

# Effectiveness of Transcranial magnetic stimulation

# rTMS



# We are here for you!

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# Overview

## Evidence-based guidelines on the therapeutic use of repetitive transcranial magnetic stimulation (rTMS): An update (2014–2018)

<b>AUTHORS</b>	Lefaucheur JP, Aleman A, Baeken C, Benninger DH, Brunelin J, Di Lazzaro V, Filipovic SR, Grefkes C, Hasan A, Hummel FC, Jääskeläinen SK, Langguth B, Leocani L, Londero A, Nardone R, Nguyen JP, Nyffeler T, Oliveira-Maia AJ, Oliviero A, Padberg F, Palm U, Paulus W, Poulet E, Quartarone A, Rachid F, Rektorová I, Rossi S, Sahlsten H, Schecklmann M, Szekely D, Ziemann U
<b>SOURCE</b>	Clinical Neurophysiology, volume 131 (2020), pp 474–528
<b>OBJECTIVE</b>	Overview of the latest research results on the therapeutic use of rTMS and evaluation of the scientific evidence.
<b>METHODOLOGY</b>	Classification of studies in terms of criteria randomized/controlled, number of patients, clear statements on procedure, primary outcome, exclusion criteria, statistical analysis, patient groups. Summary of outcomes.

### RESULTS

<b>Level A</b>	Depression (high-frequency rTMS) Neuropathic pain Post-stroke contralateral hand motor recovery in post-acute stage
<b>Level B</b>	Depression (low-frequency rTMS, bilateral rTMS) Post-traumatic stress disorder Fibromyalgia Parkinson's disease: depressive symptoms Parkinson's disease: motor symptoms Post-stroke ipsilateral hand motor recovery in post-acute stage Post-stroke nonfluent aphasia in chronic stage Lower limb spasticity in multiple sclerosis
<b>Level C</b>	Obsessive compulsive disorder Addiction/craving Schizophrenia: auditory hallucinations & negative symptoms Tinnitus Hemispatial neglect in post-acute stage after stroke Epilepsy Alzheimer's disease: cognitive function Complex Regional Pain Syndrome - type I

<b>CONCLUSIONS</b>	A review of hundreds of scientific studies has shown that rTMS can provide significant improvement in various neurological and psychiatric disorders. rTMS is scientifically proven to be definitely effective in the treatment of neuropathic pain and depression as well as in the hand motor recovery from stroke. Furthermore, scientific studies show that rTMS is probably effective for patients with motor impairment, Parkinson's disease, multiple sclerosis, post-traumatic stress disorder or aphasia.
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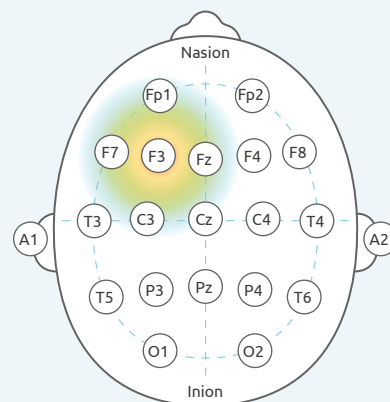
# Depression

## Simultaneous rTMS and psychotherapy in major depressive disorder: Clinical outcomes and predictors from a large naturalistic study

<b>AUTHORS</b>	Donse L, Padberg F, Sack AT, Rush AJ, Arns M
<b>SOURCE</b>	Brain Stimulation 11 (2018) 337-345
<b>OBJECTIVE</b>	Evaluation of feasibility and clinical outcome of rTMS in combination with psychotherapy in major depressive disorder. Identification of clinical predictors of response and remission.
<b>METHODOLOGY</b>	Naturalistic study including 196 patients with depression, rTMS treatment with simultaneous psychotherapy. 97% had been unsuccessfully treated with medication at least once before.

### PROTOCOL

<b>Target area</b>	left DLPFC / right DLPFC
<b>Stim. frequency</b>	10 Hz / 1 Hz
<b>Stim. intensity</b>	110 - 120 % RMT
<b>Number of pulses per session</b>	1,500 / 1,200
<b>Treatment</b>	2 - 10 per week
<b>Number of sessions</b>	21 on average
<b>Assessment</b>	BDI, DASS, response defined as $\geq 50\%$ reduction in BDI score



