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## Stroke

### Oral communications

CO01-001-e

#### Positive effects of tDCS cortical stimulation on the walking performance of chronic hemiplegic patients



E. Ojardias\*, O. Aze, D. Luneau, J. Mednieks (Dr), A. Condemine (Dr), P. Giraux (Prof)  
 Service de MPR adulte, hôpital Bellevue, CHU de Saint-Étienne, Saint-Étienne, France

\*Corresponding author.

E-mail address: [ojardiasetienne@hotmail.fr](mailto:ojardiasetienne@hotmail.fr) (E. Ojardias)

**Objective** To evaluate the effect of a single session of stimulation of the primary motor cortex (M1) with tDCS versus placebo (SHAM) on the walking performance of hemiplegic patients at a chronic stage.

**Patients and methods** Randomized, cross-over, double-blind study. Eighteen patients (6 women, 12 men, mean age: 60 years) were included. They suffered an initially complete hemiplegia due to a single stroke older than 6 months (min: 14 months, max: 11 years). Each patient participated in a single anodal stimulation session (2 mA, 20 minutes) of the area of the lower limb ipsilesional M1 (STIM condition) and a pseudo-stimulation session (SHAM condition). The order of the two sessions was randomly assigned, with an 11-day interval between the two sessions. The anodal electrode was positioned on the hotspot previously identified with TMS. The cathode was placed above the contralateral orbit. The walking performances were evaluated with the Wade Test and the 6-Minute Walking Test (6MWT). These tests were performed during the stimulation and after 1 h, and 2 days before and 10 days after each session.

**Results** The Wade Test and 6MWT showed a linear progression from the first pre-stimulation evaluation until the last evaluation (Wade average +20% +21% average 6MWT). To overcome this progression, comparisons were based on the linearly corrected data of each patient. The comparison between the 6MWT under STIM versus SHAM conditions demonstrated a significant positive effect of the stimulation by 11% during stimulation (Wilcoxon matched pairs,  $P = 0.019$ ) and 6% 1 hour after stimulation (Wilcoxon matched pairs,  $P = 0.025$ ). There is no significant difference regarding the Wade Test.

**Discussion** These results show a significant positive effect of a single session of anodal tDCS of the M1 ipsilesional area of the lower limb in chronic hemiplegic patients. This improvement affects the endurance (6MWT) but not the walking speed (Wade Test). This proof of principle study supports a follow-up study assessing the training of walking under iterative tDCS stimulation.

**Keywords** tDCS; Hemiplegia; Stroke; Walking

**Disclosure of interest** The authors have not supplied their declaration of conflict of interest.

<http://dx.doi.org/10.1016/j.rehab.2015.07.007>

CO01-002-e

#### Ipsilateral M1 transcranial direct current stimulation increases excitability of the contralateral M1 during an active motor task: Implications for stroke rehabilitation



W.P. Teo (Dr)<sup>a</sup>, M. Muthalib (Dr)<sup>b,\*</sup>, D. Kidgell (Dr)<sup>c</sup>, A. Frazer<sup>a</sup>, A. Hendy (Dr)<sup>a</sup>, A. Goodwill<sup>a</sup>, S. Perrey (Prof)<sup>b</sup>

<sup>a</sup>Deakin University, Melbourne, Australia

<sup>b</sup>University of Montpellier, Montpellier, France

<sup>c</sup>La Trobe University, Melbourne, Australia

\*Corresponding author.

E-mail address: [makii.muthalib@univontp1.fr](mailto:makii.muthalib@univontp1.fr) (M. Muthalib)

**Introduction** Anodal transcranial direct current stimulation (a-tDCS) of the primary motor cortex (M1) elicits an increase in cortical excitability that outlasts the period of stimulation. However, little is known about effects of a-tDCS on the contralateral M1 during and after ipsilateral M1 stimulation. Therefore, we investigated the changes in corticospinal excitability and inhibition of the left M1 during and after 20 min of a-tDCS to the right M1.

