

FLICO (Functional Life is Coming) – OPREL. SCH Univ. OT.

(The upper limb exercise device for home based rehabilitation of people with post-stroke)

Abstract

It is trend that the elderly people and people with stroke are increasing all over the world. Many of them are suffering from poor overall condition and weakness of body parts. To solve these problems, most people visit the therapeutic center or rely on expensive medical devices. So we developed home based exercise device for upper extremity rehabilitation. The feature of this device is that it focuses on the separated movement of the upper limb, such as the segmented movement of the wrist and the fingers. Also, because both devices are connected, when one device moves, opposite device to the same range, and depending on the subject's ability they can possible passive or active exercise.





The purpose of this device is not only to elderly people or people with stroke, but also to the subjects who have limited hand and wrist movement and weakness of the muscle, and it is possible to improve muscle strength through repetitive movements and to prevent secondary injury such as a contracture. In addition, it can reduce the burden on the user with an inexpensive cost compared to the existing similar products, and has an advantage that it can be used easily. At present, we have produced prototypes, and underway usability evaluations for experts and corresponding subjects. We will be generalizing through the update task, and our products will become universal home-use rehabilitation devices.

Problem statement/Research question and background

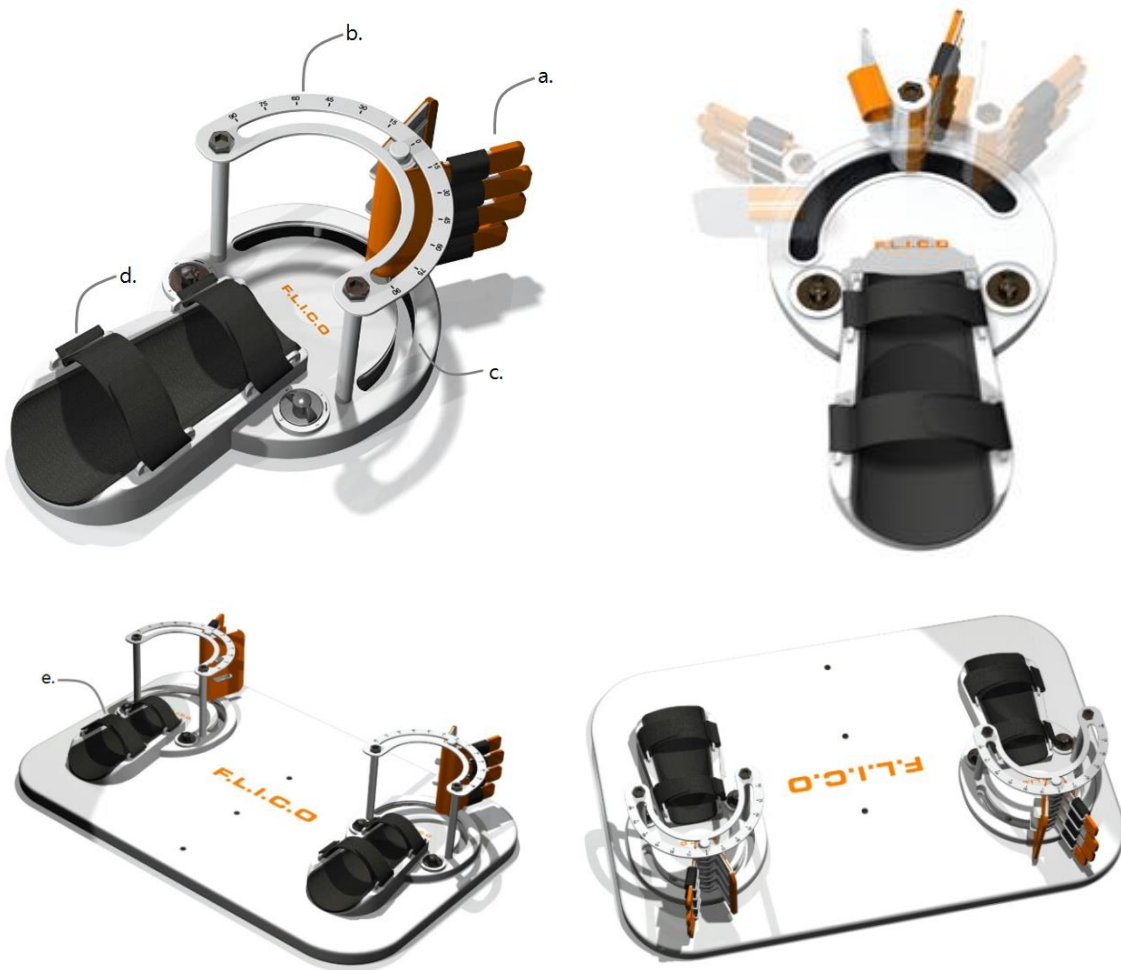
- Annually, the incidence of stroke is increasing worldwide, and the elderly people are also rapidly increasing.
- The intended audiences are patients with upper-limb dysfunction, secondary to a cardiovascular accident (stroke) or orthopedic injury.
- By Olsen (1990), 85% of people with stroke an early arm dysfunction, and 55% to 75% still have problems with their arms after 3 to 6 months.
- The upper limb function is more damaged in stroke. For the reason Feys et al. (1998) reported that first, MCA (middle cerebral artery) damage accounted for 75% of the total stroke; second recovery of upper extremity function requires restoration of not only proximal but also fine functions such as grasping and manipulation.
- By MJ Shin (2014), the improvement of the upper limb function after stroke is the theoretical background of cranial nerve rehabilitation, because passive and active exercise, experience, and rehabilitation through learning mediate neural plasticity and promote recovery.
- In Clinical Practice Guideline for Stroke (2012), upper extremity muscle strengthening exercise is strongly recommended to improve upper extremity muscle strength and physical function for stroke patients with upper limb weakness.
- Recently, Upper extremity exercise devices are a small number on the market and they are expensive and limited by individual use.
- In addition, some devices did not consider the condition of the people with stroke, which makes them difficult to use themselves.

