Effects of Peripheral Somatosensory Neurostimulation

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Researcher, Hospital Israelita Albert Einstein

Chief, Stroke group and Neurostimulation Laboratory, Neurology Department
Hospital das Clínicas/São Paulo University

ALBERT EINSTEIN
SOCIEDADE BENEFICENTE ISRAELITA BRASILEIRA

Disclosures

Active Grants

NIH: PI, R01NS076348-01

FAPESP: PI, 2018/03737-8; 2019/00956-3

CNPq: 303070/2019-6

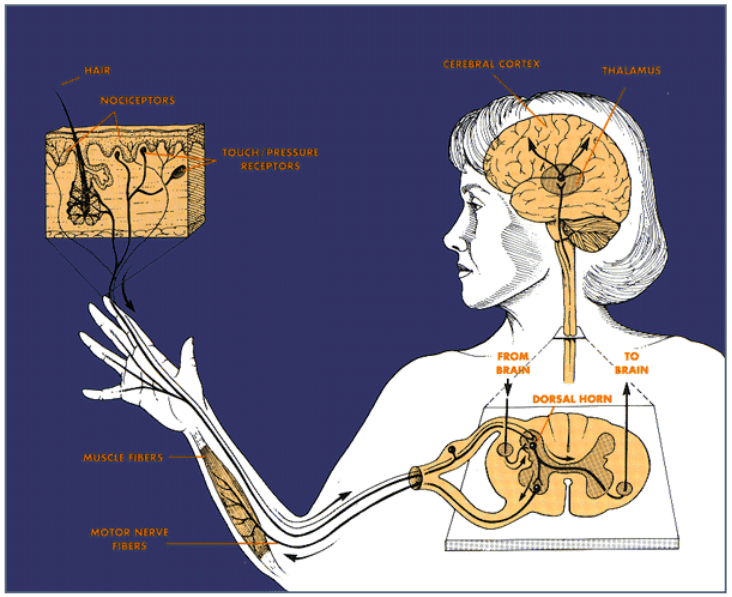
Topics

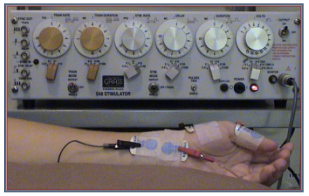
RPSS: what and why

Timeline: Cross-over studies and clinical trials

Repetitive peripheral sensory stimulation
(RPSS)

Parameters that stimulate afferent fibers



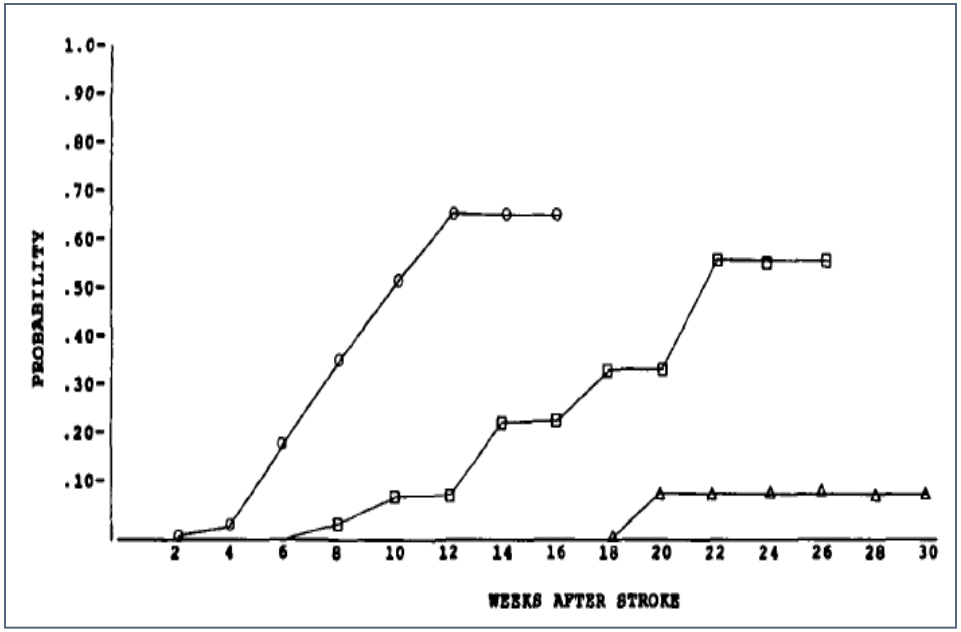


Repetitive peripheral nerve stimulation

Repetitive peripheral sensory stimulation:
(RPSS)

Repetitive peripheral sensory stimulation: (RPSS)

Probability Barthel Index ≥95

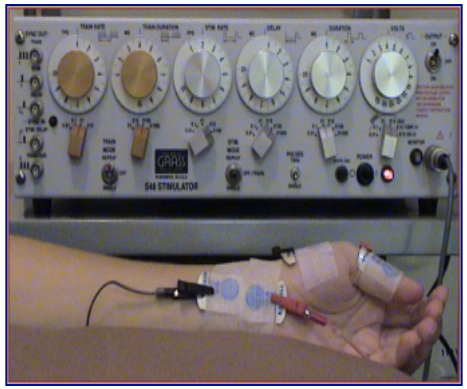


- Pure motor
- Motor + SS
- Motor + SS + hemianopia

Reding e Potes. *Stroke* 1988

Repetitive peripheral sensory stimulation: Hypothesis (RPSS)

