

## Traditional umbrella painting activity improved upper extremity function and decreased depression in stroke survivors in Northern Thailand

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### ABSTRACT

**Background:** Upper extremity (UE) dysfunction and depression often occur after a stroke. Strategies to promote UE function and reduce depression require task-related training.

**Objectives:** This study aimed to investigate the effectiveness of conventional rehabilitation combined with traditional umbrella painting activity on UE function and depression in stroke survivors.

**Materials and methods:** Twenty-two participants from rehabilitation units in Chiang Mai province, northern Thailand, were recruited according to the inclusion criteria and divided into experimental and control groups of 11 each. The experimental group received conventional rehabilitation combined with traditional umbrella painting activity for 140 minutes a day, three days a week, for a period of eight weeks, while the control group received conventional rehabilitation alone for the same amount of time. The instruments used were: 1) the Functional Test for Hemiplegic Upper Extremity (FTHUE) - Thai version; and 2) the Patient Health Questionnaire (PHQ-9)-Thai version. Statistics used were the Wilcoxon Signed Ranks test and the Mann-Whitney U test.

**Results:** The UE function was significantly higher at the post-test than at the pre-test ( $p < 0.004$ ) with a large effect size ( $d = 1.59$ ), and depression was significantly reduced at the post-test compared to the pre-test ( $p < 0.003$ ) with a large effect size ( $d = 1.62$ ), whereas the control group did not change. However, the function of UE and depression in these participants were not significantly different between the two groups both before and after the intervention ( $p < 0.05$ ).

**Conclusion:** Findings indicate that conventional rehabilitation combined with traditional umbrella painting activity appears to be more effective for improving UE function and decreasing depression in stroke survivors than conventional rehabilitation alone. This can be an alternative treatment for occupational therapists in their clinical practices.

### Introduction

Stroke is the leading cause of death<sup>1, 2</sup> and long-term disability in those who survive.<sup>1</sup> In 2012, stroke mortality was 30.7 per 100,000 people in Thailand,<sup>1</sup> and this increased to 44.8, 47.8, and 52.8 in 2014, 2017, and 2020, respectively.<sup>3,4</sup> In 2016, the total recorded incident rate of stroke was 451.4 per 100,000 people, which increased to 467.5 in 2017, 506.2 in 2018, and 542.5 in 2019.<sup>5</sup> Approximately 90% of stroke victims suffer from a sequela of stroke, mainly weakness of the muscles and

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sensory deficits on the affected side, which leads to poor performance in the upper extremity (UE) function for these individuals.<sup>6,7</sup>

Loss of UE control is frequently found after a stroke. More than 70% of clients who have suffered a stroke have some degree of UE dysfunction<sup>8</sup> due to muscle weakness, spasticity, limited joint range of motion (ROM), pain, etc.<sup>7,9</sup> Poor UE function obstructs the ability of stroke survivors to perform activities of daily living (ADL), work, and recreational activities and therefore needs sufficient care. Brunnstrom defined the six stages of motor recovery after stroke in UE as follows: stage 1 is flaccidity; stage 2 is spasticity developing with involuntary movement; stage 3 is a voluntary movement with synergy and spasticity; stage 4 is decreased synergy and the ability to initiate joint isolation movement; stage 5 is the disappearance of basic synergy and the ability to perform good joint isolation movement, and stage 6 is voluntary movement near normal.<sup>10</sup> Brunnstrom also detailed six stages of hand function after stroke as follows: stage 1: flaccidity; stage 2: little or no active finger flexion; stage 3: mass grasp but no voluntary finger extension; stage 4: lateral prehension and semi-voluntary finger extension; stage 5: palmar prehension, possibly cylindrical and spherical grasp; voluntary mass extension of digits; and stage 6: complete control of all prehension types.<sup>10</sup> A therapist can set the milestone to see a progression of clinical trials following levels of motor recovery.

Depression is a substantial consequence of a stroke. The incidence of depression in stroke survivors is 35%.<sup>9</sup> Post-stroke depression (PSD) delays the effects of therapy

and slows down the recovery process due to the patient's resignation from rehabilitation and a lack of motivation to regain physical fitness.<sup>11</sup> Depression causes neglect of self-care, physical inactivity, and substance abuse in stroke survivors.<sup>12</sup>

Art and craft can promote physical and mental health, self-esteem, and enjoyment gained from creating a useful or decorative item with the hands of participating clients.<sup>13</sup> Kim *et al.*<sup>14</sup> conducted a study on the effectiveness of art therapy on rehabilitation outcomes in a stroke survivor, which revealed that the subject showed improvement in emotional status and motor function after a 10-week, twice-weekly intervention program.

