Muscle Response During Multidirectional Interaction with a Variable Damping Controlled Ankle Robot

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Does the implementation of a variable damping controller reduce the muscle activation required to perform 2D planar tasks when compared to current fixed damping methods?

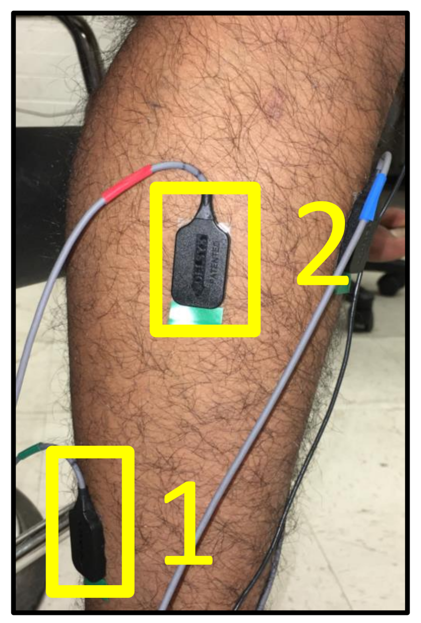
Introduction

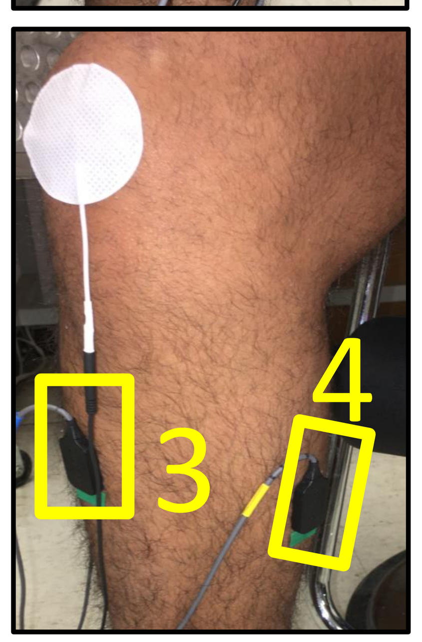
Stability + Agility = Variable Damping ✔

Variable Damping → Greater Muscle Efficiency ?

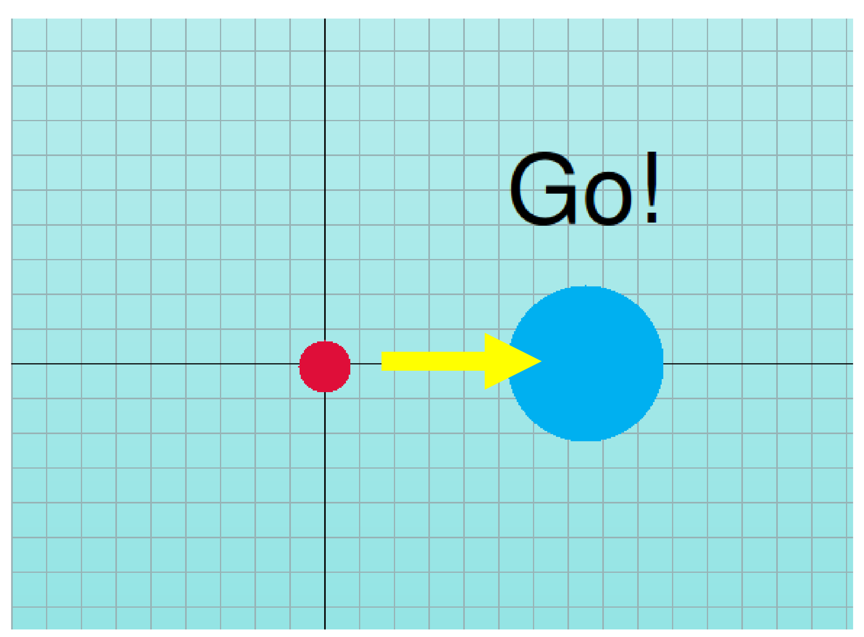
Methods

6 EMG sensors were used on the…





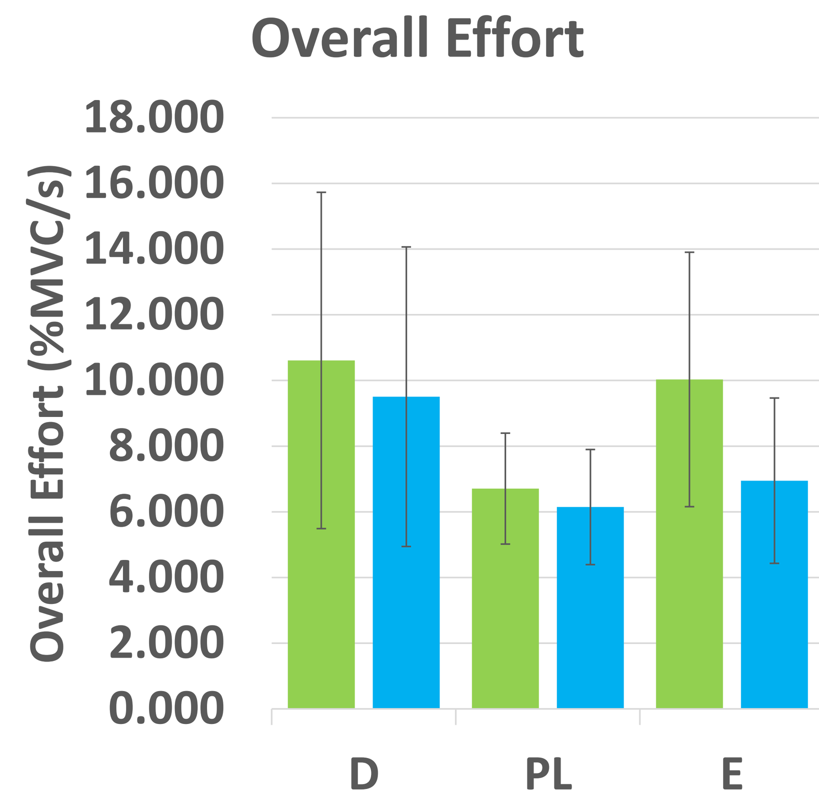
1. Soleus (SL)
2. Peroneus Longus (PL)
3. Tibialis Anterior (TA)
4. Medial Gastrocnemius (MG)

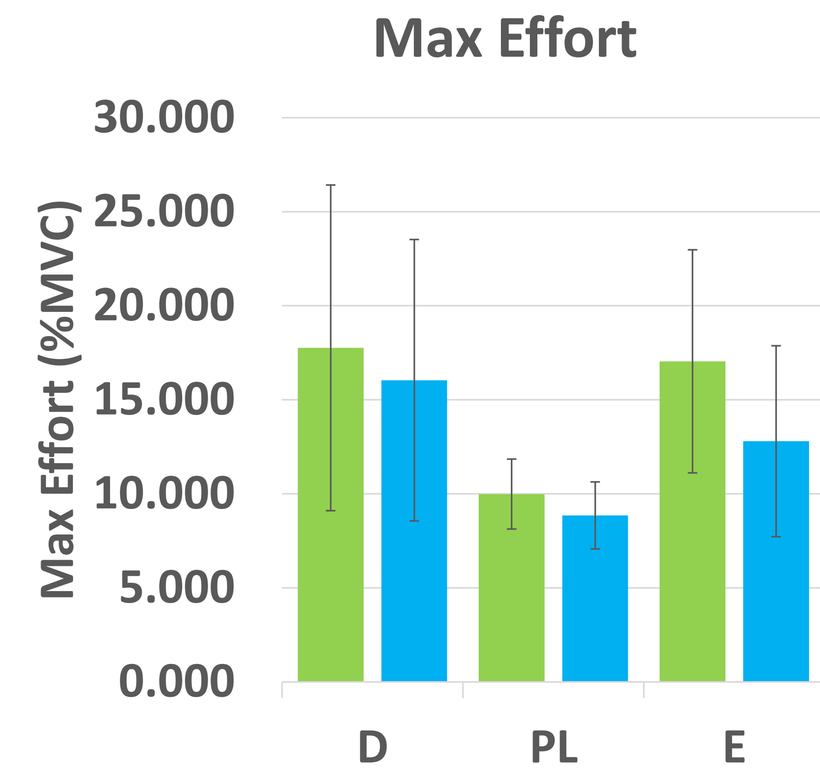


…during physical interaction with **an ankle exoskeleton robot.**

Results

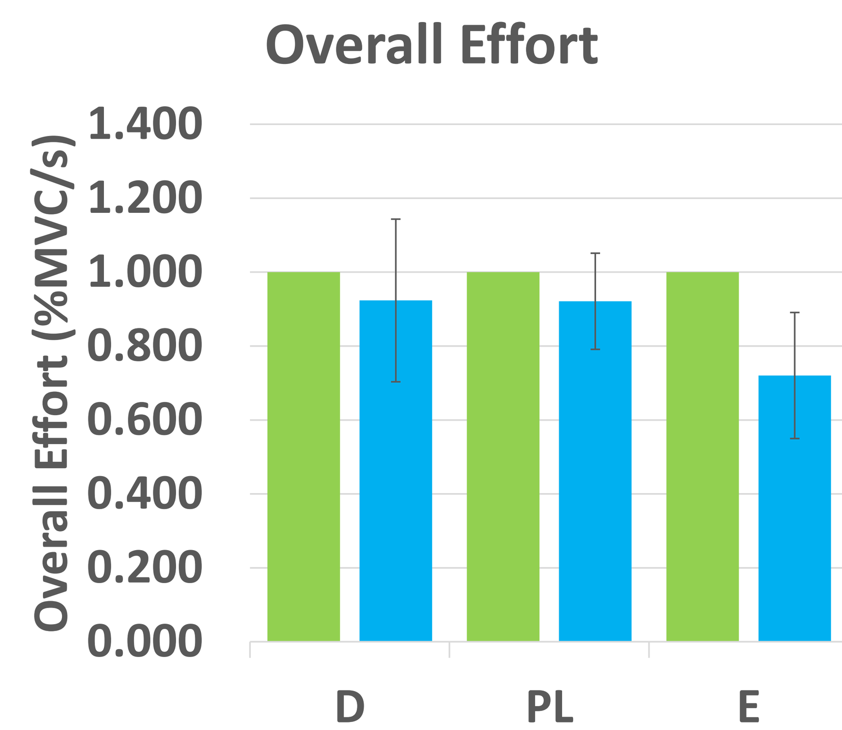
Base Result





The data show a **reduced muscle activation** in the variable damping conditions.

Normalized Result



Conclusions

- The **variable damping controller reduced muscle activation** across all measured movement directions
- These results **support** the use of **variable damping controllers** in exoskeletons
- This is an on-going study

Future Work

- Machine learning algorithms to more efficiently tune the controller gains
- Implementation of variable stiffness in addition to damping (variable impedance)

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