Modification of spasticity with transcutaneous stimulation of the spinal cord in individuals with spinal cord injury

A pilot study

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AIM

Spasticity is reported as restricting activities of daily living (ADL) in some individuals with spinal cord injury (SCI). Promising results from two smaller studies indicated that transcutaneous stimulation of the spinal cord (tSCS) could reduce spasticity in lower extremities and increase walking speed. To verify these findings, this pilot study was conducted with the aim to assess the effect of transcutaneous stimulation of the spinal cord in spasticity.

METHODS

Participants

- 13 (men/women=12/1)
- 23-66 years of age
- SCI C4-T12, AIS A-D
- 7 were able to walk

Procedure

- 30 min. of tSCS in one single session
- Device: NeuroTrac multiTENS from Quintet (symmetrical, rectangular impulses, 2 ms phase, 50 Hz)
- 4 electrodes, placed bilaterally (2 paravertebral at level T11-12, 2 on the lower abdomen)
- Assessments before (T1), directly after (T2) and 2 hours (T3) after stimulation

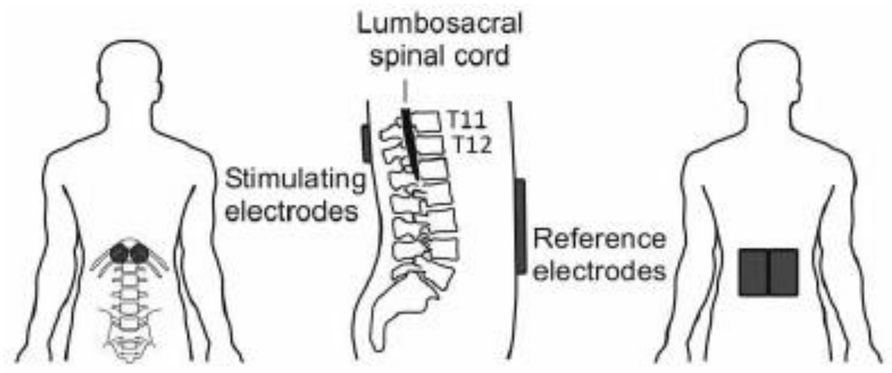

Figure 1. Sketch of the placement of the stimulating and reference skin electrodes over the back and the lower abdomen, respectively, relative to the spine and the lumbosacral spinal cord (Hofstoetter et al 2014). Reprint by permission by Taylor & Francis Group.

RESULTS

In summary: Reduced spastivcity, but minimal change in walking speed.

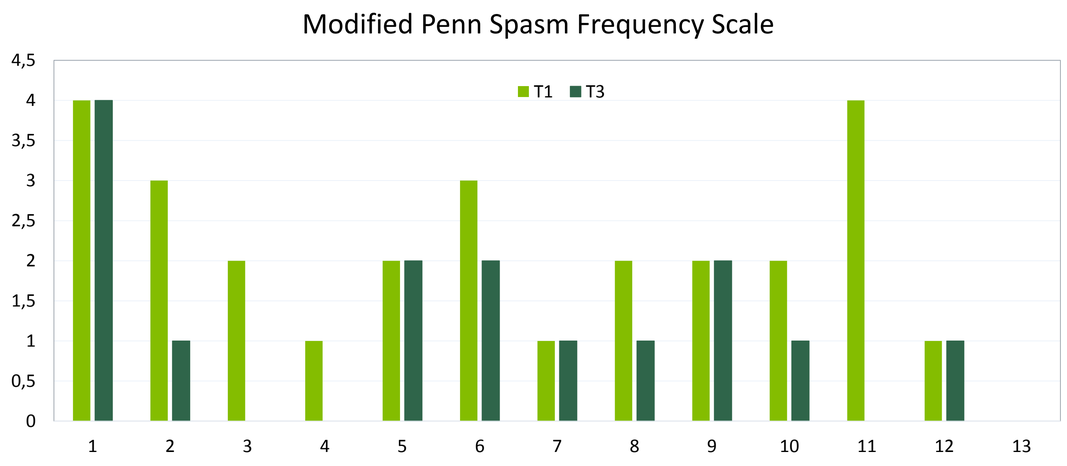

Figure 2. Individual results for Modified PSFS at T1 and T3 for all participants. Participant 13 did not report any spasticity at the time of stimulation.

Table 1. Median differences (range) and level of significance in main outcome measures.

