Subthreshold Vibration Does Not Affect Walking Performance of Transtibial Amputees

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INTRODUCTION

- Amputation below the knee causes a person to lose important pathways of sensation to central nervous system [1].
- The goal of this work is to find if a stochastic resonance pattern will help to improve walking performance of residual limb in transtibial amputees when applied as subthreshold vibration to the affected side.
- The choice to work with pink signal is based off its prevalence in natural processes. [2]

STOCHASTIC RESONANCE

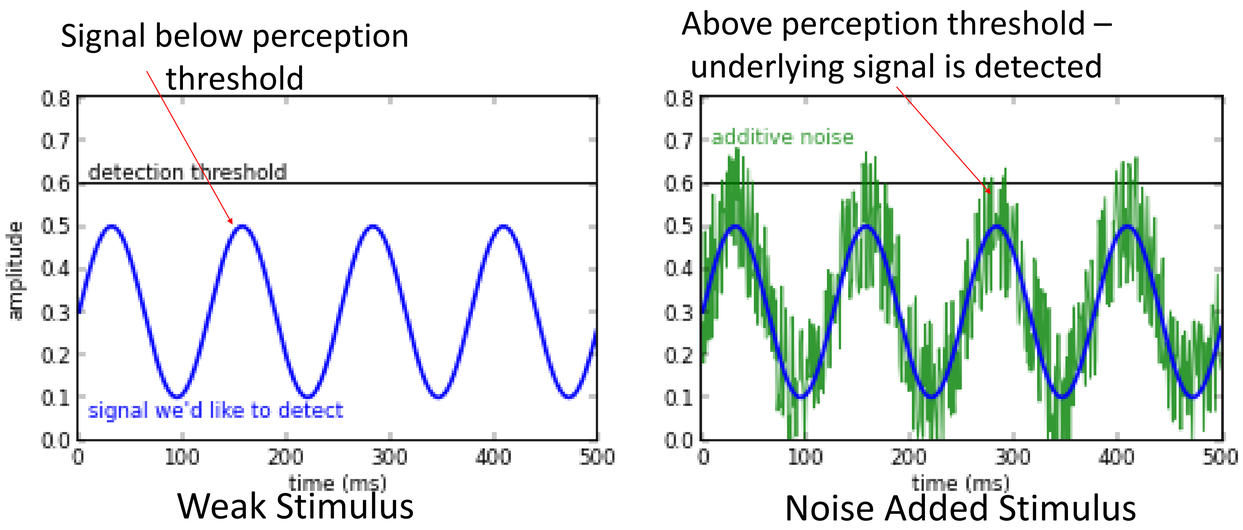


Figure 1: The differences between normal signal and stimulus with added noise.

- It has been shown that stochastic resonance (Figure 1) has improved sensation in elderly adults with neuropathy. [3]

Purpose : We specifically anticipated that stochastic resonance would enable an amputee to have better control of their prosthesis.

