

Virtual reality as therapy for stroke patient with apraxia : a case report

Jaewoo Choi^{1*}, Wookyung Park¹, Youngsu Jung¹, Jongmoon Kim^{1,2}, MinYoung Kim^{1,2†}

CHA Bundang Medical Center, CHA University School of Medicine, Department of Rehabilitation Medicine¹, CHA University, Rehabilitation and Regeneration Research Center²

Introduction:

Apraxia can occur in patients with stroke, and patients with apraxia have difficulty in using a limb when performing Purposeful movement in a specific situation; this is called "automatic-voluntary dissociation". Rehabilitation for apraxia has been directed towards inducing gestures to be performed in a variety of situations. However, consensus of the strategies of therapy for apraxia is lacking. Virtual reality (VR) has recently been studied as a Method of rehabilitation. VR is a tool that has therapeutic potential in stroke rehabilitation not only for motor function but also for cognition. Since we observed apraxia ameliorating effect of a VR intervention, we report the observed sequential findings in a patient with subacute stroke who presented ideomotor and limb-kinetic apraxia.

Case presentation

A 51 year-old man visited study hospital due to sudden development of weakness in the left side extremities and he was diagnosed as cerebral infarction in right frontal, parietal white matter and corpus callosum. After 10 days from the onset, he was transferred to department of rehabilitation medicine for intensive rehabilitation. At the start time of rehabilitation, weakness was not prominent, as fair plus grade by manual muscle test. The patient showed mild cognitive impairment, however he did not have difficulty in verbal understand and use of his right hand. He was able to perform simple activities such as grasp using his left hand (Table 1). When he was given verbal directions or commanded to follow some gestures, he could understand and expressed verbally about the motor sequences. However, performance using his left hand was seriously impaired and the tendency was more remarkable when executing Purposeful reaching, grasping, and releasing. The patient received conventional rehabilitation for facilitation of hand use and virtual reality trial was added for 30 minutes, 5 times per week for 4 weeks. The virtual environment was displayed using a head-mounted display, Oculus rift (Oculus Inc.). Virtual reality software, Blue Ocean (Hancom Inc.) was provided that included tasks of reaching and grasping the fish swimming in the sea around the user (Figure). On monitoring of his left hand performance according to the variable situations; block manipulation activity in conventional occupational therapy, commercialized augmented reality hand skill facilitation program, and the VR, we could observe best performance of left hand during his play in the VR (which will be displayed in the presentation).

Conclusions

The patient with apraxia seemed to be helped in overcoming “automatic-voluntary dissociation” with the VR rehabilitation program. VR could be used to treat apraxia by inducing more normal movement as response to motivating environment.

Table 1. Evaluation of patient’s function at baseline, 4 weeks and 12 weeks after rehabilitation (Baseline; 10 days after onset of stroke)

		Baseline	4 weeks	12 weeks
Manual muscle test	Right upper extremity	Good	Good	Good
	Left upper extremity	Fair plus	Good	Good
	Mini mental status examination	26	30	30
	Grip strength (kg)	Right	28	30
		Left	18	24
Hand function test	Lateral pinch (kg)	Right	7	8
		Left	6	7
	Tripod pinch (kg)	Right	5	6
		Left	4	5
	Manual function test	Right	93.75	96.88
		Left	62.50	87.50
	Fugl-Myer assessment	Right	65	65
		Left	39	58
	Korean modified Barthel index	55	84	87

Baseline; 10 days after onset of stroke

Table 2. Changes in Test of Upper Limb Apraxia (TULIA) scores after rehabilitation using virtual reality (Baseline; 10 days after onset of stroke)

	TULIA score			
	Baseline	2 weeks	4 weeks	12 weeks
Imitation, non-symbolic	27	34	35	35
Imitation, intransitive	22	27	27	33
Imitation, transitive	19	21	23	28
Total (Imitation) (120)	68	82	85	96
Pantomime, non-symbolic	22	27	31	31
Pantomime, intransitive	17	20	23	27
Pantomime, transitive	14	18	22	22
Total (pantomime) (120)	53	65	76	80
Total (240)	121	147	161	176



Figure. Rehabilitation using virtual reality with head mounted display