



Treatment of DOC: Where We Are and Where We May Be Going

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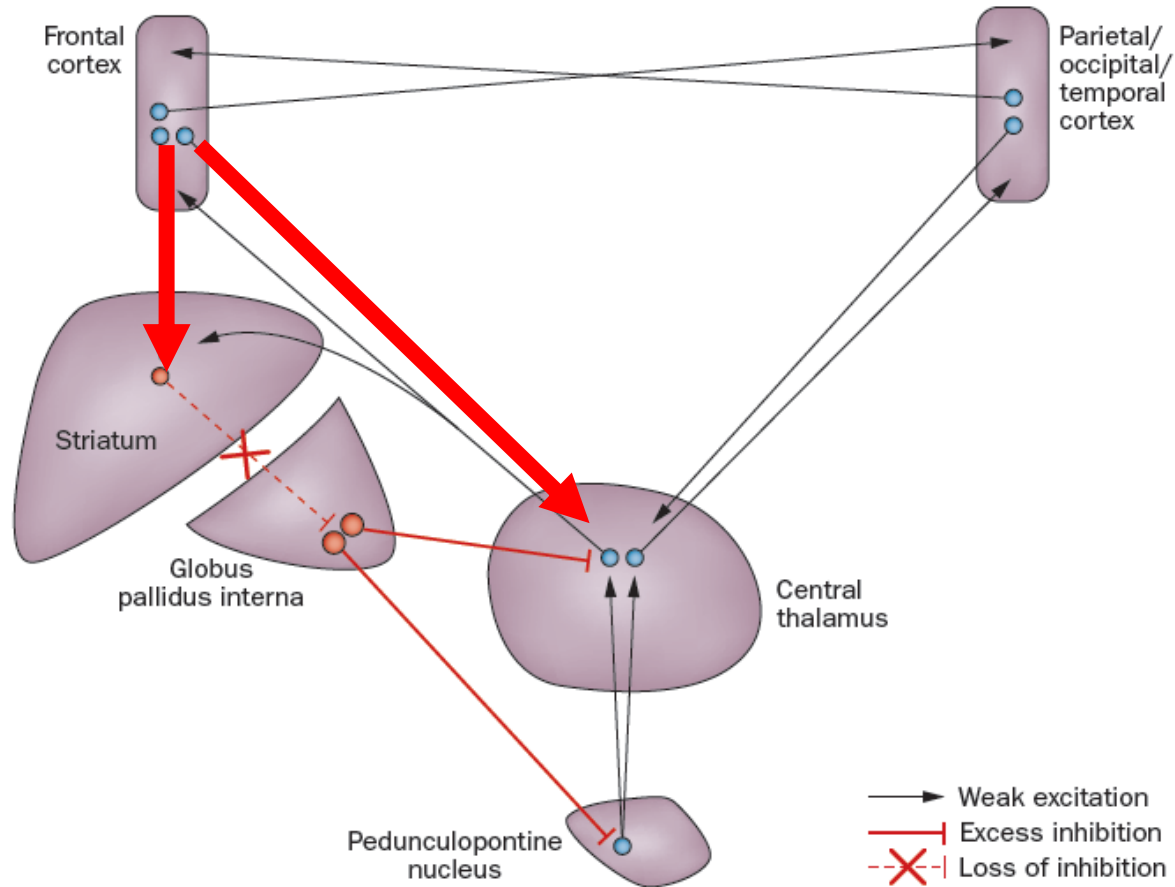
