ERP and behavioral correlates of feedback processing in neurological patients suffering from acute stroke or multiple sclerosis during ambulant rehabilitation

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Introduction

Few empirical studies are available on electrophysiological indices of cognitive performance during the course of rehabilitation for neurological patients, although cognitive improvements can be quite substantial during this time. Of particular relevance for neurological patients faced with a sudden or gradual onset of cognitive deficits is to learn how to use (predominantly negative) performance feedback effectively and not to be discouraged [1]. While very few studies examine feedback processing in patients, recent evidence suggest considerable changes over the course of the lifetime even in healthy individuals, emphasizing the relevance of this research area. Specifically, feedback will be provided in a trial-by-trial or blockwise manner, and focus on a combination of separable indices of correctness and accuracy timing.

One group of patients, suffering from acute stroke, will be assessed at the beginning and towards the end of their ambulant rehabilitation, about 2 weeks apart. The focus of these analyses is to assess electrophysiological and behavioral indices of potential neuronal plasticity following an acute neurological injury. Another group of patients suffering from multiple sclerosis will be assessed to the flanker effect with the aim of comparing electrophysiological and behavioral indices before and after the onset of fatigue induced by performing cognitively challenging tasks. Both neurological groups of patients will be compared with an age-matched sample of orthopedic patients recovering from acute physical injuries and also undergoing an ambulant rehabilitation.

Diagnostic criteria

<table>
<thead>
<tr>
<th>Group</th>
<th>Stroke</th>
<th>Multiple Sclerosis</th>
<th>Controls</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Age 40 – 70 years</td>
<td>20 – 50 years</td>
<td>age matched</td>
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<td>Inclusion criteria</td>
<td>Patients with medial or posterior stroke in a sub-acute or chronic state.</td>
<td>Patients with relapsing-remitting MS or with secondary/primary progressive MS with clinically relevant fatigue.</td>
<td>Controls undergoing orthopedic rehabilitation (in general due to implantation of hip/knee-TEP or chronic back pain).</td>
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<tr>
<td>Exclusion criteria</td>
<td>substantially or clinically impaired visual perception</td>
<td>- clinically relevant impairment of speech perception (a)</td>
<td>- clinically relevant impairment of speech perception (b)</td>
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<td>- substantially or clinically impaired hand function and FADs (Freescale in bushing)</td>
<td>- clinically relevant impairment of motor function of both hands</td>
<td>- limited capacity of informed consent</td>
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</tbody>
</table>

Stroke

Procedure

Before EEG measurement:
- selected tests from cognitive training as used in rehabilitation center
- Digit Span Memory Test
- Symbol Digit Modalities Test
- Corsi Block Tapping Test

EEG measurement:
- Flanker paradigm
- Standard paradigm

Fatigue scala (adapted from [4]):
- Scale form 0 – 20
- Questions on 4 topics:
  (1) mental demand
  (2) time demand
  (3) performance evaluation
  (4) effort

Multiple Sclerosis

Procedure

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- Scale form 0 – 20
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Illustration of N-back task
(adapted from [2])

Preliminary ERP and behavioral data
(adapted from [3])

References