### RESULTS

<b>Assessment</b>	
<b>Response</b>	<b>66.3%</b>
<b>Remission</b>	<b>56.0 %</b>
<b>BDI</b>	baseline 31.3, last session 14.1, 55,9 % reduction, $p < 0.001$
<b>DASS D</b>	baseline 28.6, last session 12.1
<b>DASS A</b>	baseline 13.7, last session 5.6
<b>DASS S</b>	baseline 22.4, last session 10.1
<b>Follow-up 6 months</b> Responder group	
<b>BDI</b>	baseline 29.4, last session 8.0, follow-up 13.8
<b>DASS Depression</b>	baseline 27.0, last session 6.5, follow-up 11.8
<b>DASS Anxiety</b>	baseline 14.1, last session 4.0, follow-up 7.2
<b>DASS Stress</b>	baseline 22.3, last session 7.3, follow-up 12.5

### CONCLUSIONS

The combined therapy rTMS + psychotherapy led to high response and remission rates. In addition, the effect also showed good stability in the follow-up. Considering the high proportion of treatment resistance against antidepressants in the sample, the result is of clinical relevance.

# Depression

## Efficacy and Safety of Transcranial Magnetic Stimulation in the Acute Treatment of Major Depression: A Multisite Randomized Controlled Trial

**AUTHORS** O'Reardon JP, Solvason HB, Janicak PG, Sampson S, Isenberg KE, Nahas Z, McDonald WM, Avery D, Fitzgerald PB, Loo C, Demitrack MA, George MS, Sackheim HA

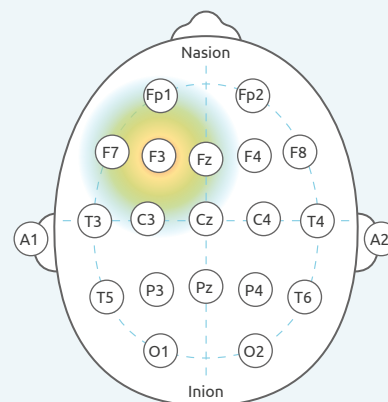
**SOURCE** Biol Psychiatry 62 (2007) 1208–1216

**OBJECTIVE** Effectiveness and safety of TMS over left DLPFC in the acute treatment of major depression.

**METHODOLOGY** Double-blind, placebo-controlled study with 301 patients with depression (155 active rTMS, 146 sham stimulation). Patients were medication-free and had shown medication resistance prior to rTMS treatment.

### PROTOCOL

<b>Target area</b>	Left DLPFC using the 5 cm rule
<b>Stim. frequency</b>	10 Hz
<b>Stim. intensity</b>	120 % RMT
<b>Number of pulses per session</b>	3,000
<b>Treatment</b>	daily, 5 times per week
<b>Number of sessions</b>	max. 30
<b>Assessment</b>	MADRS, HAMD17, HAMD24



### RESULTS

Assessment	Significance active vs. sham	Active group	Sham group
MADRS response rate*	P < 0.01	23.9 %	12.3 %
HAMD24 response rate	P < 0.05	23.9 %	15.1 %
MADRS remission rate**	P < 0.05	14.2 %	5.5 %
HAMD24 remission rate***	P < 0.05	17.4 %	8.2 %
<b>Adverse events</b>			
Scalp discomfort/pain reported as mild to moderate		35.8 % diminished after first 5 sessions	3.8 %
Increase in suicidality		<b>1 event</b>	<b>10 events</b>

\*50 % improvement from baseline    \*\*total score < 10    \*\*\*total score < 8    \*\*\*\*total score < 11

### CONCLUSIONS

rTMS administered over the left DLPFC using the parameters reported here for a period of up to 6 weeks was effective in treating major depression with a good tolerability profile. These results indicate that rTMS offers clinicians a novel alternative in the treatment of this disorder.

# Depression

## Efficacy of prefrontal theta-burst stimulation in refractory depression: a randomized sham-controlled study.

**AUTHORS** Li CT, Chen MH, Juan CH, Huang HH, Chen LF, Hsieh JC, Tu PC, Bai YM, Tsai SJ, Lee YC, Su TP

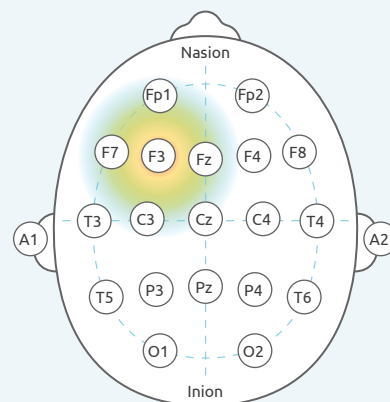
**SOURCE** Brain 137 (2014) 2088–2098

**OBJECTIVE** Antidepressant effect of right pre-frontal continuous, left-prefrontal intermittent and combined theta-burst stimulation compared to sham group of patients showing different levels of antidepressant treatment resistance.