Manipulation of sensory input → **Modulation of motor excitability/ function**



Reding and Potes. Stroke 1988

Nudo et al. Science 1996

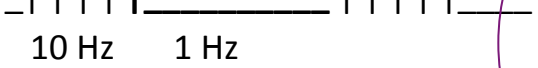
Conforto et al. Ann Neurol 2002

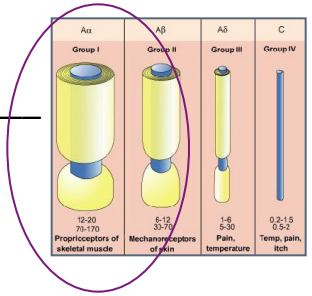
Conforto et al. NNR 2018

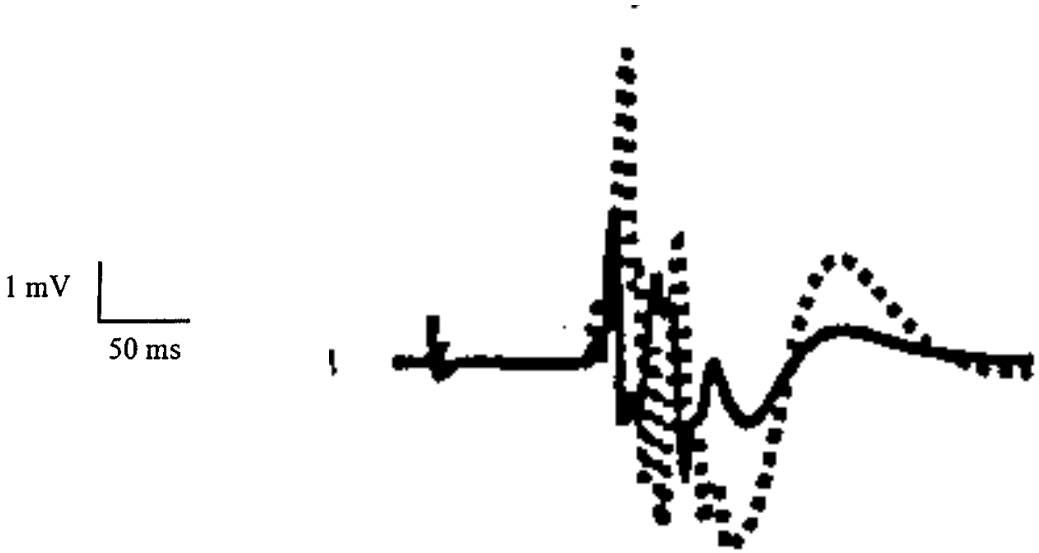
Repetitive peripheral sensory stimulation

(RPSS)

2-h ulnar nerve stimulation







Before: Solid

After: Dotted

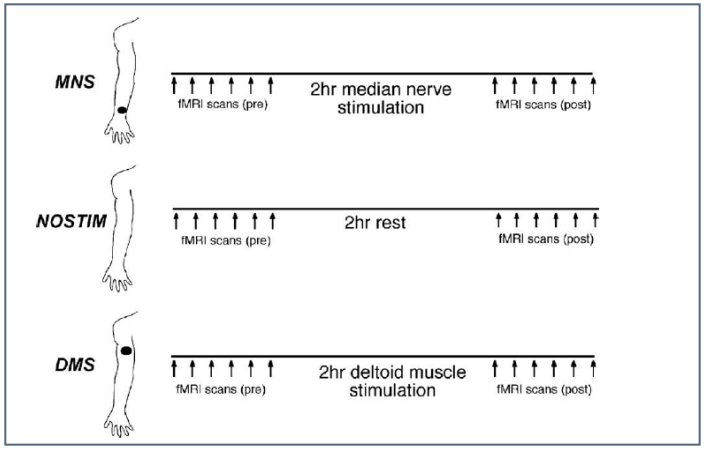
MEP

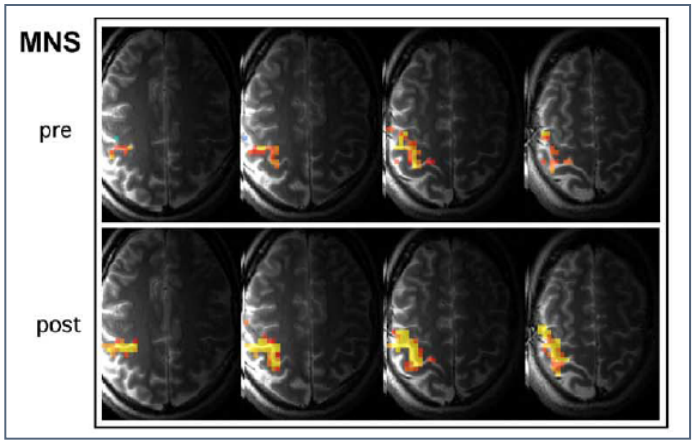
ADM

Ridding et al *Exp Brain Res 2000*

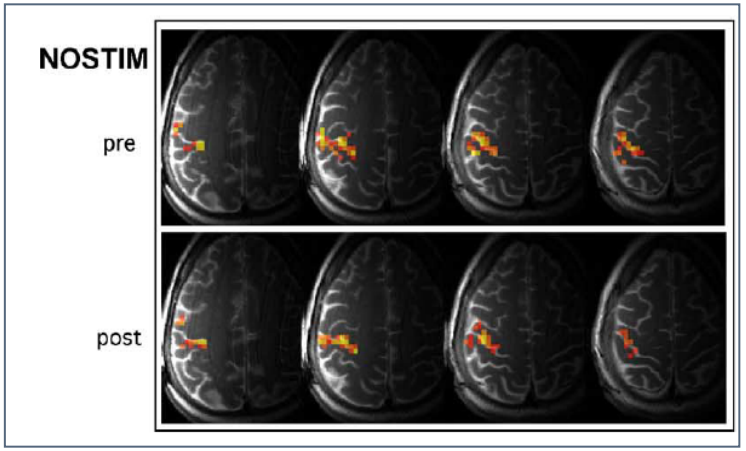
Kaeling-Lang et al *J Physiol 2002*

Repetitive peripheral sensory stimulation (RPSS)