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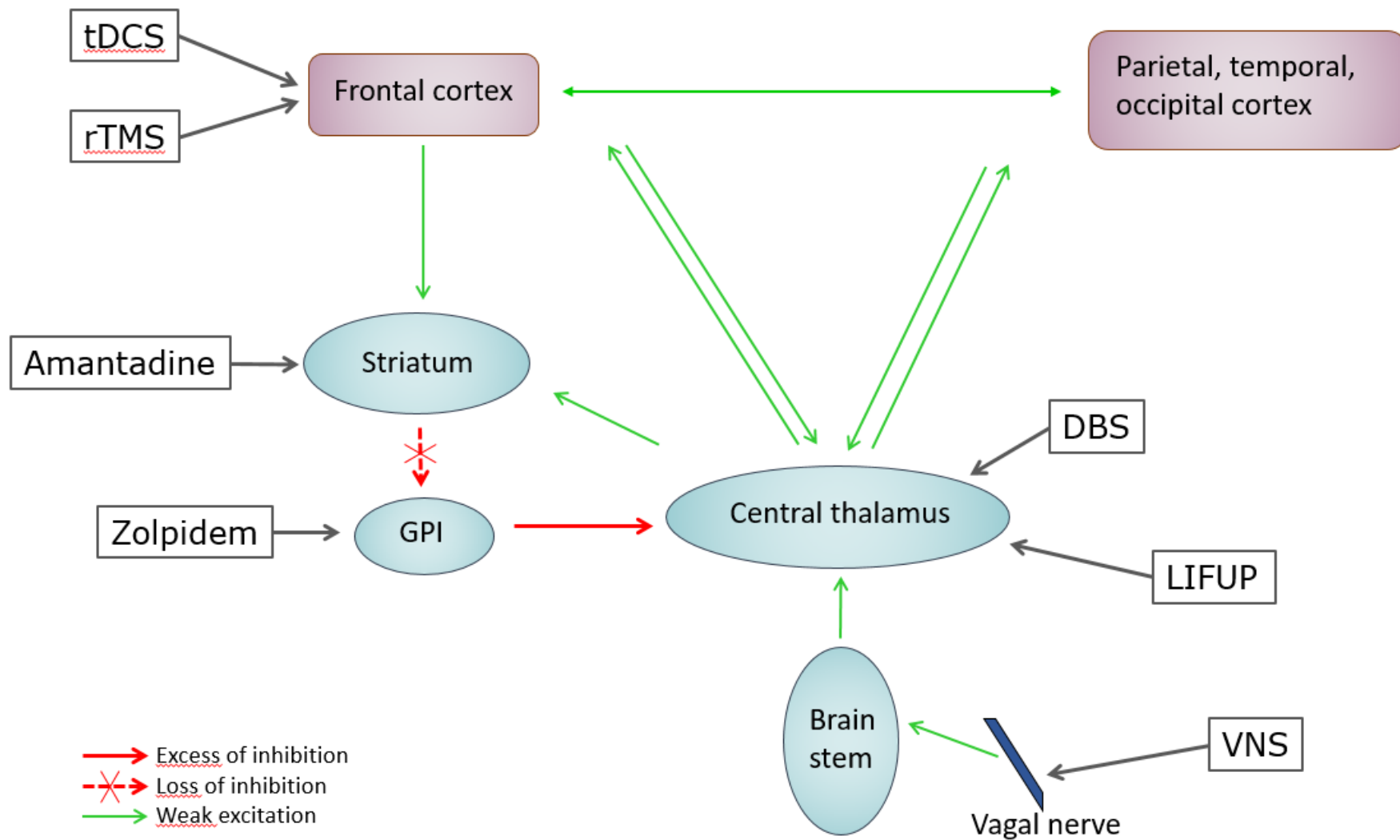
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tDCS - mesocircuit

