COGNITIVE AND NEUROPHYSIOLOGICAL EFFECTS OF NON INVASIVE BRAIN STIMULATION IN STROKE PATIENTS AFTER MOTOR REHABILITATION

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Introduction: Motor and cognitive impairment are frequent aftermaths of brain damage after a stroke.
The aim of the present study was to evaluate and compare the motor and cognitive effectiveness of two Non-Invasive Brain Stimulation (NIBS) paradigms onto M1: repetitive Transcranical Magnetic Stimulation (rTMS) and transcranial Direct Current Stimulation (tDCS) in the upper limb rehabilitation of patient with brain stroke, both have proved to be capable of inducing long lasting effect on cortical plasticity[(1,2)]. Only tDCS stimulation was paired with Mirror box Therapy (MT).

Methods: 34 patients (table 1), suffering from chronic stroke were enrolled in the study; patients were randomly assigned to 3 groups (fig. 1). To estimate the outcome of the treatments we measured, in multiple time points, cognitive auditory Evoked Related Potential (ERP P300) with EEG, neurophysiatric evaluations (*Action Research Arm Test* - ARAT) and neuropsychological performances (NPS). The study was structured as a cross-over with a control sham group.

Variable	Intervention	Sham	p*
N	24	10	-
Age [years]	57 (12)	65 (12)	.079
Gender M/F (%)	67/33%	70/30%	.999
Education [years]	10 (4)	10 (4)	.869
Affected Hemisphere R/L (%)	50/50%	40/60%	.715
Ischemic Hemorrhagic	71% 29%	70% 30%	.999

Table 1. Clinical and demographic data

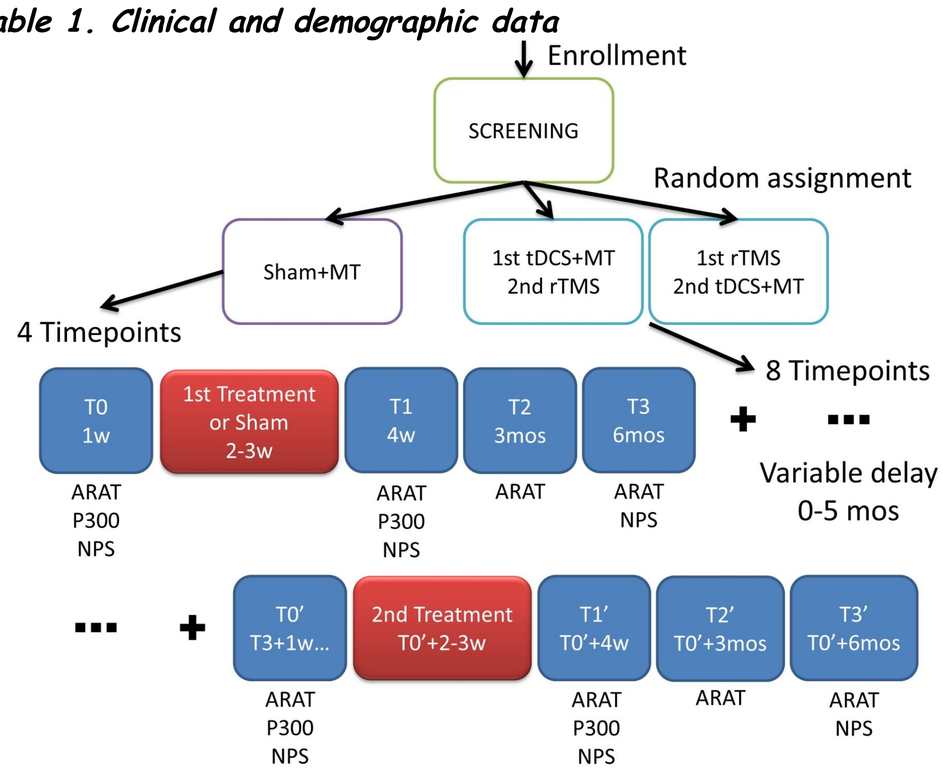

Fig 1. ***Experimental design***

Results

Clinically efficacy: We found a significant effect on ARAT scores, but only after two cycles (fig. 2), in immediate visual memory, and a transitory improvement in ERP P300.
A subgroup (44%) of patients responded to one cycle of NIBS, the 75% of responders maintained the improvements with an addictive effect after the second cycle.
Comparison of the tDCS and rTMS: the changes in ARAT, ERP P300 score did not differ between tDCS or rTMS (fig.2). tDCS + MT gave better results on NPS (table 2).
Cognitive differences in patients that responded to motor rehabilitation: There were no differences in ERP or NPS at any time points, between responders and no-responders.

