Effectiveness Of Stroke Patient's Rehabilitation Model with Thai Traditional Medicine Via Mobile Application and Rehabilitation Manual for Caregivers

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Abstracts: Stroke is the leading cause of disability. Receiving adequate and ongoing rehabilitation is a way to help them get back to normal. Caregivers and appropriate care processes are necessary for effective restoration. This quasi-experimental research aims to study the effectiveness of the stroke patient rehabilitation model. Participants are 60 pairs of caregivers and ischemic stroke patients in Nakhon Pathom Province, divided into experimental and comparison groups. Data were collected using questionnaires and analyzed by inferential statistics consisting of independent sample t-tests and paired sample t-tests at a significant level of 0.05. The results showed that after the trial, the experimental group had a higher limb muscle strength, and the level of limb pain was lower than the comparison group. In conclusion, the model of stroke patient rehabilitation with Thai tradition via mobile applications and manual for caregivers is effective in helping patients have better muscle strength and reduce muscle pain.

Keywords: Stroke Rehabilitation, Caregivers, Thai Traditional Medicine, Muscle Strength, Muscle Pain.

1. INTRODUCTION

Stroke is a non-communicable disease significant in health problems because it is the leading cause of death and disability worldwide.[1] World Stroke Organization released in 2022, there are 12.2 million new strokes yearly. In 2019, there were 101 million stroke cases worldwide, an increasing number from 2009 up to 70%, and they also found a 143% increase in Disability Adjusted Life Years (DALY). [2] The American Heart Association reported that 75% of stroke survivors have disabilities or cannot return to normal functioning, and 15-30% become permanently disabled, [3] which impacts patients' daily lives and burdens their family members and society. However, growing evidence shows that early and continuous rehabilitation after a stroke reduces functional disabilities, especially in rehabilitation care during the first 3 - 6 months after symptoms. [4] Receiving adequate rehabilitation is available to help the patient return to normal or as close to normal activities as possible. [5] A World Stroke Organization set up a campaign in 2018 called "Up Again After Stroke" to communicate its focus on patient rehabilitation and its benefits. [6] Therefore, family members or caregivers and appropriate rehabilitation forms will be able to help patients receive effective recovery.

In Thailand, the number of stroke cases has been increasing steadily, especially during one decade from 2010 to 2020; there was an almost double increase in the Thai population with stroke cases. [7] Nakhon Pathom is a province in the midden part of Thailand. The number of stroke patients also increased continuously from 5,731 cases in 2016 to 12,026 in 2021; in other words, they have increased by 1.1 times in 5 years. In this amount, there is 49.7% of people with mobility disabilities. Therefore, each year, the number of patients requiring rehabilitation increases accordingly. [8,9] Although the Ministry of Public Health has a policy for all hospitals to prepare for rehabilitation care for stroke patients from being admitted until sent home by coordinating multidisciplinary teams to organize home visit activities [10] and promote the use of Thai traditional medicine to play a role in the health service system to increase patient options [11]. With many problems, such as insufficient staffing rates and caregivers' lack of knowledge of rehabilitating stroke patients, especially during the COVID-19 pandemic, access to rehabilitation services has more obstacles, leading to many patients undergoing ineffective rehabilitation [12].

Thai traditional medicine is the wisdom of patient care used for a long time in Thai society, including Thai massage and herbal compression, which treat sore musculoskeletal and joint diseases. Therefore, Thai people are familiar with and can apply them to caring for their health and family members. Thai massage is the technique of pressing or squeezing along the muscles, thus stimulating the patient's muscles directly, increasing blood circulation, as well as benefits in producing the function of peripheral nerves and allowing the muscles to recover sufficiently [13], Conforming with the study by Jirayu Chartsuwan et al. [14] found that Thai massage can help restore the patient's physical condition, stimulate blood circulation in the muscles, reduces stiffness and sore strength and joints, help reduce inflammation, relieve stress, and reduce depression. Therefore, the researcher developed a stroke patient rehabilitation model with Thai traditional medicine for caregivers; the model compound with the 12 steps of massage followed by herbal compression for 30 minutes and 4 exercise postures provided in rehabilitation manuals and mobile applications. It is an ideal tool for caregivers. It can be used as a guideline for the rehabilitation of patients frequently at home and help them return to normal or as close to normal activities as possible.