Morris *et al.*<sup>15</sup> explored opinions on participation in visual arts programs among 11 stroke survivors and three artists during inpatient rehabilitation to identify benefits and potential mechanisms of action. The results demonstrated that the creation of art facilitated social interaction and provided enjoyment and distraction from a stroke. Research on creative art therapy to improve treatment in patients with neurological diseases found that art can reduce depression and protect against isolation and hopelessness.<sup>16,17</sup> However, most of these studies used multiple and general arts as treatment media for the participants.

The traditional umbrella or Bo Sang umbrella (Figure 1) is a hand-made bamboo umbrella and parasol at Bo Sang Umbrella Village, Chiang Mai Province, northern Thailand. It is a long-standing tradition, a beautiful culture, and a spiritual benefit. Until it has become a traditional umbrella-making community, where Thai people in Bo Sang



Figure 1 Traditional (hand-made) umbrella painting.

Umbrella Village and the surrounding area earn a good living, a traditional umbrella is not only useful in everyday life; it is also attractive and colorful. These are attractive to tourists, and many of them buy these hand-made umbrellas as souvenirs.<sup>18,19</sup>

There are four steps to making an umbrella:<sup>19</sup>

1) Make the umbrella frame using bamboo as the umbrella strips and softwood for the cap and shaft.

2) Make the canopy by laying Sa paper, which is made of Mulberry bark, on top of the umbrella ribs and gluing it with latex.

3) Paint the background of the Sa paper canopy, and

4) Draw pictures on the painted Sa paper canopy.

Through activity analysis, steps 3 and 4 are appropriate for stroke clients whose muscle recovery stage in their arms and hands is sufficient to move and hold painting equipment. Painting the background and drawing pictures on the umbrella canopy in steps 3 and 4 can increase the number of repetitive movements, which fundamentally improves arm and hand function in stroke patients.<sup>20</sup>

The present study aims to examine the effect of a combined treatment of conventional therapy with traditional umbrella painting activity on UE function and depression in stroke survivors in Chiang Mai Province, Thailand.

### Materials and methods

This study was a pre-test and post-test control group research design.

### Participants

The sample size was calculated using G\*Power 3.1,  $\alpha$  err prob = 0.05, power (1 - err prob) = 0.80, and the average

effect size from two previous similar studies by Song & Hwang,<sup>21</sup> and Pongtham *et al.*,<sup>22</sup> = 1.125. Zones of desired or acceptable effects were the intermediate ( $d=0.45-0.75$ ) and large effect sizes ( $d>0.75$ ), which indicated a practically significant level of the intervention program and a good outcome of the study.<sup>23</sup> The larger the effect size of similar previous studies, the fewer subjects are required in the present study. The appropriate sample size, as calculated, was 18 subjects. Researchers added 20% of the participants in anticipation of some dropping out during the study. Therefore, the total number of participants was 22.

Following inclusion criteria, we recruited stroke participants who received services in eight community rehabilitation centers in Chiang Mai province. Due to the pandemic of COVID-19 during the time of the research project, we could not recruit as many participants as 22 at the same time to randomly select them into the experimental and control groups. As a result, we sequentially allocated the participants into experimental and control groups in a ratio of 1 to 1 as soon as we had the subjects that met the inclusion criteria. The diagram of the recruitment and allocation of participants to the study is shown in Figure 2.

The inclusion criteria were as follows:

1) clinical diagnosis of a first stroke.

2) age between 20 and 70 years old.

3) hemiparesis for 6-24 months after onset.

