Detecting signs of consciousness in severely brain injured patients with voluntary control of sniffing: a cohort study.

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Sniffing enables communication and environmental control for the severely disabled

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Aim: Detecting signs of consciousness in non-communicative patients with disorders of consciousness.

- Through voluntary control of respiration (non-invasive)
- Sniffs rely on widely distributed neural network, allowing for increased conservation following injury
- Device usage shared neural substrates with language production, rendering sniffs a promising bypass mode of communication
**Methods**

**Sniff Controller**

Sniff-dependent interface that measures nasal pressure and converts it into electrical signals.

**Task:**
- 5 min. baseline
- 30 sec. stimulus
- 60 sec. rest
- Between 15-25 events

“Take a deep sniff in order to stop the music.”

“Just breathe normally.”

Sniff magnitude beyond a set threshold
Methods

Population
33 DOC patients: 11 VS/UWS; 3 MCS-; 17 MCS+; 2 EMCS (19 men, mean age = 35; SD = 13.27)
Etiology (n = 22 traumatic)
Since insult (mean = 40 months; SD = 34.9)

Analysis
STATA Software (version 12, Texas, USA)
- T-test differences for reaction times in rest periods vs music events
## Results

**Responders:** 0/11 VS/UWS; 1/3 MCS-; 4/17 MCS+; 1/2 EMCS

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Gender</th>
<th>CRS-R</th>
<th>Etiology</th>
<th>Time since</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>48</td>
<td>F</td>
<td>MCS-</td>
<td>Anoxic</td>
<td>1 year 6 months</td>
</tr>
<tr>
<td>2</td>
<td>31</td>
<td>F</td>
<td>MCS+</td>
<td>TBI</td>
<td>6 years 7 months</td>
</tr>
<tr>
<td>3</td>
<td>36</td>
<td>F</td>
<td>MCS+</td>
<td>Anoxic</td>
<td>1 year 5 months</td>
</tr>
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<td>M</td>
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<td>TBI</td>
<td>2 years 5 months</td>
</tr>
</tbody>
</table>
Sniffing performance

48 year-old woman; MCS-; 18 months post cardiac arrest

1st assessment

- Red: Succeeded
- Gray: Not succeeded

Reaction time (sec)

Events
Sniffing performance

48 year-old woman; MCS-; 18 months post cardiac arrest

2nd assessment

- Red bars: Succeeded
- Gray bars: Not succeeded
Conclusion

**Sniff Controller**

**Allowed to identify voluntary control of respiration in a patient without command following**

- Complementary way to assess the level of consciousness at bedside
- Alternative tool to fMRI\(^1\) or EEG based\(^2\) non-motor dependent communication
- Future perspective: trying more complex communication/self-expression

THANK YOU!