**METHODOLOGY** Double-blind, placebo-controlled study with 60 patients with treatment-resistant depression (right-sided cTBS, left-sided iTBS, combined cTBS+iTBS, sham: 15 subjects per group).

### PROTOCOL

<b>Target area</b>	Target Area: left/right DLPFC defined as navigated BA9/BA46
<b>Stim. frequency</b>	Stim. frequency: 3-pulse 50 Hz bursts applied at frequency of 5 Hz: (1) right-sided cTBS (1 train of 120 s), (2) left-sided iTBS (trains of 2 s with 10 s pause), (3) combination of both
<b>Stim. intensity</b>	80 % RMT
<b>Number of pulses per session</b>	Number of pulses per session: 1,800 pulses on each site
<b>Treatment</b>	daily, 5 times per week
<b>Number of sessions</b>	10
<b>Assessment</b>	HDRS-17



### RESULTS

	Right-sided cTBS	Left-sided iTBS	Combined	Sham
<b>Rate of change of HDRS scores</b>	-22.5 %	-42.3 %	-52.5 %	-17.4 %
<b>Responders</b>	25 %	<b>40 %</b>	<b>66.7 %</b>	13.3 %
<b>Patients with moderate treatment resistance</b>				
<b>Change in HDRS scores</b>	-9.8	-8.6	-15.0	-4.0
<b>Patients with high treatment resistance</b>				
<b>Change in HDRS scores</b>	-1.4	-8.4	-10.6	0.1

### CONCLUSIONS

Active theta-burst stimulation is safe, well-tolerated and effective in the treatment of therapy-resistant depression. The number of sessions needed for reduction in HDRS scores seems to be higher in case of greater treatment resistance. Left-sided iTBS and combined cTBS + iTBS are more effective than cTBS in highly refractory depression.

Class of the study: II



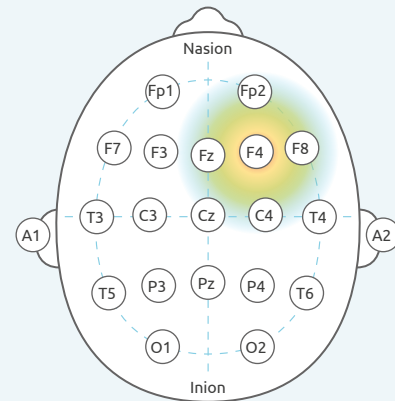
# Obsessive compulsive disorder (OCD)

## Repetitive transcranial magnetic stimulation in the treatment of obsessive-compulsive disorders: Double blind randomized clinical trial

**AUTHORS** Elbeh KA, Elserogy YM, Khalifa HE, Ahmed MA, Hafez MH, Khedr EM  
**SOURCE** Psychiatry Res 238 (2016) 264–269  
**OBJECTIVE** Effectiveness of 1 Hz and 10 Hz rTMS compared to sham in patients with OCD.  
**METHODOLOGY** Double-blind, placebo-controlled study with 45 patients (1 Hz, 10 Hz, sham: 15 subjects per group).

### PROTOCOL

<b>Target area</b>	right DLPFC (5 cm rule)
<b>Stim. frequency</b>	1 Hz / 10 Hz
<b>Stim. intensity</b>	100 % RMT
<b>Number of pulses per session</b>	2,000
<b>Treatment</b>	daily, 5 times per week
<b>Number of sessions</b>	10 sessions
<b>Assessment</b>	Y-BOCS, HAM-A, CGI-S



### RESULTS

Effects on scores of:		1 Hz	10 Hz	sham
Y-BOCS	post-treatment	-12.0*	-6.8*	-1.4***
	3 month follow-up	-11.0*	-2.5***	-2.1***
HAM-A	post-treatment	-12.3*	-7.3*	-1.6***
	3 month follow-up	-11.9*	-3.6***	-3.0***
CGI-S	post-treatment	-2.2*	-1.1**	-0.4***
	3 month follow-up	-2.0*	-0.5***	-0.5***

\*p<0.01    \*\*p<0.05    \*\*\*p>0.05

### CONCLUSIONS

1 Hz rTMS over the right DLPFC shows significant reduction of OCD symptoms after 10 sessions. The improvement is evident in obsessions and compulsions as well as in anxiety. The effect was maintained in the follow-up after 3 months. In conclusion, low frequency rTMS over the right DLPFC is a promising tool for the treatment of OCD.

