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Safety, Feasibility, and Effectiveness of At-Home Exoskeletal Device for Stroke Rehabilitation: A Tele-Health Approach

Topic: Robotics

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BACKGROUND

Many investigations have shown that technology-assisted upper extremity training improves activities of daily living in individuals with neurological impairments. The goal of this presentation is to report the preliminary findings of the safety, feasibility, and effectiveness of a novel upper-limb exoskeleton training program designed for home use in persons with chronic stroke in comparison to the Bobath-based training.

METHODS

Participants were randomly assigned to either the Bobath group (BG, n = 12) or the exoskeleton group (EG, n = 12). EG training consisted of active and active-resistive movements with the ExoRehab X device that allowed to isolate movements to single-joint on elbow flexion/extension, forearm pronation/supination, wrist ulnar/radial deviation, and wrist flexion/extension. The exercises for BG included bilateral upper extremity movement, external arm rotation in horizontal abduction, weight transfer to the affected arm, shoulder mobilization, and arm control training against antigravity. The interventions were conducted twice a week for six weeks, with the length of each session and the total number of sessions being matched. The change in Fugl-Meyer Upper Extremity (FMA-UE) from pre-intervention was the main result. The Nottingham Extended Activities of Daily Living (NEADL) index, the Motor Activity Log-30, which is divided into two sections: amount of usage (AOU) and quality of movement (QOM), and the Modified Ashworth Scale (elbow and wrist flexor muscles with one-point change as minimal clinically important difference (MCID)) score were secondary outcomes.

RESULTS

The mean (SD) FMA-UE score improved by 5.7 ± 2.9 points in the EG and 1.9 ± 1.5 points in the BG following 12 training sessions ($p < 0.05$). None of the participants in the Bobath group achieved an MCID score, although 40% of participants (5/12) showed a clinically significant improvement (≥ 5.25 points) on the FM-UE overall. AOU, QOM, and NEADL changes were substantially greater in the EG than in the BG ($p < 0.05$). Clinically significant change was observed in 7/12 (58.33%) of AOU individuals and 5/12 (42%) of QOM participants in the EG. In the EG, five out of 12 participants (42%) showed a ≥ 4.9-point rise in their NEADL score.

CONCLUSION

In a cohort of participants with chronic stroke, exoskeleton-assisted training may reduce upper limb impairment more than Bobath-based training.

Statement of Disclosures

None

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