COLLISION WORK PERFORMED BY PATIENTS WITH PERIPHERAL ARTERY DISEASE

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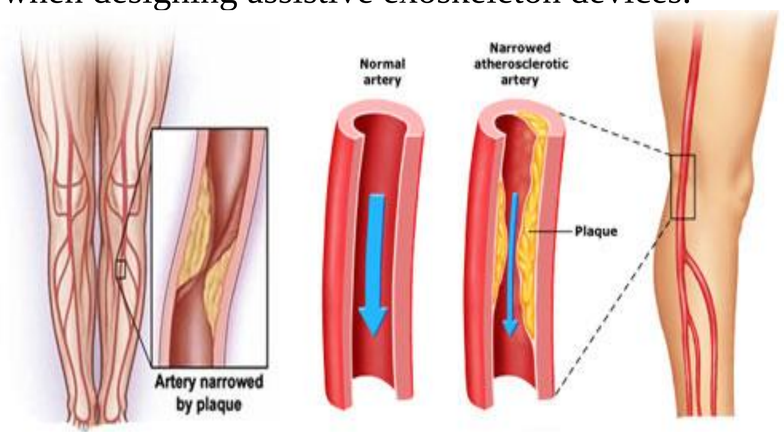
INTRODUCTION

- Collision work is energy dissipated into the surrounding environment from impact, in this case, upon heel strike.
- Research in our laboratory has found that patients with PAD exhibit abnormal gait, including consistently reduced plantarflexor torque [1].
- When designing an exoskeleton for patients with peripheral artery disease (PAD), harvesting energy lost to collision work could be a valuable mechanism to improve walking performance.
- Devices designed to utilize the normally dissipated energy to assist propulsion for improved walking performance are under-explored [2, 3].

PURPOSE

- The purpose of this study was to assess the validity of healthy, older individuals as a model for patients with PAD for fundamental research comparisons when designing assistive exoskeleton devices.



METHODS

- Subjects were age-matched, 67.4 ± 9.5 years
  - Patients with PAD, n=15
  - Healthy controls, n = 5

METHODS (continued)

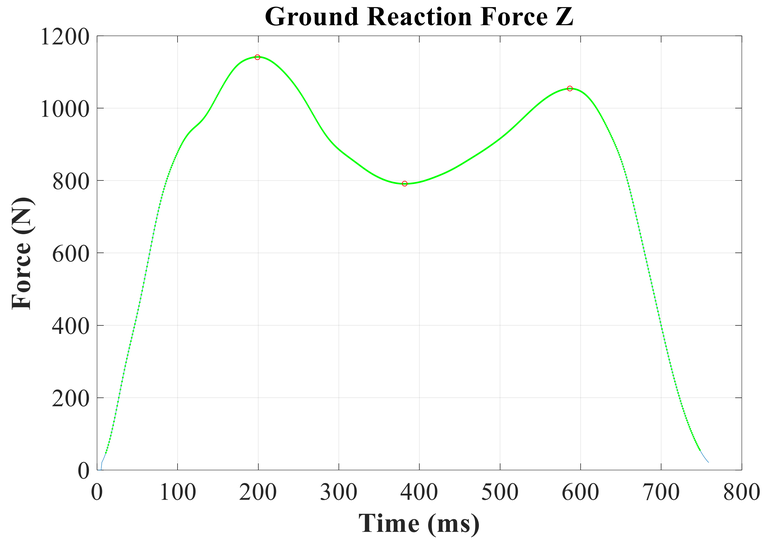


Figure 1. Vertical ground reaction force from a patient with PAD.

Resultant Collision Work [5] =

$$\sqrt{(V_x * F_x)^2 + (V_y * F_y)^2 + (V_z * F_z)^2}$$

- F = Ground reaction force value corresponding to the first peak of its corresponding coordinal axis curve
- V = average heel velocity over 0.04s period before heel strike
- Statstics consisted of a student's t-test

RESULTS

- Collision work performed by patients with PAD was not significantly different from control subjects (t = 0.73, p = 0.47).
- Average collision work and ankle power at push-off for patients with PAD was 2.54±0.83 and 1.99±0.50 watts/kg respectively.
- This allows for appropriately powered subject recruitment, and creates a wider impact for exoskeleton research dedicated to collision work.

RESULTS (continued)

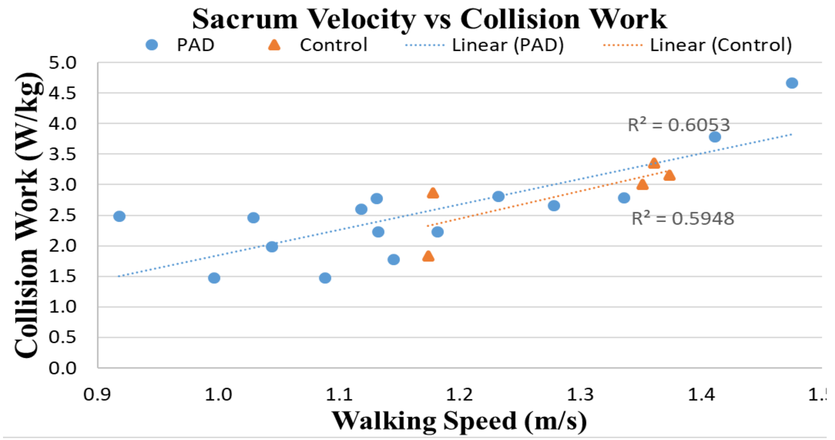


Figure 2. Estimated preferred walking speed is strongly correlated to collision work with no significant difference between patients with PAD and controls.

CONCLUSION

- Healthy, older subjects are an appropriate model to study collision work outcomes for comparison to patients with PAD.
- These analyses showcase the importance of maintaining a consistent walking speed when assessing the walking performance outcome measures for an exoskeleton device.
- This allows for appropriately powered subject recruitment, and creates a wider impact for exoskeleton research dedicated to collision work.

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