Prefrontal tDCS better than targeting other areas?



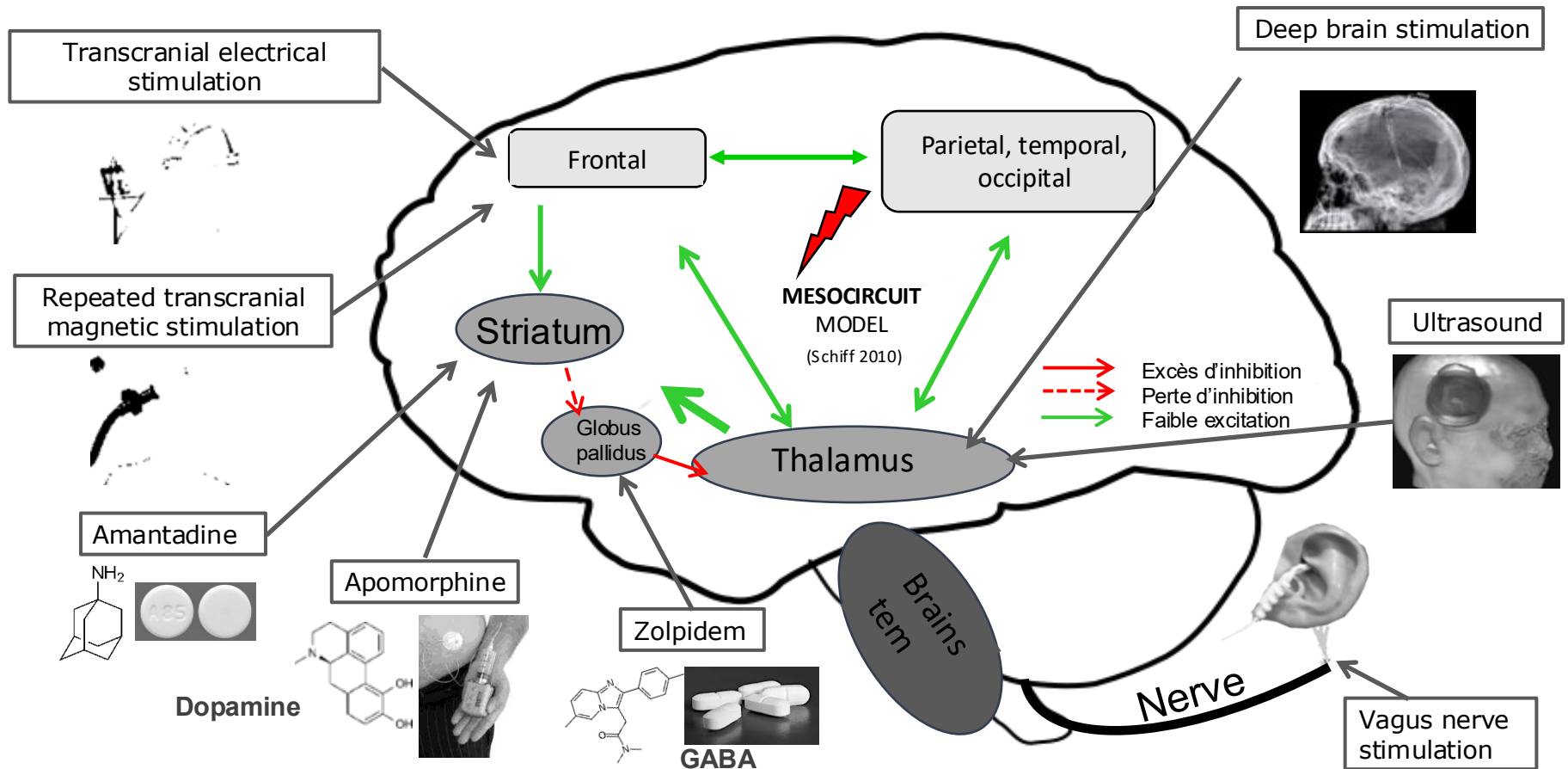
Mesocircuit fronto-parietal model



What treatments ?