Class of the study: II

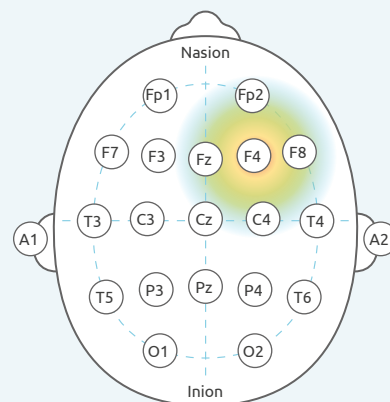
# Anxiety

## Repetitive transcranial magnetic stimulation of the right dorsal lateral prefrontal cortex in the treatment of generalized anxiety disorder: A randomized, double-blind sham controlled clinical trial

**AUTHORS** Dilkov D, Hawken ER, Kaludiev E, Milev R  
**SOURCE** Prog Neuropsychopharmacol Biol Psychiatry 78 (2017) 61–65  
**OBJECTIVE** Effectiveness of 20 Hz rTMS compared to sham in patients with generalized anxiety disorder (GAD)  
**METHODOLOGY** Single-blind, placebo-controlled study with 40 patients (15 active rTMS, 25 sham stimulation)

### PROTOCOL

<b>Target area</b>	right DLPFC (5 cm rule)
<b>Stim. frequency</b>	20 Hz
<b>Stim. intensity</b>	110 % RMT
<b>Number of pulses per session</b>	3,600
<b>Treatment</b>	5 sessions in week 1 - 4, 3 session in week 5, 2 sessions in week 6
<b>Number of sessions</b>	25
<b>Assessment</b>	HARS, HDRS-21, CGI



### RESULTS

Reduction in scores		Active	Sham	Significance
HARS	post-treatment	-25	-1	<b>p&lt;0.001</b>
	6 week follow-up	-26	-1	
HDRS-21	post-treatment	-11	0	<b>p&lt;0.001</b>
	6 week follow-up	-11	1	
CGI	post-treatment	-2	0	<b>p&lt;0.001</b>
	6 week follow-up	-3	0	
<b>Responders*</b>	-1.4	<b>100 %</b>	8 %	

\*HARS score reduction >= 50 %

### CONCLUSIONS

High-frequency stimulation of the right DLPFC showed clinically significant improvement in anxiety and depression scores in patients with GAD. Follow-up data demonstrate a sustained effect of the response. Considering 50 % of patients do not have a satisfactory response to pharmacotherapies, the treatment successes with rTMS suggest this method is a viable alternative for patients with GAD.

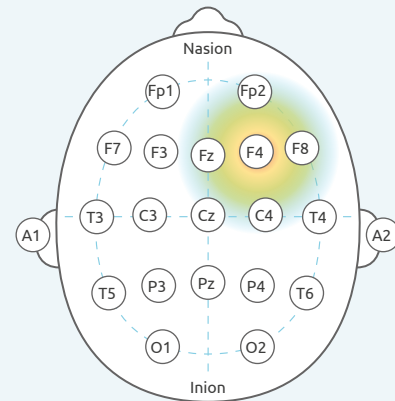
# Post-traumatic stress disorder (PTSD)

## Unilateral right and bilateral dorsolateral prefrontal cortex transcranial magnetic stimulation in treatment post-traumatic stress disorder: A randomized controlled study

<b>AUTHORS</b>	Ahmadizadeh MJ, Rezaei M
<b>SOURCE</b>	Brain Res Bull 140 (2018) 334–340
<b>OBJECTIVE</b>	Efficacy of bilateral rTMS and unilateral right rTMS compared to sham in patients with PTSD
<b>METHODOLOGY</b>	Single-blind, placebo-controlled study with 65 patients (21 unilateral, 22 bilateral, 22 sham)

### PROTOCOL

<b>Target area</b>	bilateral/right DLPFC (Beam F3)
<b>Stim. frequency</b>	20 Hz
<b>Stim. intensity</b>	100 % of RMT
<b>Number of pulses per session</b>	2,400
<b>Treatment</b>	3 times per week for 2 weeks, twice per week for another 2 weeks
<b>Number of sessions</b>	10
<b>Assessment</b>	PCL-M



### RESULTS

Change in PCL-M scores	Unilateral	Bilateral	Sham
...after 5 sessions	-2.36	-11.16	-1.8
...after 10 sessions	-21.16	-25.45	-3.62
<b>Responders</b>	<b>41 %</b>	<b>62 %</b>	

\*HARS score reduction >= 50 %

### CONCLUSIONS

Bilateral and unilateral right high-frequency rTMS leads to significant reductions of PTSD symptoms. The improvement occurs faster with bilateral stimulation. However, there is no significant difference after 10 sessions. The treatment is safe and well tolerated.

