Bench Test Validation of a Carbon Infused Polypropylene Posterior Leaf Spring Ankle Foot Orthosis

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The posterior leaf spring ankle foot orthosis (PLS AFO) is a unique lower limb orthosis used to assist dorsiflexion during swing phase to ensure toe clearance and limit falls. The design of the orthosis has changed over time with use of different materials, fabrication techniques, and trim lines. In this study, a new material consisting of a carbon-infused polypropylene composite was tested against the standard homopolymer polypropylene for a PLS AFO. Nine orthoses were fabricated with three varied ply discontinuous carbon-fiber infused polypropylene (three orthoses per carbon ply material) and three homopolymer polypropylene orthoses served as the control. Each orthosis was tested in a motorized testing device that measured resistance to torque as the orthosis was cycled through dorsiflexion and plantarflexion. The PLS AFOs fabricated with carbon-infused polypropylene composites demonstrated more dynamic mechanical properties, as indicated by increased stiffness and decreased index of hysteresis, than standard homopolymer polypropylene orthoses.