Method/Approach/Solutions considered

- Our product is a home based rehabilitation device that can be easily used at home and conveniently exercise in the place where user wants.
- It provides manual which can be easily used at home and protocol for each exercise purpose so that can use at anyone and anytime.
- Thumb finger can selective movement, and then possible to various grasp and pinch training such as tip pinch motion.
- Neuro plasticity is facilitated because the mirror neuron is stimulated by the opposite side hand movement.
- And, because both devices are connected, when one device moves, opposite device moves in the same range, so that the subjects can passive or active exercise.
- In the future, we will apply the pressure sensors to measure the grasp power and use it to accumulate the objective data, and to link the mobile device to play the game application to promote interest and motivation.
- Compared to similar products of other companies, it has an advantage in terms of price competition.

Features	FLICO	S Co.	N Co.	E Co.
Feature 1	Design for people with stroke	Design for people with stroke	Not design for people with stroke	Not design for people with stroke
Feature 2	Self-exercise & Using application	Self-exercise	Self-exercise & Using application	Self-exercise
Price	\$4,000~5,000	\$24,000	\$12,000~18,000	\$15,000
Product Image				

Description of Final Approach and Design



- a. It is spring-structured and allows separate movement of each finger
 - b. It is possible to compare ranges before and after training by measuring the range of motion
 - c. It has a smooth sliding structure, and it is able to set the resistance to move the wrist.
 - d. It has a strap type structure that makes it easy to wear and keep forearms stable.
 - e. It can be removed one by one and can perform unilateral or bilateral exercises.
- The range of motion of the wrist can be flexion/extension up to the

normal range of -90~90 degree.

- It has four separated C-shape structure which allow each movement during another four finger exercise.
- An acceleration sensor is attached to the handle to visualize the degree of movement of the wrist.

Outcome (results of any outcomes testing and/or user feedback)

- We surveyed on this product design the current rehabilitation department and orthopedic doctors and professors who participated in the 2016 Korean Academy of Rehabilitation Medicine conference.
- We gathered opinions about overall design, fit and practically.
- Opinions were that there would be a need for products of various sizes, such as pediatric and ladies and that they wanted to broaden the range of exercise intensity.
- In addition, another opinion was that moderate or mild people with stroke groups or muscle weakened elderly people groups would have the effect of improving muscle strength.
- As a result, our product was supplemented the finger and wrist fixing equipment and divided them into four steps by increasing the range of resistance to movement.

Cost(Cost to produce and expected pricing)

- We had total cost about \$5,000 to develop and prototype.
- However, we expect sales costs to between \$4,000 and \$5,000, as we aim to make them universal at low prices

Significance

- It is suitable an exercise device for rehabilitation for an aging society in the world.
- It is a satisfying device the needs and desire of the people with stroke and elderly people.
- The exercise device for rehabilitation market is an essential element for improving health and quality of life, and is increasing every year as a new industry of the future that creates high added value.
- Having the exercise device for rehabilitation for an individual can reduce the cost of medical expenses for upper extremity rehabilitation
- This device is helpful not only the people with stroke and elderly people but also people to need improving strength and function for hand and wrist movement.

Acknowledgements

Dr. Bong-Keun(Andrew) Jung, Professor, Soon Chun Hyang University
Director, Occupational Performance and Rehabilitation Engineering Lab

Reference

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