척수재활

발표일시 및 장소: 10 월 18 일(금) 14:55-15:05 Room C(5F)

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A fully immersive virtual reality for upper limb rehabilitation in spinal cord injury

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Introduction

The purpose of this study is to determine whether fully immersive virtual reality (VR) intervention combined with conventional occupational therapy can improve the upper limb function more than CR alone in patients with spinal cord injury (SCI).

Study design and method

We prospectively enrolled 15 spinal cord injury patients with upper limb dysfunction who were admitted to our rehabilitation facility. Participants were randomly assigned to either the control group (CG) (n = 10) or the experimental group (EG) (n = 5). The CG received 60 min conventional therapy per day, 4 days per week for 4 weeks. Conventional occupational therapy included one-on-one training by the therapist, including shoulder, elbow, wrist and finger joint exercises and hand grasping-release tasks, upper extremity strengthening, stretching and activities of daily living (ADL) training. The EG received 30 min of VR training and 30 min of conventional therapy per day, 4 days per week for 4 weeks. During the VR (REHABWARE VR®, Tech village Corp., Korea) training, patients sit in a chair and performed six programs (ball throwing, playing xylophones, moving strawberries into the bowl, avoiding arrows, shooting at the targets and popping the bubbles). Clinical outcome measures included active range of motion (AROM), Manual muscle test(MMT), box and block test (BBT), Nine-Hole Peg test, action research arm test (ARAT), Korean version of Spinal cord independence measure (K-SCIM). The usability test which consisted of 10 items (5-point likert scale) to measure patients' affection, efficiency and convenience was conducted after intervention in the EG. The assessments were performed at the beginning (T0) and at the end of the intervention (T1).

Result

All subjects completed 16 times of training without drop out. Both groups showed improvement in arm function and ADL. Compared with the CG, the EG showed wider range of motion in shoulder abduction and shoulder flexion. ARAT score was significantly improved after VR therapy. The usability test showed an average score of 4.6 out of 5 points.

Conclusion

This study showed that VR added to conventional occupational therapy produces similar results in upper limb function compared to only CR in patients with SCI. Moreover, the VR appears to produce high motivation during execution on the assigned tasks. However, larger sample size is needed to investigate the effectiveness and efficacy of VR.

Table 1. Demographics and characteristics of patients

	VR + CR (n = 5)	CR (n = 10)	P Value
Age (years)	59 ± 11.58	61.5 ± 12.44	0.541
Sex: male	3 (60)	2 (80)	0.251
Time since injury (days)	27.9 ± 8.7	46.5 ± 15	0.124
Neurologic level			
C4/ C5/ C6	2 (40), 3 (60), 0	3 (30), 6 (60), 1 (10)	1
ISNCSCI grade			
ASIA - C / ASIA -D	0, 5 (100)	1 (10), 9 (90)	1
MMSE	30 ± 2.49	28.5 ± 2.11	0.746

NOTE. Values are presented as mean ± standard deviation or number (%).
Abbreviation: ASIA, American Spinal Injury Association; ISNCSCI, International standard for neurological classification of spinal cord injury; MMSE, Mini mental state examination; VR, Virtual reality; CR, Conventional rehabilitation

Table 2. Changes between pre-(T0) and post-(T1) treatment

		VR + CR (n = 5)			CR (n = 10)			Intergroup P value
		T0	T1	Intragroup P value	T0	T1	Intragroup P value	
Shoulder ROM		174 ± 8.94	178 ±4.48	0.157	174 ± 15.77	175 ± 15.81	0.317	0.186
MMT								
	Flexion	3.40 ± 0.89	3.8 ± 1.01	0.157	3.6 ± 0.97	3.7 ± 0.82	0.317	0.186
Shoulder	Extension	3.60 ± 0.89	3.80 ± 1.10	0.317	3.8 ± 0.79	3.8 ± 0.79	1	0.157
	Abduction	3.20 ± 0.84	3.60 ±0.89	0.157	3.6 ± 0.97	3.6 ± 0.97	1	0.038*
Elbow	Flexion	3.60 ± 0.55	4.20 ± 0.45	0.083	3.7 ± 0.82	3.7 ± 0.82	1	0.008*
	Extension	3.80 ± 0.45	4.20 ± 0.45	0.157	3.40 ± 0.52	3.6 ± 0.70	0.157	0.425
Wrist	Flexion	3.60 ± 0.55	3.80 ±0.45	0.317	3.40 ± 0.52	3.6 ± 0.70	0.157	1
	Extension	3.60 ± 0.55	3.80 ±0.45	0.317	3.30 ± 0.48	3.6 ± 0.70	0.083	0.69
BBT		45.8 ± 8.56	55.80 ±13.07	0.068	42.4 ± 17.22	49.5 ± 15.83	0.097	0.382
Nine-Hole Peg Test		26.91 ±3.47	22.58 ± 3.31	0.043*	38.78 ± 30.45	35.42 ± 26.70	0.008*	0.902
ARAT		45.40 ±11.63	51.4 ± 6.77	0.042*	45.70 ± 11.43	47.10 ± 11.90	0.017*	0.008*
K-SCIM		81.20 ± 17.15	85 ± 16.25	0.042*	70.50 ± 18.99	74.5 ± 19.44	0.005*	0.951

NOTE: Data are expressed as the means ± SD.
Abbreviations: P intragroup, Comparison over time; P intergroup, Comparison over time between groups; T0, baseline assessment; T1, assessment after the end of intervention; ROM, Range of motion; MMT, Manual muscle test; BBT, Box and block test; ARAT, Action research arm test; K-SCIM, Korean version of Spinal cord independence measure
* statistically significant p value.