Class of the study: II

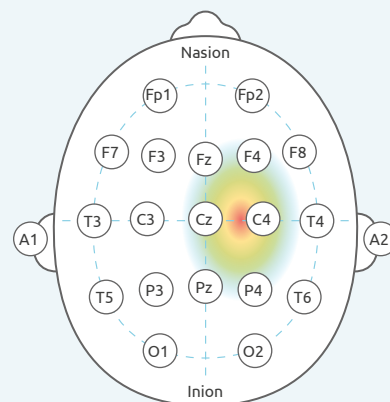
# Malignant neuropathic pain

## Repetitive transcranial magnetic stimulation in neuropathic pain secondary to malignancy: a randomized clinical trial

**AUTHORS** Khedr EM, Kotb HI, Mostafa MG, Mohamad MF, Amr SA, Ahmed MA, Karim AA, Kamal SMM  
**SOURCE** Eur J Pain 19 (2015) 519–527  
**OBJECTIVE** Efficacy of rTMS over the primary motor cortex (M1) in patients with malignant neuropathic pain.  
**METHODOLOGY** Randomized, placebo-controlled trial including 34 patients (17 active, 17 sham) suffering from malignant neuropathic pain.

### PROTOCOL

<b>Target area</b>	hand M1 contralateral to pain
<b>Stim. frequency</b>	20 Hz
<b>Stim. intensity</b>	80 % of RMT
<b>Number of pulses per session</b>	2,000
<b>Treatment</b>	daily, 5 times per week
<b>Number of sessions</b>	10
<b>Assessment</b>	VDS, VAS, LANSS, HAM-D



### RESULTS

	Active	Sham
<b>VDS, VAS</b>	Significant difference in pain relief in favor of active rTMS after 10 sessions and 15 days follow-up	
<b>LANSS, HAM-D</b>	Significant difference in pain relief in favor of active rTMS after 10 sessions and 15 days and 1 month follow-up	
<b>Response rates*:</b>		
After sessions	86.6 %	6.6 %
Follow-up 15 days	80 %	6.6 %
Follow-up 1 month	26.6 %	6.6 %

\*>30% pain relief

### CONCLUSIONS

The results demonstrate that 10 rTMS sessions over the M1 can induce pain relief in malignant neuropathic pain. A high proportion of patients in the active group responded to HF rTMS with lasting effect up to 15 days. In about one quarter of patients the effect remained stable 1 month after treatment.

Class of the study: II

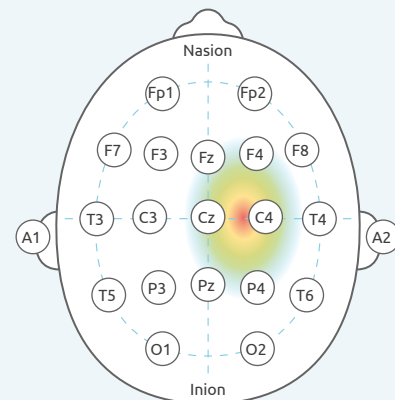
# Chronic neuropathic pain

## Time course of the response to navigated repetitive transcranial magnetic stimulation at 10 Hz in chronic neuropathic pain

<b>AUTHORS</b>	Lawson McLean A, Frank S, Zafar N, Waschke A, Kalff R, Reichart R
<b>SOURCE</b>	Neurol Res 40 (2018) 564–572
<b>OBJECTIVE</b>	Evaluation of the time to response and effectiveness of navigated rTMS at a frequency of 10 Hz in patients with chronic neuropathic pain.
<b>METHODOLOGY</b>	Prospective study including 48 patients with unilateral chronic neuropathic pain.

