Orthotics and Prosthetics

Biomechanics of Uphill Walking Using Custom Ankle-foot Orthoses (AFO) of Three Different Stiffnesses

AFOs can provide support and improve walking ability in individuals with plantarflexor weakness. Passive-dynamic AFO stiffness can be optimized for over-ground walking. However, little research exists for uphill walking, when plantarflexor contributions are key. Researchers at CRSR at USUHS compared uphill walking biomechanics in dynamic AFO users with unilateral-limb salvage across different AFO stiffnesses to determine optimal AFO stiffness. AFO users experienced less ankle motion and power generation, lower knee extensor moments, and greater hip flexion and power generation than non-users during uphill walking at a 10° incline. Despite these deviations, they walked at equivalent self-selected velocities and stride lengths. Asymmetries were present at the ankle and knee with decreased ankle motion and power, and lower knee extensor moments on the AFO limb. Stiffer AFOs increased knee joint flexion, but a 40% range in AFO stiffness had few other effects on gait. Therefore, a wide range of clinically prescribed AFO stiffness may adequately assist uphill walking. A publication documenting this study is currently in press.