4) the ability to reach Brunnstrom stages III to V in the proximal and distal arm;<sup>10</sup>

5) no significant cognitive deficits, as determined by the MSE T10,<sup>24</sup> with scores of at least 15 for uneducated people; a score of at least 18 for persons finished with

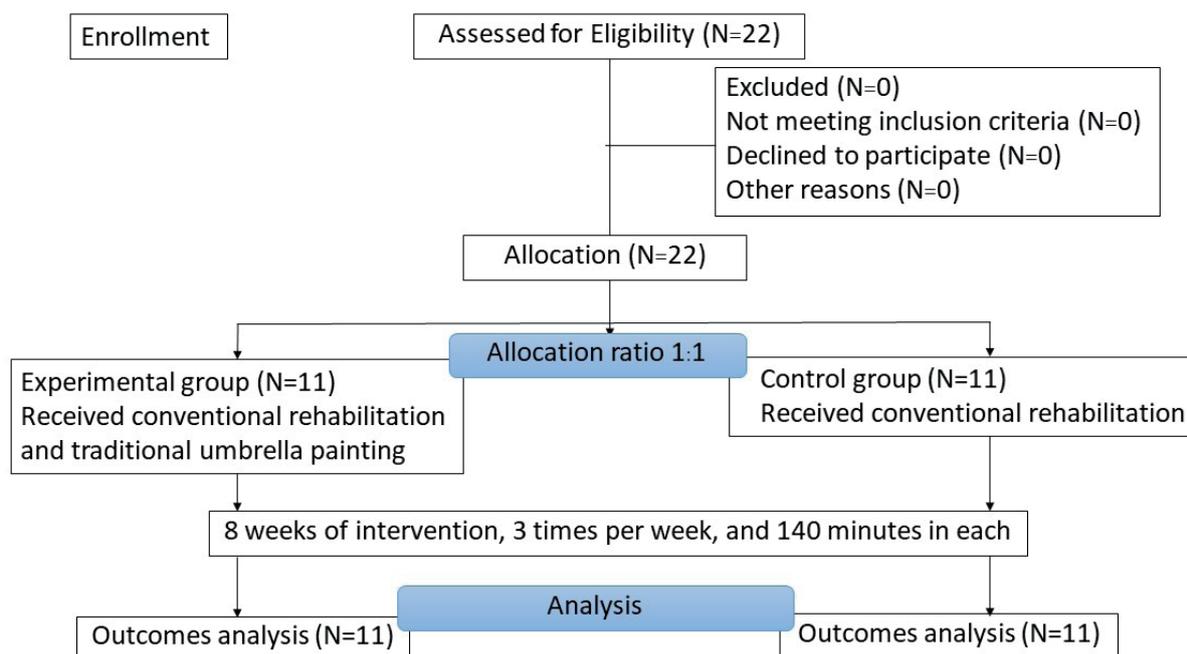


Figure 2 Diagram for the recruitment and assignment of participants to the study.

elementary school, and scores of at least 23 for individuals finished with secondary school and above.

6) no excessive spasticity in the affected UE (Modified Ashworth Scale score less than or equal to 2 in any joint)<sup>25</sup> that could prevent functional movements;

7) nobody unilateral neglect (assessed by giving the participants a blank page of paper and telling them to draw a clock);

8) risk of depression (measured by the Two Questions: Screening Test for Depression),<sup>26</sup> persons who answer "yes" to one or both questions would be classified as at risk of depression;

9) no other neuromuscular or orthopedic diseases; and

10) willing to participate in the study.

The withdrawal criteria were:

1) subjects who participated in the intervention program less than 80% of the time.

2) subjects who joined another institute's rehabilitation at the same time as receiving the intervention program in the present study.

All participants signed informed consent forms before being involved in the research project. The present study was approved by the Human Research Ethics Committee, Faculty of Associated Medical Sciences, Chiang Mai University, ethics clearance number 122/2563, and registered at the Thai Clinical Trials Registry (TCTR20220706002).

### Intervention

All participants in the experimental and control groups received 24 treatment sessions with a duration of 140 minutes per session, three times a week for eight consecutive weeks. Stroke participants in the experimental group received conventional rehabilitation guided by an occupational therapist and physical therapist, who did not receive information regarding the research goals of the present study, for 90 minutes, combined with traditional umbrella painting activity for 50 minutes. The time for the physical therapy (PT) session was 70 minutes, as usual. The period of time for occupational therapy (OT) was also 70 minutes, with 20 minutes spent mostly on activities of daily living (ADL) and 50 minutes for umbrella painting, as this activity was considered a modality that can practice not only UE function but also improve perception and cognitive function in the clients. Participants in the control group received conventional OT and PT from therapists, who had not been informed of the research goals by the research team, for 70 minutes each. The conventional treatment protocol consisted of passive and active ROM in both upper and lower extremities on the affected side; manual therapy techniques; trunk balance training; walking on parallel bars and stairs; exercises with and without resistance; basic activities of daily living (BADL) training; and UE function training designed the movement of the arm and hand to reach out, hold, carry, and release objects.

