뇌신경재활

게시일시 및 장소 : 10 월 18 일(금) 13:15-18:00 Room G(3F)

질의응답 일시 및 장소 : 10 월 18 일(금) 15:45-16:30 Room G(3F)

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Development of system assessing DOC secondary to severe TBI by eye tracking technology in 3D VR

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Introduction

Assessing disorders of consciousness(DOC) secondary to severe traumatic brain injury is important to choose a treatment strategy. And, eye movements are important physical marker for the assessment of DOC. Despite this importance, assessment of eye movements in vegetative state(VS) and minimally conscious state(MCS) is only relied on clinical evaluation using JFK coma recovery scale-revised(CRS-R) criteria. In this study, we introduced a novel eye tracking system in three-dimensional visual reality(VR) as a tool to distinguish MCS and VC. This system is expected to overcome the inaccuracy presented by the low interrater reliability of visual function scale in CRS-R criteria.

Methods

Binocular eye movements were recorded quantitatively by a computerized infrared eye-tracking system built in HMD. We made nine different types of three-dimensional stimuli which are represented with virtual reality system. Three of these stimuli were designed to mimic visual stimuli presented to the patient when the clinician evaluates visual function scale in the CRS-R. Those were visual startle, visual fixation and visual pursuit respectively. Two threatening visual stimuli were designed to make the patient blink. Other two were made for assessing optokinetic nystagmus and visual acuity. The last two were made for assessing visual pursuit, fixation for various orientations. Eye fixation to external visual stimuli is important to differentiate MCS from VS. So, the proportion of on-or off-target fixation will be analyzed for each patient. The system consists of an HTC Vive HMD, an eye-tracking module and a personal computer. Twenty healthy people(7 male, 13 female) between the ages of 23 and 40 conducted a usability test for refining of the system from 2019. 05. 25 to 2019. 06. 16. Based on the usability test results, we confirmed VR-based visual stimuli to be applicable to DOC patients.

Results

Based on results from 20 healthy subjects' response for each stimulus, we expected that some parameters such as a degree of optokinetic nystagmus, a proportion of on-off target fixation and visual pursuit could be markers to differentiate MCS from VS. According to the subjects' feedback to the module, there was opinion that the visual stimuli we offered

would be better if accompanied by auditory stimulation to distinguish MCS from VS. There were any other adverse effect except for one person suffered short dizziness for a few seconds. Twenty healthy people responded positively at a rate of about 71%(128/180) to the questions of whether each stimulus was appropriate for DOC assessment.

Conclusion

We developed a novel system to assess DOC using eye tracking system in virtual reality system. Through this system, we expect the VR eye tracking system which will be applied to DOC patients to differentiate MCS from VS in a quantitative way.