Changing Spinal Inhibition to Improve Gait in Individuals After Stroke

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Stroke is a leading cause of serious long-term disability in the United States. A major functional problem experienced by individuals with post-stroke hemiparesis during walking is trip-related falls, resulting from insufficient toe clearance during swing phase of walking. In the non-impaired individual, muscle and reflex activity are modulated relative to the phase of the walking/gait cycle. Specifically, when the dorsiflexor is active, the antagonist plantarflexors are reciprocally inhibited, allowing successful toe clearance during the swing phase. Following stroke, due to poor descending control, loss of reciprocal inhibition leads to inappropriate paretic plantarflexor activity, where hyperactive plantarflexors interferes with weak paretic dorsiflexors resulting in foot drop and inappropriate timing compromises propulsion during walking. Thus, individuals post stroke walk less efficiently, at slower walking speeds, with a less symmetrical walking pattern due to development of strategies to compensate for insufficient toe clearance, and thus are at higher risks for trips and falls. The objective of this proposed study is to explore the potential therapeutic application of operant conditioning to restore a more functional spinal circuitry post-stroke, improve walking in individuals post-stroke. This will be the first study to examine the effects of operant conditioning on the Group IA mediated reciprocal inhibitory pathway in the stroke-impaired nervous system. Once we successfully demonstrate that following operant conditioning in individuals post-stroke, appropriate reciprocal inhibition can be restored with improved locomotor control, we will have evidence to support the development of effective targeted interventions for post-stroke foot-drops, and hence reduce the occurrence of trip related fall injuries post-stroke.