1.1. Research Objectives

To study the effectiveness of rehabilitation models for stroke patients with the science of Thai traditional medicine for caregivers.

1.2. Conceptual Framework

The researcher used the findings of a preliminary study on rehabilitation as follows: barriers to patient rehabilitation and the science of Thai traditional medicine and stroke care, as a conceptual framework for developing patient rehabilitation models, as shown in Figure 1.

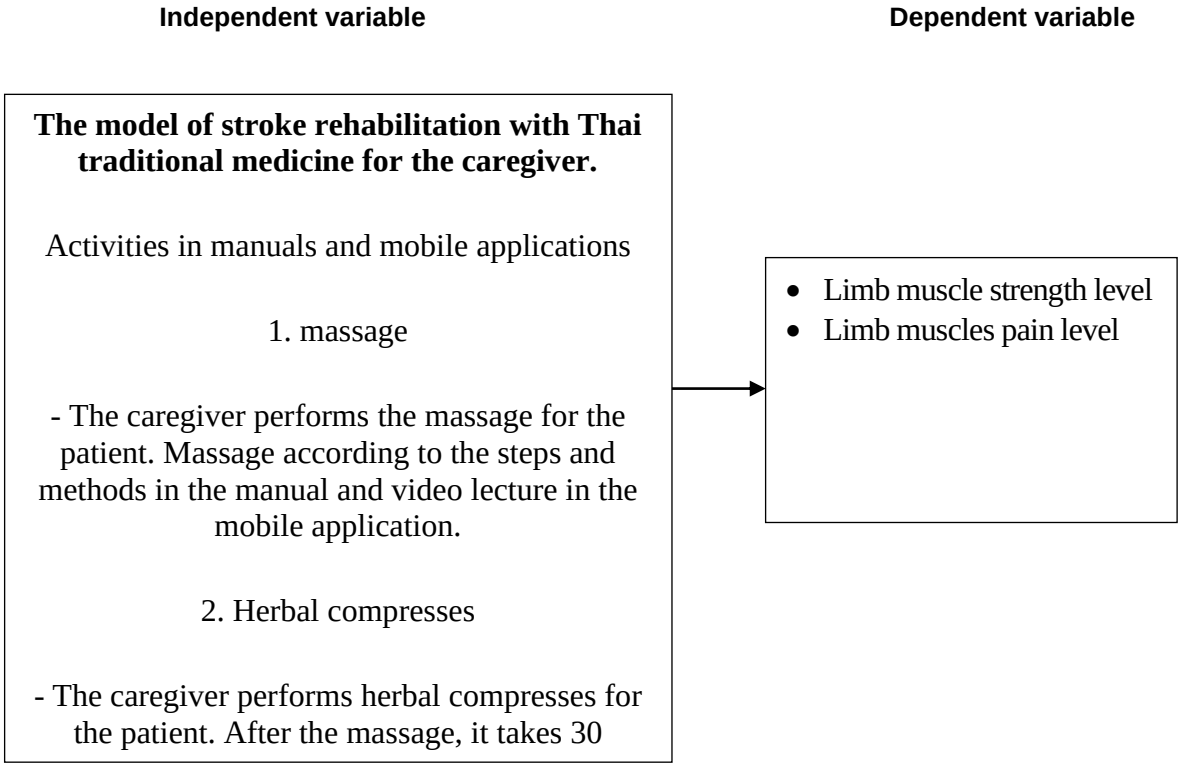

Figure 1 Research Conceptual Framework

1.3. Research Hypothesis

1. After the trial, the experimental group There was an increase in arm and leg muscle strength and a lower level of pain than before the trial.

2. After the trial, the experimental group had increased arm and leg muscle strength levels and lower muscle pain than the comparison group.

2. METHODS

This study is quasi-experimental (two-group pretest-posttest design) in caregivers and patients with ischemic stroke in Nakhon Pathom Province.

