An Auxiliary Rehabilitation Device for Parkinson's Patients With Finger Muscle Tremors and Stiffness

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Parkinson's patients often encounter challenges like irregular finger tremors and stiffness. Recent research has underscored the potential benefits of rehabilitation training, crucial for restoring active mobility through passive finger movement and enhancing flexibility. This auxiliary rehabilitation device innovatively aided patients with three key features: bending training, diagnostic tremor rating, and life assistance. The design underwent thorough theoretical research on Extensible Pneumatic Muscles (EPM), focusing on bending structure design. The relays and air pumps in the device, controlled by a microcontroller, effectively managed the inflation and deflation of the EPM structure on each finger. This capability actively guided finger during bending training, achieving a maximum flexion angle of 70 degrees with the deviation less than 10%. Additionally, the device evaluated recovery status by analyzing changes in the maximum flexion angle during the patient's self-training finger movements over time. Equipped with an accelerometer, it aided in rating the patients' finger tremors, enabling at-home monitoring. Moreover, the device extended its functionality to life assistance, often utilized to prevent inadvertent actions by restraining trembling fingers from unintentionally clicking the mouse during movement. Features were proven to be efficient through several experiments conducted. Meanwhile, user safety was ensured by examining the correlation between the EPM bending angle and speed, and the force applied to the patient's fingers. Incorporating a mobile app allowed users to connect to the equipment using Bluetooth protocol, leveraging portability and mobility to enhance the overall convenience and efficiency of the rehabilitation process for patients.

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