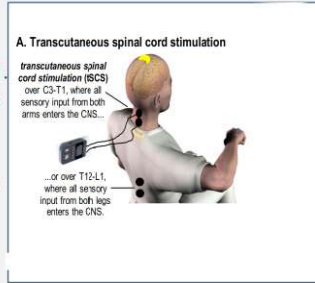


INTRODUCTION

What is transcutaneous spinal cord stimulation?

- Transcutaneous spinal cord stimulation (tSCS), is a new technology which is gaining attention due to its promising application of restoring fictional movements for people experiencing a spinal cord injury (SCI).
- tSCS in practice is applied at low intensity through the skin of the back and targets sensory axons in the dorsal roots at where they enter the spinal cord.
- When the stimulation intensity is above therapeutic levels these axons can produce contractions via reflexes, also known as dorsal root reflexes (DRRs).

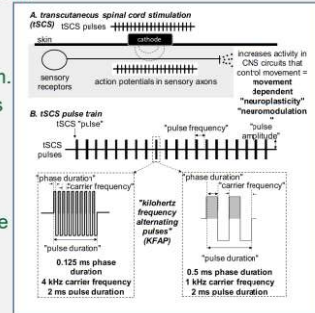


Woah hold up, what are dorsal root reflexes?

- When the dorsal roots are stimulated it causes a contraction in the muscle.
- This is due a pathway through the spinal cord from the sensory nerve to quickly send a signal to the motor nerve which leads to a contraction aka a reflex.
- A DRRs is a specific kind of reflex where the stimulation is on the dorsal roots instead of a peripheral nerve or what occurs during a tendon tap test.

Why swipe left?

- Since tSCS only works if the dorsal roots are stimulated, it would be recommended to use the most effective stimulus pulse to activate them.
- When stimulating peripheral nerves, stimulus pulses with wider phases more effectively recruit motor and sensory axons than narrow phases (see Porozni et al., poster at 13:34).



Purpose

- This project will evaluate the effect the phase duration of stimulus pulse has on stimulating the target axons via DRRs.

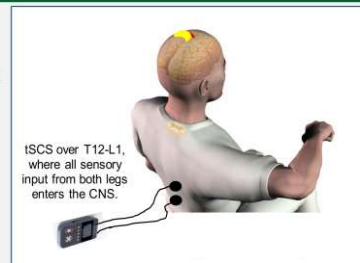
Hypotheses (What we think will happen)

- Wider phase pulses (0.5ms) would more effectively stimulate axons in the dorsal roots and produce contractions in leg muscles than narrow phase pulses (0.125ms).

METHODS

How did we do it?

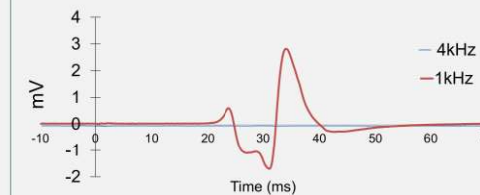
- Using the Ebramed nero9 stimulator narrow and wide phases pulses were delivered through electrodes placed on the back and hips.
- Electromyography was used to record the DRR in 4 leg muscles.
- Recruitment curves were collected to show how effectively muscle are recruited using a given stim intensity.
- 40 stimulations were recorded for both pulses at pseudorandom intensities.



RESULTS

Figure 1: Single subject

A: DRRs: same intensity, different phase durations



B: DRRs: range of intensities, different phase durations

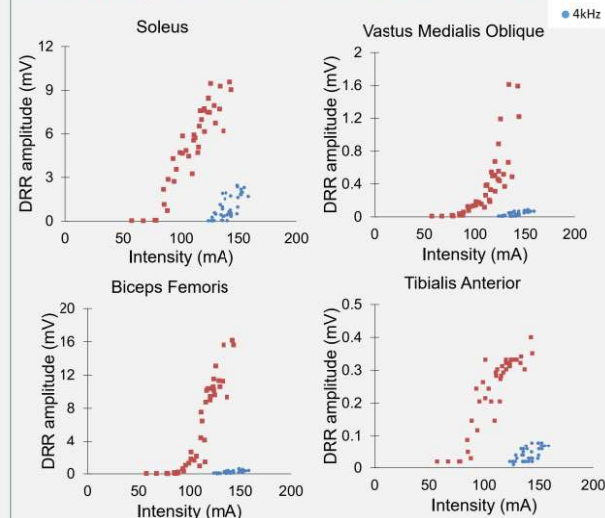
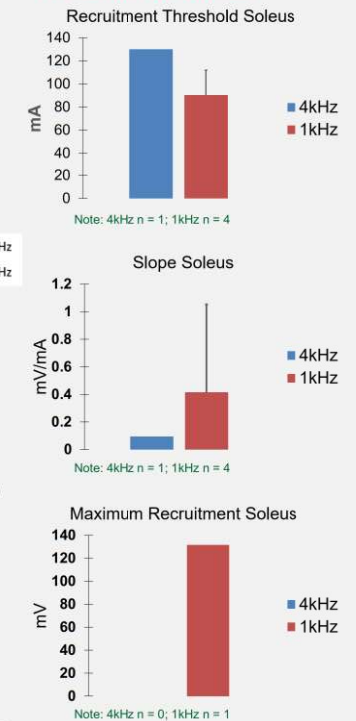


Figure 2: group data threshold, slope, & maximum for Soleus



CONCLUSION

So What?

- These wider phase pulses are better for targeting sensory axons and thus we believe they will also be better to restore function for people with a SCI.

What Next?

- The next step would be to test wider vs narrow phase pulses are more effective in helping people regain function with a SCI.

References & Acknowledgments

References:

1. Gerasimenko, Y., Gorodnichev, R., Moshonkina, T., Sayenko, D., Gad, P., & Reggie Edgerton, V. (2015). 58(4), 225–231. <https://doi.org/10.1016/j.rehab.2015.05.003>

Thank you:

Alejandro Ley, the man, the myth, the legend!