2.1. Population and Sample

The population is the patients with ischemic stroke. The sample size for two groups using the G* Power program [15] was determined by setting the effect size of 0.8, the power of 0.80, and the significance level $p<0.05$.

Inclusion criteria (1) The caregiver must be the primary caregiver. (2) The patient must be a person who has been diagnosed with ischemic stroke for the first time and has been for at least one month (3) a caregiver who can read, write, understand, and communicate in Thai (4) a caregiver who has a smartphone or tablet and can use a smartphone or tablet well.

Exclusion criteria (1) The primary caregivers were changed while participating in the program, (2) caregivers could not be contacted after receiving the manual and mobile application or had discrete access to the mobile application. (3) Patients with more severe symptoms or complications during the implementation.

2.2. Research Instrument

1. The guidebook of stroke rehabilitation with Thai traditional medicine for caregivers inside which images and letters describe the activity process, recording and accessing mobile applications.

2. The mobile application showed Thai massage for rehabilitation.

3. The evaluation form of muscular strength and pain.

2.3. Instruments and Measure

The data collected from August 29 to October 30, 2022, is as follows:

1. Before the trial, the researchers explained rehabilitation activities with Thai traditional medicine in the experimental group and evaluated the patient's limb muscle strength and pain level in both experimental and comparison groups.

2. During the trial, the researcher followed up on rehabilitation activities in the experimental group.

3. After the trial, the researcher evaluates the patient's limb muscle strength and pain levels in both experimental and comparison groups.

2.4. Statistical Analysis

The descriptive statistics describe the sample' socio-demographic characteristics, muscle strength, and pain level. To compare the muscle strength and pain level average before and after a trial in each group with a Paired Sample t-test and compare between groups using an Independent Sample t-test. The statistical significance was

determined at 0.05, and the initial agreement was based on the required statistics, finding that the data had a normal distribution.

3. RESULTS

3.1. Personal Characteristics of Participants

The stroke patients in the experimental and comparison groups have similar overall demographic characteristics. Most stroke patients in the experimental group were female, accounting for 73.3% of the average age of 63.9 years (S.D.=6.245) and an average duration of 21.8 months (S.D.=6.343). 63.3% of the caregivers in the experimental group were female, 86.7% had an average age of 46.6 years (S.D.=10.842), 36.7% had a bachelor's degree, and 33.3% were farmers. In the comparison group, 83.3% of patients were female, with an average age of 62.1 years (S.D.=7.541) and an average duration of 21.1 months (S.D.=8.162). 56.7% of caregivers in the comparative group were female, 80.0% had an average age of 48.2 years (S.D.=11.638), had a secondary school 36.7%, and 30.0% were employed. (Table 1,2)

Table 1 Shows the number and percentage of stroke patients in Don Tum District, Nakhon Pathom Province, classified by demographic characteristics.

Items	Information	experimental group (n=30)		comparison group (n=30)	
		Frequency	Percentage	Frequency	Percentage
Gender	Male	8	26.7	5	16.7
	Female	22	73.3	25	83.3
Aged	Lower than 41 years old	0	0.0	0	0.0
	41 – 50 years old	2	6.7	3	10.0
	51 – 60 years old	9	30.0	10	33.0
	More than 60 years old	19	63.3	17	56.7
		$\bar{X}$ = 63.9, S.D.=6.245		$\bar{X}$ = 62.1, S.D.=7.541	
Hemiparesis side	Left	19	63.3	17	56.7
	Right	11	36.7	13	43.3
Duration of stroke	Less than 6 months	0	0.0	0	0.0
	6 – 12 months	6	20.0	8	26.7
	13 – 18 months	11	36.7	9	30.0
	19 – 24 months	6	20.0	7	23.3
	More than 24 months	7	23.3	6	20.0
		$\bar{X}$ = 21.8, S.D.=6.343		$\bar{X}$ = 21.1, S.D.=8.162	

Table 2 Shows the number and percentage of caregivers of stroke patients in Don Tum District, Nakhon Pathom Province, classified by demographic characteristics.