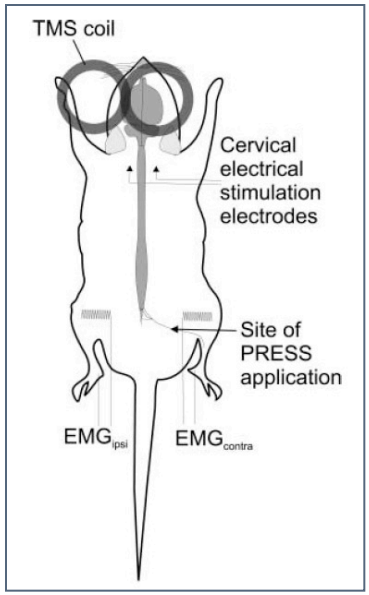


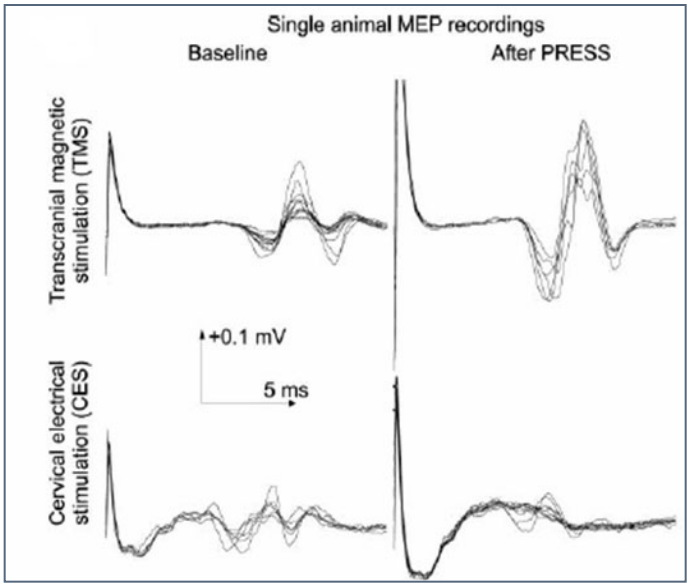
↑M1 > S1> PM



Wu et al. *NeuroImage 2005*

Repetitive peripheral sensory stimulation: (RPSS)



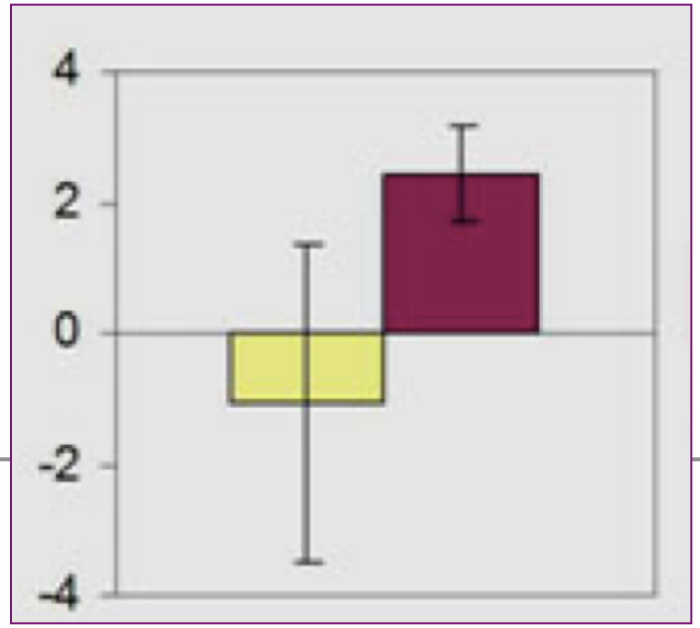


Luft et al *Exp Brain Res 2002*

Repetitive peripheral sensory stimulation:
(RPSS)

Paretic hand

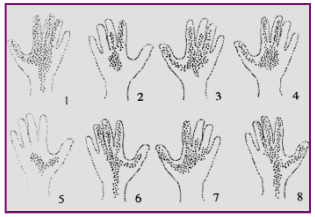
2002

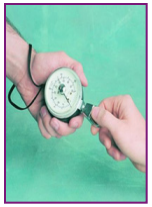


Increase in Hand Muscle Strength of Stroke Patients after Somatosensory Stimulation

Adriana B. Conforto, MD, Alain Kaelin-Lang, MD, and Leonardo G. Cohen, MD

Ann Neurol 2002;51:122–125





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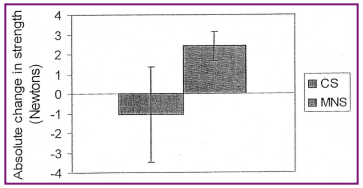

