
Abstract: Study examined whether repetitive practice with finger extension assistance in a virtual environment could improve hand function in stroke survivors with chronic upper-extremity hemiparesis. Participants received six weeks of training in reach-to-grasp of virtual and actual objects after being randomly assigned to one of three groups: finger extension assistance provided by cable orthosis, assistance provided by pneumatic orthosis, or no assistance provided. Hand performance was evaluated before, after, and 1 month after training using the Wolf Motor Function Test (WMFT), the Box and Blocks Test (BBT), the upper extremity Fugl-Meyer (FM) test, and the Rancho Los Amigos Functional Test of the Hemiparetic Upper Extremity (RLA). Biomechanical assessments included grip strength, extension range of motion and velocity, spasticity, and isometric strength. Participants in all three groups demonstrated a significant decrease in time to perform functional tasks as measured with the WMFT, an increase in the number of blocks successfully grasped and released during the BBT, and an increase for the FM score. There were no changes in time to complete tasks on the RLA or any of the biomechanical measures. Assistance of extension did not have a significant effect in this study.


Abstract: Examined aspects of usability in a virtual reality driver rehabilitation (VR-DR) system among 20 individuals with traumatic brain injury (TBI), 13 with stroke, and 21 healthy control subjects. The VR-DR is a computer-based system that uses a head-mounted display unit to virtually present a driving environment through which users can drive using a commercially available steering wheel and foot pedal. In addition to visual feedback, the VR-DR provides auditory and tactile feedback and allows the presentation of different driving challenges. All participants were administered the VR-DR and completed the VR-DR User Feedback Questionnaire. To examine group differences, a one-way analysis of variance was performed, comparing the user feedback total score between the three groups. Results indicated that the healthy control group reported significantly more favorable VR-DR ratings than both the TBI group and the stroke group. A standard multiple regression analysis revealed that age was the only significant participant factor that contributed to the differences in user feedback ratings. Finally, consistently across the three groups, as users’ discomfort increased, the likelihood of simulation sickness increased.


Abstract: Article describes the use of safe-laser technology to increase head movement in 6 individuals with locked-in syndrome due to brainstem stroke. When invited to participate in the study, none of the subjects were able to speak and none were able to use an augmentative and alternative communication (AAC) device. All subjects communicated using eye movements, eye blinks, dependent scanning with eye movements signal eye movements, eye blinking, dependent scanning with eye movements signal eye movements, eye blinking, dependent scanning with eye movements. Following intervention with the safe-laser access technology, 3 of the 6 participants developed head movement sufficient to control AAC technology.


Abstract: Article examines the role of applied robotic forces in improving arm motor function following stroke by comparing results from studies involving the Assisted Rehabilitation and Measurement (ARM) Guide and the Mirror Image Movement Enabler (MIME) robotic trainers. The key finding was that subjects who participated in non-robotic therapy (unassisted reaching in the ARM Guide study or conventional rehabilitation therapy in the MIME study) and subjects who received active assistance from the ARM Guide did not improve their reach extent. Only subjects who received movement training with the MIME improved their reach extent. The results suggest that requiring the subject to generate specific patterns of force before allowing movement is more effective than mechanically completing the movements for the subject.
Virtual Reality-Based Assessment Tool for Spatial Neglect Following Stroke

Vivek Katelyn, PhD (H133F080010) led by Vivek Katelyn, PhD. A. Cate Miller, PhD, Project Officer.

Abstract: This project develops a wearable/portable robotic device, IntelliStretch, to perform therapeutic rehabilitation of the arm with the following three integrated steps:

1. Stretching a spastic/stiff joint to its extreme position under intelligent control to loosen the stiff joint, (2) voluntary movement training using virtual reality games interfaced with assistance/resistance control when needed, and (3) quantitative outcome evaluation. IntelliStretch is first modified for wearable design to improve portability and functionality. Second, in order to motivate/facilitate patients in motor-function recovery, voluntary movement training by playing virtual reality games is added. Finally, the outcome of the robotic treatment is evaluated quantitatively in terms of the biomechanical and neuromuscular properties of the joint. The IntelliStretch device facilitates the delivery of healthcare services to remote locations, such as patients' homes and local clinics, and, thus, enables an increased number of patients to receive effective treatment and outcome evaluation conveniently while enabling the games.

Current Literature - Selections from REHABDATA


Abstract: This journal issue contains articles that reflect the topics presented at the State of the Science Conference on Strategic Development of Products and Environments for People with Strokes. Topics include: the Chicago perspective on design for the disabled, creating engaging experiences for rehabilitation, the role of people with disabilities in the design process, the design of a progressive building constructed by an independent living center, a new model for universities and companies to work together to meet the needs of 50+ consumers, and creating more desirable products for stroke survivors, designing an accessible waterfront park, designing the experience of health care, and the design and development of a robotic overground gait and balance therapy device. In addition, several articles illustrate the products and process of design for stroke survivors conducted in an undergraduate engineering design class at Northwestern University. Individual articles are available for document delivery under accession numbers J54320 through J54335, J54987, and J55003.


Abstract: Article presents the results of a follow-up survey conducted with subjects who participated in a study in which they reported a preference for a new passive arm orthosis training system called Therapy Wilmington Robotic Exoskeleton (T-WREX), compared to conventional self-directed tabletop exercises to improve arm movement and hand function after stroke. T-WREX has 4 main features: (1) a passive, gravity-balance arm support that allows a wide range of arm motion; (2) a hand grip sensor that detects even trace amounts of grasp; (3) virtual reality exercises that simulate activities of daily living; and (4) software that provides feedback about task performance. Results suggest that subjects preferred T-WREX because it is more interesting, and because it allowed them to be more successful with their movement.