Motor training for UE function by using traditional

umbrella painting activity in the experimental group has designed the movement patterns to be like those in conventional UE training, which includes reaching out for, holding, carrying, and releasing objects.

As Morris *et al.*<sup>15</sup> suggested, health professionals should be concerned with patient levels of motor recovery and the appropriateness of the art provided. If the patients struggled to use their affected arm during art-making, this could reduce the positive impact of art on recovery and cause increased stress. Therefore, the research team analyzed and designed activities that suited the ability levels of participants. Individuals with UE muscle function at stage 3 of Brunnstrom could perform bilateral arm practice using the unaffected and affected hands to hold the large handle paintbrush together and simultaneously paint the colors as a background on the plain Sa paper canopy. After finishing the background painting, participants drew pictures with their unaffected hands, as this activity was quite complicated. Pictures can be large and do not require much precision.

Participants who had their muscle function of the UE at stages 4 and 5 of Brunnstrom could use their affected hands, whether dominant or not, to hold the paintbrushes and paint the background with one hand. However, they could use their unaffected hands to help the affected one draw pictures after a background painting session.

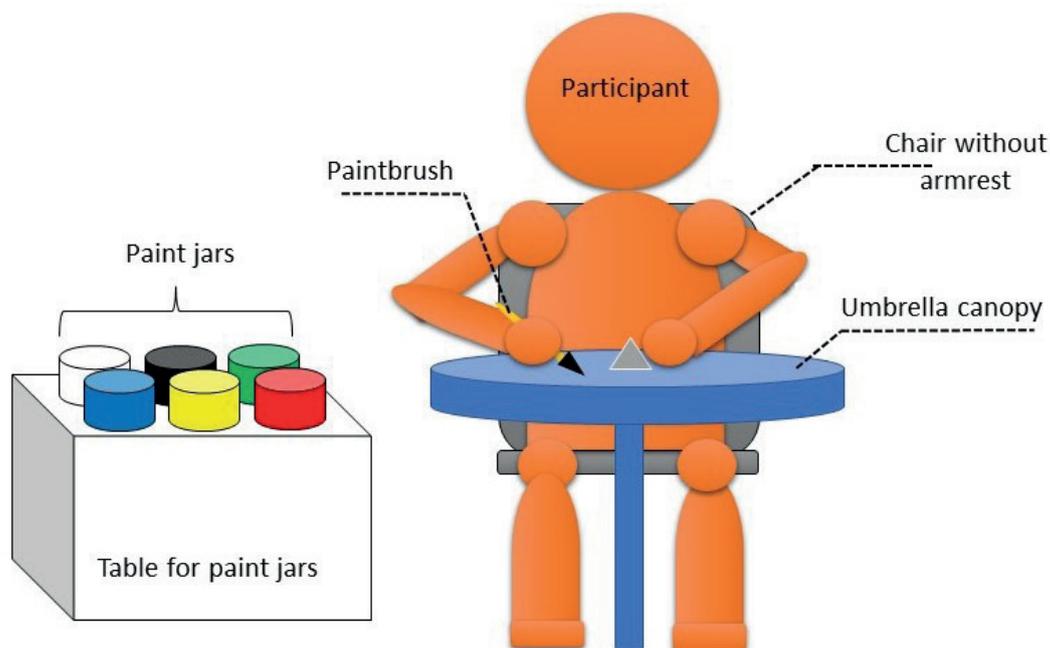
Equipment for traditional umbrella painting consisted of 1) a ready-made unpainted umbrella; 2) acrylic color; 3) paintbrushes, both round and flat types with different sizes; 4) a chair with a backrest but no armrest; and 5) paint jars, which were arranged on top of the appropriate height table. The subjects sat in chairs with hip and knee flexion at 90 degrees and both feet properly positioned on the floor. The unpainted umbrella was placed in front and the paint jars on top of the table were placed on the affected side within reachable range of the subjects. The positions of stroke participants and equipment are demonstrated in Figure 3.

