Glasses-free Virtual Reality Training to Improve Upper Limb Motor Function post stroke: Innovation from China

Le Li[1]*

1. Institute of Medical Research, Northwestern Polytechnical University, Xi'an, China.

E-mail: lile5@nwpu.edu.cn

BACKGROUND

Stroke is a global challenge and among the leading cause of long-term disability with up to 85% of patients with stroke experience upper limb motor deficits. Motor deficits of upper limb after stroke might arise from the reduced neural drive from the cortex to muscles. This project aimed to develop a novel glasses-free virtual reality training system for the recovery of upper limb motor function in stroke survivors and investigate its training mechanism .

INNOVATION

Our IGVERS(Intelligent Glasses-free 3D Virtual Environment Rehabilitation System) consists of three units, including a central processing unit (CPU), a three-dimension (3D) display, and the LMC. Figure 1 illustrates the schematic of the glasses-free VR rehabilitation system. The hybrid spatial-temporal directional backlight (HSTDB) technology within the system creates and displays 3D effects. The 3D stereoscopic vision unit works in conjunction with HSTDB to project 3D images directly into the eyes which creates the intense level of immersion. Training task included reaching, grasping, grabbing, and item tracking. Functional near-infrared spectroscopy (fNIRS) imaging and Motion trajectories during item tracking would be recorded.