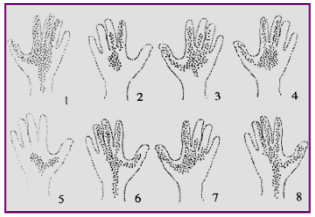

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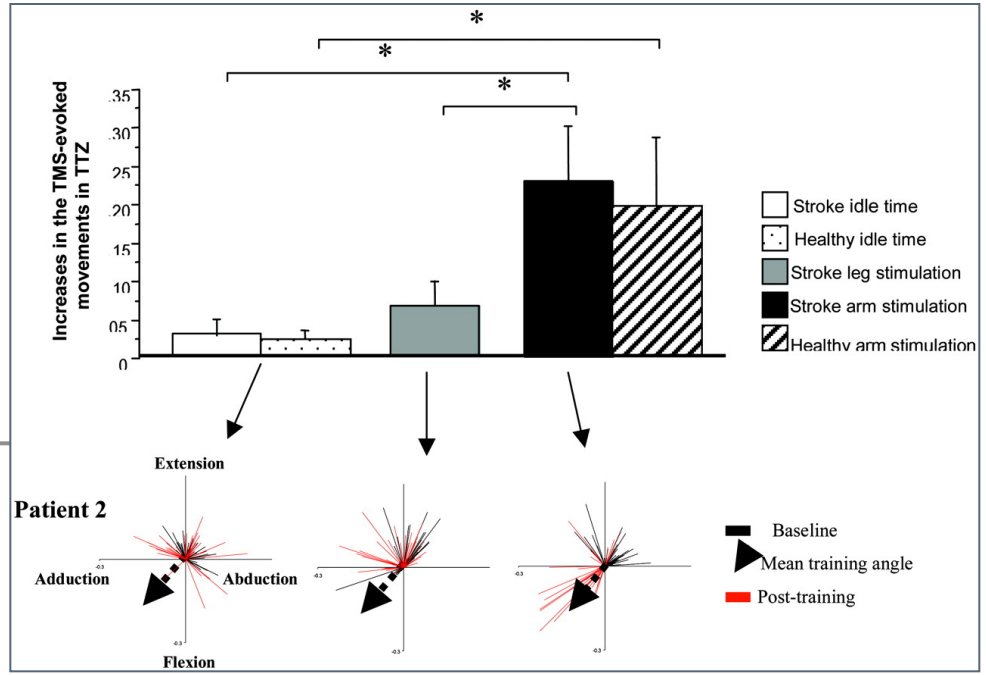
Lumy Sawaki, Carolyn W.-H. Wu, Alain Kaelin-Lang and Leonardo G. Cohen

Stroke 2006;37;246-247; originally published online Dec 1, 2005;



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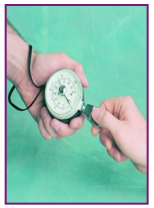

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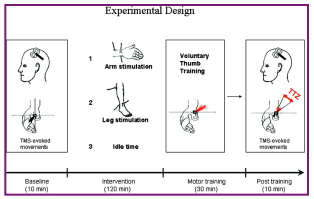

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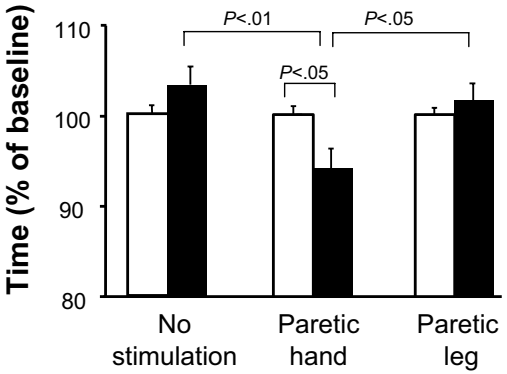

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Arch Phys Med Rehabil 2006;87:351-7.

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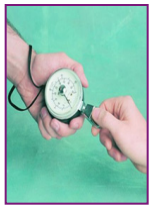

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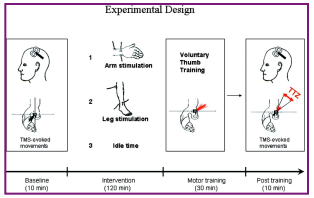

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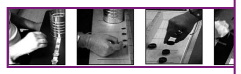

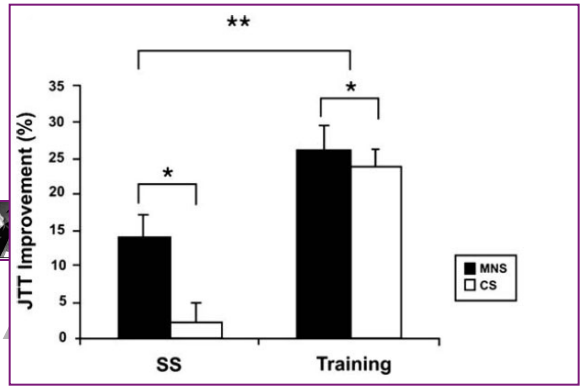

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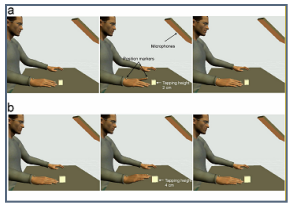
2007

ORIGINAL COMMUNICATION

Adriana Bastos Conforto
Leonardo G. Cohen
Renata Laurenti dos Santos
Milberto Scaff
Suely Kazue Nagahashi Marie

Effects of somatosensory stimulation on motor function in chronic cortico-subcortical strokes

Repetitive peripheral sensory stimulation:
(RPSS)



2008

Electrical somatosensory stimulation improves movement kinematics of the affected hand following stroke

I B M Koesler, M Dafotakis, M Ameli, G R Fink and D A Nowak

J. Neurol. Neurosurg. Psychiatry 2009;80:614-619; originally published online 14 Nov 2008;
doi:10.1136/jnnp.2008.161117

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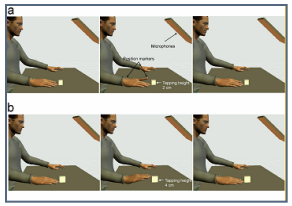