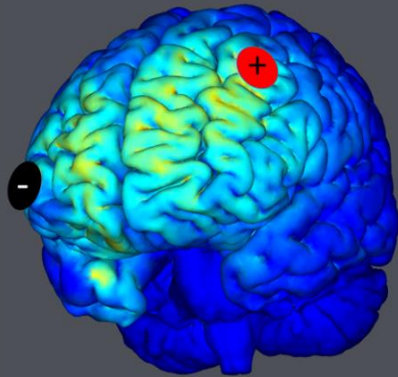
Top-down

Bottom-up

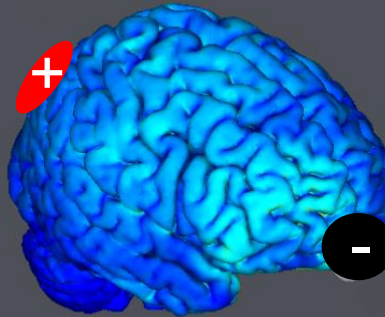


Stimulating different brain areas

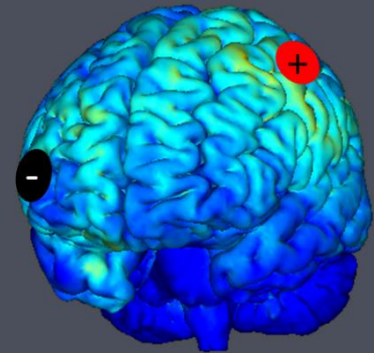
Prefrontal



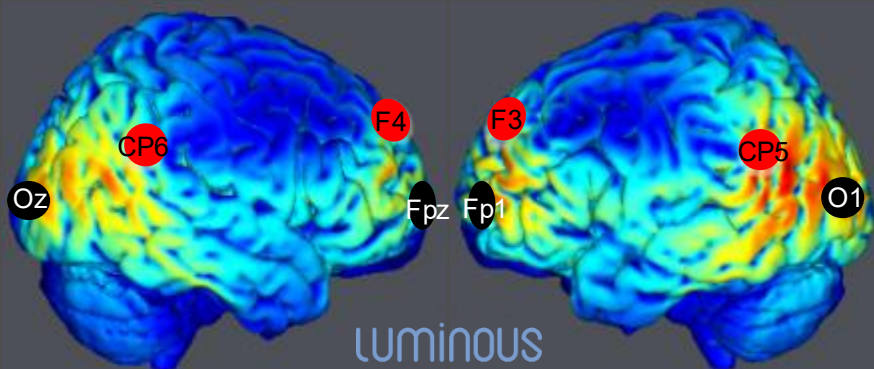
Precuneus



Motor



Multichannel frontoparietal

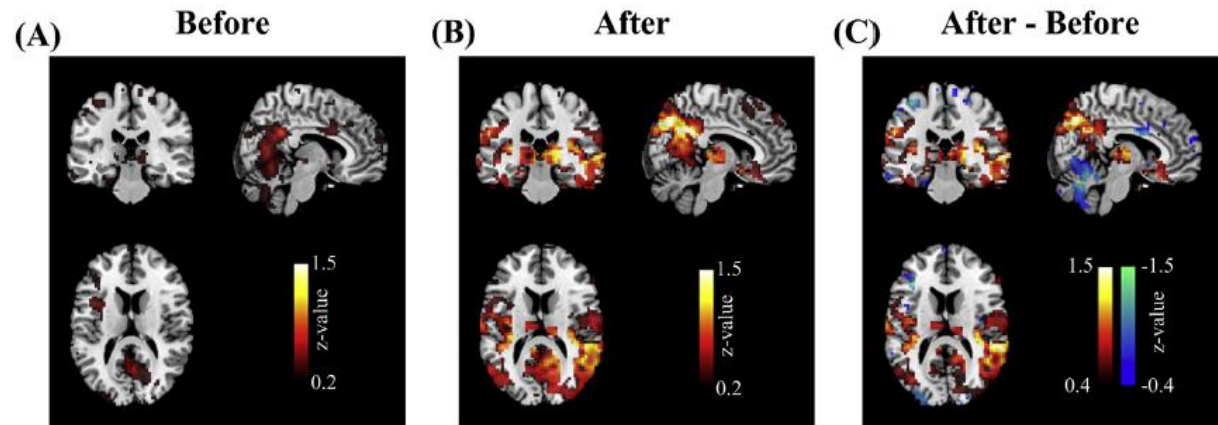


Group level: Prefrontal
tDCS best area to target

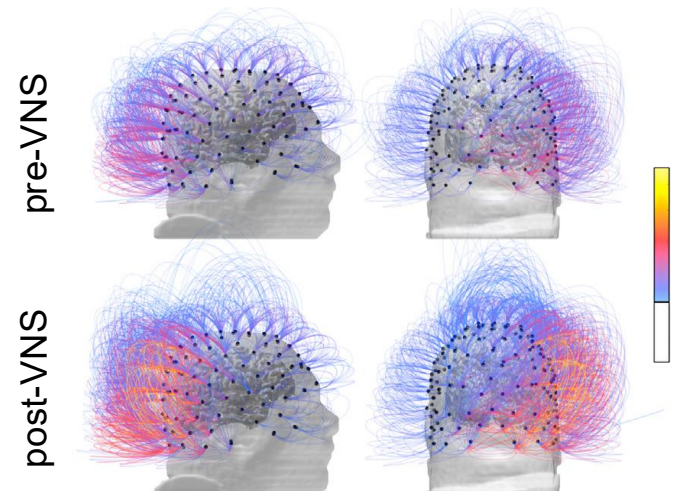
Single-subject level:
Patient's tailored montage

VNS

- Transcutaneous auricular vagus nerve stimulation - taVNS (4-6mA, 20Hz) – case-report (73 yo, 50 days post-ARCA)
UWS → MCS