Items	Information	experimental group (n=30)		comparison group (n=30)	
		Frequency	Percentage	Frequency	Percentage
Gender	Male	4	13.3	6	20.0
	Female	26	86.7	24	80.0
Aged	Lower than 41 years old	12	40.0	9	30.0
	41 – 50 years old	12	40.0	7	23.3
	51 – 60 years old	4	13.3	8	26.7
	More than 60 years old	2	6.7	6	20.0
		$\bar{X}$ = 43.9, S.D.=10.842		$\bar{X}$ = 48.2, S.D.=11.638	
Education	Elementary school	7	23.3	9	30.0
	Secondary school	9	30.0	11	36.7
	Diploma	3	10.0	2	6.7
	Bachelor or higher	11	36.7	8	26.6
Occupation	Agriculture	15	50.0	13	43.3
	Self-employed	7	23.3	6	20.0
	Company employee	7	23.3	9	30.0
	Government employee	1	3.4	2	6.7

3.2. The Effectiveness of the Stroke Rehabilitation Model is as Follows

1. Before and after the trial, the stroke patients in the experiment group had higher average limb muscle strength than before implementation (mean before = 2.77, 2.43, mean after = 3.40, 3.77; p-value <0.001. The average limb muscle pain levels were lower than before implementation (mean before = 6.57, 6.33, mean after = 5.37, 4.90; p-value <0.001, respectively, at a significant level of 0.05. For the comparison group, average limb muscle strength and pain levels among the stroke patients had no difference (p-value = 0.712, 0.830, 0.186, and 0.184), respectively, at a significant level of 0.05. (Table 3)

2. Between groups: Before the trial, the average limb muscle strength and limb muscle pain levels among the stroke patients between the experiment and comparison groups had no difference (p-value =0.597, 0.310, 0.266, and 0.710), respectively, at a significant level of 0.05. After the trial found that stroke patients' average limb muscle strength and limb muscle pain levels differed between the experiment and comparison groups, the average limb muscle strength levels in the experimental group were higher than the comparison group (mean of experimental group = 3.40, 3.77, mean of comparison group = 2.73, 2.77; p-value <0.001, respectively). The average limb pain levels in the experimental group were lower than the comparison group (mean of experimental group = 5.37, 4.90,

mean of comparison group = 5.90, 6.07; p-value = 0.021, and <0.001), respectively at a significant level of 0.05. (Table 4)

Table 3 Shows a comparison of average limb muscle strength and pain levels before and after the trial between the experimental and comparison groups.

Variables	experimental group		T	df	p-value	comparison group		t	df	p-value
	before	after				before	after			
Arm strength										
$\overline{X}$	2.77	3.40	-5.188	29	<0.001*	2.70	2.73	-0.372	29	<0.001*
S.D.	0.504	0.563				0.466	0.450			
Leg strength										
$\overline{X}$	2.43	3.77	-7.616	29	<0.001*	2.57	2.77	-1.795	29	<0.001*
S.D.	0.504	0.858				0.504	0.504			
Arm pain										
$\overline{X}$	6.57	5.37	6.180	29	<0.001*	6.23	5.90	1.355	29	<0.001*
S.D.	1.135	0.765				1.165	0.960			
Leg pain										
$\overline{X}$	6.33	4.90	9.607	29	<0.001*	5.87	6.07	-1.361	29	<0.001*
S.D.	0.547	0.759				1.279	1.202			

*P<0.001

Table 4 Shows a comparison of average limb muscle strength and pain levels before and after implementation between the experiment and comparison groups.

