A Portable Tricep Support Exosuit Built From Soft Pneumatic Actuators

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Overhead work, performing work with the hands and arms above shoulder level, is common in various professions. However, overhead work is strongly linked to musculoskeletal disorders, impaired circulation, and more. In 2018 alone, the US Bureau Labor of Statistics found 335,390 work-related musculoskeletal disorders (WRMSDs), causing 900,380 days away from work and costing $171 billion. In order to prevent such injuries and their consequences, this project constructed a compliant, lightweight, cost-effective portable tricep support exosuit from soft pneumatic actuators that provides additional torques to the tricep to support the arm upwards. A soft pneumatic actuator was created from hermetically sealing thermoplastic polyurethane film (TPU) into an air-inflatable pouch. Couplers that were attached to tubes were inserted into the TPU pouch for air inflation. The TPU pouch was encased in a smaller inextensible Nylon Oxford fabric, which prevented the TPU from bursting at high pressures due to its high tensile strength. The exosuit was then tested by recording how much torque it generated at different angles and various air pressures with a torque sensor. At 90 degrees and 30 PSI, the exosuit generated 15.39 Nm, which is greater than the maximal torque a human palm can apply of 4Nm - 9Nm. The exosuit generating 15.39 Nm is equivalent to applying 123 N of force and supporting 27 lbs, which is heavier than what is considered very heavy work by the US Bureau Labor of Statistics, demonstrating that the exosuit provides adequate support for overhead work to decrease WRMSDs.