INTRODUCTION

- Metronomes are used as a rehabilitation approach to improve gait in pathologic populations [1].
- These metronomes, however, may not be optimal as they operate on a fixed tempo and healthy walking demonstrates stride to stride fluctuations that have a pink noise type of distribution [2,3].
- Studies show increased brain activation in the prefrontal cortex during high attentional demanding tasks [4].
- It is unknown how walking with a metronome impacts brain activity and if any differences in brain activity occur between different types of metronomes.
- We investigated the response of the brain during walking with 3 different temporally structured metronomes.

HYPOTHESES

- Walking with a metronome would result in increased activity in the prefrontal cortex, which has been previously shown during arm movements with a metronome [5].
- However, walking with a metronome that is constructed temporally using pink noise would show less activation since it is more similar to natural walking.

METHODS

- Figure 1: This figure shows the fNIRS probe used for the study and the schematic of the visual metronome used for the study.
- 13 healthy young adults (25.54 ± 3.79 yrs).
- Footswitches (Noraxon) were worn to determine gait events and were used to determine the synchronization between heel strikes and the metronome.
- Two minutes of treadmill walking with: 1) fixed/non-variable, 2) random/white-noise, and 3) natural/pink-noise visual metronomes (Figure 1).
- 2 minute walking trials were recorded directly before and directly after the metronome trials to determine the baseline blood flow levels.
- Metronome was a continuous visual display attached to glasses (Figure 1).
- Blood flow was measured using a 4x4 functional near infrared spectroscopy (fNIRS) probe (Figure 1).
- Mean oxygenated blood flow was measured in the prefrontal cortex (PFC), supplementary motor area (SMA), and the motor cortex (MC).

RESULTS & DISCUSSION

- The stride times showed no significant differences (p>0.05).
- Significantly higher correlation between stride times and metronome times when walking to the pink-noise metronome (Figure 2).
- All metronomes showed increased brain activity in the PFC when compared to walking without a metronome (Figure 3).
- The increases in the PFC were potentially caused by the dual task nature of walking with a visual metronome [6].
- The pink-noise visual metronome resulted in the largest increase in the PFC, possibly indicating increased attentional demands (Figure 3).
- White-noise metronome showed the highest amounts of activation in both the SMA and MC, suggesting that there is a more active role in motor control when people walk randomly.

CONCLUSIONS

- The higher cross correlation for the pink noise metronome may have resulted in a higher PFC activation.
- The temporal structure of each metronome may result in different attentional demands to achieve and maintain synchronization which are seen primarily in the prefrontal cortex.
- Further research is needed to determine if a pink noise metronome provides a different brain response than a non-variable metronome.

REFERENCES


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