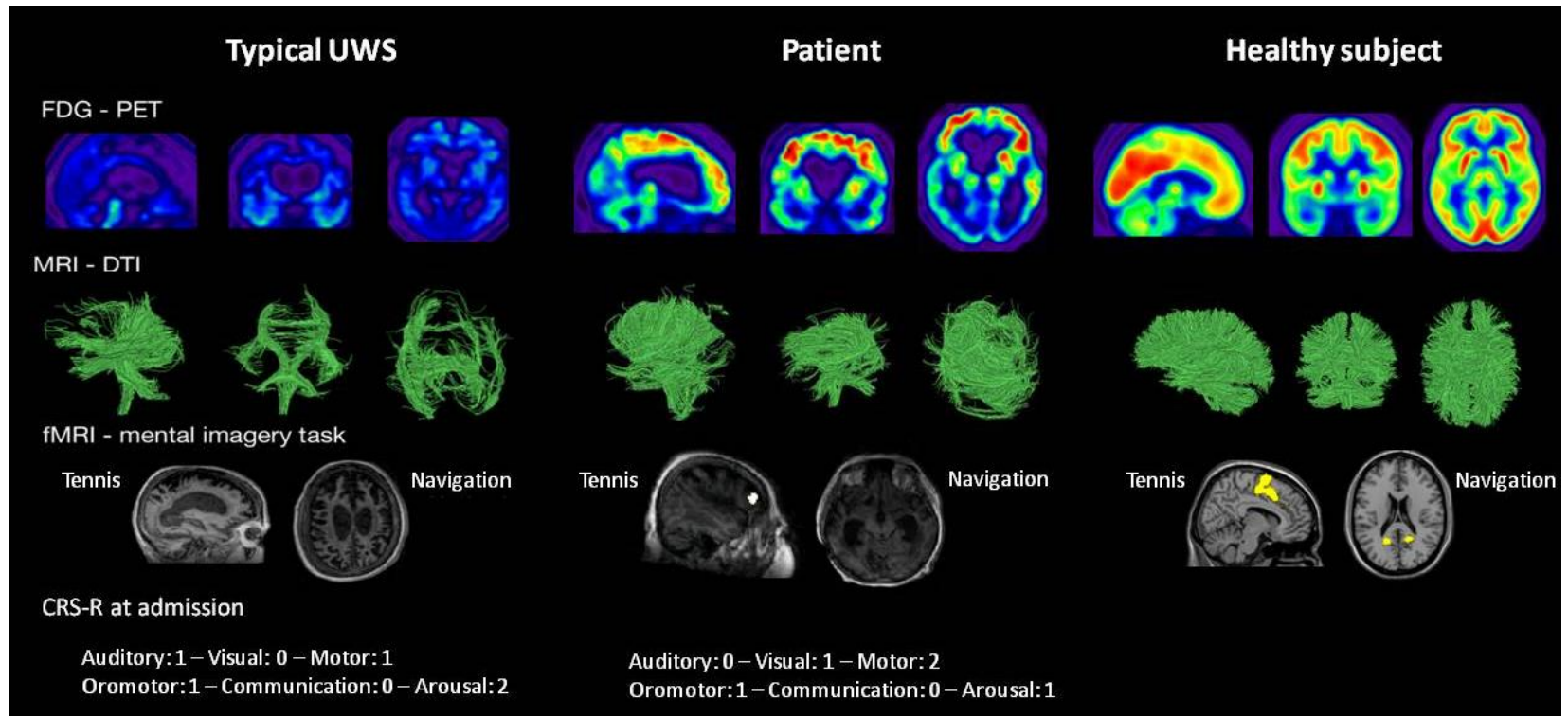


- Invasive VNS (max 1.5mA)
Case-report – 15 years post-TBI
1 month of stimulation
UWS → MCS



Unveil covert consciousness

- 67yo woman in UWS for 4y after subarachnoid hemorrhage
- Out of 7 CRS-R, 1 localization to pain
- Consistent response to command only after tDCS
- Neuroimaging consistent with MCS*



➔ tDCS may facilitate motor execution of command when cognitive functions are preserved

