NeuroTrace Study Guide

Domain: Domain I – Basic Concepts & Principles
Section: EEG Electrode Placement: The 10–20 System
Style: Spatial, applied, exam-oriented

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1. Core Principles (Must Know)

The 10–20 System Is Based on Relative Skull Measurements

- **The 10–20 system is based on relative skull measurements**
- Uses percentages of skull dimensions
- Not absolute distances
- Adapts to different head sizes
- Ensures proportional placement

Ensures Reproducible Electrode Placement

- **Ensures reproducible electrode placement**
- Standardized system
- Consistent across patients
- Reproducible across studies
- Enables comparison

Supports Consistent Localization Across Patients

- **Supports consistent localization across patients**
- Same electrode = same brain region
- Enables comparison between patients
- Supports research and clinical practice
- Essential for interpretation

Key Principle

- **Standardized placement enables meaningful EEG interpretation**
- Without standardization, interpretation is unreliable
- Standardized placement is essential
- Enables accurate localization
- Supports clinical correlation

Practical Application

- Use 10–20 system for all recordings
- Follow measurement procedures
- Verify electrode placement
- Document placement accuracy

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2. Naming Conventions

Letter = Brain Region

F = Frontal

- **F = Frontal:** Frontal lobe electrodes
- Fp1, Fp2: Frontal poles

- F3, F4: Frontal regions
- F7, F8: Anterior temporal/frontal
- Fz: Frontal midline

T = Temporal

- **T = Temporal:** Temporal lobe electrodes
- T3, T4: Mid-temporal
- T5, T6: Posterior temporal
- T7, T8: Alternative naming (same as T3, T4)
- Critical for epilepsy localization

C = Central

- **C = Central:** Central (Rolandic) region
- C3, C4: Central regions
- Cz: Central midline
- Over motor/sensory cortex
- Mu rhythm location

P = Parietal

- **P = Parietal:** Parietal lobe electrodes
- P3, P4: Parietal regions
- Pz: Parietal midline
- Less commonly used
- May be used in extended montages

O = Occipital

- **O = Occipital:** Occipital lobe electrodes
- O1, O2: Occipital regions
- Oz: Occipital midline
- Alpha rhythm (PDR) location
- Visual cortex region

Numbers

Odd = Left Hemisphere

- **Odd = Left hemisphere:** 1, 3, 5, 7
- Fp1, F3, C3, P3, O1: Left side
- F7, T3, T5: Left temporal chain
- Critical for localization

Even = Right Hemisphere

- **Even = Right hemisphere:** 2, 4, 6, 8
- Fp2, F4, C4, P4, O2: Right side
- F8, T4, T6: Right temporal chain
- Critical for localization

"z" = Midline

- **"z" = Midline:** Central placement
- Fz: Frontal midline
- Cz: Central midline
- Pz: Parietal midline
- Oz: Occipital midline

Best Practice

- Memorize letter meanings (F, T, C, P, O)
- Remember odd = left, even = right
- Know that "z" = midline
- Use naming to identify locations

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3. Electrode Locations & Regions

Frontal Poles: Fp1, Fp2

- **Frontal poles: Fp1, Fp2**
- Most anterior electrodes
- Over frontal poles
- May show eye movement artifacts
- Important for frontal lobe assessment

Central Midline: Cz

- **Central midline: Cz**
- Top of head (vertex)
- Over central sulcus
- Mu rhythm location
- Reference point for measurements

Posterior Dominant Regions: O1, O2

- **Posterior dominant regions: O1, O2**
- Over occipital cortex
- Alpha rhythm (PDR) location
- Visual cortex region
- Critical for background assessment

Temporal Chains: F7–T3–T5 / F8–T4–T6

- **Temporal chains: F7–T3–T5 / F8–T4–T6**
- F7/F8: Anterior temporal/frontal
- T3/T4: Mid-temporal
- T5/T6: Posterior temporal
- Critical for epilepsy localization

ABRET Emphasis

- **Temporal electrodes are critical for epilepsy localization**
- Most epileptiform activity is temporal
- Temporal electrodes are essential
- Must know temporal chain locations
- Critical for focal epilepsy

Best Practice

- Know electrode locations
- Understand regional groupings
- Recognize temporal chain importance
- Use locations for localization

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4. Measurement Logic

Distances Measured as Percentages

10% and 20% Intervals

- **10% and 20% intervals:** Measurement basis
- 10%: Between adjacent electrodes
- 20%: Between major electrodes
- Based on skull dimensions
- Ensures proportional placement

Reference Points

Nasion

- **Nasion:** Bridge of nose
- Anterior reference point
- Used for frontal measurements
- Landmark for placement

Inion

- **Inion:** Back of head (occipital protuberance)
- Posterior reference point
- Used for occipital measurements
- Landmark for placement

Preauricular Points

- **Preauricular points:** In front of ears
- Lateral reference points
- Used for temporal measurements
- Landmark for placement

Best Practice

- Understand measurement logic
- Know reference points
- Use percentages, not absolute distances
- Verify measurements

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5. Clinical Localization Examples

EEG Finding	Likely Region	Electrodes
Focal spikes at T3	Left temporal	T3, F7, T5
Slowing at F4	Right frontal	F4, Fp2, F8
PDR maximal at O1/O2	Occipital	O1, O2, Oz
Spikes at C3	Left central	C3, F3, P3
Generalized spike-and-wave	Both hemispheres	All electrodes