### PROTOCOL

<b>Target area</b>	contralateral motor cortex (atypical facial, upper limb and torso pain: hand area; lower limb pain: lower limb area)
<b>Stim. frequency</b>	10 Hz
<b>Stim. intensity</b>	80 % of RMT
<b>Number of pulses per session</b>	1,000
<b>Treatment</b>	daily, 4 - 5 times per week
<b>Number of sessions</b>	9
<b>Assessment</b>	VAS, German Pain Questionnaire



### RESULTS

<b>Response rate</b>	<b>58.3 %</b>
<b>Responders in 6 weeks follow-up</b>	<b>41.6 %</b>
<b>VAS</b>	
<b>Post stimulation 6 weeks follow-up</b>	<b>significant pain reduction in the responder group (p&lt;0.001)</b>
<b>Pain reduction in the responder group:</b>	
Atypical facial pain	54.8 %
Central post-stroke pain	66.3 %
Neuropathic lower limb pain	42.9 %
others	35.5 %
<b>Pain relief onset</b>	after 3 - 41 days

### CONCLUSIONS

Clinical benefit of navigated rTMS in treatment of chronic pain has been demonstrated. In particular, patients with chronic painful post-traumatic trigeminal neuropathy responded well to high-frequency stimulation. Patients with a mean pain history of less than five years benefited significantly from this treatment, so early treatment with repetitive TMS should be encouraged.

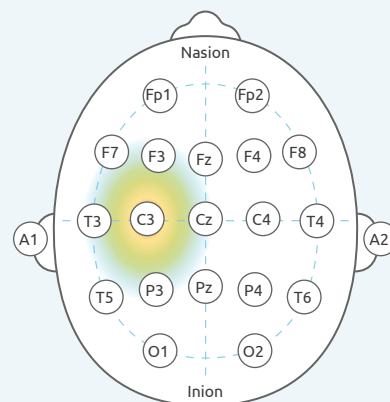
# Motor disorders - stroke

## Daily repetitive transcranial magnetic stimulation for poststroke upper limb paresis in the subacute period

<b>AUTHORS</b>	Hosomi K, Morris S, Sakamoto T, Taguchi J, Maruo T, Kageyama Y, Kinoshita Y, Goto Y, Shimokawa T, Komaya T, Saitoh Y
<b>SOURCE</b>	J Stroke Cerebrovasc Dis 25 (2016) 1655–1664
<b>OBJECTIVE</b>	Efficacy and safety of daily rTMS in motor recovery of subacute stroke patients.
<b>METHODOLOGY</b>	Double-blind, placebo-controlled study with 41 patients (20 active, 21 sham). rTMS accompanied a regular rehabilitation program. Daily rehabilitation consisted of 8 sessions a 20 min including physical and occupational therapy.

### PROTOCOL

<b>Target area</b>	Hand M1 (C3)
<b>Stim. frequency</b>	5 Hz
<b>Stim. intensity</b>	90 % RMT
<b>Number of pulses per session</b>	500
<b>Treatment</b>	daily, 5 times per week
<b>Number of sessions</b>	10
<b>Assessment</b>	BS, FMA, Handgrip strength, NIHSS, FIM



### RESULTS

	Active	Sham
<b>BS</b>	Significant improvement in hand score, Significant difference between active and sham for hand score, Significant improvement in arm score, Improvement in lower limb score	Improvement in arm and lower limb score
<b>FMA, NIHSS, FM</b>	Significant improvement compared to baseline	
<b>Hand grip strength</b>	Significant improvement No significant group difference	Improvement
<b>Adverse events</b>	No serious adverse events	

### CONCLUSIONS

Daily HF rTMS of the ipsilesional M1 is tolerable and facilitates motor recovery in the paralytic hand of subacute stroke patients. The effectiveness of physical and occupational therapy in the framework of an intense rehabilitation program in the subacute stage after stroke can be increased by accompanying rTMS.

Class of the study: II

# Motor disorders - stroke

## Effect of combined low-frequency repetitive transcranial magnetic stimulation and virtual reality training on upper limb function in subacute stroke: a double-blind randomized controlled trial

**AUTHORS** Zheng C, Liao W, Xia W

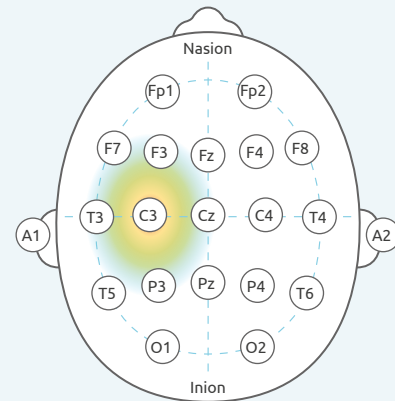
**SOURCE** J Huazhong Univ Sci Technolog Med Sci 35 (2015) 248–254

**OBJECTIVE** Effect of combined low-frequency rTMS and virtual reality training in stroke patients.

**METHODOLOGY** Double-blind, placebo-controlled trial including 108 patients with hemiplegia after stroke (55 active, 53 sham) on average 19 days poststroke. The rTMS treatment was combined with a rehabilitation program which included VR training, occupational therapy and physiotherapy.