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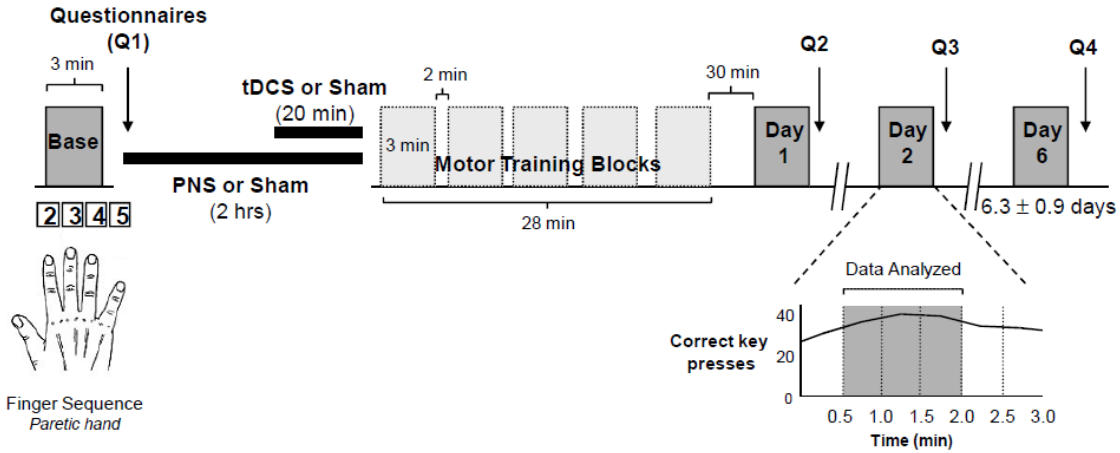
NIH Public Access
Author Manuscript
Stroke. Author manuscript; available in PMC 2010 May 1.

Published in final edited form as:
Stroke. 2009 May ; 40(5): 1764–1771. doi:10.1161/STROKEAHA.108.540500.

"Effects of combined peripheral nerve stimulation and brain polarization on performance of a motor sequence task after chronic stroke"

Pablo Celnik, M.D.[1,2,*], Nam-Jong Paik, M.D., Ph.D.[1,3,*], Yves Vandermeeren, M.D., Ph.D.[1,4], Michael Dimyan, M.D.[1], and Leonardo G. Cohen, M.D.[1]

Interventions:
PNS_{Sham}+$tDCS_{Sham}$; PNS+$tDCS_{Sham}$; $tDCS$+PNS_{Sham}; PNS+tDCS



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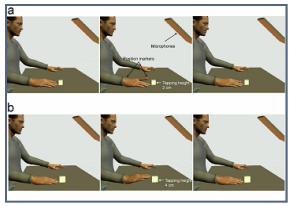

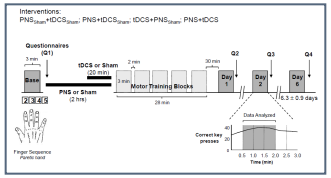

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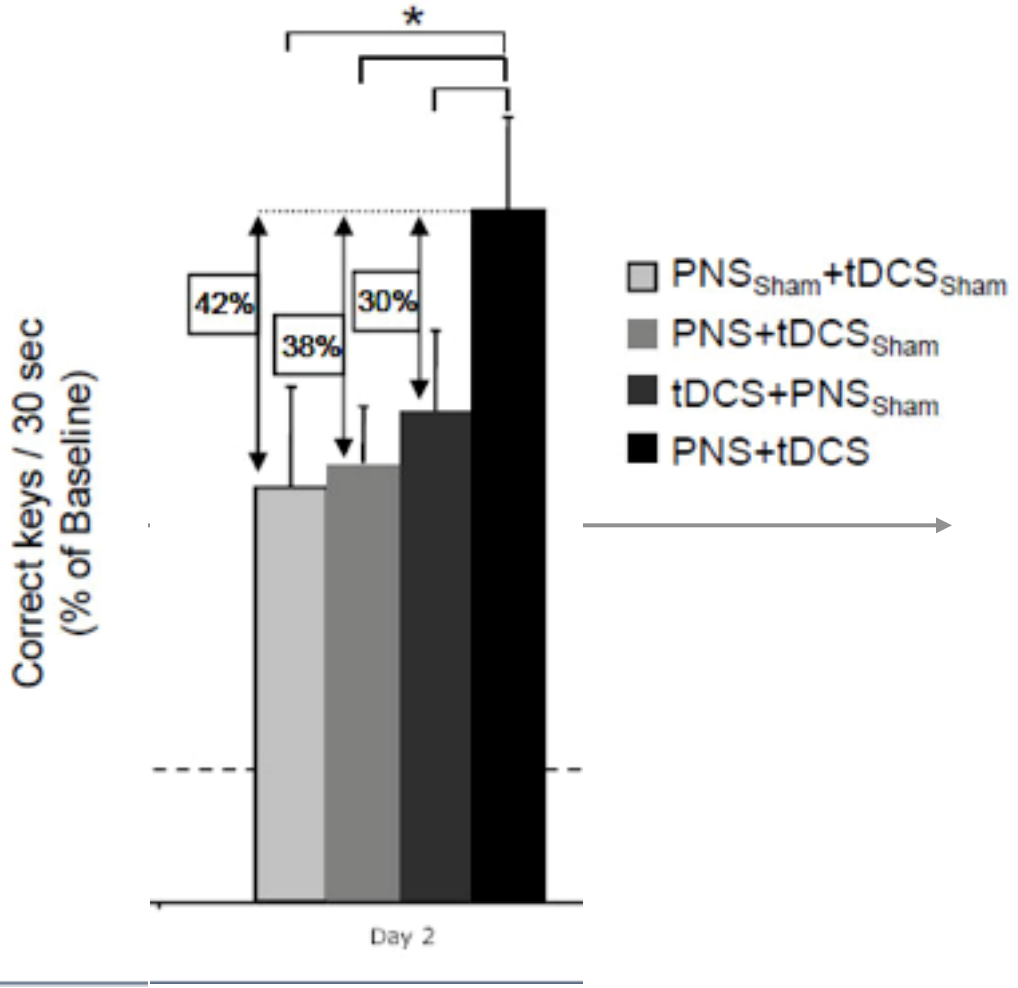

