CHAPTER I

INTRODUCTION

1. Rationale

Stroke often leads to hemiplegia, a unilateral arm and leg paralysis which is a major cause of death and disability. People with age over 60 years are the highest risk group for stroke. In Thailand, stroke is the highest cause of death in females and the third highest in males (1).

Patients with stroke who immediately start improving their arm and leg functions during the first four weeks after stroke may fully recover (2). Full recovery of upper extremity (UE) function is usually completed within 6 months after onset (3, 4). Therefore, a number of hemiplegic patients do not recover their UE function completely.

The UE motor dysfunction is a major functional disability of hemiparetic patients. Commonly, they show uncontrolled flexion synergy–closing fingers into a fist with wrist flexion and shoulder internal rotation, especially during exertion to use them. Patients are unable to easily open the fingers with normal pattern of movement, resulting in UE impairments that need to be rehabilitated (5).

Usually, patients improve their walking functions to the point that they can walk slowly on their own by a cane or a tripod, while functions of the hand frequently remain impaired. In addition, functional rehabilitation of arm and hand is generally limited when compared with lower extremity (6). Most of the rehabilitation regimens focus on self-ambulation, in-bed transfer, bed-to-chair, and chair-to-bed transfer

whereas UE dysfunctions receive less attention due to limit rehabilitation time and physical therapists (7).

Motor control restoring rehabilitative techniques such as neurodevelopmental treatment (NDT) and proprioceptive neuromuscular facilitation (PNF) have been established to be, in spite of relying upon different principles, equally improved hand functions (8). However, these techniques are time-consuming and therapist-requiring. Thus, they are not widely applied by the physical therapists. In the last decade, a number of treatment protocols such as constraint-induced movement therapy (9-11), biofeedback therapy (12, 13), and robotic assisted therapy (14, 15) have been proposed to improve arm and hand functions in hemiplegia. However, no therapy has been proved to show superior effect to the others (5).

Electrical stimulation of the upper limb has also been increasing attention as a therapeutic modality in post-stroke rehabilitation. Functional electrical stimulation (FES) is one of therapeutic strategies that has been claimed to promote recovery of muscle strength (16, 17), range of motion (18), spasticity (19, 20), and arm function (19-21). FES was also reported in sharing some features with NDT as it reciprocally inhibited finger flexor muscles, allowing patients more easily to contract wrist and finger extension (22). Other researchers (17, 19, 20) combined stimulation with task-specific or functional exercise reported that this combined treatments promoted recovery of hand function in both chronic and acute stroke, significantly. Recently, a new approach has been published, that is, synchronized muscle stimulation during performing a functional task (23). This electro-neuroprosthesis is not only synchronized the electrical currents with the functional movements but also made FES easy for patients or care takers to operate the treatment by themselves. After a

short period of training, patients can self-treat their UE at home using this device (24). Therefore, a home-based electrical stimulation (HBES) combined with functional movement exercise becomes a new approach which seems to promote the recovery of UE function in patients with hemiplegia and can reduce costs of patients transfer from home to hospital and vice versa.

Most researches (17, 20, 25) only explored the HBES combined with exercise on the recovery of UE function in hemiplegia without compared to the exercise group. Alon et al (26) found that HBES combined with task-specific exercise resulted in superior recovery of UE function in subacute stroke than exercise alone. No research has compared this protocol in chronic hemiplegia. Furthermore, only a few models of electro-neuroprosthesis are commercially available worldwide, and the price is high for Thai pateints. Therefore, the present study aimed to compare the effects of electrical stimulation combined with task-specific exercise (ES+TSE) and task-specific exercise alone (TSE) on UE function in patients with chronic hemiplegia. The present study used a custom made electrical stimulator. We believe that an appropriate program of exercise combined with stimulation will improve impairment of upper extremity in patients with hemiplegia.

2. Operational definition

2.1 Chronic hemiplegia means a stable stage after onset designated by at least two months period after diagnosed neurological involvement (27), The defined duration of chronic hemiplegia was varied, however, most of spontaneous recovery occurred between three to six weeks after onset (4).

2.2 Electrical stimulation (ES) is defined as electrical stimulation on muscles to generate movements of joints corresponding to activities such as reaching or grasping.

2.3 Task-specific exercise (TSE) means exercise which involves functional movements in goal-directed approach to improve daily living activities, such as, upper arm reaching, hand opening, or grasping.

2.4 Home-based electrical stimulation (HBES) means combination of using electrical stimulation at home while performing of TSE.

3. Purpose of the study

To compare the effects of a home-based electrical stimulation combined with task specific exercise (ES+TSE) and task specific exercise alone (TSE) in patients with chronic upper extremity hemiplegia.

4. Hypotheses

4.1 Degree of AROM of the shoulder, the elbow and the wrist flexion and extension after ES+TSE will increase significantly when compare with TSE

4.2 Degree of PROM of the shoulder, the elbow and the wrist flexion and extension after ES+TSE will increase significantly when compare with TSE

4.3 The mWMFT scores after ES+TSE will improve significantly when compare with TSE

4.4 The MAS-UA and MAS-H scores after ES+TSE will increase significantly when compare with TSE

4.5 The movement time of the goal function task after ES+TSE will decrease significantly when compare with TSE

5. Application advantages

1. Therapists can use home-based electrical stimulation combined with exercise program as another choice of treatment in patient with chronic hemiplegia.
2. Patients can receive an appropriate and sufficient physical therapy treatment with lower cost.