

Study for the Clinical Evaluation of the Effectiveness of the Mobile Game based Upper Extremity Rehabilitation Program for Patients with Upper Extremity Hemiplegia after Stroke

Hyunmi Lim¹, Minah Kim¹, Nam Jong Paik², Jongha Lee¹ and Jeonghun Ku¹

¹Department of Biomedical Engineering, College of Medicine, Keimyung University, Daegu, Korea

²Department of Rehabilitation Medicine, Seoul National University College of Medicine, Seoul National University Bundang Hospital, Seongnam, Korea

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Abstract: In the paper, we developed the mobile based rehabilitation system for patients with upper extremity hemiplegia after stroke and evaluated clinical usefulness and effectiveness of the system. The sensors built in the mobile device were used to track patients' upper limb motion and the movements was transferred to the mobile device through bluetooth connection so that the game contents could be interact with the movements. For the clinical evaluation of the effectiveness, 12 patients were recruited and make them perform an exercise of their wrist, shoulder, and forearm using the system for two weeks. The results showed significant improvement in upper limb function, quality of life and depression. Given the fact that our experiment, we verified mobile based rehabilitation program could be useful and effective for the clinical use.

1 INTRODUCTION

Stroke patients suffer from sensory impairment and motor disorder which cause problems in upper limb functions, lower limb functions and activities of daily living (J.H. Carr and R.B Shepherd, 2003). Recently, for the rehabilitaion, various mobile systems have been introduced to make rehabilitation easy at home, and our previous study for evaluation of the mobile based upper extremity rehabilitation showed that the mobile based rehabilitation have positive effects on the therapy and the motivation (Hyunmi Lim and Jeonghun Ku, 2013).

Therefore, in this paper, we aimed to conduct a clinical evaluation for the effectiveness of the mobile game based upper extremity rehabilitation program

2 METHODS

The system of the mobile based rehabilitation program is shown below in Figure 1. The gyro and accelerator sensors built in device cellular phone were used to track patients' upper limb motion and

are attached on a part of upper limbs, such as wrist, shoulder, and forearm to rehabilitate. The movements was transferred to a tablet PC through bluetooth connection so that the game contents could be interact with the movements.

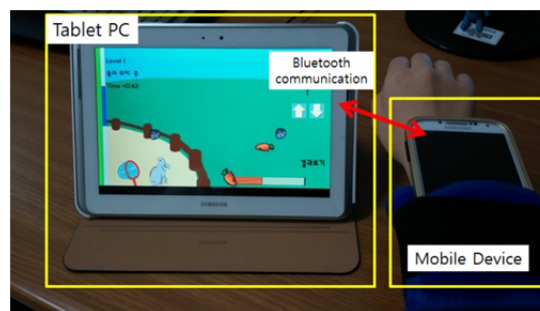


Figure 1: System.

The rehabilitation game contents were developed according to the B-stage based exercising. There were four game contents developed for the rehabilitation.

For the clinical evaluation of the effectiveness of the mobile based rehabilitation program, the program was conducted with 12 patients with upper extremity hemiplegia after stroke in Seoul National

University Bundang Hospital. And then, we measured upper limb functions at pre, post and 1 month after the training.

The experiment was conducted with 10 times for two weeks, and it was composed of an exercise of their wrist, shoulder, and forearm using the mobile game based rehabilitation program for 30 minutes plus occupational therapy for 30 minutes.

For the evaluation of upper limb function, we measured FMA-upper, B-Stage of hand and upper arm, EQ-5D and BDI (Beck's depression inventory).



Figure 2: The scene for a training with mobile rehabilitation program.

3 RESULTS

3.1 Enhancement of Upper Extremity Function

The upper extremity FMA scores showed a significant increase from 24.5 to 43.5 just after the training [F=22.925, $p<0.001$], and also did after 1 month of training 53.7 [F=22.811, $p<0.001$]. The average of B-stage(arm) increase from 1.9 to 3.9 just after the training [F=24.000, $p<0.001$], and also did after 1 month of training 4.9 [F=15.000, $p<0.004$]. The average of B-stage(hand) showed a significant increase from 1.92 to 3.75 just after the training [F=32.463, $p<0.001$], and also did after 1 month of training 4.7 [F=16.000, $p<0.003$].

3.2 Enhancement of Quality of Life

The average of the EQ-5D(Index) showed a significant increase from 0.56 to 0.80 just after 1 month of training [F=13.516, $p<0.005$] and the average of the EQ-5D(VAS) increase from 52.5 to 77.5 after 1 month of training [F=29.663, $p<0.001$]. the average of the BDI showed a significant decrease from 12.42 to 3.4 just after 1 month of training [F=6.069, $p<0.036$]. that showed that EQ-5D(Index) and EQ-5D(VAS) enhanced. Also BDI was decreased.

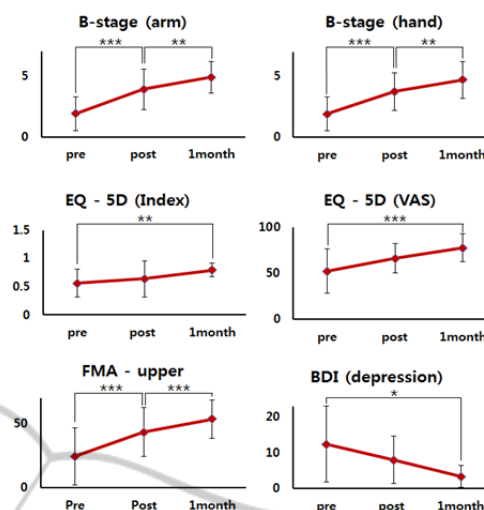


Figure 3: Training effect on the measurements. *, ** and *** represents a significant value of $p<0.05$, $p<0.01$ and $p<0.001$ respectively.

4 CONCLUSIONS

We developed the mobile based upper extremity rehabilitation program for patients with upper extremity hemiplegia after stroke and evaluated the clinical effectiveness of the program. Experimental results showed improvement in 12 patients' upper extremity function, b-stage and quality of life. And that showed significant decrease of depression.

The results confirmed that the developed mobile based rehabilitation program could be effective to the patients with upper extremity hemiplegia after stroke by conducting experimentation.

Therefore, the mobile rehabilitation program could be useful tools for the rehabilitation which could be used more conveniently.

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