	T1	T2	T3	P
Mod. PSFS; Spasms Frequency Scale (0 - 4), (n = 13)	2.0 (0-4)		1.0 (0-4)	.016[a]
Mod. PSFS; Spasms Severity Scale (0 - 3), (n = 13)	1.0 (1-3)		1.0 (0-3)	.059[a]
Perceived spasticity (NRS: 0-10) (n = 13)	3.5 (0-7.0)	.5 (0 – 5.5)	1.5 (0-5)	.001[b]
Perceived grade of difficulty in transfers (NRS: 0-10) (n = 13)	4.0 (0-7)	0 (0-5)	2 (0-5)	.002[b]
TUG (n = 6)	14.5 (7.5-29.8)	14.0 (6.7-26.0)	13.5 (7.3-24.8)	.115[b]
10 m WT (n = 6)	12.5 (6.7-29.4)	11.7 (6.2-25.4)	11.5 (6.4-22.8)	.607[b]

PSFS = Penn Spasm Frequency Scale; NRS = Numeric Rating Scale; TUG= Time up and go; 10mWT= 10 meter Walk Test; Statistics: [a)] Related-Samples Wilcoxon Signed Rank Test; [b)] Related Samples Friedman`s Two-Way Analyses of Variance by Ranks

«I slept through the whole night for the first time since injury»
(AIS C C6; 2 years post injury)

«One week without spasticity and no back pain» (AIS A T10)

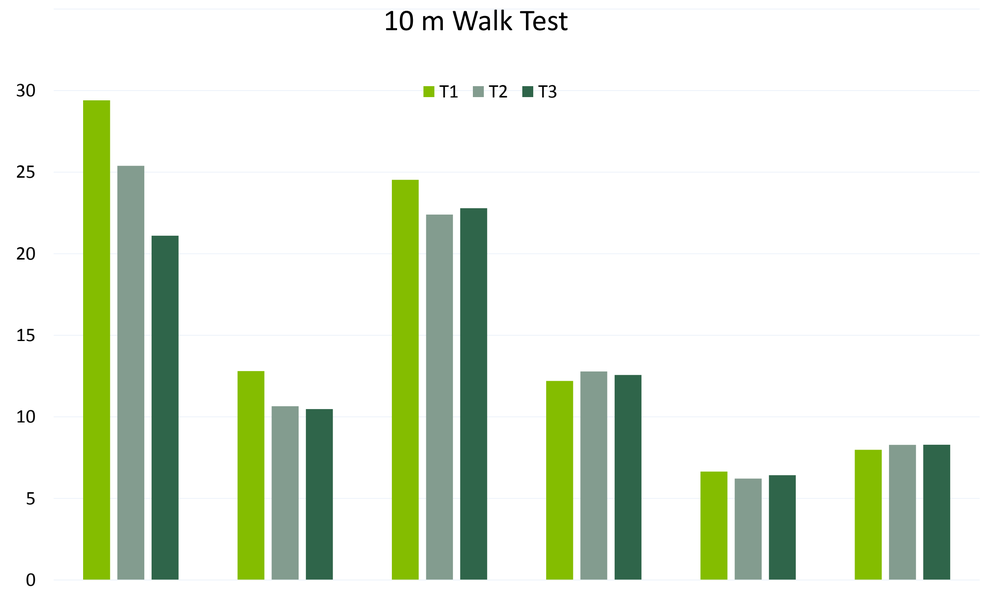

Figure 3. Individual results for 10 meter WT at T1, T2, T3 for participants able to walk.

CONCLUSION

The stimulation was well tolerated and the participants reported less spasticity after stimulation. The minimal change in walking speed in this sample could be due to the fact that some of the ambulatory participants used their spasticity for walking.
Future research should include multiple treatments over a period of time, and results should be displayed for individuals with complete and incomplete injuries separately.

References

Guðfinnsdóttir HK(2016) Processing of electrophysiological recordings and registration of residual motor control functions for the assessment of tSCS treatment. Master Thesis, Reykjavík University, Island.

Ursula S. Hofstoetter, William B. McKay, Keith E. Tansey, Winfried Mayr, Helmut Kern & Karen Minassian (2014). Modification of spasticity by transcutaneous spinal cord stimulation in individuals with incomplete spinal cord injury, The Journal of Spinal Cord Medicine, 37:2, 202-211, DOI:10.1179/2045772313Y.0000000149.

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