Before starting the umbrella painting session, therapists allowed stroke participants to warm up for 5 minutes by using their unaffected hand to hold the affected one, raise it above the horizontal shoulder line, swing the hand to the left and right sides, and flex and extend the elbow and wrist joints. There are four major movement steps in traditional umbrella painting: 1) holding a paintbrush in hand; 2) reaching out an arm to drop a paintbrush into the paint jar; 3) moving the arm back towards the umbrella canopy; and 4) painting or drawing pictures on the umbrella canopy.

Subjects had one-on-one supervision from an occupational therapist, who was blinded to the research goals during the traditional umbrella painting activity.

### Instruments

1. The Functional Test for Hemiplegic Upper Extremity (FTHUE)-Thai version. The FTHUE was first developed at Rancho Los Amigos Hospital, USA.<sup>27</sup> It aimed to measure the recovery of hemiplegic UE from nonuse to full hand function. The test comprises 18 activities sequenced in



**Figure 3** Participant and Equipment Placement.

a hierarchy of seven functional levels by the degree of difficulty, and the grading is based on a pass-fail basis for activities within each level. It took around 30-45 minutes to complete a single evaluation, which made the test impractical and time-consuming for bedside use. Fong *et al.*<sup>28</sup> has developed the FTHUE Hong Kong version to adapt the instrument to suit people in Asian culture and take less time to administer. There are 14 testing activities, which are sequenced into seven levels of difficulty. The scores are classified from 1 to 7 by difficulty levels in the FTHUE-Hong Kong version, with good psychometric properties, and it took around 10 minutes for the evaluation process.

Pingmuang *et al.*<sup>29</sup> has adapted the FTHUE-Hong Kong version into the Thai language in Thailand. The process involved back-translation, field testing of the pre-final version, and final adjustments. The test items and scoring were still the same, as we have a similar culture. The study of the psychometric properties of 30 stroke participants in Thailand demonstrated that the FTHUE-Thai version has very good internal consistency ( $r=0.83$ ,  $p<0.01$ ) and excellent inter-rater reliability ( $r=0.96$ ,  $p<0.01$ ).<sup>29</sup>

2. The Patient Health Questionnaire (PHQ-9)-Thai version: This instrument has been used as a reliable depression screening tool in primary care, demonstrating good sensitivity and specificity for depressive disorder.<sup>30</sup> The PHQ-9 is substantially shorter than most other depression screening measures, with only nine items. PHQ-9 is a self-reported measure based on the 9 DSM-IV criteria for major depressive episodes.<sup>30</sup> It refers to symptoms experienced by patients during the two weeks before answering the questionnaires. The study of the psychometric property of PHQ-9 (Thai version) in 924 patients with depression demonstrated satisfactory internal consistency (Cronbach's  $\alpha=0.79$ ,  $p<0.05$ ) and moderate convergent validity with the gold standard Thai version of the Hamilton Rating Scale for Depression (HAM-D) ( $r=0.56$ ;  $p<0.001$ ).<sup>30</sup>

Scores for PHQ-9 range from 0 to 3, where 0 stands for "not at all", 1 stands for "several days", 2 stands for "more than half of the day", and 3 stands for "nearly every day". The summed scores for this instrument range from 0 to 27. PHQ-9 can be used as a screening tool with a recommended cut-off score of nine or higher for the diagnosis of major depression.<sup>31</sup>

#### Data Collection

Two trained research assistants blinded to the objectives of the study, and to which group each participant was assigned (the experimental or control group) collected data within seven days before and after the 8-week intervention program.

#### Data Analysis

Differences in outcome measures, UE function, and depression within each group were analyzed using the Wilcoxon Signed Ranks test (Table 2). The Mann-Whitney U test was used to analyze the difference in outcomes between the two groups, pre-test, and post-test (Table 3). The statistical significance level for all tests was set at  $p<0.05$ . The effect size (Cohen's  $d$ ) was also calculated to demonstrate the practical significance of the study findings.<sup>23</sup> The intermediate or medium ( $d$  ranges from 0.45 to 0.75) and large effect sizes ( $d>0.75$ ) were preferable.<sup>23</sup>

#### Results

All participants in both groups completed the intervention programs. The results of the study were demonstrated as follows.

Data from Table 1 demonstrated that the socio-demographic characteristics of stroke participants were not significantly different between the experimental and control groups at baseline at  $p<0.05$ .

