ABSTRACT

A NOVEL PEDALING PARADIGM TO IMPROVE LOWER LIMB MOVEMENT POST-STROKE

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Marquette University, 2024

Prior work in our lab revealed that while impaired paretic neuromuscular output contributes to movement difficulties post-stroke, compensation is more related to interlimb coordination (ILC) deficits. Specifically, ILC deficits were revealed in the context of lower limb split-crank pedaling. Participants who demonstrated larger levels of compensation during a conventional, solid-crank pedaling task also demonstrated larger deficits in ILC i.e. maintaining a 180-degree phase relationship during split-crank. To address this deficit, our lab created a novel, split-crank pedaling robot named CUped. CUped (pronounced Cupid) is so called because it compels use of the paretic limb during a movement that resembles pedaling. CUped can create a training environment where ILC can be practiced while emphasizing output of the paretic limb. The purpose of this dissertation was to determine appropriate robotic control schemes and visual feedback methods for CUped.

To achieve this purpose, we evaluated ILC, paretic work output, and velocity pedaling strategy during split-crank pedaling. Aim 1 investigated three proportional control schemes: Assist, Resist, and Assist+Resist. Control schemes provided torque to restore 180-degree phasing proportional to the phasing error. Assist provided forward-direction torque to the lagging limb while resist provided reverse-direction torque to the leading limb. Assist+Resist provided both