Does training induce changes in the event related brain potentials in patients with impaired consciousness due to severe traumatic brain injury?

Lapitskaya N, MD[1]; Nielsen JF, MD, DMSc[1]; Fuglsang-Frederiksen A, MD, DMSc[2]; Jakobsen J, MD, DMSc[3]

[1] Hammel Neurorehabilitation- and Research Centre, Denmark, e-mail: neunla@sc.aaa.dk

[2] Department of Neurophysiology, Aarhus University Hospital, Denmark

[3] Department of Neurology, Aarhus University Hospital, Denmark

Abstract:

The aim of this study was to determine whether passive gait training induces changes in the event related brain potentials (ERP) in patients with severe traumatic brain injury (TBI).

Methods:
ERP with a simple oddball paradigm were recorded before and immediately after a single gait training session in the robotic gait orthosis.

Results:
P300 latency tended to increase after a single training session in the gait robot (362±28.9 ms before and 412±73.8 ms after training, p=0.06).

Conclusion:
Our preliminary results indicate that ERP may be an effective non-invasive method for measuring changes in brain potentials as a result of training. The tendency of the P300 latency to increase might be due to a fatiguing effect of gait training on bedridden patients with severe TBI.

Introduction and purpose

- Traumatic brain injury is a serious problem worldwide
- Early mobilization is important for rehabilitation
- Strong proprioceptive stimulation: upright body position and passive legs movements
- ERP (event related potentials) is a safe non-invasive method for measuring brainactivity related to cognition

To our knowledge, no studies have investigated the effects of passive gait training on brain activity in patients with severe brain damage.

The aim of this study was to determine whether passive gait training induces changes in the event related brain potentials (ERP) in patients with severe traumatic brain injury (TBI).

Fig.1 Training session in the Lokomat DGO

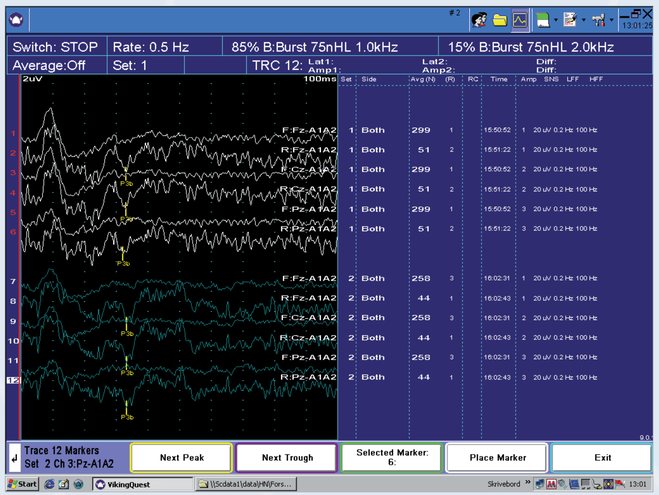

Fig.2 Example of the ERP-recording session

Materials:

Eleven patients (42.9±17.6 years old) and fourteen aged matched healthy volunteers.

Patients characteristics:

- Severe traumatic brain injury (Glasgow Coma Scale3.9±1.7 on admission to the hospital)
- Ongoing impaired state of consciousness (Rancho Los Amigos Scale 2.3±0.5) at the inclusion time 82±28 days after injury

Methods:

Single training session of passive gait training in a Lokomat DGO (training time 17.1±1.3 min, gait distance 426.7±36.7 m, gait speed 1.5±0.1 km/h, weight unload 52.7±9.5 kg, weight remain 20.3±6.2 kg)

ERP (event related potentials) with simple oddball paradigm were recorded from three electrodes (Fz, Cz, Pz) before and immediately after a single gait training session.

Effect parameters: latency of the P300-component, defined as the first positive peak after N1P2N2-complex.
Two sets were performed to secure reproducibility of the components, and following average procedure was done to reduce signal-noise ratio. Latency was measured as the peak latency of the P300-component at Pz-lead (largest P300-amplitude).

Results:

P300 latency tended to increase after a single training session in the gait robot in both patients and healthy volunteers.

Patients:
Before: 362±28.9 ms
After: 412±73.8 ms (p=0.06).

Healthy volunteers:
Before: 335.4±39.7 ms
After: 342.1±53.2 ms (p=0.5)

Conclusion: Our preliminary results indicate that ERP may be an effective non-invasive method for measuring changes in brain potentials as a result of training. The tendency of the P300 latency to increase might be due to a fatiguing effect of gait training on bedridden patients with severe TBI.