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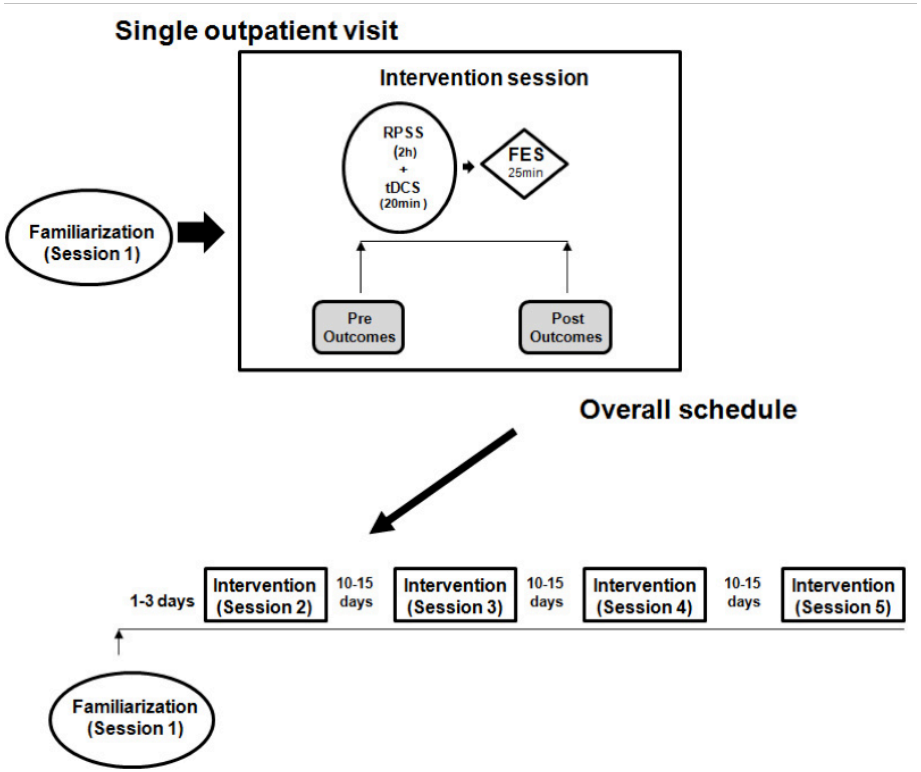


Combined brain and peripheral nerve stimulation in chronic stroke patients with moderate to severe motor impairment

Isabella S. Menezes, PT, MS[1], Leonardo G. Cohen, MD[2], Eduardo A. Mello, PT[1], André G. Machado, MD, PhD[3,4], Paul Hunter Peckham, MS, BS, PhD[4], Sarah M. Anjos, OT, MS[1,5], Inara L. Siqueira, UGS[1], Juliana Conti, OT[1], Ela B. Plow, PT, PhD[3,4], and **Adriana B. Conforto, MD, PhD[1,6]**

[1]Hospital das Clinicas/São Paulo University, São Paulo, Brazil

[2]Human Cortical Physiology and Stroke Neurorehabilitation Section, National Institute of Neurological Disorders and Stroke, National Institutes of Health, Bethesda, Maryland, United States

[3]Departament of Neurosciences, Lerner Reasearch Institute, Cleveland Clinic, Cleveland, Ohio, United States

[4]Case Western Reserve University, Cleveland, Ohio, United States

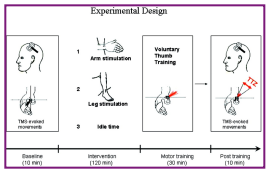
[5]Departments of Physical Therapy and Occupational Therapy; School of Health Professions, University of Alabama at Birmingham, Birmingham, Alabama, United States

[6]Hospital Israelita Albert Einstein, São Paulo, Brazil

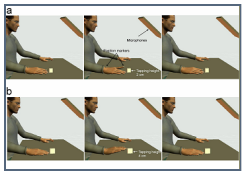
Repetitive peripheral sensory stimulation:
(RPSS)

Mildly affected patients

Crossover design



n < 20



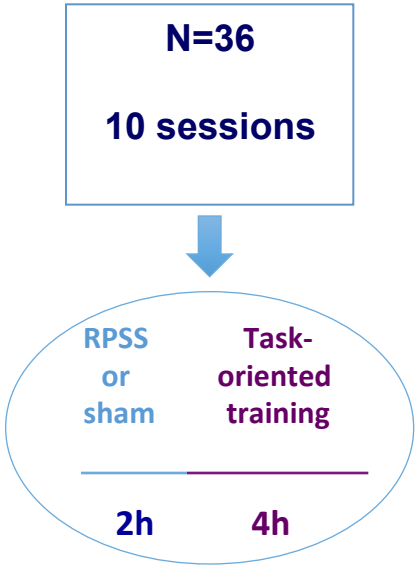
Chronic phase

Repetitive peripheral sensory stimulation: (RPSS)

Nerve Stimulation Enhances Task-Oriented Training in Chronic, Severe Motor Deficit After Stroke

A Randomized Trial

Cheryl Carrico, MS, OT/L; Kenneth C. Chelette, II, MS; Philip M. Westgate, PhD; Elizabeth Powell, MS; Laurie Nichols, BS, OT/L; Anne Fleischer, MPH, OT/L, CLT-LANA; Lumy Sawaki, MD, PhD