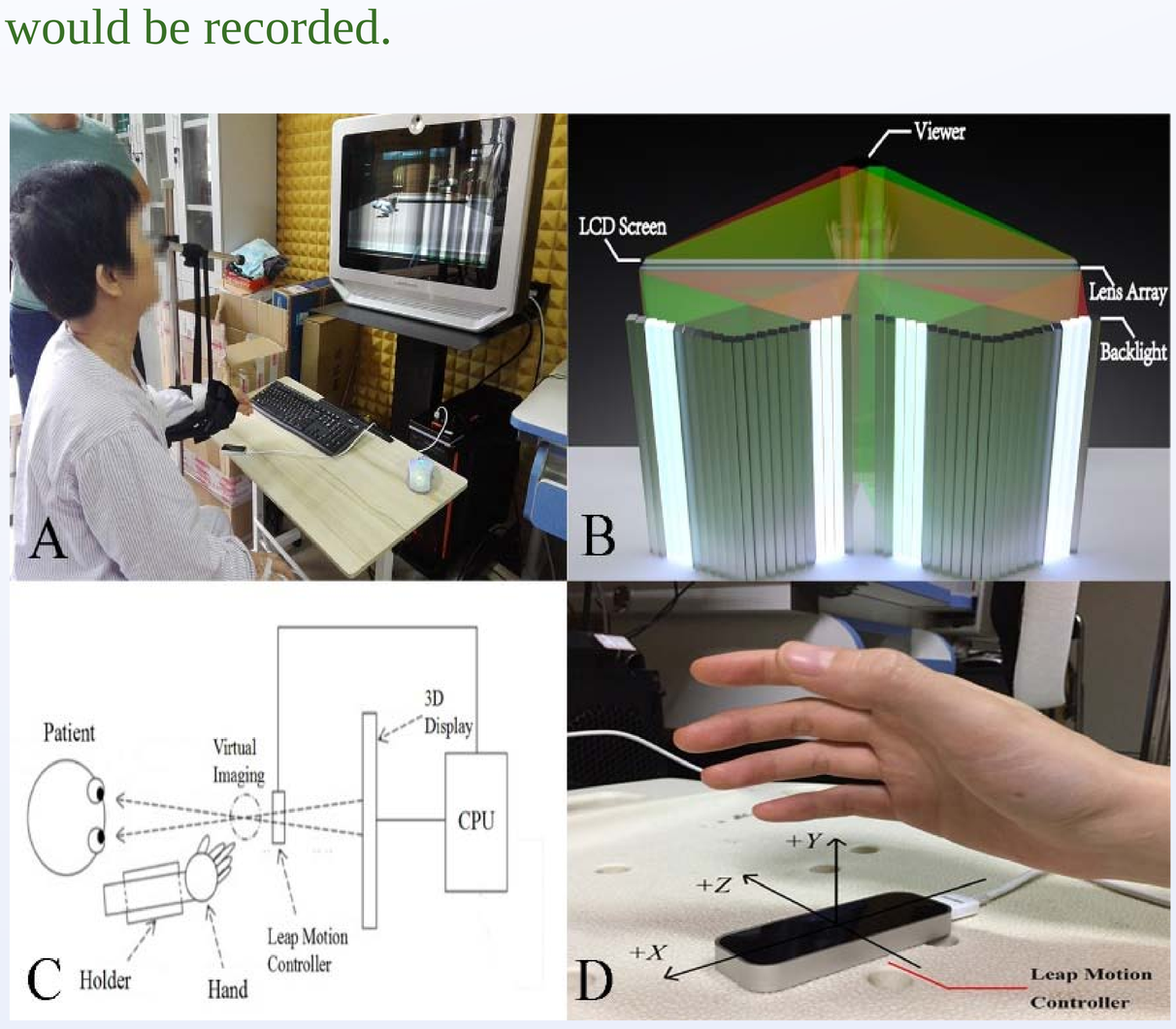

Fig 1. The glasses-free VR rehabilitation system. (A) A participant with stroke was using the glasses-free VR rehabilitation system to do VR training; (B) HSTDB projected 3D effect to a viewer; (C) Schematic diagram of the glasses-free VR rehabilitation system; (D) Leap Motion Controller.

IMPACT

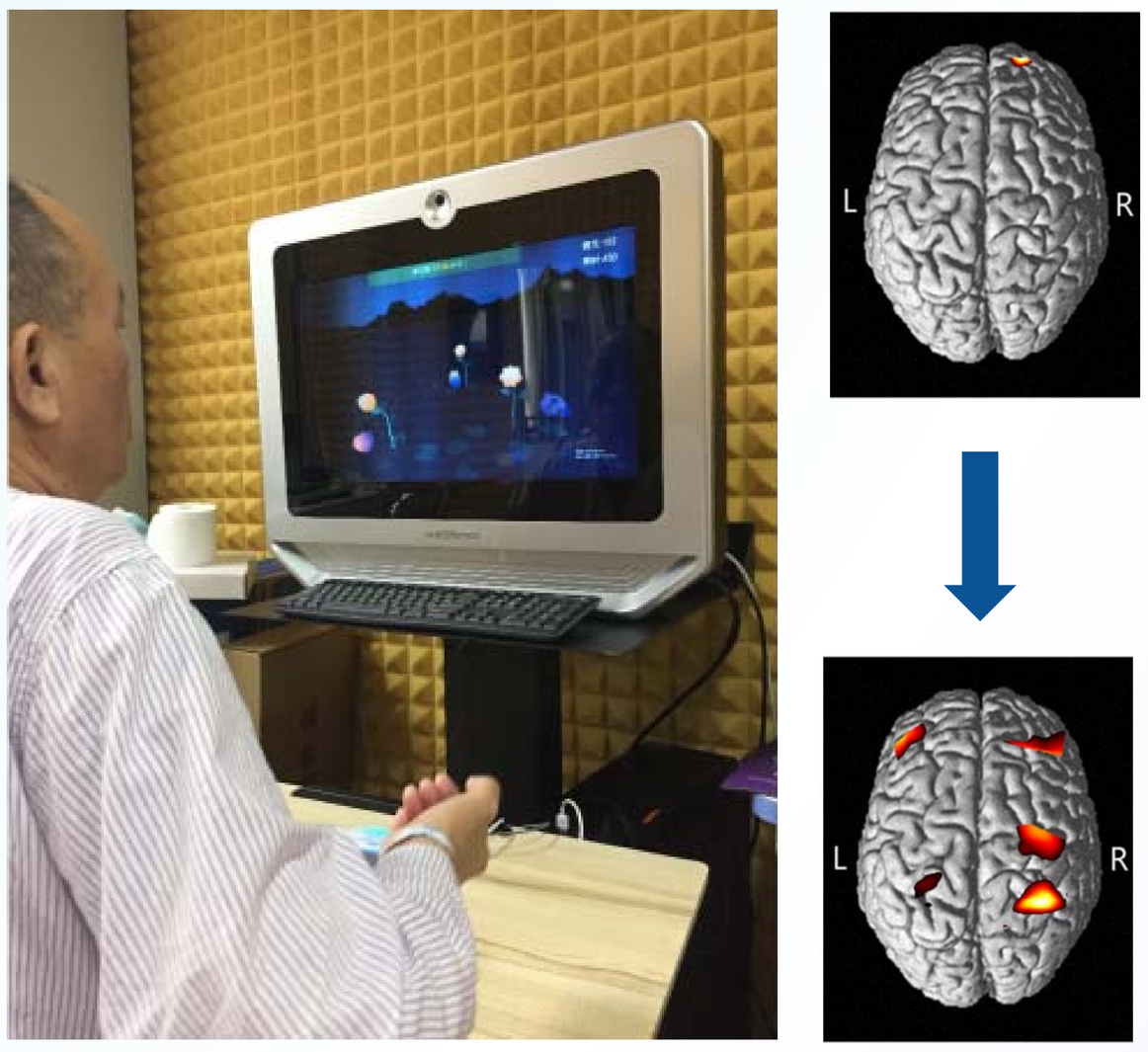

Fig. 2 Sub-acute stroke survivors under training of IGVERS and the fNIRS data at rest and during training.