Data from Table 2 demonstrated that the scores of UE function in the experimental group increased significantly after intervention ( $p < 0.004$ ) with a large effect size ( $d = 1.59$ ). In addition, the score of depression in the experimental group decreased significantly ( $p < 0.003$ ) with a large effect size ( $d = 1.62$ ).

Data from Table 3 demonstrated that the UE function and depression in stroke participants were not significantly different between the two groups both before and after intervention at  $p < 0.05$ .

## Discussion

### Upper extremity function

The results of the present study demonstrated that the use of traditional umbrella painting activity combined with conventional rehabilitation produced higher UE function scores for stroke participants in the experimental group after the intervention than at the pre-test significantly ( $p < 0.004$ ). This may be because traditional umbrella painting inspired participants to do activities more than the conventional routine treatment alone, as in Thailand, painting an umbrella is a symbol of wealth and joy. In addition, stroke participants saw

**Table 1** Sociodemographic characteristics of participants at baseline.

Baseline Characteristics	Experimental		Control		p
	N	%	N	%	
Gender					
Male	9	81.80	8	72.70	1.00 <sup>F</sup>
Female	2	18.20	3	27.30	
Age (years)					
60 and below	9	81.80	6	54.50	0.36 <sup>F</sup>
Above 60	2	18.20	5	45.50	
Time since onset (months)					
1-12	3	27.30	5	45.50	0.66 <sup>F</sup>
13-24	8	72.70	6	54.50	
Education					
None and elementary	8	72.70	6	54.50	0.66 <sup>F</sup>
Secondary and above	3	27.30	5	45.50	
Stroke recovery (Brunnstrom)					
Spasticity with synergy (stage 3)	4	36.40	5	45.50	1.00 <sup>F</sup>
Isolate movement of muscles (stage 4-5)	7	63.60	6	54.50	
Risk of depression (from 2 questions)					
Answer "yes" to 1 question	8	72.70	9	81.80	1.00 <sup>F</sup>
Answer "yes" to 2 questions	3	27.30	2	18.20	
Caregiver					
Family members	11	100	10	90.90	1.00 <sup>F</sup>
No caregiver	0	0.00	1	9.10	

Note: N=22 (11 for each group), \* $p < 0.05$ , <sup>F</sup>Fisher's Exact Test

**Table 2** Comparisons of UE function and depression in stroke participants within the experimental and control groups between baseline and post-intervention.

Outcomes	Median (IQR)**		z	p	Effect sizes
	Baseline	Post-intervention			
UE function					
Experimental (N=11)	4 (3, 4)	5 (4, 6)	-2.92	0.004*	1.59
Control (N=11)	4 (3, 5)	4 (3, 6)	-1.41	0.16	0.63
Depression					
Experimental (N=11)	12 (11, 14)	6 (5, 7)	-2.95	0.003*	1.62
Control (N=11)	12 (9, 15)	7 (5, 11)	-1.88	0.06	0.87

\* $p < 0.05$ , \*\*IQR: interquartile range

**Table 3** Comparisons of UE function and depression in stroke participants between the experimental and control groups at baseline and post-intervention.

Outcomes	Median (IQR)*		z	p	Effect sizes
	Experimental (N=11)	Control (N=11)			
UE function					
Baseline	4 (3, 4)	4 (3, 5)	-0.11	0.92	0.05
Post-intervention	5 (4, 6)	4 (3, 6)	-1.74	0.082	0.80
Depression					
Baseline	12 (11, 14)	12 (9, 15)	-0.90	0.37	0.39
Post-intervention	6 (5, 7)	7 (5, 11)	-1.03	0.30	0.45

\*IQR: interquartile range

the results of their productive outcomes at the end of every practice session, which motivated them to put more effort into creating artwork in the next session. The process of painting colors and drawing pictures on the umbrella canopy requires more repetition and variety of motions from the UE than conventional rehabilitation. Additionally, the authors designed the movement pattern specifically for arms and hands to be suitable for motor recovery stages. In subjects whose recovery level was at stage 3 of Brunnstrom, we designed bilateral movement using the affected and unaffected arms to paint the umbrella simultaneously. When the intact arm performs the same spatiotemporal pattern as the affected arm, this could lead to a more efficient performance of the affected arm.<sup>32</sup> Bilateral arm movement demonstrated a good reduction in motor impairment as measured by the Fugl Meyer Assessment.<sup>32</sup> Simultaneous activation of both hands may have rebalanced interhemispheric activation and inhibition, resulting in increased facilitation in the affected hemisphere and positive aftereffects in reducing motor impairment in the affected UE.<sup>33,34</sup> Different art modalities and task-oriented training are also suggested to help stimulate different parts of the brain and enhance the neuroplasticity process, which can help facilitate the recovery process after stroke.<sup>35,36</sup>