RESULTS AND DISCUSSION

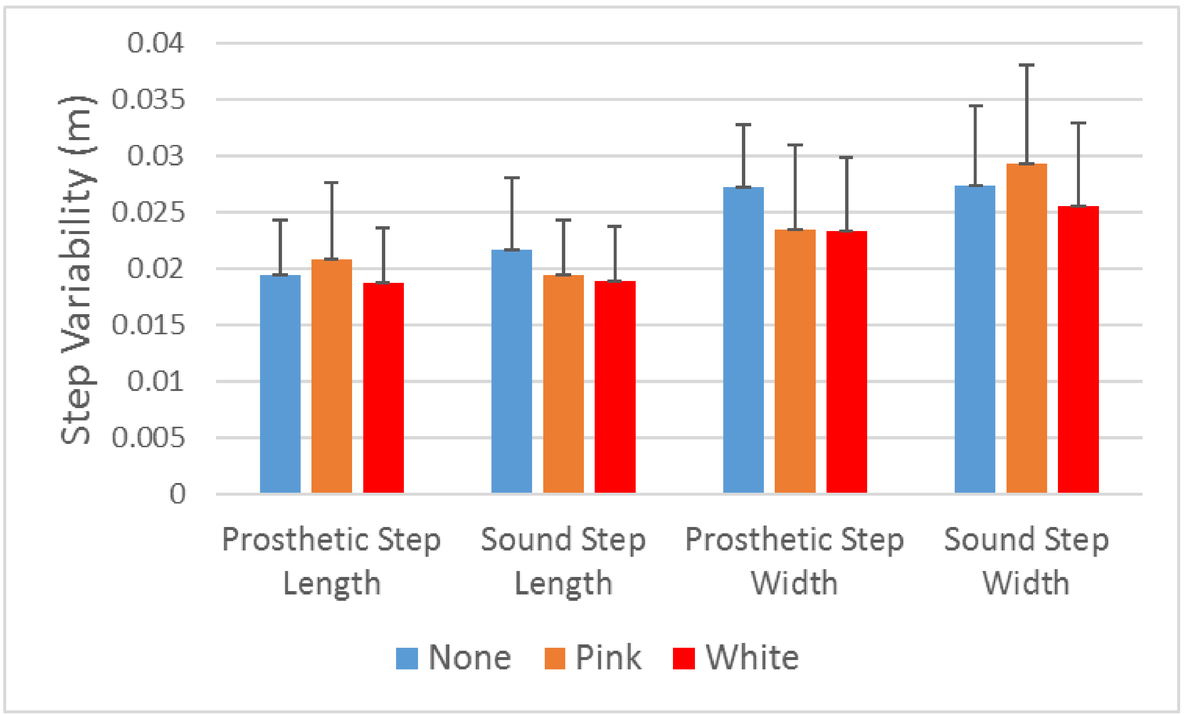


Figure 2: Step length and width variability of both prosthetic and sound leg.

- No significant differences found across conditions. (Figure 2)
- Vibration of thigh doesn't improve walking performance.
- From the variables that were choose, there is high variability among participants, reflecting heterogeneity of group.

CONCLUSION

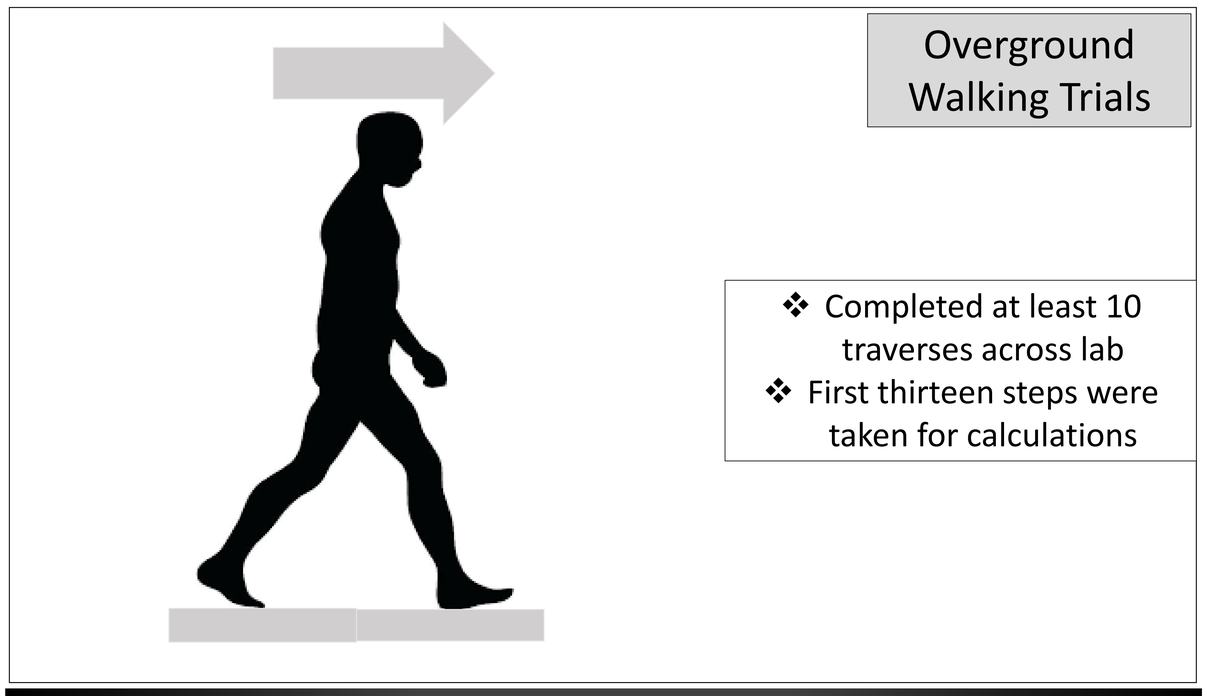
- Vibration of residual limb did not improve overall control of prosthesis from the measures that were analyzed.
- Will look into more possibilities: longer duration of vibration or testing outside laboratory setting in form of an intervention/training.

METHODS

PROCEDURES

- All subjects attended the Biomechanics Research Building for this biomechanical analysis
- Three different vibration conditions were applied: no vibration, pink noise, and white noise.
- All vibrations were applied to the mid-thigh of the affected limb.
- Participants walked across the gait laboratory floor at self-selected pace.
- At least 10 traverses were completed.
- Motion data were captured at 100Hz using Cortex; kinematic data processed in Visual 3D.
- A 1-way Repeated Measures ANOVA was used to compare variables across all three conditions; $\alpha=0.05$.

	Gender	Age (yrs)	Height (m)	Mass (kg)	Amputation etiology
Amputation (n=15)	11M, 4F	59.67 (14.8)	1.79 (0.067)	101.19 (16.3)	Trauma (n=5) Vascular (n=4) Other (n=6)



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