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Effect of the Home-based Exercise Program with the Augmented Reality System in Stroke Patients

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Objective
Recent advances in the augmented reality (AR) technology have significantly extended to the clinical rehabilitation in patients with stroke. The aim of this study is to investigate the effects of the home-based exercise program with the AR system to improve mobility in stroke patients.

Materials and Methods
The home-based exercise program with AR system was designed as prospective, randomized controlled study with blind observer. Sixty-eight hemispheric stroke patients with less than 6 months after onset who can walk independently on the surface without severe cognitive impairment were recruited in this study. In the experimental group (n=35), we provided the home-based exercise program with the AR system (Uincare®) which was composed with the task-specific game-based system. In the control group (n=33), the written home-based exercise pogrom was provided. All participants were recommended the home-based exercise with 30 minutes a day for 4 weeks. Functional assessments with Timed Up and Go test (TUG), Tinetti Performance Oriented Mobility Assessment, and Berg Balance scale were performed before (T0), immediately after (T1) and 4 weeks after the intervention (T2). We analyzed data of total 56 stroke patients who completed the intervention for 4 weeks (29 in the experimental group and 27 in the control group).

Results
There was no significant difference in general and functional characteristics before the intervention (Table 1). In each group, there was a significant improvement on mobility immediately after and 4 weeks after the home-based exercise for 4 weeks ($p<0.05$). The change of TUG at T1 was significant higher in the experimental group than the control

group ($p<0.05$). However, the change of TUG at T2 tended to higher in the experimental group than the control group without statistical significance (Table 2).

Conclusions

The results of present study revealed that a therapeutic effects of the home-based exercise program with the AR system to improve mobility in hemiplegic stroke patients. Further study with larger number of patients will be needed to clarify the effects of the home-based exercise program with the AR system.

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Table 1. Demographic and Functional Characteristics in Each Group

	Experimental group (n=29)	Control group (n=27)	P-value
Demographic characteristics			
Sex (M : F)	20 : 9	23 : 4	0.209
Age (yrs)	60.4±14.4	66.1±10.6	0.096
Height (cm)	165.2±9.0	166.8±7.6	0.483
Weight (kg)	68.5±10.0	67.9±8.6	0.795
Body mass index	24.1±2.4	23.9±2.7	0.766
Stroke type (ischemic : hemorrhage)	25 : 4	26 : 1	0.353
Affected side (right : left)	16 : 13	13 : 17	0.269
Stroke duration (months)	1.8±1.9	1.1±1.7	0.191
Functional characteristics			
K-MMSE	28.2±2.0	28.0±1.8	0.749
FAC (3 : 4 : 5)	7 : 12 : 10	7 : 6 : 14	0.273

Table 2. Change of Mobility and Balance in Each Group

	Experimental group	Control group	P-value
ΔTimed Up and Go test (s)			
T0 to T1	-2.6±2.8*	0.9±2.0	0.036
T0 to T2	2.6±2.9	1.6±2.0	0.140
ΔPOMA			
T0 to T1	0.9±2.6	0.7±1.4	0.729
T0 to T2	1.2±3.0	0.9±2.2	0.603
ΔBerg Balance scale			
T0 to T1	2.7±4.5	1.7±3.1	0.341
T0 to T2	3.4±5.3	2.4±3.2	0.423

POMA, Tinetti Performance Oriented Mobility Assessment; BBB, Berg Balance scale

*$p<0.05$