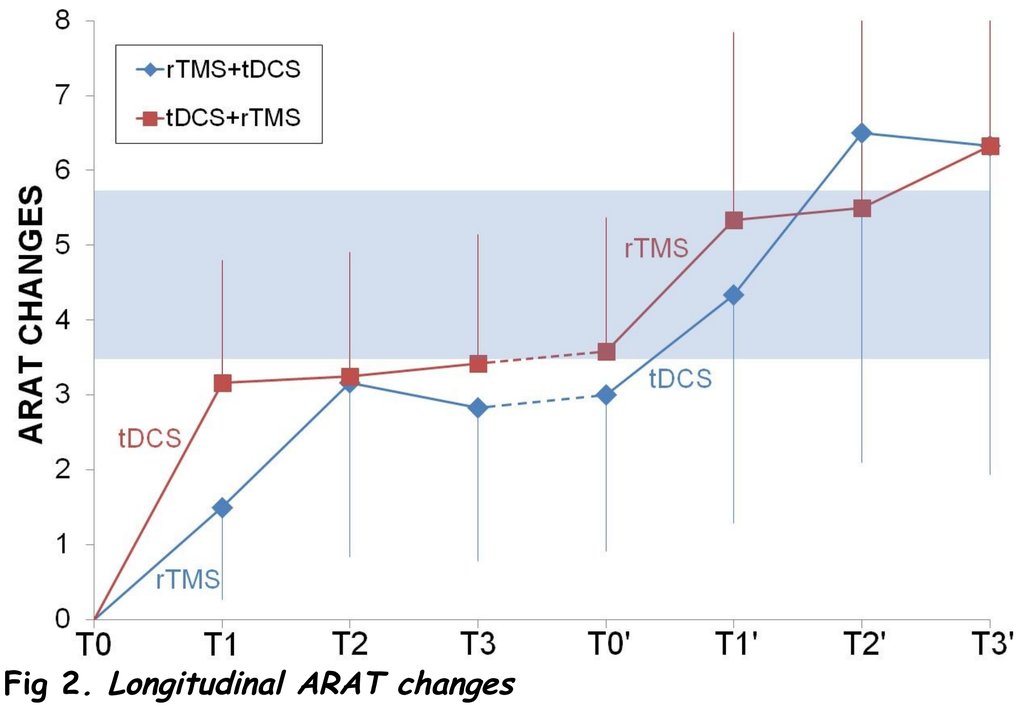

Fig 2. ***Longitudinal ARAT changes***

Conclusions: The present study showed improvement in motor and cognitive performances after both NIBS paradigms but there are some advantages of using tDCS +MT versus rTMS.
The temporary improvement of attentional performance (ERP P300) after stimulation on the motor cortex could be caused by the restoration of hemispheric balance or by distant connections effects.

sham-tDCS + MT						
Time points	t0-t1		t1-t2		t0-t2	
Copy of Figure imm recall	p=.025	.5	p=.990	NS	p=.157	NS
rTMS						
Copy of Figure imm recall	p=.008	.25	p=.380	NS	p=.260	NS
tDCS + MT						
Copy of Figure delayed recall	p=.001	.36	p=.317	NS	p=.002	.35
Copy of Figure imm recall	p=.005	.25	p=.317	NS	p<.001	.4
Attentional Matrices	p=.050	3.6	p=.822	NS	p=.023	3.1
Nelson MCST Perseveration	p=.048	-11	p=.122	NS	p=.778	NS

Table 2. Longitudinal NPS changes

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