CNV: a neural correlate of stutter frequency and compensation strategies?

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1) Background

Neural hallmark of developmental stuttering

Neurophysiological substrate of motor programming

Abnormal articulatory motor preparation

Contingent Negative Variation (CNV)

Slow, negative brain potential occurring just before a movement is executed

Warning: “be ready”

Imperative: “execute the movement”

Previous research: large interindividual variation: caused by?

2) Method

Participant:
- 28-year-old woman
- Monolingual native speaker of Dutch
- Nearly blank medical history

Medical report:
- Recurrent strokes in left superior temporal gyrus over 2.5 months due to arteriovenous malformation (AVM)
- Neurogenic stuttering appeared after the 3rd event
- AVM surgically removed after the 5th event

Evaluations: once pre-surgery and three times post-surgery (1 month, 3 months, 4 months)

Speech evaluation:
- Conversation and reading a text
- Percentage stuttered syllables (% SS)
- Stuttering Severity Instrument (SSI-4, Riley, 2008)

Language evaluation:
- Speech samples: screened for semantic and phonological paraphasias by 2 SLP’s
- Token Test of Aachen Aphasia Test
- Auditory phoneme discrimination and word recognition
  - Neurophysiological evaluation
  - PALPA 1, 2, 5

CNV task: picture naming task

Electro-encephalogram: mean amplitude of -500 to 0 msec

Warning: “be ready”

Imperative: “execute the movement”

3) Results and discussion

If % SS conversation

<table>
<thead>
<tr>
<th>% SS</th>
<th>SSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Conversation</td>
</tr>
<tr>
<td>Pre-surgery</td>
<td>0</td>
</tr>
<tr>
<td>1 month post-surgery</td>
<td>0,5</td>
</tr>
<tr>
<td>3 months post-surgery</td>
<td>0</td>
</tr>
<tr>
<td>4 months post-surgery</td>
<td>0</td>
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Stutter frequency is in accordance with the amount of dysfunction in premotor programming

No stutters during task performance:
Even without stuttered speech, motor preparation abnormalities are present

Motor preparation abnormalities are either not enough OR surmountable by compensation

Another activity pattern:

- Correspond to right frontal areas
- Engaged in motor planning and control
- Most frequently reported right-sided overactivation in stuttering
- Related to compensation strategies to overcome the left-sided primary deficit

Right sided increase in CNV amplitude at the moment of most severe stuttering may be an attempt to deal with the increase in stutter frequency

Warning -7 -3 Fz Cz

- Correspond to bilateral motor and left inferior frontal gyrus
- Core cortical regions for motor preparation and execution

- T3: left sided lesion site
- T4: contralateral homologue of lesion site

Correspond to bilateral motor and left inferior frontal gyrus

Core cortical regions for motor preparation and execution

Correspond to right frontal areas

Engaged in motor planning and control

Most frequently reported right-sided overactivation in stuttering

Related to compensation strategies to overcome the left-sided primary deficit

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