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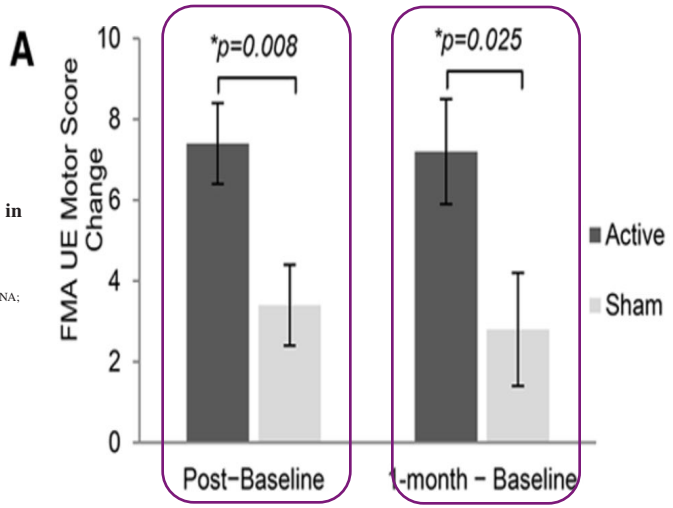
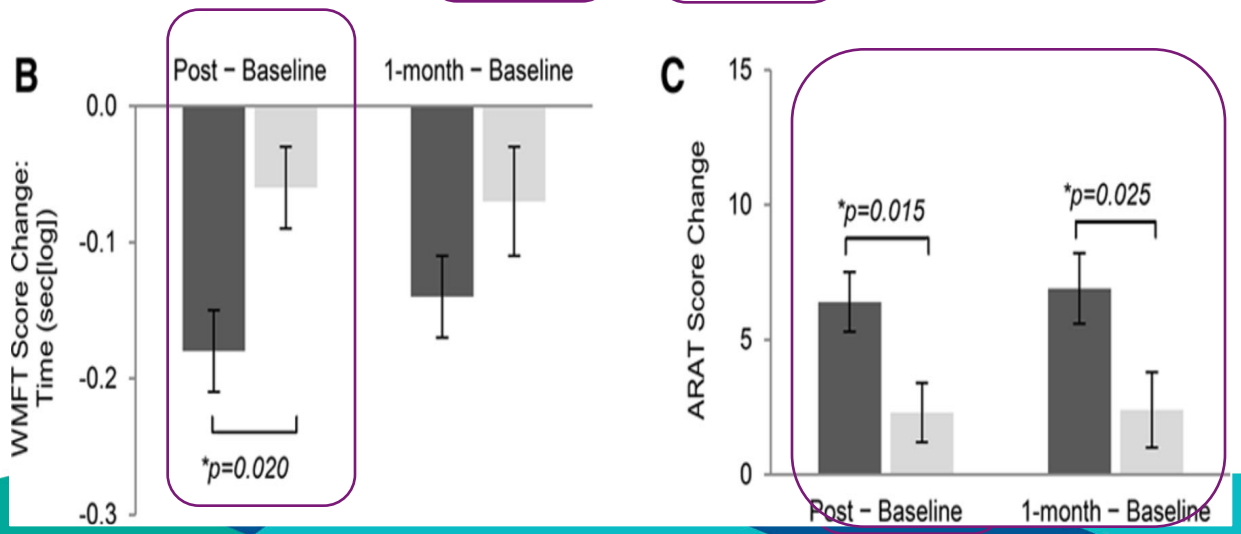




N=36

10 sessions

RPSS or sham	Task-oriented training
2h	4h

MCID, ARAT: 5.7

Repetitive peripheral sensory stimulation:
(RPSS)

Chronic phase: Standardized mean difference 1.00 (0.64-1.37)

$I^2=0$

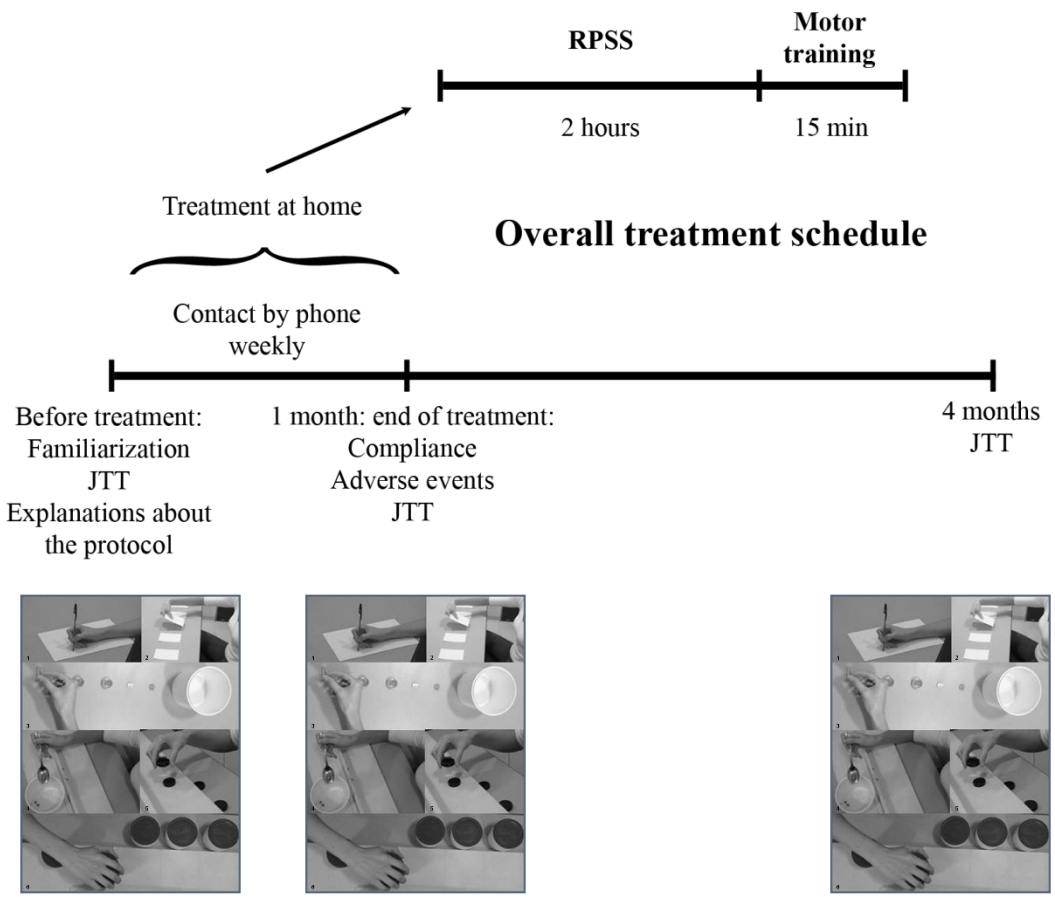
Repetitive Peripheral Sensory Stimulation and Upper Limb Performance in Stroke: A Systematic Review and Meta-analysis