Variables	before		t	df	p-value	after		t	df	p-value
	Experimental group	comparison group				experimental group	comparison group			
Arm strength										
$\overline{X}$	2.77	2.70	0.532	58	0.597	3.40	2.73	5.066	58	<0.001*
S.D.	0.504	0.466				0.563	0.450			
Leg strength										
$\overline{X}$	2.43	2.57	-1.025	58	0.310	3.77	2.77	5.503	58	<0.001*
S.D.	0.504	0.504				0.858	0.504			
Arm pain										
$\overline{X}$	6.57	6.23	1.122	58	0.266	5.37	5.90	-2.381	58	<0.001*
S.D.	1.135	1.165				0.765	0.960			
Leg pain										
$\overline{X}$	6.33	5.87	1.837	58	0.710	4.90	6.07	-4.497	58	<0.001*
S.D.	0.547	1.279				0.759	1.202			

*P<0.001

4. DISCUSSION

The study results found that after the trial, the experimental group had a higher average limb muscle strength, and the level of limb pain was lower than the comparison group. In conclusion, the model of stroke patient rehabilitation with Thai traditional medicine for caregivers is effective, helps patients have better muscle strength levels, and can reduce muscle pain, described as follows:

1. The Thai massage method is effective for rehabilitation for stroke patients because the massage involves exercising pressure on the muscles, increasing blood circulation, helping muscles relax, and reducing pain. Herbal compression helps to promote the massage effect even better, relying on heat to help dilate blood vessels and improve blood and lymphatic circulation in such areas. [13] The study by Jirayu Chatsuwan et al. [14] found that the patients who restored with Thai massage had a degree of function of the upper muscles, the sensation of the upper and lower limbs, range of joint movements, and decreased pain levels were better than those who received physiotherapy only at a significant level of p-value 0.05. Similarly, a study by Teeranan Tananchai [16] found that patients with stroke who underwent rehabilitation with massage and herbal compresses at home for 22 weeks improved muscle development by using their hands to scoop food and pick up objects. In conclusion, all three activities, massage, herbal compresses, and exercise, contribute to the effectiveness of patient rehabilitation.

2. Using the guidebook with mobile applications for stroke patient rehabilitation is essential for caregivers. The guidebook of stroke rehabilitation consists of pictures and details showing 12 Thai massage methods for rehabilitation. The caregivers can take time to study until followed. For mobile applications, the content on the screen is displayed as a demo video with subtitles to enhance the caregiver's understanding of massage and herbal compresses and exercises from the manual. In addition, the mobile application is a communication channel where caregivers or patients can ask questions by typing in the chat channel with the staff. On the other hand, health personnel can use this mobile application to track patient rehabilitation and conveniently communicate information to patient groups and caregivers by unlimited time and place. According to the study of Giuseppe Metera et al. and Megan K O'Brien et al., [17,18] mobile applications developed for home patient rehabilitation are a tool that increases convenience and is easy to follow up. Mobile applications streamline rehabilitation, allowing caregivers to perform frequent rehabilitations, with the number of weekly rehabilitation sessions encouraging improved rehabilitation effectiveness. Following Pakaratee Chaiyawat et al. [19] study, the number of rehabilitation sessions affected the ability to perform daily activities statistically significant at 0.05. The same applies to the study by Clark B, Whitall J, Kwakkel G, et al. [20], who found that many rehabilitation times per week had an encouraging effect on better arm and leg movement, helping to improve the recovery and daily life of the patient. In conclusion, both the handbook and the mobile application are tools that help caregivers understand and be able to perform rehabilitation activities correctly. Complete and consistent promote effectiveness in the rehabilitation of stroke patients.

CONCLUSION

This model of rehabilitation for stroke patients with Thai traditional medicine for caregivers using the guidebook with mobile applications is the best method for rehabilitation for stroke patients due to the process that caregivers and patients can practice at home, increasing the patient's opportunity to receive adequate and ongoing rehabilitation and the massage involving exercising pressure on the muscles, increasing blood circulation, helping muscles relax, and reducing pain.

Research Recommendations

Caregivers can rehab their patients at home using the guidebook of stroke patients' rehabilitation with mobile applications. Health care Units can suggest the stroke patient rehabilitation model with the science of Thai traditional medicine to caregivers to promote and support the adequate and continuous rehabilitation of stroke patients at home.

Ethical Approval

The information obtained from this research was encoded for confidential information not disclosed individually, and no damage will be disclosed to the research subjects. This research has approval from the Human Research Ethics Committee, Naresuan University, Thailand (No.0170/62) approved, dated 2019/ October /02.

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Declaration of conflicting interests

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