Recent RCTs on NIBS in DOC

NIBS	N	TSO	Procedure	Results	Effect sizes
tDCS Thibaut et al, 2014	55 25 TBI, 30 non-TBI 30 MCS, 25 UWS	1 week to 19 years	Single session (20 minutes) of active and sham stimulation over the left DLPFC with CRS-R before and after tDCS	13/30 patients in MCS and 2/25 patients in UWS clinically improved (recovery of visual pursuit or command following). At the group level, clinical improvement (2 points on the CRS-R) for MCS patients. No side-effects observed.	For MCS (n=30): d=0.38
tDCS Thibaut et al, 2017	16 11 TBI, 5 non-TBI 16 MCS	> 3months	5 sessions of active and sham tDCS (20 minutes a day) over the DLPFC. CRS-R performed before, after 5 days of tDCS and at 1-week follow-up	9/16 responders. Clinical improvement maintained up to one week after the end of the stimulation. No side-effects observed.	After tDCS: d=0.43 ; at 1week follow-up: d=0.57
tDCS Estraneo et al, 2017	13 1 TBI, 12 non-TBI 7 UWS, 6 MCS	> 3months	5 days of active and sham tDCS over the DLPFC (20 min/day). EEG and CRS-R at baseline, after 5 days and 3-month follow-up	Behavioral (CRS-R total score) and EEG changes in 5/13 patients (3 in MCS and 2 in UWS). At the group level, no statistical difference between the two groups. <i>No information on side-effects.</i>	/

NIBS	N	Time since injury	Procedure	Results	Effect sizes
tDCS Zang et al, 2017	26 12 TBI, 14 non-TBI 11 UWS, 15 MCS	1 to 18 months	20 sessions of tDCS over the DLPFC for 20 days		
tDCS Martens et al, 2018	27 12 TBI, 15 non-TBI 27 MCS	10 months to 14 years	20 sessions of tDCS over the DLPFC by 8 weeks, 1 tDCS (20 sessions) up.		
tDCS Huang et al, 2017	33 20 TBI, 13 non-TBI 33 MCS	> 3months	5 sessions of tDCS over the DLPFC after 5 days up		
tRNS Mancuso et al, 2017	9 1 TBI, 9 non-TBI 9 UWS	30 days to 4 months	5 sessions of tRNS over the DLPFC for 20 minutes at baseline, 1 at 3-day follow-up		
rTMS Cincotti et al, 2015	11 2 TBI, 9 non-TBI 11 UWS	9 to 85 months	5 sessions of active or sham 20 Hz rTMS for 10 minutes (1000 pulses in 5 trains) over left M1. EEG and CRS-R before and after rTMS	No behavioral or EEG improvements. No side-effects observed.	/
rTMS Liu et al, 2016	10 4 TBI, 6 non-TBI 5 UWS, 5 MCS	1 to 28 months	One session of active or sham 20-Hz rTMS over M1 for 10 minutes (1000 pulses in 20 trains). CRS-R and CBF velocity of the MCA before and after rTMS	No behavioral (CRS-R) changes Temporary increase in peak systolic velocity and mean flow velocity of the left MCA for MCS. No effects in UWS or in sham group. No side-effects observed.	/
rTMS He et al, 2018	6 4 TBI, 2 non-TBI 3 UWS, 2 MCS, 1 EMCS	1 to 28 months	5 sessions of active or sham 20-Hz rTMS over M1 (1000 pulses in 20 trains). CRS-R and EEG before, after rTMS and 1-week follow-up	No treatment effect on the CRS-R nor on the EEG. Clinical improvement in 1 patient (up to 1-week follow-up - UWS became MCS- paralleled by EEG power spectra improvement. No information on side-effects.	/

Past 5 years:

tDCS ➔ 6 RCTs (170 pts) – 5 DLPFC & 1 PPC - 1 to 20 sessions – ES: 0.38 – 2.22

tRNS ➔ 1 RCT (9 pts) – DLPFC – no clinical/neurophysiological effects

rTMS ➔ 3 RCTs (27 pts) – M1 – 20 Hz – no clinical/neurophysiological effects

Thibaut, Schiff, Giacino, Laureys, Gosseries, *Lancet Neurology*, in press

Disorders of Consciousness

Special interest Group

(DOC SIG)

Our Mission:

To provide an international forum for exchange between brain injury professionals, as well as, neuroscientists on the study, assessment, and care of persons with disorders of consciousness, their families, and the systems serving them.

Chairs:



Dr Caroline
Schnakers



Dr Nathan
Zasler

➔ **> 100 members**

➔ **2 subgroups**



Treatment subgroup
Dr Aurore Thibaut



Diagnosis/Prognosis subgroup
Dr Anna Estraneo

Website:

<http://www.internationalbrain.org/disorders-of-consciousness-sig>

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