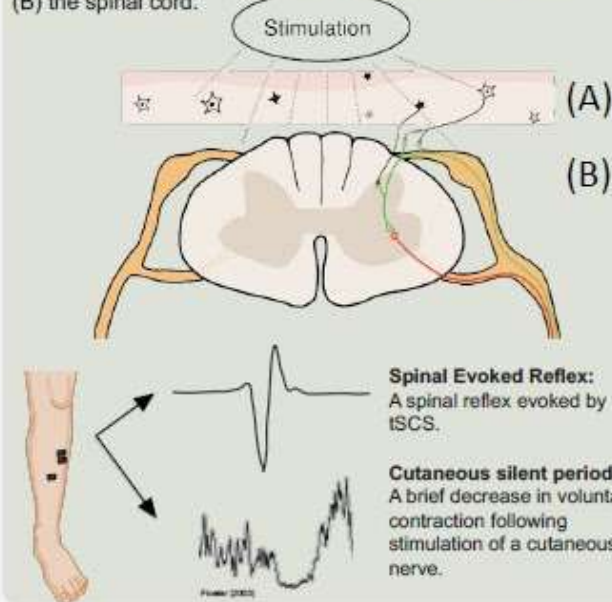


1 Background

Transcutaneous spinal cord stimulation (tSCS) is a non-invasive method of stimulating the human spinal cord. tSCS is applied on the skin of the back above the spinal cord. It can improve voluntary control of paralyzed limbs for people with a spinal cord injury.

Two main structures that tSCS might activate include:
 (A) sensory receptors in the skin and muscle of the back
 (B) the spinal cord.



2 Objectives

(A) What structures are activated by tSCS?

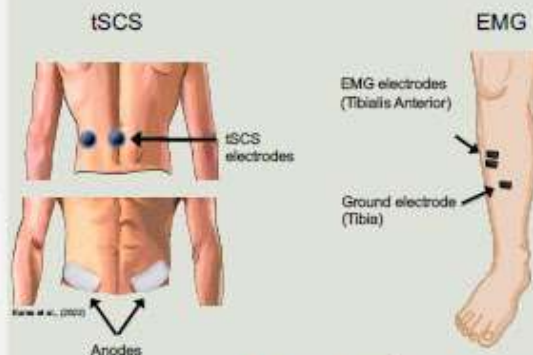
(B) At what intensity does tSCS reach the spinal cord?

3 Hypotheses

- At low intensities of tSCS, the sensory receptors would be activated, but the stimulation would not yet reach the spinal cord.
- At high intensities of tSCS, the sensory receptors would be activated and the stimulation would reach the spinal cord.

4 Methods

A. Electrode Placement



B. Protocol

Participants: 3 individuals with no history of neurological injuries or disorders participated.

Simulation: tSCS was delivered at 3 intensities over the T12-L1 region of the spinal cord (N=3). tSCS was then delivered laterally to the spine (N=1).

Recording: EMG was recorded from the Tibialis Anterior muscle.

Reflex Threshold: Intensity of stimulation that evoked a spinal reflex in 4/8 trials.

tSCS Over Spinal Cord

Hold a Small Contraction

Trail

1 Deliver tSCS @ 0.6 x Reflex Threshold

2 Deliver tSCS @ 0.8 x Reflex Threshold

3 Deliver tSCS @ 1 x Reflex Threshold

n = 3 participants

tSCS Off Spinal Cord

Hold a Small Contraction

Trail

1 Deliver tSCS @ 1 x Reflex Threshold

n = 1 participant

5 Results

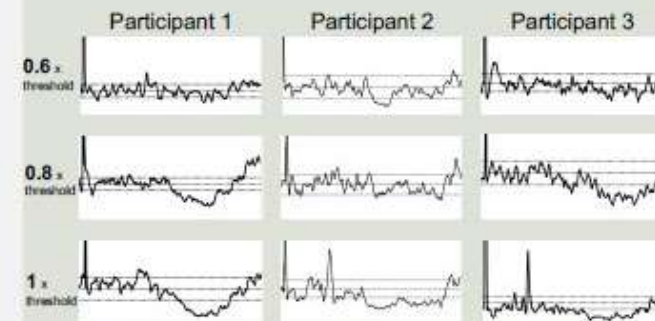


Figure 1: Average EMG recordings for each participant at 0.6, 0.8, and 1x reflex threshold. The tSCS electrode was placed over the skin above the spinal cord.



Figure 2: Average EMG recordings for one participant at 1x reflex threshold when the electrode was on the skin lateral to the spinal cord.

6 Conclusions

- High intensities (1 x threshold) of tSCS produced strong excitation of TA.
- Low to high intensities (0.6, 0.8, and 1x threshold) of tSCS produced a strong inhibition in TA. This inhibitory period is thought to be a cutaneous silent period.
- Low intensities of tSCS are suggested to help control spasticity in individuals with a spinal cord injury.
- High intensities of tSCS are suggested to aid in recovery of voluntary control of movement in individuals with a spinal cord injury.

7 Acknowledgements

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