Electrophysiological Correlates of Phonological Processing in Aphasia: A case report

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Background

Electrophysiological research using Mismatch Negativity
- Deficient processing of consonant contrasts in nearly all types of aphasia
- MMN delayed, distorted or even absent (standard between 150 – 250 ms)

Auditory comprehension problems based on phonological input problems

Functional plasticity

Reorganization of language in homotopic areas of the right hemisphere after stroke:
- Bilateral activation
- Shift to contralesional hemisphere

Better restitution without shift to contralesional hemisphere

Method

Subject
- 68 year old right-handed woman with Broca aphasia
- Ischemic stroke in left insular area + area left middle cerebral artery with involvement of Broca area

Language test battery
- AAT
- PALPA (subtests phonological input)

Electrophysiology (EEG)
- Pre-attentive oddball paradigm (MMN)
- 3 different sets of stimuli auditory presented
- Investigating processing of 3 distinctive features:
  - Voicing
  - Manner of articulation
  - Place of articulation

Results

Aachen Aphasia Test (AAT)
- No abnormal scores for auditory language comprehension
  - Auditory word comprehension: 29/30 (pc. 95)
  - Auditory sentence comprehension: 29/30 (pc. 95)

Psycholinguistic Assessment of Language Processing in Aphasia (PALPA)
- Still reveals lower scores for auditory discrimination
  - PALPA 1: 64/72 (M: 70.05; SD: 1.64; Range: 66-72)
  - Feature “place” most affected: 7/12 (M: 11.13; SD: 0.75; Range: 9-12)

Electrophysiology (EEG)
- Three MMN’s were present: either delayed, attenuated or with changed distribution
- MMN for “place” present: either delayed, attenuated or with changed distribution
- Better restitution without shift to contralesional hemisphere!

Conclusion + discussion

This case report demonstrates:
1) How electrophysiology can reveal contralesional activation when processing a particular distinctive feature
2) How this method can be a valuable supplement to logopaedic examination by:
   - Making it possible to investigate subtle comprehension problems
   - Making it possible to formulate a prognosis regarding recovery
3) Therapeutic implications:
   - Focus on phonological component that is causing the contralesional shift in order to impede activation of right hemisphere

References
2) Tyler LK, Wright P, Randall B, Marslen-Wilson WD, Stamatakis EA. Reorganization of syntactic processing following left-hemisphere brain damage: does right-hemisphere activity preserve function? Brain 2010; 133: 3396-3408