




Learnings from transcutaneous stimulation

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Nomenclature

Transcutaneous spinal cord stimulation (tcSCS)
vs
Transcutaneous spinal stimulation (TSS)

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Like other forms of afferent input TSS:

- activates both cortical and spinal circuits

- is most effective with longer pulse durations (preferentially activate afferents)

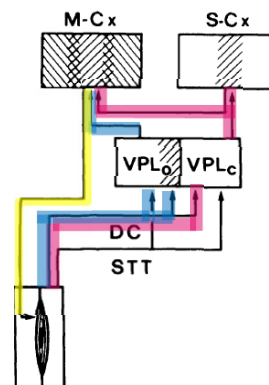


3

Cortical excitability influences descending drive...

...sensory stimulation increases corticomotor excitability

SENSORY INPUT TO MOTOR CORTEX



Asanuma & Mackel
Jpn J Physiol, 1989.

4



Carrier frequency: Help or Hype?

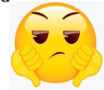
DOI: 10.1523/JNEUROSCI.2143-21.2022

ORIGINAL RESEARCH

The Journal of Neuroscience | Physiological Reports

The relationship between maximum tolerance and motor activation during transcutaneous spinal stimulation is unaffected by the carrier frequency or vibration

Gerome A. Manson¹ | Jonathan S. Calvert^{1,2} | Jeremiah Ling¹ | Boranai Tychon¹ | Amir Ali¹ | Dmitry G. Sayenko¹ 



The Journal of Neuroscience, March 25, 2020 • 40(13):2633–2643 • 2633

Development/Plasticity/Repair

Cortical and Subcortical Effects of Transcutaneous Spinal Cord Stimulation in Humans with Tetraplegia

Francisco D. Benavides,^{1,2,3} Hang Jin Jo,^{1,2,3} Henrik Lundell,⁴ V. Reggie Edgerton,^{5,6,7,8,9,10} Yuri Gerasimenko,^{1,12,13} and Monica A. Perez^{1,2,3}



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Frequency



Lower frequencies facilitate motor output (30Hz)

Higher frequencies reduce spasticity (50Hz; TENS studies show this too)

****but no statistical differences in most cases**

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Intensity
(observations on
higher intensities)

Lower extremities

- May promote motor output (paresthesia)

Upper extremities (anecdotal)

- May improve proximal stability (posture)
- Stiffness?
- Motor output?

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Training is key: i.e., circuits must be active for stim to have effect

Brain Stimulation 13 (2020) 287–301



Contents lists available at ScienceDirect

Brain Stimulation

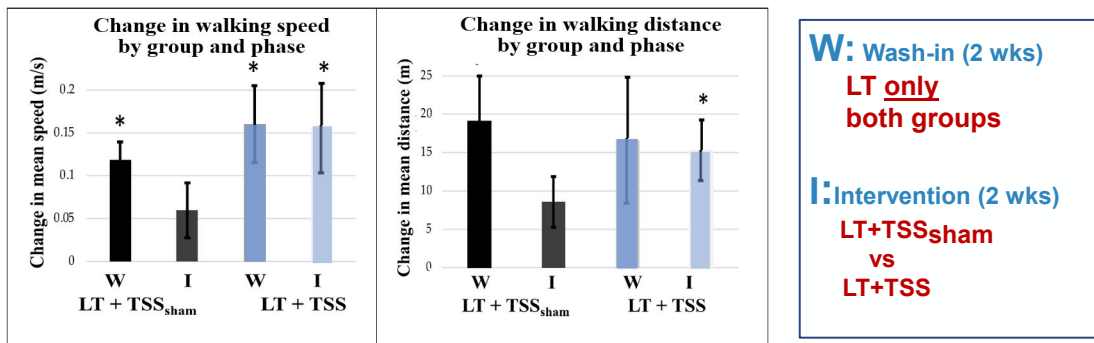
journal homepage: <http://www.journals.elsevier.com/brain-stimulation>

Direct current stimulation boosts hebbian plasticity in vitro

Greg Kronberg^{*}, Asif Rahman¹, Mahima Sharma, Marom Bikson, Lucas C. Parra

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Human subacute SCI: Pragmatic clinical trial – transcutaneous spinal stim to augment locomotor training



Estes & Field-Fote *J Clin Med.* 2021

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A note about
common spinal
fixation
instrumentation

Poor conductors

- titanium
- cobalt chrome

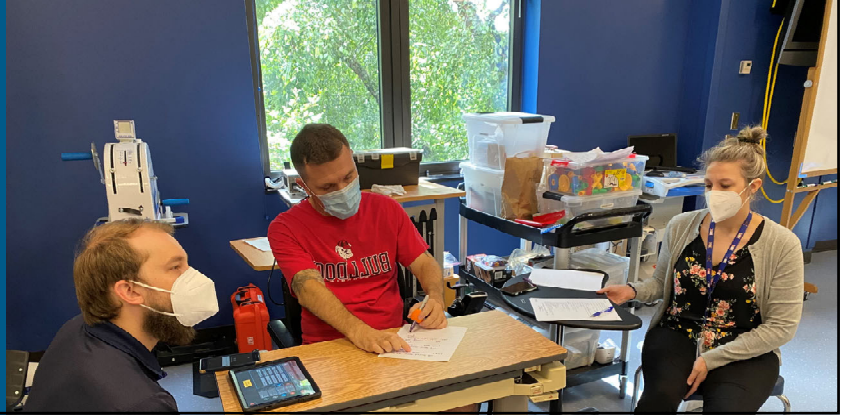
Good conductor

- stainless steel



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Chat time



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