### PROTOCOL

<b>Target area</b>	Hand M1 (C3)
<b>Stim. frequency</b>	1 Hz
<b>Stim. intensity</b>	90% RMT
<b>Number of pulses per session</b>	1,800
<b>Treatment</b>	daily, 6 times per week
<b>Number of sessions</b>	24
<b>Assessment</b>	U-FMA, WMFT, MBI, SF-36



### RESULTS

	Experimental group			Control group		
	Before treatment	Four weeks after treatment	dif	Before treatment	Four weeks after treatment	dif
<b>WMFT scores</b>	32.4	51.8	<b>25.7</b>	31.6	44.7	<b>13.1</b>
<b>MBI scores</b>	52.6	87.2	<b>34.6</b>	53.4	71.6	<b>18.2</b>
<b>SF-36 scores (PF)</b>	34.4	65.6	<b>31.2</b>	33.6	47.4	<b>13.8</b>

### CONCLUSIONS

LF rTMS combined with intensive rehabilitation programs (physiotherapy, occupational therapy, VR training) can effectively improve the upper limb function, the living activity, and the quality of life in patients with hemiplegia following stroke. The VR training seems to be particularly boosted by LF rTMS finished only a few minutes before starting the VR training.

Class of the study: I

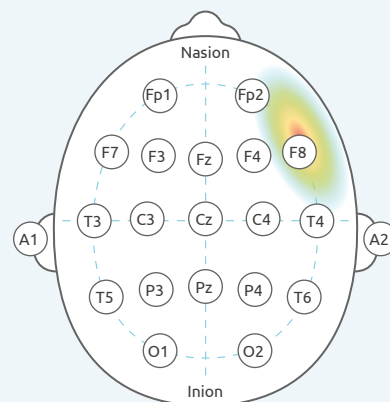
# Aphasia - stroke

## The persistent and broadly modulating effect of inhibitory rTMS in nonfluent aphasic patients: a sham-controlled, double-blind study

<b>AUTHORS</b>	Tsai PY, Wang CP, Ko JS, Chung YM, Chang YW, Wang JX
<b>SOURCE</b>	Neurorehabil Neural Repair 28 (2014) 779–787
<b>OBJECTIVE</b>	Effectiveness of rTMS on language performance in stroke patients with nonfluent aphasia. Identification of characteristics of patients predisposed to benefit most.
<b>METHODOLOGY</b>	Randomized, placebo-controlled study with 56 patients with nonfluent aphasia 18 months poststroke on average (33 LF rTMS, 23 sham) combined with 1 hour of speech therapy.

### PROTOCOL

<b>Target area</b>	contralateral pars triangularis
<b>Stim. frequency</b>	1 Hz
<b>Stim. intensity</b>	90 % RMT
<b>Number of pulses per session</b>	600
<b>Treatment</b>	daily, 5 times per week
<b>Number of sessions</b>	10
<b>Assessment</b>	CCAT, Picture naming test



### RESULTS

<b>Overall CCAT score after 10 sessions</b>	Significant improvement compared to baseline, $p < 0.001$ <b>Significant improvement compared to sham, <math>p &lt; 0.001</math></b>
<b>Subscores of CCAT after 10 sessions</b>	Significant improvement compared to sham in conversation, $p < 0.032$ , description, $p < 0.024$ , expression, $p < 0.002$ , repetition, $p < 0.023$
<b>Overall CCAT score in follow-up 3 month</b>	<b>Significant improvement compared to baseline, <math>p &lt; 0.008</math></b>
<b>Subscores of CCAT in follow-up 3 month</b>	Significant improvement compared to baseline in description, $p < 0.031$ expression, $p < 0.026$ , repetition, $p < 0.013$
<b>Impact on therapeutic outcome</b>	<ul style="list-style-type: none"> <li>- <b>outcome independent of severity of non-fluent aphasia</b></li> <li>- <b>outcome independent of time post-stroke</b></li> <li>- history of diabetes mellitus: negative impact on improvement, <math>p &lt; 0.024</math></li> <li>- high contralesional corticomotor excitability: better outcome of inhibitory rTMS, <math>p &lt; 0.006</math></li> </ul>

### CONCLUSIONS

Downregulating the circuitry of the right pars triangularis (Ptr) through inhibitory rTMS, achieves a persistent and broadly modulating effect, irrespective of aphasia severity and subtype. Patients with lower RMT in the right motor system seem to benefit the most.

