

Soft Exosuits Increase Walking Speed and Distance after Stroke

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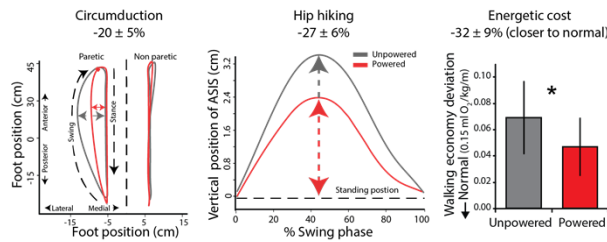
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Background

We have developed soft robotic exosuits made from garment-like, functional textiles and cable-based transmissions.



Previously, we showed that *tethered* exosuits actively assist parietic limb propulsion and ground clearance, improving:

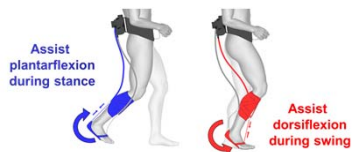


Objective & Methods

To evaluate the effects on overground walking function after stroke of assisting the parietic ankle with an exosuit.

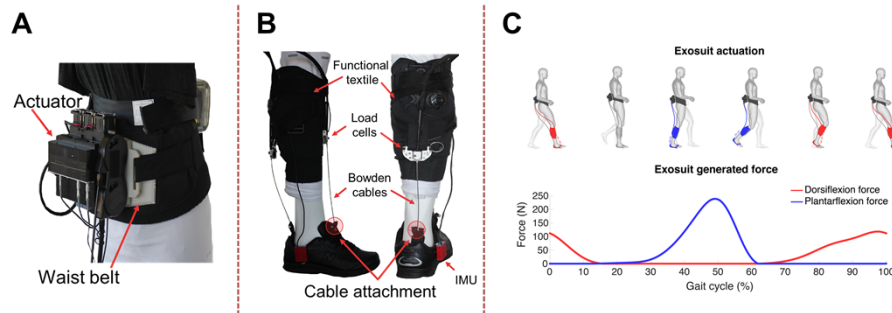


- Seven participants with chronic stroke
- Three outcomes were evaluated:
 1. Speed (10mWT)
 2. Distance (6MWT)
 3. Economy (ml/kg/m)
- Two visits tested two conditions:
 1. No Suit vs. Suit Unpowered
 2. Suit Unpowered vs. Suit Powered



Gait-Restorative Assistance

Exosuit operation: Actuator-generated forces (**A**) are transmitted via Bowden cables to functional textiles that span the parietic ankle joint (**B**) to assist plantarflexion and dorsiflexion during walking (**C**).



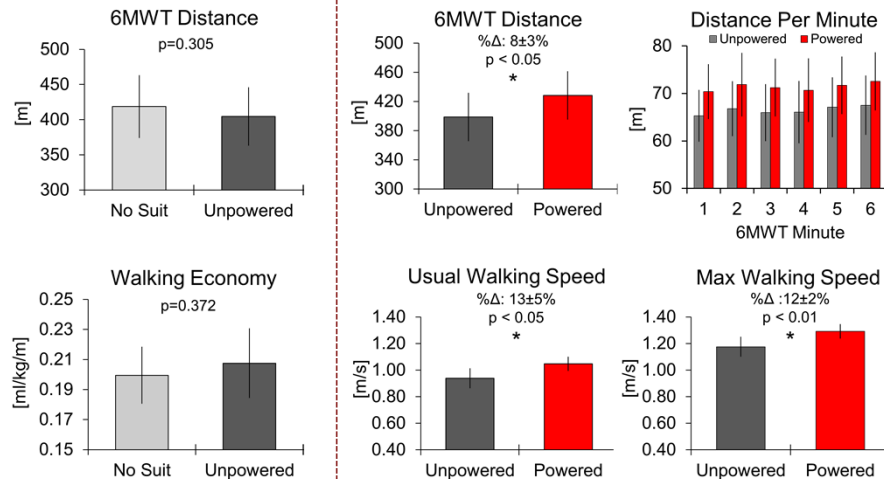
Conclusions

- Wearing an exosuit unpowered (vs. no suit) minimally influences walking economy and function.
- Walking with an exosuit powered (vs. unpowered) and assisting ankle dorsiflexion and plantarflexion improves walking.
- Participants improved usual and maximum walking speeds.
- Participants were able to sustain this walking speed increase for at least six minutes.

Results

Visit 1 Goal: To quantify the effects on walking function and economy of an unpowered exosuit.

Visit 2 Goal: To quantify a powered exosuit's effects on long- and short-distance walking function after stroke.



Clinical Translation



In collaboration with **ReWalk Robotics**, exosuits will be translated to the clinic, offering a new opportunity for targeted gait assistance.

Acknowledgements



References

- Awad LN, et al. A soft robotic exosuit improves walking in patients after stroke. *Science Translational Medicine*. 2017 Jul 26;9:eaai9084.
- Awad LN, et al. Reducing circumduction and hip hiking during hemiparetic walking through targeted assistance of the parietic limb using a soft robotic exosuit. *Am J Phys Med Rehabil*. 2017 Oct;96:S157-S164.