A Brake-based Over-ground Gait Rehabilitation Device for Increasing Paretic Propulsive Force

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***Abstract*— The ability to generate propulsion force is a key component in producing forward progression while walking in healthy adults [1] and adults with stroke [2]. After stroke, muscles in the paretic leg that generate propulsion are weakened [2]. This often results in propulsion asymmetry, wherein the paretic leg produces less propulsion force compared to the non-paretic leg [3]. Reducing propulsion asymmetry after stroke leads to improvements in walking speed [2-3]. This demonstrates a promising approach to improving functional mobility post stroke. Reducing propulsion asymmetry requires propulsion to be increased on the paretic leg while simultaneously maintaining or reducing propulsion in the non-paretic leg. Due to the bilateral nature of walking, training propulsion in only one leg presents a challenge. We introduce a novel gait rehabilitation device, the gait propulsion trainer (GPT), which is designed to periodically resist forward motion, only when the paretic leg is in the propulsion generating phase of gait (mid to late stance phase). The GPT is comprised of three main components (figure 1): (1) a lightweight harness worn around the pelvis of a participant; (2) a stationary unit that houses a rotary brake and cable spool; and (3) a cable that connects the harness to the cable spool. Event switches placed under the shoes of participants allow the monitoring of gait phase information and ensure that resistance to forward motion is applied only during mid to late stance of the paretic leg. When the participant enters mid stance with the paretic leg, the brake turns on, creating tension on the cable and requiring the participant to push off the ground harder to maintain forward motion. We present a pilot study involving one healthy participant walking with GPT resistance applied to a randomly selected leg. The purpose of this pilot study was to investigate whether the GPT could unilaterally increase propulsion as predicted. We hypothesized that the GPT would increase propulsion forces exerted by the resisted leg (the leg selected to experience GPT resistance) while the unresisted (contralateral) leg's propulsion force would remain constant.**

Keywords—Gait rehabilitation, leg propulsion, unilateral resistance, stroke, over-ground walking.

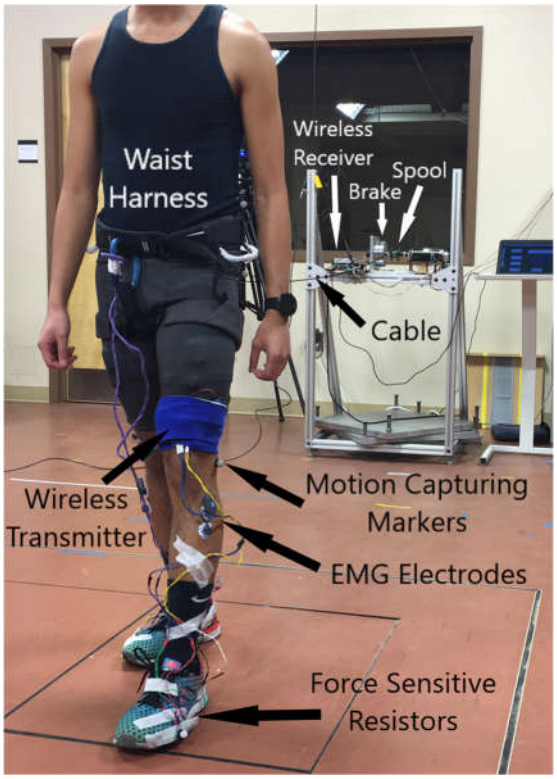

Fig. 1. The gait Porpulsion Trainer (GPT).

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