# IMPROVING POSTSTROKE WALKING WITH A SOFT EXOSUIT: A POTENTIAL PLATFORM FOR COMMUNITY-BASED NEUROREHABILITATION

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**OBJECTIVES:** Conventional neurorehabilitation approaches after stroke have had limited success restoring walking function. Compensatory gait patterns often underlie the gains observed. Our goal was to determine the feasibility of improving poststroke gait economy and stability, impaired features of poststroke gait optimized during healthy walking, using soft wearable assistive systems suitable for use in free-living settings.

**METHODS:** We built an active assistive device that interfaces to the paretic limb of persons poststroke through non-rigid, lightweight materials (Fig. 1) and delivers assistive joint torques in parallel with the impaired paretic dorsiflexor and plantarflexor ankle musculature. A soft, human-machine interface allows the device to assimilate to the different phases of gait and movement intentions of the wearer, influencing mobility only when desired—a critical feature for community-based assistive systems that is not achievable using a rigid interface. We hypothesized improvements in the energy cost of walking (EC) and walking stability (WS), respectively measured as mass-normalized oxygen consumption per meter ambulated (ml $O_2$/kg/m) and the stride time coefficient of variation (calculated as SD/Mean×100). The sensitivity of these effects to plantarflexion assistance timing (early versus late onset) was also evaluated. Specifically, six participants >6mo after stroke completed two testing sessions, one evaluating each plantarflexion timing. Each session consisted of two 8-minute treadmill walking bouts, one assisted and one unassisted, set to participants' baseline, overground comfortable walking speeds.

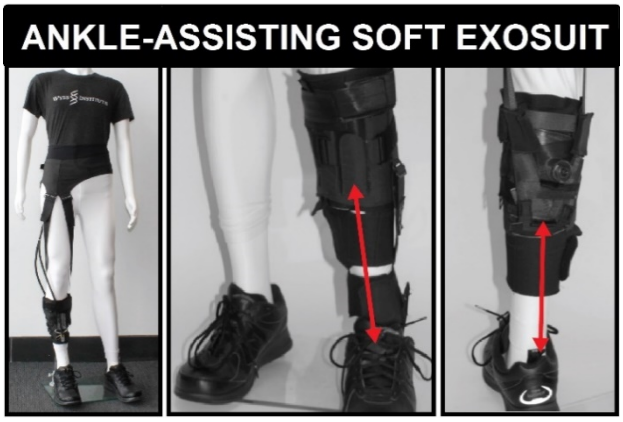


**Fig 1.** Assisting paretic limb propulsion and ground clearance with a soft exosuit.

**RESULTS:** Exosuit-induced improvements in EC (12±2%, p=0.01) and WS (15±5%, p=0.03) were observed. The better of the two plantarflexion timings varied across participants. Participants' "non-preferred" timing was not effective (p's>0.05).

**CONCLUSIONS:** This is the first demonstration of the feasibility of improving gait stability and economy after stroke using a soft, wearable active assistive device. The innovative use of only non-rigid, lightweight, and unobtrusive materials makes the device extremely compatible with community-based neurorehabilitation efforts.