Key Distinctions

Focal Findings

- **Focal findings:** Limited to specific region
- One or few electrodes involved
- Localized to specific area
- Suggests focal pathology

Generalized Findings

- **Generalized findings:** Both hemispheres
- Multiple electrodes involved
- Widespread distribution
- Suggests generalized process

Best Practice

- Use electrode names for localization
- Know which electrodes = which regions
- Understand focal vs generalized
- Apply localization logic

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6. Common ABRET Exam Traps

Trap 1: Confusing Left vs Right Numbering

- **Reality:** Odd = left, even = right
- **Trap:** May confuse left and right
- **Solution:** Memorize odd = left, even = right
- **ABRET focus:** Electrode naming

Trap 2: Misidentifying Electrode Regions

- **Reality:** Letters indicate regions
- **Trap:** May misidentify regions
- **Solution:** Memorize letter meanings
- **ABRET focus:** Regional identification

Trap 3: Assuming Cz Is Frontal

- **Reality:** Cz is central, not frontal
- **Trap:** May think Cz is frontal
- **Solution:** Know that C = central
- **ABRET focus:** Electrode locations

Trap 4: Forgetting Midline Designation

- **Reality:** "z" = midline
- **Trap:** May forget midline designation
- **Solution:** Remember "z" = midline
- **ABRET focus:** Midline electrodes

Trap 5: Not Understanding Temporal Chain

- **Reality:** Temporal chain is F7–T3–T5 / F8–T4–T6
- **Trap:** May not understand temporal chain
- **Solution:** Learn temporal chain sequence
- **ABRET focus:** Temporal localization

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7. Clinical Correlation

Accurate Placement

Improves Localization

- **Improves localization:** Accurate placement = accurate localization
- Correct electrode position = correct brain region
- Enables precise localization
- Supports clinical correlation

Reduces Misinterpretation

- **Reduces misinterpretation:** Accurate placement prevents errors
- Misplacement leads to false localization
- Accurate placement prevents confusion
- Essential for correct interpretation

Poor Placement Leads to False Localization

- **Poor placement leads to false localization**
- Incorrect electrode position = incorrect localization
- May lead to wrong diagnosis
- May lead to wrong treatment
- Must ensure accurate placement

Best Practice

- Ensure accurate electrode placement
- Verify measurements
- Document placement accuracy
- Correct misplacement immediately

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8. Case-Based Example

Scenario

Clinical Setting: Routine EEG for seizure evaluation
EEG Finding: Spike maximal at F7
Question: What region is this?

Interpretation

- **Left anterior temporal/frontal region**
- F7 = Left anterior temporal/frontal
- Spike maximal at F7 = focal finding
- Suggests left anterior temporal/frontal pathology
- May indicate focal epilepsy

Teaching Point

- **Electrode name encodes both side and region**
- F7 tells us: F = frontal/temporal, 7 = left, anterior
- Electrode name provides localization
- Essential for interpretation
- Must know naming conventions

ABRET Application

- Given electrode name → identify side and region
- Given F7 → left anterior temporal/frontal
- Given T3 → left mid-temporal
- Must know naming conventions

9. Exam Readiness Checklist

Use this checklist to verify your understanding:

- ☐ Can identify electrode locations (frontal, temporal, central, parietal, occipital)
- ☐ Can apply numbering rules (odd = left, even = right)
- ☐ Can use placement for localization (electrode name → brain region)
- ☐ Can avoid left/right confusion (odd vs even)
- ☐ Understand that 10–20 system is based on relative measurements
- ☐ Know that standardized placement enables interpretation
- ☐ Recognize that temporal electrodes are critical for epilepsy
- ☐ Know that "z" = midline
- ☐ Can identify electrode regions from names
- ☐ Understand measurement logic (10%, 20%, reference points)
- ☐ Can localize findings based on electrode positions
- ☐ Can identify common ABRET exam traps

10. Internal Cross-Links

Foundations

- **Neuroanatomy for EEG Localization:** Understanding brain regions
- **Normal EEG Rhythms:** Where rhythms are recorded

Workflow

- **Montages & Referencing:** How electrodes are connected
- **Electrodes & Impedance:** Electrode application and maintenance

Patterns

- **Epileptiform Discharges:** Localization of epileptiform activity
- **Focal vs Generalized:** Using electrodes for classification

Cases

- **Localization-based EEG cases:** Cases requiring electrode knowledge
- **Montage interpretation cases:** Cases using electrode positions

Quizzes

- **10–20 system MCQs:** Questions on electrode placement
- **Localization questions:** Questions on using electrodes for localization
- **Naming convention questions:** Questions on electrode names

Study Tips

1. **Memorize naming conventions:** F, T, C, P, O = regions; odd = left, even = right; "z" = midline
2. **Learn electrode locations:** Frontal poles, temporal chains, central, occipital
3. **Know measurement logic:** 10%, 20% intervals, reference points
4. **Understand localization:** Electrode name → brain region
5. **Remember the principle:** Standardized placement enables interpretation
6. **Know the traps:** Left/right confusion, regional misidentification, midline forgetting
7. **ABRET focus:** Expect questions on naming, locations, and localization

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End of Study Guide

For additional practice, complete quiz questions tagged: electrode-placement, 10-20, localization, hemispheres