For subjects who reached recovery stages 4 and 5 of Brunnstrom, we allowed them to use mainly only their affected limbs because stroke survivors can perform isolated movements of their arms and hands at these levels. The traditional umbrella painting activity encourages the clients to move the UE more repetitively than the routine training, where patients change practice from station to station within a short time. These repetitive movements can enhance the functional ability of the UE in these individuals.<sup>22,32</sup> The results of the present study were per a study by Kim *et al.*,<sup>14</sup> investigated the effectiveness of art therapy on UE function in a stroke case study and found that the score of the UE function, as measured by the Fugl-Meyer, was higher on the post-test than at the pre-test significantly.

However, the comparison of UE function between the experimental and control groups did not show a significant statistical difference post-intervention (Table 3) because stroke survivors in the control group still received a conventional rehabilitation program that helped improve

their ability. However, it was not as high as stroke participants in the experimental group.

### Depression

The current study found that depression in stroke participants in the experimental group was significantly lower post-intervention than at the pre-test ( $p < 0.003$ ), while its score did not change in the control group. This indicated that the traditional umbrella painting activity, combined with conventional rehabilitation, could be an effective treatment modality for reducing depression in stroke participants, especially when compared with individuals who received only conventional rehabilitation. The result of the present study was consistent with Kongkasuwan *et al.*,<sup>37</sup> studied the effectiveness of creative art therapy on depression in 118 stroke patients, revealing that subjects who attended an artwork program twice a week for four weeks in addition to conventional therapy experienced significantly lower depression than those who received conventional rehabilitation alone. Furthermore, several studies<sup>15,22,37-41</sup> demonstrated that participating in art activities helped with relaxation, self-esteem, inspiration, and distraction in a stressful rehabilitation environment, which could lead to less depression in stroke patients. Gangwani *et al.*<sup>42</sup> identified factors affecting post-stroke recovery that self-esteem, and motivation could promote good rehabilitation outcomes. Alwledat, *et al.*<sup>38</sup> studied the effects of two sessions per week, 1.5 hours per session, for two weeks of creative art therapy on depression, anxiety, and stress on 85 stroke patients, which demonstrated that art activities could significantly reduce depression, anxiety, and stress in these participants.

However, the comparison of depression between the experimental and control groups did not show a significant statistical difference after intervention (Table 3). The results might be because stroke survivors in the control group still received conventional rehabilitation programs and could meet with therapists and peers who helped lessen depression, but not as much as those in the experimental group.

### Limitations

All the participants in our study lived in the northern part of Thailand. As a result, a task such as traditional

umbrella painting may specifically inspire these people but not others. There are actually more inspired traditional task-related therapies for people in northern Thailand, for example, Thai silk weaving, wood carving, silver engraving, etc., that should be incorporated into rehabilitation in the next study, and these could add more evidence for therapists to make their decision whether or not to apply task-based treatment into their routine clinical practices.

Another limitation of the study was the small number of participants, as we needed to recruit as many subjects with similar characteristics as possible. Therefore, the present study should be considered an empirical study. Results should be considered carefully, and the findings may not be generalized for use in other regions or countries. The inclusion of a larger sample size in further studies should be considered.

### Conclusion

The findings in the present study demonstrated 2 issues involving UE function and depression in stroke participants: 1) The comparisons of outcomes variables within the group revealed that the conventional rehabilitative approach combined with the traditional umbrella painting would appear to be more effective than conventional treatment alone to improve UE function and decrease depression in stroke survivors, and 2) The comparisons of UE function and depression between the experimental and control groups did not differ both at pre-test and post-test, which indicated that the conventional rehabilitation also improved UE function and alleviated depression but was not as efficient as the combination of traditional umbrella painting activity and conventional rehabilitation.

### Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

### Ethical Approval

Ethical approval was obtained from the Human Research Ethics Committee, Faculty of Associated Medical Sciences, Chiang Mai University, Thailand; project number AMSEC-63EX-013, ethics clearance number 122/2563.

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