Brain plasticity after implanted drop foot stimulator in chronic stroke

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EAN, Berlin, June 20th, 2015
Drop foot stimulator

External control unit
Microcontroller & transmitter

Receptor

4-channels nerve stimulator
Peroneal nerve

Heel switch
Methods

- Chronic stroke patients with drop foot
- Rehazenter Lux (clinical tests) & ULg Be (neuroimaging - EEG – PET – MRI)
- 21 patients included, 7 drop-out (stimulator issue)
- 14 completed the study (5 wo, age: 47±12y, time since insult: 2±1y, 7 lesion on the left)
Clinical improvement

M -1

M +12

www.comascience.org
18F-FDG-PET-scan at rest

Pre-post: n=14 – right stroke: n=7; left stroke: n=7

7 patients with right lesion were flipped
⇒ all patients: lesion on the left hemisphere

Normalization with «flipped template»
Smoothing at 12 mm
Results: single subject

Lesion on the left

<table>
<thead>
<tr>
<th>DA</th>
<th>hypo before stim</th>
<th>improvement</th>
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<tbody>
<tr>
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<td><img src="image1" alt="Brain Image" /></td>
<td><img src="image2" alt="Brain Image" /></td>
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<tr>
<td>CS</td>
<td><img src="image3" alt="Brain Image" /></td>
<td><img src="image4" alt="Brain Image" /></td>
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<tr>
<td>SC</td>
<td><img src="image5" alt="Brain Image" /></td>
<td><img src="image6" alt="Brain Image" /></td>
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0.05 uncorr
Results: single subject

Lesion on the right

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<tr>
<td>BD</td>
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<td>JR</td>
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<td>SV</td>
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0.05 uncorr
Results: group

Hypometabolic areas

before activation                      1 year later

Motor & premotor
Prefrontal & caudate

Motor & premotor
Prefrontal & caudate

0.05 FWE
Results: group

Increase
- motor areas left & right
- Left prefrontal

No decrease
Results: group

Brain metabolism in premotor cortex (B6)

![Graph showing brain metabolism comparison between healthy and damaged sides before and 1 year later.](chart-url)
Analyses

- High density (256 electrodes)
- Resting state for 30 min, EO

- Power spectrum (delta, theta, alpha beta)
- Entropy
- Phase lag index

⇒ Motor area
Results: single subject (right stroke)

Motor cortex

- **Delta**
  - 1st exam: normalized delta pre
  - 2nd exam: normalized delta post
  - Difference: normalized delta post-pr

- **Theta**
  - 1st exam: normalized theta pre
  - 2nd exam: normalized theta post
  - Difference: normalized theta post-pr

- **Alpha**
  - 1st exam: normalized alpha pre
  - 2nd exam: normalized alpha post
  - Difference: normalized alpha post-pr

- **Beta**
  - 1st exam: normalized beta pre
  - 2nd exam: normalized beta post
  - Difference: normalized beta post-pr
Results: group

n=9

Motor area

Data flipped ➔ Left lesion
Clinical improvements correlates

• \( \uparrow \) brain metabolism (PET-scan) in motor areas
  (damaged & contralateral hemisphere)

• \( \uparrow \) cortical activity (EEG) in motor area
  (damaged hemisphere)

Plasticity of the damaged area in chronic stroke patients
Thank you!