

# Multi-functional Pneumatic Wearable Soft Rehabilitation Glove: A Novel Rehabilitation Device to Integrate Fingers and Wrist Function Utilizing Double-layer Soft Actuators

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The rehabilitation needs of hemiplegic patients have attracted great attention at home and abroad. According to the shortcomings of current rigid or soft hand rehabilitation devices, a novel multi-functional pneumatic wearable soft rehabilitation glove utilizing double-layer soft actuators with extensible bending characteristics was designed and manufactured, which was suitable for collaborative rehabilitation training of fingers and wrist and also assisting patients to complete grasping actions. It has many advantages: compatible deformation with human-body, better rehabilitation training effect, lighter, safer, strong adaptability, low cost. The glove is mainly composed of five double-layer segmented hollow soft fingers, one double-layer hollow soft upper wrist, one double-layer hollow soft lower wrist and control system. The segmented soft fingers and wrists are made of elastomer and textile materials. They fit better with human-hand. The pure soft glove weighs 0.45kg. Filling air, the rehabilitation training and grasping action can be realized. Experiments showed the following results. Wearing the glove, when the air pressure was 130kPa, the maximum bending angles of four soft fingers, the soft thumb, the soft upper wrist and lower wrist reached 90°, 110°, 60° and 40°, respectively. Compared with requirement of rehabilitation training (8 times/minute), the bending/stretching times of four soft fingers, the soft thumb, the soft upper wrist and lower wrist were up to 37.5%, 125%, 37.5%, 12.5% improvements, respectively. It can grasp objects as heavy as 1kg. This project has great research and application value, especially in medical fields (hand dysfunction caused by central and peripheral nerve injury, stroke, brain injury).