Design and validation of virtual reality: Task for Neuro-rehabilitation of Distal upper extremities

Debasish Nath

Indian Institute of Technology Delhi (IITD), India

Stroke, affecting approximately 15 million people worldwide, has long been a global cause of death and disability. Virtual Reality (VR) has shown its potential as an assistive tool for post-stroke rehabilitation. The objective of this pilot study was to define the task-specific performance metrics of VR tasks to assess the performance level of healthy subjects and patients quantitatively and to obtain their feedback for improving the developed framework. A pilot prospective study was designed. We tested the designed VR tasks on forty healthy right-handed subjects to evaluate its potential. Qualitative trajectory plots and three quantitative performance metrics—time taken to complete the task, percentage relative error, and trajectory smoothness—were computed from the recorded data of forty healthy subjects. Two patients with stroke were also enrolled to compare their performance with healthy subjects. Each participant received one VR session of 90 min. No adverse effects were noticed throughout the study. Performance metrics obtained from healthy subjects were used as a reference for patients. Relatively higher values of task completion time and trajectory smoothness and lower values of relative % error was observed for the affected hands w.r.t the unaffected hands of both the patients. For the unaffected hands of both the patients, the performance levels were found objectively closer to that of healthy subjects. A library of VR tasks for wrist and fingers were designed, and task-specific performance metrics were defined in this study. The evaluation of the VR exercises using these performance metrics will help the clinicians to assess the patient's progress quantitatively and to design the rehabilitation framework for a future clinical study.

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debasish.nath15@gmail.com