CHAPTER I
INTRODUCTION

Stroke is a major cause of death and disability in Thailand, approximately two thirds of stroke patients survive with some levels of neurological impairments (1). First time stroke results in a hemiparesis of the upper and lower limbs (1, 2). The disability resulted from stroke is very critical, due to the tremendous expenditures arising from the cost of intensive treatment, the large demand for continued nursing care, and the lost of productivity. The impact of upper extremity (UE) impairments on disability and health is obvious (3). Impairment of arm function in stroke survivors can make it extremely difficult to perform basic function and daily living tasks (4-6). Functional recovery of an arm and hand are generally limited when compare with that of the lower extremity (7, 8). Moreover, the upper extremity of patients with stroke is received less treatment than the lower extremity and balance (9).

The upper limb rehabilitation programs are generally limited from the length of hospital stay. This time constraint affects the goal of treatment. Therapists primarily focus on the functional activities that are important for a safe return home such as improving balance, gait and bed mobilities training. Therapists also often focus on compensatory strategies rather than restitution of motor function of the affected arm (10). When patients are incapable to use their paretic arms, they compensate either by using the non-affected arms, which can lead to learn nonuse of the affected arms (11), or

by using the affected arm with learning abnormal compensatory movement strategies which can be difficult to change later and may cause problems for relearning performance of the affected arms (12). The effectiveness of rehabilitation programs for the upper limb intervention is needed. The effects of various treatment methods on improving arm function after stroke have been reported (13). At present, the number of evidences suggested that repetitive, bilateral, and task-specific trainings were the key characteristics of the effectiveness in the UE rehabilitation program (14-20). However, the emphasis on these techniques is concentrated mainly in the acute phase after stroke and self motor practice technique may also be suboptimal.

In Thailand, program of upper limb rehabilitation in patients with stroke vary considerably depending on the occupational therapist's or physical therapist's therapeutic approach and on the patient's physical and motivational state. During the last decades, only the neurodevelopmental treatment (NDT) and the traditional training including passive ROM exercise, motor learning and functional retraining were mostly used. The NDT approach was useful on patients in the acute and the subacute stages but there were a few studies on chronic stroke stage (15, 21). Meta-analysis of the NDT approach versus a traditional exercise demonstrate little difference in outcome (22-24). The methods of stroke rehabilitation have been focused within the first 3 months after stroke (5, 24). Recently, both the paradigms for rehabilitation interventions and the time frame for possible UE motor recovery have been challenged. Experiments demonstrate that neural plasticity and functional gain can occur, via active practice, long after spontaneous

recovery would be expected to end (25). If these data can be extrapolated to stroke, there is open question that how the patient's resources can be the best allocated for hemiplegic UE management. Unfortunately, the benefit of therapeutic strategies aiming at improving upper limb motor function in stroke patients has been limited by the reduction in rehabilitation length of stay and outpatient services, the low ratio of therapist and patient and the increased cost of intensive treatment.

This study plans to develop a new outpatient technique entitled circuit training program which consists of self training workstations to train the affected UE in patient with stroke. The term circuit training refers to therapeutic techniques combined together with maximize or restore motor function. Patients perform self directed training on one station and then moving to another station (26). Circuit training therapy may eventually prove to be an approach to improve function of the hemiplegic arm. This therapeutic program bases on current knowledge such as unilateral and bilateral movement exercise (16, 17), task-specific with repetitive affected limb practice (18-20), strengthening (43), and repetitive sensory motor training (15). The intensive training of the paretic arm through active participation in circuit station will decrease the effect of learn nonuse of a paretic limb. The clinical trail design with the repeated measurements of the pre-training baseline was used. Parameters represented impairment and disability of patients were compared between the pre-and post-training.

Operative definitions

- Circuit upper arm training

This is a proposed program consists of 7 therapeutic stations in which patients will perform self-practicing, that is, 1) stretching exercise, 2) active exercise of the shoulder and the arm, 3) bilateral arm training, 4) repetitive sensory training, 5) repetitive task-specific training, 6) bilateral isokinetic training, 7) strength training exercise. These stations are explained in detail in the methods section.

- Impairment

Impairment is any loss or abnormality of psychological, physical, or anatomical structure or function (27), for examples; arm paresis, sensory loss, and decreased postural control. The present study measured muscle torque, range of motion, and spasticity of the UE as parameters of impairment. The measurement technique is described in the methods section.

- Disability

Disability is any restriction or lack of an ability to perform an activity in the manner or within the range considered normal for a human being. These functional consequences affected by impairment (27), for examples: inability to feed or dress after stroke. The Modified Wolf Motor Function Test (mWMFT) (28) was used to measure UE functional performance. The outcome parameters were time to complete the tasks and functional ability score. The detailed information of the test is presented in the method section.

- Handicap

Handicap is a disadvantage for a given individual, resulting from an impairment or a disability that limits or prevents the fulfillment of a role that is normal (27). The Motor Activity Log (MAL) (29) was used to determine the use of the affected UE during activities of daily living. The outcome parameters were the ordinal score of both quantity and quality of daily activities. The test is introduced in detail in the methods section.

Purposes of the study

General objectives

This study is designed to determine whether circuit training program can

- resolve or prevent impairments.
- improve the recovery of upper extremity control, especially in transport phase of upper limb function.
- improve functional tasks, including the capacity to adapt strategies to the daily living tasks

Specific outcomes of interest

To examine effects of circuit training on

- Motor recovery including active range of motion, strength and spasticity of the upper limb
- Upper extremity functional recovery (modified Wolf Motor Function Test; mWMFT)

- Daily living tasks (The Motor Activity Log; MAL)

Hypothesis of the study

- Peak isokinetic torque of the shoulder, the elbow and the wrist flexors and extensors after treatment will increase significantly when compare with baseline.
- Degree of active range of motion of the shoulder, the elbow and the wrist flexion and extension after treatment will increase significantly when compare with baseline.
- Level of spasticity of upper extremity will not increased when compare with baseline.
- The functional ability score and speed of functional movement (mWMFT) will increase significantly when compare with baseline.
- The average score of the MAL (amount of use and how well the limb was used) will increase significantly when compare with baseline.

Advantages of the study

The knowledge derived from the present study would be useful for designing an effective upper extremity rehabilitation program for patients with stroke.