**Material and methods** Eight healthy participants received real (2 mA) and SHAM a-tDCS to the right M1 randomized across 2 testing sessions. Single- and paired-pulse transcranial magnetic stimulation (TMS) was applied to the left M1 to measure changes motor-evoked potential (MEP) amplitude from the right extensor carpi radialis (ECR) at 130% of resting and active motor threshold, cortical silent period (CSP) and short-interval cortical inhibition (SICI). Active motor threshold was measured during a wrist extension contraction that was less than 5% of maximal electromyographic activation of the ECR. TMS measurements were recorded at baseline, every 5 min for 20 min during and 10 min after a-tDCS.

**Results** The results showed a significant ( $P < 0.05$ ) increase in left M1 MEP amplitude and reduction in CSP duration during (10 and 15 min) and after (immediately and 10 min post) a-tDCS to the right M1, only during the active motor task. A significant reduction ( $P < 0.05$ ) in SICI during the active task was also found immediately and 10 min post a-tDCS. No significant changes in MEP amplitude, CSP and SICI were observed in the resting or active task during SHAM tDCS.

**Discussion** The increase in left M1 MEP amplitude and reduction in CSP and SIC1 during and after 20 min of right M1 a-tDCS is most likely to be attributed to a reduction in interhemispheric inhibition that is modulated by a-tDCS during the performance of an active task. Our findings may have significant implications for stroke rehabilitation whereby the application of a-tDCS on the contralesional M1 during neurorehabilitation of the paretic limb may be beneficial for inducing neuroplasticity of the ipsilesional M1 to improve motor function.

**Keywords** Transcranial direct current stimulation; Primary motor cortex; Excitability; Transcranial magnetic stimulation; Stroke

**Disclosure of interest** The authors have not supplied their declaration of conflict of interest.

<http://dx.doi.org/10.1016/j.rehab.2015.07.008>

#### CO01-003-e

### Study of the effects of a 5-day brain stimulation with Paired Associative Stimulation (PAS) against placebo in 28 hemiplegic patients

M. Tarri<sup>a</sup>, M. Simonetta-Moreau (Dr)<sup>a</sup>, I. Loubinoux<sup>a</sup>, X. De Boissezon (Prof)<sup>b</sup>, D. Gasq (Dr)<sup>b</sup>, P. Marque (Prof)<sup>b</sup>, E. Castel-Lacanal (Dr)<sup>b,\*</sup>

<sup>a</sup>Inserm U 825, Toulouse, France

<sup>b</sup>Service de MPR, CHU Rangueil, Toulouse, France

\*Corresponding author.

E-mail address: [c\\_evelyne@yahoo.com](mailto:c_evelyne@yahoo.com) (Castel-acanal)

**Objectives** The Paired Associative Stimulation (PAS) is a non-invasive brain stimulation technique combining an electrical peripheral stimulation and a magnetic cortical stimulation. Applied on the wrist extensor muscles, one session induced changes in cortical excitability. We studied the effects of a repetition of 5 PAS sessions against placebo.

**Material and methods** This is a prospective, randomized, double-blind against placebo study. One session consisted in applying an electrical peripheral stimulation on the wrist extensor muscle followed by a 25-ms later magnetic cortical stimulation over the wrist area, at a 0.1-Hz frequency during 30 minutes, the patient receiving 180 paired stimuli. In the SHAM group, the patient received the electrical peripheral stimulation and a SHAM magnetic stimulation. One session was applied every day during 5 days. The changes in area of the motor-evoked potential (MEP), reflecting the changes in cortical excitability, and motor changes studied by the Fugl-Meyer score were assessed at the end of the 1st and 5th session, 3, 5 and 7 days after the end of the 5 days session. **Results** Twenty-eight patients were included (19 men, mean age: 49.9 ± 13.5 years), with stroke from 10.0 ± 5.1 weeks. Only data from 24 patients were exploitable, 13 patients being included in the PAS group. It was not found significant differences between the two groups regardless of the time after stimulation, or the electrophysiological parameters, neither the motor scores. However, there is a greater MEP variability in the PAS group compared to the SHAM group. All patients ( $n = 5$ ) for which PAS increased cortical excitability (D8-MEP > +200% D1-MEP) were those with a low initial level of cortical excitability.

**Discussion** The initial level of cortical excitability seems to play a key role of repeated sessions of PAS on the lasting effects on brain plasticity. Our results confirm the importance of the initial level of neuronal activation in the cortical modulation induced by TMS.