Class of the study: II



# Multiple sclerosis

## High-frequency repetitive transcranial magnetic stimulation and intermittent thetaburst stimulation for spasticity management in secondary progressive multiple sclerosis

**AUTHORS** Korzhova J, Bakulin I, Sinitsyn D, Poydasheva A, Suponeva N, Zakharova M, Piradov M

**SOURCE** Eur J Neurol 26 (2019) 680-686

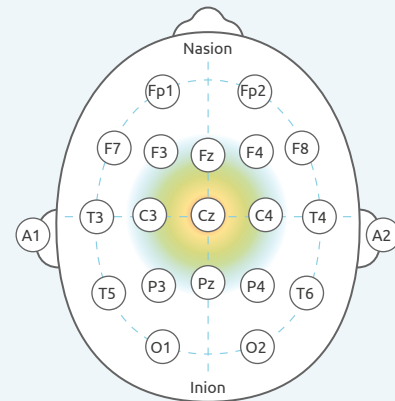
**OBJECTIVE** Comparison of HF-rTMS (20 Hz) and iTBS on the level of spasticity and concomitant symptoms in patients with secondary progressive multiple sclerosis.

**METHODOLOGY** Randomized, placebo-controlled study with 34 patients (12 HF-rTMS, 12 iTBS, 10 sham, each combined with physical therapy).

### PROTOCOL

<b>Target area</b>	Bilateral leg M1
<b>Stim. frequency</b>	20 Hz / iTBS*
<b>Stim. intensity</b>	80 % MSO**
<b>Number of pulses per session</b>	1,600 / 1,200
<b>Treatment</b>	daily, 5 times per week
<b>Number of sessions</b>	10 sessions
<b>Assessment</b>	MAS, NAS, SESS, MFIS

\* bursts at 5Hz containing 3 pulses at 35 Hz      \*\*Maximum stimulant power



### RESULTS

	20 Hz	iTBS	Sham
<b>MAS, SESS, NAS after 10 sessions</b>	Significant reduction of spasticity in MAS, NAS, not significant in SESS	Significant reduction of spasticity	No significant reduction of spasticity
<b>NAS, SESS follow-up 2 weeks</b>	Significant reduction of spasticity	Significant reduction of spasticity	No significant reduction of spasticity
<b>NAS, SESS follow-up 12 weeks</b>	No significant reduction of spasticity	<b>Significant reduction of spasticity</b>	No significant reduction of spasticity
<b>Pain level (spasticity related)</b>	<b>Significant reduction of pain</b> at end of sessions and in follow-up 2 weeks, not significant in follow-up 12 weeks	No significant reduction	No significant reduction
<b>Fatigue (MFIS)</b>	<b>Significant reduction of fatigue</b> at end of sessions and in follow-up 2 weeks, gradual increase until follow-up 12 weeks	No significant reduction	No significant reduction

### CONCLUSIONS

The results show that HF-rTMS and iTBS significantly reduce spasticity, in contrast to sham stimulation. Some evidence was found in favor of a longer-lasting effect of iTBS. A reduction in pain and fatigue could be achieved by HF-rTMS but did not result from iTBS.

Class of the study: II



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## Abbreviations

BS	Brunnstrom stages
CCAT	Concise Chinese Aphasia Test
CGI-S	Clinical Global Impression-Severity scale
DASS	Depressions-Angst-Stress-Skala
DLPFC	dorsolateral prefrontal cortex
FIM	Functional Independence Measure
FMA	Fugl-Meyer Assessment
GAD	general anxiety disorder
HAM-A	Hamilton Anxiety Rating Scale
HAM-D	Hamilton Rating Scale for Depression
HF-rTMS	high-frequency rTMS
iTBS	intermittent theta-burst stimulation
LANSS	Leeds Assessment of Neuropathic Symptoms and Signs
MADR	Montgomery–Asberg Depression Rating Scale
MAS	Modified Ashworth Scale
MBI	Modified Barthel Index
MFIS	Modified Fatigue Impact Scale
MSO	Maximum Stimulant Output
NAS	Numerical Analog Scale
NIHSS	National Institutes of Health Stroke Scale
OCD	obsessive compulsive disorder
SESS	Subjective Evaluating Spasticity Scale
SF-36	Short Form Health Survey Questionnaire
TPC	temporo-polar cortex
U-FMA	Fugl-Meyer Assessment for upper limb
VAS	Visual Analogue Scale
VDS	Verbal Descriptor Scale
WMFT	Wolf Motor Function Test
Y-BOCS	Yale-Brown obsessive compulsive scale

## Imprint

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