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USER NEEDS ANALYSIS OF CUSTOMIZABLE ROBOTIC EXOSKELETON FOR POST-STROKE PATIENTS

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Background: Flexor hypertonia, one of the most common symptoms in stroke affects flexors and indirectly affects the antagonists- the extensors, which plays an important role in ADL; e.g. wrist extension and fingers grasped, eating, bathing, holding a door-knob or glass of water etc. Commercially available devices focus on shoulder-elbow movements instead of distal-joints, which contribute a lot to ADL. Robotic-exercise therapy offers potential for recovery but are inherently large and demand a semi-permanent or permanent set-up with trained staffs for handling it and are highly expensive, are accessible to less patients and compel for everyday hospital visits.

Material & Methods: We have designed low-cost, portable, 3D printed, brain computer interface hand exoskeleton for upper limb rehabilitation of stroke patients at the Indian Institute of Technology (IIT) Delhi. It focuses on flexion and extension of wrist and fingers in functional pattern to improve Activities of Daily Living (ADL) and reduce spasticity. It is user friendly, patient-specific, muscle-activity controlled. CAD-model of linkages were printed using fused deposition modeling. The embedded-system and control-mechanism allow device to be active-assist with adaptive visual performance-feedback. The Institutional Review Board (IEC/NP-99/13.03.2015) approved the study.

Results: Two hours of testing with robotic device was done on each patient for taking subjective questionnaire feedback and System Usability Scale (SUS) from six patients with chronic-stroke to assess usability. Average SUS score of 81 indicates high acceptance across patients. It allows easy don and doff individually by the patient with time as minimum as 48 and 23 seconds respectively. Device is low cost, lightweight and portable.

Conclusion: It might help faster recovery and prove to be home based rehabilitation device.



Note: