

ArmAssist: A Lightweight, Concealable Active Arm Support That Empowers Victims of Muscular Atrophy

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Muscular Atrophy severely restricts an individual's ability to conduct Activities of Daily Living (ADLs), with 70% of Muscular Dystrophy patients requiring the aid of a caretaker or an orthotic to undertake ADLs. To assist victims of muscular atrophy, a wearable apparatus was developed with the goal of creating a slim, lightweight powered orthotic. Three primary device actuators were tested with the goal of optimizing size and weight: a Twisted and Coiled Polymer (TCP) Artificial Muscle design wrapped around a mandrel (AM 1), a supercoiled TCP Artificial Muscle (AM 2), and a DC motor with a gearbox reducer. AM 2 outperformed AM 1, generating a torque within two standard deviations of AM 1 while weighing less than half its weight (0.22 g, 0.5 g). The force of AM 2 was then extrapolated to compare the lifting force of the constructed elbow brace with 35 AM 2s running in parallel and with the DC motor serving as actuators. The mean lifting force of AM 2 was within two standard deviations of that of the DC motor, a considerable feat considering that the combined weight and volume of the 35 muscles were 2.6% and 5.7% of those of the DC motor. Thus, AM 2 yielded a lifting force similar to that of a mainstream actuator in a smaller, lighter package. The implementation of AM 2 has the potential to create a new generation of ultra-lightweight orthotics with potential applications in the medical, defense, and manufacturing industries.

Awards Won:

Fourth Award of \$500