Neurorehabilitation and Neural Repair
1–9

DOI: 10.1177/1545968318798943
journals.sagepub.com/home/nnr
SAGE

Adriana Bastos Conforto, MD, PhD[1,2], Sarah Monteiro dos Anjos, MS[3], Wanderley Marques Bernardo, MD, PhD[4], Arnaldo Alves da Silva, MD, PhD[2], Juliana Conti, MS[1], André G. Machado, MD, PhD[5], and Leonardo G. Cohen, MD, PhD[6]

Home-based stimulation



Chronic phase

Home-based

Peripheral stimulation

+ Training

Home-Based Nerve Stimulation to Enhance Effects of Motor Training in Patients in the Chronic Phase After Stroke: A Proof-of-Principle Study

Renata Laurenti dos Santos-Fontes, MsC[1], Karina Nocelo Ferreiro de Andrade[1], Annette Sterr, PhD[2], and Adriana Bastos Conforto, MD, PhD[1,3]

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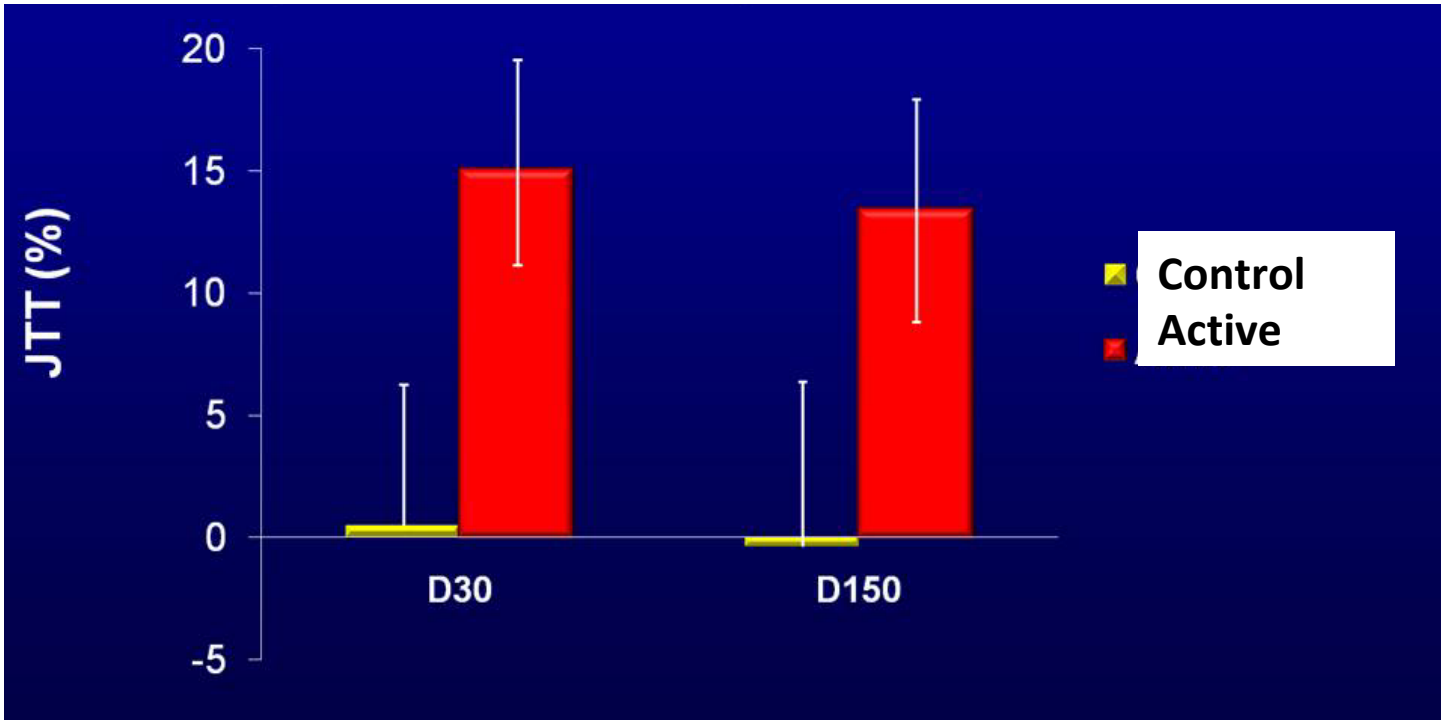

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Renata Laurenti dos Santos-Fontes, MsC[1], Karina Nocelo Ferreiro de Andrade[1], Annette Sterr, PhD[2], and Adriana Bastos Conforto, MD, PhD[1,3]

Active studies

R01NS076348-01: Shorter duration of training and RPSS compared to previous studies

2018/03737-8: Comparison of RPSS in chronic and subacute stages after stroke

2018/16352-7: RPSS in acute stroke

Take-home messages

Promising

Needs:

More knowledge about mechanisms

Optimal duration and parameters

Bigger trials with clinically relevant outcomes

Match right patient to right treatment

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