasopharyngeal, EOG, ECG)
- [ ] Can troubleshoot electrode artifacts (high impedance, pop, drift)
- [ ] Understand that electrodes convert ionic currents to electrical signals
- [ ] Know that proper application ensures low impedance and stable recordings
- [ ] Recognize that electrode choice affects signal quality
- [ ] Know that good electrodes cannot compensate for poor application
- [ ] Can identify electrode materials (gold, silver, Ag/AgCl)
- [ ] Know that Ag/AgCl is preferred for stability
- [ ] Understand application technique steps
- [ ] Can identify common ABRET exam traps

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10. Internal Cross-Links

Workflow

- **EEG 10-20 System:** Electrode placement locations
- **Amplifiers, Impedance & Grounding:** Impedance requirements and troubleshooting

Patterns

- **Artifacts:** How electrode problems create artifacts
- **Noise patterns:** Technical vs physiologic noise

Cases

- **Electrode artifact simulations:** Cases involving electrode problems
- **High impedance cases:** Cases requiring impedance correction

Quizzes

- **Electrode application MCQs:** Questions on electrode types and application
- **Impedance questions:** Questions on impedance and troubleshooting
- **Special electrode questions:** Questions on special electrode use

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Study Tips

1. **Memorize electrode types:** Cup (most common, reusable), Disk (often disposable), Needle (specialized, higher risk)
2. **Learn application steps:** Measure, prep, paste, secure, check impedance
3. **Know electrode materials:** Ag/AgCl preferred for stability
4. **Understand the principle:** Good electrodes cannot compensate for poor application
5. **Remember the traps:** Electrode type selection, infection control, impedance balance
6. **Know special electrodes:** Sphenoidal, nasopharyngeal, EOG, ECG
7. **ABRET focus:** Expect questions on electrode types, application technique, impedance, and artifact troubleshooting

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End of Study Guide

For additional practice, complete quiz questions tagged: electrodes, application, impedance, electrode-types