There were more activation in contralateral Motor Cortex and PFC of stroke patients during the training of the hemiplegic upper limbs(Figure 2). Hand motion trajectory (red line) post intervention was more consistent with the expected trajectory (green line) when compared to pre training (Figure 3).

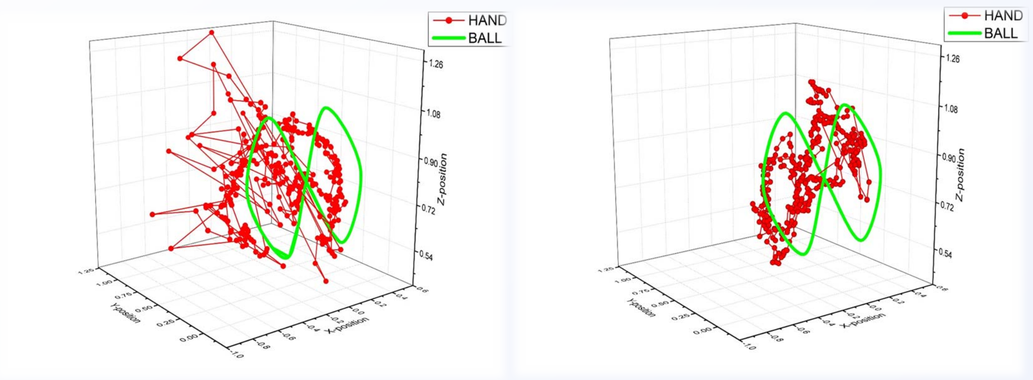

Fig 3. Hand motion trajectory before (left) and post intervention (right) .

SUMMARY and FUTURE DIRECTION

The glasses-free virtual reality training in this study was able to improve the motor function of upper limb in the stroke subject. We will continue to develop new module for promoting recovery of cognitive function for stroke survivors in the near future.

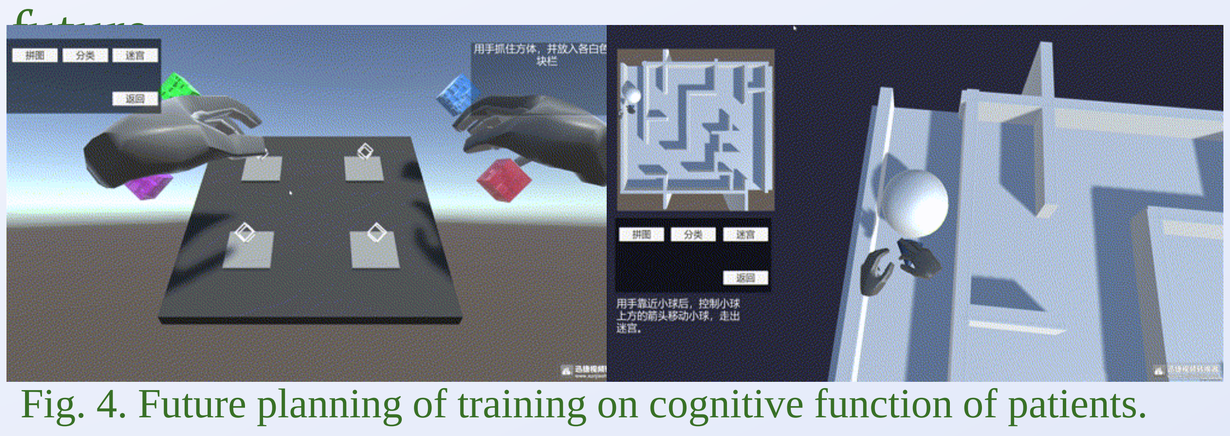

Fig. 4. Future planning of training on cognitive function of patients.

Acknowledgement

This work was supported by the Non-profit Central Research Institute Fund of Chinese Academy of Medical Sciences (No.2020-JKCS-005).