**Keywords** Stroke; Transcranial magnetic stimulation; Cerebral plasticity

**Disclosure of interest** The authors have not supplied their declaration of conflict of interest.

<http://dx.doi.org/10.1016/j.rehab.2015.07.009>



#### CO01-004-e

### Study of motor and electrophysiological effects induced by the association of motor imagery exercises and Paired Associative Stimulation in 6 hemiplegic patients

N. Brihmat<sup>a</sup>, M. Tarri<sup>a</sup>, X. De Boissezon (Prof)<sup>b</sup>, P. Marque (Prof)<sup>b</sup>, I. Loubinoux<sup>a</sup>, E. Castel-Lacanal (Dr)<sup>b,\*</sup>

<sup>a</sup>Inserm U 825, Toulouse, France

<sup>b</sup>Service de MPR, CHU Rangueil, Toulouse, France

\*Corresponding author.

E-mail address: [c\\_evelyne@yahoo.com](mailto:c_evelyne@yahoo.com) (Castel-acanal)

**Objective** Motor imagery (MI) is a cognitive process of imagining a movement without actually doing it. This technique has demonstrated its benefits in the rehabilitation of hemiplegic patients. Non-invasive brain stimulation (NIBS) is still at a preclinical stage but has demonstrated their adjunct effect in the learning of a motor task. In this study, we studied the motor and electrophysiological effects of a session combining Paired Associative Stimulation (PAS), a technique of NIBS and MI exercises (PAS-MI).

**Methods** A prospective, randomized cross-over study where six patients were included (4 men, age = 44.5 ± 13.7 years; 5.7 ± 7.7 months post-stroke). They randomly underwent three 15-minute sessions of stimulation, one week apart: PAS-MI, PAS alone and ShampAS associated with MI exercises (ShampPAS-MI). The PAS intervention consisted in an electrical stimulation of the hemiplegic extensor carpi radialis (ECR) associated with cortical magnetic stimulation over the wrist motor area. In MI condition, the patient was instructed to imagine extension of his hemiplegic wrist and in ShampAS intervention, we used a SHAM probe. We compared the surface variation of the motor-evoked potential (MEP) of the ECR and the amplitude of active extension (AE) of the hemiplegic side obtained after each session. **Results** Twenty-five minutes after the end of session PAS alone, an increase of MEP surface (+91% ± 150.3%) which reveals a higher cortical excitability associated with a slight motor improvement ( $\Delta EA = 1.33 \pm 3.14^\circ$ ) was shown. A smaller facilitation was shown after sessions PAS-MI and ShampPAS-MI (+45.97 ± 134.32% and 44.85 ± 28.77%, respectively) and, in these cases, was not associated with motor improvement.

**Conclusion** The session PAS alone seems to induce motor improvement associated with increased cortical excitability not shown after the other two sessions. The combination of two types of stimuli seems to have less effect, perhaps because of the mechanisms regulating the homeostasis of brain plasticity. The results have to be confirmed on a larger sample.

**Keywords** Stroke; Transcranial magnetic stimulation; Cerebral plasticity

**Disclosure of interest** The authors have not supplied their declaration of conflict of interest.

<http://dx.doi.org/10.1016/j.rehab.2015.07.010>

#### CO01-005-e

### Submental sensitive transcutaneous electrical stimulation reverses virtual lesion of the oropharyngeal cortex

E. Cugy (Dr)<sup>a,\*</sup>, A.M. Leroi (Prof)<sup>b</sup>, J. Kerouac-Laplante (Dr)<sup>c</sup>, P. Dehail (Prof)<sup>c</sup>, P.A. Joseph (Prof)<sup>c</sup>, E. Gerardin (Prof)<sup>b</sup>, J.P. Marie (Prof)<sup>b</sup>, E. Verin (Prof)<sup>b</sup>

<sup>a</sup>Centre hospitalier Arcachon, La Teste-De-Buch, France

<sup>b</sup>CHU de Rouen, Rouen, France

<sup>c</sup>CHU de Bordeaux, Bordeaux, France

\*Corresponding author.

E-mail address: [emmanuelle.cugy@chuordeaux.fr](mailto:emmanuelle.cugy@chuordeaux.fr) (E. Cugy)

