Use of Kinetic Orthosis with Post-Stroke Male  
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INTRODUCTION  
To actively assist ambulation for persons with disabilities, much work has been done in the area of powered exoskeletons. These devices consist of an external support structure with powered, articulated joints and are touted to provide unbridled potential as assistive devices for the mobility-impaired. However, they require expensive and bulky actuators and power supplies that limit their ability for widespread use.  

Instead of using expensive robotic systems, it may be beneficial to borrow from nature to improve mobility for people with disabilities. Inspired by equine anatomy where long tendons span multiple joints to facilitate elastic energy exchange and enable efficient walking and running, van den Bogert developed a computational model that showed parallel elastic structures stretching from the hip to the ankle of humans could reduce the muscular effort required to walk (van den Bogert, 2003). In this study, we explore the ability of a physical system with parallel elastic structures called a kinetic orthosis to improve mobility for a man recovering from a stroke.

METHOD  
Subjects: A sixty-four-year-old male 3 months post-stroke presenting with left-side hemiparesis gave informed consent to participate in this study.  
Apparatus: An optical motion capture system (Motion Analysis, Santa Rosa, CA) was used to measure walking velocity and cadence.  
Procedures: Five walking trials at a self-selected walking velocity down a ten meter path were completed with and without the kinetic orthosis. The subject used a four-pronged cane in both conditions and was given a five-minute accommodation period before beginning the kinetic orthosis condition.

RESULTS  
The key results are that the subject was able to walk faster and with a higher cadence with the kinetic orthosis than without. Walking velocity increased 29.7% (.248 m/s without vs. .336 m/s with) when using the kinetic orthosis. Additionally, cadence increased 8.1% (62.0 steps/min without vs. 67.3 steps/min with) when using the kinetic orthosis.  

Anecdotally, the subject reported several findings. First, he felt the kinetic orthosis improved his balance. Second, he felt the device helped him lift and advance his impaired leg. Lastly, he remarked that when he walked with the kinetic orthosis it was the best he had walked since he had his stroke.

DISCUSSION  
The main findings of this study are that the kinetic orthosis was able to immediately improve walking speed and cadence for a man three months into his rehabilitation. This is an important clinical finding given that walking velocity early in the rehabilitation process is a strong predictor of functional outcomes with faster velocities predicting community ambulation rather than simply household ambulation (Holden et al., 1984). Future work will explore these findings with more subjects, more diagnoses, and with longer term use of the kinetic orthosis.

REFERENCES  